COLLEGE OF NATURAL AND AGRICULTURAL SCIENCES

University of California, Riverside

MASTER SPACE PLAN
2005-06 through 2015-16

Submitted by:

Steven R. Angle, Dean
Donald A. Cooksey, Executive Associate Dean
Gary Scott, Associate Dean, Student Academic Affairs
Linda L. Walling, Associate Dean, Biological Sciences
Jory Yarmoff, Associate Dean, Physical and Mathematical Sciences

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Executive Summary

The CNAS Master Space Plan (MSP) is the key to implementing the CNAS 2005 academic plan and has been in preparation since 2005. The focus of the MSP is CNAS space on the East Campus. The overall space related conclusions are presented in Section III "Findings and Conclusions" and will not be repeated here. Projections for the number of faculty are conservative and do not incorporate the recent developments such as establishment of the HSRI. Thus, the projected space needs are conservative as well.

We examined CNAS space as it currently exists and was assigned in 2005. We have then used campus planning numbers of 21,060 and 25,000 for student enrollment in 2011 at "midterm" and 2015 at "long term." These projections were used to project the number of new faculty positions to be filled in CNAS. These projections were used in the 2005 CNAS Academic Plan and incorporated into this space plan. It is already clear that the numbers must be updated immediately and we plan to do so with the assistance of UCR Capital Planning.

The issue of QUALITY of space is paramount, especially in the near term. CNAS has many old buildings in its inventory – 65% of the current CNAS space is more than 34 years old – and no major renovations have been completed thus far. CNAS must modernize older laboratory space if our faculty are to remain competitive and for the college to remain competitive in attracting and retaining the very best faculty. We propose a series of major renovations to deal with the quality issue and four new major academic buildings to replace outdated, nonfunctional space and provide for faculty growth. QUANTITY is the important issue for the long term and given the long lead times required for major buildings, planning must begin immediately.

The MSP does not address a detailed plan for additional General Assignment Classroom space – there is a clear need, but this must be addressed at a campus level.

This MSP is only a step in the process – after the campus agrees on CNAS space requirements for the future, an implementation plan must be developed. It is clear this will require multiple fund sources and creative thinking, but the plan is not the end goal; the goal is the implementation on the CNAS academic plan. Obviously, the MSP must be viewed as a work in progress and require modification and updating on a regular basis.

I. Mission, Academic Plan and Overall Space Needs

A. Introduction

This Master Space Plan (MSP) for the UCR College of Natural and Agricultural Sciences (CNAS) addresses space needs for research, teaching, administrative functions, and specialized facilities over the next decade, with a focus on the East Campus buildings housing research space. It is intended to allow CNAS to achieve its goals and vision laid out in the most recent academic plan. The anticipated growth in enrollment will lead to increased need for teaching space, particularly class laboratory space. Hiring of additional faculty will create a need for increased space for research, administration, and specialized facilities. An equally important issue to be addressed is the quality of our facilities. Thus, the focus of this Master Space Plan is twofold: provide sufficient quantity and suitable quality of future space to ensure implementation of the Academic Plan.

B. College Mission and Structure

The CNAS mission is the expansion of fundamental scientific knowledge in the agricultural, biological, physical, and mathematical sciences and exploration of innovative approaches for application and dissemination of research findings and discoveries to the betterment of human society, through both teaching and outreach. The three principal objectives supporting this mission are: (1) delivery of the highest quality undergraduate and graduate education; (2) continued cultivation and augmentation of a world-class faculty; and (3) enhancement of our strong foundation in the fundamental life, physical and mathematical sciences, as well as focused areas in the agricultural sciences.

The College benefits by having the Agricultural Experiment Station departments, life sciences, physical, and mathematical sciences in a single college. CNAS is complex and has a unique and distinctive faculty research portfolio that is unparalleled in the University of California system. For example, unlike colleges at the other UCs, CNAS provides a research continuum in the life sciences from the agricultural sciences to the health sciences, which promotes innovation and collaboration. CNAS harbors dynamic research programs that address basic questions in agriculture, life sciences, environmental science, physical and mathematical sciences, and strong applied programs that address the immediate and long term needs of California's economy. The location of the mathematical, physical, and life sciences in one college provides CNAS distinct advantages and opportunities, such as promoting interdisciplinary research and teaching endeavors.

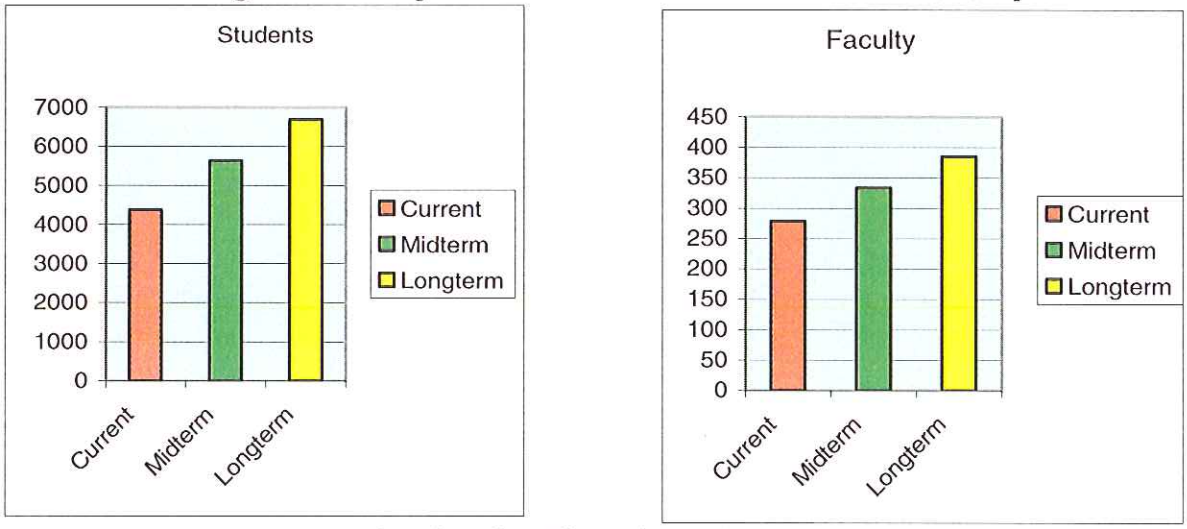
The College consists of 13 academic departments as well as a constellation of institutes and centers enhancing faculty/student collaboration as well as shared facilities, equipment and resources. Administrative support is provided via professional staff housed within either individual departments, centers or institutes, the Dean's office, or one of three "administrative service units" established by the College to consolidate and streamline core functions such as purchasing and academic personnel support.

At the undergraduate level, CNAS offers 13 academic majors, many of which have "tracks" or "options" focusing on particular topics within the disciplines. In Fall 2005, the College had 4,017 undergraduate majors. College faculty members currently participate in 17 of the graduate programs offered by UCR, many of which are interdisciplinary.

C. Student and Faculty Growth

The programmatic goals driving the development of this Master Space Plan are contained in the *CNAS Academic Plan FY2005-06 to 2008-09* which calls for the current faculty of 281 to grow to 328 within five years and to 387 at campus maturity of 25,000 students. Academic Planning and Budget provided the overall campus student enrollment projections for the midterm and long term as 21,060 and 25,000 respectively. Given the current enrollment trends and the planned investments in the HSRI, it is clear that these projections are conservative estimates of growth for the college. Student enrollment in CNAS is projected to grow from a budgeted FTE of 4,373 in 2004-05 to an estimated budgeted FTE of 5,628 by the year 2010-11 (MIDTERM) and 6,681 by 2015-16 (LONG TERM) as depicted below.

Figure 1. Projected Growth in Students and Faculty.



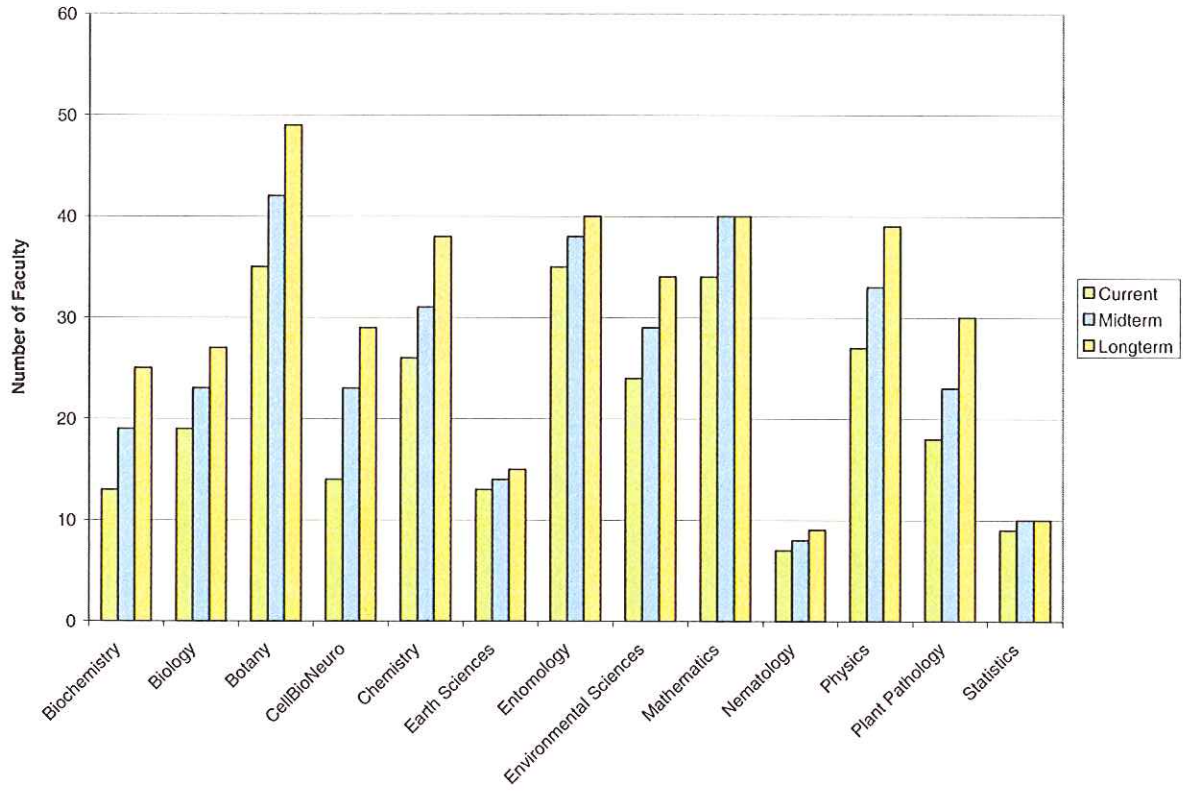
Note: Total Students (G+UG); Faculty # = head count AES plus I&R
Current = 2005/06; Midterm = 2010/11; Long term = 2015/16

D. Academic Plan for Faculty Growth

In terms of future faculty appointments, the College will continue to make investments in the fundamental and applied sciences, while also further building on areas of strength and taking advantage of emerging opportunities in new areas. The seven multidisciplinary focus areas for the college are: genomics and bioinformatics, evolution and ecology, agricultural sciences, environmental sciences, materials science and nanotechnology, health sciences-related research, and computational sciences/ modeling and simulation. The *CNAS Academic Plan FY2005-06 to 2008-09* is our most recent academic plan which lays out a clear vision for investments across the college

(see Appendix A). Using the current CNAS academic plan and applying a linear growth one gets the proposed distribution of new faculty by department shown in Figure 2 below. Obviously, there will be some redistribution of faculty between areas, but the proposed distribution will be fairly close to what we anticipate for the type of space required at the midterm and long term periods.

Figure 2. Proposed Faculty Growth by Department.



Note: Current refers to 2005/06; Midterm refers to 2010/11; Long term refers to 2015/16

It is important to note that CNAS faculty strive for advancement beyond their research and teaching commitments to enhance an already vibrant educational program providing leadership for academic enrichment programs such as the California Alliance for Minority Participation (CAMP), NSF Research Experiences for Undergraduate programs, MARC U* program, and the UC wide Science-Mathematics Initiative (CaTEACH@UCR). We anticipate participation in these programs to grow and the college space plan will need to provide flexibility to allow assignments to these important programs.

E. Overall Space Needs vs. Available Space

Our most pressing unfunded need is for renovation of older space. Buildings constructed as premier structures in their day are now obsolete, as we will show later in this document in Table 6. CNAS Space on East Campus by Major "Standard" Building on page 21, approximately 65% of CNAS research space is in buildings which were

constructed between 1936 and 1974 and none of these buildings have undergone major renovations.

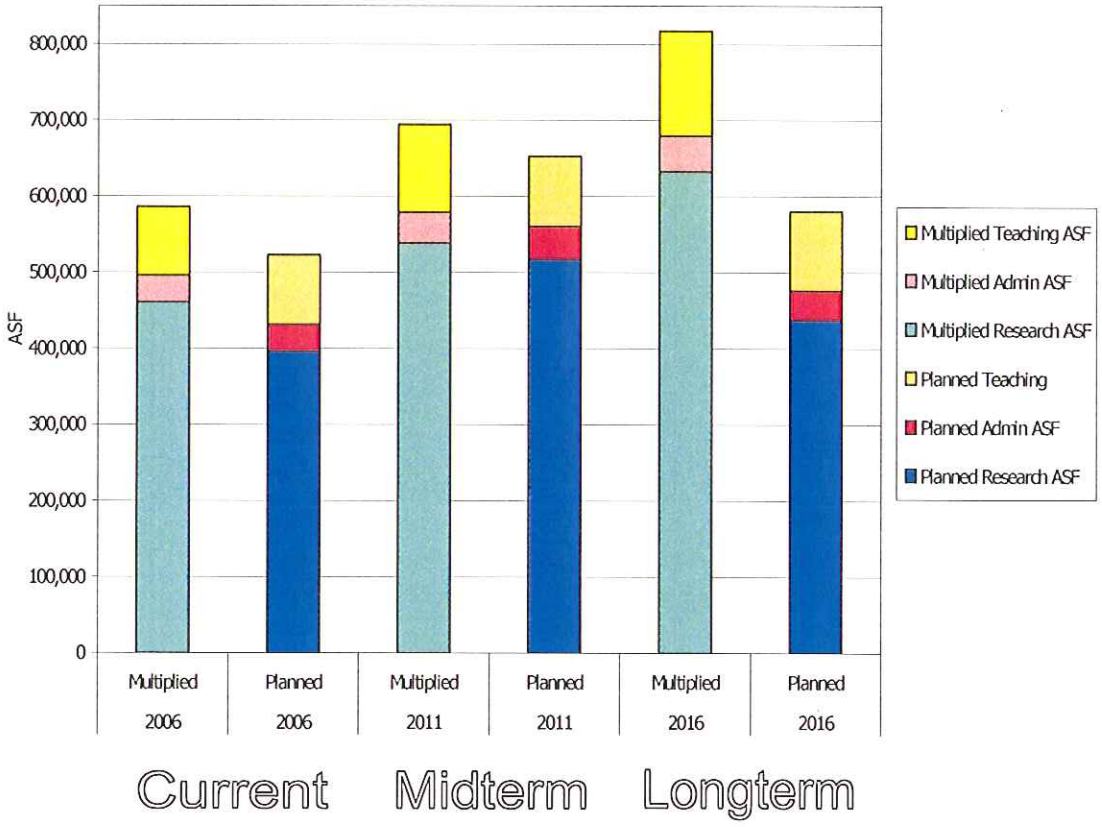
The college must be in a position to address the needs for growth and the incorporation of new technology into our teaching research and service programs. In addition, we face the major challenge of aging facilities which are not suitable for modern research in their current condition. This plan will present a justification for space multipliers for faculty in various disciplines that incorporates research and administrative space. These multipliers have been used to generate a "current need" as well as to project the space required space in 2010/11 (midterm) and 2015/16 (long term). Teaching multipliers based on increased student numbers lead to projections for the needs for additional teaching space.

Teaching space refers to dedicated class laboratories and does not incorporate a need for general assignment classroom space. Projections for teaching were generated by looking at the proposed growth in students relative to 2005/06 and applying a multiplication factor to project an increase in need for the midterm and long term. This type of approach incorporates our assessment that the current amount of class laboratory space is sufficient; however, quality is not addressed in this analysis.

Figure 3 presents a summary of CNAS space available vs. need. The space projected to be available to CNAS faculty is labeled "Planned" and the space required based on the multipliers mentioned above is labeled "MULTIPLIED". The quality of CNAS space is a MAJOR concern for the college. Our plan will call for several buildings to be demolished, thus resulting in a net decrease in available space in the long term (2015/16). Currently, CNAS is overall short of space and this need will be alleviated by major capital projects recently completed and in the planning stages (Biological Sciences, Genomics, MS&E). These projects are included in the "Planned" space available, in Figure 3. As one can see, at the midterm, CNAS will come close to having sufficient quantity of space, the issue is quality. In the long term, if we address quality of space by removing some buildings from the CNAS inventory or demolition, there is a decrease in ASF, which when coupled with growth in students and faculty, results in a significant long term short fall (see Figure 3). We must begin to plan now to confront this huge challenge. Should we leave this older space in the CNAS inventory, we create a bigger need for major renovation of space that is so old and inflexible that it is not worth the investment of a major renovation.

The need for modern science facilities cannot be stressed enough. CNAS faculty are working in buildings built long before some of their research fields were discovered. Molecular biology, nanotechnology/materials science, and genomics are areas of research not even thought of when our pre-1974 buildings were built. A majority of CNAS facilities and infrastructure are simply not compatible with modern research.

Figure 3. Available vs. Required Space.



Planed = Projected Space Available; Multiplied = Space Generated by Growth and Generators.

II. Findings and Conclusions

To keep pace with today's pace of technological advancement, UCR's scientific research space requires major renovation and/or replacement. This will require a number of major renovations and new buildings between now and 2015. Table 1 summarizes the buildings proposed for major renovation targeting both infrastructure and room upgrades. Table 2 summarizes the proposed new buildings. In an effort to place these projects in context, a discussion of some of these projects in included in this section. Figure 4 puts these projects into a time line on a single page.

A number of projects expected to provide state-of-the-art research space for CNAS are currently in various stages of the Capital Planning process. These include three new buildings and several major renovations (see Tables 1 and 2 for summary). The ASF allocated to CNAS during the planning process has been incorporated into the figures and forecasts in this Plan. Details on the ASF for each of the new buildings can be found on the summary sheets by department for Research, Teaching, and Administrative space (Tables 12-14), and in the summary by building (Table 15). A brief narrative of these projects is provided below.

Table 1. Recommended Major Renovations			
Building Name	***Ti5me Period***	***Proposed Scope***	***Considerations***
Batchelor PHASE 1	Midterm 2009/10	Research infrastructure on all floors.	Currently in DPP stages. Phasing will be critical to allow surge into the Genomics Building while coordinating with Boyce/Webber renovation. Focus will be on infrastructure for the building.
Batchelor PHASE 2-5	Midterm 2011	Research space reconfiguration on all floors.	Phasing will be critical to allow surge into the Genomics Building while coordinating with Boyce/Webber renovation.
Boyce/ Webber PHASE 1	Midterm 2008	Building Infrastructure and research space.	Research space reconfiguration on 5th Floor of Boyce (4h floor impact possible) and 3rd Floor of Webber. Will require coordination with the completion of Genomics Building and Batchelor renovation to ensure adequate surge space.
Boyce/ Webber PHASE 2	Midterm 2009	Research, administrative, vivaria renovations.	This will finish out the building renovations. Weber floors 1 and 2 are Biomed space, but planning this as part of Boyce Phase 2 makes sense. Phasing and surge space will be major issues.
Chapman	Midterm 2009	Reconfigure space for office use.	Relocation of the Dean's Office will require additional space for Entomology in the new "Pest Management Building."
Geology Phase 1	Current 2006	Infrastructure, research, administrative renovations.	Administrative space in the former PS Library and Env. Sci. research space on the second floor will be renovated and reconfigured. FUNDED PROJECT to begin work 2006. Some minor renovations in Physics Magnet Lab.
Geology Phase 2	Midterm 2008	Research space renovations	Focus on Earth Sciences research space on the first floor of Geology.
Physics	Longterm 2012	Reconfigure space for Math Dept, Physics teaching needs.	The Physics Building will need renovation for use by the Mathematics Dept. after a new Physical Sciences 2 Building would allow for move-out of the Physics Dept.
Spieth	Longterm 2012	DEMOLITION	The East/Southeast plan calls for replacement of Spieth. Requires current occupants be moved to a new building (Life Sci. II).

Table 2. Proposed New Building Construction			
Proposed New Building	***Proposed Location***	***Proposed ASF***	***Proposed Occupants***
Biological Sciences 2	Lot 11 or current site of Univ. Office Building (UOB) and Univ. Lab Building (ULB).	80,000 asf	Biology, Botany & Plant Sciences, Cell Biology & Neuroscience, surge space for Spieth replacement.
Pest Management	In place of Boyden/SPI and Old Entomology Building.	100,000 asf	Botany, Entomology, Nematology, Plant Pathology.
Physical Sciences 2	Lot 13.	100,000 asf	Physics, Chemistry.
Spieth Hall Replacement	Existing Site	100,000 asf	Life Sciences Research, Teaching laboratories, lecture halls, general assignment classrooms

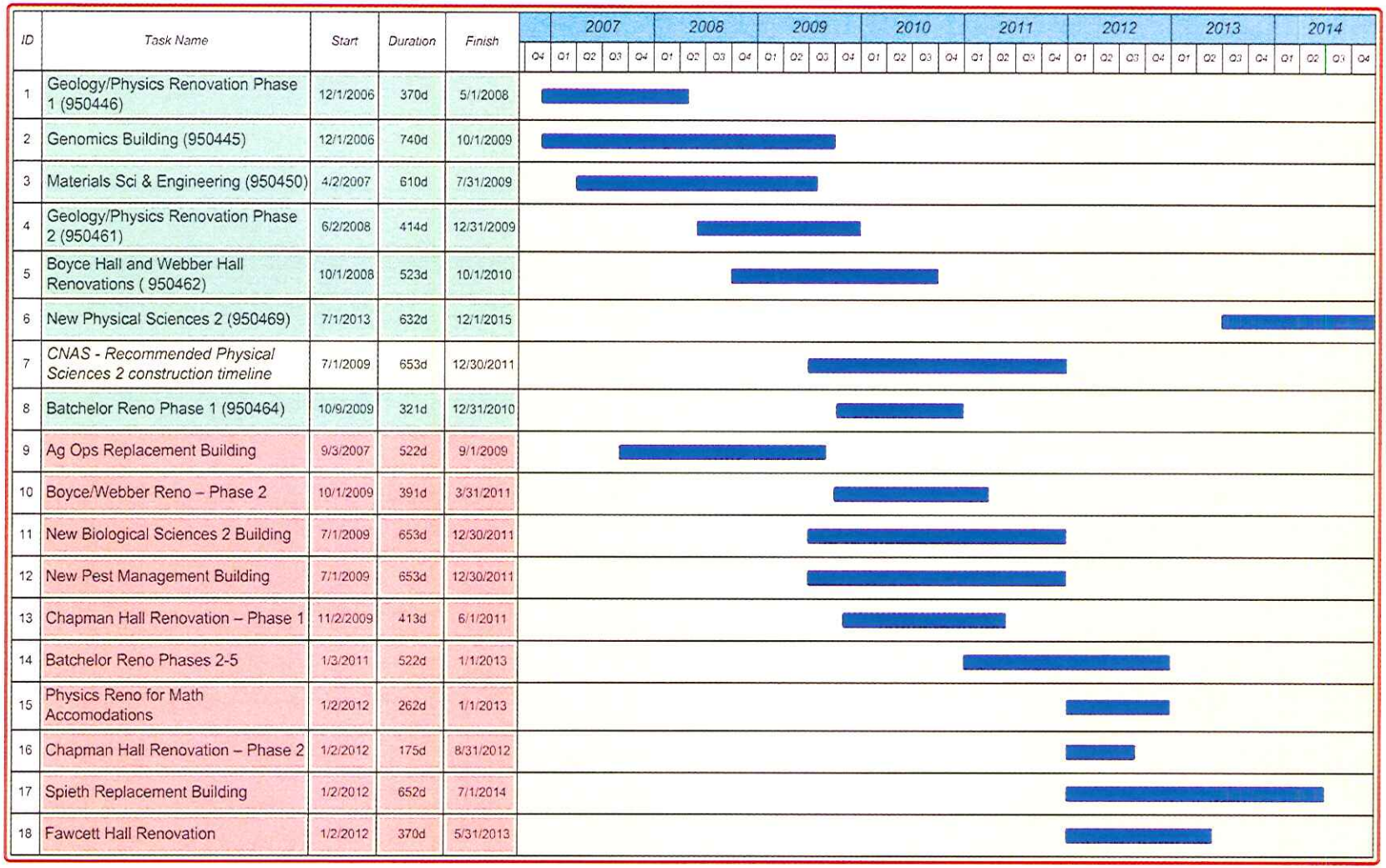
Figure 4 CNAS Building Projects

CNAS BUILDING PROJECTS - Construction Phase

Major renovations and New construction

The projects outlined below represent those currently in the Capital Queue [GREEN] and other which are needed but have not yet been programmed [RED].

ID	Task Name	Start	Duration	Finish
1	Geology/Physics Renovation Phase 1 (950446)	12/1/2006	370d	5/1/2008
2	Genomics Building (950445)	12/1/2006	740d	10/1/2009
3	Materials Sci & Engineering (950450)	4/2/2007	610d	7/31/2009
4	Geology/Physics Renovation Phase 2 (950461)	6/2/2008	414d	12/31/2009
5	Boyce Hall and Webber Hall Renovations (950462)	10/1/2008	523d	10/1/2010
6	New Physical Sciences 2 (950469)	7/1/2013	632d	12/1/2015
7	*CNAS - Recommended Physical Sciences 2 construction timeline*	7/1/2009	653d	12/30/2011
8	Batchelor Reno Phase 1 (950464)	10/9/2009	321d	12/31/2010
9	Ag Ops Replacement Building	9/3/2007	522d	9/1/2009
10	Boyce/Webber Reno – Phase 2	10/1/2009	391d	3/31/2011
11	New Biological Sciences 2 Building	7/1/2009	653d	12/30/2011
12	New Pest Management Building	7/1/2009	653d	12/30/2011
13	Chapman Hall Renovation – Phase 1	11/2/2009	413d	6/1/2011
14	Batchelor Reno Phases 2-5	1/3/2011	522d	1/1/2013
15	Physics Reno for Math Accomodations	1/2/2012	262d	1/1/2013
16	Chapman Hall Renovation – Phase 2	1/2/2012	175d	8/31/2012
17	Spieth Replacement Building	1/2/2012	652d	7/1/2014
18	Fawcett Hall Renovation	1/2/2012	370d	5/31/2013



A. New Buildings: Funded Projects

Biological Sciences 1 Building. The Biological Sciences Building will be occupied by faculty from the Department of Cell Biology & Neuroscience and several new hires associated with the planned Health Sciences Research Institute. This building alleviates the immediate crisis in space in the Life Sciences and was a critical part of our plans to build the faculty in this area of research.

Genomics Building. The Genomics Building is scheduled to break ground in fall 2006 and will be completed in early 2009. It will house selected faculty from several departments (Biochemistry, Biology, Botany & Plant Sciences, Cell Biology & Neuroscience, Plant Pathology, Statistics, Entomology, Nematology). The Genomics building will also house current and new faculty in the fields of plant and microbe functional genomics and vector-disease research.

Materials Science and Engineering Building. The Materials Science and Engineering Building, planned jointly with the Bourns College of Engineering, will contain research space for nanomaterials scientists in the Departments of Physics and Chemistry. In addition, the Clean Room and electron lithography system in the building will service investigators in both colleges. The clean room was moved under the main structure of the building displacing a large amount of valuable ground floor research laboratory space. This will have a significant impact on the building program since nanosystems research typically requires very low vibration levels. Future projects may need to address this need.

B. Funded Renovation Project

Geology/Physics Renovations, Phase 1. The Geology/Physics Renovation Phase 1 is scheduled to commence during the Fall of 2006. The main focus of the project is to renovate the center wing and second floor of the Geology building, which provide improved quality of space for the department of Environmental Sciences and the AEE administrative unit. There will be some limited impact on the Earth Sciences Department, via the first floor center wing and three additional first floor lab modules. The Physics department will have a limited impact on their research. Four lab modules will be added by installing a floor into their "two-story lab", and their high bay "magnet lab" will be renovated to become more useful research space. Expected completion is 2007 for the Physics Building and 2008 for the Geology Building. Note that a budget short fall precluded the complete renovation of research labs for Earth Science faculty currently housed in Pierce Hall, and thus this space will need to be retained until workable laboratories can be secured in the Geology Building.

C. Proposed Renovation Projects

Geology Renovations, Phase 2. The Geology Building Renovation Phase 2 is in the planning stages, and funding for it will come as a part of the higher education construction bond on the ballot in November 2006. Expected completion is in 2009. The project will renovate the basement and complete the renovations of the first floor, which is the home of the Earth Sciences Department. While the renovations (Phases 1 and 2) are underway, the department is using surge space in Pierce Hall. At the

conclusion of this project, it should be possible to provide for the Earth Sciences research need completely within the Geology building, but their teaching needs (class labs) will remain in Pierce Hall.

Boyce/Weber Renovation Phase 1 and Phase 2. The Boyce/Webber renovation is expected to occur in two phases over the next five years. Phase 1 is in the planning stages and will gear up should the higher education construction bond pass in November 2006. This project will target building infrastructure and provide funds for the renovation of the third floor of Weber Hall and a floor of Boyce (depending on the bidding environment, it may be possible to renovate an additional floor of Boyce. Given the configuration of Boyce Hall, it should be dedicated for high end research purposes. Phase 2 will complete the renovation of remainder of Boyce and Weber and modernize/reconfigure the space in accord with the requirements of modern research in the life sciences. The current Biochemistry class laboratories could be relocated to release additional high-end research space currently occupied by teaching labs. Lower floors of Webber Hall are occupied by the Division of Biomedical Sciences and may be better suited to less intensive research functions, class laboratories, or administrative functions. Renovations on the 3rd Floor of Webber could be used to house Plant Pathology, Nematology, and other Life Sciences researchers.

Batchelor Hall Renovation Phase 1 and Phases 2-5. The planned Phase 1 of the Batchelor Hall renovation (DPP in development) is expected to result in modest recovery of space for research use with the relocation of the CNAS Student Academic Affairs Office and Biological Sciences Undergraduate Advising Office to Pierce Hall in 2006/07. We propose the Botany and Plant Science administrative unit move to the first floor and the existing Botany administrative space be renovated for research laboratories and lab support. Phase 1 will focus on building infrastructure and little work will be done to renovate laboratories. Phases 2-5 will result in the renovation of space within the building and modernize/reconfigure the space in accord with the requirements of modern research in the life sciences.

Physics Building. We recommend that the Physics building undergo a major shift in usage. We propose that the Department of Physics move to a proposed new Physical Sciences 2 building. We would retain the lower-division teaching space in Physics and high-bay research space in the magnet lab. Vacated space will be remodeled (where needed) to house the Department of Mathematics. The College shops (machine, glass, electronics) will also consolidate into this building in the near future. The Physics building will require moderate renovations to accommodate these recommended uses. If space permits, creation of classrooms designed to accommodate the needs of mathematicians would be desirable (i.e. projection screens placed to the sides of the room and allowing use of a centered whiteboard concurrently).

Pierce Hall. We recommend that Pierce Hall be retained in the College space inventory as a mixed-use facility. It is likely the renovations will be done in a phased fashion as multiple small projects. Pierce will house some teaching functions, be home to interdisciplinary centers, accommodate temporary moves during major renovations in Geology, and be used as surge space for programs that will eventually be housed in

new facilities. While we have not proposed a specific renovation project for Pierce Hall, it is important to keep this space on the page as decisions are made regarding the long term use of this building. The Department of Chemistry will maintain its CHEM 1 class laboratories in Pierce and also occupy research space in Pierce Annex through the midterm. Additional teaching lab space for Chemistry 1 will require renovation of space on the first floor of Pierce in the long-term. The Departments of Earth Sciences, Environmental Sciences and Plant Pathology are currently, or will in the near future, conduct various laboratory courses in Pierce Hall. In addition, the Biochemistry class laboratories currently housed on the 2nd floor of Boyce could relocate to Pierce to accommodate enrollment growth in the near term (in the long term these labs would relocate to the Spieth replacement meeting. Three Biochemistry class labs and a computer lab will be needed for this transition. The Department of Physics will utilize research space on the first floor of Pierce in the short- and mid-term (during construction of the Materials Science & Engineering Building and a proposed new building for physical sciences). For the Second Floor of Pierce, the space plan calls for the Institute of Geophysics and Planetary Physics remaining in the building and for the Air Pollution Research Center to permanently relocate here. Pierce Hall will also serve as temporary space for some Earth Sciences research activities during renovation of the Geology building. The third floor of Pierce currently contains class labs and some research activities (cold rooms, radioisotope lab, and instrumentation room) of the Department of Environmental Sciences and APRC. For mid-term use, a portion of the third floor is needed as a temporary location for the Center for Conservation Biology (during construction of a proposed new building for life science). In the long term, the third floor will be used to accommodate growth of the Departments of Environmental Sciences and Chemistry.

D. Recommended New Buildings

In order to meet the long-term research needs of CNAS faculty, it is recommended that planning commence immediately for three new buildings totaling approximately 260,000 ASF and a replacement for Spieth Hall. The proposed timeline for construction of the new buildings is given in Figure 4. These four new buildings are summarized in Table 2 on page 14 and some additional details of the proposed program are discussed below.

Pest and Disease Management (Pest Management). This proposed new building of approximately 100,000 ASF would serve selected faculty from Entomology, Plant Pathology and Nematology – all Agricultural Experiment Station departments. The Department of Nematology, currently scattered in four different buildings, would be particularly well-served by co-locating its faculty. This proposal also assumes we would relocate a majority of the Plant Pathology faculty from Boyce, Webber, and Fawcett to a new Pest Management Building. Ideally, this building would replace the Old Entomology Building and SPI/Boyden. We recommend the inclusion of two to three class labs to serve upper division life science education of the future. These labs will serve the increased needs of the faculty of Nematology, Entomology, and Plant Pathology. The class laboratories should be designated for the ground floor of this

building to support student traffic flow. Administrative space should also be programmed into this building.

Biological Sciences 2. We propose that projected research space shortages in the Departments of Biology, Cell Biology & Neuroscience, and Botany & Plant Sciences be resolved by construction of a Biological Sciences 2 building of approximately 80,000 ASF. Most of the Biology faculty are currently housed in substandard space in Spieth and University Laboratory Building and a research space deficit of nearly 15,000 asf is anticipated in the long-term. Botany will incur a similar longterm space shortage of approximately 15,000 asf. Growth in faculty ranks in Cell Biology & Neuroscience and in Biology could also be accommodated within this building, as well as potential uniting of faculty from several departments associated with the Center for Conservation Biology. With proper sequencing, this building could serve as temporary Biology class labs surge space during the Spieth replacement project. Due to the nature of Life Sciences research labs, open design for teaching labs could be strategized to revert to research labs with a modicum of cost and effort.

Physical Sciences 2. This recommended building is currently in the campus capital queue and would become the home of the Department of Physics, a department currently housed in the Physics building. As shown in Figure 4 the campus capital queue calls for construction to begin in 2013, and CNAS has proposed moving this building up to a 2009 start date. If we are to address the long term needs of the Department of Mathematics, we must move this building up in the queue. The Physics building, completed in 1965, is better suited to administrative and teaching functions, and is additionally undersize to accommodate future growth in the Physics department. It is recommended that all of the research needs of the department, except state-of-the-art nanoscience materials, condensed matter, and biophysics research housed in the Materials Science & Engineering Building and the high bay space (magnet lab), be housed in this new building. In addition, offices for faculty, postdocs and graduate students, department staff, upper-division class labs, and meeting spaces will be included. With the recent design changes to the MS&E Building and existence of only one or two synthetic labs with multiple fume hoods, there will be a need for further synthetic lab space as the nanoscience program develops. To anticipate this need and coordinate optimal usage, the Pierce Annex chemists will also relocate to this new Physical Sciences 2 Building. This will allow the use of the Pierce Annex for materials science research and the ability to accommodate faculty supporting megalab levels of space utilization. The Department of Chemistry will have a research space deficit in the long term of over 12,000 asf; it would be appropriate to locate physical chemists in this building to circumvent this shortage. To meet these long-term needs for both departments, this building would need to have approximately 100,000 asf. The Physical Sciences 2 Building would be optimally located in close proximity to Physical Sciences 1. This 'panhandle district' is the last bastion of flat ground within the CNAS sector. Future buildings should design to highest allowable density to accommodate the greatest asf for current and future use.

Spieth Hall Replacement Building. Currently Spieth Hall is not suitable for current or future research in the life sciences. Constructed in 1958, this building

contains grossly outdated research laboratories and has significant vibration problems on the upper floors. While the building could house ecology/evolution faculty after significant infrastructure upgrades, it will not adequately support molecular/cellular laboratories. We propose this building be demolished. In the meantime, we propose that much of the building, particularly the first floor, be converted to instructional space (general assignment classrooms and/or biology and biological science class laboratories). The proposed Life Science Building would allow CNAS to relocate the current occupants of Spieth Hall on either a temporary or permanent basis. The preferred alternative is the replacement of Spieth with new construction as proposed by the East/Southeast Campus Area Study. This would provide state-of-the-art teaching labs at lower levels, and possible research and/or administrative space at upper levels. Phasing with the construction of the Genomics Building and/or the new Biological Sciences 2 Building would allow surge space to accommodate the otherwise immovable number of residents simultaneously.

Potential HSRI Building. At the present time, it is unclear when an HSRI building will be constructed. Since the HSRI is a university-wide program, the College has not proposed an HSRI building in its plan. If an HSRI building is constructed, it would likely house the HSRI faculty in life science departments in CNAS and Biomed faculty associated with HSRI. If this indeed occurs in the future, some of the severe space needs for the life sciences might be alleviated to some extent.

E. Buildings Recommended for Demolition

CNAS promotes the demolition of the following buildings/structures: Fawcett Lab, Old Entomology, SPI/Boyden, Speith Hall, University Office Building, University Lab Building, Trailers currently used as offices and laboratories. These same structures are all targeted for demolition in the East/Southeast Campus Area Study. There has been recent discussion regarding the fate of Fawcett Lab. Should this building be retained and not demolished, it will require extensive renovation.

F. CNAS Space Challenges

Other major challenges to support CNAS research into the future were identified and compiled in Table 3 (below). It is important that we address these issues before they become a crisis – this is particularly true for space for the Department of Mathematics, which will soon reach the state of crisis.

A plan for implementation and sequencing of the projects/issues noted in Tables 1-3 is imperative. Many of the project require the availability of surge space and the sequential timing of several of the projects is critical to the success of the college. Of particular issue will be the funding strategy to allow major facilities such as Pest Management which will be a largely research based project to become a reality. While no single fund source will be the answer, as much State funding as possible will be required to meet the needs of CNAS faculty and students. Our proposed time line for each project is summarized in Figure 4.

Table 3. CNAS Space Challenges/Concerns	
Item	***Considerations***
Outdated biological teaching labs	This concern could be addressed in the replacement of Spieth Hall. The teaching labs could be surged into a new Biological Sciences 2 Building during the demolition and reconstruction of Spieth. For biological laboratories, the transition from teaching labs to research labs could be designed in as a component approach to facilitate a cost-effective transformation in utilization.
Mathematics Department space shortage.	The Mathematics Dept. currently housed on the Campus Surge Building 2nd Floor has exceeded growth expectations and maximized its allocation. There is no further room for departmental growth. Alleviation of this situation was portrayed as a longterm need, however it now presents as a midterm crisis. Portions of the Department will necessarily relocate to Pierce Hall within two academic years to allow for growth in faculty and graduate student groups within the Campus Surge building. Ideally, a Physical Sciences 2 Building could be in place at the Midterm, allowing the Physics Department to move to the new building and Mathematics to consolidate in the Physics Building. Alternatively, the Mathematics Department could relocate to Pierce, however this would necessitate the use of wet lab space for dry lab and administrative functions.
Pierce long term function as student-centered building.	In the ideal long term, Pierce Hall would house only student-related functions: teaching labs, teaching support space, student advising, supplementary instruction programs, etc. To dedicate Pierce for this use, new construction will be needed prior to the long term to provide adequate facilities for research space.
Pierce Annex to be used as nanosystems growth/ overflow space.	The MS&E building has very limited synthetic chemistry space with only two labs being constructed with this type of fume hood density. It is anticipated that growth in the area of nanosystems research will progress rapidly and the fume hood intensive space in Pierce Annex will provide the optimum solution for location of nanosystems researchers in synthetic chemistry. The current Pierce Annex occupants would relocate to the new Physical Sciences 2 Building.
Insufficient General Assignment Classroom space in close proximity.	Many lectures take place in a variety of locations across the Campus. Future operations would be facilitated and teaching experiences enhanced by localized settings.
Need for meeting rooms.	CNAS is in short supply for meeting rooms for research and administrative use. Future buildings should incorporate designated meeting areas and evacuated asf revamped as meeting rooms as appropriate.

III. Current Space Profile

The College consists of a unique compendium of functions and operations utilizing a vast array of facilities and space types. Categorization and analysis was based on figures compiled in the Facilities Management System (FMS).

A. Space Characterization

Table 4 (below) illustrates the characterization of CNAS space into four major groupings as addressed within this Plan. Assigned space listings within the FMS have been placed into one of the four space types (typically correlating with the FMS Room Codes): Research Space, Teaching Space, Administrative Space, Specialized Facilities

Space. The overall quantity of CNAS asf accruing to each category is displayed in Table 5 below.

Table 4. CNAS Space Types

1. Research Space		
Room Type	**FMS Code**	**Description**
Research Laboratory	210	Includes wet, dry, computational, instrument, or other research labs.
Research Office	211	Offices housing faculty, professional researchers, postdocs, graduate students. Does not include undergraduate students.
Research Lab Service	225	Includes research support areas such as environmental rooms, dark rooms, procedure rooms, equipment rooms, lockers/showers, internal halls or vestibules.
Research Office Service	226	Hallways or vestibules internal to research offices area.
Academic Offices	310	Faculty offices
2. Teaching Space		
Class Laboratory	260	Laboratories designated for teaching students in a scheduled coursework setting.
Special Class Laboratory	261	Class laboratories incorporating specialized operations.
Class Laboratory Service	265	Support areas for class laboratories, i.e. stockrooms, equipment rooms, cold rooms, etc.
Open laboratory	270	Laboratories setup for unscheduled use such as computer labs.
Open laboratory service	275	Support areas for open laboratories
Teaching Assistant	310T	Offices for teaching assistants, either individually or in groups, and shared space for office hours.
Lecturers	310L	Offices for lecturers and "hoteling" space for office hours.
3. Administrative Space		
Other Office	320	Offices for personnel other than faculty or research support staff.
Office Service	335	Support areas for administrative offices.
Conference Room	340	Conference room.
Conference Services	345	Areas supporting conference room use such as media rooms.
4. Specialized Facilities		
Field Building	570	Includes various outbuildings such as storage, garages, pumps, etc.
Animal Quarters	580	Areas utilized for housing animals participating in research programs.
Animal Quarters Service	585	Support spaces for animal housing.
Greenhouse	590	Specialized plant growth facilities.
Greenhouse Service	595	Support for plant growth facilities.
Shop: General & Research	710	Glass Shop, Mechanical Shops, Electronics Shops

Table 5. Summary of Current CNAS Space by Type

Location	Research	Admin	Teaching	Subtotal	Specialized	Total ASF
EAST CAMPUS	400,761	35,935	91,567	528,263	168,949	697,211
WEST CAMPUS	0	0	0	0	119,705	119,705
REMOTE	0	112	0	112	61,316	61,428
TOTAL:	**400,761**	**36,047**	**91,567**	**528,375**	**349,970**	**878,344**

Figure 5. CNAS Space Distribution in ALL East Campus Structures

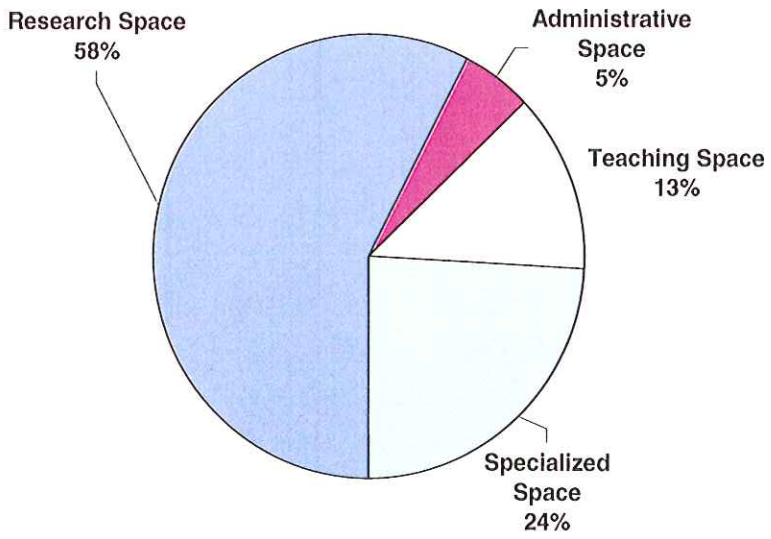
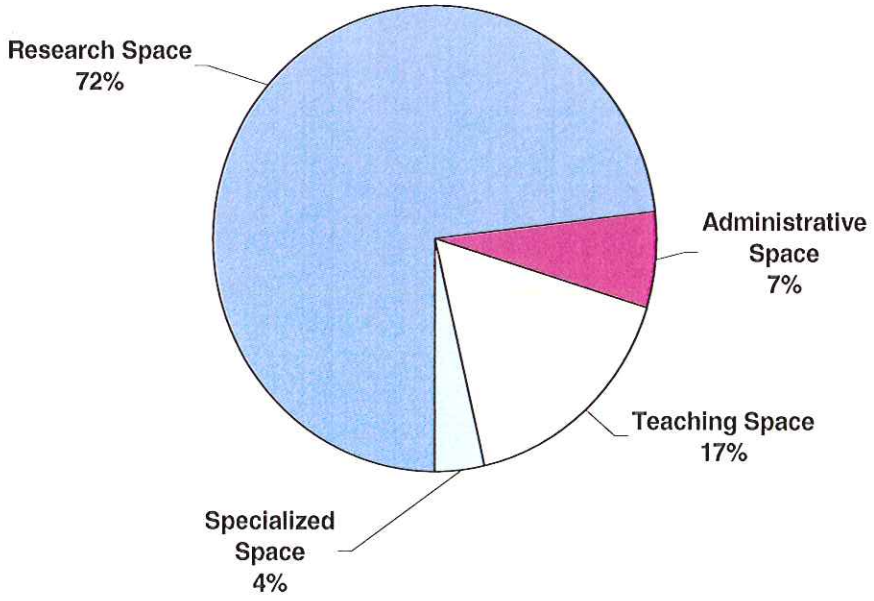


Figure 6. CNAS Space Distribution in East Campus Standard Buildings



B. Current CNAS East Campus Space

Our detailed discussion will focus on the standard instruction and research buildings located on the East Campus. Figure 5 shows the distribution of space within CNAS assignments in all East Campus buildings and Figure 6 shows the distribution in Standard East Campus Buildings. We have defined Standard East Campus Buildings as those regular academic buildings (for a complete list see Table 6). The space beyond

that in Standard East Campus Buildings is in non-standard facilities such as Green Houses, Lath Houses, Storage Buildings and so forth (for a complete list see Table 11).

As revealed in the above charts, the majority of CNAS space is dedicated to research. The vast majority of Specialized Facilities, both on and off the East Campus, also function to support research operations in some fashion. A detailed summary of CNAS occupancy in the major East Campus standard buildings is outlined in Table 4 (below). By definition, any space not part of a "standard academic building" is in "non-standard building". Examples of non-standard buildings include but are not limited to green houses (and associated head houses), trailers, and storage rooms. The list is compiled by age of the building to stress the overall age of CNAS laboratory facilities. It is important to note that specialized facilities such as plant growth facilities and shops can be located in either "standard buildings," or in "non-standard buildings."

Table 6. CNAS Space on East Campus by Major "Standard" Building

CAAN	Building Name	Year Built	Building Age	Research ASF	Admin ASF	Teaching ASF	Subtotal CNAS ASF	Specialized ASF	Total CNAS ASF	Building ASF	Bldg Occupancy
5215	CHAPMAN	1931	75	7,966	0	0	7,966	0	7,966	7,966	CNAS
5517	COLL BLDG NO	1936	70	2,198	4,390	0	6,588	0	6,588	6,588	CNAS
5335	GEOLOGY BLDG	1953	53	32,913	1,354	8,838	43,105	0	43,105	57,271	CNAS, GEN ASSIGN
5342	WEBBER	1953	53	7,358	1,951	60	9,369	0	9,369	27,051	CNAS, BIOMED
5316	LSP BLDG	1958	48	2,195	681	0	2,876	0	2,876	27,520	CNAS, CHASS, GEN ASSIGN
5323	SPIETH	1958	48	35,856	2,611	13,129	51,595	1,582	53,178	59,815	CNAS, GEN ASSIGN
5482	SPI/BOYDEN	1960	46	6,179	0	126	6,305	0	6,305	6,305	CNAS
5503	FAWCETT LAB	1963	43	13,314	1,381	0	14,694	0	14,694	14,694	CNAS
5501	BATCHELOR	1965	41	40,679	2,474	4,684	47,837	355	48,192	48,227	CNAS
5501	KEEN	1965	41	1,760	470	934	3,164	4,673	7,837	7,837	CNAS
5504	PHYSICS BLDG	1965	41	29,767	4,037	12,135	45,938	4,471	50,410	55,548	CNAS, GEN ASSIGN
5508	PIERCE	1966	40	10,330	130	20,377	30,836	4,054	34,890	67,175	CNAS, IGPP, BCOE, GEN ASSIGN
5508	PIERCE ANNEX	1966	40	13,984	0	0	13,984	470	14,454	16,218	CNAS
5341	BOYCE	1974	32	51,991	2,962	1,966	56,919	0	56,919	64,910	CNAS, BIOMED, GEN ASSIGN
5588	STAT COMP BLDG	1974	32	4,545	1,129	2,038	7,711	0	7,711	24,396	CNAS, BIOMED, GEN ADMIN
5205	UNIV OFC BLDG	1991	15	483	0	0	483	0	483	13,147	CNAS, GEN ADMIN
5256	ENTOM MUSEUM	1993	13	3,489	0	3,356	6,845	0	6,845	6,845	CNAS
5263	UNIV LAB BLDG	1994	12	8,184	0	0	8,184	0	8,184	8,185	CNAS
5261	BOURNS	1995	11	3,526	0	0	3,526	0	3,526	103,544	CNAS, BCOE
5380	CAMPUS SURGE	2001	5	7,767	3,541	6,882	18,190	0	18,190	50,931	CNAS, GEN ADMIN
5417	ENTOMOLOGY BLDG	2002	4	38,796	3,652	0	42,448	0	42,448	42,448	CNAS
5416	SCIENCE LAB 1	2003	3	15,359	744	9,768	25,871	0	25,871	25,888	CNAS
5414	PHYSICAL SCI 1	2005	1	55,678	4,072	5,465	65,215	5,349	70,564	70,837	CNAS, EH&S
		Median Age:	*40*							813,347	Total Existing Bldg ASF
	Standard Space Totals			394,317	35,579	89,758	519,654	20,954	540,608		
	Non-Standard Space Totals (from Table 11)			6,444	356	1,809	8,609	147,994	156,603		
	East Campus Buildings Totals			400,761	35,935	91,567	528,263	168,948	697,211		

The East Campus structures constitute an assemblage of variety in building age, condition, architectural style, functionality, and configuration. None of these older buildings has undergone renovation but several are in the planning stages (see Table 1). **The median building age is 40 years. Approximately 65% of CNAS research space is housed in buildings predating 1974; buildings spanning 32 years to 75 years in age!!** A graphical representation of this is shown in Figure 7. The age of CNAS facilities is another way to view the critical issue of quality of space. If our faculty are to be competitive and we are to recruit and retain the very best, we must either renovate or replace the older space in the CNAS inventory.

Figure 7. CNAS East Campus Research Space in Standard Buildings by Age.

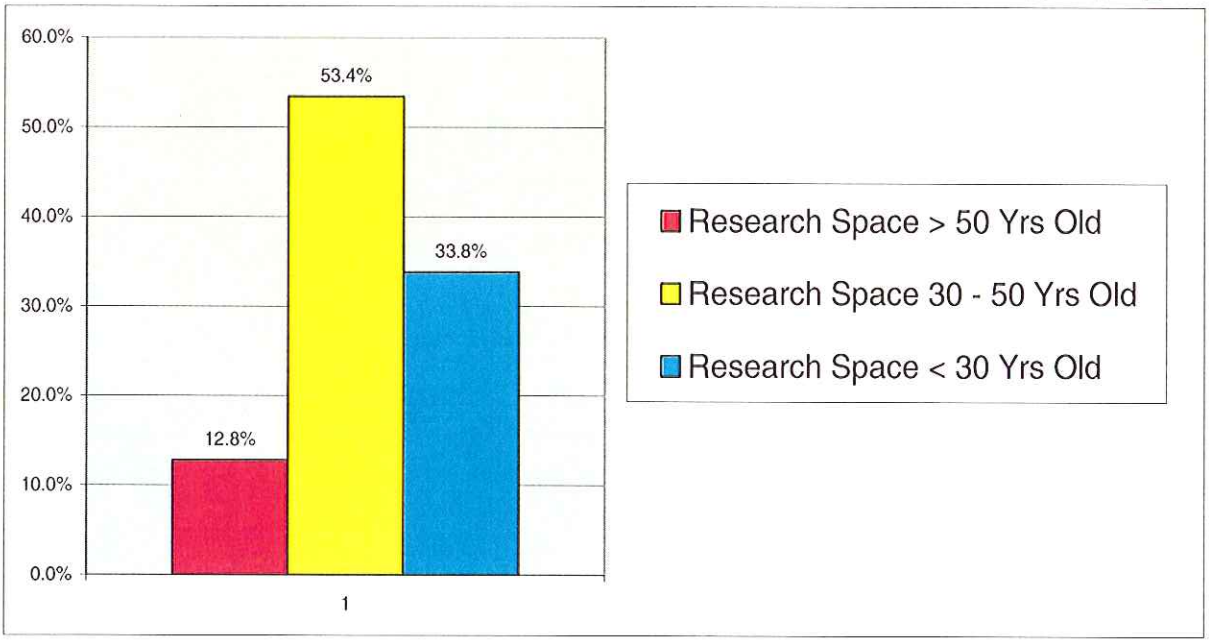


Table 7 (below) depicts the East Campus CNAS asf by Department/Group. This aspect of the space distribution forms the basis for space projections and planning on a departmental level throughout the Plan.

During the course of examination, certain space descriptions arose which lay outside the outlined criteria. Proper space assessment and planning require an understanding of these conditions.

1) The CFAMM facility located in Bourns is headed by a CNAS faculty member and is utilized extensively by CNAS Departments. The area allocated for this facility is designated as BCOE space, however, CNAS relies on this facility to conduct some research programs as well.
2) Campus clean rooms, one located in Bourns and a future unit planned for Materials Science & Engineering, are essential to Physics and Chemistry research and will be used extensively upon opening of these facilities.
3) The Earth Sciences Department houses the Geology Museum which is used primarily for teaching purposes. A portion of the Museum's display is located in the 1st Floor corridor of the Geology Building. Although the corridor area occupied by these displays is formally non-assignable space, it should be notated so that the Museum could be compensated with an equivocal amount of space should any change in this arrangement be required.
4) Assigned square footage of 53,327 in use by the Salinity Lab tabulates as CNAS space within the FMS but is unusable by the College. The Salinity Lab facility is not a UCR facility. The Salinity Lab was constructed by the USDA and is currently operated by the USDA. No UCR faculty are located at this facility. This facility should be coded separately in the FMS to avoid reflecting as assignable CNAS space. Calculations and figures included in this plan do not include asf for the Salinity Lab.

5) Germplasm of 24,767 asf is also a facility constructed and controlled by the USDA and the asf should also be recoded so as not to accrue to CNAS asf in the FMS. This asf amount has been deleted from numbers used in this Plan.

Table 7. CNAS Space on the East Campus Buildings by Department/Unit

Group Name	Research ASF	Admin ASF	Teaching ASF	*Subtotals*	Specialized ASF	*Totals*
AEE	0	3,286	0	3,286	0	3,286
APRC	5,174	0	0	5,174	0	5,174
Biochemistry	25,897	0	2,026	27,923	0	27,923
Biology	28,219	0	13,129	41,348	1,582	42,930
BNN	0	3,666	0	3,666	0	3,666
Botany	42,262	2,474	1,125	45,862	355	46,217
CCB	0	0	0	0	0	0
CellBioNeuro	21,422	0	0	21,422	0	21,422
Chemistry	69,662	4,072	26,614	100,348	9,873	110,221
Dean's Office	0	4,390	7,238	11,628	0	11,628
Earth Sciences	16,528	0	9,588	26,116	0	26,116
Entomology	62,026	3,652	3,482	69,160	0	69,160
Environmental Sciences	40,655	0	4,472	45,128	0	45,128
IGPP	4,643	207	0	4,850	0	4,850
IIGB	176	470	0	646	4,673	5,319
Mathematics	7,767	3,541	6,882	18,190	0	18,190
Nematology	6,929	0	514	7,443	0	7,443
NPPS/Biochem	0	5,861	0	5,861	0	5,861
Physics	30,067	3,960	12,135	46,162	4,471	50,633
Plant Pathology	28,343	0	514	28,857	0	28,857
Statistics	4,545	0	2,038	6,583	0	6,583
Standard Space Totals	**394,317**	**35,579**	**89,758**	**519,654**	**20,954**	**540,608**
Non-Standard Space To	**6,444**	**356**	**1,809**	**8,609**	**147,994**	**156,603**
East Campus Space Tot	**400,761**	**35,935**	**91,567**	**528,263**	**168,948**	**697,211**

IV. Space Projection Methodology

A. Background

During the 2004-05 academic year, development of the Master Space Plan began with focus group meetings including faculty, associate deans, representatives from Academic Planning & Budget and a consulting firm retained by the Capital & Physical Planning Office. Meetings were convened individually with departments to ascertain their space planning issues and future needs. Drafting of this plan began in summer 2005, with the Associate Deans' inventory of each building. Subsequently, the CNAS Space Management Committee worked to determine appropriate multipliers and strategic planning for the needs of each department. Calculations, projections, and planning are based on data obtained during summer 2005

A first draft of the plan was assembled in Fall 2005 following discussions with Capital & Physical Planning and input from CNAS department chairs. A revised draft was then vetted with Capital & Physical Planning and CNAS faculty through the department chairs. This plan is the result of this work. The CNAS Master Space Plan is intended as a continual "work in progress" due to the dynamic changes taking place in the core scientific disciplines and the emerging and rapidly developing growth of College faculty. Annual updates will be required.

B. Research Space Allocation Guidelines

In 2005, the CNAS Space Management Committee developed space allocation guidelines for the life sciences departments, which have been leveraged in broader College discussions on space planning. The CNAS Space Management Committee's recommendations have been further refined to enable the development of space multipliers for space planning purposes. *The guidelines presented below are used for current and future planning purposes only; they should not be viewed as strict space entitlements.* The Space Management Committee will begin to further formalize space management principles and policies. These principles will provide guidelines to Department Chairs for management and allocation of current and future space in department and interdepartmental buildings. In addition they allow a basis for analysis of current space allocation to departments by the Dean's office and for the development of space multipliers and projections for future CNAS expansion.

For the life sciences departments, including Agricultural Experiment Station departments, the configuration of research lab space can be typified so that the design of space required is fairly uniform. The quantity of space allocated per faculty member generally scales with the number of personnel per laboratory. Outlined here are guiding principles for the allocation of research space to individual investigators. These guidelines form the basis for the space needs calculations for the life sciences departments (including Agricultural Experiment Station departments), and have also been useful in validating the research space needs for some of the physical sciences departments. The physical sciences encompass a greater range of lab diversity due to a wide variance in equipment needs, typically involving large apparatus items such as laser tables and vacuum chambers.

Departmental variations in proposed space allocation per faculty member (PI) are based on PI equipment space needs and the number of co-workers per PI in the respective disciplines. To assist in developing projections, CNAS recommendations have been compared with space allocations of universities with similar complexities and departmental composition whenever possible. These comparative statistics were provided by Capital & Physical Planning. These groundwork formulations are presented in Appendix B.

C. Space Allocation Guidelines

The CNAS Space Allocation Committee has established a four-tier scale for research space allocations in the life sciences. The space guidelines, which include

laboratory research and support space, and research offices for graduate students/postdocs/SRA's and faculty appear in Table 8.

Table 8. Life Science Research Space Tiers and Guidelines

Research Tier	Number Personnel[A]	Research Lab Space Allocation[B]	Research Support Space[C]	Postdoc/ Grad Office[D]	Faculty Office	Total Research Allocation
Tier 1	1-3	330 asf	165	110	140	745
Tier 2	4-6	660 asf	330	275	140	1,405
Tier 3	7-9	990 asf	495	440	140	2,065
Mega-lab[E]	10-20	1,485 asf	745	700	140	3,070

[A] Number of personnel include PI, graduate students, postdoctoral fellows, SRAs, technical help, professional researchers, etc. Undergraduate researchers are not included.
[B] The Research Lab Space Allocation includes main laboratory/bench space. Calculated on the basis of 3 personnel per 330 asf (one module).
[C] Research Support includes space for instrumentation, both individual PI and shared. Calculated at 50% of Research Lab Space Allocation. In some cases, specialized equipment needs may dictate larger or smaller space allocations.
[D]Calculated at 55 asf per person (graduate students, postdoctoral fellows, SRAs)
[E]The average size of "mega" labs is estimated at 13.5 personnel.

Due to the ever increasing quality of CNAS faculty and the large investments by the College in hiring and retaining faculty, the overall competitiveness of CNAS in the federal granting arena will continue to increase. Current and new faculty will garner larger numbers of grants and grants with larger budgets. Thus, we expect the number of Tier 3 and "mega," laboratories will increase. This trend has begun; in the 2004-05 academic year, CNAS faculty were awarded grants totaling more than $64.6 million, a 41 percent increase over the previous year. (www.ora.ucr.edu/ORA/Pdf/annual2005.pdf)

D. Development of Departmental Research Space Multipliers

To evaluate current research space needs, the current research space allocations to each department and the number of research personnel per department were examined in detail. The research personnel statistics presented in each department were tabulated in March 2005. Research personnel include the PI, graduate students, postdoctoral fellows, SRAs, technical help, professional researchers, and other academic titles, but do not count undergraduate lab helpers or undergraduate researchers (as noted in Table 8). Using these data, determined the existing asf/faculty. Faculty numbers used in these calculations indicate departmental headcount as of summer 2005. We will update numbers in fall 2006.

To articulate current and future space "needs" of a department, a space multiplier is created. This space multiplier is not intended for use by Department Chairs for space allocations. It is an abstract planning parameter for the College reflecting the average space needs of a department per faculty member. The multiplier incorporates the diversity of research needs within a department that may span theoretical, field, and wet lab research. Thus, a department with faculty doing field and theory-based

research will likely be less than one with only laboratory-based faculty. Similarly, the distribution of laboratories between Tier 1, 2, 3, and mega-labs will also impact the space multiplier.

The life science multiplier was formulated based on an estimate of the number of labs in each of the research Tiers (Table 9). Based on this space allocation scale and proposed growth in the size of research teams, CNAS evaluated several possible scenarios, which varied the percentage of Tier 1, 2, 3, and "mega" laboratories. In the future, the distribution of CNAS faculty across the three tiers will skew toward Tier 3 and mega laboratories. Approximately 15%, 25%, 40% and 20% of the faculty will fall into the Tier 1, 2, 3 or "mega" lab categories, respectively, in the future (the current distribution is 34%, 31%, 22%, and 13%, respectively). The resultant space multiplier for the average molecular/cellular/biochemical laboratory College-wide is 1,950 asf. While this represents a convenient College-wide statistic, each departmental multiplier has been individually derived from the Tier-system guidelines based on departmental operations and criteria which are utilized for projection calculations.

To determine the appropriate space multiplier for a department, we have evaluated current personnel, grant trajectories, and proposed hires. The detailed rationale for each department's space multiplier is iterated in Appendix B.

A significant working assumption within the calculation of the multipliers is that research space allocations will consist of high-quality space. Given the current state of CNAS facilities, this means that we assume new or newly renovated space will be available for the faculty. Many of the aging facilities currently housing research operations require allocations of asf substantially beyond the multipliers to adequately support contemporary research functions and applications.

E. Academic Departments Factors

The research, teaching and administrative space needs of the academic departments in the College are highly diverse. Types and quantities of research space needs range from dry space in departments such as Mathematics and Statistics to fume hood intensive wet laboratories. As noted earlier, some faculty conduct field-based and theory-based research which will affect their space needs and lead to a smaller multiplier for a particular department. Future changes in the distribution of such faculty will necessitate the multiplier be adjusted accordingly.

Research space, which includes faculty laboratories and offices, research support space, and grad student and postdoc office space, comprises the vast majority of the CNAS East Campus space inventory (see Tables 5-7). A key component of current and future space planning is the location of faculty in each department or research clustering in close proximity to one another and their research staff members. A current example is the planned consolidation of IIGB faculty in the Genomics Building. This approach not only allows collaboration but also enforces a concept of "neighborhood". This allows for a higher levels of space efficiency due to the availability of shared resources, equipment, and personnel, and a local capacity for configuring space to its maximize utilization. A sense of "neighborhood" contributes to camaraderie at all levels: students, staff, faculty, visitors, etc.

The following table provides an overview by department of the per-faculty multipliers applied for estimating future research space needs and the summary rationale for each. Additional detail is contained in Appendix B.

Table 9. Summary of Research Space Multipliers in CNAS

Dept/Ctr	*Area*	*Mult.*[1]	*Space Factors*
Biochemistry	Life Sci	1,950	Wet labs needed for molecular/cellular/biochemical research. Current avg. asf is 2,026 and there is potential that new recruitments will result a few larger labs. More than half of labs are currently Tier 2, with 5.8 personnel/lab.
Biology	Life Sci	1500	This multiplier reflects a faculty distribution of 50% molecular/cellular/physiological and 50% field work, as well as the smaller average size of biology labs @ 3 personnel/lab.
Botany/Plant Sciences	Life Sci	1,950	BPS is a diverse department with field-based, computational research and molecular/cellular research. Several Tier 3 and "mega" labs are present The department averages 7-8 personnel/lab. Given this, its current research productivity, and presence of field-based PIs, a multiplier slightly below the Tier 3 level is recommended.
Cell Biology/Neuro science	Life Sci	1,950	All molecular/cellular or physiology labs. Development of HSRI anticipates some "mega-labs" will be established in this department. The department averages 5.8 personnel/lab currently. However, given that some future HSRI-type appointees will find an academic home in this department, a multiplier of 1,950 asf is recommended.
Chemistry	Physical Sci	2,200	Wet lab space required for all faculty (none are theoretical). Because of hood and equipment needs, avg. space per PI should be slightly higher than that of life science faculty.
Earth Sciences	Physical Sci	1,700	Department needs mixture of wet and dry space for the Organic and Paleoenvironmental Evolution (OPE) and Earthquake Physics groups. Multiplier calculated based on specialized needs of these groups.
Entomology	Life Sci	1,950	Sizeable department with average personnel/lab between 7 and 8. About half of faculty/CE have field-based programs. Using the same logic as for BPS, 1,950 asf/faculty is recommended.
Environmental Sciences	Physical Sci	1,300	About a quarter of faculty are economists with computational space, rather than wet labs. Faculty with labs (about 75%) average 5-6 personnel each (Tier 2). Based on this ratio, 1,300 calculated as asf needs per faculty.
Mathematics	Physical Sci	500	Includes office space (140), shared research space (210) and 50 asf for each of approx. 3 grad students per faculty.

Table 9 Continued

Dept/Ctr	*Area*	*Mult.*[1]	*Space Factors*
Nematology	Life Sci	1800	Lab personnel average 4-5 per faculty, with about 30% field-based programs, which would justify a Tier 2 space multiplier. Trend toward molecular-based programs with increased grant activity. Similar to Plant Pathology mix of fundamental and practical programs. Intermediate 1,800 between Tier 2 and Tier 3.
Physics	Physical Sci	1,400	Highly diverse department with both experimental and theoretical programs. Average of 2,140 for condensed matter, 1,000 for high energy, and 540 for theoretical, weighted by the anticipated future mix of faculty.
Plant Pathology	Life Sci	1,800	Grant expenditures on upward trajectory. Lab sizes average 5, but ~30% have field-based programs. A multiplier slightly higher than Tier 2 recommended.
Statistics	Physical Sci	540	As faculty perform both basic and applied research, they require a bit more research space on average than a purely theoretical department, because of use of high-end computational facilities. Multiplier includes faculty office (140 asf), shared research space (250 asf) and 50 asf for each of approx. 3 grad students per faculty.
Air Pollution Research Center	Physical Sci	2000	Both wet chemistry and instrumentation space needed, similar to that of analytical chemists.

[1]Includes research lab, research space, and office space for grad students/postdocs/SRAs and faculty offices.

F. Specialized Research Facilities

In addition to customary instructional and research space, the College operates a number of centers, instrumentation facilities, and remote research stations which contribute to the overall CNAS asf stated above. These "specialized facilities" cannot be easily classified into the Research, Teaching, or Administrative Space groupings. This amalgamation of facilities constitutes the category designated Specialized Facilities in this Plan.

G. Non-Standard Structures

Significant portions of CNAS asf accrue to nonstandard structures, such as field buildings, greenhouses, lath houses, etc. on the Main Campus. Located throughout the West Campus Agricultural Fields and the East Campus perimeters, these buildings provide space for fundamental growing operations, supporting research and teaching programs. Given the direct tie to research, many of the CNAS Specialized Facilities, and thus the nonstandard structures housing them, must be located in close proximity to the standard Instructional & Research (I&R) buildings on the East Campus. Table 11 provides a list of standard and nonstandard structures on the East Campus (standard buildings are also included).

Table 10. CNAS East Campus Specialized Facility Overview.

Specialized Center/Facility	Location	SpecializedASF	Inventory Unit
ACIF	PHYSICAL SCI 1	2,493	Chemistry
ACIF	PIERCE	1,195	Chemistry
ACIF	PIERCE ANNEX	470	Chemistry
AGRICULTURE EXPERIMENT STATION	COBALT 60	441	CIT RS C-AES
ARABADOPSIS GROWTH FACILITY	ARAB 1	200	Botany
BIOLOGY SHOP	SPIETH	1,582	Biology
BOTANY ELECTRONICS SHOP	BATCHELOR	355	Botany
CHEMISTRY SHOP	PIERCE	1,382	Chemistry
ELECTRONICS SHOP	PIERCE	521	Chemistry
FIELD BLDG	BIO CTRL CUL	1,852	Entomology
FIELD BLDG	PLNT DRY BLD	1,441	Environmental Sciences
FIELD BLDG	SOIL BLDG	76	Plant Pathology
FIELD BLDG	STOR 6	482	Entomology
GLASS SHOP	PIERCE	956	Chemistry
GREENHOUSE	GREENHOUSE	4,693	APRC
GREENHOUSE	GREENHOUSE	2,361	Biology
GREENHOUSE	GREENHOUSE	30,583	Botany
GREENHOUSE	GREENHOUSE	911	Entomology
GREENHOUSE	GREENHOUSE	10,105	Environmental Sciences
GREENHOUSE	GREENHOUSE	12,476	Nematology
GREENHOUSE	GREENHOUSE	19,450	Plant Pathology
GROWTH CHAMBER BLDG	GRTH CH BLDG	607	Botany
HEADHOUSE	HH STOR	1,302	Botany
HEADHOUSE	HH STOR	1,302	Entomology
INSECTARY & QUARANTINE FACILITY	EAST I&Q FAC	13,494	Entomology
INSECTARY & QUARANTINE FACILITY	EAST I&Q GH	600	Entomology
INST INT GENOMICS BIO	KEEN	4,673	IIGB
LATHHOUSE	LATH 1	200	Entomology
LATHHOUSE	LATH 3	2,400	Botany
LATHHOUSE	LATH 3	1,800	Nematology
LATHHOUSE	LATH 3	5,956	Plant Pathology
LATHHOUSE	LATH 4	3,069	Plant Pathology
LATHHOUSE	LATH B	11,956	Botany
MAIN BLDG	PHYSICAL SCI 1	2,856	Chemistry
PHYSICS SHOP	PHYSICS BLDG	4,471	Physics
PLANT TRANFORMATION RESEARCH CORE	COLD BX ROOF	1,104	Plant Transformation
PLANT TRANFORMATION RESEARCH CORE	PLANT TRANSF	3,249	Plant Transformation
SCREENHOUSE	SCRNHSE BOT	1,212	Plant Pathology
UCR BOTANIC GARDENS	BOT GDN HSE	2,266	Botanical Gardens
UCR BOTANIC GARDENS	BOTAN INFO C	121	Botanical Gardens
UCR BOTANIC GARDENS	GEODESIC DM	1,597	Botanical Gardens
UCR BOTANIC GARDENS	GREENHOUSE	3,163	Botanical Gardens
UCR BOTANIC GARDENS	HHSE BOT GDN	569	Botanical Gardens
UCR BOTANIC GARDENS	LATH LS	1,218	Botanical Gardens
UCR BOTANIC GARDENS	MULTI PURP	1,478	Botanical Gardens
UCR HERBARIUM	HERBARIUM	3,788	Botany
UCR NATURAL RESERVES	T10A	472	Natural Reserves
	Total:	**168,949**	

*Specialized facilities noted with * and their associated asf figures are incorporated within the detailed calculations, and projections throughout this Master Space Plan. **Inventory Unit refers to the unit where the space is incorporated into this plan.

Given the importance of research in plant science, greenhouses play a particularly vital role in CNAS research. These facilities provide tightly-controlled plant growth facilities within close proximity to East Campus laboratory buildings. A large amount of research in the plant sciences and pest and disease sciences requires close proximity of plant growth facilities to faculty research labs due to the need to frequently sample plants, inoculate plants with pathogens, or carry out other procedures while avoiding transportation in the open atmosphere.

Some older greenhouses on the East Campus are scheduled for demolition in the Campus Long-Range Development Plan and East/Southeast Area Study; however, the value of these research support structures has been acknowledged by the campus in the East/Southeast Area Study which provides for the establishment of a modern Plant Growth Facility Service Center on the east side of East Campus Drive as well as for rooftop greenhouse facilities on new and/or renovated buildings. Other plant growth facilities, such as the Biotechnology greenhouses and adjoining Plant Transformation Facility must remain on the East Campus. The West Campus greenhouses provide research support space for longer-term perennial crops and other plants not requiring constant attention by researchers.

The acreage-based portions of facilities such as the Botanic Gardens, Agricultural Operations fields, and Natural Reserves are not accounted for within the asf calculations. These essential facilities support research, teaching, and service for a majority of the CNAS departments and institutes and are vital to the future of CNAS. CNAS will develop a plan for land-based facilities and plant growth facilities in a separate forthcoming report to be completed during the 2006/07 academic year.

The use of many Specialized Facilities, especially those housed in nonstandard structures, does not align with the standard ratio applied to research and teaching support areas. The exception to this is the small amount of space in nonstandard structures that is currently utilized as research (6,444 ASF), teaching (1,809 ASF), or administrative space (356 ASF; see Table 11 for ASF details). For example, Nematology Professor P. Roberts has his laboratory in the head house of a green house and the Department of Botany and Plant Sciences has a teaching laboratory in the head house of a green house.

Table 11. CNAS East Campus in Non-Standard Structures

BuildingName	Group Name	Research ASF	Admin ASF	Teaching ASF	Specialized ASF	Totals
ARAB 1	Botany	0	0	0	200	200
BIO CTRL CUL	Entomology	0	0	0	1,852	1,852
BOT GDN HSE	Botanical Gardens	0	0	0	2,266	2,266
BOTAN INFO C	Botanical Gardens	0	0	0	121	121
COBALT 60	CIT RS C-AES	0	0	0	441	441
COLD BX ROOF	Plant Transformation	0	0	0	1,104	1,104
EAST I&Q FAC	Entomology	0	0	0	13,494	13,494
EAST I&Q GH	Entomology	0	0	0	600	600
GEODESIC DM	Botanical Gardens	0	0	0	1,597	1,597
GH 51	Entomology	0	0	0	455	455
GH 52	Entomology	0	0	0	456	456
GH AP FL2	Botany	0	0	0	300	300
GH AP FL3	Botany	0	0	0	300	300
GH AP FL7	Botany	0	0	0	208	208
GH AP FL8	Botany	0	0	0	208	208
GH BOT GDNS	Botanical Gardens	0	0	0	3,163	3,163
GH01 RESRCH	Botany	0	0	612	3,702	4,314
GH02A	Botany	0	0	0	2,015	2,015
GH03 RESRCH	Botany	0	0	1,197	3,128	4,325
GH06	AEE	0	83	0	0	83
GH06	Environmental Sciences	373	0	0	4,333	4,706
GH07	Environmental Sciences	75	0	0	4,632	4,707
GH08	Environmental Sciences	0	0	0	1,140	1,140
GH08	Nematology	0	0	0	2,076	2,076
GH08	Plant Pathology	0	0	0	1,385	1,385
GH09	Nematology	120	0	0	4,450	4,570
GH10	Botany	0	0	0	981	981
GH10	Nematology	1,484	0	0	1,032	2,516
GH10	Plant Pathology	0	0	0	971	971
GH11	Plant Pathology	120	0	0	4,354	4,474
GH12	Plant Pathology	0	0	0	4,586	4,586
GH13	Plant Pathology	0	0	0	4,473	4,473
GH14	Botany	0	0	0	836	836
GH14	Plant Pathology	0	0	0	3,213	3,213
GH15	Nematology	0	0	0	4,918	4,918
GH16	Biology	0	0	0	2,361	2,361
GH16	Botany	0	228	0	1,714	1,942
GH16	Nematology	248	0	0	0	248
GH17	Botany	0	0	0	4,050	4,050
GH17	Plant Pathology	0	0	0	468	468
GH18	Botany	120	0	0	4,415	4,535
GH19	Botany	240	0	0	4,385	4,625
GH20	Botany	240	0	0	4,341	4,581
GH21	APRC	0	0	0	4,693	4,693
GRTH CH BLDG	Botany	0	0	0	607	607
HERBARIUM	Botany	0	0	0	3,788	3,788
HH STOR	Botany	0	0	0	1,302	1,302
HH STOR	Entomology	0	0	0	1,302	1,302
HHSE BOT GDN	Botanical Gardens	0	0	0	569	569
LATH 1	Entomology	0	0	0	200	200
LATH 3	Botany	0	0	0	2,400	2,400
LATH 3	Nematology	0	0	0	1,800	1,800
LATH 3	Plant Pathology	0	0	0	5,956	5,956
LATH 4	Plant Pathology	0	0	0	3,069	3,069
LATH B	Botany	0	0	0	11,956	11,956
LATH LS	Botanical Gardens	0	0	0	1,218	1,218
MULTI PURP	Botanical Gardens	0	0	0	1,478	1,478
PLANT TRANSF	Plant Transformation	0	0	0	3,249	3,249
PLNT DRY BLD	Environmental Sciences	0	0	0	1,441	1,441
SCRNHSE BOT	Plant Pathology	0	0	0	1,212	1,212
SOIL BLDG	Plant Pathology	0	0	0	76	76
STOR 6	Entomology	0	0	0	482	482
T CNAS	AEE	0	45	0	0	45
T CNAS	Earth Sciences	1,252	0	0	0	1,252
T10A	Natural Reserves	0	0	0	472	472
T14	APRC	1,164	0	0	0	1,164
T7 AP	APRC	1,008	0	0	0	1,008
Space Type Totals		**6,444**	**356**	**1,809**	**147,994**	**156,603**

V. Research Space Needs

A. Renovation, Demolition, and Reconfiguration

The quality and quantity of research space is the single greatest challenge to CNAS due to the aging facilities in the college inventory. As we will show below, CNAS has a need for additional quantity of space, but an equally important concern is the quality of research space. If we are to recruit and retain outstanding faculty, we must address the *QUALITY* of our research space. Thus, the "bottom line" of asf deficit is only part of the story.

Some buildings, such as Chapman Hall have historical value and can better be used as administrative space upon renovation. The cost to renovate Chapman for modern research will be equal or above the cost of new construction and even then the configuration of space will not be in line with the needs of modern research. Buildings, such as Weber, Boyce, Life Sciences, Batchelor, Geology, Pierce, and Physics require major renovation of the building infrastructure and the laboratory facilities (see Table X for a listing of CNAS standard buildings by year of construction). Major renovation is necessary to modernize these buildings and allow efficient use of the ASF. Reconfiguration of these older buildings to provide open lab spaces with associated support rooms, and equipment areas will optimize future flexibility, space assignments, and operating costs. Space management will play an increasingly important role in the future and this must be incorporated in to the planning of new facilities and renovations of existing buildings.

Other buildings such as Spieth Hall, Boyden Hall, Fawcett Labs, UOB, and ULB are antiquated buildings that poorly utilize their footprint. These buildings represent low density land use of prime campus real estate and in the long term should be replaced with modern laboratory intensive structures that incorporate higher density (3-6 stories).

B. Calculation and Understanding of Research Space Needs

Table 12 presents an overview of research space by department at the current (2005/06), midterm (20010/11) and long term time (2015/16) frames. The research multiplier from Section III (labeled multiplier; column 2) has been used with the number of faculty projected for a particular department at the specified time frame (column 5) to develop a "multiplied ASF" (column 7). The columns labeled "Alt Multiplier" (column 3) and "Alt No. Faculty" (column 6) refer to visiting assistant professors in the Department of Mathematics. The column labeled "Planned ASF" is the current space assigned to each department for the current time frame. For the midterm and longterm time frames, "Planned ASF" refers to current CNAS ASF, and new CNAS space currently in the capital queue. Details for each department can be found in Appendix X.

Summary information on Research Space is given at the bottom of Table 12. Currently assigned research space in CNAS totals approximately 389,500 ASF, a nearly 64,600 ASF deficit from the calculated need based on multipliers using the number of faculty from 2005. To accommodate the future research needs of College faculty, we

estimate 538,000 ASF will be required in the mid-term and 632,400 ASF in the long-term.

Table 12. Research Space Overview by Department and Building
See page 41

Specialized Facilities Space Needs. As discussed above, CNAS administers a number of special facilities that support the research programs of CNAS and campus faculty – such as the Analytical Chemistry Instrumentation Facility (ACIF), Central Facility for Advanced Microscopy and Microanalysis (CFAMM), Greenhouses/Headhouses, various shops (mechanical, glass, and electronics), etc. While most of these facilities adequately serve the campus research enterprise, growth in the faculty ranks and the pursuit of new research areas will require additional facilities. Projections for existing specialized facilities are difficult to formulate due to the varied nature and functions of the many specialized facilities. For now, we anticipate the amount of ASF required to be easily incorporated to existing plans and a detailed evaluation with specific facilities and ASF requirements will be incorporated into the 2007 revision of the CNAS Master Space Plan.

Institute of Integrative Genome Biology (IIBG). The IIGB houses four cores – Microscopy and Imaging, Proteomics, Bioinformatics and Genomics – located in Noel T. Keen Hall. The Bioinformatics core will move to the new Genomics Building in 2009, providing room for future expansion of the Microscopy and Imaging and Proteomics cores, the latter of which currently has a 1-1/2 month waiting period for analyses.

Discussions about expansion or integration with the proteomics portions of the Analytical Chemistry Instrumentation Facility (ACIF) have been initiated. The Genomics Core has adequate room for expansion in the near future with the anticipated move of IIGB Director Jian-Kang Zhu's faculty laboratory to Boyce Hall in January 2007, thereby freeing up additional space in Keen Hall.

College Shops. Through consolidation of the Chemistry and Physics machine, electronics, and glass shops, the "College Shops" are being established in the Physics Building. While the move of the Chemistry machine shop is nearly complete, the Glass and Electronic Shops are delayed by the Geology/Physics Building renovation project. However, in strategizing this consolidation, it was determined that the Glass Shop, which currently occupies nearly 1,000 asf will be unable to fit into the proposed room in the Physics Building. An alternative location or additional asf will need to be found.

Animal Care Facilities. Substantial growth in vivaria space will be required to support the expanding area of health science-related research and to support the expansion of the programs of existing faculty. Approximately 8,000 ASF is planned as part of the Psychology building which began construction this summer (2006). However, existing vivaria space in Spieth and Boyce Halls is in need of upgrading. Future HSRI-related faculty will have heavy demands for high-end vivarium space. The Research Office, which currently oversees Campus vivaria, is cognizant of these

limitations. We support the development of initiatives to expand the size and increase the quality of our current animal care facilities.

Proposed Molecular Imaging Facility. Advancements at UCR in health science-related research and the establishment of a Health Sciences Research Institute will require development of capabilities in molecular imaging of small animals. This new field offers a variety of technologies for non-invasive *in vivo* studies aimed at understanding biological processes involved in both normal and pathological events. These technologies include microPET, microSPECT and bioluminescence imaging – techniques becoming more common in cancer research, pharmacology and developmental biology.

VI. Teaching Space

CNAS teaching space includes the areas assigned to function as class laboratories and support areas, lecturers offices, recall faculty offices, computer laboratories and support areas, teaching assistant offices, student advising offices and other spaces utilized to support instructional activities including but not limited to grading exams, teaching assistant meetings, teaching assistant office hours, research group meetings/discussions, oral examinations, and journal clubs. Visiting Assistant Professors in Mathematics contribute to the research program as well as the teaching program and the office/research space for these appointees has been incorporated into the research space analysis.

The teaching space needs in both quantity and configuration/type vary greatly within the college. Departments like Biology, Mathematics, Chemistry and Physics, teach the majority of science and engineering undergraduate majors in large lower division laboratory courses. In contrast, a department Plant Pathology has relatively modest class laboratory needs at the upper division (Microbiology) and graduate level.

A. Teaching Space Multipliers

Space multipliers for mid- and long-term factors are currently based solely on projected enrollment percentage increases as described below. Teaching space refers to dedicated class laboratories and does not incorporate a need for general assignment classroom space. Projections for teaching were generated by looking at the proposed growth in students relative to 2005/06 and applying a multiplication factor to project an increase in need for the midterm and long term. This type of approach incorporates our assessment that the current amount of class laboratory space is sufficient; however, quality is not addressed in this analysis.

A more detailed analysis on a course-by-course basis and incorporating new courses and changes to the curriculum is pending department-level analysis. Current methodology reflects a linear correlation to student population growth and assumes that current teaching space is adequate in both condition and location – an assumption in direct conflict with the true condition and amount of space (e. g. current teaching labs in Spieth Hall, and needs for Neuroscience wet laboratory space). A detailed evaluation will be undertaken in 2006/07 and incorporated in the 2007 update of the CNAS Master Space Plan.

The Office of Academic Planning & Budget provided the overall Campus student enrollment projections for the midterm and longterm: 21,060 and 25,000 respectively. Expressed as a percentage of current enrollment, the resultant factors are 127.2% and 152.8% respectively. Thus our projected needs for teaching space in the midterm and long term are derived from current ASF by multiplying by 1.272 and 1.528. As shown in Table 13 (below), CNAS teaching space needs go from 91,567 ASF in the current time frame, to 114,825 ASF in the midterm, and 137,934 ASF in the long term. We view this estimate as conservative given the plans underdevelopment for expansion of our teaching laboratories.

Table 13. Summary of Teaching Space Needs by Department

See Page 42

B. Teaching Space: Specific Issues

Several College-wide priorities are recommended for future space considerations, 1) increasing the quality, functionality and size of life-science class labs, 2) space allocation to strategically house and facilitate Teaching Assistant office hours and discussion section activities, 3) space allocation and design for supplementary instruction programs. These are described below.

Physical Science Class Laboratories. The Physical Sciences class labs are administered departmentally within the Chemistry, Physics and Earth Sciences departments. They will need to grow as the student population grows, but they can be largely accommodated within existing building by reassignment of the space.

Lower division Chemistry and Physics labs serve the largest number of students. Chemistry will need to expand the Chem 1 labs within Pierce Hall by utilizing some of the space currently assigned to Physics research as surge awaiting completion of the MS&E building. The organic chemistry labs may also need to utilize space in Pierce Hall in order to serve additional students. The lower division Physics labs (2 and 40) will expand within the Physics building utilizing space evacuated when the Physics department moves to the proposed Physical Sciences 2 Building.

The upper division Chemistry labs, which are only for Chemistry majors, are located in PS1, and can possibly handle the student growth. The Physics department will move its upper division labs into new space within PS2.

Earth Sciences utilizes three teaching labs, which are being moved to Pierce Hall, where they will be permanently located.

Mathematical Science Computer Labs. The Mathematics and Statistics departments have needs for computer labs for teaching undergraduate and graduate students. Currently, these labs are located in the Surge and Statistics building, respectively. The math department will increase the size of its computer labs when they move to the Physics building.

Life Science Class Laboratories. To accommodate future growth and a changing curriculum, Life Sciences class labs will require substantial investment. Configurations that allow flexible usage will assist in supporting increasing demands for state-of-the-art

class labs from multiple departments. Computer labs will require modernizing and expansion to keep pace with technological progress and curriculum changes.

The immediate need is for CNAS upper division laboratories to support students with interests in the basic life and health sciences: particularly, laboratories in microbiology (MCBL 121L), and animal/human anatomy and physiology (BIOL 161A, 161B, 170). Projections indicate that, biochemistry class lab spaces will require expansion in the near future to meet the needs of that department's majors (BCH101, BCH102, BCH 162). Future provision of upgraded and new enrollment growth-based class laboratories within CNAS "neighborhoods" will create an enhanced undergraduate and graduate training environment.

Teaching Assistant Office Space. In each department with extensive teaching responsibilities, expansion of suitable TA space is needed to conduct office hours and help sessions to keep pace with the growing student population. These needs can be evaluated on a College-wide basis to identify and correlate current and future ASF needs for optimal space utilization. This would allow departments in close proximity to one another to share office and teaching interaction space that would constitute "TA resource centers" within the College. Centralization of a significant portion of these teaching rooms in Pierce Hall would lend to efficiencies in these shared TA spaces and provide a central location convenient to students.

Undergraduate Student Advising. The College plans to consolidate and expand its undergraduate student advising operation and academic enrichment programs (e.g. CAMP, Medical and Health Careers Program, Science-Mathematics Initiative) onto the first floor of Pierce in early 2007. Academic advising is crucial to student success in CNAS because of the rigorous nature of the curriculum, the high number of course prerequisites needed, and the general level of preparedness of our incoming freshmen. The proposed centralization/relocation space (formally requested in March 2006) will ensure a high-quality, easily accessible environment for CNAS Undergraduate Advising Program as well as the College's academic enrichment and career preparation programs. Rooms for Freshmen Discovery Seminars and Freshmen Advising Seminars are also proposed. Already resident in Pierce are the Dean's Office Health Professions Advising staff and the Coordinator for Undergraduate Research. Moving the CNAS Undergraduate Student Affairs office from Batchelor will also will free up space in Batchelor Hall needed for future growth in the Botany & Plant Sciences research program.

Supplementary Instruction. In addition to the space needed for lower-division laboratory courses and upper-division laboratory/seminar courses, CNAS has a critical need for space to carry out a College-Based Supplementary Instruction Program. The need for College-based supplementary instruction, tutoring, and study groups is motivated by the anticipated divestment of these activities by the campus Learning Center as early as Fall 2007. The CNAS Student Academic Affairs Unit is proposing to launch a College-based program serving from 1,000 to 2,000 freshmen and sophomores in the entry-level "gateway" science courses (BIOL 5 series, MATH 5, MATH 9 series, CHEM 1 and 112 series, and PHYS 2 and 40 series).

General Assignment Classroom Space. While this Master Space Plan does not address general assignment classroom space on campus, it is an important part of our teaching space that must be addressed. CNAS lectures are currently held in a variety of general assignment classrooms located across the campus. Development of a campus-wide general assignment classroom plan that incorporates the need for lecture halls with demonstration capabilities and incorporation of state-of-the-art, "smart" classroom technology, is required for the campus to address future needs. In addition, the development of learning communities and the incorporation of discussion sessions in courses such as Chemistry 1 have created a huge demand for 20-45 student classrooms. Faculty are now planning how they teach around the space available, rather than seeking the type of space required to meet the needs of our students.
As the new buildings are designed, general assignment classrooms must be included to accommodate CNAS teaching. There is a particular need for lecture halls that accommodate 50, 100, 200 and 300 students. These lecture halls could double as rooms for department-based seminars, which are currently held in Statistics B650, Science Library 240, Bourns A124, or scattered across the campus.

VII. Administrative Space

Administrative space in CNAS Departments and the Dean's office currently totals 35,558 ASF and will need to increase to approximately 47,214 ASF in the long-term to accommodate the growth in faculty research and teaching programs. CNAS Administrative space is summarized in Table 14. Based on the current size of our administrative units, administrative space needs are calculated at 100 ASF per faculty member (excluding Dean's office administration). The projections for increases in administrative space are based on the increase in faculty the same way the research space projections were done.

Table 14. Summary of Administrative Space by Unit

See Page 43 for Table 14.

Several CNAS units currently have significant administrative space shortages (Botany & Plant Sciences and the AEE Administrative Service Unit). Our projections indicate that AEE will gain space in the mid-term by renovation of the Geology building, but will experience a space deficit in the long-term based on faculty growth projections. Botany & Plant Sciences, NPPS/Biochemistry and Mathematics will have administrative space shortages in the five to 10 year window. The space issues for individual departments and administrative units are discussed in Appendix B.

With regard to administrative space in the College, we recommend relocating the Dean's office administration from College Building North to Chapman Hall. This is contingent upon Entomology faculty being relocated from this obsolete research space and renovation of Chapman Hall for administrative uses by CNAS. Upon renovation, Chapman Hall would be ideally suited for this administrative use as and will place the Dean's offices in close proximity to the main academic functions of the College.

There is a crucial need in CNAS for additional conference room space. Additional and larger administrative conference rooms to meet the current and future needs are incorporated into departmental and administrative unit plans.

VIII. Overview of Projected Building Occupancy

Continued development of a CNAS academic identity within a defined portion of the Campus will promote both instructional and research opportunities for the College by allowing strategic configurations of adjacencies to support interdisciplinary groups and access to research infrastructure and shared instrumentation facilities. A summary of CNAS space by building at the current, midterm and long term time frames is included in Table 15.

IX. Conclusion

New construction and extensive renovation to update existing buildings are required to ensure a state-of-the-art scientific education and research programs well into the future. As functional, flexible space is key to attracting and retaining world-class faculty, supporting student population growth, and incorporating new programs/initiatives, ample quality facilities comprise the cornerstone to the future.

This study of CNAS facilities, targeting those on the East Campus, has outlined strengths as well as areas for development. UCR's stellar history, emanating from agricultural research, has expanded into a solid foundation of scientific research and instructional programs and is poised for continued and further eminence. CNAS welcomes this momentous period of growth and its unfolding opportunity to support, facilitate, and enhance the ascendance of UCR to an unparalleled level of prominence within the UC System and the Inland Empire. The provision of strategically planned facilities launches this vital step into the future.

Table 15. Summary of CNAS East Campus Building Occupancies
(Current and Projected)

Building	Current Use	Midterm Use	Longterm Use
Batchelor	Botany & Plant Sciences research, teaching and administration, plus College-based advising functions.	Undergraduate advising moves to Pierce Hall .	Botany & Plant Sciences will remain.
Biological Sciences 1	New building under construction. Move-in of CBNS faculty in spring 2006. Some HSRI faculty.	CBNS and HSRI faculty to continue occupying	This building will continue to be used by CBNS, with the potential that some HSRI-affiliated faculty could also continue to locate here.
Biological Sciences 2			Biology, CBNS, Botany 2012 – move in
Bourns	Approx. 3,500 asf of research space for the Department of Environmental Sciences.	Wet lab space will be vacated upon completion of wet labs renovations in the Geology Building.	**Bourns College of Engineering space.**
Boyce	Research space for Biochem, CBNS, Nematology, Entomology, and Plant Path. Biochem teaching space. NPPS/Biochem Administrative Unit. Plant Path. Move-out of CBNS and Entomology to Bio Sci 1 Bldg.	Biochem, Plant Path, Botany, Nematology faculty and HSRI and Biochem teaching. BPS to have surge research space in mid-term only pending Genomics Bldg const.	Biochemistry and HSRI faculty long-term, Plant Pathology is moved to a new Pest Management Building.
Boyden Lab	Entomology research and small amount of teaching.	Entomologists move to new Pest Management Building.	Demolish along with Old Entomology Building
Campus Surge	Department of Mathematics (2nd Floor)	No change.	Mathematics move-out. Remove from CNAS space inventory.
Chapman	Entomology research.	Move entomology to new Pest Mgt Bldg and relocate part of the Dean's office from CBN.	Relocate entirety of Dean's Office to 1st and 2nd Floors from CBN.
College Bldg North	Dean's office administrative headquarters and small amount of Entomology research.	Relocate entomologists to new Pest Management Building and partial Dean's Office move out.	Used by CE regional directors following CNAS move-out.
Ento-mology	Entomology research and administration.	No change.	No change.
Entomol-ogy Museum	Entomology research and teaching.	No change.	No change.
Fawcett	Air Pollution Research Center laboratories, AEE functions and Plant Path.	APRC relocation to Pierce Hall as Surge space. Move Plant Path faculty to Pest Management Building.	Demolish or renovate. ?APRC
Fawcett	Air Pollution Research Center laboratories, AEE functions and Plant Path.	APRC relocation to Pierce Hall as Surge space. Move Plant Path faculty to Pest Management Building.	Demolish or renovate. ?APRC
Genomics	In design, not yet constructed.	Research in BPS, Entomology, Statistics, Nematology, Plant Pathology, CBNS.	No change.
Geology	Research and teaching in Earth Sci and Envl Sci, AEE functions.	Research and teaching in Earth Sci and Env Sci, AEE functions.	No change.
Green-house	Research lab space for Nematology and Environmental Sciences. BPS teaching and research. Plant Path	Nematology vacates research lab space. Greenhouses re-urned to traditional functions.	Updated growth facilities to replace East Campus green-ouses adjacent to Fawcett Lab.

Table 15 continued

Building	Current Use	Midterm Use	Longterm Use
Keen Hall	Institute for Integrative Genome Biology; also Botany & Plant Sci faculty laboratory (on loan).	Institute for Integrative Genome Biology Core Instrumentation Facility.	No change.
Life Science	Small amt of admin space for the BNN. Offices for CBNS students associated with Bio Sci 1 Building.	No change.	No change.
MatSci Eng	Building not yet constructed.	Approx. **9,750** asf will be for nanoscience-related faculty in Physics.{Verify asf}	No change.
Pest Mgt Bldg.			Botany, Nematology, Entomology, Plant Path. 2012 – move in
Phys Sci 1	Department of Chemistry research, teaching and administration.	No change.	No change.
Phys Sci 2		Physics moves to PSII	Chemists from Pierce Annex
Physics	Department of Physics research, teaching and administration.	Some Physics faculty move to MS&E. Mathematics expansions relocates Teaching functions to Physics Bldg.	Physicists to retain research high-bay, magnet lab space. Entire Mathematics Dept. relocates here.
Pierce	Chem 1 teaching, Physics surge research, and CNAS student affairs 1st Floor. Earth Sci teaching and surge research, plus Glass Shop 2nd Floor. Env Sci teaching, research and temporary Plant Path teaching space on 3rd Floor. Surge space.	Chem teaching, CNAS student affairs, and Physics research surge space on 1st Floor. Earth Sci teaching and surge res. 2nd Floor. Env Sci research and teaching 3rd Floor. APRC 2nd, 3rd floors. IGPP 2nd floor.	Chem teaching, CNAS student affairs, Student advising on 1st Floor, Earth Sci teaching on 2nd Floor, Env Sci teaching and research on 3rd Floor. APRC 2nd and 3rd floors. IGPP on 2nd floor.
Pierce Annex	Department of Chemistry research.	No change.	Chemists move-out to new PS 2. Move-in materials science/ nano overflow from MS&E.
Spieth/ Replace	Research space for Biology, CBNS and Nematology; Biology teaching.	No change.	Demolish. Move occupants to Biological Sciences 2 Building.
Sci Labs 1	Environmental Sciences research, upper division Chemistry teaching.	No change	No change.
Statistics	Department of Statistics research, teaching and administration.	No change.	No change.
Trailers	Environmental Sciences research.	Move faculty to Pierce, APRC.	Remove from CNAS inventory.
Univ Lab Bldg	Research space for the Departments of Biology, Entomology, Nematology, Plant Pathology.	Move Entomology, Nemato-logy, Plant Path to Pest Mgt Building, Biology Research	Move Biological faculty to Life Sciences Bldg., Demolish/ Remove from CNAS inventory.
Univ Off	Biology, Nematolory Research	Same.	Demolish
Webber	Plant Pathology research on 3rd floor.	Move Plant Path faculty to Pest Mgmt. Building. HSRI growth space.	Plant Pathology and HSRI research. Possible admin space for NPPS/Biochemistry

*Boyden/SPI, Fawcett, Greenhouse headhouses, Trailers and the University Lab building are not well designed for current or future research. Furthermore, these antiquated buildings occupy strategic footprints on the UCR campus that could be better utilized by contemporary, multi-story buildings.

COLLEGE OF NATURAL AND AGRICULTURAL SCIENCES
University of California, Riverside

MASTER SPACE PLAN
2005-06 through 2015-16
Appendix B

Detailed Departmental Parameters for Research and Administrative Space

Table of Contents

I. DEPARTMENTS

Department of Biochemistry

The Department of Biochemistry maintains prominent strengths in three areas crucial to UCR's success: active research programs that span the study of the structure and function of molecules, particularly as it relates to the health sciences; a large undergraduate teaching program; and a graduate program in Biochemistry and Molecular Biology. While the department is committed to the mission of the Agricultural Experiment Station, with faculty-directed research in plant biochemistry, future growth will be directed mammalian biology, including such areas as stem cell biology, signal transduction, molecular imaging/structural biology, and epigenetics. Development in all of these areas will contribute toward the campus aspirations for a Health Sciences Research Institute and a four-year School of Medicine.

Research

Calculation of research space needs. Faculty members in the Department of Biochemistry need wet laboratories suited for molecular, cellular and biochemical research. The department does not propose to hire any strictly computational biologists in the future. For this reason, a multiplier of 1,950 asf per faculty member will be used for this department for future planning purposes. Current average asf per faculty is 2,026 and the quality of the current research space used by this department meets their needs well. The average number of personnel per faculty laboratory is currently 5.8 (Tier 2), which would support an allocation of 1,405 asf/PI. While there are no "mega-labs" in the department at this time, it is anticipated that faculty potentially associated with the planned Health Sciences Research Institute will garner larger grants and assemble larger research teams.

Biochemistry: Current and Future Research Space Needs

Multiplier	Time Period	No Faculty	Multiplied ASF	Planned ASF	BOYCE	Excess/ Deficit ASF
1950	Current	13	25,350	25,897	25,897	547
1950	Midterm	19	37,050	33,160	33,160	-3,890
1950	Longterm	25	48,750	45,980	45,980	-2,770

[1]Number of faculty does not represent a commitment of FTE. Given recent enrollment trends, it is not clear when new FTE will be allocated to the College.
[2]Based on a multiplier of 1,950 asf per faculty member.

The Department of Biochemistry is currently housed in Boyce Hall, scheduled to be renovated in a two-phase process within the next five years. Boyce Hall laboratories are designed for wet lab research. However, support spaces are in need of renovation; cold rooms in particular are in poor shape.

The Department currently has 13 faculty research labs. At the present time, most faculty are allocated equivalent amounts of space due to the current design of the laboratories.

The Department currently does not have sufficient scholarly activity rooms (1 X 200 asf). There is one large conference room on the second floor; however, smaller research conference rooms for group meetings and to enhance interdisciplinary initiatives are lacking in close proximity to Biochemistry faculty. This is an important consideration for the future utilization of space in Boyce.

Recruitments are underway for a Chair and a stem cell biologist (AY2005-06). Midterm, the department proposes searches for a structural biologist and four additional health science-related positions. The department is likely to have three additional retirements mid- to long-term (Dunn, Traugh, and Henry). This will bring the department headcount to 19 at the midterm. Growth in Biochemistry will be dependent on new IR FTE investments.

This projected space deficit in the mid-term could be resolved in various ways. First, we recommend that all teaching be removed from the research space areas and returned to research use (3,263 asf). Teaching could move to Pierce to contribute further to the student-centric use of this building. We would propose this space move immediately. The College would prefer that Biochemistry laboratories remain in the CNAS quadrant of the UCR campus to maintain and nurture a scientific academic and training environment for our undergraduates.

Additively, we propose to allocate 4,000 asf to Biochemistry from the space released by the CBNS/Entomology move out of Boyce. The remaining 9,000+ asf will be allocated temporarily to Botany as surge space pending the Genomics Building occupancy. Following which, this space will be utilized as surge for the Boyce/Webber Renovations project. Finally, in the longterm, this asf can be utilized as surge for the Batchelor Hall Renovations Phases 2-5 which will upgrade the research labs. Eventually, sometime past the longterm this space could be returned to Biochemistry use to satisfy their future growth needs.

In the long term, we anticipate growth of Biochemistry to a total of 25 faculty. With the construction of the new Pest Management Building, we propose moving current Plant Pathology and Nematology faculty out of Boyce Hall (12,820 asf) providing adequate space for growth expansion for Biochemistry into the future.

Long term, Biochemistry will need two 200-asf and one 300-asf scholarly activity rooms to meet its research and training needs.

Administration

Biochemistry belongs to the Nematology-Plant Pathology-Statistics-Biochemistry (NPPS/Biochemistry) Administrative Services Unit. This unit is described in detail in the Administrative Service Units section. Of particular concern is the lack of a Biochemistry Chair's office in proximity to the administrative staff, a situation that should be remedied in the renovation of Boyce Hall.

Department of Biology

The Department of Biology is a broad-based instruction and research unit, with research and training programs at both the undergraduate and graduate level that span disciplines from cellular biophysics to landscape ecology. Importantly, it administers and provides the support personnel for the laboratories associated with the large core classes required of all life science majors (BIOL 5A-B-C), large non-major laboratories (BIO 2 and 3), as well as several upper division laboratories in high demand by students with career aspirations in the health sciences (MCBL 121L, BIOL 161A, BIOL 161B, and BIOL 170).

Biology faculty have research expertise in: cellular and molecular mechanisms; evolutionary mechanisms, from physiology to behavior; and ecology and conservation biology. At the intersection of these foci are several interdependent research areas – evolutionary genomics and molecular evolution, evolutionary development, evolutionary ecology, and metapopulation dynamics. These areas bridge faculty research interests, support such campuswide initiatives as genome biology and environmental research, and characterize the future of research in biology. The department also will grow in the area of animal physiology and physiological evolution; these investments will directly impact health science-related research initiative. The department's goal is to maintain existing areas of strength and position itself for cutting-edge, interdisciplinary research in these emerging areas.

Research

Calculation of research space needs. A modified life science multiplier will be used for the Department of Biology. The fields that are emphasized by this Department tend to garner smaller grants from federal agencies. In March 2005, Biology faculty had 34 postdocs, grad students and techs, which averages 2.8 personnel per faculty laboratory (including the faculty member). This corresponds to the upper end of the Tier 1 laboratory category. However, it should be noted that lab sizes range from 1 to 11 at the present time and granting activity has increased substantially within the last few years. There is currently one "mega" laboratory in the department. Therefore, using the Tier 1 space allocation as the basis of a multiplier for this department would result in significant inaccuracies. It also seems unreasonable to utilize the full life-science multiplier (1,950 asf). We base the multiplier for the department on its current research trajectory per the rationale below.

The Biology Department has 10 faculty in the ecology area and nine who need more molecular/cellular labs. In the future, the planned faculty appointments retain this research balance. Approximately 50% of the faculty will need field/wet space and 50% of the faculty will need lab spaces designed for molecular/cellular studies. Faculty in the area of ecology need smaller wet labs since much of their work is done in the field. For these faculty, a research allocation between Tier 1 and 2 of 1,200 asf/faculty is appropriate. The life science multiplier for molecular/cellular faculty is 1,950; however, since the fields that are emphasized by this department currently garner smaller grants from federal agencies, a smaller multiplier is recommended. For this reason, a multiplier of 1,750 asf/faculty in the fields of cell/molecular biology is appropriate at the present time. Therefore, the multiplier for space planning for the future of the Department of Biology must reflect its proportion of the various research groups. We propose a multiplier of 1,500 asf/faculty. Should the profile of the Department change, which is likely to occur with new hires, the multiplier may need to increase in the future. The Department counts current faculty at 22.

To evaluate current space allocations in Biology, two tactics were taken. Based on the average lab size (2.8 personnel/PI), the Department would justify Tier 1 space allocations (746 asf/faculty). On this basis, the Department would need 14,155 asf to meet its current research needs. However, the space that is allocated to the Department is of poor quality since its faculty are located in Spieth, University Lab Building and University Office Building. The department's current research asf per faculty member is ~1,400, which is close to the proposed multiplier for the future. Temporary space in Life Science (1,935 asf) has been allocated to house Biology a portion of its 34 graduate students and postdocs (~2,000 asf).

Planned faculty investments will strengthen the Biology Department's integration of cell and developmental biology to evolution to ecology and conservation biology. We anticipate adding one faculty by the midterm and four additional faculty in the long-term plan. Space needs will result in a longterm space deficit of over 38,000 asf.

Biology: Current and Future Research Space Needs

Multiplier	Time Period	No Faculty	Multiplied ASF	Planned ASF	LSP BLDG	SPIETH	UNIV LAB BLDG	UNIV OFC BLDG	Excess/ Deficit ASF	NEW BLDG - BIOLOGICAL SCIENCES 2	NEW BLDG - SPIETH REPLACEMENT
1,500	Current	22	33,000	28,219	2,195	20,685	4,976	363	-4,781	0	0
1,500	Midterm	23	34,500	29,774	2,195	22,240	4,976	363	-4,726	0	0
1,500	Longterm	27	40,500	2,195	2,195	0	0	0	-38,305	15,004	23,301

[1]Number of faculty does not represent a commitment of FTE. Given recent enrollment trends, it is not clear when new FTE will be allocated to the College.
[2]Based on a multiplier of 1,500 per faculty member.

Spieth Hall is poorly configured and ill-equipped to support current or future research in the life sciences. The infrastructure is antiquated and research labs grossly outdated. Additionally, there are vibration concerns on upper floors. While this building must harbor Biology faculty in near- and mid-term, removal of the Biology department from this space would be recommended in the long term. Spieth will need extensive lab renovations to accommodate new hires.

University Laboratory Building was constructed as a temporary research building. It is poorly suited to the research conducted by Biology faculty. There is inadequate space for research offices to house personnel and faculty. All faculty have their academic offices in remote locations (Spieth) and students and postdocs are either in University Office Building, Spieth, or the basement of Life Science. Such dispersed facilities lead to inefficient work operations.

The Biology faculty do not currently have sufficient scholarly activity spaces. The department has one administrative conference room (the Darwin room). For a faculty of 19, the Department currently needs two scholarly activity rooms. We propose adding two 300 asf conference rooms in Life Sciences (first floor) to facilitate scholarly interactions as soon as possible (this is reflected in the midterm number).

Given the current space deficit that the Biology Department will experience (based on a multiplier of 1,500 asf), we propose permanent allocation of 1,925 asf in the Life Science building to the department to accommodate students and postdoctoral fellows. This will allow the space in Spieth to be primarily used for research and research support. In requesting this Life Science basement space, we consider this a temporary fix since this space is substandard, as it floods during the rainy season.

In the mid-term, Biology faculty will grow to 23 and a space deficit of over 4,700 asf will exist. Mid-term, the College proposes to retain space in University Lab Building and University Office Building. Space in Spieth will increase due to the release of the Martins-Green space from CBNS and return of space that was loaned to CBNS for Martins-Green (1,555 asf net gain).
In the long term, when faculty numbers rise to 27, Biology will have a space deficit of ~ 38,000 asf. This deficit occurs due to relinquishing obsolete space in University Office Building , University Lab Building, and Speith Hall from the CNAS space roster. Construction of larger capacity, contemporary research buildings to support progress is sorely needed.
With the proposed consolidation of Nematology in a portion of a proposed Pest Management Building, Biology will recover an additional 4,493 asf. However, we also propose to return a wing of Life Sciences (rooms 1338-1383) to teaching laboratories. Biology will lose 3,372 asf of research space in this conversion.

Spieth remains a substandard building for life science research. Improvements in the infrastructure of this building must be made or life science laboratories should be

relocated as they become further impaired in the current space. It is possible that less demanding ecology/evolution labs could exist in this building after significant infrastructure upgrades. It will be hard to support molecular/cellular labs in the building due to electrical fluctuations and vibration issues.

Administration

Biology belongs to the BNN Administrative Services Unit, serving the Departments of Biology and Cell Biology & Neuroscience, as well as the Natural Reserves. This unit is described in detail in the BNN unit section. The Department lacks adequate research conference rooms to promote scientific exchange. We propose retaining the Darwin Room (Spieth 1239) as administrative space for the department. Two additional 10-15 person conference rooms are needed to facilitate research interactions. These can also be carved out of space in Life Science.

Department of Botany & Plant Sciences

Botany faculty have appointments with varying Instruction & Research (IR), Organized Research (OR) and Cooperative Extension (CE) FTE ratios. The Department's faculty fall into three broad areas with regard to their research, teaching and extension: 1) Ecology, Systematics and Evolution; 2) Cell, Molecular and Developmental Biology; and 3) Germplasm Development and Improvement, and Horticultural Sciences; with overlap among all categories. Within these areas, faculty have research programs that address pure science in plant biology to applied questions directly impacting growers.

The Department has been exceptionally successful in grantsmanship in recent years, with contract and grant expenditures per faculty FTE increasing by more than 50% between AY 2002-03 and AY 2004-05 to $252,000. Several high-profile grants help account for this dramatic growth – UCR's first-ever NSF IGERT (Integrative Graduate Education and Research Traineeship) program and the highly successful NSF Research Experiences for Undergraduates program in plant cell biology. In addition, the department's faculty garner large biodiversity, genomics and NSF 2010 program grants.

Research

Calculation of research space needs. BPS has one of the highest personnel to laboratory ratios in the college at 7.7. This corresponds to mid-Tier 3 for the average lab (2,065 asf). The department has faculty that conduct field and computational biology research (who need slightly smaller space), as well as molecular/cellular biology. With these factors in consideration, and given the presence of several mega-labs in the department, the multiplier for Botany and Plant Sciences is recommended to be 1,950 asf.

As of Fall 2005, BPS had a total of 35 faculty who conduct research. This headcount includes a new hire Louis Santiago, since space has been allocated to his laboratory. Dr. Grantz, whose laboratory is located at the Kearney Station, is not included in the faculty headcount for space planning purposes.

Growth in BPS is dependent on new IR FTE investments, reinvestment of OR FTE, and replacement and new CE FTE. In the long-term, it is anticipated that BPS faculty will total 49.

Botany and Plant Sciences: Current and Future Research Space Needs

Multiplier	Time Period	No Faculty	Multiplied ASF	Planned ASF	BATCHELOR	BOYCE	GENOMICS BLDG	KEEN	GREENHOUSE/ TRAILER	Excess/ Deficit ASF	NEW BLDG - BIOLOGICAL SCIENCES 2
1950	Current	35	68,250	42,863	40,503	0	0	1,760	600	-25,387	0
1950	Midterm	42	81,900	73,303	40,503	3,600	26,840	1,760	600	-8,597	0
1950	Longterm	49	95,550	77,306	40,503	0	36,203	0	600	-18,244	18,244

[1]Number of faculty does not represent a commitment of FTE. Given recent enrollment trends, it is not clear when new FTE will be allocated to the College.
[2]Multipler = 1,950 per faculty member.

BPS is currently housed in Batchelor Hall and Keen Hall occupying over 42,000 asf. The space allocation in Keen Hall is a temporary allotment to accommodate the hire of Dr. Jian-Kang Zhu (Director of the Institute for Integrative Genome Biology).

With 35 laboratories, the average space allocation to BPS is ~1,230 asf/faculty member. Using the 1,950 asf/faculty multiplier, the Department currently has a research space deficit of more than 25,000 asf. Batchelor Hall is not well equipped to support current or future research in the life sciences. The infrastructure is antiquated and research labs outdated. Support space for equipment is lacking since halls are crowded with incubators, freezers, and growth chambers. Planning for renovation of the infrastructure (phase I) of Batchelor Hall is in progress.

The Department is in desperate need of scholarly activity rooms to facilitate research group meetings, student qualifying exams, etc. At the present time, there is one

administrative conference room (BH2158) that is used for faculty meetings and there is only one other meeting room (BH4169; 170 asf) available to 35 faculty for scholarly activity. With 35 faculty, there is an immediate need for a minimum of 3 additional scholarly activity rooms at 200-250 asf per room.

The BPS department has 7.7 personnel/faculty laboratory. This translates to approximately 230 personnel (not counting faculty members) who need shared office space. If an average of 55 asf is provided per personnel, the Department currently needs > 12,000 asf to house its research personnel. Currently all personnel are housed outside of laboratories in Batchelor Hall due to building design and only 6,200 asf is currently available for research offices for students, postdocs, research staff and other academic appointments. The release of approximately 2,100 asf from the BPS admin office move to the first floor of Batchelor Hall (see below) will provide needed space for BPS students and postdoctoral fellows.

To accommodate searches in the next three years, we propose allocation of three laboratories in Boyce Hall on a temporary basis to house two new plant cell biologists and a plant evolutionary biologist (~3,600 asf). The plant cell biologists will move into the Genomics Building and it is likely that the evolutionary biologist will move into Batchelor Hall.

Midterm, when the Genomics Building is completed (Winter 2009), a minimum of six current cell and molecular BPS faculty and the two new plant cell biologists will move out of Batchelor and Boyce freeing up ~11,817 asf space in Batchelor Hall and returning Boyce space to the College. These faculty will occupy an estimated 26,840 asf in the Genomics Building. In addition, Thomas Girke (BPS Academic Coordinator) will move the Bioinformatics Core to the Genomics Building and JK Zhu will move his laboratory out of Keen Hall to the Genomics Building, returning 2,574 asf to IIGB. The eight plant cell biologists from BPS will have adequate scholarly space in the Genomics Building. The need for scholarly space for the remaining 36 faculty will continue to be severe.

Alternatively, we propose either (1) moving other members of the Center for Plant Cell Biology with research emphases in the area of functional genomics into the Genomics Building as these faculty garner large genomics grants and would complement the research programs of faculty currently proposed for this building, or (2) move new hires in the field of agricultural genomics into the vacant spaces on the 2nd and 3rd floors of the Genomics Building. These new faculty may have interests more integrated with BPS faculty that will remain in the renovated Batchelor Hall; however, they are anticipated to garner large research grants. This allocation would contribute 9,363 asf to the Department of BPS (added to the BPS space long-term) as reflected in the projected figures

In the long-term, Botany and Plant Sciences will add 14 additional faculty to their ranks to reach a total of 49. At this time, the department would need 95,550 asf to accommodate its faculty

The space deficit in BPS is present now and will be slightly alleviated with the Genomics building. It is clear that there is great urgency in the need to plan for a new Biological Sciences 2 building, as the BPS department has acute needs for contemporary laboratories.

Impact of a renovation of Batchelor Hall. The proposed renovation of Batchelor Hall will cause several major changes to space use in this building. First Floor: Administrative space including the BPS admin. unit, Graduate Student Affairs office, and two teaching labs (9,212 asf) is proposed. BH 1001, 1001A, and 1001B will be converted into a large administrative conference room (1,162 asf). The 2nd, 3rd and 4th floors will be solely used for research activities. The current renovation plan adds approximately 5,563 asf to BH research, including large computational labs totaling 1,312 asf, and can accommodate up to 24 faculty by applying the space multiplier to the overall asf.

Administration

The BPS Administrative unit, serving 35 BPS faculty, is housed on the second floor of Batchelor Hall with one administrative conference room (BH 2158; 467 asf). The Administrative unit uses 228 asf in greenhouse 16 for its computer server and this is included in the administrative asf value in the table below.

Botany & Plant Sciences: Current and Future Administrative Space Needs

Multiplier	Time Period	No Faculty	Multiplied ASF	Planned ASF	BATCHELOR	GENOMICS BLDG	GREENHOUSE / TRAILER	Excess/ Deficit ASF	NEW BLDG - BIOLOGICAL SCIENCES 2
100	Current	35	3,500	2,702	2,474	0	228	-798	0
100	Midterm	42	4,200	2,614	2,474	140	0	-1,586	0
100	Longterm	49	4,900	2,614	2,474	140	0	-2,286	2,286

[1]Number of faculty does not represent a commitment of FTE. Given recent enrollment trends, it is not clear when new FTE will be allocated to the College.
[2]Based on 100 asf/faculty.

As can be seen in the table, the unit is currently under-spaced by 798 asf. The department lacks adequate interactive research space for lab meetings and student qualifying exams. There is one administrative conference room (BH 2158) and one scholarly activity room (BH 4169; counted in the research asf), totaling 637 asf to support 35 faculty. This clearly inadequate for the department's current and future needs.

The mid- and long-term plans for the BPS administrative unit are based on the premise that the College undergraduate advising services currently located on the first floor of Batchelor Hall will relocate to Pierce and that Bachelor Hall will undergo renovation. Should the advising center and Biological Sciences Advising Office relocation (3,244 asf) be accomplished, the Department's current administrative needs (3,500 asf) could be accommodated on the first floor of Batchelor. To accommodate the administrative conference room (for 49 faculty long term), a conference room of approximately 1,000 asf is needed. We propose converting the current Graduate Student Affairs office in Batchelor Hall into this large administrative conference room. The Graduate Student Affairs Office (currently 939 asf) will be moved to the first floor of Batchelor Hall in close proximity to the BPS administrative offices after the Batchelor Hall renovation. It is hoped that this move will allow for expansion of the Graduate Student Affairs office due to increased graduate student enrollment.

Department of Cell Biology & Neurosciences

The Department of Cell Biology and Neuroscience has defined several areas of strength upon which the Health Science Research Initiative could build, including glial-neuronal cell interactions, genome maintenance and stability, stem cell biology, and proposes to build in the area of infectious disease. For the first three areas, UCR has current strengths and unique opportunities for investment and centers of excellence which have been proposed. The area of infectious disease will complement the College's investments in Vector-Disease Research and enhance a critical area of health-related research.

Research

CBNS is a relatively young department, with 18 faculty currently. The relatively youthful nature of the Department means we anticipate there will be only one retirement over the next 5 years. Growth in CBNS is dependent on new FTE investments.

The recruitment of the Director for the HSRI will be underway shortly; this Director may choose CBNS, Biology or Biochemistry as an academic home. In addition, it is anticipated that five HSRI faculty hired in the next few years will find homes in this Department. Should all of these positions come to fruition, there is potential for the department to add 9 faculty members in the mid-term. In the long-term we anticipate further additions of 5 HSRI faculty to total 29 faculty.

Calculation of research space needs. All faculty in the Department of Cell Biology and Neuroscience have molecular/cellular or physiology labs. The average number of personnel per laboratory is currently 5.8. This places the average CBNS laboratory at the top end of the Tier 2 category. The life science multiplier of 1,950 asf is most appropriate for this department.

Cell Biology and Neuroscience: Current and Future Research Space Needs

Multiplier	Time Period	No Faculty	Multiplied ASF	Planned ASF	BIO SCI BLDG	BOYCE	GENOMICS BLDG	LSP BLDG	SPIETH	Excess/ Deficit ASF	NEW BLDG - BIOLOGICAL SCIENCES 2	NEW BLDG - SPIETH REPLACEMENT
1950	Current	18	35,100	21,422	0	10,745	0	0	10,677	-13,678	0	0
1950	Midterm	23	44,850	42,705	29,677	0	1,873	3,660	7,495	-2,145	0	0
1950	Longterm	29	56,550	35,210	29,677	0	1,873	3,660	0	-21,340	13,845	7,495

[1]Number of faculty does not represent a commitment of FTE. Given recent enrollment trends, it is not clear when new FTE will be allocated to the College.
[2]Based on 1,950 asf per faculty member.

CBNS faculty are currently located in Boyce and Spieth, the latter of which is antiquated and not suitable for future research needs in molecular/cellular biology. The department's current research asf per faculty member is ~1,450, which is lower than the proposed research multiplier would justify (1,950 asf). At the present time, CBNS has a space deficit of 13,678 asf.

In the mid-term, CBNS will release all space in Boyce Hall (10,745 asf). A majority of the CBNS Department will be consolidated in the new Biological Sciences Building in the winter of 2006 (~29,667 asf). Floors will cluster current and future faculty with interests in glial-neuronal cell interactions, cell-cell interactions and signal transduction (including stem cell biology), and genome maintenance and stability. The Biological Sciences building will also house one faculty member with a partial appointment in CBNS. This space allocation is noted in the Entomology space plan. The Biological Sciences Building provides conference rooms on each floor to accommodate meetings.

When the Genomics Building is on line, Karine LaRoche will move to the new Genomics building (1,873 asf). The vacated Biological Sciences space will be used for an HSRI hire. Some space in Spieth will be retained due to the rapid growth of this Department. The research spaces currently allocated to Hatton, Currie, Talbot, Parpura, Huh, and Zidovetski labs will be retained in Spieth (7,495 asf).

The new Biological Sciences Building lacks sufficient postdoctoral and graduate student offices. The 2nd floor of the Life Science Building (former psychology wing) will be used to house these research personnel. To accommodate the personnel for the 10 faculty members that will move to the Biological Sciences building in May 2006, approximately 2,250 asf will be needed immediately. The Biological Sciences building will be filled by 2007-08 and an additional 2,250 asf of space for students, postdoctoral fellows, and professional researchers will be needed in the Life Sciences Building. This is based on a very conservative estimate of 6 personnel per PI. It is likely that these faculty will be members of the HSRI and should be supporting 6-8 graduate students and 2-3 postdoctoral fellows. This estimates that the faculty in the Biological Sciences Building will require 4,500 asf at midterm.

In addition, CBNS faculty that remain in Spieth need space to house their students and postdoctoral fellows. Therefore the demand for research support offices was also calculated based on the current and future faculty of CBNS and current personnel/PI. At the present time, CBNS faculty have approx. 67 graduate students and postdocs. Based on 44 asf per graduate student /postdoc, the Department currently needs 2,700 asf of suitable office space to house these personnel. Mid-term faculty numbers are to increase to 24. If lab sizes are similar in size during the interim period (5 people/lab), CBNS will require approximately 5,400 asf to house personnel. In the Biological Sciences DPP, the 2nd floor of the Life Science Building (3,660 asf) was to be dedicated to housing students and postdoctoral fellows, thus we anticipate a significant deficit in the mid-term. If most laboratories reach Tier 3 levels and mega-laboratories are established, the research office space deficit will become more severe mid-term. A larger space allocation for research support offices is needed.

In the long-term, CBNS will add five additional faculty to its ranks, bringing the total to 29. Its space deficit will increase in excess of 20,000 asf. This may be an underestimate of the future space needs of this department. If HSRI faculty are to have labs supporting 6-8 graduate students as well as postdoctoral fellows and professional researchers, the multiplier of 1,950 asf/faculty member may not be an adequate indicator of future space needs.

The long-term space deficit for CBNS may be alleviated by: (1) the construction of a university HSRI building (not addressed in our current plan), (2) location of new CBNS faculty in the existing Life Science Building, or (3) placement of new faculty in a new Biological Sciences 2 Building.

Administration

CBNS belongs to the BNN administrative unit, serving the Departments of Biology and Cell Biology & Neuroscience, as well as the Natural Reserves. This unit is described in the BNN unit section.

Department of Chemistry

The UCR Department of Chemistry has a very active, outstanding research program – one that consistently has among the highest grant expenditure per PI rates in the college, with much of its grant income coming from the National Institutes of Health. Exceptional junior and senior level faculty appointments in recent years have propelled Chemistry toward the status of a top-tier department nationally.

The space needs of the department are driven by the very active research activities of the faculty. Many of the faculty support large programs, typically between seven and eight personnel per lab (excluding undergraduate students). Also, the UCR Chemistry department currently has no theoretical chemists, which results in an increased asf need per faculty when compared with other universities. Thus, the space needs of the

Chemistry department are higher than those of other CNAS departments, and even higher than those of other chemistry departments within the University of California.

Chemistry departments are traditionally divided up into the areas of physical chemistry, organic chemistry, analytical chemistry and inorganic chemistry. At UCR, there is much integration among these traditional sub-disciplines, resulting in considerable depth in materials, biological and environmental chemistry. The department plays a major role in UCR's materials science and nanotechnology initiative and, through partnership with the Air Pollution Research Center, in the environmental sciences initiative. Planned growth in biomaterials, biophysical, bioanalytical and bioorganic chemistry is expected to result in strong interconnections with the Health Sciences Research Initiative.

Research

Calculation of research space needs. For the purposes of space planning, department research can be divided into three major types of research labs: Organic/Inorganic, Physical and Analytical. The space needs vary somewhat between each of these groups.

The *Organic/Inorganic group* has similar space needs as those of the life science faculty (wet lab bench-type research space that scales with the number of people per lab) and their group, on average has 7.5 personnel per lab. However, the multiplier we propose (2,265 asf) is slightly higher than the corresponding life sciences value due to the fact that hoods required for this research occupy additional space (estimated at 200 asf per faculty).

The *Physical Chemistry group* primarily requires instrumentation labs and thus has space needs that scale more closely to the size of the equipment rather than the number of personnel per lab, although at UCR this group does average six to seven personnel per faculty. Physical chemists require space for large pieces of equipment, with the typical research group occupying roughly 2,140 asf. This number includes a laboratory of 1,500 asf, shared facilities and student/postdoc offices of 500 asf (one-third ratio), and a faculty office of 140 asf. The 1,500 asf average for the research lab assumes that new and less active faculty would have a 1,000 asf research lab, but that senior faculty often require a lab of 2,000 asf or more.

Analytical Chemists utilize a mixture of lab bench space and instrumentation. The multiplier estimated for this group is roughly halfway between the organic/inorganic and physical chemists, or 2,200 asf per faculty.

The anticipated future distribution among these areas, including current recruitments and future planned recruitments is: 21 in the Organic/Inorganic group; 13 in the Physical Chemistry Group; and four in the Analytical Chemistry group. Using this weighting, the average asf per faculty member is calculated at 2,200.

In 2005-06, Chemistry has 26 faculty. The plan over the next 10 years is to increase the total number of faculty to 38. This will require additional space to house the department in the long term.

Chemistry: Current and Future Research Space Needs

Multiplier	Time Period	No Faculty	Multiplied ASF	Planned ASF	PHYSICAL SCI 1	PIERCE ANNEX	Excess/ Deficit ASF	NEW BLDG - PHYSICAL SCIENCES 2
2200	Current	26	57,200	69,662	55,678	13,984	12,462	0
2200	Midterm	31	68,200	69,662	55,678	13,984	1,462	0
2200	Longterm	38	83,600	55,678	55,678	0	-27,922	27,922

[1]Number of faculty does not represent a commitment of FTE. Given recent enrollment trends, it is not clear when new FTE will be allocated to the College.
[2]Multiplier = 2,200 asf/faculty member.

The Chemistry department research is currently housed in two main buildings, Physical Sciences I and Chemical Sciences (or "Pierce Annex"), which will serve the department's needs through the mid-term. However, there will be a deficit of research space in the long-term, which could be designed into the new Physical Sciences 2 building.

Administration

Calculation of administration space needs. The Chemistry department has its administrative headquarters housed entirely in the recently opened Physical Sciences. Using an administrative multiplier of 100 asf per faculty member, the department's administrative space needs will be adequate over the next 10 years.

Chemistry: Current and Future Administrative Space Needs

Multiplier	Time Period	No Faculty	Multiplied ASF	Planned ASF	PHYSICAL SCI 1	Excess/ Deficit ASF
100	Current	26	2,600	4,072	4,072	1,472
100	Midterm	31	3,100	4,072	4,072	972
100	Longterm	38	3,800	4,072	4,072	272

[1]Number of faculty does not represent a commitment of FTE. Given recent enrollment trends, it is not clear when new FTE will be allocated to the College.
[2]Multiplier = 100 asf/faculty.

Department of Earth Sciences

The Department of Earth Sciences has recently become reinvigorated, due in large measure to high-profile hires that have further strengthened the research areas of Organic and Paleoenvironmental Evolution and Earthquake Physics. Notable hires include National Academy of Sciences Member James Dieterich, who adds additional vigor to the geophysics group and who has enabled UCR to become a core member institution of the Southern California Earthquake Center, along with Caltech, Columbia, Harvard and MIT. Biogeochemist Timothy Lyons positions the department to expand astrobiology research. Faculty regularly publish in high-impact journals such as *Science* and *Nature* and the graduate program concentration in organic and paleoenvironmental evolution has a national reputation. In addition to an undergraduate major in geology that has grown commensurately with campus enrollment expansion, the Department teaches a large number of courses for non-science majors relative to other departments in the College.

Research

Calculation of research space needs. The Earth Sciences Department has two major thrusts: Organic/ Paleoenvironmental Evolution (OPE) and Earthquake Physics. Both the OPE and Earthquake groups require a mixture of wet and dry space for research.

The OPE group is made up of experimental geochemists (4 faculty), who require a combination of wet lab bench space and instrumentation labs, which are similar needs to those of the analytical chemists. Thus, we will use 2,200 asf as the multiplier for this group. Others in the OPE group (4 faculty) utilize a mixture of laboratory and field-based research, and require less wet lab space. We will use 1,600 (slightly higher than Tier 2) asf per faculty for this subset of faculty.

The earthquake physics group is split between experimentalists and modelers. The former group (2.5 faculty) utilizes large pieces of equipment, and would require labs of 2,100 asf on average (1,400 asf laboratory plus 700 asf research support), yielding a multiplier of 2,240 with the addition of faculty office. The modelers (2.5 faculty) do computational work, and would thus require a multiplier of 540 asf, similar to the needs of Statistics and theoretical physicists. (National Academy of Sciences member James Dieterich's work spans both the experimental and modeling groups.)

When using these numbers in conjunction with the makeup of the department, a multiplier of 1,704 asf is obtained, which we round down to 1,700. Personnel per laboratory in this department is currently 3.8, which might suggest a lower multiplier. However, the specialized equipment needs of the geochemists and earthquake physics experimentalists justify the higher proposed multiplier.

Earth Sciences: Current and Future Research Space Needs

Multiplier	Time Period	No Faculty	Multiplied ASF	Planned ASF	GEOLOGY BLDG	PIERCE	GREENHOUSE/ TRAILER	Excess/ Deficit ASF
1700	Current	13	22,100	17,780	14,358	2,170	1,252	-4,320
1700	Midterm	14	23,800	26,679	26,679	0	0	2,879
1700	Longterm	15	25,500	26,679	26,679	0	0	1,179

[1]Number of faculty does not represent a commitment of FTE. Given recent enrollment trends, it is not clear when new FTE will be allocated to the College.
[2]Multipler = 1,700 asf/faculty.

The Earth Sciences department is currently housed in the Geology building, with a small amount of space taken up in Pierce Hall and in trailers. The Geology building will soon undergo an extensive renovation, expected to be completed by fall 2007. At that time, the department's research needs can be met entirely within the Geology building, so the department will release research space currently utilized in Pierce Hall and the trailers, which constitutes substandard space remotely located from the rest of the department.

Administration

Environmental Sciences is administered by the AEE administrative cluster (discussed in a subsequent section of this plan).

Facilities

The Department of Earth Sciences administers the campus's extensive rock and mineral collections, maintained in the sub-basement of Geology and on the first-floor corridors of the building. This space is not counted as research, teaching or administrative asf. It also operates and maintains the Earth Sciences Museum, under the direction of Museum Scientist Marilyn Kooser, in the corridors of the Geology building. While not occupying assigned space, it is a popular "public face" of the department – visited by K-12 teachers and their students and prospective UCR students – that should be maintained.

Department of Entomology

The Department of Entomology is among the elite of Entomology Departments in the nation. In a recent ranking of Entomology departments by the Institute for Scientific Information (July 4, 2005), UCR ranked second only to the University of Florida (UC Davis ranked 5th). The entomology department at UCR has the highest contract and grant expenditures per faculty in CNAS ($253,773 in AY2005), a position it has held for several years.

Faculty in the department generally have active laboratories of between two and 20 research personnel, averaging seven to eight per faculty member. A significant portion (~50 %) of faculty are Cooperative Extension Specialists or otherwise have primarily field-based programs. Following the same logic as used for Botany and Plant Sciences,

an average of 1,950 asf/faculty was assumed for research space needs for Entomology. We project modest growth of the Entomology faculty from 35 currently to 38 in the mid-term, and 40 in the long term.

About two-thirds of the current faculty are housed in excellent new space in the Entomology building, but several are housed in substandard research space (Chapman, Boyden/SPI, University Lab Building, and College Building North), which should be removed from the CNAS research space inventory, and new space assigned.

Research

Entomology has adequate total space for its current needs, but a considerable amount of that space is substandard for research purposes. This includes space in Chapman Hall, Boyden/SPI, College Building North, and University Laboratory Building. We propose gradually taking these buildings out of the Entomology space inventory, starting with one floor of Chapman, after some entomologists move to the new Genomics building. The released space in Chapman could be renovated for administrative space to provide a new location for the CNAS Dean's office. In the long term, we propose consolidating Entomology faculty from the substandard space listed above to a new Pest Management Building, along with faculty laboratories from Plant Pathology and Nematology. This new building could be constructed at the site of the old entomology building and SPI/Boyden, as suggested in the recent East/Southeast Campus Plan. Entomology would need approximately 18,746 asf of research space in this new building, as illustrated in the table below.

Entomology: Current and Future Research Space Needs

Multiplier	Time Period	No Faculty	Multiplied ASF	Planned ASF	BOYCE	CHAPMAN	COLL BLDG NO	ENTOM MUSEUM	ENTOMOLOGY BLDG	GENOMICS BLDG	SPI/BOYDEN	UNIV LAB BLDG	Excess/ Deficit ASF	NEW BLDG - PEST MANAGEMENT
1950	Current	35	68,250	62,025	2,529	7,966	2,198	3,489	38,796	0	6,179	868	-6,225	0
1950	Midterm	38	74,100	65,486	0	4,056	2,198	3,489	38,796	13,115	0	868	-8,614	0
1950	Longterm	40	78,000	58,364	0	0	0	3,489	38,796	13,115	0	0	-19,636	19,637

[1]Number of faculty does not represent a commitment of FTE. Given recent enrollment trends, it is not clear when new FTE will be allocated to the College.
[2]Multiplier = 1,950 asf.

Administration

Current administrative space for Entomology is adequate. We project that additional administrative space of 148 asf will be needed in the mid-term, and 348 asf will be needed in the long-term. There is adequate additional office space on the first floor of the new Entomology building, across the lobby from the administrative area, to accomplish this. This additional space is currently used as faculty and graduate student office space, which could be accommodated in a new Pest Management Building.

Entomology: Current and Future Administrative Space Needs

Multiplier	Time Period	No Faculty	Multiplied ASF	Planned ASF	ENTOMOLOGY BLDG	Excess/ Deficit ASF	NEW BLDG - PEST MANAGEMENT
100	Current	35	3,500	3,652	3,652	152	0
100	Midterm	38	3,800	3,652	3,652	-148	0
100	Longterm	40	4,000	3,652	3,652	-348	348

[1]Number of faculty does not represent a commitment of FTE. Given recent enrollment trends, it is not clear when new FTE will be allocated to the College.
[2]Multiplier = 100 asf/faculty member.

Facilities

Specialized facilities outside of the main Entomology building that support research for this department include the Insectary and Quarantine Facility, the Entomology Research Museum, greenhouses at Agricultural Operations, and other smaller support buildings, all of which are adequate for the department.

Department of Environmental Sciences

The Department of Environmental Sciences is currently a medium-sized department with average grant expenditures of just over $100,000 per faculty member annually. However, as the department is aligned with the campus-wide Environmental Research Institute, it is projected to grow significantly from its current size of 24 faculty to 29 in the mid-term and 34 in the long-term.

Research

Faculty with laboratories have programs ranging in size from one to 15 research personnel and average five to six. However, a significant portion of the faculty (~25%) are economists with only computational lab space. A multiplier of 1,300 asf/faculty was calculated based on this ratio and considering that the average faculty member with a laboratory was in the Tier 2 laboratory size range.

A number of faculty are currently housed in excellent new space in the Science Laboratory 1 building, and most others will be housed in renovated space in Geology. However, there will be an additional need for research space in Pierce Hall in the long-term, space which will need to be renovated.

Environmental Sciences: Current and Future Research Space Needs

Multiplier	Time Period	No Faculty	Multiplied ASF	Planned ASF	BOURNS	GEOLOGY BLDG	PIERCE	SCIENCE LAB 1	GREENHOUSE/ TRAILER	Excess/ Deficit ASF
1300	Current	24	31,200	41,103	3,526	18,554	3,216	15,359	448	9,903
1300	Midterm	29	37,700	37,577	0	18,554	3,216	15,359	448	-123
1300	Longterm	34	44,200	43,871	0	18,554	9,510	15,359	448	-329

[1]Number of faculty does not represent a commitment of FTE. Given recent enrollment trends, it is not clear when new FTE will be allocated to the College.
[2]Multiplier = 1,300 asf/faculty.

In the mid-term, Environmental Sciences will move out of Bourns Hall and gain space in the renovated Geology building (currently inactive space assigned to the department). The department will have adequate total space at that time.

In the long-term, we propose that the department maintain its space in Geology and Science Laboratory 1 and gain additional space in Pierce Hall to accommodate projected growth. We project that the department will have adequate total space in these buildings, and if the Pierce space is renovated, most of the department will have space of high quality.

Administration

Environmental Sciences is administered by the AEE administrative cluster (discussed in a subsequent section of this plan).

Facilities

Environmental Sciences maintains a number of facilities, such as greenhouses and soil storage and soil analysis facilities; many are old and in need of replacement. Any future East Campus building projects that impact these current facilities will prompt their replacement.

Department of Mathematics

The UCR Department of Mathematics has achieved a critical mass in the fundamental research areas of Algebra, Analysis, Geometry and Topology, and has aggressive aspirations to build upon this excellence and to develop a more vigorous applied mathematics program. To achieve these goals, the department requires additional and higher-quality space for research, teaching and administration.

The department is somewhat unusual in CNAS, in that the teaching load is very high, the second highest in the College with an Adjusted Student Workload per I&R Faculty FTE of 50.55 in AY04-05). It also supports a large graduate student population, currently at 57 and projected to reach 70 in 2006-07. This leads to decisions that justify the department's faculty and graduate student size more in terms of the teaching responsibilities, and less by programmatic needs.

In 2005-06, the Math department has 26 faculty and 10 Visiting Assistant Professors (VAPs). The plan over the next 10 years is to replace most of the VAPs with faculty, but to also increase the total number from 34 to 40. This will require additional space to house the department in the long term.

The quality of the space in the current location of the department is also substandard, however, and needs to be upgraded. The department is currently housed on the second floor of the Surge Building. The current space allocation results in a significant deficit, which will continue to increase with Departmental growth, and the condition of the space is very poor and cannot be justified for the long-term use of an academic department. The lack of sound dampening between the offices and the narrow size of the corridors are significant factors leading to this decision.

Research

Calculation of research space needs. The Mathematics department requires research space for both ladder-rank faculty and VAPs. Both are involved with teaching and research. For faculty, we recommend a multiplier of 500 asf, comprised of a faculty office of 140 asf, shared interaction space of 210 asf, and 50 asf for each of three graduate students (the average number of grad students supervised by each faculty member). Visiting Assistant Professors do conduct research, but do not supervise graduate students. Thus, the multiplier of 350 asf includes a faculty office and shared research space, but not space for graduate students.

Mathematics: Current and Future Research Space Needs

Multiplier	Alt Multiplier	Time Period	No Faculty	Alt No Faculty	Multiplied ASF	Planned ASF	CAMPUS SURGE	PHYSICS BLDG	Excess/ Deficit ASF
500	350	Current	26	10	16,500	7,767	7,767	0	-8,733
500	350	Midterm	30	10	18,500	7,766	7,766	0	-10,734
500	350	Longterm	37	3	19,550	19,550	0	19,550	0

[1]Number of faculty does not represent a commitment of FTE. Given recent enrollment trends, it is not clear when new FTE will be allocated to the College.
[2]Multiplier = 390 asf per faculty member and 240 asf per Visiting Assistant Professors (VAPs) do conduct research, but they do not supervise graduate students.

For the mid-term, the department will remain on the second floor of the Surge building. However, additional space will be required to accommodate the increase in number of grad student numbers.

In the long term, it is proposed to move the Mathematics department to the Physics building second and third floors, after the Physics department vacates to occupy the proposed Physical Sciences 2. The third floor can be used by Mathematics, as it contains 35 faculty offices with windows, and other non-window offices that could be used for additional faculty. . Modest renovation of the second and third floors is recommended to make the building optimal for mathematics research.

Administration

Calculation of administration space needs. The Math department's current administrative needs are accommodated in the 2,389 asf administrative suite in the Surge building. In addition, the department has 1,152 asf of conference room space in Surge. With the proposed move to the third floor of the Physics building in the long-term, the administrative unit will retain the two conference rooms, but would experience a reduction in office space. This would necessitate a reconfiguration/renovation of space on the third floor of Physics or augmentation by utilizing additional space on the second floor of Physics. The space deficit demonstrated in the long term may be accommodated by renovation of the "Barkas Lounge" (Room 3049, 556 asf, which currently serves as interaction space, mail room and break room for the Physics Department) and by converting the patio adjacent to this administrative unit to interior space.

Mathematics: Current and Future Administrative Space Needs

Multiplier	Time Period	No Faculty	Multiplied ASF	Planned ASF	CAMPUS SURGE	PHYSICS BLDG	Excess/ Deficit ASF
100	Current	36	3,600	3,541	3,541	0	-59
100	Midterm	40	4,000	3,541	3,541	0	-459
100	Longterm	40	4,000	4,000	0	4,000	0

[1]Number of faculty does not represent a commitment of FTE. Given recent enrollment trends, it is not clear when new FTE will be allocated to the College.

Department of Nematology

The Department of Nematology has great opportunities for expanding on its expertise in host-parasite genetics and genomics – consistent with College's emerging reputation in genome biology and in developing strength in the model system *C. elegans*. Specifically, the department would like to expand into the area of phytonematode genomics, an emerging area that has potential practical implications for agriculture and which is attracting new federal grant support. Developing greater expertise in *C. elegans* research would also contribute to campus aspirations in the health sciences.

Nematology is a small department with faculty scattered in several locations: Boyce, Spieth, University Laboratory Building, University Office Building, and a greenhouse. The Department's space is substandard in Spieth, University Laboratory Building, and in the greenhouse. There is a great need to consolidate the Department in one location with quality research laboratories.

The number of personnel per laboratory is 4.6. A relatively large proportion of the faculty on campus are Cooperative Extension Specialists (~30%) with largely field-based programs. Labs average between the Tier 2 and Tier 3, with a trend toward larger labs with future hire. A research space multiplier of 1800 would therefore be appropriate for this department. Currently, they do not have adequate space, averaging 1,237 asf per faculty. Furthermore the quality and quantity of space in Spieth and greenhouses are particularly poor for research lab/office use.

Research

The Department of Nematology plans on growth from seven to nine faculty, which would require a total of 16,200 asf of research space in the long term.

Nematology: Current and Future Research Space Needs

Multiplier	Time Period	No Faculty	Multiplied ASF	Planned ASF	BOYCE	GENOMICS BLDG	SPIETH	UNIV LAB BLDG	UNIV OFC BLDG	GREENHOUSE / TRAILER	Excess/ Deficit ASF	NEW BLDG - PEST MANAGEMENT
1800	Current	7	12,600	8,781	1,431	0	4,493	885	120	1,852	-3,819	0
1800	Midterm	8	14,400	10,677	1,431	1,896	4,493	885	120	1,852	-3,723	0
1800	Longterm	9	16,200	1,896	0	1,896	0	0	0	0	-14,304	14,304

[1]Number of faculty does not represent a commitment of FTE. Given recent enrollment trends, it is not clear when new FTE will be allocated to the College.
[2]Multiplier = 1,405 asf/faculty.

In the mid-term, we project that Nematology will gain space in the new Genomics Building by placing one new faculty member in 1,896 asf of research space in that building. We propose that the department will retain its other current space in Boyce, the greenhouse, Spieth, and University Laboratory Building. In the long-term, we propose that Nematology move its research laboratories from Boyce, the greenhouse, Spieth, and ULB into new space in the proposed Pest Management building (occupying approximately 14,304 asf). The department would retain one faculty member in the Genomics building. If this occurs, then the department would have adequate research space.

Administration

Departmental administration for Nematology is included within the NPPS/Biochemistry administrative cluster (discussed in a later section).

Facilities

Nematology has adequate greenhouse and nematode quarantine space for its current and projected needs, although many of the facilities are old and in need of replacement. Any future East Campus building projects that impact current facilities will require their replacement.

Department of Physics

Physics encompasses experimental research that investigates the most fundamental aspects of matter, space and time, and theoretical research that develops a comprehensive description of the universe. Physics is one of the fundamental core disciplines whose strength works to benefit the entire UCR campus.

The department's research program can be classified into (1) *Condensed Matter Physics*, which includes physics at the nanoscale level, materials science and biophysics, (2) *High Energy Physics*, which includes heavy ion physics and cosmology, and (3) *Astrophysics*. A strength of the department is the size of each of these groups, which enables synergistic collaboration on projects. For example, the high energy and heavy ion physics faculty work together within the *Center for Accelerator, Astroparticle and Particle Physics* (CAAPP), while many of the condensed matter physicists are involved in the *Center for Nanoscale Science and Engineering* (CNSE).

Within this broad context, the UCR Department of Physics contributes significantly to three major campus and college initiatives – materials science/nanotechnology, environmental research, and, through an emerging strength in biophysics, the Health Sciences Initiative. These three multidisciplinary areas evoke multiple opportunities for building additional bridges with other campus units, most notably the CNSE, the Environmental Research Institute, and a prospective bioengineering center in the Bourns College of Engineering. With the anticipated hires in biophysics, participation in the Health Sciences Research Initiative is also likely.

The department has a goal to be one of the top 15 Physics departments nationally by 2013. A key component of achieving that goal is for the department to grow to a competitive size. In 2005-06, Physics has 30 faculty, housed in the Physics building and portions of Pierce Hall. It is planned to increase the number of faculty to 39 over the next 10 years. Current space in both buildings is substandard for a modern, active department and constrains our ability to recruit additional faculty to meet this goal. For these reasons, it is critical to generate additional new space for the long-term future of the department.

Research

Calculation of research space needs. The experimental and theoretical condensed matter physics, experimental and theoretical high-energy physics, and astrophysics groups are highly diverse, requiring a multifaceted calculation of their space needs. The calculation has been made by analyzing the distribution that the department will have in these various areas in the long term, and then assigning space accordingly. (Note that we anticipate space for the computational Astrophysics faculty will be allocated through the Institute of Geophysics and Planetary Physics and that ORA will have administrative responsibility for the institute, thus they are not taken into consideration for space planning purposes.)

Condensed matter physics experimental labs house large pieces of equipment, so that even junior faculty with few students require large labs. As faculty mature and expand their activities, the required space grows with the addition of new instrumentation. Research space of 2,140 asf is considered the average space requirements for a condensed matter experimentalist. This number includes a laboratory of 1,500 asf, shared facilities and student/postdoc offices of 500 asf (one-third ratio), and a faculty office of 140 asf. This average assumes that a new faculty, or less active faculty, would be assigned 1,640 asf at a minimum, but that senior faculty often require 2,640 or more. The average value of 2,140 asf per faculty thus assumes that about half of the faculty are at the junior or less active level.

High energy physics experimental faculty have most of their research program located off-campus at a major accelerator facility. Their on-campus needs include some amount of office space for students and postdocs, along with laboratory space for detector development and other hardware development in preparation for its deployment at an accelerator. They often have need for high bay space for the construction of large detectors. It is planned to assign a total of 1,000 asf per experimental high-energy physics faculty to accommodate their on-campus needs.

Theoretical physicists (high energy and condensed matter) have needs for office space for themselves, their students and postdocs, and interaction and computer space in which to do their work. We have allocated 540 asf per faculty for these needs in the following manner. Each faculty member will need 140 asf for an office, an average of two graduate students and one postdoc that require 50 asf apiece (total of 150 asf), and 250 asf toward shared research interaction and computer facilities space.

The long-term college academic plan calls for a distribution of 9, 13 and 17 for theory, high energy and condensed matter, which corresponds to 23%, 33% and 44%, respectively. If the 540, 1,000 and 2,140 is weighted by these percentages, the average space per physics faculty is then 1,391 asf. We thus used a multiplier of 1,400 asf.

Physics: Current and Future Research Space Needs

Multiplier	Time Period	No Faculty	Multiplied ASF	Planned ASF	MATL SCI & ENG	PHYSICS BLDG	PIERCE	Excess/ Deficit ASF	NEW BLDG - PHYSICAL SCIENCES 2
1400	Current	30	42,000	30,068	0	25,124	4,944	-11,932	0
1400	Midterm	33	46,200	43,952	9,750	25,124	9,078	-2,248	0
1400	Longterm	39	54,600	15,169	9,750	5,419	0	-39,431	39,431

[1]Number of faculty does not represent a commitment of FTE. Given recent enrollment trends, it is not clear when new FTE will be allocated to the College.
[2]Multiplier = 1,400 asf.

Currently, the Physics department is primarily housed in the Physics building, but there are also faculty on the first floor of Pierce Hall. The department will be assigned new space for up to five faculty in the Materials Science & Engineering (MS&E) building when it comes on line in 2009. Thus, for the midterm, the amount of research space will be sufficient, although the quality of most of it is substandard.

For the long term, however, more and improved space will be the highest priority for the department. It is planned to move the Physics department research out of the Physics building, with the exception of the Magnet lab, making way for the planned move of the Department of Mathematics into the building, as well as the College machine, glass and electronics shops. The Magnet lab will be retained as high bay space for certain kinds of condensed matter or high energy physics research.

A significant amount of new space will need to be created in order to house the future research needs. There are no other buildings in the College that can be utilized effectively for this type of research. It is thus necessary that a new building be planned in order to hold approximately 40,000 asf of research space that cannot be accommodated in the Magnet lab and the MS&E building. This is the principal basis for our proposal to plan and construct a new building, which we dub "Physical Sciences 2." This building will house the needed research space, as well as the departmental administration and upper division teaching.

Administration

The Physics department has its own administrative unit, which is housed in 3,960 asf on the third floor of the Physics building. The unit does not fit completely into the space designed for administration, and thus uses other rooms on the floor (which are included in the 3,960 asf total). As the size of the faculty grows, the size of the administrative unit must also increase due to the extra work in personnel, purchasing, accounting, travel, etc. We will use the standard of 100 asf per faculty in determining the optimum size of the administrative space. In the long term, it is planned to meet the administrative needs of the Department entirely in the proposed new Physical Sciences 2 building.

Physics: Current and Future Administrative Space

Multiplier	No Faculty	Time Period	Multiplied ASF	Planned ASF	PHYSICS BLDG	Excess/ Deficit ASF	NEW BLDG - PHYSICAL SCIENCES 2
100	30	Current	3,000	3,960	3,960	960	0
100	33	Midterm	3,300	3,960	3,960	660	0
100	39	Longterm	3,900	0	0	-3,900	3,900

[1]Number of faculty does not represent a commitment of FTE. Given recent enrollment trends, it is not clear when new FTE will be allocated to the College.

Department of Plant Pathology

The Department of Plant Pathology has expanded its mission to include a focus in microbiology, and is proposing a corresponding name change. The department faculty has assumed the majority of campus teaching needs in this area, which is expanding. Together with this new focus, the department plans to grow from 20 faculty to 23 mid-term and 30 long-term.[1] Plant Pathology has active research programs averaging just over $200,000 in grant expenditures per faculty. The number of research personnel ranges from three to 13 and averages about five. Grant awards have been on an upward trajectory, and the demographics of the department suggest that this will continue. However, there will likely continue to be a significant proportion of the department with primarily commodity-funded, field-based programs (~30%). A research space multiplier somewhat higher than the Tier 2 level, a multiplier of 1,800 asf seems appropriate at this time.

Research

The Department of Plant Pathology is housed in several locations: Boyce Hall, Webber Hall, Fawcett Laboratory, and University Laboratory Building. Its current research space is inadequate in size (short by 7,537 asf), and the space in Webber, Fawcett, and ULB is inadequate in quality.

Plant Pathology: Current and Future Research Space Needs

Multiplier	Time Period	No Faculty	Multiplied ASF	Planned ASF	BOYCE	FAWCETT LAB	GENOMICS BLDG	UNIV LAB BLDG	WEBBER	GREENHOUSE/ TRAILER	Excess/ Deficit ASF	NEW BLDG - PEST MANAGEMENT
1800	Current	20	36,000	28,463	11,389	8,140	0	1,456	7,358	120	-7,537	0
1800	Midterm	23	41,400	40,948	11,389	8,140	12,485	1,456	7,358	120	-452	0
1800	Longterm	30	54,000	19,843	0	0	12,485	0	7,358	0	-34,157	34,157

[1]Number of faculty does not represent a commitment of FTE. Given recent enrollment trends, it is not clear when new FTE will be allocated to the College.
[2]Multiplier is 1,800 asf/faculty.

In the mid-term, we plan to move four existing Plant Pathology faculty into the new Genomics building and to hire two new faculty in that department who would also be housed in Genomics, for a total of 12,485 asf in that building. Current space is proposed to be retained in the mid-term in Boyce, Webber, Fawcett, and ULB. At that time, the department will have adequate research space quantitatively, but the quality of space will be poor, and there will be a need for consolidation from their several locations.

In the long-term, we propose removing Fawcett laboratory and ULB from the department space inventory, but we propose to retain the space in Genomics. This would leave the department short of research space. In addition, we propose to remove Plant Pathology from Boyce Hall (12,352 asf) and Webber Hall (7,358 asf). Thus, we

propose that the department occupy 34,156 asf of research space in the proposed Pest Management building. [Are we keeping Webber long term per previous discussion? If so, figure changes to 41,515 asf]

Administration
Departmental administration for Nematology is included within the NPPS/Biochemistry administrative cluster (discussed later).

Facilities
Plant Pathology has adequate greenhouse and nematode quarantine space for its current and projected needs, although many of the facilities are old and in need of replacement. Any future East Campus building projects that impact current facilities will require their replacement.

Department of Statistics
The Department of Statistics contributes to the development of this core discipline and, importantly, has established collaborations with researchers in the life sciences, engineering, agricultural sciences and social sciences. The newly developed Statistical Consulting Collaboratory (jointly managed by CNAS, the College of Humanities, Arts and Social Sciences, and Computing & Communications) has quickly become an integral part of the teaching, research and service endeavors of the Department. Faculty in this Department also support a very large service teaching course load, the highest in the College at 57.05 Adjusted Student Workload/FTE. Several courses offered by the Department serve majors in the College of Engineering, College of Humanities, Arts and Social Sciences, and Anderson Graduate School of Management, as well as our own students. Recent enrollment growth in new Ph.D. students is on par with the number of new Ph.D. enrollees at UCLA and UC Berkeley.

Research
The UCR Department of Statistics performs basic and applied research. The latest thrust of the department is in the area of bioinformatics.

The Statistics Department, currently housed entirely in the Stat/Comp building, requires dry space for research, teaching and administration.

In 2005-06, the Statistics department has nine faculty. The plan over the next 10 years is to add one additional faculty member. This will require some additional space to house the department in the long term. Since some of the current and new faculty are involved in bioinformatics research, however, it is proposed to house them in the new Genomics building, where it is expected that three Statistics faculty will reside. For the midterm and long term, the bulk of the department will stay where it is in the Stats/Comp building. Ultimately, there will be seven faculty remaining in Stat/Comp, with a bit more space per each PI that could be justified by the natural growth in their programs, and three faculty members in the Genomics building.

Calculation of research space needs. The multiplier of 540 asf/faculty was determined in the following way. It is first assumed that each faculty will need 140 asf (average office size in the Stats building) for an office. Then, on average each faculty will have three graduate students that require 50 asf apiece. Finally, each faculty requires 250 asf toward the shared research interaction and computer facilities space.

Statistics: Current and Future Research Space Needs

Multiplier	Time Period	No Faculty	Multiplied ASF	Planned ASF	GENOMICS BLDG	STAT COMP BLDG	Excess/ Deficit ASF
540	Current	9	4,860	4,545	0	4,545	-315
540	Midterm	10	5,400	6,418	1,873	4,545	1,018
540	Longterm	10	5,400	6,418	1,873	4,545	1,018

[1]Number of faculty does not represent a commitment of FTE. Given recent enrollment trends, it is not clear when new FTE will be allocated to the College.
[2]Multiplier = 540 asf/faculty.

The current needs of the Department are well met in the Stat/Comp building, in spite of the small deficit shown in the table above. The Department's long term needs will be met with the addition of the Genomics building, in which three of the bioinformatics faculty will be housed.

Administration

The bulk of the administrative functions for the Department of Statistics are centralized within the NPPS/Biochemistry Administrative Services Unit (discussed later in this plan). The Department uses its local 1,129 asf of administrative space in Stat/Comp for the Chair's office, two staff members, and copy/supply and mail rooms. This space will be sufficient to serve the department's "local" administrative needs through the long-term.

II. CENTERS AND INSTITUTES

Air Pollution Research Center

The Air Pollution Research Center (APRC) is an organized research unit that focuses on studies of various aspects of air pollution. For the last decade, the majority of research has dealt with studies of the atmospheric chemistry of organic compounds emitted into the atmosphere from anthropogenic and biogenic sources, and APRC has achieved an international reputation in this area. The APRC faculty have joint appointments with academic departments. However, their research needs are met with wet lab space assigned through the Center. There is currently a search underway for a new Director for the Center.

In 2005-06, there are three APRC faculty with assigned space. The plan over the next 10 years is to increase the total number to five. This will require some additional space to house the department in the long-term.

Research

Calculation of research space needs. APRC researchers require wet research space. We are using a life sciences multiplier between Tiers 2 and 3 (1,700 asf/faculty) to calculate the anticipated needs, due the necessity of these researchers to house and utilize relatively large pieces of equipment.

APRC is currently housed in Fawcett Lab and in some trailers. It is planned to temporarily expand APRC into the north wing of the second floor of Pierce Hall in the near future, as the new Director comes on board. APRC will relinquish the space in the trailers in the long-term. The space in Fawcett is assigned to two faculty (Atkinson and Arey) who will retire within a few years. APRC will continue to utilize this space for their replacements in addition to space relinquished by a longterm move of Plant Path into the new Pest Management Building, adding over 8,000 asf for APRC use. This space will only be suitable with major renovation. At this time, the Director could relinquish space in Pierce and relocate to Fawcett.

Air Pollution Research Center: Current and Future Research Space Needs

Multiplier	Time Period	No Faculty	Multiplied ASF	Planned ASF	FAWCETT LAB	GREENHOUSE/ TRAILER	Excess/ Deficit ASF
2000	Current	3	6,000	7,346	5,174	2,172	1,346
2000	Midterm	5	10,000	7,346	5,174	2,172	-2,654
2000	Longterm	5	10,000	13,314	13,314	0	3,314

[1]Number of faculty does not represent a commitment of FTE. Given recent enrollment trends, it is not clear when new FTE will be allocated to the College.
[2]Multiplier = 1,700 asf/faculty.

Administration

APRC is administered through the AEE Administrative Services Unit (discussed below), located in the Geology building. The proposed move to Pierce in the mid-term will diminish the current inconvenience of having administrative functions far distant from Fawcett Lab.

Institute for Integrative Genome Biology

Established in 2000, the Institute for Integrative Genome Biology (IIGB) capitalizes on the genomics revolution and on the UCR's expertise in biotechnology, the plant sciences, agricultural pest and disease management, and mammalian biology. IIGB houses several successful Centers including the Center for Plant Cell Biology and its cores, the Center for Vector-Disease Research, and the Biotechnology Impacts Center.

In the past few years, the campus and the College have invested heavily in the areas of genome biology, specifically through faculty FTE, scientific instrumentation, and infrastructure enhancements. This has resulted in significantly increased collaborative research efforts, sizeable increases in grant awards, and a growing reputation as a national center for functional genomics research and training. A key to this success is the IIGB Core facilities. These facilities, available to investigators campuswide, are located in Noel T. Keen Hall (former BioAg Library; north wing of Batchelor Hall) and contains advanced instrumentation in genomics, bioinformatics, proteomics, and confocal microscopy and imaging. It also serves as the administrative hub for the Institute.

IIGB: Current and Future Research and Research Support Space Needs

	Keen (Res Supp, Acad Offc)	Keen (Zhu lab)	Keen (Admin. Support)	Total
Current	4,377	2,574	667	7,618
Midterm	6,951	0	667	7,618
Longterm	6,951	0	667	7,618

It is anticipated that Keen Hall will provide sufficient space for potential growth in IIGB-associated research support through the long-term. Approximately 2,600 asf within Keen Hall is on temporary loan to Botany & Plant Sciences for the laboratory of Jian-Kang Zhu, the IIGB Director. Dr. Zhu will move to the Genomics Building when it is complete, along with the bioinformatics core currently in Keen Hall (Thomas Girke, Academic Coordinator; 575 asf). When these two moves occur, there will be space available in Keen Hall for expansion of the Core Instrumentation Facility.

Center for Conservation Biology

Established in 1999, the Center for Conservation Biology (CCB) provides objective scientific data to decision-makers, thereby helping society understand the extent and consequences of biodiversity loss. The Center's accomplishments have been extraordinary. Strong ties to county and city governmental agencies have been developed and Center-affiliated investigators have been awarded significant research funding from these agencies to evaluate the local environment. Faculty also participate in several large federally funded programs based out of UCR's Natural Reserves. In 2004, Center-associated faculty were awarded two new multi-million dollar National Science Foundation Biocomplexity grants, a testament to the strength of this relatively young Center.

The Center for Conservation Biology provides a collection of innovative researchers who could find additional synergy if they were housed together. Because Center-affiliated faculty have their research space assigned through their home departments, most are located distant from one another. Thus, we propose to move the Center for Conservation Biology and a number of its affiliated faculty into Pierce Hall on a temporary basis. The move of life scientists into Pierce is not optimal given the distance

from the other life science buildings on the campus. However, the localization of Center faculty in Pierce will place them in close proximity to the Air Pollution Research Center, Department of Environmental Sciences, and Department of Earth Sciences. Many of the faculty in these departments have research programs that complement the research initiatives of CCB.

This proposal was discussed with the Chairs of Biology, Plant Pathology (including the Director of CCB), and Botany and Plant Sciences in the fall of 2005. There was a consensus that such a research clustering would be beneficial to scientific endeavors. This proposal has the advantage of helping to temporarily alleviate the current and future projected space deficits in these life science departments. This is proposed with the knowledge that the current space on the 3rd floor would need significant renovation to provide the office spaces and interactive spaces needed for CCB faculty. In addition, there have been concerns about the presence of heavy isotopes in the former Chemistry laboratories. If heavy isotope contamination is an issue, the allocation of this space to CCB would not be advantageous. The College is currently investigating the previous use of this space to determine the feasibility of this move.

Specifically, it is proposed that 13,900 asf on the third floor of Pierce be allocated to CCB and associated faculty. The space needed for this move would include administrative space for CCB (estimate at 300 asf) and a conference room of at least 400 asf. Thus, the total temporary space allocation need for CCB is estimated at 15,000 asf.

The relocation of the Center for Conservation Biology is seen as one potential temporary remedy for space shortfalls in the life sciences. Ideally, these deficits should be addressed by construction of a new Biological Sciences 2 building as a long-term permanent home for the Center and other life scientists.

III. DEAN'S OFFICE AND ADMINISTRATIVE SERVICE UNITS

CNAS Dean's Office

College-wide administrative staff is currently housed in College Building North, in space totaling 4,390 on two upper floors. This accommodates offices for the Dean, three Associate Deans and 16 administrative and professional staff, as well as one large conference room (769 asf) and one small conference room (174 asf). While the amount of space is adequate for current staffing needs, it is located far remote from UCR's science precinct, making interaction between the Dean's office staff and academic departments often problematic. Additionally, as the College grows, we anticipate need for additional staff in the long-term, yet the College will outgrow its space in College Building North with the addition of even a single staff member.

We recommend that the Dean's office be relocated to Chapman Hall, in a phased manner beginning in the mid-term and completing in the long-term. This will be

contingent upon and coincide with the removal of Entomology faculty from this substandard research space to the Genomics building and the proposed new Pest Management building. Chapman Hall contains a total of 7,966 asf – 3,910 on the first floor and 4,056 on the second floor. Space plans for Entomology call for the department to relinquish the first floor in the mid-term and the second floor in the long-term. Following conversion of the first floor from research- to office-suitable space, a portion of the Dean's office could relocate at this time. The Dean's office would then be re-consolidated in the long-term, as the second floor of Chapman is renovated. The relocation of the Dean's office within the science precinct will enhance the administration of the College, with Chapman Hall absorbing all of the anticipated staff growth in the Dean's office.

Administrative Service Units within CNAS

The College of Natural and Agricultural Sciences has created three administrative service units in an effort to address budget cuts that occurred as a consequence of reduced state allocations to the University of California. These units – AEE, NPPS/Biochemistry and BNN – were created by the consolidation and reorganization of staff in a number of academic departments in order to streamline and combine core functions such as purchasing and academic personnel support.

Each of these units has been allocated space as outlined in the following sections.

AEE Administrative Services Unit

The AEE Administrative Services Unit provides staff support to the Air Pollution Research Center (APRC) and the Departments of Earth Sciences and Environmental Sciences.

AEE: Current and Future Administrative Space Needs

Multiplier	Time Period	No Faculty	Multiplied ASF	Planned ASF	FAWCETT LAB	GEOLOGY BLDG	SCIENCE LAB 1	GREENHOUSE / TRAILER	Excess/ Deficit ASF
100	Current	40	4,000	3,413	1,187	1,354	744	128	-587
100	Midterm	48	4,800	4,699	1,187	2,640	744	128	-101
100	Longterm	54	5,400	3,512	0	2,640	744	128	-1,888

[1]Number of faculty does not represent a commitment of FTE. Given recent enrollment trends, it is not clear when new FTE will be allocated to the College.
[2]Based on 100 asf per faculty member.

Renovation of the Geology Building, expected to begin in summer 2006, will create over 1,000 additional asf for the AEE administrative unit, which will be satisfactory in the mid-term. However, if Fawcett Lab is removed from the CNAS space inventory, as we suggest, there will be a serious administrative space deficit in the long-term.

NPPS/Biochemistry Administrative Services Unit

The departments of Nematology, Plant Pathology, Statistics and Biochemistry are administered by the NPPS/Biochemistry Administrative Services Unit. This administrative unit is primarily housed within Boyce, Webber and Statistics. The primary offices are located on the first floor of Boyce, with satellite offices in Webber and Statistics. It currently serves a total of 57 faculty. With a multiplier of 100 asf per faculty, the unit will need a total of 7,500 asf in the long-term, as shown in the table below. A possible remedy to this space shortfall is planning for some administrative space in the proposed Pest Management building.

NPPS/Biochemistry: Current and Future Administrative Space Needs

Multiplier	No Faculty	Multiplied ASF	Planned ASF	Time Period	BOYCE	FAWCETT LAB	STAT COMP BLDG	WEBBER	GREENHOUSE/ TRAILER	Excess/ Deficit ASF	NEW BLDG - PEST MANAGEMENT
100	57	5,700	5,973	Current	2,588	193	1,129	1,951	112	273	0
100	60	6,000	5,973	Midterm	2,588	193	1,129	1,951	112	-27	0
100	75	7,500	5,973	Longterm	2,588	193	1,129	1,951	112	-1,527	1,527

[1]Number of faculty does not represent a commitment of FTE. Given recent enrollment trends, it is not clear when new FTE will be allocated to the College.
[2]Based on 100 asf per faculty member.

Currently, some of the Chairs' offices are not in close proximity to the administrative unit. Another challenge is a serious shortage of conference rooms and interactive spaces in these departments for laboratory group meetings, qualifying exams, and journal clubs meetings. Careful thought should be given during planning for renovations and future new buildings to remedy these challenges. In particular, each department served by this administrative unit should have in close proximity some "local" administrative space for a Chair's office and associated staff support, as well as conference room space.

BNN Administrative Services Unit

The BNN Administrative Services Unit provides staff support for the departments of Biology and of Cell Biology & Neuroscience, as well as the eight University of California Natural Reserves managed through UCR.

BNN: Current and Future Administrative Space Needs

Multiplier	Time Period	No Faculty	Multiplied ASF	Planned ASF	BIO SCI BLDG	BOYCE	LSP BLDG	SPIETH	Excess/ Deficit ASF	NEW BLDG - SPIETH REPLACEMENT
100	Current	40	4,000	3,666	0	374	681	2,611	-334	0
100	Midterm	47	4,700	4,783	130	0	4,032	621	83	0
100	Longterm	52	5,200	4,783	130	0	4,032	621	-417	417

[1]Number of faculty does not represent a commitment of FTE. Given recent enrollment trends, it is not clear when new FTE will be allocated to the College.
[2]Based on 100 asf per faculty member.
[3]Mid and long term values are increased by 500 asf to accommodate an additional seminar room to accommodate interdepartmental graduate programs administered by BNN and BPS.

The BNN Administrative unit is primarily housed on the first floor of Spieth with one office and conference room in Boyce. The unit currently serves 18 faculty from CBNS and 22 faculty from Biology. The unit has three conference rooms (621 asf, 225 asf, and 83 asf) and until recently no Departmental Chairs' offices.

BNN has received a temporary space allocation in the Life Science Building to accommodate Chairs offices and adjacent administrative support LS 2400A, 2400, 2405 2410, and 2415).The "Darwin Room" (Spieth 1239; 621 asf) will serve the Department of Biology through the long-term administratively. The newly allocated LS 2550 (554 asf) should meet the administrative needs of CBNS long-term; renovations are underway.

To meet the administrative needs of the new Biological Sciences Building, we propose one administrative office in Biological Sciences (130 asf). We propose to move the BNN Administrative office from Spieth (first floor; 1,889 asf) to Life Science (old psychology wing) first floor. This move provides contiguous space for the BNN administrative office with adjacent Chairs' offices. As soon as possible, this space should be converted into research support space for faculty in the Biol Sciences building.

We propose to retain the Darwin room and LS 2550 as administrative conference rooms for Biology and CBNS, respectively, which totals 1,175 asf. We recommend adding one additional administrative conference room (500 asf) to address the needs of interdepartmental graduate programs, which are administered by the BNN and BPS administrative units. Therefore, we propose allocation of an additional 500 asf in the Life Science building, which is above the administrative units' multiplier.

We propose allocating 3478 asf to the BNN administrative unit on the first floor of Life Sciences. This space will need to be renovated to accommodate this unit and the move of the Biology and CBNS Chairs offices in close proximity to the administrative unit. IF this move is accomplished, the BNN will have a space deficit of 417 asf.

We propose conversion of the Spieth Office complex into a general assignment classroom, a college computer laboratory, or a College wet lab. In the long term, it might also be useful to convert the Darwin room into teaching space (Spieth 1239). A new administrative conference room (>600 asf) would need to be found if this shift in usage were to occur. Perhaps space in Life Sciences could accommodate this move.

Long term when the BNN administrative unit is serving 52 faculty, there will be a space deficit of 417 asf.

COLLEGE OF NATURAL AND AGRICULTURAL SCIENCES

ACADEMIC PLAN
FY 2005/06 to 2008/09

April 1, 2005

By:
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College of Natural and Agricultural Sciences
Academic Plan FY 2005/06 to 2008/09

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I. Vision and Mission of the College of Natural and Agricultural Sciences

The vision of the College of Natural and Agricultural Sciences (CNAS) at UCR is to become a premier college of science, mathematics, and agriculture. In doing so, CNAS can contribute to bringing the campus into the front rank of research universities by emphasizing academic and research excellence through investment in selected areas where we have an advantage relative to competing institutions.

The mission of the College is to expand fundamental scientific knowledge in the agricultural, biological, physical, and mathematical sciences and to find innovative ways to apply and disseminate that knowledge, through both teaching and outreach, to the betterment of human society. Three principal objectives will be pursued in support of this mission: continuing to build a world-class faculty; enhancing our strong foundation in the fundamental life, physical and mathematical sciences, as well as focused areas in the agricultural sciences; and delivering the highest quality undergraduate and graduate education. This academic plan outlines our strategies for achieving these goals.

The top priority for CNAS is to continue to build a world-class faculty, comprised of scholars who conduct research at the forefront of their disciplines, who lead high-quality graduate programs, and who provide the best possible undergraduate educational experience. It is the quality of our faculty that will propel us to the forefront of public universities in the United States. While quality is our overriding concern, we must also confront the major issue of quantity – CNAS needs to increase the number of faculty if we are to advance our research visibility, improve the National Research Council (NRC) rankings of our programs, and enhance the quality of our graduate and undergraduate programs. With very few exceptions, universities with larger high-quality programs receive higher NRC rankings than smaller ones. CNAS has lacked the required "critical mass" of faculty in many key areas and we view the hires in this academic plan as our opportunity to achieve this "critical mass." The current size of the UCR student body and the CNAS workload should allow the College to hire the faculty to build the required critical mass.

Continuing to build the faculty will enable us to maintain and enhance a strong foundation in the fundamental life, physical and mathematical sciences, and focused areas in the agricultural sciences. Advances in fundamental science are the basis for all of the applications of science-based knowledge to the solution of societal problems. We plan to build on the current foundation in basic and applied science, particularly those linkages that are enabled by the strong, focused programs in the Agricultural Experiment Station (AES). The presence of AES departments provides CNAS with a competitive advantage and unique opportunities to leverage investments for maximum impact. Investments are also needed to progress in our joint efforts with the College of Humanities, Arts, and Social Sciences, the Division of Biomedical Sciences, and Bourns College of Engineering (BCOE) on such multidisciplinary initiatives as genomics and bioinformatics, materials science and nanotechnology, and the environmental sciences.

We also seek to deliver the highest quality undergraduate and graduate education. The College is exploring new mechanisms to attract, retain and motivate undergraduates and graduate students to attain their educational and career goals. The efforts outlined in this academic plan will

provide an even more nurturing educational and dynamic research environment in which our students can excel.

We emphasize that the key to achieving these goals is to build an outstanding faculty who are excellent researchers and teachers. Thus, the hiring and retention of outstanding faculty are our most important endeavors. Our success will require the College to address important challenges in the areas of facilities, start-up funding, graduate student recruitment, and undergraduate program enhancement.

II. General Background, Key Objectives, and Philosophy

The forefront philosophy of CNAS is that the faculty are the University and that an excellent university requires an excellent faculty.

CNAS is committed to building on our strengths, fostering interdisciplinary research, and bringing the excitement of this research into our classrooms. The success of our faculty requires a significant, focused investment in research infrastructure. These investments promote innovative and energetic research programs. It is imperative that we continually evaluate our needs for growth and change so that we continue to attract and retain the most talented and diverse undergraduate and graduate students and faculty.

CNAS has and will continue to focus on strategies that assure success by: building on strengths and reevaluating current programs on a continual basis; thinking creatively; seizing opportunities by responding quickly when promising scenarios present themselves; and finding new solutions as our research and education climate evolves. The history of scientific discovery clearly demonstrates that investment in basic research promotes innovation and new research applications that positively impact society.

Structure of the College. CNAS benefits from the "Riverside Advantage" – having the Agricultural Experiment Station departments, life sciences, physical, and mathematical sciences in a single college. CNAS is complex and has a unique constitution that provides a distinctive faculty research portfolio that is unparalleled in the UC system. For example, unlike colleges at the other UCs, CNAS provides a research continuum in the life sciences from the agricultural sciences to the health sciences, which promotes innovation. CNAS harbors dynamic research programs that address basic questions in agriculture, life sciences, environmental science, physical and mathematical sciences, and strong applied programs that address the immediate needs of California's economy. The location of the mathematical, physical, and life sciences in one college provides CNAS distinct advantages and opportunities, which will continue to be utilized for our growth and development.

This unique melding of basic and applied sciences was termed the "Riverside Advantage" by a Blue Ribbon Committee that evaluated the life sciences at UCR. It is this advantage – leveraging the strengths of our AES programs in combination with basic research – that helped UCR justify funding for our new Genomics Building. This building will have a huge impact on all faculty in the biological sciences, not just those with AES appointments.

Combined with a strong research infrastructure, the "Riverside Advantage" will enable us to foster the development of biotechnology and high-technology opportunities that will attract and retain high-tech businesses in the Inland Empire. Research programs in materials science and nanotechnology, and many areas in the basic sciences, will also provide significant opportunities for bringing high-tech industry to the Inland Empire. There is a synergistic relationship between the high-tech industry and a university. It is clear that UCR must do all it can to encourage the establishment of viable high-tech companies in the vicinity of campus.

Key Issues. CNAS must continue to evaluate its organizational structures to create and maintain the vibrant educational and research environment that will propel UCR to AAU status. Our structures must be responsive to administrative, faculty and student needs. Specific objectives to be pursued during the next year are as follows:

- Examination of the organization and structure of the life science majors to attract, retain and motivate the best undergraduates.
- Consolidation of the Biological Sciences Undergraduate Advising Office with the CNAS Office of Student Academic Affairs to provide the best possible advising for our students.
- Establishment within CNAS of a new TA Advisory Committee, which will be charged with developing a two-year plan for allocation of TA resources to all departmental and interdepartmental graduate programs that will leverage TAships in graduate student recruitment.
- Formation of a College Planning Committee. The initial task of this group will be to complete the Master Space Plan for the College by May 2005. In the long term, this committee will continue to function to promote college-department communications and planning activities.
- Revamp the Advisory Committee for the Institute for Integrative Genome Biology's Genomic Core Facility and Plant Transformation Research Facility to provide better oversight and assure the long-term economic success of these units.

The Research Infrastructure and Resources Required for Excellence. If CNAS faculty are to excel, the College must address important challenges in the areas of facilities, start-up funding, graduate programs, and undergraduate programs. It is our opinion that providing faculty and students with state-of-the-art research space and infrastructure and promoting interdisciplinary initiatives will set the stage for success.

To this end, CNAS must continue to:

- Provide junior and senior faculty hires competitive start-up packages while they seek extramural funding to propel their research programs to the forefront of scientific discovery.
- Promote interdisciplinary centers that highlight CNAS and campus research strengths.
- Leverage CNAS investments in the research infrastructure by continuing to support multi-user instrumentation facilities (Analytical Chemistry Instrumentation Facility, Central Facility for Advanced Microscopy and Microanalysis, Genomics Core Facility including the Center for Plant Cell Biology's Proteomics, Bioinformatics, and Imaging

and Microscopy facilities) that provide cutting-edge research tools to as many faculty as possible. Continued investments in these facilities through NSF, NIH and private foundation equipment grants will require CNAS funds to be available for the "College" match that most of the programs require.

- Leverage the college investment in 'shops' (machine, glass, electronic) to provide cost-effective service for faculty and generate the desired pay off of research productivity in terms of extramural funding, publications and overall visibility of our research programs.
- Enhance public awareness of the Natural Reserve System through campaigns and outreach.
- Facilitate the preparation of multi-PI grants, such as program projects, center grants (e.g. NSF Science and Technology Centers), and graduate training grants (e.g. IGERTs).
- Foster a development mentality among the faculty, students and staff. Resources are limited and it is imperative that CNAS has a strong and vital development program. A separate development plan is under development and will be discussed with Vice Chancellor for University Advancement Bill Boldt.
- Evaluate how limited seminar funds can be better leveraged to foster interdisciplinary research and nurture UCR's research prominence.
- Apply for federal infrastructure grants to enhance current buildings and vivaria, and to bring whole animal imaging capabilities to UCR.
- Develop specific procedures and policies (handbook) for college-based faculty searches.

III. Diversity

Commitment to Diversity. UCR has a competitive advantage in the diversity of its student body. We have a unique opportunity and a huge responsibility to continue to recruit a diverse group of students, provide these students with the skills and tools they need for success, and to build a diverse faculty and staff, who can serve as role models for our students. This diversity, coupled with the anticipated growth of UCR, places us in a position that is unique in higher education in the United States. CNAS will continue to strive for gender equity and diversity in our students, staff and faculty that is reflective of our region's population. Given the diversity inherent in our region, this goal should be easily achieved for our staff and students. Our challenge is to achieve similar diversity in the faculty, postdoctoral and graduate student ranks. Several mechanisms are proposed in this document to achieve these goals. Working with Assistant Vice Provost Yolanda Moses, CNAS will develop a college diversity action plan by October 2005.

Faculty Diversity. While CNAS has made some recent advances in the area of faculty diversity, we are limited by the diversity in the national and international hiring pools. Clearly, we must be aggressive and proactive if we are to make substantive progress. In the long term, we must cultivate our diverse undergraduate population and enhance the success of our graduate students and postdoctoral fellows. This should ultimately increase the numbers of women and underrepresented minorities in future faculty hiring pools.

CNAS is in the process of developing a diversity action plan that will serve as a guide for faculty recruitment and retention. The key philosophy is to build a diverse faculty and concomitantly enhance the quality of our faculty. We currently lack an adequate number of role models for our students, and achieving gender and ethnic balance will be a challenge in many areas of science

due to the limited numbers of women and underrepresented minorities in many fields. To achieve this goal, we have already identified several key elements which are outlined below:

- CNAS will hold back several faculty lines each year and provide these positions to departments as top-quality minority faculty candidates are identified either in existing searches or as "targets of opportunity."
- Each search committee will have a woman and/or minority member and be tasked to consider diversity as they formulate a search plan and consider applications. The pool of applicants should at the very least reflect the national availability of minorities in the area of the search.
- Prior to sending out invitations for interviews, the Dean or an Associate Dean will review all files in a search to see that diversity has been taken into account and that any minority candidates with competitive records are included in the interview pool.
- CNAS will enhance the success of our new and current junior faculty, professional researchers, and postdoctoral fellows by implementing the Howard Hughes Medical Institute (HHMI) Scientific Laboratory Management program to provide guidance for the challenges in grantsmanship, publications, and laboratory management.

Student Diversity. As mentioned above, UCR has attained diversity at the undergraduate level and the challenge is to see this carried into our graduate student ranks, to ultimately impact positively future pools for faculty hires. CNAS will work cooperatively with the Graduate Division to recruit a diverse group of graduate students. Clearly, success will require a partnership effort and must carry through across the campus. Specific plans are under discussion with the Graduate Division.

To achieve these goals, UCR must be more competitive for the very best students and continue to maintain our diversity. We must also ensure the success of those students who come to UCR. Several new and emerging CNAS initiatives are designed to recruit, retain and motivate our diverse cadre of students. The details of these initiatives are covered in the section on undergraduate programs. We highlight a few initiatives here:

- Nurturing the newly initiated CNAS Freshman Scholars program.
- Aggressively recruiting Regents' and Chancellors' scholars by sponsoring receptions for students as soon as names can be obtained.
- Expanding opportunities for undergraduate student research through the College's new Coordinator of Undergraduate Research, the California Alliance for Minority Participation, and MARC U* STAR programs.
- Enhancing student advising with the CNAS pilot mentoring program and consolidating the location of the Biological Sciences Undergraduate Advising and Student Academic Affairs Offices.
- Providing a clear route for students with an interest in the allied health professions that is open to the entire campus and is integrated with all majors/tracks and opportunities in the College.

By creating innovative educational and research opportunities and providing enhanced advising and mentoring, we can increase the number of women and underrepresented minorities who

pursue professional and post-baccalaureate studies. These initiatives should impact postdoctoral and faculty pools in 4-5 years.

IV. Measures of Success in Meeting our Goals

Our vision for CNAS must include mechanisms to regularly evaluate whether we are meeting our goals in becoming a premier college of science and agriculture. The following are specific measures or criteria for success that we will track.

Faculty Quality. We will implement annual assessments of faculty quality in the college and review the results within academic units. Criteria to be used in measuring the quality and recognition of our faculty will include: 1) awards and fellowships, including membership in the National Academy of Sciences, 2) National Research Council rankings, 3) publication and citation data from the Institute for Scientific Information, 4) expenditures on competitively funded federal research support, and 5) placement of postdoctoral associates in jobs. In addition, faculty diversity will be reviewed annually with each academic unit, including comparisons with national trends in each disciplinary area.

Impact of CNAS. In addition to measurements of the quality and visibility of faculty activities, we will document the impact of faculty research on the state and regional economy, and on the quality of the environment and society. CNAS already has strong technology transfer mechanisms in the agricultural sciences through Cooperative Extension and has played a significant role in enhancing the economic success of the agricultural industries of Southern California. Beginning last year, CNAS has regularly documented specific examples of Agricultural Experiment Station research and extension programs that have had a significant impact on agricultural practices and economics. These are publicized through the "UC Delivers" web site (http://ucanr.org/delivers/) maintained by the University of California Division of Agriculture and Natural Resources.

In addition to such a qualitative approach, economic analyses of our impacts will be conducted regularly. These will follow methods that have been used previously by the UC Agricultural Issues Center in statewide evaluations of the economic benefits that have resulted from investments of public funds in agricultural research. The expansion of our ties with industry in sectors other than agriculture will be critical in improving our role in the development of the regional economy. We will encourage and track increases in industry-sponsored research and direct industry connections with faculty and Centers in partnership with the Vice Chancellor for Research.

Undergraduate and Graduate Education. We will track indicators of undergraduate and graduate student quality and review them annually with academic units. We will assess the impact of our advising/mentoring programs by examining retention, GPAs, time-to-degree and achievement of career goals. Targets for carrying capacity of graduate students per faculty in each academic unit will be developed and monitored annually. Increased efforts to maintain active communication with our alumni will allow us to better track the impacts of our educational programs on the success of our students.

V. Current State of the College

The College of Natural and Agricultural Sciences is a place of vigorous growth and excitement. During the past five years, 72 new and replacement faculty and CE Specialists have joined the College (48 new and 24 replacement). Uniformly, these new faculty are the best and brightest in their fields. In the past, there has been some question regarding our ability to hire a sufficient number of faculty to meet growth projections. We have clearly addressed this concern and have demonstrated that CNAS can indeed recruit the best faculty given the required resources (space and start-up/initial complement funding). In spite of our faculty growth, CNAS currently has fewer faculty than in 1992 when the campus had approximately 7,000 students.

The College intends to build upon this positive hiring trajectory by continuing to make investments in the areas noted in this plan. It is important that the College continues to support the fundamental sciences while also taking advantage of emerging opportunities in multidisciplinary research areas. Many of the national rankings of research universities are in areas of basic science, not multidisciplinary areas. Thus, we must leverage investments in both areas for maximum benefit. Furthermore, increasing numbers of faculty in fundamental disciplines is one of the keys for success for NRC rankings; which will ultimately impact our quest for Association of American Universities status.

Multidisciplinary Initiatives

There are seven multidisciplinary initiatives that are a part of the CNAS academic plan:

1. Genomics and Bioinformatics
2. Evolution and Ecology
3. Agricultural Sciences
4. Environmental Sciences/Conservation Biology
5. Materials Science and Nanotechnology
6. Health Sciences-Related Research
7. Computational Sciences, Modeling and Simulation

Areas of Basic Science

The basic sciences provide the underpinnings for scientific innovation. Investments will be made in several areas of current strength as well as areas in which we must develop strength. The current areas of basic science fall into the following general areas: life sciences, physical sciences, and mathematical sciences. The 13 academic departments of the College are:

Biochemistry
Biology
Botany and Plant Sciences
Cell Biology and Neuroscience
Chemistry
Earth Sciences
Entomology

Environmental Sciences
Mathematics
Nematology
Physics
Plant Pathology
Statistics

The rapid growth of the faculty ranks in recent years has also enabled the College to build upon and strengthen many existing research centers and affinity groups, and to create research foci around several emerging multidisciplinary areas, such as genomics and nanoscale science. Table 1 compiles the current and emerging research Centers and Institutes organized within CNAS, as well as the proposed or emerging centers and affinity groups, several of which are discussed in detail in this academic plan.

Table 1. Current and Emerging Centers and Facilities in CNAS

Current Centers and Institutes and Affinity Groups	**UCR Director or Lead Faculty)**
Air Pollution Research Center (APRC)	Roger Atkinson
Center of Astroparticle, Accelerator & Particle Physics	Gail Hanson
Center for Conservation Biology	Mike Allen/Edie Allen
Center for Invasive Species Research	Tim Paine
Center for Nanoscale Innovation for Defense (w/ UCLA, UCSB)	Robert Haddon
Center for Nanoscale Science & Engineering (w/ BCOE)	Robert Haddon
Center for Water Resources	Andrew Chang
Dry Lands Research Institute	Tom Perring
Institute for Integrative Genome Biology (IIGB)	Jian-Kang Zhu
Center for Plant Cell Biology (CEPCEB)	Natasha Raikhel
Biotechnology Impacts Center (w/ CHASS)	Norm Ellstrand
Institute for Geophysics and Planetary Physics (IGPP)	Gary Zank
Affinity Group in Mammalian Signal Transduction & Regulation of Transcription (mSTART)	Francie Sladek
Affinity Group in Chemical Genetics	Michael Pirrung
Off-Campus Centers in which UCR Faculty Participate	
Institute for Complex Adaptive Matter	(David Pines) Ward Beyermann at UCR
Southern California Earthquake Center	James Dieterich
Proposed or Emerging Centers and Affinity Groups	
Center for Genome Maintenance and Stability	Sarjeet Gill
Center for Evolution and Ecology in a Changing Environment	Len Nunney
Center for Glial⇔Neuronal Interactions	Mike Adams
Center for Disease-Vector Research	Alex Raikhel
Center for S and P Block Chemistry	Francois Mathey, Pingyun Feng, Guy Bertrand, Chris Reed
Center for Stem Cell Biology	Francie Sladek
Center for Water Science and Policy	Walt Farmer
Health Sciences Research Institute	Campuswide Initiative
College Facilities Supporting the Research Enterprise	
Natural Reserve System	John Rotenberry
Analytical Chemistry Instrumentation Facility	Chris Switzer
Citrus Variety Collection	Tracy Kahn
Central Facility for Advanced Microscopy and Microanalysis	Harry Green
IIGB/CEPCEB Core Instrumentation Facility	Jian-Kang Zhu, Natasha Raikhel
Plant Transformation Research Core	Martha Orozco-Cardenas
Plant Resources Information Lab (Q'TAXA)	Arturo Gomez-Pompa
Citrus Clonal Protection Program	Mike Allen (Plant Path. Dept. Chair)
Agricultural Experiment Station	Steven R. Angle (Dean, CNAS)

VI. Plans for Strategic Investment

As described above, CNAS plans to make strategic investments in multidisciplinary initiatives in the applied and fundamental sciences and targeted areas within the basic sciences. Each of the areas is discussed in more detail below. In addition, the academic plans prepared by the 13 CNAS departments can be found at http://www.cnas.ucr.edu/about/strategic_initiatives.html. The departments did an outstanding job developing their plans. They contain considerable details which support our proposed investments and these should be consulted for a complete picture of the impact of the hires and investments. The College supports the departmental plans, and given sufficient resources, we would support each and every request. However, resources are not unlimited and priorities must be set. (For a complete list of the faculty position requests from the Departments, see Appendix B).

Section VI describes the proposed CNAS faculty investment plan through 2007/08. The specific positions are our best description of what we see as top priorities. This hiring plan will be a dynamic document and it will be updated annually to create a rolling 3-year plan that reflects the current strengths and changes in CNAS. However, it is important to stress that the positions proposed in this plan are not a promise of resources to the individual programs. Appendix A provides a listing of proposed faculty hires through 2010/11. It is difficult to be accurate about specific areas this far in advance, but the positions are included to provide some perspective on our current thoughts on faculty hiring beyond 2007/08.

Due to the multidisciplinary nature of research in the biological, physical and mathematical sciences, hires in one strategic area often impact one or more additional strategic areas of investment. This is particularly true for the life sciences where diverse fields are interwoven. But examples are also seen in the physical sciences. For example, a proposed hire in biophysics/biomaterials will impact the Physics Department, the materials science and nanotechnology initiative and the Health Sciences Initiative. Thus, a single proposed hire may be listed in multiple locations in Section VI. The overall, non-duplicative, summary of every hire proposed in CNAS can be found in Appendix A.

A. Multidisciplinary Research Initiatives

1. Genomics and Bioinformatics

With the recent availability of complete genome sequences for several animals and plants and dozens of genome sequences for microbes, the agricultural, environmental and biomedical sciences have changed profoundly. Technologies now permit scientists to follow the expression of thousands of genes at a single time allowing investigators to develop a genome-wide understanding of organismal responses to developmental and environmental cues. Today, life-science research is approached at the systems-level combining these new technologies and computational methods allowing the study of complex biological problems at a global level. Multidisciplinary research in the life sciences is the norm. Computer scientists, statisticians and mathematicians, engineers, physical scientists, and biologists join forces to dissect the complexities of life.

The campus and CNAS have invested heavily in the area of Genomics and Bioinformatics in the past four years with the creation of the Institute of Integrative Genome Biology (IIGB) and its dynamic Centers – the Center for Plant Cell Biology (CEPCEB) and the Biotechnology Impacts Center (BIC). In addition, IIGB oversees the multi-million dollar investment in infrastructure and state-of-the-art genomics tools including the Core Instrumentation Facility and CEPCEB's Proteomics, Imaging and Microscopy, and Bioinformatics Core facilities. Future investments in the area of genomics and bioinformatics will leverage: (a) our newly developed research infrastructure, (b) the new state-of-the-art Biological Sciences building (February 2006) and Genomics Building (February 2008), and (c) recent senior and junior faculty hires that have propelled UCR to the forefront of functional genomics.

a. Institute for Integrative Genome Biology (IIGB). Realizing current interdisciplinary trends in the life, mathematical and physical sciences and with a vision for the future, the campus and College have made robust investments in the area of genomics and bioinformatics in the past four years. CNAS is already realizing the earnings from these key investments, with sizeable increases in grant awards in the past three years. CNAS plans to capitalize on these investments in infrastructure and faculty to propel UCR to the forefront of functional genomics. The Institute for Integrative Genome Biology (IIGB), formerly named the Genomics Institute, provides an umbrella that has fostered a new interdisciplinary graduate training track (Genomics and Bioinformatics) and an undergraduate degree in the Biological Sciences (Bioinformatics and Genomics track). IIGB harbors two established Centers – the Center for Plant Cell Biology (CEPCEB) and the Biotechnology Impacts Center, (BIC), which are already garnering world-wide recognition. The recent funding of the Genomics Building, construction of the Biological Sciences Building and planned renovation of Webber and Boyce Halls will allow UCR to fully realize the potential of this investment by attracting and retaining faculty at the forefront of this discipline.

Thus far, our investments in genomics have been tied to the historic strengths of the AES at UCR. These investments will strongly enhance the success of our future endeavors to create a vital and preeminent research environment that exploits the Riverside Advantage – promoting innovative research from the agricultural to the health sciences – spanning both basic research and applied technologies. Our established infrastructure will not only enhance UCR's traditional strengths in the agricultural and environmental sciences, but will serve to enhance our proposed investments in health sciences-related research and model systems, thereby impacting the developing Health Sciences Initiative.

Faculty hires that impact the area of Genomics and Bioinformatics are a primary focus for the College. In the next four years alone (2004-2008), CNAS proposes to hire 44 faculty to enhance this multidisciplinary area of investigation (Table 2). Thirty-four of these positions are new positions for the College. Recent hires, current searches, and proposed hires for the next four years 2004/05 to 2007/08 are summarized in Table 2. This focused initiative will allow the College to advertise its new positions in a single advertisement, highlighting our vision and commitment to growth in this research area. While some of the proposed searches will be department-based, many of the searches are proposed at the College level. This affords the College important flexibility; we will be able to examine a broader pool of candidates for each position, hire the best, and find the best match for a candidate's academic home. Many of the

new hires will be housed in the new Biological Sciences Building, the new Genomics Building and the renovated Boyce/Webber Hall spaces.

Under the leadership of Michael Clegg, the IIGB focused on developing the technological infrastructure to attract, motivate and retain the best students and faculty. Many of these investments in people and tools are described below and will be used to transition IIGB into its new phase of development. With the hire of the new IIGB Director (Dr. Jian-Kang Zhu) in January 2004, IIGB is beginning to redefine its leadership role on the UCR campus. IIGB has begun this initiative by sponsoring visits and seminars from distinguished scientists in this multidisciplinary field, thereby fostering interactions of UCR's faculty with research foci in the physical, mathematical and biological sciences, as well as engineering. In addition, links to the Keck Graduate Institute (KGI) in Claremont are actively being pursued. This is an important Biotechnology/Genomics/Bioinformatics and business linkage for IIGB, CNAS and the UCR Policy Initiative. A joint IIGB-Keck Symposium was held October 28-29, 2004 to initiate these important bridges.

Under the directorship of Dr. Zhu, the first research area that will be emphasized to enhance the notoriety of UCR's IIGB is RNA silencing or RNA interference (RNAi). MicroRNAs are small RNAs primarily transcribed from regions between genes in eukaryotic genomes. MicroRNAs have been shown to have profound impacts on gene regulation and organization of chromatin structures influencing virtually all processes with cells including uncontrolled cell growth (cancers), organ development, responses to human, insect and plant viruses, and responses to abiotic environmental stresses. UCR already has strength in this area with faculty in the departments of Plant Pathology (Ding), Botany and Plant Sciences (Zhu), and Biochemistry (Sauer), as well as pending NIH grants joining interests in Entomology and Plant Pathology (Ding, Atkinson, Raikhel) actively pursuing the role of RNAi in mosquito biology. CNAS also has more than 15 faculty using RNAi gene silencing strategies to investigate mechanisms of diseases and resistance as well as basic mechanisms of gene regulation. We propose to begin this strategic investment with the search (open level) for Evolutionary Genomics (2004-05). This will be complemented by two additional searches for a faculty in the fields of epigenetics/stem cell biology and developmental regulation in 2006-07.

The proposed hires in Genomics and Bioinformatics impact many fields in the life sciences. As highlighted in Table 2, the proposed hires will strengthen the agricultural sciences by building on CNAS strengths in plant (see CEPCEB), microbial and insect genomics (see Agricultural Sciences, Table 6) as well as ecology and evolution (Table 5). In addition, proposed hires in health sciences-related research and model organisms will form the strong basic science foundation for the developing HealthSciences Initiative, which is also dependent on strong capabilities in bioinformatics and computational biology (Table 4).

Table 2. Recent and Future Hires Impacting IIGB (Genomics & Bioinformatics)[A].

Year	Position	Department	Research Area [B]
2001-02	Dist Prof (N Raikhel)	Botany & Plant Sciences (CEPCEB)	Plant Cell Biology (Ag, C, G&B)
2002-03	Asst Prof (Cui)	Statistics	Bioinformatics/Data Mining (Ag, C, G&B, HSRR)
	Asst Prof (Mao)	Statistics	Bioinformatics/Data Mining (Ag, C, G&B,

			HSRR)
2003-04	Prof (Zhu)	Botany & Plant Sciences (Director, IGBB)	Plant Cell Biology (C, G&B, Ag, HSRR, E, V)
	Asst Prof (Eulgem)	Botany & Plant Sciences (CEPCEB)	Plant Cell Biology (C, G&B, Ag)
	Asst Prof (Smith)	Botany & Plant Sciences (CEPCEB)	Plant Cell Biologist (C, G&B, Ag)
2004-05	Asst Prof (Jin)	Plant Pathology (CEPCEB)	Plant Cell Biology (C, G&B, Ag)
	Asst Prof (Robertson)	Statistics	Baysean Statistics (C, G&B, Ag, HSRR, E, V)
	Open (Clegg)	College (BPS)	Evolutionary Genomics (RNAi, chromatin) (C, G&B, Ag, HSRR, E, V)
	Asst/Assoc Prof	College	Molecular Basis Vector borne disease – medical (G&B, HSRR, V, Ag)
Feb 2005	Open (Huh) (requested)	Cell Biology & Neurosciences	Neurobiology-Glial↔Neuronal Interactions (C, G&B, HSRR)
2005-06	Open	Biochemistry	Structural Biology/X-ray Crystallographer (C, G&B, Ag, HSRR, E, V)
	Asst/Assoc Prof	Botany & Plant Sciences (CEPCEB)	Plant Cell Biology (C, G&B, Ag)
	Asst Prof	Botany & Plant Sciences	Plant Cell Biology (C, G&B, Ag)
	Asst Prof (Ashe)	Cell Biology & Neurosciences	Neurobiology-Glial↔Neuronal Interactions (G&B, HSRR, C)
	Asst Prof	Entomology	Molecular basis of medical virus vector interactions (G&B, HSRR, V)
	Asst Prof (Pinto)	Entomology	Evolutionary Insect Systematics (C, G&B, Ag, E, V)
	Asst Prof (Sims)	Plant Pathology	Functional Genomics of Prokaryotes (G&B, Ag, HSRR, E, V)
	Asst Prof (Press)	Statistics	Computational Statistics/ Data Mining (C, G&B, Ag, HSRR, E, V)
	Asst Prof (Beaver)	Statistics	Computational Statistics/Data Mining (C, G&B, Ag, HSRR, E, V)
	Asst Prof	College (BIOL)	Developmental Genetics (C, G&B, Ag, HSRR, E, V)
	Asst Prof	College (NEM) (G&B)	*C. elegans* Genetics/Genomics (C, G&B. Ag, HSRR, E, V)
	Asst Prof	College (CBNS)	Genome Maintenance & Stability (C, G&B, Ag, HSRR, E, V)
	Asst Prof	College (G&B)	Evolutionary/Environmental Genomics (C, G&B, Ag, HSRR)
	Asst Prof	College (G&B)	Bioinformatics/Systems Biology (C, G&B, Ag, HSRR, E, V)
	Assistant Prof	College	Health Sciences-Related Research (C, G&B, HSRR, V)
2006-07	Asst Prof	Biochemistry/Chemistry	Structural Biology (C, G&B, Ag, HSRR, E, V)
	Asst Prof	Biology	Evolutionary Development (C, G&B, Ag, HSRR, E)
	Open (Dugaiczyk)	Biochemistry	Epigenetics/Stem Cell Biology (RNAi) (C, G&B, HSRR, E, V)
	Asst Prof	Cell Biology & Neurosciences	Extracellular Matrix (Cell-Cell Dynamics)/Glial↔Neuronal Interactions (G&B, HSRR, C)
	Asst Prof	College (BIOL; G&B)	Evolutionary Genomics (C, G&B, Ag, HSRR, E, V)

	Asst Prof	College (BIOL)	Developmental Regulation (RNAi) (C, G&B, Ag, HSRR, E)
	Asst Prof	College (BPS)	Community and Ecosystems Genomics (G&B, Ag, E)
	Asst Prof	College (CBNS)	Health Sciences-Related Research (Extracellular Matrix Receptors & Signaling (C, G&B, HSRR, V)
	Asst Prof	College (CBNS)	Health Sciences-Related Research (Stem Cells) (C, G&B, HSRR)
	Asst Prof	College (ENT)	Molecular Basis of Plant Pathogen Acquisition & Transmission (C, G&B, Ag, V)
	Asst Prof	College (PP)	Evolutionary Microbial Genomics (C, G&B, Ag, HSRR, E)
	Asst Prof	College (Stat)	Bioinformatics (C, G&B, Ag, HSSR, E, V)
	Asst Prof	College (G&B)	Genomics (C, G&B, Ag, HSSR, E, V)
	Asst Prof	College (G&B)	Ag Genomics (C, G&B, Ag, HSRR, E, V)
	Open	College (G&B)	Biotechnology Impacts (C, G&B, HSRR, E, V)
2007-08	Asst Prof	Biochemistry	Mammalian Molecular Signal Transduction (G&B, C, HSRR)
	Open (Dunn)	Biochemistry	Protein/Membranes (C, G&B, HSRR)
	Asst Prof	Botany & Plant Sciences	Computational Biology/Systems Biology (C, Ag, HSRR, E, V)
	Asst Prof	College (BIOL)	Evolutionary Microbiology (C, G&B, Ag, HSRR, E)
	Asst Prof	College (PP)	Host Virus Interactions (C, G&B, Ag, V)
	Asst Prof	College (Stat)	Genomics/Bioinformatics (C, G&B, Ag, HSRR, E, V)
	Asst Prof	College (G&B)	Ag Genomics (C, G&B, Ag, HSRR, E, V)
	Asst Prof	College (CBNS)	Health Sciences-Related Research (G&B, HSRR)
	Asst Prof	College (G&B)	Ag Genomics (C, G&B, Ag, HSRR, E, V)
	Asst Prof	College (G&B)	Biotechnology Impacts (C, G&B, HSRR, E)
2008-09	Asst Prof (Traugh)	Biochemistry	Health Sciences-Related Research/Signal Transduction (C, G&B, HSRR)
	CE	Entomology	Medical Urban Entomology (Ag, HSRR, V)
	Asst Prof	Plant Pathology	Molecular Pathogen-Host Interactions (C, G&B, Ag, HSRR, V)
	Asst Prof	College (BCH)	Health Sciences-Related Research/Proteins-Membranes (C, G&B, HSRR)
	Asst Prof	Cell Biology & Neuroscience	Health Sciences-Related Research/Genome Maintenance & Stability/Chromatin Remodeling (C, Ag, G&B, HSRR, V)
	Asst Prof	College	Health Sciences-Related Research (C, G&B, HSRR, V)
	Asst Prof	College	Health Sciences-Related Research/Genomics & Bioinformatics (C, G&B, HSRR, V)
	Asst Prof	College (G&B)	Ag Genomics (C, G&B, Ag, HSRR, E, V)

KEY:
Red: Name of Recent Hire
Green: Replacement; name of faculty member leaving UCR

[A] Investments in Genomics and Bioinformatics (G&B) impact virtually all programs in the life sciences from applied to basic research and from agricultural science to biomedical science. Several positions are replacement positions (faculty member names in green are included). Several of the new positions were committed to Dr. Natasha Raikhel (CEPCEB) or Michael Clegg (G&B) in hiring and retention initiatives. Some College searches were originally proposed in Department plans. In these cases, Department names are in parentheses. Note: Many of the hires in the departments of Chemistry and Physics, as well as BCOE, will impact all life science research, including genomics-based initiatives. These positions can be found in Tables 10 and 13.

[B] The positions that most strongly impact CEPCEB (C), Health Sciences-Related Research (HSRR), Vector Biology (V), Agricultural Science (Ag), Genomics & Bioinformatics (G&B) and Ecology and Evolution (E) are indicated in parentheses. Given the interdisciplinary nature of research, positions may be listed in multiple tables to emphasize their importance to each initiative.

b. The IIGB Core Instrumentation Facility (CIF). Genomics-related research is driven by access to modern equipment and trained personnel to provide services and to assist in faculty, postdoc, and student training. The Core Instrumentation Facility serves as the nerve center of IIGB and is housed in the newly renovated Noel Keen Hall. The Core is essential to our research and teaching activities in genomics, including the recruitment of top-notch faculty and graduate students. This facility was funded by a loan to CNAS and is being repaid by overhead from grants (indirect cost recovery). The Core Instrumentation Facility is at the heart of our genomics and bioinformatics infrastructure providing: (a) a reasonably priced DNA sequencing service, (b) microarray printing, hybridization and scanning, (c) gene chip probe synthesis, hybridizations and scanning, (d) colony-picking robots, (e) machinery to visualize gel images, (f) quantitative RT-PCR, and (g) fluorescence activated cell sorter (FACS). The Core facility is supported by an Academic Coordinator and two staff members and provides services for faculty, postdocs and students from ten CNAS Departments, as well as the Department of Chemical Engineering and the Division of Biomedical Sciences.

It is clear that the IIGB Core Instrumentation Facility and the CEPCEB Proteomics, Imaging and Microscopy and Bioinformatics Cores (see below) are major factors in recruiting high-profile junior and senior faculty, who use the tools of functional and structural genomics. Our recent increases in federal contract and grant activity are strongly correlated with the College's emerging strengths in insect, plant and microbial genomics. This facility will provide the technical foundations for our proposed investments in life and agricultural sciences and the emerging area of health sciences-related research, which relies on the instrumentation provided by the IIGB and CEPCEB Cores. IIGB faculty have used CNAS investments as matching funds for the purchase of the FACS and DNA sequencing machinery from the NIH. CNAS was also successful in obtaining a Keck Foundation grant to establish and enhance proteomics at UCR. It is critical that we keep the IIGB Core Instrumentation Facility modern and update instrumentation regularly using NSF, NIH, and private foundation grants to leverage any campus investment. To assure that the established infrastructure is meeting campus needs, CNAS has initiated the first campus review of the IIGB Core Facility to assure that the Core is providing UCR researchers the economical services and training needed for today's research and a vision for the future that enables adaptation to the changing trends in genomics.

c. The Center for Plant Cell Biology (CEPCEB). The Center for Plant Cell Biology (CEPCEB) was established in January 2002 with hiring of its Director, Dr. Natasha Raikhel. CEPCEB is one of two established Centers under the IIGB umbrella. CEPCEB has already emerged as the preeminent center for plant cell biology in the world. The Center is built on existing UCR

strengths in plant biology and several senior and junior faculty hires in the College and across the campus have created this unique interdisciplinary research initiative. Plant cell and molecular biologists have joined strengths with computational scientists, engineers, bioengineers, chemists, and nanoscientists to forge a new frontier in plant biology. With a theme of plant chemical genomics, which uses small molecules and genetics to dissect complex biological and biochemical pathways, CEPCEB faculty have acquired two NSF-funded Research Experience for Undergraduates grants (2002-2005, 2005-2010), which bring 10 under-represented minority students to UCR each year for a summer research experience. In addition, CEPCEB faculty submitted an NSF Science and Technology Center grant (February 2004), which unfortunately was not funded, and an NSF IGERT grant (invited to submit a full proposal in October 2004, still pending). Finally, in January 2003, CEPCEB and the Department of Botany and Plant Sciences hosted an international conference entitled "Frontiers of Plant Cell Biology: Signals and Pathways, Systems-Based Approaches" in Riverside. Scientists from around the world had the opportunity to visit our new IIGB and CEPCEB Core Facilities. This is an auspicious beginning for the two-year-old CEPCEB.

With the establishment of CEPCEB within IIGB, CNAS and the campus created three state-of-the-art Cores in Proteomics, Imaging and Microscopy, and Bioinformatics. Each core is supported by an Academic Coordinator, who brings these high-end technologies and research experiences to UCR faculty, students and postdoctoral fellows. Joining with the Departments of Botany and Plant Sciences and Plant Pathology, CNAS has invested in three junior faculty in 2003 and 2004 to enhance CEPCEB (Table 2). The Genomics Building was a key recruitment tool for these faculty and for future hires that impact CEPCEB (Tables 2 and 4). Specifically, CNAS proposes to hire two additional plant cell biologists in 2005-06. Furthermore, the five proposed hires in agricultural genomics (2005 to 2009), as well as three plant-pathogen interaction positions (2006-2008) will also specifically enhance CEPCEB. All additional future investments in genomics and bioinformatics, mammalian biology, and agricultural sciences (see below) enhance CEPCEB by contributing to a vital and diverse research environment. Both junior and senior CEPCEB members with strengths in the fields of plant cell biology and statistics will occupy the new Genomics Building, Webber/Boyce Hall or Bachelor Hall.

d. Biotechnology Impacts Center (BIC). The Biotechnology Impacts Center (BIC) is the second Center that was established under the IIGB umbrella. BIC, which has evolved through joint efforts of faculty in CHASS and CNAS, addresses the ethical, social, economic, environmental, and public policy implications of biotechnology. The resulting knowledge will inform public policy discussions among public interest groups, the biotechnology industry, academics, elected officials and policymakers.

This Center hosted a major international conference in Riverside titled "GMOs in 2030: Reaping the Promise While Leaping the Pitfalls?" in October 2003. Most recently, BIC directors received a $1.5 million grant from the NSF Biocomplexity Program to support research in this field. As the campus Health Sciences Initiative develops, it is anticipated that BIC will be broadened and address pressing ethical and societal issues that confront medicine in the post-genomics era. Additional synergies are anticipated with development of the new Policy Institute, Environmental Research Institute, and Law and Science initiatives.

As these efforts move forward, we will develop a comprehensive plan for this Center that is synergistic between the Colleges and newly emerging Institutes. We anticipate that BIC will be ready for additional investments in 2006-07 and 2007-08, with the addition of one faculty member each year and a third faculty member in the College of Humanities, Arts, and Social Sciences in 2007-08 or beyond. The first will be for a senior person to help provide leadership within this important area of research. These searches need to be discussed by CNAS faculty and the BIC Director needs to develop a 5-year plan for the Center before moving forward with these investments.

e. The Proposed Center for Disease-Vector Research. Vector-borne diseases permeate the daily news. Mosquitoes transmit the deadly West Nile Virus and the Glassy-Winged Sharpshooter that transmits Xylella fastidiosa has the potential to decimate California's table grape and wine industries. UCR is uniquely positioned to become a leader in the field of vector-borne diseases. Leveraging UCR's strengths in insect, plant and microbial genomics, as well as current Cooperative Extension and outreach efforts, the Center for Disease-Vector Research is currently being developed and will be housed under the IIGB umbrella. Dr. Alex Raikhel leads this initiative, which engages faculty from the Departments of Entomology, Plant Pathology, Biology, Cell Biology & Neuroscience, Nematology and Botany and Plant Sciences. The Center builds on the College's rich history in the field of vector biology for both human and plant disease.

While impacting agriculture, this Center will primarily focus on insect-pathogen interactions pertaining to human diseases. The Center is sponsored 3-4 seminars in the winter of 2005 to launch this initiative. The Center could be a component of UCR's emerging Health Sciences Initiative and will also impact homeland security by addressing mechanisms disease transmission and food security. Faculty in this research area will rely on NIH for the major portion of their grant support. In the next three years, CNAS will strengthen this Center with College-wide and department-based searches (Table 3). New hires will be housed in the new Genomics Building, Biological Sciences Building, or renovated Boyce/Webber Hall space depending on their research emphasis.

f. The Proposed Center for Genome Maintenance and Stability. Formation of a Center for Genome Maintenance and Stability is proposed to capitalize on UCR's existing substantial strength in this emerging field, which seeks to understand how the genetic material of the cell is maintained in an intact form and is faithfully transmitted to future generations. Interest in this area has been stimulated by an increasing appreciation of the role that genome integrity plays in human health and development. Genome maintenance and stability represents a large and expanding component of biomedical research.

More than a dozen UCR faculty members from six departments – all with significant extramural funding – currently undertake projects in genome maintenance and stability. Through coordinated efforts, this group can comprise a nucleus of research excellence for UCR. The proposed Center will focus on two key areas: 1) providing a forum for investigators to pursue a common research agenda and 2) recruiting additional faculty in the area. The objectives of the proposed Center include: promoting a shared research agenda by creating an organizational framework within which faculty from several departments can coordinate their efforts;

stimulating multi-investigators funding proposals, such as Program Project Grants from the National Institutes of Health; enhancing research facilities through development of core facilities and development of shared research equipment; and training the next generation of researchers in the field.

g. The Proposed Center for Glial ⇔ Neuronal Interactions. The proposed Center for Glial ⇔ Neuronal Interactions will synergize on-going research at UCR and serve as a nucleus around which to unify strength in this research area in Southern California. The human brain is composed of 100 billion neurons and 10 to 50 times as many glial and other non-neuronal cells. Glial cells were long considered to serve merely as the supporting cast and scenery against which the starring neuronal roles would be played out. Relatively recent evidence, however, indicates that glial cells are intimately involved in many brain functions, including computation.

A small but internationally recognized group of neuroscientists in the UCR Department of Cell Biology and Neuroscience and the UCR Division of Biomedical Sciences comprise a relatively high density of scientists working in this area, compared to institutions worldwide. Thus, the campus is uniquely positioned to become a national and international leader in this emerging and dynamic area in brain research. The proposed Center will serve as an organizing entity around which investigators interested in glial ⇔ neuronal interactions can collaborate. The Center will also facilitate submission of proposals to the National Institutes of Health for Program Project and Center grants, and to the National Science Foundation for Science and Technology Centers (STC) and Research Experiences for Undergraduates (REU).

Table 3. Recent and Future Hires Impacting Disease-Vector Research [A]

Year	Position	Department	Research Area[B]
2001-02	Prof (A. Raikhel)	Entomology	Mosquito Biology/Disease Vector Research
2004-05	Asst/Assoc Prof	College	Molecular Basis of Human Vector-Borne Disease (G&B, HSRR, V)
	Asst Prof (Gumpf)	Plant Pathology	Viruses of Subtropical Crops and Vectors (Ag, V)
2005-06	Asst. Prof (Semancik)	Plant Pathology	Invasive Pathogens (Ag, V)
	Asst Prof	Entomology	Molecular Basis of Medical Virus-Vector Interactions (G&B, Ag, HSRR, V)
2006-07	Asst Prof	College (PP)	Plant Virus-Vector Interactions (G&B, C, Ag, V)
	Asst Prof	College (ENT)	Molecular basis of Plant Pathogen Acquisition & Transmission (G, C, Ag, V)

KEY:
Red: Name of Recent Hire
Green: Replacement; name of faculty member leaving UCR

[A] All investments in Disease-Vector Research will impact many programs in the life sciences from applied to basic research and from agricultural science to biomedical science. Several of positions are replacement positions (names of the faculty member are included in green). Some College searches were originally proposed in Department plans; in these cases, department initials are in parentheses.

[B] The positions that most strongly impact CEPCEB (C), Health Sciences-Related Research (HSRR), Vector Biology (V), Agricultural Science (Ag), Genomics and Bioinformatics (G&B) and Ecology and Evolution (E) are indicated in parentheses. Given the interdisciplinary nature of research, positions may be listed in multiple tables to emphasize their importance to each initiative.

h. Computational Biology and Bioinformatics. In our current research environment, it is critical for statisticians, computer scientists and mathematicians to join forces with cell and molecular biologists, structural biologists, evolutionary biologists, chemists, and physicists. This union allows for the development of new algorithms to address the vast data sets that are generated when monitoring whole genome expression programs, predicting of gene structures, identifying of regulatory RNAs, and predicting protein and chemical interactions, which are critical for current and future life-science research endeavors. CNAS has already begun this strategic investment with the hire of two Bioinformaticians in the Statistics Department and the CEPCEB Bioinformatics Academic Coordinator in 2002 (Table 4). The concerted efforts of life-science faculty, the Statistics Department and computer scientists from the BCOE created a new graduate Ph.D. degree program in Genomics and Bioinformatics within the Interdepartmental Graduate Program in Genetics (recently renamed Genetics, Genomics and Bioinformatics). This is complemented by a new Bioinformatics and Genomics track in the Interdepartmental Biological Sciences major, which was launched in 2003.

CNAS will continue to make investments in computational biology that impact Genomics and Bioinformatics (Tables 2 and 4). These hires will not only impact the agricultural, environmental and health sciences-related research, but they will create a robust mathematical and statistical core of researchers that is essential for establishing collaborations in the life and physical sciences throughout the College and across the campus. CNAS investments in bioinformatics and computational biology will have synergy with the proposed multidisciplinary CNAS Modeling and Simulation Initiative (Section A.7). The College proposes seven hires in Bioinformatics over the next four years (2004/05 – 2007/08). Three of these positions are replacement positions; four positions are new. Faculty hires will be facilitated by either departmental or college-based searches (Table 4). These Bioinformatics/Computational Biology faculty will focus on the development of new techniques and theory for data mining, analysis, and retrieval of data generated in and required to address biological problems with genomics tools. In addition, faculty who will address the complex networks of gene and protein interactions (systems biology) will be added. Finally, as part of UCR's research in structural biology, it is anticipated that one new hire will have a research program focused on developing algorithms to model protein structure and interaction with ligands.

Table 4. Recent and Future Hires in Bioinformatics and Computational Biology [A]

Year	Position	Department[A]	Research Area
2002-03	Asst Prof (Cui)	Statistics	Bioinformatics/ Data Mining
	Asst Prof (Mao)	Statistics	Bioinformatics/ Data Mining
	Acad Coord (Girke)	Botany & Plant Sciences/CEPCEB	Bioinformatics
2004-05	Asst/Assoc Prof (Robertson)	Statistics	Baysean Statistics
2005-06	Asst Prof (Press)	Statistics	Computational Statistics/Data Mining
	Asst Prof (Beaver)	Statistics	Computational Statistics/Data Mining
	Asst Prof	College (G&B)	Bioinformatics/Systems Biology
2006-07	Asst Prof	College (STAT)	Bioinformatics

2007-08	Asst Prof	Botany & Plant Sciences	Computational Biology/Systems Biology
	Asst Prof	College (STAT)	Genomics/Bioinformatics

KEY:
Red: Name of Recent Hire
Green: Replacement; name of faculty member leaving UCR

[A] All investments in bioinformatics and computational biology have impact on many programs in the life sciences from applied to basic research and from agricultural science to biomedical science and the Department of Statistics. Several positions are replacement positions (names of the faculty member are included in green). Investments in this area also influence the physical and mathematical sciences Modeling and Simulation Initiative (Section A.7).

i. Structural Biology. With the maturation of genomics and the rapid advancements in the fields of proteomics and metabolomics, scientists are focusing on the function of genes and their products. Expertise in structural biology – the determination of the 3-dimensional configuration of biological macromolecules with emphasis on interactions between structure and function – will be essential to realize the full potential of genomics. This field builds the empirical methods for resolving macromolecular structures and molecular-level interactions including X-ray crystallography, advanced NMR (particularly solution NMR), ESR (electron spin resonance) imaging, and high-resolution electron microscopy. These key technologies need to be complemented with computational modeling for theoretical predictions of protein structure and protein-ligand interactions.

Building strength in structural biology is critical for creating the essential interdisciplinary research environment that meshes basic and applied research initiatives in the life and physical sciences, as well as bioengineering. CNAS investments in structural biology will significantly enhance agricultural, environmental and biomedical research, as well as provide needed links to facilitate the development of new biomaterials thereby advancing both life and physical sciences. Because of shared technology and approaches, structural biology faculty should also have strong links to chemistry, nanotechnology, and computational modeling and simulation. Investments in structural biology will enhance the College's current strengths in plant, insect and microbial genomics (see IIGB, CEPCEB, Disease-Vector Research, and Agricultural Sciences, Tables 2, 3, and 6). Structural Biology is also critical for our proposed investments in mammalian biology and model organisms that form the foundations for the campus Health Sciences Initiative.

CNAS began its investments in structural biology with an offer to Dino Moras, who was anticipated to join our Biochemistry Department in January 2005. However, he has decided to decline the offer. The College is considering renewing that search in 2005-06 and recruiting a leading scientist in structural biology. This appointment will be leveraged to hire a second structural biologist in the 2006-07 academic year with a search led by the Departments of Biochemistry and Chemistry (Table 2). It is likely that several of the genomics, bioinformatics or agricultural genomics positions will also strength structural biology.

2. Evolution and Ecology

UCR has achieved considerable strength, as well as national and international visibility, in the area of Evolution and Ecology. UCR's strengths in this discipline was the most highly ranked science program on the campus in the last NRC survey of graduate education. UCR's

prominence in Evolution and Ecology is largely due to the quality and number of faculty in this research area, with more than 48 faculty spread across the Departments of Biology, Biochemistry, Botany and Plant Sciences, Entomology, Earth Sciences, Environmental Sciences, Nematology, and Plant Pathology.

CNAS is committed to retaining and enhancing this area of excellence. In the winter of 2004, CNAS formed a focus group to examine the college's programs in Evolution and Ecology and make recommendations on what we can do to capitalize on this area of strength. This report can be found on the CNAS homepage (http://www.cnas.ucr.edu/about/documents/Evolution_and_Ecology_Focus_Group.pdf). As this report highlights, UCR's major asset is the fact that UCR faculty have research initiatives to address all levels of study (molecular, organismal, population, landscape) and time scales (from paleontological studies to predicting the future of landscapes and endangered species). CNAS has recognized strengths in evolutionary ecology, conservation biology, systematics, and evolutionary physiology. Furthermore, CNAS research programs span the pure/applied research boundary, so that the advances in basic research are applied to current problems.

One recommendation of the 2004 Evolution and Ecology Focus Group was the establishment of a "*Center for Evolution and Ecology in a Changing Environment.*" This Center would allow CNAS to leverage our past and future investments in Evolution and Ecology (Table 5). The Center would further focus faculty interest and enhance national and international visibility. This, in turn, would aid the recruitment of graduate students, and provide a base for developing training grants. The Center would emphasize research on the interacting dynamics of ecology and evolution placed in the context of global and local environmental change. The research topics would include current strengths in conservation and restoration biology, the biology of invasive species, and the evolution and ecology of pathogens, as well as landscape ecology, community paleobiology, evolutionary ecology, systematics, and functional genomics. A first step to highlight the College's training strengths in Evolution and Ecology has already been achieved. The Department of Biology has changed the name of its graduate program to "Evolution, Ecology and Organismal Biology" in recognition of this area of strength and the current National Research Council classifications. This graduate program has opened its doors to Evolution and Ecology faculty across the College. The Evolutionary and Organismal/Physiology tracks are developed. There are campuswide discussions regarding the need for either an Ecology track in the EEOB major and/or distinct graduate training alternatives to meet the diverse training and research interests of CNAS and campus ecologists.

Evolution and ecology has very strong synergies with other campus strengths, notably conservation biology, genomics, environmental sciences, and agricultural sciences. Evolution is the most fundamental unifying principle in the life sciences. The connections to organismal biology, ecology, and conservation biology are pervasive and self-evident, but its importance extends to all levels of biological integration. With the advent of genomics, it is increasingly clear that most genes in humans and other animals are not recent innovations, but instead are evolutionary descendents of ancient gene families that appear across the spectrum of organismal diversity from bacteria to vertebrates. Thus, the application of evolutionary principles is essential for cutting-edge research in cell, developmental and molecular biology as it impacts health, the

environment and agriculture. Structural biology and biomedical research is profiting from insights derived from novel evolutionary approaches to old problems.

Genomic methodologies provide powerful new insights into traditional evolutionary questions ranging from systematics to social behavior. Rapid accumulation of sequence data is fueling the new interdisciplinary theme of evolutionary genomics, which examines the evolution of genomic architecture and how changes in genome structure affect speciation and major evolutionary transitions (e.g., 'innovations' in body form and function). CNAS faculty are using sophisticated molecular tools such as microarrays to track changes in thousands of genes and their protein products during adaptation. Finally, genomic approaches and modern molecular techniques are reunifying the themes of evolutionary and developmental biology into a dynamic new discipline ("Evo/Devo") that has now been recognized at the National Science Foundation with a dedicated grant panel.

In the next four years, we propose 19 faculty hires that will impact the fields of Evolution and Ecology (Table 5). These positions span the fields of conservation biology to evolutionary genomics and from microbes to mammals. Six of the proposed positions are replacements due to recent and anticipated retirements in Biology, Entomology and Botany and Plant Sciences. The remaining 13 positions are designed to leverage our current strengths in Evolution and Ecology. Special emphasis has been placed on expanding strengths in the fields of landscape and community ecology and Evolution and Ecology impacts on genomics and bioinformatics. Both department- and College-based searches are proposed. New hires are anticipated to be housed in Spieth/Life Sciences, Batchelor Hall and the renovated Webber/Boyce Halls.

Table 5. Future Hires Impacting Ecology and Evolution.[A]

Year	Position	Department	Research Area [B]
2004-05	Open (Clegg)	College (BPS)	Evolutionary Genomics (RNAi/Chromatin) (C, Ag, G&B, HSRR, E, V)
	Asst Prof (Madore)	Botany & Plant Sciences	Physiological Ecosystems Ecologist (C, Ag, E)
	Open; Director CCB (Waser)	College (BIOL)	Evolutionary Ecology (C, Ag, G&B, E)
	Open; Water Center Director	Environmental Sciences	Water Resources (Ag)
2005-06	Asst Prof	College (BIOL)	Developmental Genetics (C, G&B, HSRR, E)
	Asst Prof (Price)	Biology	Evolutionary Ecology (Ag, G&B, E)
	Asst Prof (Pinto)	Entomology	Evolutionary Insect Systematics (Ag, G&B, HSRR, E)
2006-07	Asst Prof	Biology	Evolutionary Development (C, G&B, Ag, HSRR, E)
	Asst Prof	Plant Pathology	Microbial Ecology and Population Biology (Ag, G&B, E)
	Asst Prof	Botany & Plant Sciences	Spatial Landscape Ecology (Ag, E)
	CE	Botany & Plant Sciences	CE Weed Science (Ag, E)
	Asst Prof	College (BPS)	Community/Ecosystems Genomics (Ag, G&B, E)
	Asst Prof	College (PP)	Evolutionary Microbial Genomics (C, Ag, G&B, HSRR, E)
	Asst Prof	College (BIOL)	Developmental Regulation (RNAi) (C, G&B, Ag, HSRR, E)
	Asst Prof	College (BIOL) (G&B)	Evolutionary Genomics (C, G&B Ag, HSRR, E, V)
2007-08	CE	Botany & Plant Sciences	CE Conservation Biology (Ag, E)
	Asst Prof	Botany & Plant Sciences	Community Genetics (Ag, G&B, E)

	Asst Prof (Goeden)	Entomology	Applied Ecology of Natural Enemies of Weeds (Ag, E)
	Asst Prof	College (BIOL)	Evolutionary Microbiology (C, Ag, G&B, HSRR, E)
2008-09	Asst Prof	Botany & Plant Sciences	Community Ecology (Ag, E)
	CE	Botany & Plant Sciences	Urban Landscape Horticulture (Ag, E)

KEY:
Red: Name of Recent Hire
Green: Replacement; name of faculty member leaving UCR

[A] All investments in Ecology and Evolution have wide impact on many programs in the life sciences from applied to basic research and from agricultural science to biomedical science. Several of the new positions were committed to Dr. Michael Clegg (G&B) during retention negotiations. Several positions are replacement positions (names of the faculty member are included in green). Some searches were originally proposed in Department plans, (their names are in parentheses); these broad reaching searches are now College searches.

[B] Many of the positions impact CEPCEB (C), Health Sciences-Related Research (HSRR), Vector Biology (V), Agricultural Science (Ag), Genomics and Bioinformatics (G&B) and/or Ecology and Evolution (E); the areas of impact are thus indicated. Given the interdisciplinary nature of research, positions may be listed in multiple tables to emphasize their importance to each initiative.

3. Agricultural Sciences

The agricultural sciences at UCR have a nearly 100-year history, since the opening of the Citrus Experiment Station in 1907. Basic and applied research and extension of this knowledge in citrus and other subtropical crops are still major research priorities. These research areas are richly supported from federal agencies, industry and more recently with UC Discovery Grants, which partner industry and academia. In addition, the faculty of our Agricultural Experiment Station now address a much broader array of agricultural, urban, and natural resource problems that involve plant biology, insect pests, pathogens, weeds, and soil and water issues. The areas of Plant Biology, Pest and Disease Science, Microbiology, Invasive Species, Water Quality, and Conservation Biology (see Environmental Sciences below) are some of our most visible and recognized campus strengths that primarily draw from AES departments. CNAS is committed to continued growth and excellence in these areas (Table 6).

a. Plant Biology. College strengths in plant biology are focused in the areas of molecular and cellular biology, physiology, ecology, and crop improvement. CNAS is committed to continuing to develop and enhance these strengths (Table 6). The College and the campus have already invested heavily to develop the Center for Plant Cell Biology, which is described above in the Genomics/Bioinformatics section. CNAS will further develop this internationally recognized strength by its future investments in genomics and bioinformatics (Table 2). Plant biology, including CEPCEB, gains additional strength from continued CNAS investments in basic areas of plant biology, such as physiology, ecology and evolution (Tables 5 and 6). Application of this basic research for the improvement of horticultural crops through applied research in plant breeding, plant nutrition, and weed science has been a long-term strength in the AES and will be enhanced by hires in focused areas at UCR. Enhancing our ability to address problems associated with urban horticulture (turfgrass and ornamentals) will be a particular emphasis, consistent with the increasing urbanization of our region. All faculty hires directly impacting plant biology are consistent with proposed plans from the Departments of Botany and Plant Sciences and Plant Pathology (Table 6). However, the Departments of Biology, Biochemistry,

Entomology, Nematology and Statistics also harbor faculty that provide important depth and diversity to this research area and the proposed hires will also impact these programs.

b. Pest and Disease Science. The area of Pest and Disease Science primarily gains its strengths from the departments of Entomology, Nematology, Cell Biology and Neuroscience, and Plant Pathology, but faculty from the departments of Biology, Botany and Plant Sciences, Chemistry, Environmental Sciences, and Statistics also contribute to research on agricultural pests and diseases. Pest and Disease Science is a highly interdisciplinary area, requiring a strong foundation in insect, pathogen, and plant biology, as well as field-based expertise for extending fundamental information to the creation of practical solutions. Our departments have assembled teams of researchers and Cooperative Extension Specialists to achieve a continuum of basic to applied research. Our academic plan includes a number of replacement hires in areas that are essential to maintain our effectiveness in addressing the basic mission of pest and disease management (Table 6), but it also includes many hires that represent new directions and greater integration with major campus initiatives in Genomics and Bioinformatics (Table 2), Disease-Vector Research (Table 3), Plant Cell Biology (Table 2), and Ecology and Evolution (Table 5).

c. Microbiology. CNAS has a significant strength in plant and environmental disease microbiology. Genomics research on pathogenic and model microorganisms is essential to the future development of sustainable plant disease resistance strategies, improved biological control of pests and diseases, and applications of microorganisms in bioremediation and restoration of natural systems. In addition, genomics approaches are critical to better understand the relationships between microbial pathogens and insects that vector them to plants and animals. In partnership with the Center for Disease-Vector Research, we will invest in the genomics of microorganisms that are vectored by insects, in addition to the investments in the genomics of insect vectors. This integrative genomics approach will be the most effective way to understand why certain pathogens are transmitted by insects and how to design strategies to block that transmission. In addition, several investments in microbial evolution will enhance these CNAS strengths.

d. Invasive Species. Invasive species research has been an important component of the pest and disease sciences since the beginning of the Citrus Experiment Station at UCR. There is a long list of introduced exotic pests in California for which UCR researchers have investigated the fundamental biology and developed successful management strategies. However, the rate of introduction of exotic pests, diseases, and weeds has increased with the globalization of world trade and increased international travel, providing continuing threats to agricultural, urban, and natural environments, as well as human health. UCR's Center for Invasive Species Research provides a forward-looking approach to pest and disease invasions. Investments in microbial and insect genomics and vector biology, described in the genomics section, are critical to this effort. Improving our teams of experts to address invasive species problems will also require further investments in our expertise in systematics, applied ecology, biological control, and extension.

e. Water Quality. The interface of agricultural activities and the environment is of increasing concern and is an area that UCR is well positioned to address through research in water quality, management, and policy. This will be addressed further in a subsequent section on environment-related research, but the integration of these efforts with agricultural research is important to

emphasize. New regulations on irrigation water runoff require new approaches to containment and purification of agricultural drainage. Increasing soil salinity is also related to agricultural irrigation practices and impacts both the productivity of agricultural crops and the health of natural plant ecosystems. Building on existing strengths in research on water resources and natural resource economics, a new Center for Water Science and Policy is being developed and involves faculty from both CNAS and the Bourns College of Engineering. A new senior-level AES faculty position is in recruitment to provide enhanced leadership for this new initiative.

Table 6. Future Hires Impacting Agricultural Sciences.[A]

Year	Position	Department[A]	Research Area[B]
2004-05	Asst Prof (Madore)	Botany & Plant Sciences	Physiological Ecosystem Ecology (Ag, E)
	Open	Environmental Sciences	Water Resources (Ag, E)
	Open (Menge)	Plant Pathology	Water and Soil-borne Pathogens (Ag)
	Asst. Prof (Gumpf)	Plant Pathology	Subtropical Viruses & Vectors (Ag, G&B, V)
	Open (Clegg)	College (BPS)	Evolutionary Genomics (RNAi/Chromatin) (C, Ag, G&B, HSRR, E, V)
	Open (Waser)	College	Director Center Conservation Biology/Evolutionary Ecology (Ag, G&B, E, V)
2005-06	Asst Prof	Botany & Plant Sciences (CEPCEB)	Plant Cell Biology (C, Ag, G&B, HSRR)
	Asst/Assoc Prof	Botany & Plant Sciences (CEPCEB)	Plant Cell Biology (C, Ag, G&B, HSRR)
	Assoc CE (Gibeault)	Botany & Plant Sciences	Turfgrass Management (Ag)
	Asst Prof (Pinto)	Entomology	Evolutionary Insect Systematics (Ag, G&B, E, V)
	Asst Prof (Sims)	Plant Pathology	Functional Genomics of Prokaryotes (Ag, G&B, V)
	Asst Prof (Semancik)	Plant Pathology	Invasive Pathogens (Ag, V)
	Asst CE	Plant Pathology	Vegetable Crops (Ag)
	Asst Prof	College (NEM) (G&B)	*C. elegans* Genetics/Genomics (Ag, G&B, V)
	Asst Prof	College (G&B)	Evolutionary/Environmental Genomics (C, Ag, G&B, E, HSRR)
2006-07	Asst Prof	Botany & Plant Sciences	Spatial Landscape Ecology/Remote Sensing (Ag, E)
	CE (Cudney)	Botany & Plant Sciences	CE Weed Science (Ag, E)
	Asst Prof	Plant Pathology	Microbial Ecology and Population Biology (Ag, E)
	Asst Prof	College (BPS)	Community Ecosystems Genomics (Ag, G&B, E)
	Asst Prof	College (ENT)	Molecular Basis of Plant Pathogen Acquisition & Transmission (C, Ag, G&B, V)
	Asst Prof	College (PP)	Evolutionary Microbial Genetics (C, Ag, G&B, HSRR, E)
	Asst Prof	College (G&B)	Ag Genomics (C, Ag, G&B, HSRR, E, V)
2007-08	Asst Prof	Botany & Plant Sciences	Computational Biology/Systems Biology (C, Ag, G&B, HSRR, E)
	CE	Botany & Plant Sciences	Conservation Biology (Ag, E)
	Asst Prof	Botany & Plant Sciences	Community Genetics (Ag, E)
	Asst Prof	Entomology	Applied Ecology of Natural Enemies of Weeds (Ag,

	(Goeden)		E)
	Asst Prof	College (G&B)	Ag Genomics (C, Ag, G&B, HSRR, E, V)
	Asst Prof	College (PP)	Host-Virus Interactions (C, Ag, G&B, V)
	Asst Prof	College (G&B)	Ag Genomics (C, Ag, G&B, HSRR, E, V)
2008-09	Asst Prof	Botany & Plant Sciences	Community Ecology (Ag, E)
	CE	Botany & Plant Sciences	Urban Landscape Horticulture (Ag, E)
	Asst Prof	Environmental Sciences	Aquatic Ecology (Ag, E)

KEY:
Green: Replacement; name of faculty member leaving UCR

[A] All investments in Agricultural Genomics have wide impacts on programs in the life sciences from applied to basic research and from agricultural science to biomedical science. Several of the new positions were committed to Dr. Michael Clegg (G&B) during retention negotiations and to Dr. Natasha Raikhel (CEPCEB) during hiring. Several of positions are replacement positions and the names of the faculty member are included. Some College searches were originally proposed in Department plans, which are in parentheses.

[B] Many positions impact CEPCEB (C), Health Sciences-Related Research (HSRR), Vector Biology (V), Agricultural Science (Ag), Genomics and Bioinformatics (G&B) and/or Ecology and Evolution (E). Given the interdisciplinary nature of this research, positions may be listed in multiple tables to emphasize their importance to each initiative.

4. Environment-Related Research

Like genomics, environmental sciences has been selected as a major cross-campus initiative, and the campus has established an Environment Institute that will serve as a marketing mechanism (umbrella) for campus programs that impact the environment. It is our understanding that the research within the Air Pollution Research Center (APRC), the Center for Conversation Biology, and the Department of Environmental Sciences will in some way be associated with this new Institute, but the direct reporting relationship of these units will remain unchanged. The details and operation of the Institute are still being developed, but CNAS does plan to take full advantage of whatever opportunities this Institute might afford to build on established areas of CNAS strength.

CNAS is keenly committed to research, teaching and service through Cooperative Extension that involve the Environment. Within CNAS, expertise exists in the areas of atmospheric chemistry, environmental and resource economics, microbiology, ecotoxicology, environmental toxicology, conservation biology, and various aspects of soil and water sciences. Faculty in the Departments of Environmental Sciences, Biology, Botany & Plant Sciences, Chemistry, Earth Sciences, Statistics, Physics, Cell Biology and Neuroscience, Plant Pathology, and Chemical and Environmental Engineering are at the forefront of many of these issues, supported in their efforts by the Air Pollution Research Center (APRC), the Analytical Chemistry Instrumentation Facility, the Center for Conservation Biology, and the U.S. Salinity Laboratory, a U.S. Department of Agriculture facility located on campus. Relevant graduate programs include Soil and Water Sciences, Environmental Sciences, Economics, Microbiology, Environmental Toxicology, and Ecology and Evolution. The Departments of Environmental Sciences and Botany & Plant Sciences have CE specialists working on environmental-related issues.

In spite of the campus strengths in the environment, we have not made the strides in this area that we have made in the genomics area. This is likely due to the magnitude, diversity and complexity of environmental research. To have impact, CNAS must focus its investments and

continue to build on strengths. Accordingly, we have decided to focus our efforts on water issues, which will build around this area of strength and potential within CNAS and the campus. This area is also one of great need for southern California – the water crisis is upon us.

a. ***Proposed Focus on Water Quality: Science, Technology, Management, and Policy.*** A 2004 CNAS focus group has prepared a position paper/report (see http://www.cnas.ucr.edu/about/documents/Water_report.pdf) describing the area and making recommendations for moving ahead. There are four primary groups within the water resources area:

(1) Hydrology and Water Management
(2) Aquatic Ecosystem Functioning
(3) Water Quality
(4) Resource Economics and Public Policy

Faculty working in this area are primarily in the Departments of Environmental Sciences, Earth Sciences, and Chemical and Environmental Engineering (BCOE). The focus on water quality ties in well with our strengths in water-related resource economics, water microbiology, soil physics, Cooperative Extension programs in water, and water-related research. In the two Colleges, there are approximately 28 faculty working on water-quality research, as well as supporting resources. The issue is how best to focus our efforts to leverage multi-PI funding opportunities, training grants, visibility, and impact.

UCR has the critical mass to launch a concerted water quality initiative. However, for the success of this initiative, a senior hire in this area is required to provide the necessary leadership and additional research breadth. This search is a top priority for CNAS. The historical origin of the Department of Environmental Sciences is in Soil Science and is still a strength in our program. We must exploit our areas of strength and also acknowledge our areas of weakness. While resource economics is a developing strength, we are weak, or not represented, in the area of public policy. Dr. Roberto Sánchez-Rodríguez was recently hired as a faculty member in Environmental Sciences and appointed Director of the UC MEXUS program. This is an excellent start for us in the policy area, but we clearly have a long way to go. We must work with CHASS to develop a plan to build a solid water policy group that will be tied to the basic and applied science in CNAS. This can then be used to branch out into other areas of environmental policy, such as land and air. This has clear links to the Policy Initiative being developed by our campus.

CNAS will refine the plans and work with the Deans of BCOE and CHASS to discuss hiring of faculty and resource investment to maximize our impact. A majority of the expertise and resources supporting this research effort are housed within the Department of Environmental Sciences and it is imperative that this department provide the leadership and continue to invest departmental and AES resources in the water area.

b. Air Pollution Research. UCR has great strengths in air pollution-related research with the activities in the Air Pollution Research Center (APRC). There are currently four ladder-rank faculty in APRC and there are two unfilled openings: (1) Director of APRC; and (2) Assistant Professor in APRC/Chemistry. APRC faculty, appointed in the Departments of Environmental

Sciences and Chemistry, have a worldwide reputation for outstanding research. They participate in several graduate programs including Environmental Sciences, Chemistry, and Environmental Toxicology and teach at both the graduate and undergraduate level. This ORU provides an excellent opportunity for UCR to have great impact in air pollution research as we search for a new APRC director in the area of multimedia modeling (see Table 7).

c. Conservation Biology. In 1999, UCR's Center of Conservation Biology (CCB) was established under the leadership of Dr. Michael Allen. CCB's mission is to help society understand the extent and consequences of biodiversity loss, and to provide objective scientific data to decision makers. The research within the CCB is intimately tied to CNAS activities in Cooperative Extension (several specialists have programs impacting the CCB), Natural Reserves and AES. CCB's accomplishments in the past four years have been extraordinary. Strong ties to county and city governmental agencies have been developed and CCB investigators enjoy research funding from these agencies to evaluate our local environment. In addition, CCB faculty participate in several large federally funded programs based out of UCR's Natural Reserves. Importantly, in 2004, CNAS faculty were awarded two new multi-million dollar NSF Biocomplexity grants. These are a testament to the strength of our programs. UCR received approximately 10% of the NSF Biocomplexity Program grant budget; a remarkable accomplishment for a relatively young Center.

The current Director of CCB has recently accepted another important leadership role in CNAS. CNAS is committed to the further growth and expansion of CCB and is conducting a national search for a new CCB Director during this academic year. A number of hires that impact Ecology and Evolution (Table 5) will also strengthen CCB. The College's current and future support of the Natural Reserves is critical for CCB's vitality and success.

Table 7. Future Hires Impacting the Environmental Sciences[A]

Year	Position	Department	Research Area[B]
2004-05	Open Director (APRC) (Atkinson)	Air Pollution Research Center (APRC)	Director APRC – Air Pollution (Ag, HSRR)
	Prof (Simùnek)	Environmental Sciences	Modeling-Soil Transport Water (Ag)
	Open Director – Water Resources	Environmental Sciences	Director Center for Water Resources (Ag, HSRR)
	Open Director CCB (Waser)	College (BIOL)	Director – CCB/Evolutionary Ecology (C, Ag, G&B, E)
2005-06	Open	Environmental Sciences	Multi-Media Chemical Modeler
	Asst Prof	Environmental Sciences	Invertebrate Ecotoxicologist
	Asst Prof	APRC/Chemistry	Air Pollution (Ag, HSRR)
2006-07	Open	Environmental Sciences	Environmental Health/Risk Assessment
2007-08	Asst Prof	Environmental Sciences	Sediment Fate & Transport
	Asst Prof	Environmental Sciences	Environmental Policy & Management (Ag, HSRR)
2008-09	Asst Prof	Environmental Sciences	Aquatic Ecology (Ag, E)
	Asst Prof	Environmental Sciences	Ground Water Hydrology

KEY:
Red: Name Recent Hire

Green: Replacement: name of faculty member leaving UCR

[A]Please see Tables 5 and 6. Most positions impacting Ecology and Evolution (Table 5) and Agricultural Sciences (Table 6) also impact the Environmental Sciences initiatives on the campus.

[B] Many positions impact CEPCEB (C), Health Sciences-Related Research (HSRR), Vector Biology (V), Agricultural Science (Ag), Genomics and Bioinformatics (G&B) and/or Ecology and Evolution (E). Given the interdisciplinary nature of this research, positions may be listed in multiple tables to emphasize their importance to each initiative.

5. Materials Science and Nanotechnology

The control and understanding of materials at the nanometer length-scale holds vast potential for the transformation of current information, communication and medical technologies, and will ultimately have a profound impact on society. A major initiative on campus led to the creation of the Center for Nanoscale Science and Engineering (CNSE), which was established under the direction of Robert Haddon to bring together scientists from the physical, life and biomedical sciences to focus on the development of nanomaterials science. The mission of the Center is to become a world leader in nanoscale research, technology and education, and to stimulate the creation of new industries based on nanotechnology. The coordination that CNSE leads between CNAS and the Bourns College of Engineering (BCOE) has been an essential factor leading to its success.

CNSE has also benefited from the funding associated with the establishment of the Center for Nanoscale Innovation for Defense (CNID). CNID is a collaborative partnership between UCSB, UCLA and UCR that couples the strengths of a University-based research program with commercial and national defense industries and national labs. CNID is funded by DOD/DARPA/DMEA to facilitate the rapid transition of research innovation in the nanosciences into applications in the defense and commercial sectors. The three UC campuses serve as the hub of a national center, facilitating the exchange of new ideas, scientific discoveries, and demonstration technologies with industrial partners.

Despite the rapid success of CNSE, it is important to keep moving forward quickly and aggressively. Fierce competition has already developed in the field with many universities moving to take advantage of the scientific and funding opportunities. Virtually every other university with a strong research program, in California and in the rest of the country, has targeted nanotechnology as a critical new area. As a result, there are few "nanotechnology niches" remaining without a group of strong players. Since UCR already has CNID funding of close to $5 million/year in place, we are in an ideal position to achieve an international leadership position in selected areas. The challenge is to determine which area(s) should be targeted for future growth.

A CNAS focus group met in 2003 to address opportunities in the area of materials science and nanotechnology (http://www.cnas.ucr.edu/about/documents/Material_Science.pdf). It was decided to initially focus on silicon, carbon and biological materials, as these areas already demonstrate the power of the nanoscale world, and they fall within the existing expertise of the campus. The semiconductor industry currently leads the nanotechnology field via the fabrication of engineered devices that are constructed in a top-down manner. Carbon is the basis of life and is able to self-assemble amazing structures, again on the nanometer length scale. Carbon is also the most versatile of all elements, and offers many new opportunities for devices, such as those

currently being constructed from carbon nanotubes and molecule-based materials. In the area of carbon-based nanomaterials, we have already achieved expertise and leadership.

For the next major thrust, the faculty and CNSE Director have targeted the emerging field of spintronics (see Table 8). Spintronics includes research in nanoscale magnetic, magneto-electronic, and magneto-optic materials synthesis, physical properties, device design, device manufacturing and packaging, and systems integration. The timing for investment in this area has never been better. The science has advanced to the point that the first viable commercial product, magnetic random access memory (MRAM), is just now coming to market. Spintronics is the only future technology capable of continuing to scale memory devices significantly smaller than current semiconductor technology, which provides the motivation for industry to pursue spintronics research and development. UCR's emphasis will be to develop an academic research environment that fuels the science and technology of spintronics beyond MRAM. This includes the possibility of using magneto-photonic devices in new communications applications, magneto-electronic devices for novel electronics applications, and molecular magneto-optic devices for new kinds of medical applications. Research in these areas is at the forefront of science and technology and will be able to attract extramural funds from both federal and industrial sources for the commercial lifetime of MRAM and any other related technology.

To jump start the spintronics program, CNAS and BCOE have begun a joint multi-college level search in 2004/05 for two senior positions (nominally one for each college). CNAS and BCOE will each target two additional junior positions in 2005/06 to this effort. DARPA, through CNID, will provide a significant portion of the initial complement support for these hires. Because of this, we will be able to attract scientists at the forefront of the spintronics field. Note that we have also recently hired two exceptional junior faculty, Roland Kawakami and Jeanie Lau, both of whom have expertise is in spintronics. All of these investments will pay off in enabling us to establish a national center in spintronics research at UCR.

In addition to spintronics, specific areas within nanomedicine will also be important in the near future and UCR must be poised to move forward on these, as well. Helping jumpstart our efforts in this area is the hire in 2000 of Vlad Parpura in the Department of Cell Biology and Neuroscience. This area will run hand-in-hand with the proposal to develop a program in bio-engineering and CNAS investments in mammalian molecular and cell biology, CEPCEB and IIGB. This effort will be supported in CNAS through hires in biomaterials physics and chemistry (see Table 8).

Table 8. Recent and Future Hires in Nanoscience and Biomaterials[A]

Year	Position	Department	Research Area
2002-03	Asst Prof (Kawakami)	Physics	Spintronics
2003-04	Asst Prof (Lau)	Physics	Nanomaterials
2004-05	Assoc/Full	College	Materials Science/Nanotechnology - Spintronics
2005-06	Asst Prof	College	Materials/Spintronics
	Asst Prof	College	Materials/Spintronics
	Asst Prof	Chemistry	Physical Chemistry/Materials Science
	Open	Physics	Biophysics (HSRR, G&B)

2006-07	Asst Prof	Chemistry	Materials/Biological (LS)
	Asst Prof	Chemistry	Organic/Inorganic/Materials/Biological (LS)
	Asst Prof	Physics	Condensed Matter Physics/Biomaterials (LS)
	Asst Prof	Physics	Condensed Matter Physics - Nanophysics Experimental (LS)
2007-08	Open	Chemistry	Materials/Biological Chemistry
	Asst	Physics	Condensed Matter Physics/Biophysics Theory
2008-09	Asst	Chemistry	Organic/Inorganic/Materials/Biological
	Asst	Physics	Condensed Matter Physics/Biomaterials-Biophysics/Experimental
	Asst	Physics	Condensed Matter Physics/Biomaterials-Nanotechnology/Computational

KEY:
Red: Name of Recent Hire
Green: Replacement: name of faculty member leaving UCR

[A]Many of the nanoscience and biomaterials positions may also impact the Life Sciences (LS), CEPCEB (C), Health Sciences-Related Research (HSRR), Vector Biology (V), Agricultural Science (Ag), or Genomics and Bioinformatics (G&B) and Ecology and Evolution (E).

6. Health Sciences-Related Research

The life sciences departments at UCR contain a group of strong faculty with diverse interests. There is considerable strength within areas impacting agriculture (due to the presence of the Agricultural Experiment Station), the environment, and in evolutionary biology and ecology (as described above). In addition, CNAS harbors a sizable number of faculty working in the areas of animal biology and, in particular, mammalian biology and signal transduction. CNAS faculty strengths are complemented by faculty in Psychology (CHASS) and Biomedical Sciences.

CNAS plans to strategically invest in the field of basic research impacting the health sciences. Faculty hires will be shaped by current research strengths and should result in a significant increase in funding from the NIH. We plan to make investments in faculty focusing on understanding the molecular and cellular mechanisms of human responses to the environment and its relationship to health and disease. Their research programs may utilize mammals or animal model systems (i.e., yeast, *Drosophila, C. elegans,* rodents, chickens, *Xenopus*, zebra fish, etc). These systems are well funded by the NIH and NSF and will complement established CNAS research strengths in genomics and bioinformatics, vector biology, plant cell biology, evolution, and nanosciences. These hires will also complement the evolving program in bio-engineering.

The CNAS investment will leverage our current faculty strengths, our investments in the IIGB and CEPCEB research infrastructure, and the new Biological Sciences Building (estimated completion February 2006), the Genomics Building (2008), and the planned renovations for Boyce and Webber Halls. The strategic hires proposed in Table 9 bring research programs using cellular, molecular and genomics techniques, as well as analysis at the molecular level, to whole organisms to CNAS. As with all life science initiatives in CNAS, it is anticipated that there will be significant interactions with bioengineering, nanoscience, and IIGB. These proposed hires

will enhance both graduate and undergraduate education and provide a critical synergy for three established mammalian biology research strengths in CNAS.

In 2002, a team of CNAS faculty described potential future directions of mammalian molecular cell biology (http://www.cnas.ucr.edu/about/documents/IMMCBProposal.11.21.02.pdf). Three areas for strategic investment that would build on current strengths and create synergistic activities across the campus are: signal transduction, genome maintenance and stability, and molecular and cellular mechanisms of neuro-endocrine-immuno interactions. These fundamental areas of research were again emphasized in a 2003-04 CNAS Mammalian Biology Focus Group (http://www.cnas.ucr.edu/about/documents/Mammalian_Focus_Group.pdf) that met to discuss the investment opportunities for CNAS. Given the fact that the research programs in the Division of Biomedical Sciences substantially overlap and enhance CNAS strengths, one Biomed faculty member and the Dean of this unit were included in these discussions. Faculty from the Departments of Biochemistry, Biology, Cell Biology and Neurosciences, Entomology, and Physics also participated in these meetings.

Both the 2002 and 2003/04 groups proposed building on CNAS strengths at the interface of the environment and health and by enhancing research in mammalian biology and model systems. Such an investment would highlight the College's unique undergraduate and graduate degrees in Environmental Toxicology, but would also impact the graduate programs in Genetics, Genomics & Bioinformatics, Cell Molecular & Developmental Biology, Neuroscience, and Biochemistry. The justification for this research focus is that nearly everything an organism does is a response to its environment. Furthermore, it is clear many human diseases are influenced by environmental factors.

The three areas of strength identified by the 2002 team and 2003 focus group are highlighted below.

a. Signal Transduction. The largest and most cohesive group in mammalian biology is the Mammalian-oriented Signal Transduction and Regulation of Transcription Group (mSTART). Established in 2000, the monthly mSTART meetings have provided an important forum for 28 UCR laboratories to discuss current advances and initiatives in signal transduction and gene regulation. While 25 of these laboratories focus on mammals or model systems, there are important bridges to AES faculty studying signal transduction in plants, insects and microbes. Hires to strengthen this area will focus on cellular and molecular mechanisms of signal transduction and gene expression, which are fundamental research areas that support health science-based research in the fields of neurobiology, immunology, endrocrine biology, cancer biology, vector-biology and well as mammalian genomics. This could include areas of investigation that examine microRNAs, kinase cascades, transcriptional regulation, genetic susceptibility, receptors, translational control, or proteolysis. With the passage of Proposition 71, CNAS faculty would like several of the hires in this mammalian signal transduction to focus in the area of stem cell biology.

b. Genome Maintenance and Stability. CNAS has a significant nucleus of investigators that focus their research on the structure, dynamics and stability of chromosomes. A Center for Genome Maintenance and Stability was proposed in the Fall of 2004 to highlight these strengths

and provide new opportunities for collaborative research and new training grants. At the present time, 13 laboratories from the departments of Biochemistry, Cell Biology & Neuroscience, Chemistry, Entomology, Botany & Plant Sciences, and Plant Pathology form a nucleating center on which to build prominence; 10 of these labs current enjoy research support from the NIH. Investigators in the Center will seek to understand how genetic material in cells is maintained in an intact form and faithfully transmitted to future generations. Future hires that support this strength may target research areas including genome stability, apoptosis, chromosome aberrations, or microRNA impacts on chromatin organization. The current IIGB search (Winter 2004) will likely add strength to this group. With the passage of Proposition 71, it is possible that hires in this research area may impact stem cell biology.

c. Neuroscience-Endocrine Biology-Immunology Interactions. CNAS and Biomed faculty have identified a novel niche for impacting human health: the interface of the environment and human responses that integrate neurological, endocrine, and immunological signals. It is clear that a better understanding of the interactions of the neuro-endocrine-immuno systems is essential for developing a basic understanding of the molecular, cellular and physiological responses to the environment and its influence on health, chronic disease and the timing and duration of interventional strategies. CNAS and Biomed faculty have nucleated this area by submission of a training grant to the NIH. This grant proposed to train a workforce that will be prepared to carry out research into the mechanisms governing the interaction of these systems. While not successful in its first round, this initiative shows the commitment of our faculty, outreach to area institutions (i.e., City of Hope), and potential for future investments. Hires in this area would focus on basic research at the molecular, cellular and physiological level to investigate areas such as autoimmune diseases, stem cell biology, immuno-neuroscience interface, effects of air pollution on the respiratory, cardiovascular or immune systems, or development. Clearly all the hires that support this initiative have impact on the Health Sciences Initiative and will attempt to leverage Proposition 71 funding for stem cell biology. In addition, a unique focus in the field of neuroscience that complements faculty interests in neuroscience-endocrine biology-immunology interactions is emerging. The proposed Center for Glial⇔Neuronal Interactions at UCR will highlight and synergize on-going research in the Department of Cell Biology and Neuroscience, Department of Entomology and the Division of Biomedical Sciences. In addition, this Center will serve as a nucleus to unify strengths in glial/neuronal interactions in southern California region. UCR is uniquely positioned to become a national and international leader in this emerging field. To this end, the College proposes a cluster hire to support the Glial⇔Neuronal Interactions initiative (3 positions in the next 2-3 years). We propose to launch this initiative with an open-level search in Spring 2005.

These hires would strengthen the graduate programs in Neuroscience, Cellular, Molecular & Developmental Biology, Biochemistry & Molecular Biology, and Genetics, Genomics & Bioinformatics, as well as the emerging Graduate Programs in Bioengineering and Biomaterials. Additionally, these hires will strengthen our links with the Center for Nanoscale Science & Engineering; they will also participate in the Health Sciences and Biomaterials initiatives and synergize with Chemical Genomics affinity groups in Chemistry and the Center for Plant Cell Biology.

The proposed investments in basic research that impact signal transduction, genome maintenance and stability, and neuro-endrocrine-immuno biology are important enhancements of established and emerging strengths in CNAS. These strategic investments are outlined in Table 9. Searches will be performed at the departmental or, more often, at the College level to assure that the best candidate and departmental match is identified, hired and retained. The proposed replacement and new positions impacting mammalian biology also include proposed investments in disease-vector research (Table 3), as well as continued investments in basic areas such as structural biology and protein and membrane interactions. The College's proposed investments in Genomics and Bioinformatics (Table 2) will also have profound impacts in this area.

Another developing opportunity is presented by the passage of Proposition 71, the stem cell research initiative. Faculty in the Departments of Cell Biology and Neuroscience and Biochemistry and the Division of Biomedical Sciences are currently discussing the role UC Riverside should have in embryonic and adult stem cell biology research. A plan should emerge within the next months that the College will able to consider for future investments in Health Sciences; this must be balanced with current CNAS Departmental strengths and future aspirations. With the passage of Proposition 71, California has a unique opportunity to contribute to the field of stem cell biology and can provide research homes to prominent junior and senior investigators in this field. While CNAS departments did not express a strong sentiment for hires in these areas in their 2004 academic plans, their increased interests are emerging and will be accommodated in hiring plans for the future. The faculty positions associated with the campus Health Sciences Initiative (Health-Science Related Research positions) in our plan should accommodate these changing research foci of CNAS faculty in the field of mammalian biology.

Infrastructure. The future investments in mammalian and model systems-based research will present additional infrastructure challenges to our campus. Continued investments in vivaria and whole animal imaging may be necessary to attract and retain talented faculty using mammalian or model-based systems. In addition, to assure that new (Biological Sciences building) and renovated (Webber/Boyce Halls) facilities will meet the needs of this new wave of hires, CNAS is committed to actively pursuing NIH Infrastructure grants to leverage state funding to enhance building and vivarium infrastructure. CNAS will continue to be proactive to assure the very best facilities are available for all future hires. Additional infrastructure grants to enhance the Genomics Building, Webber/Boyce Hall renovation and its vivaria, and the new Psychology Building vivarium are being discussed.

Impact of the proposed UCR Medical School. The Chancellor has endorsed developing a proposal for a UCR medical school with a unique community-based plan. This proposition has garnered strong support from the city and county governments and local hospitals. While it is not yet clear when or if UCR will be successful in this endeavor, investments in CNAS faculty with basic research programs that impact health sciences will create a strong research nucleus that will be critical for the ultimate success of the proposed medical school. CNAS believes that it is important that any investments in mammalian-related research should be pursued irrespective of whether plans for a medical school move forward or not. CNAS believes that investment in health science-related basic research is critical for the retention of current faculty and college growth that continues to build on our existing strengths in mammalian and agricultural research, as well as physical and mathematical sciences.

Leveraging AES Strengths in the Health Sciences Initiative. The AES provides UCR with a competitive advantage within the biological sciences. Two examples of an AES NIH-supported human health-related research are in the areas of disease-vector research and gene silencing. We propose strategic investments to strengthen both of these areas, as well as Genomics and Bioinformatics, which impacts studies in all organisms including mammals, insects, plants, and microbes (Table 2 and 3). CNAS hopes that the Health Sciences Research Institute will incorporate the important CNAS strengths in disease-vector research and gene silencing. It is critical for CNAS to invest college resources in these current areas of strength; they have and will continue to have a high priority and represent the best opportunity for a short-term pay off in health science-related research.

CNAS will continue to work with Vice Chancellor for Research Charles Louis to develop a plan for investment in mammalian biology within the College that will allow us to have an impact in selected areas. We have an initial plan, which we present in Table 9. We expect revisions and refinements of this plan in conjunction with the developing Health Sciences Research Institute in the next months. We anticipate our goals will be solidified by mid-2005. The critical decisions that are pending include:

- Making a firm decision on which research area(s) CNAS will choose for emphasis and development. This is critical to leverage our current strengths and propel UCR into a status of increased national and international notoriety. This may involve an external visiting committee to provide an extramural analysis of our strengths and areas of competitive advantage.
- Developing specific search plans and target areas of research for two senior and two junior faculty searches (January 2005 search date for senior, fall 2005 for junior).
- Developing a multi-year plan for investment of resources in mammalian-based research such as, faculty FTE (new and replacement), space, and support facilities.

Table 9. Recent and Future Hires Impacting Health Sciences-Related Research.[A]

Year	Position	Department[C]	Research Area[B]
2002-03	Asst Prof (Cui)	Statistics	Bioinformatics/Data Mining (Ag, C, G&B, HSRR)
	Asst Prof (Mao)	Statistics	Bioinformatics/Data Mining (Ag, C, G&B, HSRR)
2003-04	Prof (Zhu)	Botany & Plant Sciences (Director, IGBB)	Plant Cell Biology (C, G&B, Ag, HSRR, E, V)
2004-05	Asst Prof (Zanello)	Biochemistry	Mammalian Biology (C, HSRR)
	Asst/Assoc	College Search (ENT)	Molecular Basis of Human Vector-Borne Disease (Ag, G&B, HSRR, V)
	Open (Clegg)	College Search (BPS)	Evolutionary Genomics (RNAi/Chromatin) (C, Ag, G&B, HSRR, E, V)
Feb 2005	Open (Huh)	Cell Biology & Neurosciences	Neurobiology-Glial↔Neuronal Interactions (G&B, HSRR, C)
2005-06	Asst Prof	Biochemistry	Structural Biology (C, Ag, G&B, HSRR, E, V)
	Asst Prof (Ashe)	Cell Biology & Neurosciences	Neurobiology/Glial↔Neuronal Interactions (C, G&B, HSRR)

	Asst Prof	College Search (BIOL)	Developmental Genetics (C, Ag, G&B, HSRR)
	Asst Prof	College Search (CMDB)	Genome Maintenance and Stability (C, G&B, HSRR)
	Asst Prof	College Search	Health Sciences-Related Research (C, G&B, HSRR, V)
	Asst Prof	Entomology	Molecular Basis of Medical Virus-Vector Interactions (Ag, G&B, HSRR, V)
	Asst Prof	College Search (NEM) (G&B)	*C. elegans* Genetics/Genomics (C, Ag, G&B, HSRR, E, V)
	Asst Prof (Press)	Statistics	Computational Statistics/Data Mining (C, G&B, Ag, HSRR, E, V)
	Asst Prof (Beaver)	Statistics	Computational Statistics/Data Mining (C, G&B, Ag, HSRR, E, V)
	Asst Prof	College (G&B)	Bioinformatics/Systems Biology (C, G&B, Ag, HSRR, E, V)
	Asst Prof	College (G&B)	Evolutionary/Environmental Genomics (C, G&B, Ag, HSRR)
2006-07	Open (Dugaiczyk)	Biochemistry	Epigenetics/Transcription (C, G&B, HSSR)
	Asst Prof	Biology	Evolutionary Development (C, G&B, HSRR, E)
	Asst Prof	College Search (BIOL)	Developmental Regulation (RNAi) (C, Ag, G&B, HSRR, E, V)
	Asst Prof	College (BIOL) (G&B)	Evolutionary Genomics (C, G&B, HSRR, E)
	Asst Prof	College Search (CBNS)	Health Sciences-Related Research – Extracellular Matrix: Receptors & Signaling (C, G&B, HSRR, V)
	Asst Prof	College Search (CBNS)	Health Sciences-Related Research – Stem Cells (C, G&B, HSRR, V)
	Asst Prof	College (G&B)	Genomics (C, G&B, Ag, HSRR, E, V)
	Asst Prof	College (STAT)	Bioinformatics (C, G&B, Ag, HSRR, E, V)
	Asst Prof	College (G&B)	Ag Genomics (C, G&B, Ag, HSRR, E, V)
2007-08	Open (Dunn)	Biochemistry	Protein/Membranes (C, G&B, HSRR)
	Asst Prof	Biochemistry	Mammalian Molecular Signal Transduction (C, G&B, HSRR, V)
	Asst Prof	College Search	Health Sciences-Related Research - Cell plasticity (C, G&B, HSRR)
	Asst Prof	Botany & Plant Sciences	Computational Biology/Systems Biology (C, Ag, HSRR, E, V)
	Asst Prof	College (STAT)	Genomics/Bioinformatics (C, G&B, Ag, HSRR, E, V)
	Asst Prof	College (G&B)	Ag Genomics (C, G&B, Ag, HSRR, E, V)
	Asst Prof	College (G&B)	Ag Genomics (C, G&B, Ag, HSRR, E, V)
2008-09	Asst Prof (Traugh)	Biochemistry	Health Sciences-Related Research - Signal Transduction (C, G&B, HSRR)
	Asst Prof	College (BCH)	Health Sciences-Related Research - Proteins/Membranes (C, G&B, HSRR)
	CE	Entomology	Medical Urban Entomology (Ag, HSRR, V)
	Asst Prof	College	Health Sciences-Related Research (C, G&B, HSRR, V)
	Asst Prof	College	Health Sciences-Related Research/Genomics and Bioinformatics (C, G&B, Ag, HSRR, V)
	Asst Prof	Cell Biology & Neuroscience	Health Sciences-Related Research – Genome Maintenance & Stability/Chromatin Remodeling (C, Ag, G&B, HSRR)
	Asst Prof	College (G&B)	Ag Genomics (C, G&B, Ag, HSRR, E, V)
2009-10	Asst Prof (Henry)	Biochemistry	Signal Transduction (C, G&B, HSRR, V)
		College	Health Sciences-Related Research (C, G&B, HSRR, V)
2010-11	Asst Prof (Norman)	Biochemistry	Regulation of Gene Expression (C, G&B, HSRR, V)
		College	Health Sciences-Related Research (C, G&B, HSRR, V)

KEY:
Red: Name of Recent Hire

Green: Replacement: name of faculty member leaving UCR

[A] All investments in health science-related research have wide impacts on many programs in the life sciences from applied to basic research and from agricultural science to biomedical science. Several positions are replacement positions and the names of the faculty members are included. Some College searches were originally proposed in Department plans, which are in parentheses. In addition, several recently-filled positions in the Department of Chemistry (Prof Larive, Asst Prof Bardeen, and Prof Pirrung in 2003-04; and several replacement and new positions) have significant relevance to UCR's Health Sciences Initiative. These positions can be found in Table 10.

[B] All positions that strongly impact CEPCEB (C), Health Sciences-Related Research (HSRR), Vector Biology (V), Agricultural Science (Ag), Genomics and Bioinformatics (G&B) and Ecology and Evolution (E). Given the interdisciplinary nature of research, positions may be listed in multiple tables to emphasize their importance to each initiative.

[C] Parentheses indicate department in which position is planned.

7. Computational Sciences, Modeling and Simulation

With the continual advances being made in computer hardware and software, it is now possible to perform modeling and simulation of complex systems at an unprecedented level. These tools have become an important part of modern research methods and impact all areas of science. For example, computer modeling and simulation is used by theoretical astrophysicists studying solar wind, botanists studying ecological complexity, chemists studying reaction dynamics, and physicists studying nanomaterial properties.

The true potential in modeling and simulation lies in its ability to investigate integrated systems and provide opportunities to find answers to questions that were not asked in the past. For example, the human genome study has contributed a huge data set for a new kind of biological research, but we still have a very long way to go to understand the functional roles of each gene. In order to understand how nature works in all of its enormous complexity, mathematical, statistical and computational approaches are crucial. We must start now to prepare ourselves for the next phase of scientific research, which will require more integrated approaches to problem solving, linking deterministic and stochastic methods together to deal with complex, nonlinear, dynamic processes, and the coupling of biological, physical and chemical systems.

Interdisciplinary research that couples physical, chemical, biological and human systems is viewed by the international community, administrations and funding agencies to be at the core of what is required to make progress in global change research. Therefore, we propose to actively promote research that utilizes modeling and simulations. This will allow UCR to focus investments and research activity to maximize the return on our investment and better understand the fundamentals behind many different applications. At minimum, it provides an alternative research and teaching method to supplement laboratory research since simulations can be used to conduct experiments that are otherwise too dangerous, expensive, prohibited by law, massive in variables, complex in functional relationships, or extreme in spatial or temporal scale.

CNAS convened a focus group in the spring of 2004 to examine the underlying similarities and infrastructure of research in this area (http://www.cnas.ucr.edu/about/documents/UCR_Computational_Sciences_Initiative.pdf). The field was divided into the biological and physical areas, and the importance of applied

mathematics in developing new tools was apparent. We anticipate that several faculty positions will be requested to support research in computational science over the next three years; however, we are still in the process of formulating definitive plans in this area.

B. Areas of Basic Science

CNAS must continue to hire faculty in the basic sciences. This section discusses proposed investments in the basic life, physical and mathematical sciences.

The hiring plan for the College is provided in the next section along with general comments on the various positions proposed. Many of the positions impact the targeted areas of programmatic emphasis discussed above; however, there is also a need to ensure that the College is strong in the basic sciences that form the foundation for future growth and where ever possible we have integrated basic scientific areas with multidisciplinary research initiatives. Interdisciplinary research builds upon discoveries in the basic sciences. In addition, AAU membership, NRC rankings and external recognition are based to a large extent upon the strength of the basic sciences.

1. Life Sciences

Investment in the biological sciences is essential, and is discussed above in one of the five sections impacting the life sciences--Genomics & Bioinformatics, Evolution & Biology, Agricultural Sciences, Environmental Sciences, and Health Science-Related Research. It is important to note that the life sciences at UCR that span agricultural to biomedical sciences are intertwined and interdependent to such a degree they cannot be separated. Therefore, hiring must be viewed in this multi-disciplinary manner. Investments in these broader areas strengthen each department but create a college synergy. For this reason, we have not iterated each life science department's hiring plans here. The impacts to the Departments of Biology, Biochemistry, Botany and Plant Sciences, Cell Biology and Neuroscience, Entomology, Nematology and Plant Pathology can be viewed in Tables 2-6 and 9.

A large part of our undergraduate curriculum in the biological sciences is taught by AES faculty and much of our research infrastructure has been funded through the AES. It is important that we leverage the strength of the AES as investments in health science-related biology are made. There is no need to duplicate facilities or infrastructure. As discussed in earlier sections, virtually all life science positions that are proposed impact one or more interdisciplinary research and educational initiatives. The investments of new FTE will largely be focused on molecular-based research in genomics-related areas of agriculture and more general areas of mammalian biology (Tables 2-8).

2. Chemistry

The Department of Chemistry supports an outstanding research program, and provides service courses for engineering and the physical and biological sciences. The department has recently made great strides in several research areas with the appointment of outstanding junior and

senior hires. The main goal over the next five years is to become ranked as a top-tier department. Additional goals are to attain extramural funding in excess of $6 million by 2005/06 and to recruit 30 new Ph.D. students each year. Progress toward these goals is commendable, and clearly they are attainable given sufficient resources.

The Department's research strengths include physical chemistry, organic chemistry, analytical chemistry, and inorganic chemistry. The programmatic integration between organic and inorganic chemistry has resulted in a huge strength in materials and supramolecular chemistry. Development of a Center in S and P Block Chemistry based on the research programs of Professors Mathey, Feng, Bertrand, and Reed will be forthcoming (Table 1). Despite the enormous importance of silicon to the semi-conductor chip industry, aluminosilicates to the petroleum catalyst industry, and phosphorus compounds to biological chemistry, s & p block chemistry research is significantly underrepresented in academic institutions across the U.S. UCR already has a critical mass of three internationally renowned faculty in main group chemistry. As there are currently no academic centers in *s* and *p* block chemistry in the nation, UCR thus has an opportunity to establish national recognition in this area. The center is envisioned to have three principal scientific foci: a new class of drugs based on phosphorus(III); new smart materials; and new chemical catalysts.

The Department will also play a major role in the development of materials science and nanotechnology in the College. Through a partnership with APRC, the Department of Chemistry will contribute to the campus initiative in environmental sciences. In addition, an undergraduate major and graduate program in environmental chemistry has been recently discussed; additionally, an NSF proposal to establish an Undergraduate Research Center in Environmental Chemistry will be submitted in early April 2005.

Perhaps the most important area for future growth is biological chemistry. The planned concentration in biophysical, bioanalytical and bioorganic chemistry will have a strong linkage with health sciences-related research at UCR, as well as natural synergies with faculty in Biochemistry, Biomedical Sciences, and Cell Biology and Neuroscience, as well as the agricultural sciences. A number of future hires will be clustered around biological chemistry. The bioanalytical group represents a particularly strong group of faculty and we plan to commit further resources to build on this area of strength. These investments, coupled with hires in biophysical and bioorganic chemistry, should provide increased funding from NIH. There is an open search allocated for 2004/05 to bootstrap this effort, followed by a junior position in bio-analytical chemistry in 2005/06 and another junior position in bio-related chemistry in 2006/07.

The second area targeted for investment is Materials Science and Nanotechnology. A graduate program is under development by CNAS and BCOE faculty. Chemistry hires, who will develop new materials and new molecular devices, are crucial to our research in this field. The strength in S and P Block Chemistry is an asset, although minimal additional investment in this fundamental area is needed to retain national and international recognition; however, application to the development of novel materials and molecular devices will allow hires in Materials/Nanotechnology to build this group. A proposal for a "center" in S and P block chemistry will be forwarded by the end of this calendar year. Although the effort in

nanomaterials is described in more detail above, the Department of Chemistry will contribute a junior Physical Chemistry position in 2005/06 specifically to materials science.

Table 10. Recent and Future Hires in Chemistry[A]			
Year	**Position**	**Department**	**Research Area**
2003-04	Prof (Larive)	Chemistry	Bioanalytical, NMR (LS)
	Asst Prof (Bardeen)	Chemistry	Physical/Bioorganic (LS)
	Prof (Pirrung)	Chemistry	Organic/Bioorganic Chemistry (LS)
2004-05	Open (Rettig)	Chemistry	Bio-related Phys/Inorganic/Organic (LS)
	Asst Prof (Lillard)	Chemistry	Analytical Chemistry (LS)
	Asst Prof (Okamura)	Chemistry	Organic Chemistry
2005-06	Asst Prof	Chemistry	Physical Chemistry/Materials Science (LS)
	Open	Chemistry	Analytical/Bioanalytical Chemistry
	Asst Prof	APRC/Chemistry	Air Pollution (LS)
2006-07	Open	Chemistry	Biological Chemistry (LS)
	Asst Prof	Chemistry	Organic/Inorganic/Materials/Biological
	Asst Prof	Chemistry	Organic/Inorganic/Materials/Biological
2007-08	Open	Chemistry	Materials/Bio/Chem (LS)
2008-09	Asst Prof	Chemistry	Organic/Inorganic/Materials/Biological

KEY:
Red: Name of Recent Hire
Green: Replacement; name of faculty member leaving UCR

[A] All positions that strongly impact the life sciences (LS) are indicated. These positions will impact CEPCEB (C), Mammalian/Health Science-Related Research (HSRR), Vector Biology (V), Agricultural Science (Ag), Genomics and Bioinformatics (G&B) and Ecology and Evolution (E). Given the interdisciplinary nature of research, positions may be listed in multiple tables to emphasize their importance to each initiative.

3. Earth Sciences

The Department of Earth Sciences has recently become reinvigorated due to a number of developments, including two high-profile hires and new research directions. New faculty in the area of space sciences have been hired (Table 11) and the Department's name is planned to change to *Earth and Space Sciences* to recognize this new research direction. The effort in space sciences will be described below under "*Astrophysics.*"

A senior geophysicist, James Dieterich, who is a member of the National Academy of Sciences, joined the faculty in January 2005. This hire adds to an existing strength in geophysics, and has enabled UCR to become a core member institution of the *Southern California Earthquake Center*, along with 11 other institutions including Caltech, Columbia, Harvard, and MIT. An additional hire in geophysics in 2005/06 is planned to enable UCR to be a clearly recognized center of excellence in this important area of research.

The department also has great strength in studies of very long-term environmental change, and macro-evolution. The department is continuing to contribute to both the biological and environmental sciences initiatives in this college and on campus through studies of astrobiology. A recent senior hire in the area of organic paleoenvironmental evolution (Dr. Tim Lyons) will

position the department to expand astrobiology research and thus have a second area of excellence. This area of research will connect the traditional areas within Earth Sciences to astrophysics/planetary physics. The department has a goal to develop a concentrated effort in astrobiology by building on our existing faculty, Dr. Lyons, and a new junior-level position for this research area in 2006-07 (Table 11).

Note that the two areas of excellence within Earth Sciences are both supported by a close relationship with the Institute for Geophysics and Planetary Physics (IGPP).

Table 11. Recent and Future Hires in Earth Sciences

Year	Position	Department	Research Area
2003-04	Asst Prof (Canalizo)	Earth Sciences/IGPP	Astronomy/Space Sciences
2004-05	Prof (Dieterich)	Earth Sciences/IGPP	Geophysics
	Prof (Lyons)	Earth Sciences	Biogeochemistry
	Asst Prof (Rice)	Earth Sciences/IGPP	Astrophysics/Space Sciences
2005-06	Asst Prof	Earth Sciences/IGPP	Chemical/Metamorphic Seismology
2006-07	Asst Prof	Earth Sciences	Astrobiology
2007-08	Open (Park)	Earth Sciences	Geophysics

KEY:
Red: Name of Recent Hire
Green: Replacement; name of faculty member leaving UCR

4. Mathematics

Mathematics may be considered the most basic of all sciences, yet it is critically important to all areas of fundamental and applied science. The Department of Mathematics plan calls for strengthening the existing areas of analysis and geometry/topology. Due to recent resignations, it is necessary to hire some algebraists in the next three years to maintain or improve the strength of the algebra group. Functional investigation of various types of dynamics falls into the broad category of analysis in general, or differential equations and numerical analysis in particular. The proposed move into applied mathematics is viewed as a very positive development and CNAS will do everything possible to support this initiative. Research programs in the biological sciences and engineering increasingly rely on the development of new modeling techniques that are founded on developments in applied mathematics. These positions will support the College's Modeling and Simulation efforts through hiring in the area of applied partial differential equations and numerical analysis (Table 12). Thus, the central position of Mathematics will only increase in the future.

The Department of Mathematics has an extremely large teaching program that serves the physical and biological sciences as well as the three other colleges and schools. Accordingly, the department cannot handle all of the teaching needs with ladder-rank faculty and must rely on lecturers and visiting assistant professors to assist with the teaching duties. Because of this, budgeted FTE is considerably larger than academic FTE, and it is the budgeted FTE that needs to be used in any determination of the space requirements of the Mathematics Department.

Although it is not possible to allocate sufficient faculty positions to cover all of the teaching needs of the Department of Mathematics, we plan on allocating selected positions to increase the role of ladder-rank faculty in undergraduate teaching. The Department has made great strides in developing a coherent academic plan and a shared vision for the future. For our future growth as a quality academic institution, it is imperative that we address the need to hire ladder-rank faculty in the Department of Mathematics. There are currently 10 visiting assistant professors in the Department and several temporary lecturers. If we are to offer a quality curriculum and provide the research base required for our goals in modeling and simulation, new ladder-rank faculty members must be hired. To address this need, CNAS has three searches ongoing in 2004/05 (two of these are replacements), and will allocate one or two new positions each following year. Positions in analysis and its applications are particularly critical to the teaching and the programmatic needs of CNAS as well as the College of Engineering. We endorse the departmental recommendation for building the strength of the analysis group and investing in applicable mathematics to strengthen its applied mathematics degree and to participate in college-wide initiatives.

CNAS was allocated two Mathematics faculty FTE per year beginning in 2001/02 through 2003/04 for a total of six (6) faculty positions. The intention of these positions was to meet enrollment growth in Mathematics without hiring ladder-rank faculty. CNAS has hired visiting assistant professors for these positions, but would like to hire ladder-rank faculty. We strongly request removal of the administrative barrier that prevents CNAS from using these FTE to hire ladder-rank faculty.

Table 12. Recent and Future Hires in Mathematics

Year	Position	Department	Research Area
2004-05	Asst Prof (Greenstein)	Mathematics	Algebra
	Open (Jones Chair – Viro)	Mathematics	Topology
	Asst Prof (Oddson)	Mathematics	Analysis
	Asst Prof	Mathematics	Geometry or Topology
2005-06	Asst Prof	Mathematics	Analysis
	Asst Prof	Mathematics	Algebra
	Open (Penkov)	Mathematics	Algebra
2006-07	Asst Prof	Mathematics	Geometry/Topology
	Open	Mathematics	Applied Mathematics
2007-08	Asst Prof	Mathematics	Analysis
	Asst Prof	Mathematics	Applied Mathematics

KEY:
Red: Name of Recent Hire
Green: Replacement: name of faculty member leaving UCR

5. Statistics

The Department of Statistics is home to the graduate program in applied statistics and research programs in development of new statistical methods and applied programs as well. Statistics supports work in many other departments, particularly in the biological sciences. Currently, the CNAS hiring plan calls for three replacement searches (vacancies created by retirements) and

four new faculty in the next four years in the area of Bioinformatics and Computational Biology. It may be that our proposed investment in bioinformatics is too small and additional searches will be requested. The college-based searches in bioinformatics that will likely result in hires in the Department of Statistics, but we are open to other options since computational biology and wet lab science are now being melded into single research programs. The proposed hires in this area were summarized in Table 3.

Table 13. Recent and Future Hires in Statistics

Year	Position	Department	Research Area
2002-03	Asst Prof (Cui)	Statistics	Bioinformatics/Data Mining
	Asst Prof (Mao)	Statistics	Bioinformatics/Data Mining
2004-05	Asst/Assoc Prof (Robertson)	Statistics	Bayesian Statistics
2005-06	Asst Prof	Statistics	Computational Statistics/Data Mining
	Asst Prof	Statistics	Computational Statistics/Data Mining
2006-07	Asst Prof	College	Bioinformatics
2007-08	Asst Prof	College	Genomics/Bioinformatics

KEY:
Red: Name of Recent Hire
Green: Replacement; name of faculty member leaving UCR

6. Physics

Physics encompasses experimental research that investigates the most fundamental aspects of matter, space and time, and theoretical research that develops a comprehensive description of the universe. The Physics department's current research program can be classified into two basic categories: (1) Condensed Matter Physics, which includes Physics at the nanoscale level, materials science and biophysics, and (2) High Energy Physics, which includes Heavy Ion Physics and some areas of Astrophysics. The department has a goal to be one of the top 15 physics departments nationally by 2013.

The Condensed Matter Physics group will add to its existing strength with new positions in Biophysics, Nanoscale Physics, and Condensed Matter Theory. The largest new effort will be in Biophysics/Biomaterials, as this strongly supports the CNAS health science-related research initiative. One new position in biophysics or biomaterials will be added each year for the next five years. The first, recruited in 2004/05, will be at the open level. There will be junior positions in bio-physics or bio-materials for the next four years, with one of them being a theorist.

The positions requested for Nanoscale Physics will directly impact nanoscale and semi-conductor materials, as described above under *Materials Science and Nanotechnology*, and will closely interact with the Center for Nanoscale Science and Engineering. Some of these positions may end up in the Department following the college-level searches in Spintronics, but a junior position specifically for the Physics department is targeted for 2006/07.

With the recent hire of Chandra Varma, UCR's Condensed Matter Theory group is now poised for prominence. Thus, we plan to hire additional theorists in this area in order to attain critical mass. The Condensed Matter Theory group is also an integral part of UCR's interdisciplinary effort in Modeling and Simulation, described above. A junior level Condensed Matter theorist is being recruited in 2004/05, and another one is allocated for 2007/08.

High Energy Physics addresses some of the most fundamental questions in science, and UCR's group has an international reputation that far exceeds its size. In addition, the highly successful Heavy Ion Physics program, which investigates matter in the state that it was in shortly after the Big Bang, is in need of a theorist to complete their group, in 2009/10.

Table 14. Recent and Future Hires in Physics

Year	Position	Department	Research Area
2002-03	Asst Prof (Kawakami)	Physics	Spintronics
2004-05	Asst Prof (Long)	Physics	High Energy Experimental
	Asst Prof (Lau)	Physics	Materials/Nanophysics
	Asst Prof (Castro Neto)	Physics	Condensed Matter Theory
2005-06	Open	Physics	Biophysics
	Open	Physics	Cosmology/Astrophysics
2006-07	Asst Prof	Physics	Condensed Matter Physics – nanophysics experimental
	Asst Prof	Physics	Condensed Matter Physics – biomaterials/ biophysics-experimental
	Asst Prof	Physics	Cosmology/Astrophysics
2007-08	Asst Prof (MacLaughlin)	Physics	Condensed Matter Physics
	Asst Prof	Physics	Condensed Matter Physics-Biophysics Theory (TOP offer extended spring 2005)
	Asst Prof	Physics	Cosmology/Astrophysics
2008-09	Asst Prof	Physics	Condensed Matter Physics/Biomaterials-Biophysics-Experimental
	Asst Prof	Physics	Condensed Matter Physics/Biomaterials-Nanotechnology-Computational

KEY:
Red: Name of Recent Hire
Green: Replacement; name of faculty member leaving UCR

Astrophysics. Astrophysics is a science that draws from a vast range of disciplines to accommodate the extraordinary diversity of possible states and conditions that exist, and have existed, throughout the universe. Astrophysics' purview expands as new discoveries and observations are made, often in directions that are quite unexpected. Astrophysics research at UCR is currently housed in both the Department of Physics and the Department of Earth Sciences, and all of the faculty currently have joint OR appointments in the Institute of Geophysics and Planetary Physics (IGPP).

In the past 3 years, the UCR Astrophysics group has grown to be one of the major new strengths on campus. There are currently five Astrophysics faculty, 14 professional researchers, and seven postdocs. Fueling this growth has been an expansion of grant and contract funding from ~$350,000 three years ago to ~$1.8 million as of July 2004. The UCR astrophysics group is heavily involved in computation, and has obtained an NSF Information Technology Research (ITR) grant from the computer science division in the NSF. The cluster maintained by this group provides the backbone for large-scale computing on campus. It is clearly important to support the efforts of the computational Astrophysics group. To enhance this effort, a search is allocated to the IGPP in 2005/06 for a junior faculty position in computational astrophysics.

The academic home of the computational Astrophysics faculty will likely be the about-to-be renamed Department of Earth and Space Sciences. The Department of Earth and Space Sciences will pursue a vigorous research program in the areas of space and solar physics, plasma and high-energy astrophysics, stellar evolution, planetary physics, and astronomy. In addition, the Department of Earth and Space Sciences has new a program in astrobiology, as described above, which ties in with the planetary physics component of the astrophysics effort. A new position is planned for astrobiology in 2006/07.

The Department of Physics plans to establish a strong program in cosmology and particle astrophysics. Research programs will be chosen to address fundamental questions and scientific goals, and the experimental techniques will be selected to best carry out the research programs. An immediate goal will be to seek understanding of the evolution of the early universe and the nature of dark energy and dark matter, which make up more than 90% of the universe. This area of research is directly related to the interests of the high-energy physics faculty, and is a natural growth direction for the campus to pursue. Toward this end, we are targeting three new positions in cosmology for 2005/06, 2006/07 and 2007/08, with the first one at the open level. This strategy of hiring a cluster of cosmologists, in conjunction with the existing high-energy physics group, will enable us to put together a world-class effort in cosmology.

Note that any attempt to strictly delimit certain areas of astrophysics within either the Department of Physics or the Department of Earth and Space Sciences would be impossible, and any delimitation necessarily should be viewed as a guideline. Nonetheless, certain parts of astrophysics fall more clearly within the interests of a particular Department. Other areas fall into a more "grey zone," and we need to recognize that in these areas departmental directions will be determined largely by individual faculty.

Since astrophysics research will be housed in at least two different departments, a new interdepartmental graduate program in Astrophysics is currently under development. The development of a new program is warranted for other reasons as well. The taxonomy for research doctorate programs, which is maintained by the National Academy, considers Astrophysics and Astronomy a separate discipline and not a part of either Physics or Earth Sciences. Since this taxonomy defines the areas for which the NRC rankings are performed, it is in the best interests of UCR to have separate, well-defined graduate program in Astrophysics. A strong emphasis of the anticipated graduate program will lie in the general areas of plasma astrophysics (which includes space physics), astroparticle physics, cosmology and origins, as

defined by NASA to reflect extra-solar planets, planetary formation, and astrobiology, as well as covering the more traditional areas of astrophysics and observational astronomy.

Table 15. Recent and Future Hires in Astrophysics			
Year	**Position**	**Department**	**Research Area**
2002-03	Asst Prof (Cannalizo)	Earth Sciences	Observational Astronomy
2003-04	Asst Prof (Rice)	Earth Sciences	Computational Astrophysics
2005-06	Asst Prof	IGPP	Computational Astrophyics
	Open	Physics	Cosmology/Astrophysics
2006-07	Asst Prof	Earth Sciences	Astrobiology
	Asst Prof	Physics	Cosmology/Astrophysics
	Open	College	Observational Galactic Astronomy
2007-08	Asst Prof	Physics	Cosmology/Astrophysics

KEY:
Red: Name of Recent Hire
Green: Replacement: name of faculty member leaving UCR

VII. Faculty Hiring Plan

This section provides a summary of the proposed hires to support the academic programs described above. The departments began this academic planning process with the submission of detailed plans that reflect their priorities for faculty hiring over the next three years to five years (see Appendix B for the individual department hiring plans).

The Faculty Renewal Model. The June 2004 faculty renewal model called for no new faculty FTE to come to CNAS for the next eight years. However, an August 20, 2004 e-mail from Assistant Vice Chancellor Matt Hull approved 220 I&R Faculty FTE for our planning purposes. CNAS currently has 192 I&R FTE, thus we have a total of 28 new FTE that need to be part of our plan. In addition, CNAS currently has 36 open I&R FTE for a grand total of 64 faculty FTE that can be used for planning purposes. The campus has required CNAS to keep 20% of our faculty FTE open at any given time, resulting in a relatively high student/filled faculty FTE ratio. As noted in the introduction of this Academic Plan, the top priority for CNAS is to build a quality faculty. Currently, we lack sufficient numbers to have the desired visibility and impact of our research programs. We simply cannot continue to keep such a large percentage of our faculty FTE open – we must build our faculty in quality and numbers. Accordingly, our plan calls for filling all open faculty positions. Several replacement searches are included in the spreadsheet or planned searches, but this does not represent all of the planned separations.

Appendix A summarizes the proposed searches for 2005/06 through 2009/10. CNAS has more than 100 AES/OR FTE, and 19 CE FTE thus, the number of searches proposed is greater than the number of I&R FTE.

CNAS has several new buildings coming on line over the next several years: Physical Sciences (Winter 2005), Biological Sciences (Winter 2006), Genomics Building (Winter 2008), and

Materials Science and Engineering (Fall 2008). These new projects will create space in existing buildings (Pierce, Webber, Boyce, Batchelor, and Spieth) that can be renovated and used for hiring new faculty. The funding is in place for Phase 1 of the Geology building renovations and parts of the Physics building. CNAS proposes to leverage state investments in new and renovated buildings and whenever possible apply for extramural grants to enhance CNAS and UCR infrastructure.

Clearly, this is a unique opportunity for CNAS: *both space and faculty lines are available and we are in a position to take a huge step forward.* However, an enormous challenge faces us in securing the start up (initial complement) for these faculty, but this is a solvable problem. If we are to be successful in meeting this challenge, our faculty, staff and administration at both the college and campus level must work as a team to come up with many different fund sources (grants, gifts, loans, and college/campus funds).

A Special Note on Faculty Hires in Mathematics. CNAS was allocated two Mathematics faculty FTE per year beginning in 2001/02 through 2003/04 for a total of six (6) faculty positions. The intention of these positions was to meet enrollment growth in Mathematics without hiring ladder-rank faculty. We strongly request removal of the administrative barrier that prevents CNAS from using these FTE to hire ladder-rank faculty.

Appendices A and B present the following information:

Appendix A: Proposed CNAS Faculty Hiring Plan including all CNAS *approved* searches for the current year. New faculty positions are noted in blue and replacement positions in green.

Appendix B: All departmental requests for searches in the 2004/05 – 2009/10 timeframe for new and in several cases, replacement positions. (Provided for informational purposes only)

VIII. Measures to Assure Faculty Success - Development of a Scientific Laboratory Management Program

Faculty in all disciplines on our campus must balance the rigors of teaching, research and administration. Graduate school and postdoctoral experiences rarely provide the training to achieve this important balance. CNAS faculty must learn how to develop, fund and maintain vital and rigorous research programs, manage their laboratory's data and personnel, and mentor students, staff and postdoctoral fellows. In addition, faculty must become good university citizens by contributing to departmental, College, Academic Senate and campus committees that contribute toward advancing UCR's national and international reputation. These new challenges to junior faculty can be daunting, since many are also learning to balance professional and family obligations.

The Howard Hughes Medical Institute and Burroughs Welcome Fund have developed a Scientific Laboratory Management Program that provides training for their fellows to assure success in teaching, grant funding, laboratory management and administration. CNAS has the

opportunity to participate in the 2005 program and will bring the strategies for developing a laboratory management program to UCR. In conjunction with the Vice Chancellor for Research, CNAS will first develop a Scientific Laboratory Management Program for the life sciences.

The goals of the UCR program will be to acquaint young investigators with strategies for academic success at UC Riverside and beyond including:

- principles and demands of grantsmanship (how to get and stay funded)
- project management strategies (the key to meeting programmatic goals)
- methods for laboratory organization and data notebook and data management
- guidelines for student and peer mentoring
- establishing productive collaborations without losing scientific identity
- publishing (data organization, planning for publication, the review process)
- guidelines for merit and promotion in the UC system
- time management
- recruiting and maintaining productive students and personnel
- issues of gender and ethnic/cultural diversity in the lab environment
- balancing administration and the lab (when to say no)
- establishing a balance of extramural and intramural professional activities
- reviewing grants and manuscripts (what is expected)
- ensuring integrity in research and publishing
- resources at UCR (i.e., funding opportunities, research support facilities, Centers and Institutes that provide academic and research focus)
- principles of technology transfer and how to work with the UCR and the UC system offices
- understanding the research diversity at UC Riverside (agriculture to medicine)
- guidelines for course development and teaching in a large classroom setting

It is anticipated that this Scientific Laboratory Management Program will be open to junior faculty, professional researchers, and postdoctoral fellows. Portions of this program may also be valuable for established faculty who have not been introduced to this "strategic" approach to laboratory management. For example, we have found that in hiring senior scientists from other nations, there is occasionally a lag prior to acquiring federal funding. This is due to the different criteria used by sponsoring agencies, and the evaluation criteria that are used by federal funding agencies in the U.S. The grantsmanship section would be most helpful during this transition period. Both junior and senior faculty find personnel management challenges continually throughout their careers. Refresher sessions in the problems and possible solutions in personnel management may also be valuable for all faculty.

While first developed for the life sciences, this program will be adapted to the physical and mathematical sciences and engineering. We also hope that this program can be modified to provide an enhanced career development opportunity for UCR graduate students. This program will enable CNAS to enhance the success and retention of students, postdoctoral fellows and faculty in the sciences. We hope this will indirectly enhance the entry and retention of women

and underrepresented minorities in the sciences, thereby increasing the diversity of the faculty pools for colleges and universities nationwide.

IX. Undergraduate, Graduate, and Postdoctoral Education in CNAS

UC Riverside has one of the most diverse undergraduate student populations in the nation. Unfortunately, science faculty rosters at most universities are not reflective of the ethnic diversity of our nation. While CNAS currently strives to achieve ethnic diversity and gender balance in its faculty, the lack of diversity in faculty candidate pools makes it difficult for CNAS to achieve this goal. UCR has the unique opportunity and obligation to assist in solving this problem by cultivating the next generation of life, physical and mathematical scientists. For this reason, CNAS is exploring new mechanisms to attract, retain and motivate its undergraduates to assure that higher percentages of our students are aware of the diversity of careers in the life, physical and mathematical sciences. CNAS hopes to instill an enthusiasm for scientific discovery and learning so that our students may enroll in the best professional and graduate schools, thereby providing an ethnically rich and gender-balanced pool of candidates for future faculty positions.

CNAS faculty are committed to providing excellent teaching, novel research experiences and individual mentoring to attract, retain and motivate our undergraduates. CNAS believes that this academic-research-mentoring triad is the key to success for UCR undergraduates.

By hiring the best faculty, promoting innovative interdisciplinary research programs and providing state-of-the-art research infrastructures, CNAS will continue to provide a nurturing educational and dynamic research environment that will foster cutting-edge discoveries and encourage our undergraduates, graduate students and postdoctoral fellows to pursue their passions. By providing clear mentoring structures at all levels, CNAS can increase ethnic diversity and gender balance in student and faculty pools for academia and other scientific professions.

Below we describe the current status of undergraduate, graduate and postdoctoral training in CNAS. We highlight our current and proposed initiatives to make CNAS and UCR the first choice for education and research.

A. Undergraduate Education

The major advances in technology and the application of these tools to problems in science provide incredible opportunities for our researchers to address significant problems that heretofore were unsolvable. Access to information and databases provides our students with tools that no other generation of student has enjoyed. These advances, coupled with the quality of the UCR faculty, their commitment to teaching and mentoring students, and the diversity of our undergraduate student population, provide UCR with a unique opportunity to reevaluate our curriculum and training of students.

Current State of the Undergraduate Program. The undergraduate student population in CNAS has expanded rapidly during the last four years, growing from 3,152 (fall headcount) in 2001 to 4,023 in 2004 (Table 15). As discussed at the Enrollment Management Summits held during AY 2003-04, the College Deans expect continued growth in the CNAS undergraduate population, with enrollment in the sciences approaching 5,000 students over the next five years. Concomitantly with this increase, we expect an overall improvement in the quality of undergraduates entering the College, especially with students having better preparation. The College expects to meet the dual goals of improved student preparation and increasing student numbers by several means. We expect to: (1) tighten admissions standards for majors entering the College; (2) provide sufficient summer bridge programs for enhancing student preparation; and (3) improve student retention by decreasing academic probation rates. Several programs are being developed that will assist us in meeting these goals.

Table 16. Undergraduate Majors in CNAS

Year	1999	2000	2001	2002	2003	2004	2009
CNAS Fall Headcount	3,121	3,173	3,152	3,487	3,916	4,023	5,000 Projected

One way that we can improve the rate of retention of students in the sciences is by improving advising. In particular, we are exploring practical ways for re-instituting mandatory advising for all CNAS students. This is a particularly crucial element in the improvement of retention within the Life Science majors.

Another area where we face challenges is in the advising of undeclared students in the College. As Table 16 shows, the numbers of undeclared students in the sciences have increased over the past four years, albeit decreasing somewhat this year. The decline in 2004 occurred primarily at the freshman level because we encouraged incoming undeclared Life Sciences freshmen to declare a major upon entrance, and many did so.

Table 17. Number of Undeclared Students in CNAS

Year	1999	2000	2001	2002	2003	2004
CNAS Fall Undeclared Headcount	859	1,001	1,037	1,179	1,263	1,060

Academic Advising. The College is developing new models for academic advising that will engage students more quickly in the academic atmosphere of the university. We believe that high quality, consistent academic advising of CNAS undergraduates is crucial to students' success in our College because of the rigorous nature of our curriculum, the high number of course prerequisites required to meet the curriculum, and the general level of preparedness of our incoming freshmen. Investments in this area will allow CNAS to increase recruitment and retention of high-quality students. High quality advising that meets the needs above is made up of two inseparable components:

- Highly-qualified, well-trained, customer-friendly Staff Advisors, who understand and disseminate UC, UCR, and academic department policy and regulations. Staff advisors promptly diagnose patterns of academic difficulty and recommend strategies for remedy

and regularly monitor and track students' compliance with appropriate university policies and regulations and intervene when necessary.

- Knowledgeable and mentoring Faculty Advisors, who disseminate information to students regarding research opportunities, career planning, and graduate and professional school preparation.

CNAS is aggressively pursuing new avenues to enhance student advising. Some of these initiatives are summarized below. Several of the CNAS advising initiatives are new and will need to be routinely evaluated to assure they are having high impact on CNAS undergraduate retention and success.

Freshman Advising Seminars. The freshman advising seminars provide every new freshman in CNAS the opportunity to enroll in a seminar that is led by a ladder-rank CNAS faculty member during the fall quarter. These are offered for departmentally based majors within the framework of a course offered by the academic department and for interdepartmental majors and undeclared students in the College as a course given by the College. Seminars will provide 1 unit, S/NC grading (fall quarter only) and will incorporate relevant materials that faculty present to freshmen to assist their motivation and progress in the sciences. Typical seminar topics will include, for example:

- Career Planning
- Major choices in the Sciences
- Career options in the Health Sciences (or Physics Research, etc.)
- Looking ahead to Graduate School
- What is this thing called "Research?"
- What do faculty at UCR do?
- Campus resources to assist student learning
- Faculty expectations in lower division courses

Pilot advising seminars were run in 2003-04. They were a resounding success with students and faculty. In Fall 2004, we used the Freshman Discovery Seminar rubric (NASC092) to expand this program. This is the first time that CNAS has undertaken such a large-scale advising experiment. There were 40 sections of up to 20 students each offered in the fall. There were 686 new freshmen enrolled in these seminars. Some of our students (26) enrolled in Physics 39—a similar seminar for Physics majors—and some (21) enrolled in Environmental Science 92, another similar course. Those CNAS students who are in the Honors program took an honors seminar. Collectively, these seminars provided almost all CNAS freshmen with this valuable faculty-student mentoring option.

We plan to expand this program during the 2005-06 academic year, as we move away from the Discovery Seminar rubric. Further, we expect to develop a similar program for incoming transfer students. To assist faculty in these advisory seminars and becoming student mentors, a Faculty Handbook has been developed based on spring 2004 advising seminars and an improved version will be developed for the next academic year.

Faculty Advisors. The College's goal is to provide every CNAS undergraduate with a faculty mentor advisor. The freshman advising seminar has provided some of these initial faculty-student pairings, which can be one of the most positive experiences of a student's entire educational career at UCR. This goal will be accomplished over the next few years by making sure that all incoming students have a faculty mentor/advisor with whom they may address appropriate academic problems. Faculty are guided by the Faculty Mentor Handbook and interactions with CNAS Staff Advisors.

To further facilitate the ability of faculty to effectively mentor, student academic records must become more readily available to faculty mentors. Currently, few faculty access student information directly from SIS+ due to its cumbersome nature, including loss of access after periods of inactivity and required knowledge of screen and action codes. A more user-friendly, web-based SIS+ interface is being developed and implemented, so that faculty will no longer need to rely on paper transcripts or degree audit summary sheets which are hand-generated and filed by student advising staff. In addition, an online, electronic system for generating, maintaining and accessing advising notes will be implemented so that student advising files require little if any administrative support. These changes will enable advising staff to spend less time servicing faculty needs and more time servicing student needs. (See below)

Staff Advising. CNAS will improve and further develop staff advising. Student advising services in the College are being consolidated to provide the opportunity for students to meet with professionally trained staff advisors. CNAS is fortunate to have an outstanding group of staff advisors; however, it is not clear that we provide the necessary administrative structure, professional development, or time to focus on students that these individuals require to do the best possible job for our students. Most of the current College staff advisors are supervised by departmental MSO or FAO titles. Since the MSO/FAO titles have little if any student contact, advising or otherwise, many staff advisors have maximum autonomy but minimal training, supervision, or support in regards to their advising duties. Often staff advisors have evolved from department clerical positions, and most departmental student advisors currently spend a third to a half of their time each day in duties that are not strictly student advisory in nature. These departmental administrative duties include, but are not limited to, student enrollment in courses/discussion/laboratory sections, scheduling of discussions/laboratory sections, scheduling of department rooms and facilities, faculty/TA teaching evaluations, and departmental key distribution. Such duties are consistent with those assigned to AA titles. If non-advising duties were reassigned, staff advisors could devote their time and energy to advising more students, decreasing the need for additional staff advisors. CNAS also has a faculty committee looking at the structure of our undergraduate advising. The major questions are whether we should move to a centralized structure for staff advising.

CNAS Freshman Scholars Program. This year CNAS initiated a pilot program that is designed to improve the academic progress of CNAS freshmen in all of their courses. This program, the CNAS Freshman Scholars Program, is for freshmen in CNAS, who are participating in the three-quarter Chem 1 series on-sequence. CNAS Freshman Scholars enroll in a single lecture section of Chem 1A (Fall), B (Winter), and C (Spring) during AY 2004-05. These lecture sections have been offered by ladder-rank faculty who agree to coordinate and supervise the Master TAs assigned to the course. Each Freshman Scholar participates in a

Chem 1 discussion section of 20-25 students led each quarter by one of the Master TAs appointed by the Chemistry department. This program was open to up to 200 freshman applicants who agreed to participate in the add-on discussion section (Chem 1DA, 1DB, and 1DC, 1 unit each, S/NC grading). Freshman Scholars also agreed to participate in mandatory workshops throughout the year given by peer mentors who are trained and supervised by the Learning Center. Workshops focused on problem-solving skills, test-taking skills, library usage, and other university acclimatization issues. In Fall 2004, 191 CNAS freshman were enrolled in Chem 1DA. Freshman scholars, who plan to complete the program, have been offered the opportunity to apply for a limited number (25) of CNAS summer research positions in faculty labs for summer 2005. In Fall 2004, students enrolled in the Scholars Program achieved an average grade in Chem 1A of 3.31 vs. 1.86 for students not in the program. A full statistical regression analysis attributes at least 0.5 of this grade differential to participation in the program. Assuming continuing success of this program, we plan to expand the elements of the program to all Chem 1 students. For Fall 2005, it will be offered to 300 freshmen. Implementation of this strategy to other introductory science sequences such as Biology 5 and Math 9 will need to be considered by CNAS faculty.

Academic Workshops. CNAS hopes that by recruiting and retaining the best students, and providing personalized advising and mentoring for all CNAS students, many instances of academic difficulty will be avoided. However, it is realized that selected students will make personal and academic errors that jeopardize their academic achievement. Freshmen who are in academic difficulty after their first quarter in CNAS are given the opportunity to attend academic workshops in early January. These workshops have been offered for the last four years in January. However, the participation rate has been less than 50%. While we plan to continue to offer these workshops, we need to increase participation and to expand the services available to provide assistance to more of our at-risk students.

Undergraduate Research Opportunities. Undergraduate research opportunities are critical for instilling an understanding of the excitement, rigor and challenges encountered in the basic sciences. CNAS Departments and faculty have always been very active in working with students and encouraging them to undertake undergraduate research. Clearly, this is one major reason for students to attend a research university like UCR. While the Research Office currently provides a listing of research opportunities for UCR undergraduates, CNAS is committed to making these research opportunities more visible to our undergraduates and providing individual help to each student seeking assistance. The Freshman Scholars Program is one step in this direction (see above). CNAS is committed to making these opportunities more visible and available for undergraduates throughout the College. Furthermore, grant and development funding is being sought to provide stipend and research support for undergraduates seeking to engage in research in the College.

To this end, CNAS hired a Coordinator of Undergraduate Research to begin this process. Within a year, we expect to add a Director's position to the CNAS Office of Undergraduate Research to provide more service to students in this area.

The CNAS Undergraduate Research Office will coordinate programs within the College that involve undergraduate students in research. The Director will be coordinating activities designed

to promote faculty-mentored student research and student access to on- and off-campus research opportunities for the College. The Director will work closely with the Career Center to facilitate these initiatives. The Director will also monitor available funding opportunities, distribute available information to faculty, and assist in proposal preparation, review, and approvals. The Office will advertise available research opportunities, work with students on research placement, and assist students in application processes. We will likely develop a Spring Research Colloquium for students to present the results of their research, either independently or in collaboration with other colleges in this region. Currently, we are collaborating with the Learning Center on the New Directions Undergraduate Research Conference to be held here at UCR on May 7, 2005.

- ***NSF STEP Proposal.*** The College recently submitted a proposal for the NSF **S**cience, **T**echnology, Engineering, and Mathematics Talent **E**xpansion **P**rogram (STEP), Professor Michael Marsella, PI. The goal for this proposal is to increase overall retention of STEM (Science, Technology, Engineering and Mathematics) majors, while decreasing the gap in the campus's attrition rates between females and males in the STEM fields. The UCR Program is called "InSTEP: Increasing Science, Technology, and Engineering Participation at UCR." It has the following goals:Create a sense of community in STEM fields by offering special housing options and increasing the number of social support activities
- Bolster self-confidence through preparedness (Summer BRIDGE program), and internships
- Improve the quality of support and advising within STEM departments
- Highlight post-graduate employment opportunities for InSTEP graduates via student-oriented seminars given by invited (predominantly female) speakers from academia and industry
- Increase the emphasis of "real-world" applications via InSTEP Research Opportunity Awards
- Involve students in shaping their own community: InSTEP Student Organization

One element of this proposal is a special housing option that will be instituted, irrespective of proposal funding. It is called InSTEP Hall: A Science, Technology, Engineering, and Mathematics Residence Hall. Students in the College of Natural and Agricultural Sciences and the Bourns College of Engineering (BCOE) may choose to reside as freshmen in the InSTEP Residence Hall. InSTEP Hall will provide an environment that is conducive to informal study groups with suitemates or neighbors, offer formal study groups organized by the Learning Center, and serve as a focus for InSTEP social and academic activities. Resident Advisors and mentors on this hall are CNAS or BCOE majors. Residence in this community is especially recommended for those intending to participate in academic research programs in CNAS or BCOE.

New Student Outreach. We plan more active CNAS faculty participation in campus outreach programs. These include the presentations at Bourns Science and Engineering Day, Chancellor's Welcomes, Discover UCR Days, Preview Day, Chancellor's Receptions, and the Transfer and Re-entry Services Academic Spotlight program. We had faculty make phone calls to prospective Regents' and Chancellor's Scholars during the February/March recruitment season and invited

these students and their parents to a Chancellor's Scholarship Celebration on Feb. 26, 2005. We are planning to invite a select group of scholarship students to receptions in alumni homes during April. One will be in San Diego and one in San Leandro. We are also working with the Admissions Office to improve knowledge of the UCR tour guides about CNAS buildings, resources and programs. We believe that tour guides can help instill the enthusiasm that CNAS has for research and education in the life, physical and mathematical sciences.

Premedical Education. At the request of the Dean, the CNAS Executive Committee appointed a committee to examine the best structure for assisting our students in their preparation for professional schools in health-related sciences. This committee also reviewed the medical biology track in the Biological Sciences major, the emphasis in medical in the Biochemistry major and the proposal by the Department of Cell Biology and Neuroscience to have a health science major. The committee reached a consensus on the best structure for campus programs in the health sciences area and the final report has been submitted. CNAS has recently added a second health careers student affairs officer to assist our students in their preparation for application to professional schools. A plan for reconstituting a "Pre-Professional" committee of faculty to write letters for their students, with additional staff support, has been developed. The development of a high-profile mechanism to attract and retain the best students to UCR is critical for a vibrant academic community and to assure UCR has the best students to enter the 24 seats in the UCR Thomas Haider Biomedical Sciences Program.

Restructuring Life Science Education Paths. The CNAS Executive Committee is reviewing a proposal by the College to examine the current structure and recommend a future structure for undergraduate majors in the life sciences. Currently, there is confusion among students and faculty as to the difference between department-based majors and the interdepartmental majors in the biological sciences. The Executive Committee will provide recommendations on the structure for life science majors or tracks, as well as the administrative structures critical for the long-term success of the newly organized majors/tracks.

B. Graduate Student Education

Active and vibrant graduate programs are the life-blood of a university. CNAS is committed to seeing our graduate enrollment grow in size and quality. With the appointment of a new Graduate Dean, the role of CNAS in managing the finances for graduate recruiting has changed. We plan to work in partnership with Dean Rabenstein to see our programs continue to grow and prosper.

The CNAS graduate student enrollment has grown steadily over the past seven years (Table 17). Our projection for growth assumes that new graduate student enrollments will grow by ~ 10% per year. This projection was not realized this year, but we are hoping to get back on track for fall 2005 with a class of 200 incoming students. The Graduate Division is currently working with each graduate program to set enrollment targets for the next five years, but we anticipate little if any change from our goal of a 10% increase per year.

Table 18. CNAS Graduate Student Enrollment

Year	1997/98	1998/99	1999/00	2000/01	2001/02	2002/03	2003/04	2004/05
Graduate Fall	501	463	466	498	517	552	605	615

Headcount								
New Graduate Student Headcount	153	99	120	136	125	156	172	169

There are several reasons CNAS must work toward increasing the size and quality of our graduate programs. These include:

Faculty Require Active Graduate Programs. If we are to continue to recruit new faculty and to retain the ones we have, we must provide a supply of talented graduate students. As new faculty are hired, the College has continually heard that potential faculty are concerned about the UCR commitment to our graduate programs.

Graduate Students Function as Teaching Assistants. Our graduate students play a major role in our undergraduate curriculum by serving as teaching assistants. Currently, our mathematics, chemistry and physics programs are hiring lecturers to serve as teaching assistants. Without exception, our programs feel that our undergraduates are better served by having graduate students lead the discussion sections and laboratory sections.

Reputation. The national and international perception of UCR as a major research institution is directly linked to the quality of our graduate programs. In addition, admission to the AAU and the NAS rankings of research programs are tied directly to the quality and size of the graduate programs.

The challenge of recruiting increasing numbers of new graduate students will remain a difficult one as long as the central support budget for graduate fellowships remains flat. During the past three years, the college has changed the expectations of many faculty; faculty are now expected to support students for years 3-5 of their Ph.D. programs. This still requires central funds for the first year of graduate study. CNAS will continue to encourage our faculty to include graduate student stipends in their grants; additionally, they are encouraged to write training grants and center proposals that can support a number of students. The Dean's office has provided staff support for these granting endeavors.

There is an increasingly stiff competition for the best candidates in the sciences, resulting in a decreasing domestic applicant pool and prompting an increased reliance on international students to fill the graduate student ranks. This reliance, in turn, results in an additional logistical problem of TA competency, namely the oral fluency problems of international students appointed as TAs must be assessed and corrected. Recently visa issues are a major obstacle to recruiting foreign students. There is also the issue of increased costs associated with non-resident tuition.

New and Revised to Graduate Programs. Faculty in CNAS and BCOE are working on a proposal for a new campus-wide graduate program in material science and nanotechnology. As mentioned earlier in the section on Astrophysics, faculty from Earth Sciences and Physics are also putting forward a proposal for an interdepartmental graduate program in astrophysics that may also include astrobiology in the future. A major challenge facing the College is the number and structure of our graduate programs in the biological sciences. Currently we have separate admissions and recruiting for every program in the biological sciences, even thought many

students apply to more than one of our programs. We have proposed that the Graduate Division conduct a program review of the campus graduate programs in the biological sciences (including Biomedical Sciences) and are currently encouraging our faculty to consider reorganizing our graduate programs into a program similar to the UCLA ACCESS program. Clearly, this will be a much more productive process if faculty are driving the changes rather than if this is from a Graduate Division or College mandate.

These initiatives must focus on increasing the quality and quantity of both undergraduate and graduate students. The size of graduate programs is often a criterion for recognition by the NRC. For UCR to achieve AAU status, this is a critical objective. CNAS is working with the Graduate Division to find new organizational and funding mechanisms to achieve this goal.

CNAS will develop a unique graduate mentoring program to guide our students into prominent postdoctoral and faculty positions. CNAS will partner with Dean Dallas Rabenstein to pioneer these programs. This program will build on the Scientific Laboratory Management Program in conjunction with Vice Chancellor Charles Louis (Research Office) to provide postdoctoral fellows and junior faculty essential guidance to assure their academic success. It is anticipated that once these programs are developed for the life sciences, they will be extended to the physical and mathematical sciences and engineering.

C. Postdoctoral Research Associates

CNAS faculty have been very successful in obtaining grant funds to support postdoctoral research associates. This group of researchers will continue to play a key role in our research efforts. Campus planning numbers forwarded to CNAS on August 20, 2004 provide a target number of 170 postdoctorals for CNAS once we achieve an undergraduate enrollment of 20,000. CNAS currently has 222 postdoctoral research associates. The target number of 170 represents a decrease of over 20% of our total postdoctorals. If the 170 cap is imposed, it will clearly have a huge negative impact on research productivity and lead to a drastic decrease in extramural funding. At this stage, we assume the proposed cap in postdoctoral researchers is a miscommunication.

X. Conclusion

This academic plan for the College of Natural and Agricultural Sciences has outlined strategies in support of our mission to create the fundamental scientific knowledge in the biological, physical, mathematical and agricultural sciences and to apply that knowledge through education and public service. The overriding priority of our plan is to build upon our faculty strength, as it is the faculty of a university that gives rise to outstanding academic and research programs and it is the faculty who serve as the most valuable mentors and role models to inspire our students to pursue their dreams. It is imperative that we provide faculty with the tools they need to do this important job – state-of-the-art facilities, attractive initial complement packages, and effective student recruitment and retention programs. Several specific objectives of this plan address these issues. While carrying out this plan, we are also mindful of the need for this plan to remain dynamic, so that it can be modified as new technologies and research areas emerge and evolve, and as campus circumstances change.