FAU

Charles E. Schmidt College of Science

Florida Atlantic University

Program Review 2009

CHARLES E. SCHMIDT COLLEGE OF SCIENCE

Create the Future

PROGRAM REVIEW 2009

Dr. GARY W. PERRY DEAN

Year of Science 2009

As we prepare to enter the second decade of the 21st Century, it is fitting that we conduct this program review of the Charles E. Schmidt College of Science in 2009—a year that has been designated as the Year of Science. After all in 2009 we celebrate anniversaries of events that have shaped scientific thought and process for hundreds of years and include the following:

- The 200th anniversary of Darwin's birth and the 150th Anniversary of the publication of "On the Origin of Species."
- The 200th anniversary of the birth of Abraham Lincoln whose contributions to science include founding the National Academy of Sciences, as well as creating the Land grant system of agricultural Colleges through signing the Morrill Act, which was very important to the development of applied biological sciences.
- The 400th anniversary of the publication of Johannes Kepler's first two Laws of Planetary Motion.
- The 100th anniversary of the discovery of the Burgess Shale by the paleontologist Charles D. Walcott.
- The 100th anniversary of the establishment of USDA Forest Service Experimental Forest and Ranges, the largest system of dedicated experimental sites in the US.
- The 400th anniversary of Galileo's first use of a telescope to study the skies.

That 2009 is designated the Year of Science also seems particularly prescient given the new administration installed in Washington, DC at the beginning of this year, and the clear support for science by a new President of the United States -

"We will restore science to its rightful place, and wield technology's wonders …… And we will transform our schools and colleges and universities to meet the demands of a new age. All this we can do. All this we will do." — *President Barack Obama, January 20, 2009.*

Mission Statement

The mission of the Charles E. Schmidt College of Science is to provide the benefits of scientific understanding to our students and the public through teaching, research and service.

In teaching, our mission is to provide excellent, accessible, affordable education in science through degree programs at the bachelors, masters and doctoral levels, and through general education in science for all FAU students.

In research, our mission is to apply the power of discovery to fundamental problems of scientific importance, as well as to subjects of current topical interest.

In service, our mission is to provide scientific expertise that supports the needs of the region and nation.

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Dean's Statement

I have been dean of the Charles E. Schmidt College of Science for a little over three years now, although this is my twentieth year as a faculty member at Florida Atlantic University. When I came here twenty years ago, I knew that there was enormous potential here and that continues to be the case. The College and the University are different places to what they were two decades ago, and we can be proud that we continue to build a better institution on the shoulders of those who came before us, and we will continue to do so for those who will come after us. As I prepared this Program Review with my colleagues I was reminded constantly of the quality of all the individuals who make up our College and contribute to the success of its programs, and have so for many years. This includes not only the faculty of the College but also the staff and of course our students, past and present, and I am grateful to them all.

As I think about our College and FAU's future, I am reminded of the words of the Victorian English Poet, Robert Browning - "Grow old along with me, the best is yet to be."

Cheers!
Gary W. Perry, Dean
October, 2009

Executive Summary

The Charles E. Schmidt College of Science is the primary source of science research and education for more than three million people living and working in our service region of Southeast Florida. The College plays a crucial role in the intellectual life of FAU students. Our lower-division math and science courses service the university's Intellectual Foundations Program and our academic departments and research centers provide outstanding opportunities for both undergraduate and graduate science majors. The education and research programs of the College span the sciences and mathematics with major efforts in many fields ranging from biotechnology, bioinformatics and brain science to cryptology, developmental systems, dynamical systems, environmental sciences, geo-information science, marine science and space-time physics. The College's programs extend over many of FAU's campuses and its programs occupy buildings that include more than 300,000 square feet of state-of-the-art instructional and research space. This program review covers the period from 2001-02 to 2007-08. It includes an examination of key College trends as they pertain to the University Strategic Plan and Goals and the core missions of the College in teaching, research and service. Also included are department reviews and Academic Learning Compacts.

In teaching, since 2001, the College has shown significant increases in all instructional productivity measures such as annualized FTE productivity, headcount enrollment, sections offered, degree production and instructional quality. FTE production by the College is very high at well over 3,000 FTE for 2007-08 or about 22% of the total FTE generated at FAU by all programs. The increased undergraduate FTE is, of course, attributable to the increased headcount enrollment not only in Science, but also in other colleges at FAU. The increase in headcount enrollment and the increased FTE production have resulted in a significant increase in the total number of sections offered by the College. The College houses two of the largest enrolled majors in the University—Biological Sciences and Psychology. Increased headcount enrollment, number of sections offered and FTE productivity have translated into an increased number of degrees awarded by the College, with 556 undergraduate degrees awarded in 2007-08 and 111 graduate degrees. Clearly, students perceive the instruction they receive from science faculty to be, on the whole, very good to excellent as judged by the Students Perception of Teaching (SPOT) surveys. This quality of instruction has been a hallmark of the College for at least the last decade. An increasing number of granting agencies have recognized our excellence and innovation in science teaching with large grants to fund new pedagogical approaches in our undergraduate programs and outreach efforts toward science teaching in K-12 institutions. Student diversity has increased (to ~2 white:1 non-white) as the headcount has increased in science at both undergraduate and graduate levels, with large populations of Hispanic and African-American students; our student body is also more female than male (~2:1), each thus mirroring the university as a whole. After several years of neglect, the College has instituted curricular assessment plans in all programs and now routinely uses nationally accepted assessment procedures to refine programs. All programs in the College are current with their assessment plans and actively working to improve those plans especially for graduate programs. These findings are in accord with Goals 1&2 of the University Strategic Plan. In summary, the College is meeting its mission in teaching.

In research, the number of research publications in the College has steadily increased especially over the last several years. The College ranks second in the University as far as total number of publications per year (457) which translates to about 3-4 per regular faculty member in 2007-08. With regard to sponsored research activity, the College is highly successful and has shown a steady and marked increase in sponsored funding during the last decade, ranking second in the University in 2007-08. Sponsored funding per faculty member in science is about $70,000 per year with a target level of $100,000 per faculty member attainable in the next five years. Graduate education and research are central to the research mission of the College and in this regard the College has steadily increased its graduation of Master's and PhD students, adding several new programs since last review. Notably, in 2007-08, the College graduated the most PhD's (22) among FAU's colleges. Assessment plans for research are currently being implemented. These findings are in accord with Goal 3 of the University Strategic Plan. In summary, the College is meeting its mission in research.

In service, the College continues to meet its responsibilities. This includes not only service to the university, but also service to the profession and the community. The amount of service provided by the faculty in areas of the university, the community and the profession has remained relatively constant during the last decade. However, in community service the College has continued its outreach programs to middle and high schools through competitions such as Math Day and Science Olympiad, and teacher engagement programs in mathematics and chemistry; the College also engages the community through our annual Frontiers in Science Public Lecture Series and the Nobel Symposium. There has been a marked increase in the amount of professional service provided by faculty members on editorial boards or as reviewers for scientific journals and granting agencies such as the NIH and NSF. This is an important indicator of faculty quality and the high esteem in which many of our faculty members are held by their peers. Moreover, it reflects on the continuing maturation of the research enterprise in science at FAU. Assessment plans for service are currently being implemented. These findings are in accord with Goal 4 of the University Strategic Plan. In summary, the College is meeting its mission in service activities.

The number of regular faculty in the Charles E Schmidt College of Science has remained essentially constant at around 120 during almost the entire last decade, despite the fact that, as outlined above, most other productivity measures such as student headcount, degrees awarded, sections offered, research dollars and publications, and service have increased, in some cases dramatically. The diversity of the instructional faculty in the College has remained essentially unchanged for the last five years, although today it is significantly greater than in 2001-02, with a small increase of about 20% in diversity in recent years. Faculty salaries are less competitive than our peer institutions and this has become a problem for retention of the best faculty. Nonetheless, the majority of the faculty members of the College are dedicated members of the academy who work tirelessly on behalf of the College, the University and our students.

Both our Nation and the State of Florida are reeling from the current world economic turndown; however, such circumstances necessarily engender opportunities for change. For our College, change may come in the form of campus-specific missions or it may present itself in opportunities for exciting new program initiatives. As we conclude this Program Review, indeed exciting new initiatives are being considered that will take the College in new directions and to new levels of excellence. These involve university-wide initiatives in climate change and environment, alternate energy, and partnerships with such research powerhouses as Scripps Florida and Max Planck Florida Institute. In any event, the Charles E. Schmidt College of Science stands ready to thoroughly and completely engage in these programs.

While this program review has identified numerous strengths and opportunities in teaching, research and service within the College, it has also highlighted weaknesses and threats that need to be addressed as we move forward. Foremost among our weaknesses has been an inadequate continual assessment of our programs according to nationally acceptable guidelines and principles. We have begun to implement such assessment procedures of our programs in the last year or two. A serious threat to the mission of the College is our inability to increase the size of the regular faculty to meet the increasing demands of teaching and research. Probably the most disappointing aspect of this Program Review today is that there has been essentially no increase in the number of regular faculty in the College for almost a decade, despite significant increases in all other aspects of college productivity.

In conclusion, this Program Review highlights that the Charles E. Schmidt College of Science continues to be a pivotal college for the future development of Florida Atlantic University as a comprehensive research university. The College's teaching and research missions and programs dovetail beautifully with what have become regional state initiatives in science and technology. Our academic programs continue to swell with students interested in making a career in science and our programs provide them with ample opportunity to do so. We continue to build our programs and assess their relevance as they relate to today's local and global marketplace, making adjustments or proposing new programs as necessary to provide our students with a 21st Century education. Clearly, we are meeting our mission and have every reason to be very proud, and optimistic for the future, of the Charles E Schmidt College of Science at Florida Atlantic University.

Preamble

The Charles E. Schmidt College of Science, named in honor of the patriarch of one of Florida Atlantic University's greatest benefactors, is the primary source of science research and education for more than three million people living and working in our service region of Southeast Florida. Through its academic departments and research centers the College provides outstanding opportunities for both undergraduate and graduate science majors.

The education and research programs of the College span the sciences and mathematics with major efforts in many fields ranging from biotechnology, bioinformatics and brain science to cryptology, developmental systems, dynamical systems, environmental sciences, geo-information science, marine science and space-time physics. The College's programs extend over many of FAU's campuses and its buildings include more than 300,000 square feet of state-of-the-art instructional and research space.

Research and scholarship are central to the College's mission and play vital roles in the life of the College as a whole. External research funding, the great majority of it coming from Federal agencies such as the National Science Foundation and the National Institutes of Health, underwrites major programs of research by faculty and students. Science faculty members throughout the College have developed state-of-the-art research programs in diverse disciplines and important new interdisciplinary areas. Faculty have active collaborations that extend not only across FAU's Colleges but also to local research institutions such as Scripps Florida, the Torrey Pines Institute for Molecular Studies, and the Max Planck Florida Institute, as well as affiliations with national laboratories such as Los Alamos and Oak Ridge National Laboratories, and international collaborations that span the globe.

In the knowledge-based economy of the 21st Century that demands graduates with higher math and science skills, the College trains students who can enter the workforce prepared to meet local, national and international needs in a globally competitive environment. In Science, we create the future!

Organization of this Program Review

The organization of this Program Review consists of two parts. Part I will include my overview of the progress of the College as a whole since the last Program Review and will contain salient points with respect to key College trends as they pertain to the Goals of the University Strategic Plan. It also includes a comparison on key issues with other Colleges at FAU and with other Colleges of Science, or their equivalent, at peer institutions. Part II will comprise a self study and assessment of each academic program within the College conducted by the departments and programs.

Acknowledgments

This program review would not have been possible without the help of the faculty and staff in each of the departments and I am indebted to them for their diligence in preparing their self studies and program assessments. They are: Rod Murphey, Jim Hartmann, Jay Lyons, Nwadiuto Esiobu, Joseph Carusso and David Binninger (Biological Sciences); Jerry Haky, Debbie Louda, Evonne Rezler and Ram Narayanan (Chemistry and Biochemistry); Armin Fuchs and Jan Blanks (Complex Systems and Brain Sciences); Diane Owen and Dale Gawlik (Environmental Sciences); Dave Warburton and Russ Ivy (Geosciences); Spyros Magliveras and Lee Klinger (Mathematical Sciences); Armin Fuchs and Warner Miller (Physics) and Jenny Peluso and Dave Wolgin (Psychology). I am especially indebted to Jenny Peluso who has guided this process with complete aplomb and who brought her wealth of experience and enthusiasm to the task, and to my Executive Assistant, Lynn Sargent, who crunched the numbers for my overall review in Part I.

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Part I: Dean's Overview

Strategic Planning: University Goals and College Objectives

Since our last program review in 2001 the Charles E. Schmidt College of Science has completed strategic planning and visioning and developed specific College Objectives. These objectives are consistent with the current University Strategic Plan: Goals and Objectives. The following four strategic goals developed by the Florida Board of Governors were adopted and included by the FAU Board of Trustees as part of FAU's Strategic Plan. Since their inception in 2006, the College has fulfilled its part in meeting these Goals which are consistent with our College's mission and our own college objectives. This Program Review will be organized to review College Trends and Analyses and how these conform to the University Goals. The Goals of the University Strategic Plan are:

GOAL 1: Providing Increased Access to Higher Education

Florida Atlantic University will continue to provide access to higher education for residents of the region, the state and the nation and will respond to the competitive economic environment by increasing the number of degrees granted to students at all levels.

GOAL 2: Meeting Statewide Professional and Workforce Needs

Florida Atlantic University will commit academic and fiscal resources to meeting Florida's need for trained professionals in nursing, teaching and advanced technology. FAU will demonstrate its commitment to recruiting and preparing students in these vital professions and to identifying emerging trends in the labor force.

GOAL 3: Building World-Class Academic Programs and Research Capacity

Florida Atlantic University will develop academic and research programs of the highest caliber to support Florida's strategic engagement in building an economy based on high technology and to foster a culture enriched by scholarly inquiry.

GOAL 4: Meeting Community Needs and Fulfilling Unique Institutional Responsibilities

Florida Atlantic University will be a full participant in the life of its seven-county service region. It will advance economic development, encourage regional cooperation and sustainability, build partnerships in key areas of community need and enrich lives through lifelong learning

Previously, the Charles E. Schmidt College of Science adopted the following college objectives to guide the College's development during this last review period and a brief statement on outcomes to date are provided to highlight where the College is in meeting these objectives. Greater detail is provided in the section on College Trends and Analyses below.

College Objective 1: The Charles E. Schmidt College of Science will increase the growth rate of its overall undergraduate and graduate degree production to about 5% per year (Goal 1).
Outcome to date: The College has had an average growth rate exceeding 5% per year for the past 7 years in its undergraduate degree programs and a rate exceeding 8% in its graduate programs.

College Objective 2: The Charles E. Schmidt College of Science will provide excellent advising to its undergraduate majors (Goal 1).
Outcome to date: The nationally accepted ratio of student per advisor for advising purposes is 300:1. Currently, the College's professional advisors are responsible for advising students at a ratio of 500:1. Additional professional advisors are needed to meet this College objective in the next review period.

College Objective 3: The Charles E. Schmidt College of Science will continue to provide excellent service course instruction for students majoring in other Colleges (Goals 1 & 4).
Outcome to date: Much of the new Intellectual Foundation Program of the core curriculum is provided by the College including required courses in science and mathematics. Non-science majors have had greater difficulty with these courses although the College has reduced by 10-25% the DFW rates in courses such as introductory biology and chemistry and mathematics through innovative instructional programs such as ChemBond and Lifeline which involve Peer Led Team Learning, and Supplemental Instruction.

College Objective 4: The Charles E. Schmidt College of Science will provide adequate infrastructure support for its programs (Goals 1 & 3).
Outcome to date: State-of-the-art teaching and research equipment and laboratories, machine shop support, generous faculty start up packages, adequate Teaching Assistants and department/program administrative staff and budget coordinators are provided for departments and programs.

College Objective 5: The Charles E. Schmidt College of Science will have adequate space for its mission (Goals 1-4).
Outcome to date: Since last review several science buildings have been completely renovated and several new buildings constructed to house the College's instructional and research programs. Currently, the college occupies over 300,000 GSF of state-of-the-art space on several FAU campuses.

College Objective 6: The Charles E. Schmidt College of Science will orient its graduate programs primarily to doctoral degrees (Goals1, 2, & 3).
Outcome to date: PhD programs have been added in Chemistry and Integrative Biology and most recently (2009) the PhD in Geosciences was implemented bringing the total number of PhD program offered by the College to seven, and thus making the College a fully doctoral college.

College Objective 7: The Charles E. Schmidt College of Science will strengthen doctoral programs to a position of national leadership by recruiting outstanding graduate students (Goal 2, 3).
Outcome to date: Our PhD programs successfully recruit students from in and out of state as well as from abroad whose average GRE scores are 1150.

College Objective 8: The Charles E. Schmidt College of Science will strengthen research programs to a position of national leadership (Goal 3).
Outcome to date: Interdisciplinary research centers, such as the Center for Complex Systems and Brain Sciences, have gained national prominence through significant funding from federal agencies, and significant local and state funding as for the Florida Center for Environmental Studies.

College Objective 9: The Charles E. Schmidt College of Science will expand its collaborations with area research agencies such as the Scripps Florida Institute, Harbor Branch Oceanographic Institute, the US Geological Survey, the Torrey Pines Institute for Molecular Studies, and the Max Planck Florida Institute (Goals 3 & 4).
Outcome to date: Institutional academic program and research agreements have been signed with all of the institutions listed in the Objective 9. HBOI has been incorporated as a research institute within FAU.

SWOT Analysis

It has been more than five years since the College conducted its own strategic planning and visioning exercise and we will use this Program Review as the spring board for our visioning exercise as part of the universities Project Vision in the coming year. Clearly, the current national and world economic outlook together with the local state economic forecasts require that we reassess the mission and vision of the Charles E. Schmidt College of Science to determine how best its current and future programs can best serve the citizens of Florida, especially those within our service region of Southeast Florida. Current budget reductions require that we have already begun this process. As part of any strategic planning process, we need to review the College's Strengths, Weaknesses, Opportunities and Threats to understand how best to plan for the future of the College. Key aspects of the current environment are listed below:

Strengths:

Faculty: Our faculty members remain strong and dedicated in teaching, research and service. In teaching our faculty members continue to receive very high praise from students to whom they are committed. Research productivity for the College is at an all time high as measured by publications and sponsored research funding. Our faculty members are nationally recognized and serve on editorial boards and grant review panels for federal agencies and many others.

Interdisciplinary graduate program: With the final approval of the new PhD in Geosciences by the Board of Governors this year, the College reached a significant milestone in its history and became a fully doctoral College with PhD programs in Integrative Biology, Chemistry, Complex Systems and Brain Sciences, Geosciences, Mathematical Sciences, Physics and Psychology. Many Master's programs are professionally oriented providing students with an entrée in to a specific profession.

Undergraduate programs: The College offers a broad spectrum of strong undergraduate programs in the science disciplines with Biology and Psychology in the top ten undergraduate programs at FAU. In addition to our majors, we provide a great deal of service to non-college majors and non-degree seeking students.

Program assessment progress: The College has fully instituted assessment plans in all areas that follow nationally acceptable guidelines and procedures, and routinely uses assessment as a tool to refine programs.

Facilities: Science programs are housed in state-of-the-art facilities on all campuses; no science program is housed in a building built before 1992. For the last decade, new science facilities have been constructed and currently new facilities are building built on the Davie campus and HBOI campus to house science programs.

Research/Technology infrastructure: The College houses state-of-the-art equipment in core facilities such as the Proteomics Core, the Nucleic Acid Core, and near supercomputing capability offered through the Boca-5/Beowolff cluster.

Community engagement: The College has an active advisory board made up of influential community members from business, industry, and education who are committed to the growth of the College. The Board meets quarterly and its two standing committees, Development and Legislative Affairs, meet in the interim period. The College also has a very successful "Frontiers in Science Public Lecture Series" and "Nobel Symposium" on an annual basis, as well as several outreach programs to middle and high schools in our service region through events such as Math Day, Physics Pumpkin Drop and Science Olympiad. Federally funded programs also provide for our Math and Chemistry faculty to work with middle and high school teachers.

Weaknesses:

Faculty shortage: While faculty members who leave are replaced, this has not and is not always the case and the College has not grown significantly in faculty number when instructional loads have increased. The faculty to student ratio is relatively high for a college of science.

Faculty Salaries: Faculty salaries are not competitive considering the high cost of living in Southeast Florida—this is especially true today more so than it was 15-20 years ago.

Graduate Stipends: Stipends for graduate students in science are not competitive and although benchmarked against the NIH doctoral stipend level five years ago, we have not been able to keep up with increased stipends. Moreover, the lack of good health care insurance for graduate students is problematic.

Fundraising: It is typically difficult to raise philanthropic dollars for science unless projects are biomedical in nature and/or disease related; there is no natural constituency for science as there is in the arts and humanities, or nursing for instance.

Community exposure: The community in our immediate service area is essentially unaware of the programs and research in the College, although we are trying to rectify this situation by providing our best faculty to go out in to the community to deliver lectures on their programs and research.

Opportunities:

Campus specific missions: It is an expensive proposition to expect to have a full slate of science programs on every campus of the university, and so the College plans to continue to develop specific programmatic missions associated with each of FAU's multiple campuses. This will involve consolidation of some programs, for example psychology, and expansion of other programs such as biology, chemistry, environmental science and geosciences. In so doing, the College will build upon its strengths in broad areas such as Brain and Behavior, Cosmology and Cryptology, Drug Discovery and Disease, and Earth and Environment.

Partnerships: The arrival in Southeast Florida of Scripps Florida, Torrey Pines Institute for Molecular Studies, and the Max Planck Florida Institute has provided the College with an unprecedented opportunity to partner with world renowned biomedical research institutes to develop world class programs in the life sciences. Indeed, current planning is underway for the College to launch a "Life Sciences Initiative" at FAU that proposes to partner with these institutes as well as other colleges to develop world class graduate and post-doctoral programs in bioengineering, bioimaging, bioinformatics and biomaterials & nanotechnology, and biotechnology, to name a few, on FAU's MacArthur Campus in Jupiter.

Economic development: As a result of these economic development initiatives, the College is at the center of the "biocluster" in Southeast Florida and so is positioned to take the maximum advantage of this development. The changing economic environment of South Florida will place extraordinary demands on FAU science programs that require careful analysis and planning but in so doing will provide for great opportunity for our graduates. The Charles E. Schmidt College of Science together with other colleges at FAU will absolutely need to be the primary source of the workforce to sustain the biocluster development.

Regional initiatives: Florida is on the frontline of global climate change and Florida Atlantic University and the College must be at the forefront of regional initiatives to address the issues raised by climate change. State, national and international focus has been brought to this issue and the College in partnership with other colleges at FAU, clearly has the broad expertise to begin to address the issues raised by global climate change. Associated with this, but more local in focus, is the issues surrounding water in South Florida—its quality and its availability, and its management as a critical resource. As both state and federal

resources are made available to address these problems, the College and FAU are poised to take advantage of these resources in training the workforce necessary and developing the policy to find solutions to these problems. Similarly, the College can provide the scientific expertise to enhance regional initiatives in alternate energy, such as that being pioneered in the Center for Ocean Energy Technology.

Community outreach: Our Science, Technology, Engineering and Math (STEM) initiatives in middle and high schools are gaining national recognition and we already have some programs involved in STEM projects; the College is poised to do much more in this area and to collaborate with schools and teachers.

Threats:

Faculty number: Of great concern is the lack of significant growth in regular faculty numbers in all departments in the College during the last decade. Such a trend will seriously impact the ability of the College to continue to deliver its current programs in teaching, research and service, while taking full advantage of opportunities to develop meaningful new initiatives for our students, and our region, state and nation.

Faculty salary/rewards: Currently, faculty salaries in science are less competitive than at our immediate peer institutions in the state system, as well as peer institutions outside the state. This includes starting salaries but is most prevalent for faculty members who have been employed at FAU for more than five years where salary compression and inversion has diminished real salary. This has led to loss of faculty over the last several years and continues to be a problem since significant salary adjustments across the board or through merit raises have not been possible in the last two years or likely in the next few years, due to budget constraints. While of course this is not just our problem, it is a serious problem we face in recruiting and retaining the best faculty. In addition to salary, budget constraints restrict funds for faculty rewards and professional development, such as release time, travel to meetings and expense money for new or upgrade of equipment such as computers.

Instructional load: With decreasing budget and the inability to recruit significant new regular faculty, and therefore the need to increase teaching loads for faculty, or recruit adjunct faculty, provides less time for research and the associated grant proposal activities. While in both these respects the College has maintained productivity, there will, at some point, be a negative impact on research productivity. It is critical that the College maintain research productivity if FAU is to be recognized as a world class research university and we are to take advantage of regional economic initiatives.

Graduate stipends: Six years ago, the College adjusted and benchmarked graduate student stipends in science against the Federal pre-doctoral stipend level. Since that time, science and engineering graduate student stipends have increased markedly across the nation and we are once again not competitive with our graduate stipends. This problem is compounded in that many institutions are now providing excellent health insurance for their graduate students making us less competitive for recruiting top graduate students.

Cost of living: Despite recent downturns in the real estate market in Southeast Florida, the cost of living in our region remains relatively high and faculty, especially our junior faculty, are challenged financially to maintain a good standard of living that justifies remaining at FAU. This will become especially the case when the economy does turn, but in all likelihood, as most economists predict, states such as Florida will be on the end of the recovery.

Community/State College Expansion: As the junior colleges in our service area continue to develop baccalaureate programs in areas of apparent need, a time will likely come when they offer the full slate of bachelors programs that will then compete with our own bachelor programs. While this might seem like a threat, it may indeed be an opportunity for us to reassess our bachelor programs and perhaps link them to graduate degree programs providing a seamless transition from undergraduate to graduate education.

College Trends and Analyses

On the whole, since the last program review conducted in 2001, the College has grown significantly in many areas. One notable achievement was the development and growth of the Department of Biomedical Sciences which was "spun out" of the Charles E Schmidt College of Science in Fall 2006 to create its own College -- the Charles E. Schmidt College of Biomedical Sciences. Faculty in both colleges continue to collaborate in graduate programs and research. Most notably the two Colleges share the PhD program in Integrative Biology, now in its fifth year of implementation, and already graduating several PhDs each year. However, in the trends analyses provided below, the data for Biomedical Sciences has been subtracted from the Science data for that time Biomedical Science was part of Science.

In this section I will review how specific College Trends conform to the specific goals outlined in the University's Strategic Plan implemented for 2006-13. Broadly taken, the four Goals of the University Strategic Plan encompass the teaching, research and service missions of the College, and the University.

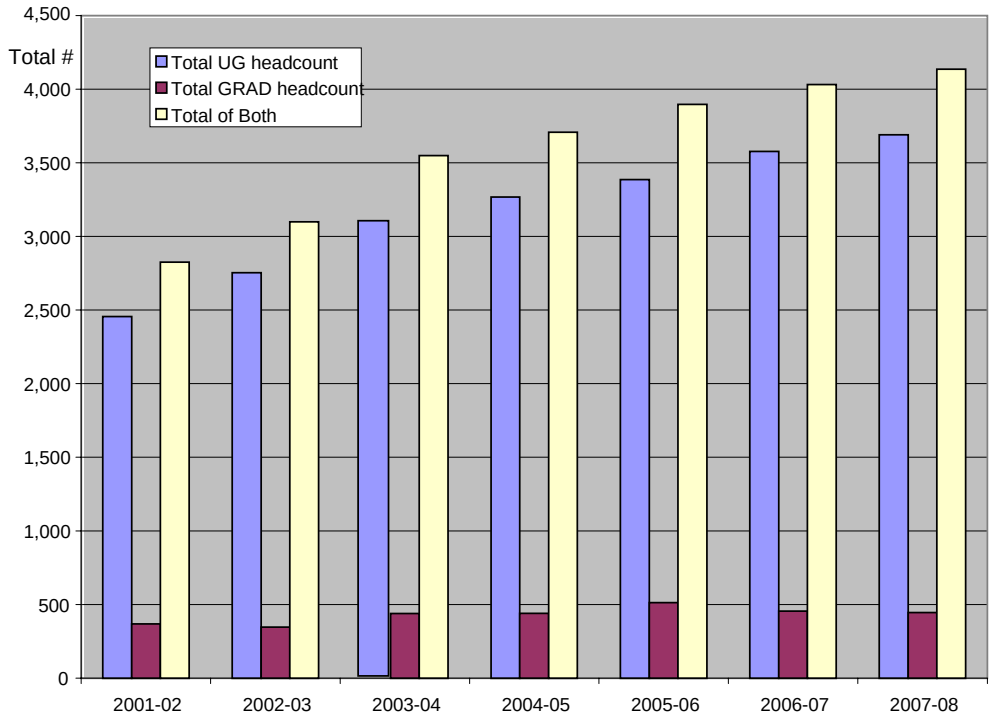
Section 1: Providing Increased Access to Higher Education (Goal 1); and Meeting Statewide Professional and Workforce Needs (Goal 2)

In the following Section 1, we will see how the College has increased access through greater availability of courses and programs, and responded to a competitive environment by increasing degree production at all levels (Goal1); and meets workforce needs through training an increased number of individuals in the sciences and in advanced technology (Goal 2).

1.1. Student Headcount/Enrollment and FTE Productivity

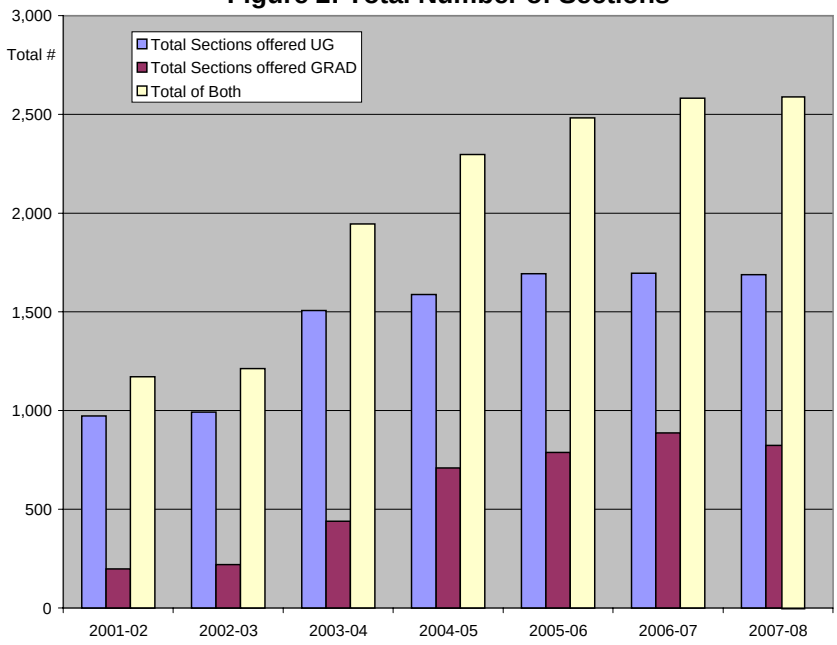
That the College is providing access can be seen by the number of science majors that has shown a steady and significant enrollment growth during the last decade (see Figure 1) increasing to about 4200 undergraduates in 2007-08 from 2800 in 2001-02, or about 33%.

Figure 1: Student Headcount



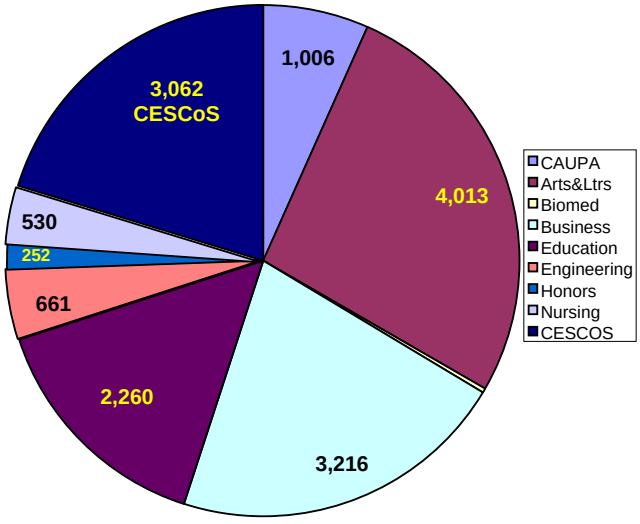
The increase has occurred across all programs in the College, but most notably in the biology and psychology programs (see Part II: Department/Program review). There has been an increase in graduate enrollment, although this has leveled in the last two years but has increased in 2009. The increased headcount enrollment not only in the College but also the university in general has resulted in a significant increase in the total number of sections offered by the College. This is clearly shown in Figure 2. Not only is this increased number of sections for our majors but also especially lower division service courses. For example, the number of college algebra sections is up 25% from 2001-02. Both undergraduate and graduate sections have increased steadily each year since 2001-02.

Figure 2: Total Number of Sections



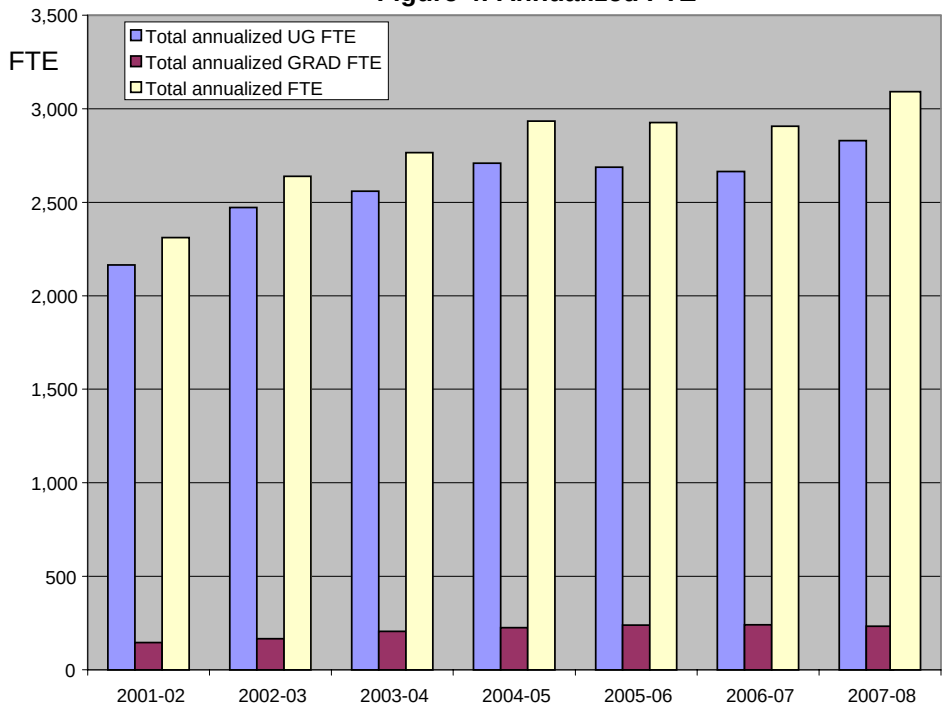
The increased headcount enrollment not only in science, but also in other colleges at FAU has resulted in increased FTE (Full Time Equivalent) productivity. FTE production by the College is very high at well over 3,000 FTE for the last year (see Figure 3) or about 22% of the total FTE generated at FAU by all programs. Clearly the lower division classes contribute enormously to this percentage and about two thirds the FTE is from non-science majors. Figure 4 illustrates the steady increase in the total annualized fundable FTE generated by the College since 2001-02.

Figure 3: Total FTE Generated at FAU 2007-08



Both undergraduate and graduate FTE have increased markedly in the most recent year. While the Boca Raton campus generates by far the bulk of the FTE in the College, the total FTE generated in Davie represents about 7.5%, and, of course, is only upper division and graduate FTE. The small psychology program on the Jupiter campus generates about 3.5% of the total college FTE.

Figure 4: Annualized FTE

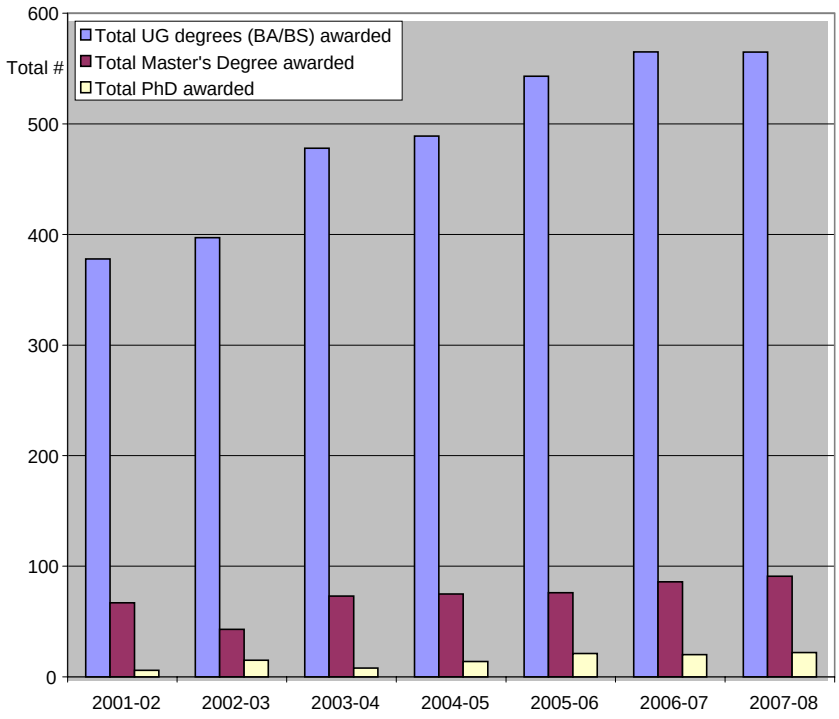


Given the current year's (2009) record number of applications to FAU programs, we believe that the upward trend in all of these key College indicators will continue for the foreseeable future and will place additional demands on faculty, facilities and staff of the College. One area in which we have not been able to address the large student demand is for advising. Currently, we have only four professional advisors in the College, although faculty members are also assigned advisees but primarily junior and senior students seeking career advice. According to the National College Advising Association, the accepted ratio of advisor to students is 1:300, and in many state universities it is less. However, the ratio of students to advisors in our College is currently 1:500 and is clearly an area that will need improvement as soon as college finances permit hiring of additional advisors.

1.2. Degree Productivity

Increasing headcount enrollment, number of sections offered and FTE productivity translates into an increasing number of degrees awarded by the College (see Figure 5). The total number of degrees awarded by the College at both the undergraduate and graduate level has steadily increased since 2001-02. At the undergraduate level there has been an increase of 32%, although there was a very small fall back in 2007-08 which we believe will not be sustained based on current enrollment data. Both Master's and Ph.D. productivity continue to increase and in the current academic year (2008-09) we have graduated from the College the most PhD's ever in one year –34!

Figure 5: Total Degrees Awarded



In 2007-08, the College ranked third in production of undergraduate degrees at FAU (556) as shown in Figure 6. The College produced the greatest number of Ph.D. degrees (22) at FAU in 2007-08, although it ranked second in production of doctoral degrees after the College of Education (both Ed.D. and Ph.D.)--see Figure 7. During the last decade we decided that the research degree in the College would be the PhD and new PhD programs have been introduced. With the approval of the PhD in Geosciences, the College is now a fully doctoral college with PhD programs associated with all its major departments and programs. While these PhD programs may be administratively housed in academic departments (with the exception of Complex Systems and Brain Sciences), these programs are fully interdisciplinary and in many cases involve not only faculty from different departments within the college but faculty from other colleges at FAU.

Figure 6: Undergraduate Degrees Awarded at FAU 2007-08

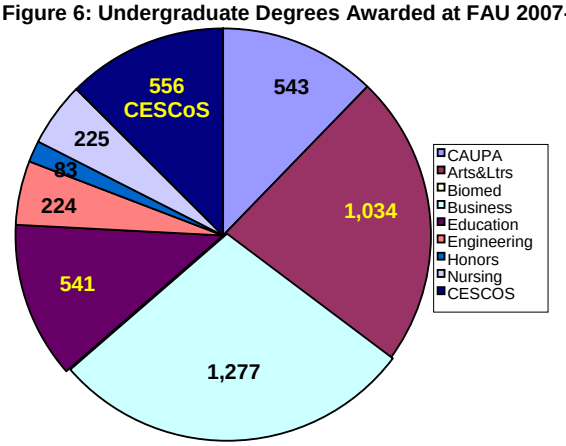


Figure 7: Doctoral Degrees Awarded at FAU 2007-08

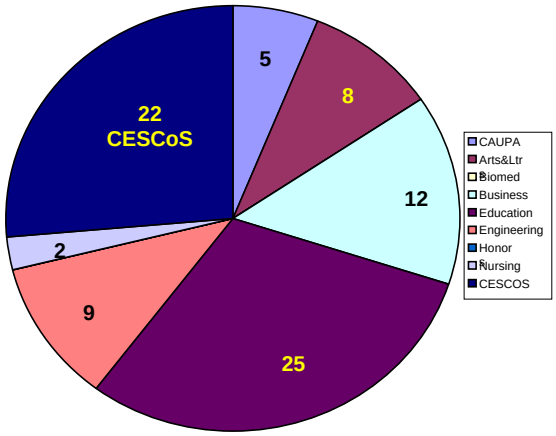
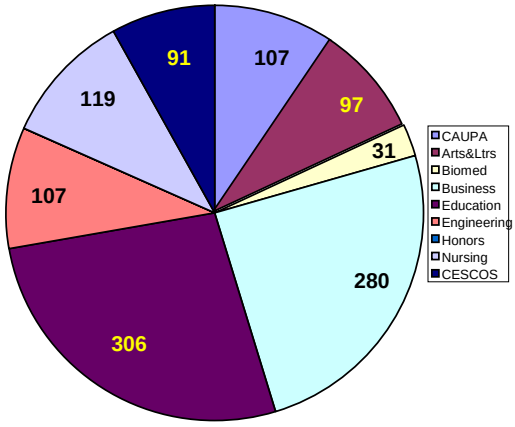


Figure 8: Master Degrees Awarded at FAU 2007-08

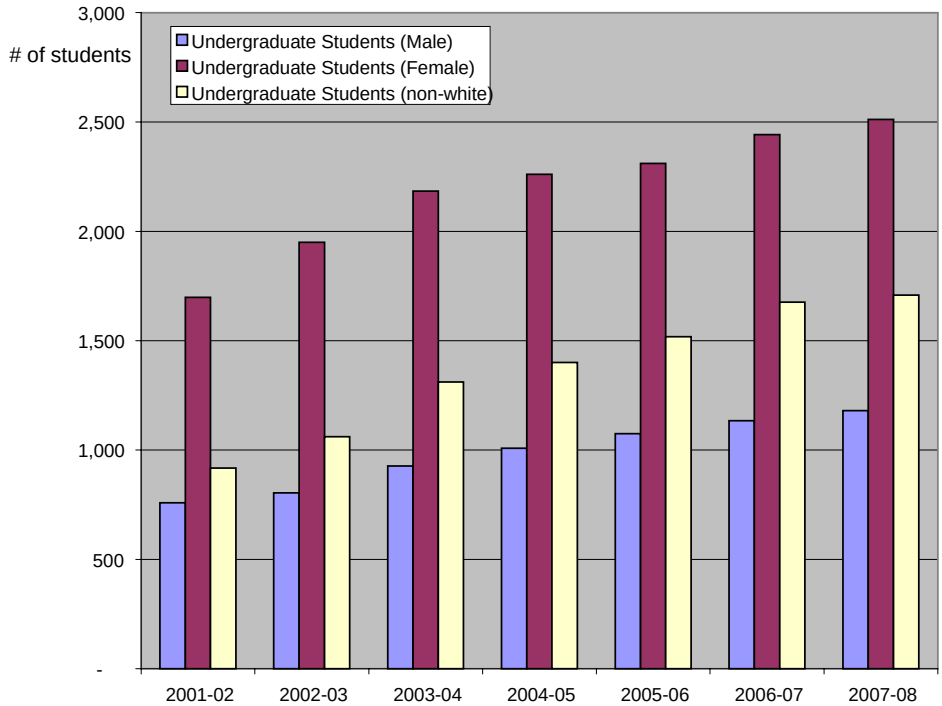


With increased priority given to the Ph.D. degree as the research degree in the College, we are re-tooling our Master's Degree programs to be directed towards specific professional training as terminal degrees. Nonetheless, there has been increased graduation of Master's students peaking in 2007-08 at 91 (Figure 5) and Figure 8 shows that the College ranks sixth at FAU in production of Master's Degrees for 2007-08.

1.3. Student Diversity

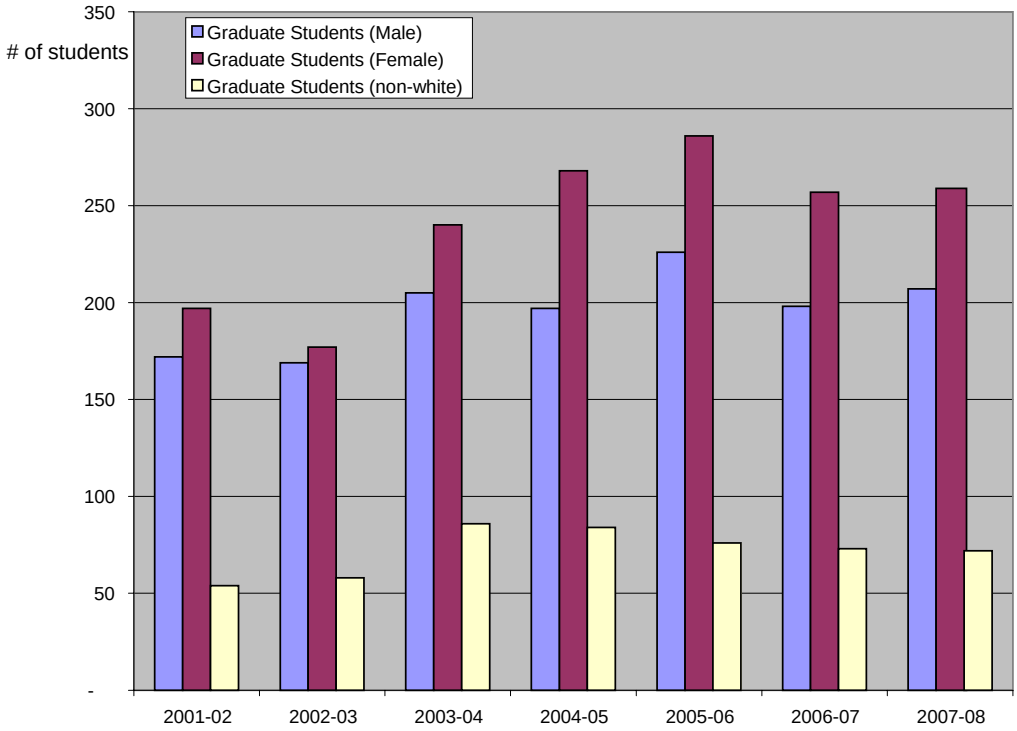
Since 2001-02, student diversity among undergraduate students pursuing science as a major has continued to mirror the overall increase in the headcount enrollment in the College. This trend is shown in Figure 9. Diversity as used in this program review indicates race other than White, ie Black, Hispanic, Asian, Native American as a group. As a whole the diversity of science majors has also remained a little below 2:1. Moreover, Figure 9 shows that the ratio of female to male students has remained a little more than 2:1 during nearly the last decade as the number of majors has steadily increased. Psychology accounts for a large number of females (3.5female:1male), although both biology and chemistry have greater numbers of female than male students.

Figure 9: Undergraduate Students by Gender & Diversity



These figures somewhat reflect university diversity which currently has a ratio of about 1.5:1 for female to male students, and a diversity of also about 1.5:1. Analysis of the ethnic diversity is shown for each program in Part II, but clearly we have a large population of Hispanic and African-American students. The graduate student body in the College is more evenly distributed between female and male (see Figure 10) although females remain overall the predominant group. This trend has been maintained since 2001-02 although in recent years the number of female students has dropped slightly, while the number of male students has remained flat. Similarly Figure 10 shows that the number of graduate students comprising the diversity group has also remained somewhat flat over the last several years and represents 15% of graduate students in the College.

Figure 10: Graduate Students by Gender & Diversity



1.4. Peer Institutions

When some instructional statistics from above are compared with those from peer institutions we compare very favorably. For example, Table I shows a comparison of the Average Undergraduate SCH/FTE Faculty for each discipline in the College. These data are reduced from the National Study of Instructional Costs & Productivity (The Delaware Study) for 2007-08. The College average shows that we exceed both our peer institutions and a comparison research group defined by the study.

Table 1: Comparison with Peer Institutions (Delaware Study)

	Average Undergraduate SCH/FTE Faculty		
	FAU	**Peer**	**Research**
Biology	**378**	**416**	**362**
Mathematics	**265**	**366**	**347**
Chemistry	**325**	**400**	**420**
Geology	**428**	**299**	**300**
Physics	**402**	**243**	**288**
Psychology	**439**	**403**	**407**
Geography	**664**	**516**	**326**
AVERAGE	**414**	**377**	**350**

1.5. Quality of Instruction

The instructional quality delivered by the faculty members of the College is evaluated every semester for each course offered by each program through the use of the Student Perception of Teaching (SPOT) survey administered by the Office of Institutional Effectiveness and Analysis at FAU. Each program will address this measure in Part II of this Program Review; however, Table 2: shows the average SPOT analyses for the College over the last decade for question 21 on the SPOT survey that asks students to "rate" their professor. Clearly, students perceive the instruction they receive from science faculty to be, on the whole, very good to excellent. This quality of instruction has been a hallmark of the College for at least the last decade. In the last year 2007-08, the College average was 2.0 and the university average was 1.9. In prior years the scores were concordant at 1.7.

Coupled to the quality of our instructional program is a unique initiative started in 2003 called the Master Teacher program. This program identifies a Master Teacher in each department, who with the other department Master Teachers form a core group who review teaching practices of the junior faculty, especially those yet to be promoted and tenured, and provide a resource for new faculty who have little experience. The Master Teachers annually review the tenure track faculty and provide input for their annual evaluations. The program has been unique among the colleges at FAU, and will be used as a model by the Dean of Undergraduate Studies at the university level for a similar program to be offered by the Center for Teaching and Learning.

Table 2: Quality of Faculty Instruction

	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08
College	1.7	1.8	1.7	1.7	1.7	2
University	1.7	1.7	1.7	1.7	1.7	1.9
Range	Excellent	Very Good	Good	Fair	Poor	
	1	2	3	4	5	

Section 2: Building World-Class Academic Programs and Research capacity (Goal 3)

In addition to our mission of providing an excellent science education for our students, the College is committed to conducting state-of-the-art research that applies the power of discovery to fundamental problems of scientific importance. It is clearly evident that, for the majority, those college faculty members actively engaged in research in their discipline make the best teachers of their discipline.

To meet its mission in research, the College enjoys state-of-the-art research facilities constructed on several of FAU's campuses. Older science buildings constructed at the time that FAU first opened its doors in the early 1960's have been completely renovated from the ground up to provide state-of-the-art science buildings. Several new science buildings have been constructed or are currently under construction. No science program is housed in a building built before 1992**,** and currently the College occupies over 300,000 GSF of instructional and research space.

2.1 Publications

Measures of research productivity and expectation vary in different scientific disciplines, but in general the two most widely applied measures are number publications in highly rated scientific journals and levels of sponsored research funds from Federal sources, such as the National Institutes of Health, the National Science Foundation, the Departments of Energy, Defense or Interior, and non-Federal sources such as the American Cancer Society, Alzheimer's Association, Muscular Dystrophy Association, American Heart Association or local government entities such as the South Florida Management District. These are but a few of the sources of funding in the College. Figure 11 shows that the number of publications in the College has steadily increased over the last several years.

Figure 11: Total Number of Publications

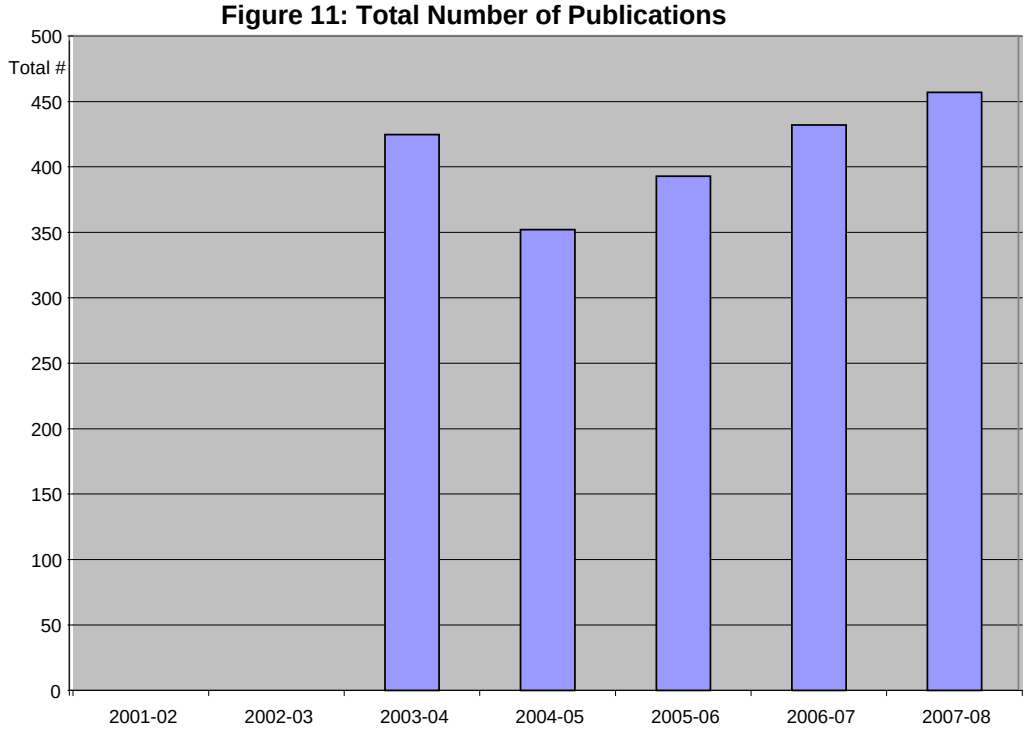
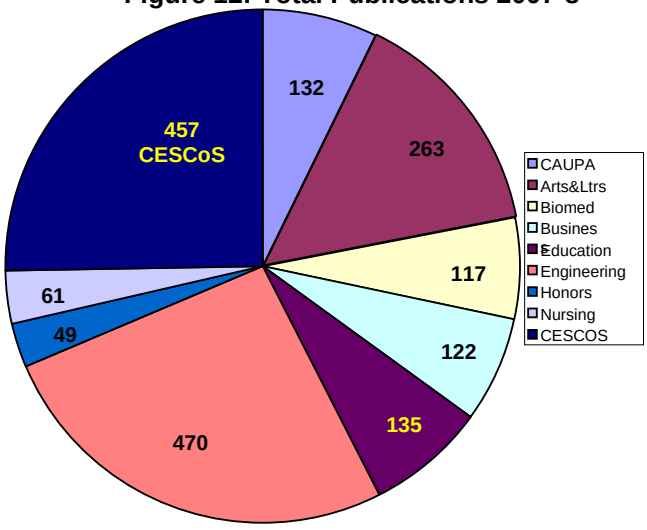


Figure 12: Total Publications 2007-8



The College ranks second in the university as far as total number of publications per year (457) after the College of Engineering and Computer Science (470) -- see Figure 12. The two Colleges tend to alternate for who published the most in any one year, although between them they accounted for more than half the publications in 2007-08 from FAU.

2.2 Research Funding

With regard to the second measure of research productivity - sponsored research dollars - the College is highly successful and has shown a steady and marked increase in sponsored funding during the last decade (see Figure 13). The decreased funding level seen in the last year (2007-08) represents the loss last year of several key faculty members in the College whose research programs were very well funded. The loss of key faculty is becoming a problem for the College, and indeed for the university, as the best faculty members are recruited away from FAU to better job offers at other institutions. This issue will also be discussed elsewhere as a potential threat to the success of the science program at FAU. Nonetheless, sponsored funding per faculty member in science is about $90,000 per year and I believe our target level of $100,000 per faculty member is attainable in the next few years.

Figure 13: Total Sponsored Research Dollars

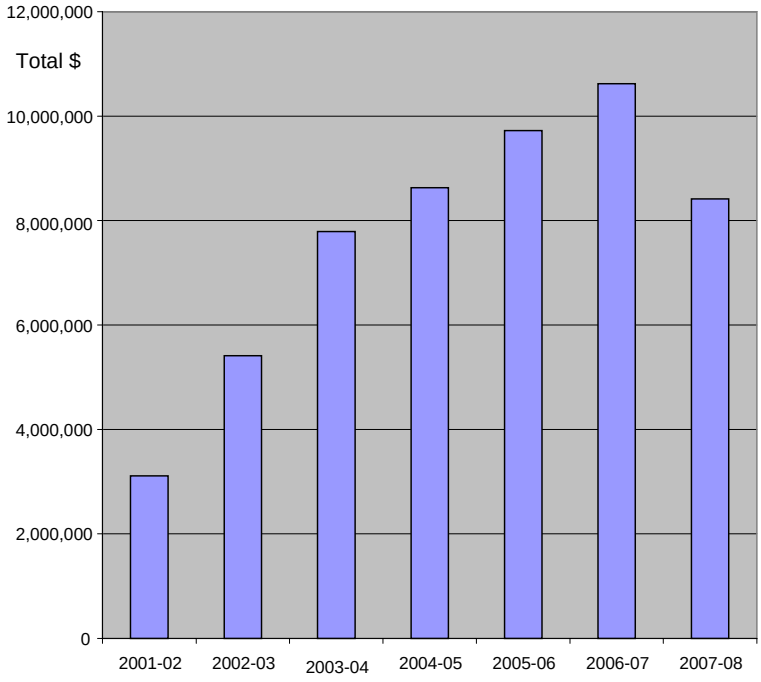
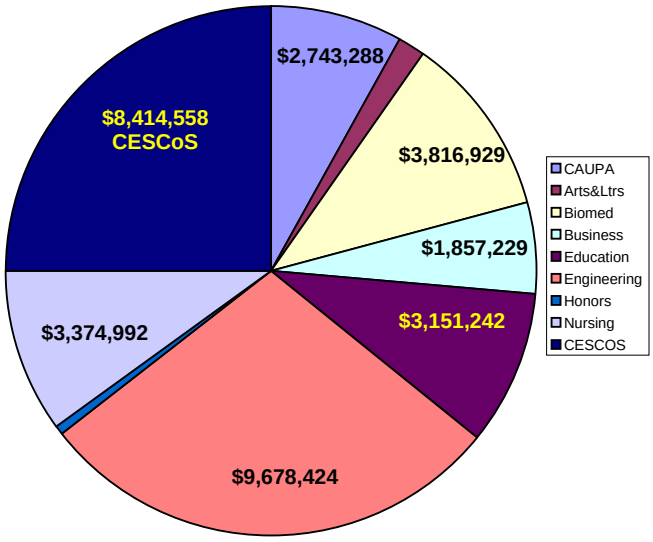


Figure 14: Sponsored Research Dollars 2007-08



In research funding the College ranks second in the level of funding after the College of Engineering and Computer Science (see Figure 14), although we tend to alternate with engineering for the top spot!

The level of research funding in a college, and especially in science, is directly related to the number of grant proposals that the faculty submit to the various agencies for funding. Faculty members in all departments are actively encouraged to submit proposals to support their research and their students. Being awarded a research grant or contract not only provides the faculty member with funds to support their research, travel to national and international scientific meetings, and support students, but also brings prestige to their research program, the College and the University through the peer review process. Figure 15 demonstrates that the number of proposals submitted from the College has remained relatively constant for the last several years after rising dramatically in 2001-02 through 2003-04. The subsequent small decrease and flattening in proposal submissions results from faculty getting funded and therefore not submitting as many proposals! In grant proposal submissions, the College consistently ranks first in the university (see Figure 16).

Figure 15: Total Number of Proposals Submitted

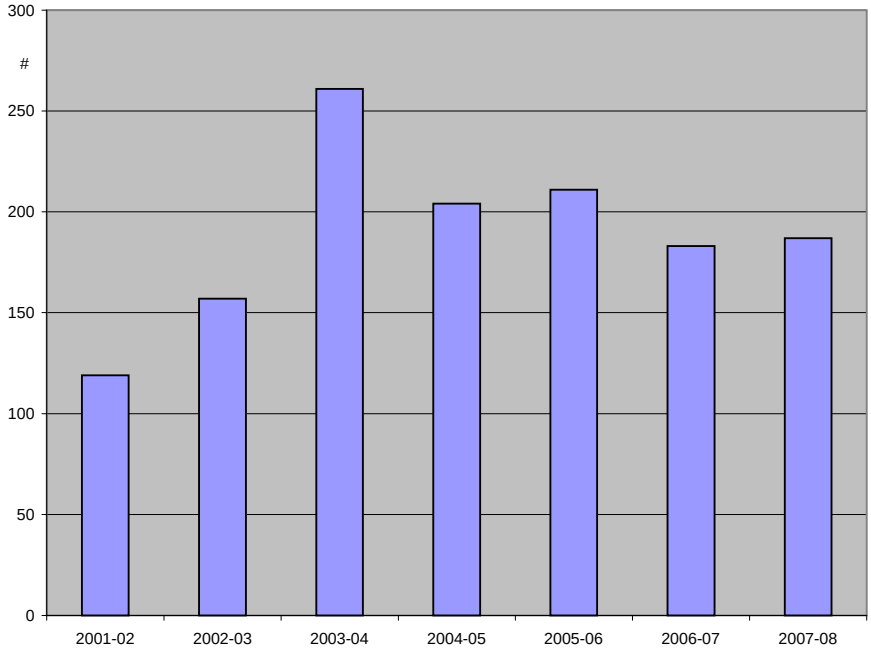
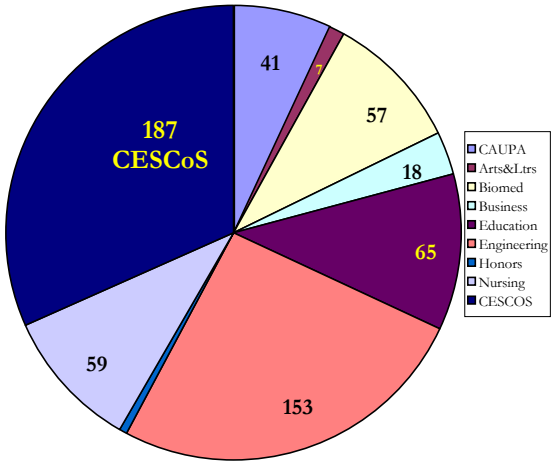


Figure 16: Grant/Contract Proposals Submitted 2007-08



2.2 Research Centers

The College houses several Research Centers that bring together faculty from across the College's departments and programs to focus on interdisciplinary research and training. In most cases, faculty members from other colleges also participate in the activities of the Research Centers, these might include joint grant proposals and seminar programs. Faculty act as directors of the centers and some centers have academic programs associated with them. The College's research centers include:

The Center for Complex Systems and Brain Sciences, established in 1985, brings together scientists from different backgrounds including laboratory biologists, psychologists, applied mathematicians and theoretical physicists. Various research and training programs at the center blend emerging concepts from complex dynamical systems with experimental techniques at the molecular, cellular, behavioral and cognitive levels in brain science. This center is unique in that it has a Ph.D. program in Complex Systems and Brain Sciences (See Part II), as well as administers the recently approved Graduate Certificate in Neuroscience.

The Center for Biological and Materials Physics was established in 1989, originally as the Alloy Research Center, and provides a focus for collaborations to facilitate studies in biological physics and material physics. Biological physics deals with the study of biological phenomena using physical techniques. Materials physics applies fundamental condensed matter physics concepts to complex and multiphase media, including materials of technological and biological interest.

The Florida Center for Environmental Studies was established in 1994 as a Type 1 center to represents ten state universities, including FAU, and four major, private universities. The center serves as a facilitator and coordinator of research and training related to the environment and as a locus for environmental information. Grounding its activities in the Florida sub-tropical environment, the center's mandate also encompasses global tropical and sub-tropical environments as well as issues related to freshwater and estuarine ecosystems worldwide.

The Center for Molecular Biology and Biotechnology was established in 1997 and is committed to developing research and training programs in molecular biology and biotechnology, and serves as a link between FAU, other institutions and industries in this field. The center's primary goals have been to create a strong base in molecular biology, functional genomics and related fields; maintain cutting-edge research; and to train students in this discipline to prepare them for careers in the pharmaceutical and biotechnology industries. The center administers the Certificate in Biotechnology, as well workforce training programs.

The Center for Geo-Information Science was established in 1998 and pursues excellence through applied and theoretical research in spatial information technology. In that spatial information technology enables work across disciplinary lines, the center focuses on encouraging multi-disciplinary research. The center functions as a key resource for business, industry, government, social services, with responsiveness to local, regional, and international problems. The center administers the Certificate in Geo-Information Science.

The Center for Cryptology and Information Security was established in 2003 and is focused on innovative and cutting-edge research in cryptology and other related areas of information security. The center trains research students and information technology professionals, and promotes collaboration with information technology industries within the region and with federal and state government departments in the areas of information security.

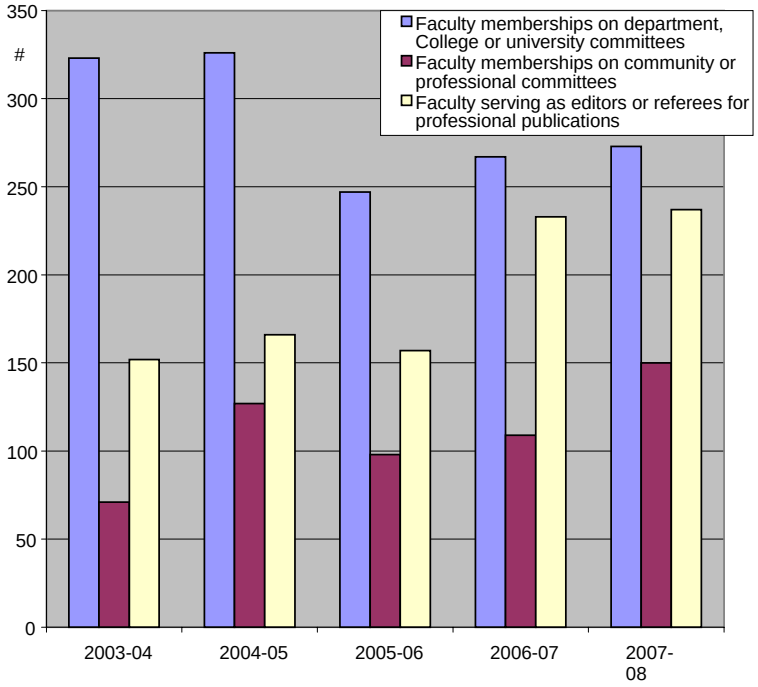
Section 3: Meeting Community Needs and Fulfilling Unique Institutional responsibilities (Goal 4)

In addition to teaching and research, an important component of the College mission is service. This component includes service to the university as well as service to the profession and the community. In addition, the College advances regional cooperation through building partnerships and outreach programs in the local community.

3.1 Service to University, Community and Profession

In each of the service areas College faculty members are very active and take such responsibility very seriously. During the last decade, the levels of service in areas of the university, the community and the profession have remained relatively constant during the last decade (see Figure 17). However, in one area of professional service, that is service by faculty members on editorial boards or as referees for scientific journals, there has been a marked increase in the level of service as shown in Figure 17. This is an important indicator of the high esteem in which many of our faculty members are held by their peers. Moreover, it reflects on the continuing maturation of the research enterprise in science at FAU. In addition, we are seeing more and more faculty members asked to serve on grant review panels of Federal agencies such as the NIH and NSF—yet another measure of the quality of our faculty.

Figure 17: Service to University, Community and Profession



The College also provides community service through its outreach programs to middle and high schools in the form of very successful events such as Math Day and Science Olympiad. These Math and Science competitions are organized and run by the faculty. In addition the College has a long tradition of federally funded programs (NSF) that engage in Math and Chemistry education at middle and high schools.

3.2 Community Partnerships

The University and the College are well positioned to develop partnerships with local community partners and stakeholders in higher education. While the details are beyond this programmatic overview of the College, the university has active academic program and research agreements with Scripps Florida, the Max Planck Florida Institute, and the Torrey Pines Institute for Molecular Studies. Clearly, our College has a central role to play in these partnerships and indeed we have active programs with these three research

powerhouses and internationally recognized research institutions. In addition, the College has cooperative relationships with organizations interested in collaborative research and programs. A few examples of such relationships are with:

- Harbor Branch Oceanographic Institute (Marine Science Program)
- South Florida Water Management District (Comprehensive Everglades Restoration Project & Kissimmee River restoration)
- National Park Service (Everglades & Coastal Park regions)
- US Geological Survey (Everglades Restoration and Geo-Information Science)

3.3 Community Outreach

The College is committed as part of its mission to develop outreach programs not only with the public at large but also, and more importantly, with schools in our service region. Examples of such outreach programs are:

- **Frontiers of Science Public Lecture Series** - a series which highlights current scientific research and thought by nationally recognized experts as well as our own faculty.
- **Nobel Symposium** – annual presentation by Nobel Laureates.
- **Life Long Learning Lecture Series – Exploring Science Today** – an eight week course offered College faculty for FAU's LLL Societies in Boca Raton and Jupiter.
- **Math in Middle Schools – Teacher/Curriculum enhancement** – an NSF funded program (in its 10^{th} year) to provide training for middle school math teachers. This program has graduated 60 MST students since its inception in 1998.
- **ChemBond - The next Generation** – an NSF funded program that allows PhD students to spend time in local high schools telling high students about their research.
- **Math Days** – day long mathematics competitions for middle and high school students.
- **Pumpkin Drop –** a day of physics demonstrations for middle school students.
- **Science Olympiad** – The College hosts local science competitions for teams of middle and high school students; winning teams go on to State and National competitions.

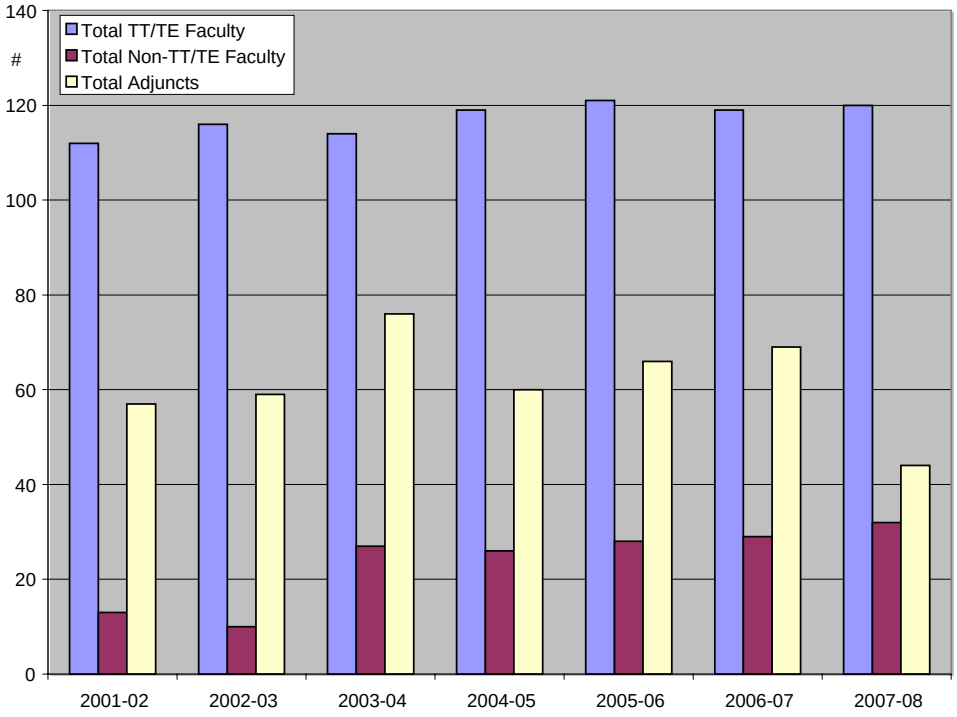
Section 4: Faculty Number, Diversity and Quality (Goals 1, 2, 3, and 4)

4.1 Faculty Number

Related to all Goals of the University Strategic Plan is the Faculty. Figure 18 shows that the number of regular tenured/tenure earning faculty in the Charles E Schmidt College of Science has remained essentially constant at around 120 during almost the entire last decade, despite the fact that student enrollment has increased 33%, and as will be seen later, most other productivity measures such as student FTE, degrees awarded, sections offered, research dollars and publications, and service have increased, and in some cases substantially.

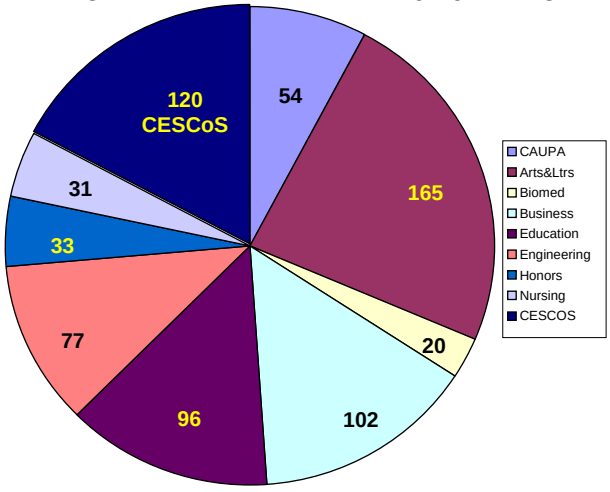
Figure 19 also shows that the number of adjuncts and non-tenure appointments have remained relatively constant during this same period, again highlighting increased productivity, although in the last several years the College has enacted a policy to convert adjunct positions to more career oriented non-tenure track positions that carry long term contracts. In this way individuals become vested in the College and are as committed as regular faculty to its overall success.

Figure 18: Number of Tenured, Tenure Earning, Non-Tenure Earning & Adjunct Faculty



Based on faculty number however, the Charles E Schmidt College of Science ranks as the second largest College at FAU (see Figure 19) coming second to Arts and Letters. This is not surprising and not to be unexpected since Science and Arts and Letters are the two principal colleges that contribute most to lower division teaching and provide, for the most part, the bulk of core courses in the Intellectual Foundations General Education Curriculum that is required of all FAU freshmen and sophomores.

Figure 19: Number of Faculty by College at FAU 2007-08



4.2. Faculty Diversity

The diversity of the instructional faculty in the College as shown in Figure 20 has remained essentially unchanged for the last five years, although today it is significantly greater than in 2001-02, with a small increase of about 20% in diversity in recent years. This diversity is better than the university as a whole. However, the majority of faculty members are white males with approximately 33% of the College faculty being female. These figures compare very favorably with peer institutions and nationally.

Figure 20: Instructional Faculty & Adjuncts by Gender & Diversity

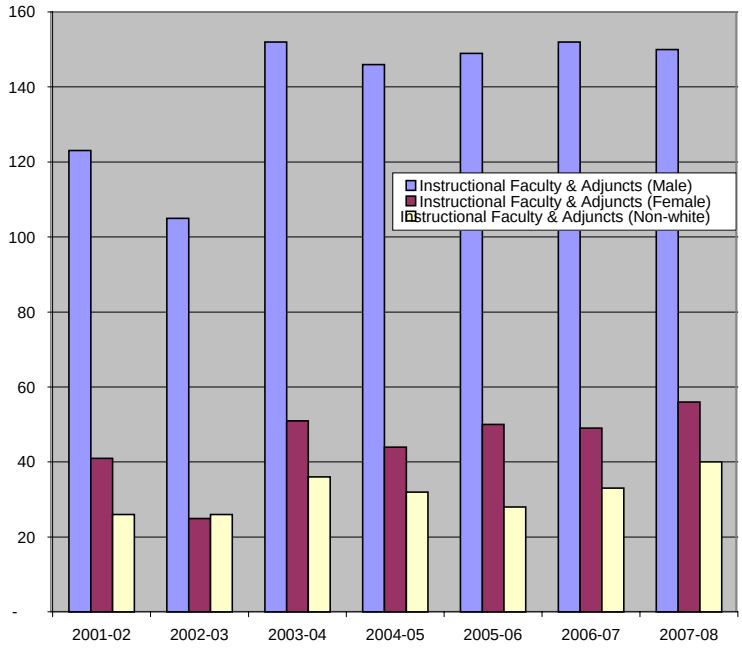


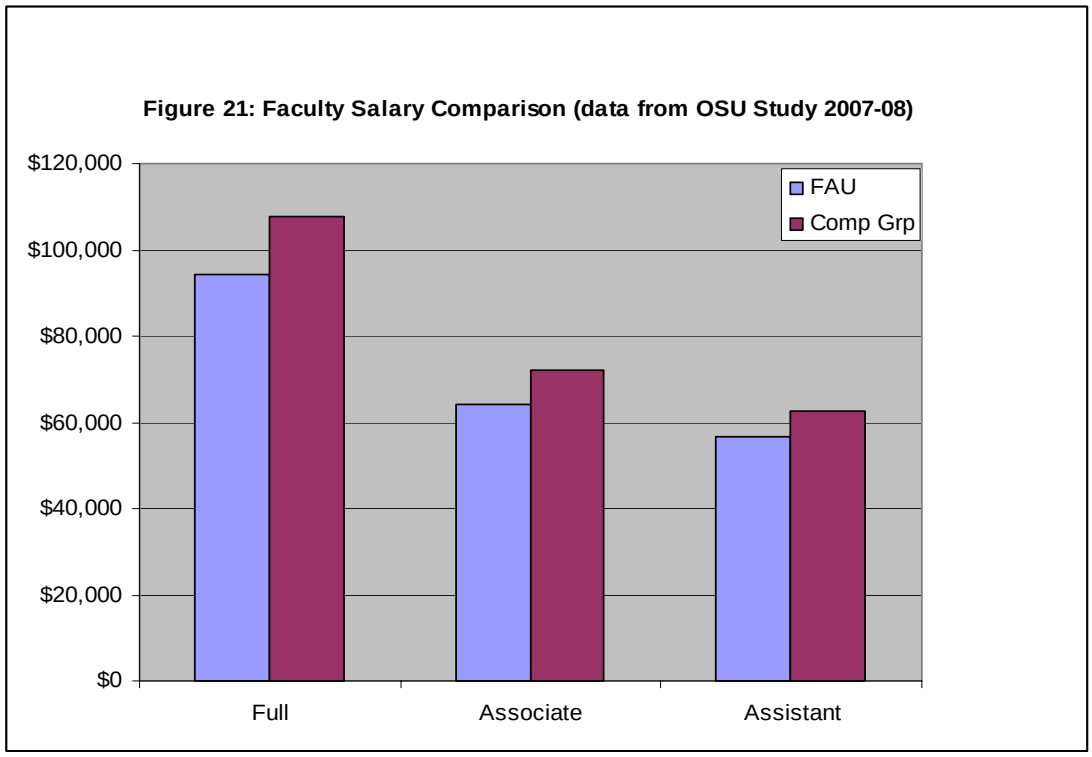
Table 3 shows the distribution of male and female faculty members by academic rank in the College. Female faculty members represent 15% of senior faculty, 17% of associate professors and 21% of assistant professors. These figures reflect a national trend that more and more women are entering academia to pursue a career.

Table 3: Faculty Rank and Gender

	Full Professor	Associate Professor	Assistant Professor	Other Faculty	Total Faculty
Male	36	24	22	31	113
Female	6	5	6	13	30

4.3. Faculty Salary

Currently, faculty salaries in science are less competitive than at our immediate peer institutions in the state university system, as well as peer institutions outside the state. Figure 21 shows that the average 9 month faculty salary at each professorial level is below that of a national comparison group. This is particularly so for senior faculty whose salaries are ~15% below the national average and Associate Professors who are ~12% below the national average; however, this differences will also deviate depending on the discipline. While starting salaries for assistant professor are less than optimal, the salary differential is most prevalent for faculty members who have been employed at FAU for more than four years where salary compression and inversion has diminished real salary.



Section 5: Budget (Goals 1, 2, 3, and 4)

To meet the Goals of the University Strategic Plan requires the College (and the University) to have an adequate budget to meet its mission. To operate a relatively large and complex organization such as the Charles E. Schmidt College of Science requires an adequate budget in order to ensure the quality of the program delivered by the faculty and staff of the College to our students. For 2007-08, the College had the third largest College budget at FAU (see Figure 22); however, this followed two recent years of budget reductions across the university. Continued budget reductions will continue to decrease the ability of the College to deliver its programs and maintain their quality. Reduction in the Educational & General budget of the College not only impacts the instructional mission of the College but also its research and service mission. As faculty are required to increase their teaching commitments, the time they have to do funded research, write grant proposals and publish papers will diminish. Reallocation of E&G funds to support those activities central to the mission of the College and to deliver our academic programs will necessitate that certain activities are decreased or curtailed entirely. Clearly, science education at FAU is of great value and the cost per student FTE generated makes it a bargain for our students. That the cost per student FTE is only $7,798 is quite remarkable for such a technology and laboratory-intensive discipline, and compares very favorably with other Colleges at FAU (see Figure 23) as well as all of our peer institutions, especially those not in Florida.

Figure 22: E&G Operating Budget 2007-08

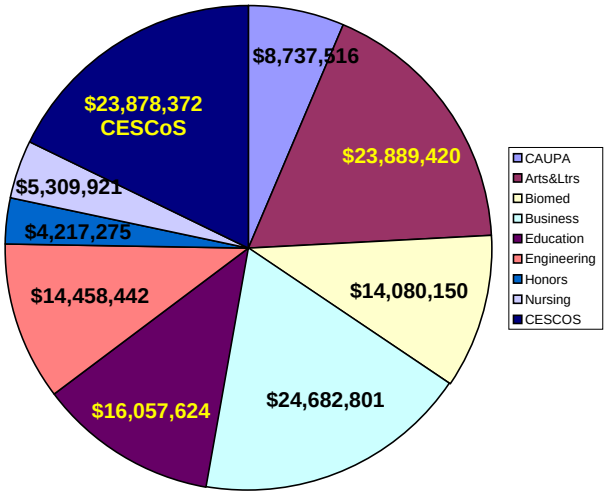


Figure 23: E&G $/FTE by College

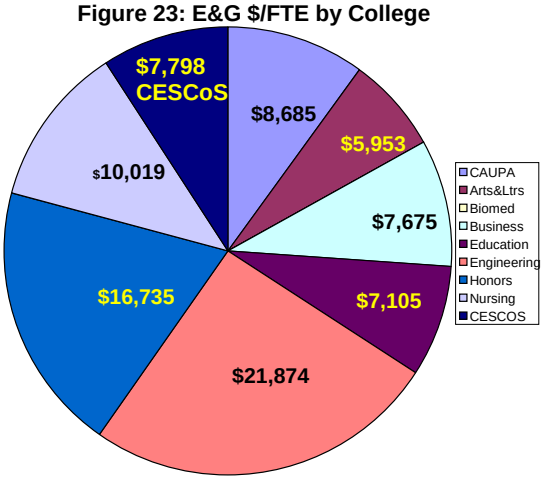


Table 4 shows data taken from the National Study of Instructional Costs & Productivity (The Delaware Study) for 2007-08. Average instructional cost per student FTE in our College is lower than both our peer group of universities based on "size and mission," and to a peer group of "doctoral/high research activity" universities. Research expenditures per faculty FTE are greater than that of our peer group and only a little less than the peer research group. These results are quite remarkable and attest to the overall productivity of our College.

Table 4	Instructional Cost per FTE Student			Research Expenditures per FTE T/TT Faculty		
	FAU	Peer	Research	FAU	Peer	Research
Biology	$5,448	$4,798	$6,682	$88,674	$131,286	$95,505
Mathematics	$5,440	$4,381	$5,071	$46,818	$11,515	$16,937
Chemistry	$5,267	$6,584	$7,412	$153,063	$70,518	$148,881
Geology	$4,426	$7,778	$8,353	$15,999	$37,307	$73,186
Physics	$6,985	$7,038	$8,157	$19,528	$56,509	$105,250
Psychology	$4,688	$5,497	$4,887	$44,601	$66,454	$55,662
Geography	$4,376	$5,722	$5,757	$15,999	$16,533	$38,567
AVERAGE	**$5,233**	**$5,971**	**$6,617**	**$64,114**	**$55,732**	**$76,284**

Section 6. Assessment of Departments/Programs

Let me presage my comments by saying that in past years our assessment of academic programs according to nationally acceptable assessment guidelines and principles has been somewhat "patchy." However, in the last few years we have begun to correct this situation and a concerted effort by our programs have brought our assessment activities to a point where they are now doing assessment on a regular basis with defined measures and mechanisms to assess outcomes. Still, not all programs are where we want them to be in their assessment plans and activities and to address this as well as continual assessment I have constituted a College Assessment Committee (as have some departments) and appointed an Assessment Director, Dr. Jenny Peluso, to lead this important effort, and who co-wrote this section.

Undergraduate Programs

Overall, assessment efforts for the undergraduate programs of the College are guided by Academic Learning Compacts (ALCs) established by each department/program in accordance with Policy Guideline #PG 05.02.15 issued by the Chancellor of the State University System. These ALCs explicitly identify the core student learning outcomes to be met within the curriculum of each program, namely: a.) at least two content/discipline knowledge and skills (e.g., declarative knowledge like vocabulary, history, theories, concepts; procedural knowledge like research skills or technical skills); b.) at least two communication skills (i.e., written, oral, graphical, team/collaborative); and c.) at least one critical thinking skill (i.e., analytical, creative, practical). In compliance with the State guideline, the ALC for each of our undergraduate programs is publicly accessible on its respective web site (see Appendix). The ALCs serve as a foundation for much of the ongoing assessment within our undergraduate programs, though additional curricular goals are also tracked in some programs. Not every outcome in each ALC is assessed each year, however. Thus, what is provided in FAU's Assessment Database should be best thought of as only a representative sample of the outcomes and achievements within the assessment programs of our undergraduate curricula.

Our undergraduate programs describe a wide variety of measures used to assess outcomes. The majority of measures for content knowledge and skills rely upon common sets of "embedded" examination questions (e.g., Chemistry, Biological Sciences, Psychology/Psychobiology, Geography, Mathematics). Practical and technical skills are tracked via field observation assignments, laboratory examinations, and embedded exam questions (e.g., Chemistry, Psychology/Psychobiology, Physics). Communication skills are mainly assessed via rubrics for specific elements of writing projects within courses and/or oral presentation (e.g., Geography/Geology, Psychology/Psychobiology, Chemistry). On average, the criteria for most outcomes are set at or near 70% (a few are set at 60%). Of those programs reporting results (see Section II), the average achievement among our programs: ranges between 59 and 90% for declarative knowledge (average is about 84%), is consistently high (mean of over 88%) in practical and technical skills; and falls between 75 and 89% for communication skills. Some of the additional program outcomes (non-ALC) that have been examined are: rates of student participation in undergraduate research (B.S. Physics, Biological Sciences); student participation in appropriate academic events (B.S. Physics, Mathematics); student contribution to social activities (e.g., B.S., Physics); rates of course attendance; and dispersion of students across percentile ranks in grade distributions (e.g., B.A./B.S. Biological Sciences).

The above numbers are encouraging, but the college has had mixed success in achieving consistent compliance among our departments and programs in the utilization of the university's Assessment Database. That is, while every program within the College is responsible for maintaining an annual assessment plan to track curricular achievements, the consistency with which some of our departments actively updated their plans and/or reported results in the Assessment Database has fluctuated during the period of this review. For instance, through the end of the 2007-08 academic year, only 67% of our undergraduate programs and 87% of our graduate programs were fully up-to-date in the Assessment Database. This has been due, in part, to the fact that each of these departments has been transitioning (albeit slowly) between assessment plans and procedures for their programs, though they have been

engaging in at least some informal assessments of their curricula during this time. However, it should also be noted that there have been multiple changes in university-level leadership for FAU's Assessment Office during the last four years. These changes resulted in conflicting information being given to our departments about the adequacy of their assessment plans, the sufficiency of their measures, what was to be entered/updated in the Assessment Database, and by what deadlines. Thus, without guidance on what was to be prioritized in college assessment efforts, some program assessment plans were neglected. The university now has a new Assessment Director who has provided much more structure, established an air of collaboration, and offered explicit feedback for program improvement. We are hopeful that her leadership will serve as a catalyst for even more progress.

In the meantime, the College has undertaken steps in the last two years to address the deficiency in assessment compliance. A part-time College Assessment Liaison (now Director) was appointed (Peluso) to work with each department and program to foster understanding of the purposes of assessment and to improve greater compliance moving forward. An assessment task force (now the College Assessment Committee), composed of chairpersons and other faculty from each program in the College, was also convened; it meets periodically each semester to discuss assessment needs in the college and to advise the Dean about assessment-related issues. This group has helped informed the assessment work in the college about what we deem appropriate time frames for assessment, what kinds of curricular outcomes are generally acceptable for our programs, and what resources may be needed for effective assessment. Progress has already been made; the number of programs reporting in the Assessment Database has increased and the quality of the measures used for assessment purposes has also improved. All programs are now engaging in assessment and preparing to explicitly report the plans and results in the Assessment Database for 2008-09, and will have complete and detailed plans in place for 2009-10 by October 1, 2009.

As programs have revised their assessment procedures, it has taken a few assessment cycles to establish the reliability of their assessment results. Most of our programs are finally at the point of being able to determine the consistency with which their assessment criteria are being met. Ongoing review of results patterns has been occurring throughout our programs and has allowed program faculty in many cases to shift the emphases in their assessment plans to focus on other program outcomes, or to make specific informed changes in their curricula. Both successes and failures in achievement have been noted in the Assessment Database, and some programs have detailed specific decisions about curriculum maintenance or changes that have been informed by these achievements. However, because different programs have implemented different assessment plans (with varying outcomes) at different points in the last seven years, there is a great deal of heterogeneity among our College's programs in their status with respect to being in "continuous improvement mode." Some have just entered this mode in the current year, some have been in this mode for a year or two already, and others will be entering this mode by the end of the current year. The College Assessment Liaison has been working with all programs over the last two years to formalize faculty efforts to interpret the meaningfulness of assessment trends for their programs' curricula, and/or to implement curricular changes. We have improved the number of programs that are now more explicitly documenting curriculum improvement efforts in the Assessment Database. The 2008-2009 year will be the first year that all programs will provide such information.

Graduate Programs

Unlike undergraduate program assessment, which is guided by a set of "unifying principles" across programs, the approaches to assessment of our graduate programs vary greatly within the College. In truth, many departments have only begun formal and systematic assessments of their graduate programs more recently; as a result, evidence of outcomes-based curricular decision-making in many of our graduate programs was not reported in the Assessment Database until about two years ago. About half of our graduate programs are in continuous assessment mode; the other half are just collecting their first full set of data for assessment purposes, or are waiting to aggregate enough data points to be able to draw valid conclusions about curricular successes and needs for improvement. As noted above, we've had greater

compliance in assessment within our graduate programs, though there is certainly much room for improvement in this.

The assessment plans for masters and doctoral programs include multiple outcomes. Many center on the successful mastery of advanced concepts within specific disciplines and sub-disciplines by measuring achievement on embedded exam questions (e.g., Mathematics), treatment of issues in student thesis and dissertation proposals and final documents (e.g., Geography, Geology, Psychology), and student presentations in program seminars (e.g., Complex Systems). Other outcomes focus on graduate student participation in appropriate professional activities (as in attendance and/or presentations at meetings and conferences, e.g., Complex Systems, Environmental Sciences, Geosciences, Physics), numbers of publications (e.g., Complex Systems, Physics), and job placement or admission to more advanced training programs (e.g., Complex Systems, Geosciences, Mathematics, Physics).

The ultimate measure of success of the graduate and undergraduate programs in the College would be to ascertain the achievements of our students beyond graduation. The extent to which they are finding placement in graduate and postdoctoral programs, professional training programs, and employment in their chosen fields would help us determine how well the knowledge and skills our students have attained actually serve them in their professional environments. We would also do well to track impact measures of our graduates in these arenas, that is, how much they are "making a difference" in the lives of the individuals and communities around them. The development of formal department- and program-level alumni tracking procedures, coordinated through a college tracking system would enable us to examine our curricula more globally (literally) and longitudinally. Such systems do not currently exist.

Service and Research

Without question, the faculty members within the College are highly productive in terms of the research goals set by the departments and programs. As reviewed above, the rates of publication, conference and meeting presentations, and grant proposals submitted (and funded!) all reflect the commitment and caliber of our highly qualified faculty (at all ranks). Research and scholarly activities focus on discipline-specific pursuits, but a wide range of efforts are interdisciplinary in nature, represent community outreach, and/or investigate pedagogical questions and infrastructure improvements. We expect this level of productivity in the College to increase as current graduate programs and as newer doctoral programs "mature."

Our faculty members are also actively engaged in serving both the university and the greater national and worldwide communities. A considerable number of our faculty serve as book and journal editors, consultants and coaches to local school districts, advisors to student groups, university committee members and chairpersons, regional and (inter)national conference and event organizers, and the like. We are at or above the goals set by all departments and programs for service.

Perhaps the greatest service the College provides to the University is that we are responsible for providing all FAU students with general science and math education. Through FAU's Intellectual Foundations General Education Curriculum, FAU students take core courses in Biology, Chemistry, Geography, Mathematics, Physics and Psychology. Clearly, Science and Math are challenging for many of our incoming freshman and transfer students without AA degrees, and especially so for non-science majors. Since last program review we have made great strides in our retention and pass rate of students in introductory science courses through innovative programs such as ChemBond and LifeLine, both peer-tutoring programs run by faculty. Our program in Chemistry –ChemBond-- has garnered national attention and received significant funding from the National Science Foundation. In addition, in cooperation with the Center for Learning and Student Success at FAU, we have introduced Supplemental Instruction (SI) sessions which have further increased the pass and retentions rates in our introductory classes. Mathematics has been particularly problematic. This is not just an FAU problem but a national problem. However, in the last few years we have seen a steady decrease in the DFW rates especially in lower division

mathematics courses. Figure 23 shows the average DFW percentage rates for lower division math courses since 2006, and Figure 24 shows the dramatic results specifically for College Algebra (MAC1105).

Figure 23. DFW rate in Lower Division Mathematics Classes*

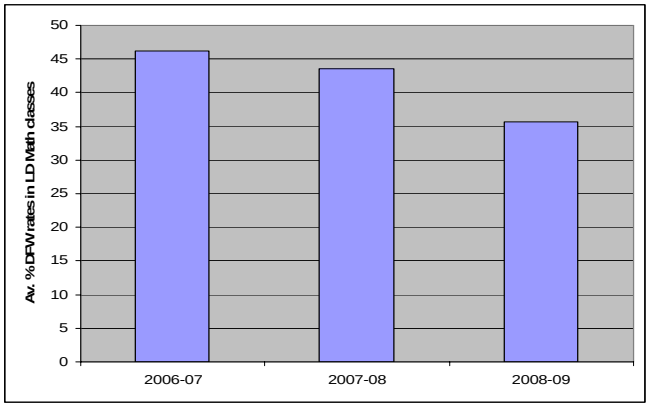
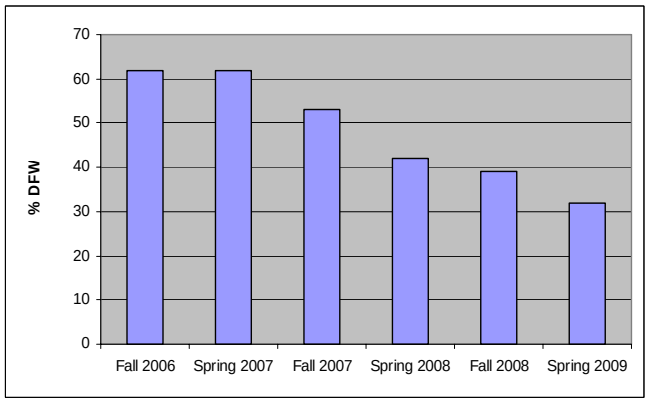


Figure 24: DFW rate in College Algebra (MAC 1105)*



*Courtesy of Dean Ed Pratt

Our success in reducing the DFW rates in lower division math courses is the result of providing students with a placement test, so that they do not register for a math class beyond their capability, adequate math tutoring and supplemental instruction (see Section II -- Mathematical Sciences). These initiatives have been started in cooperation with the Office of Undergraduate Programs, as well as the development of a new Math Learning Center.

13. Future Directions

Both our Nation and the State of Florida are reeling from the current world economic turndown. As state revenue continues to decline, so will the budgets of state agencies including the Florida State University System and its constituent universities such as FAU. Even so, these conditions will engender opportunities for change. For the College, change may come in the form of campus-specific missions and presence; it may also present itself in opportunities for exciting new program initiatives.

The Charles E. Schmidt College of Science has always looked to improve itself through expansion or consolidation of programs and development of specific missions to build upon its strengths associated with specific campuses of the university. Some of these initiatives were outlined for the Campus Academic Planning exercise conducted by FAU's Board of Trustees in Fall 2006. For instance, on FAU's Davie campus, the decision was made some time ago to develop the hub of our Environmental Sciences Program on FAU's Davie campus to take advantage of the neighboring locations of the US Geological Survey and the University of Florida's Institute for Food and Agricultural Science (IFAS), as well as Davie's proximity to the Everglades. We are committed to expand our Geosciences program and offerings in Davie too, to

complement the development of the environmental sciences there. Articulating campus specific academic plans/missions provides a rationale to develop marine science on the Treasure Coast with the Harbor Branch Oceanographic Institute (HBOI) as a partner, and this decision becomes even more appropriate now more than ever given that HBOI is now fully part of FAU. Many of these programs are tied together by water – a critical commodity in South Florida. Lastly, the greatest concentration of undergraduate instruction in science occurs on the Boca Raton Campus and necessitates continued development of all of our core science programs in Boca Raton.

The presence in Boca Raton of the College of Biomedical Science and relevant departments of the College of Engineering and Computer Sciences requires that our teaching and research in the areas of biomedical interest continue to flourish on the Boca campus. However, the opening of Scripps Florida and the Max Planck Institute Florida on the John D McArthur Campus of FAU in Jupiter absolutely requires us to reconsider a science presence on the Jupiter campus, as well as how we will work with these world renowned institutions to implement new world class programs in science now and into the future. Related to this, as part of the Campus Academic Planning exercise together with the College of Engineering and Computer Science, we proposed implementing a new program in Bioengineering on the Jupiter campus that would be a start to complement the presence of Scripps and Max Planck. Moreover, we have started the planning for an expanded strategic life sciences initiative on the Jupiter campus – an Institute for Biomedical Science and Technology – that would include programs not only in bioengineering but also bioinformatics, bioimaging, brain science and biotechnology to name a few. However, it is premature to report on this early stage initiative in this Program Review at this time.

Several other early-stage initiatives are also worth mentioning. One is an overarching program in Climate Change and the Environment that will begin to examine ways to mitigate the effects, for example, of sea level rise on coastal environments. A second initiative, in which science faculty are actively engaged, is the Ocean Energy Project being implemented through the College of Engineering and Computer Science, which represents an overarching project at FAU to develop solutions to current energy problems. As the university begins to explore new ways to brand itself though its academic programming, the Charles E. Schmidt College of Science stands ready to thoroughly and completely engage in the process.

14. Conclusions

Clearly, this Program Review has highlighted that the Charles E. Schmidt College of Science continues to be a pivotal college for the future development of Florida Atlantic University as a comprehensive research university. The College's teaching and research missions and programs dovetail beautifully with what have become regional state initiatives in science and technology. Our academic programs continue to swell with students interested in making a career in science and our programs provide them with ample opportunity to do so. We continue to improve our programs and assess their relevance as they relate to today's local and global marketplace, making adjustments or proposing new programs as necessary. Recent examples of this are the completely revised undergraduate curriculum in physics introduced two years ago, and the newly implemented PhD in Geosciences—a unique professionally oriented program that provides cutting edge interdisciplinary graduate research and training in geosciences.

Probably the most disappointing aspect of this Program Review today, however, is that there has been essentially no increase in the number of regular faculty in the College for almost a decade, despite significant increases in all other aspects of college productivity. Of course, an academic program review such as this will inevitably, as a good friend and colleague of mine once wrote, "…..wind up making four recommendations: more faculty, higher salaries, higher graduate stipends and more program money. Rarely if ever do these recommendations get acted upon." I make no recommendations here but rather I leave it to the reader to make your final conclusions (and recommendations). Clearly, we have every reason to be very proud the achievements, and enthusiastic for the future, of the Charles E Schmidt College of Science at Florida Atlantic University.

Part II: Department/Program Review and Assessment

A. Department of Biological Sciences

1. Mission and Purpose of the Program

The 21st Century is bringing new career opportunities in the area of life sciences, ranging from biomedical research to environmental sciences. Many of these new jobs require a non-traditional education that crosses disciplinary boundaries. The mission and challenge for the Department of Biological Sciences is to train students for traditional careers such as medicine as well as the emerging new careers in a global economy. The Department of Biological Sciences offers both B.S. and B.A. degree programs in biological sciences. These programs are designed to prepare students for careers in life sciences and advanced education in graduate and professional schools. We also provide graduate education leading to M.S. or M.A. degrees in biological sciences and environmental sciences and Ph.D. in Integrative Biology

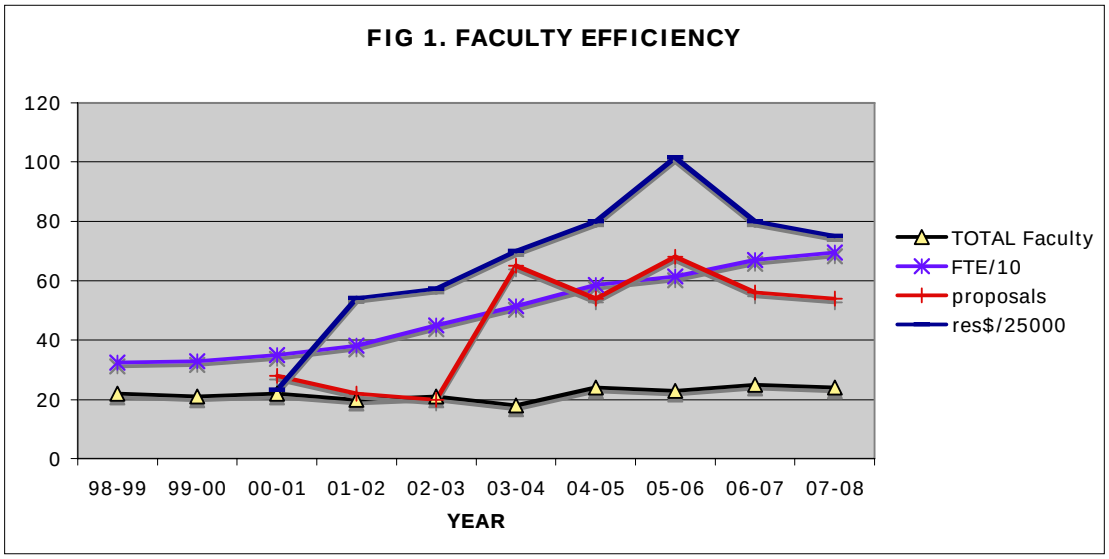
2. Date and Description of Last External Review.

The program was last evaluated in May, 2001**.** The number of majors in the period 1997-1999 averaged 953 students from a student body averaging 13,689. Biological Sciences was listed as the third most popular major and the department serviced nursing, agriculture and education. Ethnic composition was 77% white, 3% black, and 5% Hispanic while 14% were non-resident aliens. All tenure and tenure-track faculty, as well as instructors, possessed the PhD. At the time of the previous review, the department had a significant number of senior faculty with very few Associate and Assistant Professors. It was primarily an undergraduate teaching department with an active Masters program, but no PhD program. External funding for research was modest and only a few faculty had active research programs. The senior faculty have since retired or taken new positions, which allowed us to hire new faculty who were recruited for their research potential as well as their teaching prowess.

2.1 Findings and Recommendations

The most significant change since the previous review is the dramatic increase in effort and efficiency of the faculty. Offering competitive salaries and good “start-up” funds has enabled recruitment of outstanding scientists. As described herein, this “new faculty” has facilitated improvement in both teaching and research in the Department of Biological Sciences.

Although the department is currently made up of nearly the same number of faculty and instructors as at least a decade ago these twenty-two faculty and two instructors produce more than double the effort in every major category considered; FTEs generated, papers published, proposals submitted and research expenditures (Fig 1). ***We are the largest undergraduate major at FAU and our courses serve both majors and non-majors in thousands of hours of instruction.***



The Department offers a wide variety of programs for undergraduate and graduate student research that lead to various careers in the life sciences. The Departmental research effort has major focal points in conservation biology, molecular biology and marine biology. The faculty currently generates approximately $2 million dollars per year in research support, compared to the $57,000 per year in 1992-1999. Our students are a major part of this effort and 115 graduate students and 110 undergraduates work in research labs throughout the year. Currently eight undergraduate students are supported by a $700,000 grant from the National Science Foundation (NSF) that specifically provides undergraduate research training for under-represented minorities.

Three new graduate programs have been implemented or are in the process of being approved. The most important was the establishment in 2003 of a doctoral program in Integrative Biology, now enrolling 63 doctoral students. The program has granted PhD degrees to eleven candidates. This ability to train PhD students was instrumental in recruiting high caliber faculty. Approximately 100 Masters students are involved in our programs. We also added a FastTrack BS/MS program to recruit and retain our most talented undergraduates and recently, a new Masters in Environmental Sciences program is working it way through the various committees toward formal approval.

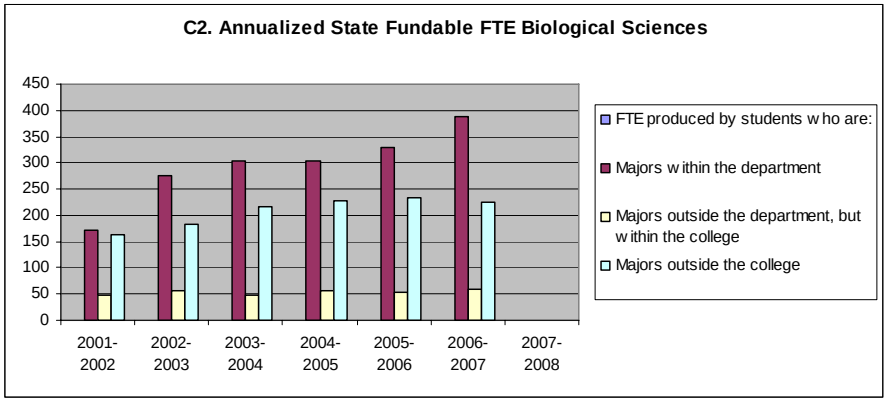
2.2 Major Changes since Last Program Review

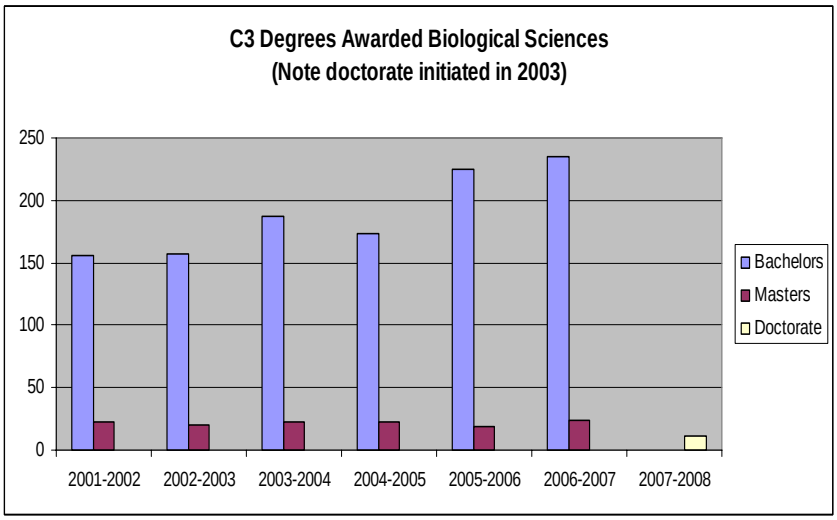
- The primary change since the last Program Review is the overall increase of effort and efficiency. By all measures the faculty are doing 2-3 times the work observed in the previous review.
- A doctoral program in Integrative Biology was initiated in 2003 fostering research initiatives in a variety of areas.
- A new Chair, Professor Rod Murphey, appointed in 2006 has added to the cohesion and enthusiasm of the faculty to improve both research and teaching efforts.
- New Facilities for research and teaching.
    - The Biological Sciences Building (Sanson Life Science Building) was renovated providing an excellent facility.
    - A new FAU/UF Building is under construction on the Davie campus that will consolidate the Environmental Sciences research and teaching and offer improved opportunities for joint research between the two universities.

3. Instruction

3.1 Review of Undergraduate & Graduate Departmental Dashboard Indicators

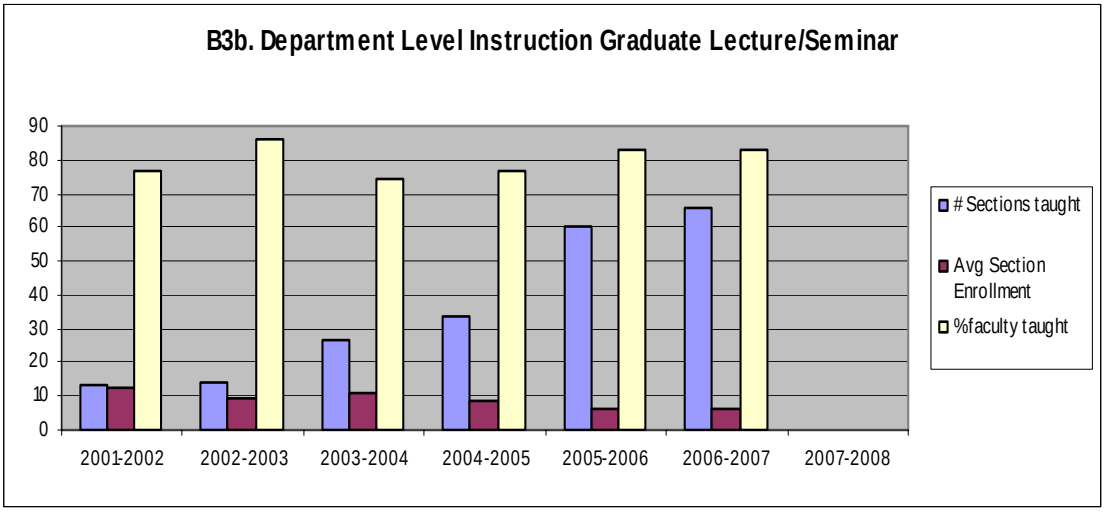
Although there has been no growth in the number of faculty, the Department now presents twice as many courses as we did at the time of our last assessment. The number of students enrolled in our courses also doubled during the past five years. The greatest increase in enrollment was from biological science majors (Figs C2 and C3).





Trends in Majors and Ethnicity. There has been a significant evolution in the diversity of our undergraduate students in the past five years. The fraction of African American students enrolled in our bachelor's program dramatically increased from 3% in 1999 to 20% in 2007. Hispanic representation in our department increased from 5% in 1999 to 19% in 2007. We enroll roughly twice as many females as males.

Graduate Program Dashboard Indicators. The number of graduate sections presented has increased from 12 in 2001 to 65 in 2007. This five fold increase is partially the result of the addition of our PhD Program in 2003. The development and presentation of a PhD program by our seriously understaffed faculty is another example of the productivity of our faculty. The Masters Degree program has consistently produced 22 to 24 students per year and the doctoral program begun in 2003 has graduated 11 PhD students in five years.



3.2 Establishment of Goals for Student Learning.

The goals for the Department of Biological Sciences undergraduate programs are consistent with the institution's definitions of content knowledge, communication skills and critical thinking skills within our discipline. Our program is designed to educate and evaluate our students in biological sciences in each of the following parameters

Declarative knowledge: Students will demonstrate knowledge of the vocabulary, history, theories or concepts. These include but not limited to Microscopy, Cell structure and function, Genetic principles, processes and applications, Structural and functional diversity of viruses and organisms in the biosphere, as well as Ecological principles and processes. Declarative knowledge is usually assessed via in-class or standardized tests, typically in an objective (multiple-choice; short answer) format.

Procedural knowledge: Research skills: Students will demonstrate knowledge of the procedures involved in research (e.g., process of scientific inquiry, idea generation, literature review, data collection, reporting). These skills are usually measured via the evaluation of a research project, thesis, or dissertation.

Procedural knowledge: Technical skills: Student will demonstrate technical skills (e.g., microscopy, staining, dissection, cell culture and electrophoresis). This type of procedural knowledge is assessed by both written and practical laboratory examinations.

Written communication: Students will produce writing that is grammatically correct, well-organized, and properly formatted for the purpose of the assignment and the discipline. This is usually assessed via individual paper assignments where applicable. Instructors assess the quality of written expression.

Oral communication: Students will prepare and deliver informative and/or persuasive oral presentations that attend to the audience and are well-organized. This is usually assessed via individual oral presentations in a classroom setting.

Team/Collaborative communication: Students will demonstrate team-oriented, collaborative skills in which they contribute to group products. This is usually assessed via group laboratory exercises.

Analytical skills: Students will analyze, evaluate, compare/contrast or judge discipline-specific theories, issues, events, or other content. This is usually assessed through examining the quality of argument in a student essay, oral presentation, or formal report.

Creative skills: Students will create a product by synthesizing knowledge from a discipline. The product is usually assessed by an instructor or supervisor examining a student product for the quality of its synthesis of current knowledge into a new product.

Practical skills: Students will put into practice their knowledge and skills within the laboratory.

3.3 Assessment of Expected Learning Outcomes.

Prior to 2009, the Department chose one upper-division course required by most under-graduate biology students (*General Microbiology*; MCB 3020) as a reference course to develop and pilot our assessment protocols. Although student learning has been tracked for several years, the Department submitted its first formal report to the database last year. Only sections in Boca and Davie were assessed, with Davie results representing every year since 2004 and Boca results representing 2008-2009. Based on the results from these pilot trials, the Department of Biological Sciences established an Assessment Committee to oversee the implementation of a comprehensive plan for evaluating learning in Biology.

First, three higher order learning outcomes and the criteria for success were developed viz:

Outcome 1: Students will show a comprehension of the core principles and knowledge base associated with their studies of biological sciences. [These core concepts include Cell structure and function, Diversity and adaptation of Life forms, Genetic principles and processes, Cell nutrition and metabolism, Evolution and interaction of living things as well as ecological principles and processes].
Outcome 2: Students must develop the ability to critically analyze data and apply concepts to problem solving. They interpret results of an experiment and draw conclusions from data.
Outcome 3: Students will be able to communicate the results of scientific inquiry in a clear and concise manner [Students communicate scientific inquiry or data clearly and concisely]

Secondly, the Biology faculty identified four representative courses - Biodiversity (BSC 1011), Biological Principles (BSC 1010), General Microbiology (MCB 3020 and 3020L) and Genetics (PCB 3063) to use in the assessment. These courses are taken by almost all Biology majors and cover key biology concepts at introductory, intermediate and advanced levels. The instructors who teach these courses use master syllabi which identify key concepts; and meet regularly to discuss course presentation and progress of students. Learning of the core concepts of each course could be evaluated at any or all, of the Outcome levels above, as the instructors deem appropriate. By grouping learning of biology concepts and skills into overarching themes of "Outcome" as described above, our model permits a robust comparison and diagnosis of learning between courses whose specific objectives may differ.

Thirdly, the assessment tool for Learning Outcomes 1 and 2 are questions of various formats designed to assess declarative knowledge, skills and understanding of the principles of key concepts in Biology. The multiple choices of these questions provide diagnostic data for program improvement. At least 10% of each exam comprise of questions drawn from a database (*Anchor Questions*) created by all the instructors to evaluate each of the identified concepts of that course. Learning Outcome # 3 is assessed primarily in laboratory course sections (MCB 3020L). Students conduct experiments on microbial growth curve, report their findings, interpret data and solve assigned mathematical problems in a clear and concise manner. Student learning will be deemed satisfactory (criteria for success of program) for this outcome when Written lab reports and data analysis are clear concise scientific communication with logical deductions and correct grammar (assessed at 70% or higher). Lab reports on microbial Growth Curve Experiment in MCB 3020L will be assessed using a rubric to evaluate 1) ability to collect and present data correctly (20%), interpret and analyze data with correct deductions (40%), correct grammar and overall presentation (20%) and Problem solving for batch culture modeling (20%)

Finally, student learning will be deemed satisfactory (criteria for success of program) when: 1) The overall average of students' correct responses to all embedded questions is at least 60% for Biodiversity and Biological Principles, and 65% for General Microbiology and Genetics; 2) Responses to specific anchor questions range from 30 for questions with highest difficulty factor to 100% for easy questions; and 3) Written lab reports and data analysis are clear, concise scientific communication with logical deductions and correct grammar (assessed at 70% or higher).

3.4 Description of How Results of Assessment are used for Continuous Program Improvement.

The "Criteria for Success" described above, provide a diagnostic baseline, which the instructors use to make changes to course instruction and student mentoring as needed. In addition, the Department has set up a standing committee to collate and analyze overall student learning data from the four biology courses used for learning assessment.

In the first year of a systematic student learning assessment (2008 -2009), anchor questions representing the major course objectives / concepts were included in exams in all general microbiology sections. Analysis of results from 2008/2009 showed that average number of students who responded correctly to the anchor questions ranged from 65 to 72% depending on the section and semester.

All faculty who teach various sections of the Biology Assessment courses compare notes regularly on students' performance to identify any possible trends and address it. For each anchor question with less than 30% correct responses, the professor reviews the delivery method and question format. In addition, the instructor reviews the individual item analysis report to possibly identify why students missed or did not learn a concept, by noting which wrong option most students gave. Sometimes this is a result of media propagated misconceptions, culture or student preparation. If faculty determines that there is an "instructor" component; that is addressed in subsequent teaching. When individual students perform poorly on the anchor questions consistently, they are invited to a private meeting with the instructor for tutoring, evaluation of studying strategies etc.

Overall, the department is on an upward trajectory and students seem to be achieving the desired learning goals. For example, the least average for Learning Outcome 1 (55.5 %) was noted in 2004 / 2005. This has steadily risen to averages above 71 - 88% in recent semesters. This trend is attributed to adaptation of instruction via multimedia and technology to facilitate student learning as well as the improvement of admission standards into FAU.

Early results from the Microbiology anchor questions have been evaluated by our departmental standing committee. The following observations were made:

- Some students who performed poorly on the anchor questions (i.e. did not fulfill the expected outcome), were found to be deficient in basic reading & comprehension unrelated to biology when the faculty invited them for personalized tutoring.
- Students perform almost as well in problem solving (Outcome 2) as in knowledge-based (declarative, Outcome 1) anchor questions in Davie. For example, average percent correct response (% CR) was 69.27 and 67.67 for outcomes 1 and 2 respectively in the Fall of 2008. At the Boca campus with large class size; % CR was 80 and 66.5 for outcomes 1 and 2, showing a clear dichotomy.
- The lowest performance in this pilot assessment (18 – 32%) is with integration of facts for problem solving; as shown in the low score for embedded diagnostic anchor questions.

The Biological Sciences Department has approached the assessment of our teaching effectiveness and student learning through the use of new technology. To this end, the Chairperson encouraged four faculty to apply to and eventually attend the Summer Institute for Undergraduate Education –

Sponsored by the National Academies of Science and Howard Hughes Medical Institute. This Institute is focused on improving teaching for large undergraduate courses particularly Freshman Biology. The program is focused on technology for teaching as well as assessment of the results and our faculty has focused on these issues.

Biology faculty use the "i-clicker" technology in a number of the core courses as well as other courses with enrollments from 100 – 300 students. Casual observation showed that attendance was improved by 10 – 25%, performance on exams improved 5 – 10% and there was a decrease in the fraction of the students in the lower third of the distribution and increase in the middle third. However, use of technology is not a learning goal in biology and is therefore not specifically assessed.

MS Biology (Thesis) Assessment Plan

The student writes a thesis proposal in their first year. A final written thesis is assessed by the thesis committee and the departmental graduate coordinator, who assess the candidate's knowledge of the subject. A formal thesis defense assesses the ability to create a testable hypothesis, design and conduct experiments, draw appropriate conclusions and communicate information effectively. Because of the individual nature of scientific research and graduate training, a specific rubric for assessment is not appropriate. The department is considering establishing a generic rubric which will be used to evaluate thesis proposals and final thesis using a 3-point scale. (1=below expectation, 2= Meets expectation; and 3 = Exceeds expectation) Items assessed will include: a) Quality of Literature review, b) Soundness of proposed hypothesis and Methods, c) appropriateness of proposed data analyses (For Proposal); and a) Scientific merit of research, b) Quality of data collected, c) Intellectual merit of data interpretation and analysis and d) Potential for publication from the work. (For Final thesis evaluation)

PhD Biology Thesis (since 2003)

The Integrative Biology Program is continually up-grading its methods of assessment and monitoring of graduate students. They are monitored for their course work by the Program office and are required to maintain a B average. Students meet with an Advisory committee at least once per semester to monitor progress. They are required to write a thesis proposal to advance to candidacy and this is actively critiqued by the Advisory committee. A final written thesis is written and assessed by the thesis committee and the departmental graduate coordinator. The thesis defense assesses the ability to create a testable hypothesis, design and conduct experiments, draw appropriate conclusions and communicate information effectively. Because of the individual nature of scientific research and graduate training, a specific rubric for assessment is not appropriate. The department is considering establishing a generic rubric which will be used to evaluate thesis proposals and final thesis using a 3-point scale. (1=below expectation, 2= Meets expectation; and 3 = Exceeds expectation) Items assessed will include: a) Quality of Literature review, b) Soundness of proposed hypothesis and Methods, c) appropriateness of proposed data analyses (For Proposal); and a) Scientific merit of research, b) Quality of data collected, c) Intellectual merit of data interpretation and analysis and d) Potential for publication from the work. (For Final thesis evaluation)

Average GRE scores for students admitted into each our graduate programs: For the M.S. degree, the average score improved from 1,094 in 2004 to 1,153 in 2007. For the doctoral program, the 2004 score was 1,172 and remained much the same in 2007 at 1,149.

3.5 Review of lower level prerequisite courses

The Common Prerequisites Manual (CPM) maintained by the State of Florida provides the list of community college courses that students must have completed in order to transfer into a four-year baccalaureate program at a state university. The department of Biological Sciences is in compliance with the CPM. Students who transfer to FAU from a community college but have not met the prerequisites delineated in the CPM are able to complete them after transferring to FAU. In addition to

general University requirements, the Biology Department requires transfer students to have a minimum of 2.0 Grade point average (GPA) in the following courses: Biodiversity (BSC 1011), Biological Principles (BSC 1010), General Chemistry CHM 2045 and Lab; 2046 and Lab; Organic Chemistry 1 & 2 – CHM 2210, 2211 and Lab; Physics – PHY 2053, 2054 and labs 2048 and 2049; as well as Calculus – MAC 2233 OR MAC 2311.

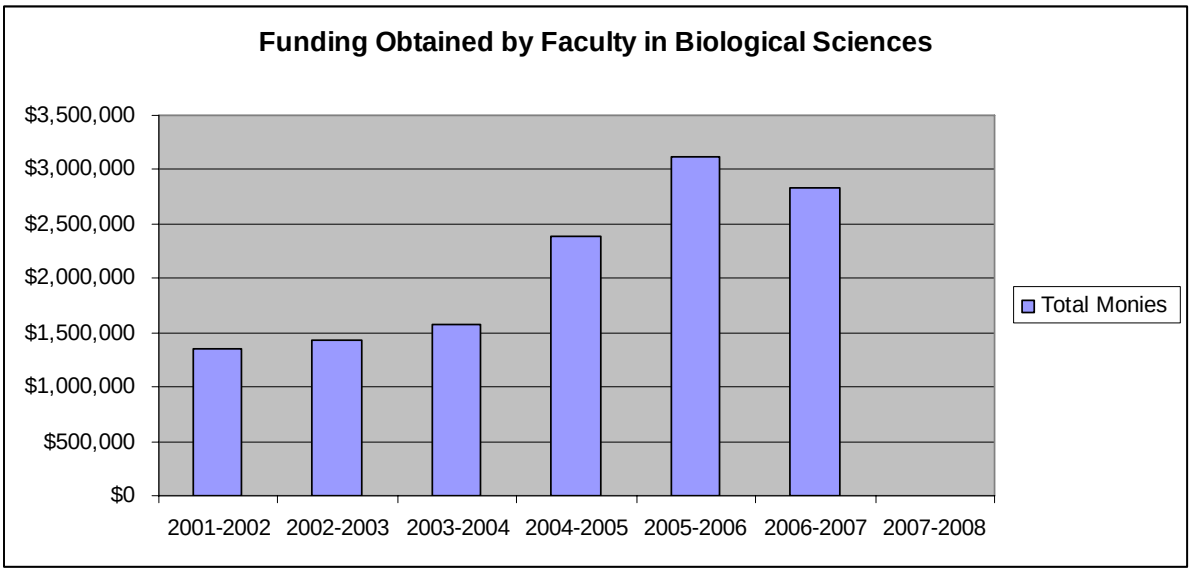
3.6 Status of Limited Access Programs

The Department of Biological Sciences currently has no limited access programs.

4.0 Research

4.1 Review of Dashboard Indicators for Research

Research funding more than doubled in five years from $1.3 million to $2.8 million, and the number of grant proposals submitted by departmental faculty increased 75% from 37 to 65.



While the number of faculty in the Department has remained stable the number of peer reviewed publication has increased from 22 in 2001-2002 to 37 in 2007-2008. Presentations at scientific meetings have remained fairly constant at 70 per academic year.

4.2 Research Goals

- Enhance research groups in the areas of marine science, environmental science, molecular biology (with emphasis on oxidative stress and aging)
- Increase the number and quality of graduate students in research labs
- Increase funding for research experience for undergraduates.
- Apply for undergraduate and graduate training grants
- Strengthen contacts with Scripps Institute of Florida, Torrey Pines Institute and develop new contacts with Max Planck Institute
- Develop productive relationships with HBOI and promote a overarching plan for marine sciences

5.0 Service

5.1 Dashboard indicators

Faculty memberships on department, college or university committees increased from 20 in 2003 to 55 in 2006. Faculty memberships on community or professional committees increased from 6 in 2004 to 32 in 2006. The number of times faculty served as editors or referees for professional publications increased from 8 in 2003 to 58 in 2006.

5.1 Goals in assessment database:

The chair and personnel committee will determine the level of faculty participation on college and university committees by reviewing the annual reports submitted by each faculty member.

5.2 Assessment of how well goals are being met.

The majority of the faculty serve on at least one standing committee for the department and college.

6. Other Program Goals.

A major unfilled goal is to recruit an eminent scholar for appointment at the Harbor Branch Oceanographic Institute.

7.0 Strengths and Opportunities.

7.1 Strengths in Teaching.

- The Biological Sciences department offers the most popular major within the university and gains evaluations (SPOT scores) superior to most other departments and colleges within the university.

- The department began a new doctoral program in 2003 and graduated eleven students in 2008.

- Four key faculty and instructors attended the Summer Institute for Undergraduate Education sponsored by the National Academies of Science and Howard Hughes Medical Institute and have returned to apply their skills in classrooms and laboratory.
- NSF has funded a URM program ($700,000) for undergraduate research and mentoring.
- The Department has spent more than $150,000 on undergraduate laboratory technology enabling updated labs in every area of life sciences at FAU
- Initiation of a Certificate in Biotechnology program for undergraduates with increased enrollment in laboratories that teach the technology

7.2 Strengths in Research

- New faculty have brought national recognition and research funding to FAU. These new faculty have added strength to the research and teaching capacity in biological imaging, statistical analysis, quantitative modeling and neuroscience.
- The department increased its extramural funding by 100% since 2001 and initiated significant partnerships with both the private and public institutions.

- A new Director of Environmental Sciences has developed a new curriculum and new research initiatives with SFWMD and National Parks services internships ($500,000)
- The faculty have established a research group in oxidative stress and aging with a National Academy member and Director of the Center for Molecular Biology & Biotechnology (CMBB) at its center. The group presently consists of six faculty with four NIH grants and two NSF grants.
- The establishment of Scripps Institute of Florida and the Max Plank Institute on our Jupiter campus will dramatically enhance the research culture at FAU as well as visibility of our research efforts nationally.

8. Weaknesses and threats:

- The size of the departmental faculty has remained constant for at least a decade in spite of dramatic increases in both undergraduate and graduate enrollment. This has resulted in increased workload for faculty and staff. The workload has probably reached a new plateau and additional faculty will be required if this increase in productivity is to be continued.

- Lack of resolution in the Marine Science Program and the difficulty of integrating HBOI into the FAU marine science has slowed development of this group. It has prevented hiring the Eminent Scholar in marine sciences and led to the loss of young faculty in this area.

9. Resource analysis:

The facilities are excellent, the resources and financial support for teaching are very good and the support for faculty hiring (i.e. "start-up costs") is very good. And a new environmental sciences building is under construction at our Davie campus.

10. Major findings and Recommendations

To strengthen the research and teaching of the Department, additional faculty need to be recruited. However, we have completed the recruitment of two new (replacement) faculty in Environmental Science and in the molecular aspects of stress and aging in the last year. We need to foster research alliances with biotechnical institutes and industry moving to south Florida due to the presence of Scripps Florida and the Max Plank Florida Institute. This will raise the department's research profile.

While research collaborations already exist, we need to further support and enhance the environmental science program's relationships with the University of Florida in Davie, the National Park Service and the South Florida Water Management District. Upon completion of the Program Review of HBOI, currently underway at the university, plans should be made to hire a nationally renowned individual to fill the McGinty Eminent Scholar Chair in Marine Science and additional marine science faculty. Molecular and cellular biology programs should be expanded to provide opportunities to interact with Scripps Florida and the Max Planck Florida Institute. With regard to both our undergraduate and graduate programs, we need to improve the curriculum through use of technology and application of assessment tools.

B. Department of Chemistry and Biochemistry

1. Mission and purpose of the program

Consistent with the mission of the university and college, the Department of Chemistry and Biochemistry has recently developed the following mission statement: "The mission of the Department of Chemistry & Biochemistry is to provide high quality education and state-of–the–art training in research in the fields of Chemistry & Biochemistry through excellence in teaching, research and service. In teaching we will provide to our students the foundation to build a chemistry knowledge base and introduce them to the recent advances in the field. In research we will provide high quality research experience in both fundamental and applied research. We will contribute to discovering new drugs for the treatment of major diseases and developing new materials for enhancing the quality of life. We will provide service to the university through joint interdisciplinary programs in biomedical, life and environmental sciences and will provide a strong infrastructure consisting of modern and powerful investigative instrumentation. We will provide service to the region and nation by contributing scientific expertise. We will help train high tech workforce needed to help meet the growing demands of industry in Southeast Florida in order to support and sustain economic development in the region."

2. Date and description of last external review
- Findings and recommendations

The Committee on Professional Training of the American Chemical Society (ACS) reviews undergraduate chemistry programs every five years. Our last full review was reported in July 2001, when it found our program to be consistent with their guidelines for program certification. In July of 2006, we sent to the Committee the requested materials for our program's scheduled review. However, at about the same time, the Committee suspended all program evaluations in order to focus on restructuring their certification guidelines. They have recently completed this restructuring, and resumed their program evaluations. We have not heard from them yet, but our own internal evaluation indicates that our program is consistent with both the old and new guidelines.

Our Ph.D. program began in August of 2000. As part of the approval process, the old SUS Board of Regents conducted an extensive review of all our existing and proposed new graduate programs. These reviews were positive.

-Major changes since last review

Since the last review of our undergraduate program, the following changes occurred:

- A new 3-credit introductory course in chemistry was introduced for those students who do not have sufficient prior knowledge to enroll in General Chemistry 1.
- An innovative honors level General Chemistry 2 course was established that meets both the requirements of second semester chemistry and college writing
- Two one-credit organic chemistry laboratory courses were consolidated into one two-credit course in the 2006-2007 academic year. Besides being necessary due to space limitations, this change enabled students to experience more interesting and complex experiments in their curricula.
- Our new OrgoBOND discussion sections in the introductory organic chemistry course were introduced in the 2006-2007 year, with some 600 students registered each year since then. Analysis of test scores, Student Perception of Teaching (SPOT) surveys and our own survey indicates that that these peer-led group discussion sections improved student achievement and attitudes in organic chemistry.
- The Instrumental Analysis and Advanced Biochemistry Laboratory courses were consolidated into a single course (Bioanalytical Instrumentation) which is now required for all B.S. Chemistry majors.

The new course reflects the growing emphasis of biochemical processes in the chemistry profession.

Since the last review of our graduate programs, no major changes in our graduate programs have been made. We continue to review these programs internally on a yearly basis.

3. Instruction
- Review of Part 1 of Departmental Dashboard Indicators

The department teaches a substantial number of courses to non-majors. Despite having about 200 undergraduate majors each year, over 4000 students took undergraduate Chemistry lecture courses and over 2000 took lab courses each year during the period 2003-2008. The aforementioned consolidation of the two Organic Chemistry laboratory courses resulted in a reduction of laboratory enrollment from about 3000 to about 2500 students per year since 2006. Average section enrollment per lecture section has been about 90 students during that same period; almost double the college average and triple the university average.

At the graduate level, while the number of sections offered per year remained relatively stable at about 10 from 2001-2008, the average number of students enrolled per section dropped from ~16 in 2001-2002 to 8.6 in 2007-2008. While still higher than the college average of 6.6, this is a disturbing trend resulting from the reduction of graduate enrollment in our department.

Total full-time equivalents (FTEs) produced in our department grew from ~340 on 2001-2002 to about 460 in 2007-2008. Students in lower division courses generate about 75% of these FTEs each year. Furthermore, students who are not chemistry majors generate 85% of these FTEs each year. It is clear from these data that our department provides a great deal of service to the students of FAU, especially in the lower division.

The quality of instruction and advising in the Chemistry Department has remained good with Student Perception of Teaching (SPOT) mean ratings in the range 1.9-2.4 for various quality indicators over the 2001-2008 time period. These ratings compare within 0.1-0.2 points of the averages found for all faculty in the College of Science and within 0.2-0.4 points of the averages found for faculty in the University. In Student Satisfaction Surveys reporting on the "Mean Rating of Satisfaction With Instruction & Advising In Program" the undergraduate chemistry faculty rated quite well and in 2007-2008 the ratings were within 0.1-0.2 of the College of Science averages and University-wide averages.

The numbers of students enrolled in a bachelor's degree in Chemistry (either BS or BA) have increased from 174 in 2001-2002 to 239 in 2007-2008. The ethnic composition of the student population enrolled in the bachelor's degrees has fluctuated somewhat but the overall trends observed from 2001 through 2008 were as follows: there was a significant increase in students from Hispanic origin (17 to 47), there was an overall slight increase in students from Asian or Pacific Islander origin (16 to 25), the numbers of Black (Not of Hispanic Origin) students remained relatively steady through 2006 (35 to 37) with a peak of 40 in 2003 and a low of 32 in 2005-2006. A significant increase to 56 in the number of Black (Not of Hispanic Origin) students occurred in 2007-2008. The reason for this recent increase is not clear. The number of White (Not of Hispanic Origin) students grew from 80-100 over the 2001-2008 time period, but as a proportion of the enrolled student population this subset of students has decreased from 50% to 45 %. Furthermore, during 2001-2008 on average every year more female students were enrolled in a bachelor's degree in Chemistry than male students and the percentage of females enrolled has increased from 54% of the total enrollment in 2001-2002 to over 61% in 2007-2008. The numbers of bachelor's degrees awarded in Chemistry increased from 26 in 2001-2002 to 42 in 2006-2007 and then dropped back down to 26.5 in 2007-2008. This number now represents 4.5 % of all CES College of Science Bachelor's Degrees.

The mean grade point averages (GPAs) of graduating undergraduates in the Chemistry program since 2001 have fluctuated very slightly (as mentioned above) and are between 3.0-3.2. The average length of time for undergraduates to graduate is currently (2007-2008) 5.50 years for first time in college (FTIC) students, 1.83 years for Community College transfers with an associate's degree and 1.3 years for the Community College transfers without an associate's degree. All other transfer students take on average 3.00 years to complete their degrees. These statistics fluctuate from year to year, however for 2001-2008 the FTIC students have consistently required 4.00 or more years to complete their degrees.

At the graduate level, enrollment in the doctoral program (range = 23-51) increased from its inception until 2006-2007 when enrollment decreased due to fewer new graduate students. Ethnic and gender diversity is good and has remained relatively constant. The number of doctoral degrees has increased as the program has become established, from 1 awarded in 2002-2003 to 6-7 per year in the last three years. Chemistry doctoral degrees accounted for one-third of doctoral degrees awarded by the college in 2007-2008. Enrollment in the master's program (range = 9-32) has decreased since the emphasis has shifted toward the doctoral program. Ethnic and gender diversity is good and has remained relatively constant. The number of master's degrees awarded per year (range = 2-9) has remained relatively constant within normal variation.

The number of graduate lecture course sections (range = 7-12 per year) increased since the inception of the doctoral program in 2000, but has started to decrease in recent years due to a decreased number of graduate students in the program. The decrease in student numbers is also seen by the decreased enrollment per section (range = 7.2-15.7), although the number of students per section still exceeds the College average of 6.6. Faculty teaches almost all courses, more than the College average of 88.2%. FTE levels also increased since the start of the doctoral program but have started to decrease due to fewer students (range = 26.8-41.4). Departmental majors produce almost all FTEs in the graduate programs in chemistry. The quality of instruction has remained good and is comparable to the college average of 1.5-1.8. Data for satisfaction with the graduate program's quality of instruction and advising is not available.

- Establishment of goals for student learning

Students enrolled in a BA or BS in chemistry degree are expected to have a thorough understanding of the basic concepts, theories, and experimental findings in the core areas of chemistry (analytical, biochemical, inorganic and physical). In addition students will be expected to produce writing that is grammatically correct, well organized, and properly formatted in accord with the American Chemical Society's (ACS) Style Guide. Furthermore, students are expected to become adept at using critical thinking to evaluate information and data related to chemical processes by applying basic principles of scientific methodology including (1) the nature of scientific explanations, (2) threats to the validity and reliability of observations, (3) the limitations of measurement scales, (4) the use of experimental and quasi-experimental designs to test hypotheses and (5) the proper interpretation of correlated and experimental data. Students in the BA program are also expected to perform laboratory techniques sufficient to conduct basic and advanced experiments in Chemistry and Biochemistry. A committee was appointed to assess these learning goals in four courses, which encompass four core areas of chemical knowledge: Quantitative Analysis (Analytical Chemistry), Inorganic Chemistry 1 (Inorganic Chemistry), and the introductory Physical Chemistry course (Physical Chemistry). In addition we also established expected learning outcomes that included the implementation of a C- or higher as a criterion for success. We were recently advised that such minimum grade criteria is not a preferred method for evaluation purposes, and so we are considering using other methods in the future, such as employing standardized and nationally normalized examinations from the Examinations Institute of the American Chemical Society in each of the core courses. These examinations were developed to evaluate the undergraduate program standards of the ACS Committee on Professional Training, upon which our own learning outcome goals are based. Therefore, using these examinations, we will be able to quantitatively evaluate our students' understanding and application of chemical principles consistent with nationally recognized expected learning outcomes and compare them to national averages, which the Examinations Institute has established based on its compilations of data for over forty years.

At the master's level, students are expected to be familiar with the scientific literature in their fields of study, demonstrate competence in applying the scientific method, and be qualified for professional employment in academia, government, the private sector or for further graduate study toward the doctoral degree.

At the doctoral level, students are expected to be thoroughly familiar with the scientific literature in their field of study, be able to write summaries and/or reviews of scientific literature, demonstrate the ability to conduct independent scientific research, and be qualified for professional employment in academia, government, or the private sector.

- Assessment of how well students are achieving expected learning outcomes

On the basis of the GPAs of students awarded baccalaureate degrees in Chemistry over the 2001-2008 period, it is evident that graduating students are achieving expected learning outcomes. Review of papers, lab reports and exams from the four selected core courses (Quantitative Analysis, Inorganic Chemistry, Introduction to Physical Chemistry) by a department committee indicated general good quality in accord with the 5 departmental criteria listed above (average of 3.0 on a 1-5 scale, with 5 being outstanding quality). The core courses in the Department of Chemistry and Biochemistry remain ACS certified and all courses are periodically evaluated for content and level of instruction through examination of course syllabi by a departmental committee, which has indicated no major problems. All faculty are also assessed for quality of teaching by a master teacher on a regular basis.

At the master's level, based on review of student work, 90-100% of students are meeting the learning criteria. The same percentages are employed in appropriate professional positions or are attending graduate school. The average total GRE score of admitted master's students was:

1187 in 2004-2005 (10 students); 1137 in 2005-2006 (3 students);
1190 in 2006-2007 (3 students); 1079 in 2007-2208 (7 students)

It has remained relatively constant, and is essentially the same as the average for students who were admitted and registered. The average time required to complete the degree over the past seven years has varied from 1.67 to 3.50 for between 2-9 students each year. This is normal variation seen in a doctoral program given the varying situations of individual students.

At the doctoral level, review of student papers and research indicates that 95-100% of students are meeting the learning criteria. All graduates are employed in appropriate professional positions. This program requires a minimum GPA and GRE scores, as well as an undergraduate degree in chemistry or biochemistry (or equivalent). These criteria are warranted to insure that incoming students have the ability and background to succeed in the programs.

The average total GRE score of admitted doctoral students was:
1204 in 2004-2005 (9 students); 1119 in 2005-2006 (9 students);
1128 in 2006-2007 (4 students); 1163 in 2007-2008 99(16 students)

It has remained relatively constant, and is essentially the same as the average for students who were admitted and registered. The average time required to complete the degree over the past seven years has varied from 2.67 to 7.50 for between 1-7 students each year. This is normal variation seen in a master's program given the varying situations of individual students.

- Description of how results of assessments are used for continuous improvements

Results of all assessments are discussed among the members of the appropriate program committee (i.e., undergraduate or graduate), who then make recommendations on any needed changes, including possible modifications or additions to specific courses and/or programs. The recommendations are then assigned to appropriate faculty who are charged with responding to them. For example, in response to concerns about the increasingly large enrollments and resulting impersonal nature of the organic chemistry lecture and laboratory classes, the department's Undergraduate Programs Committee recommended a re-evaluation of the curricula of these courses. As a result, the organic chemistry faculty then developed a plan for instituting the small-group OrgoBONDing sessions into the lecture course and consolidating the Organic Chemistry 1 and Organic Chemistry 2 lab courses, as described earlier. This plan was then discussed and approved by the entire faculty during their annual retreat. After review by the appropriate college and university committees, these changes were incorporated into the chemistry curriculum.

- Review of lower-level prerequisite courses to ensure compliance with state-approved prerequisites

For our baccalaureate degree program, these courses include the following:

General Chemistry 1 and Lab (CHM 2045 and CHM 2045L)
General Chemistry 2 and Lab (CHM 2046 and CHM 2046L)
Organic Chemistry 1 (CHM 2210)
Organic Chemistry 2 and Lab (CHM 2211 and CHM 2211L)

These courses are not only compliant with state-approved prerequisites, but are also compliant with those approved by the Committee on Professional Training of the American Chemical Society.

- Limited access programs

The department has no limited access programs.

4. Research
- Review of Part II of the Department Dashboard Indicators

Research has been quite active in the Department. Over the last six years, an average of 35 peer-reviewed publications and 55 presentations were made each year by the faculty and students of the department. During this same period, research funding exceeded $1,000,000 each year, the high being reached in 2003-2004, when such funding exceeded $3,500,000. Since then, research funding has significantly declined to $1,300,000 reported in 2007-2008. This decline is primarily due to the expiration of a major research grant from the State of Florida that supported the Center of Excellence in Marine and Biotechnology Research and the resignation of its director, Professor Russell Kerr, who had substantial external funding in addition to that grant. We expect additional declines as a result of the recent resignation of Professor Gregg Fields, who held some of the largest research grants in the college.

- Establishment of goals for research

As reported in the FAU Assessment Database, our goals for our research program consist of (1) at least 50% of full-time faculty publishing or having accepted for publication at least 1 article, book or chapter in an appropriate outlet per academic year, (2) at least 50% of full-time faculty presenting at least one poster or paper at a professional meeting per academic year, and (3) at least 50% of full-time faculty obtaining funding for research over a three year period.

- Assessment of how well goals are being met

The departmental goals for research have been consistently met over the past seven years. Consideration of raising these goals to higher levels in future years may thus be indicated.

5. Service
- Review of Part III of Departmental Dashboard Indicators

The Department's record of service is good, with an average of at least one membership on one membership on departmental, college, and university committees each year. Additionally, at least half of the faculty are members of community or professional committees and virtually all have served as referees for professional publications.

- Establishment of goals for service

As reported in the FAU Assessment Database, our goals for our service program consist of (1) at least 50% of full-time faculty being active in the service activities of professional organizations and associations each academic year, (2) at least 50% of full-time faculty being active in the service activities of the university and college, and (3) 100% of full-time faculty being active in the internal and external research activities of the department.

- Assessment of how well goals are being met

While the first two service goals have consistently been met, the Department has come short in the third, owing to the non-participation of some faculty in the service activities of the department. These faculty will need to be encouraged to engage in such activities in the future.

6. Other Program Goals

A major additional goal of the department has been the recruitment of outstanding faculty. Thanks to support from the CES College of Science and the Division of Research, this goal has been met. In the past seven years, the following faculty have been recruited to the department, mainly as replacements for faculty who have retired or resigned:

- Dr. Predrag Cudic, an organic chemist who has worked with a Nobel Prize winning chemist at the University of Paris and has already obtained major funding from the American Heart Association and other agencies.
- Dr. Andrew Terentis, a spectroscopist who is breaking new ground in the characterization of cancer cells using Raman Spectroscopy.
- Dr. Donna Chamely-Wiik, a chemical education specialist who recently obtained a $2.5 million grant to enable graduate students to work with local high school students and teachers.
- Dr. Stefan Vetter, a biochemist recruited from the prestigious Scripps Research Institute.
- Dr. Guodong Sui, an analytical chemist who is developing new techniques for the detection of diseases using microfluidic techniques.
- Drs. Alberto Haces, Krista Kasdorf, and Evonne Rezler, who have spearheaded innovative teaching methods in our undergraduate courses,

In addition, a new department chair, Dr. Ramaswamy Narayanan was recruited from the Biological Sciences Department last year. Dr. Narayanan is an expert in Bioinformatics and has recently established a drug-testing facility in the department. He has also worked to generate new collaborative opportunities with recently established local institutions such as the Scripps Institute, the Torrey-Pines Institute and the Max Planck Institute

7. Strengths and opportunities that support achievement of program goals

At the undergraduate program level, strengths and opportunities of our program include the following:

- Highly qualified faculty teach all levels of undergraduate chemistry and biochemistry courses.
- Innovative conceptually based peer learning initiatives were developed through the ChemBOND project are currently instituted in the following courses: General Chemistry I (ChemBOND), Organic Chemistry I (OrgoBOND) and as of 2009, on a voluntarily basis, Biochemistry I (BioBOND). These have been shown to improve student learning and student grades.
- Undergraduate laboratory courses offer students real experience in spectroscopic techniques (as opposed to virtual labs only) such as NMR, IR, CD and others. This is a direct result of the previous establishment of a state of the art core facility in the Department.
- The National Science Foundation and other agencies have awarded several grants to department faculty for innovative undergraduate chemistry education initiatives.
- Our lower division undergraduate courses have experienced large enrollment growth and have yielded a significant number of high quality students that have been accepted to various professional schools or doctoral programs.
- The American Chemical Society has approved our undergraduate courses and programs.

At the graduate and research levels, our strengths and opportunities include the following:

- Strong individual faculty members have good external funding publishing in superior journals
- High quality graduate students have gone on to prestigious post-doctoral training.
- The NSF GK-12 Program, funded at $2.5 million, enables graduate students to work with local high school students and teachers.
- Opportunities and relationships have been established with Scripps Institute, Max-Plank Institute, and Torrey-Pines Institute.
- We have excellent instrumentation, including a drug-testing facility and core instrumentation facilities.
- Research collaborations have been established between departments within FAU (Biological Sciences, Environmental Science, Biomedical Science).
- The merger of the Harbor Branch Oceanographic Institute with FAU offers additional opportunities for research collaborations.

8. Weaknesses and threats that impede program progress

At the undergraduate program level, weaknesses and threats of our program include the following:

- Increasing class sizes (some now exceeding 300) impedes student success.
- Outdated computers and insufficient numbers of basic laboratory equipment often lead to unpleasant lab experiences and frustration among students.
- Inadequate preparation of many freshman students impedes their success in lower –division courses
- Increasing DFW rates in introductory chemistry courses needs attention.

At the graduate and research level, weaknesses and threats to the department include the following:

- Two major research faculty (Drs. Kerr and Fields) left the university, which significantly reduced research activity and funding.
- There is little money for recruiting of high-quality graduate students.
- There have been significant problems maintaining our research equipment, due to inadequate funding and inability to hire support personnel.

- Faculty salaries have not kept up with national norms, which could lead to more losses and failures to attract high quality new faculty.
- Graduate student stipends have not kept up with those of other chemistry graduate programs at other institutions, making recruiting increasingly difficult.

9. Resource analysis

Owing to acquisition of new instrumentation from grants and some internal funds, research facilities in the department are quite good. These include a core facility consisting of a variety of spectroscopic instruments for characterization of new compounds (NMR, MS, FTIR) and equipment for protein synthesis and analysis. More recently, a drug screening facility was created to test compounds synthesized by departmental and external investigators for biological activity. Unfortunately, there have been difficulties keeping all this equipment properly maintained, due to inadequate funding. Equipment used in teaching laboratories is aging, with some equipment having been used for over 20 years. Since there is little prospect of university funds being allocated for replacement of this equipment, other sources of funds need to be identified and sought.

10. Major findings and recommendations

Over the last seven years, the Department has met its increasing teaching responsibilities, primarily by increasing class sizes in lower division courses. Our undergraduate B.A. and B.S. degree programs are solid and thriving. On the other hand, while our graduate programs and research funding remain very active, there are disturbing negative trends in both. Inadequate recruiting, uncompetitive stipends and the loss of highly productive faculty have led to significant reductions in graduate enrollment and external research funding. Additional resources need to be allocated to meet these increasingly threatening problems. Unfortunately, recent state budget cuts have made such allocations from university funds unlikely. Other sources of funding for these activities will need to be pursued. In any event, growth of the Department's teaching and research efforts is imperative. Recruiting new tenure-track faculty with good potential for attracting external funding is of the highest importance in continuing this growth.

C. Complex Systems & Brain Sciences

1. Mission and purpose of the program

The mission of the Center for Complex Systems & Brain Sciences is to understand the principles and mechanisms underlying complex behavior at all levels, from molecules and cells to whole brain functioning, including the interactions of people working together. Such understanding is crucial not only for understanding the function of the normal brain but also for the treatment and rehabilitation of neurological and neuropsychiatric diseases that afflict society from early childhood to old age. The Center contains state-of-the-art research facilities in the areas of human brain imaging and cognition, neural growth and development, cellular neurophysiology, biophysics, and theoretical and computational neuroscience. A central focus of the Center is the Ph.D. program in Complex Systems & Brain Sciences, created to provide a multi-disciplinary training program with the goal of creating a "new breed" of scientist who can unite theory and experiment, computational modeling, and complex data collection and analysis using sophisticated methods and the latest technologies.

2. Last external review

Since the last review in 2001 we have made significant improvements to our Ph.D. program by introducing a Graduate Student Evaluation Committee that performs annual reviews of all students in the program and evaluates their progress based on an evaluation form that is filled out and signed annually by the student and his/her advisor. Since 2006, the Center administers the new Neuroscience Certificate program at FAU. A major change occurred in 2004/05 when faculty lines in the Center were transferred to either the Department of Physics or Psychology, depending on the tenured line of individual faculty members with the result that only two line positions (Dr. J.A.S. Kelso and Dr. J. Blanks) remain within the Center.

3. Instruction

3.1 Review of Departmental Dashboard Indicators

During the academic years from 2001-02 to 2007-08, the Center offered an average of 15 graduate lecture/seminar courses with an average enrollment of about 9 students, and over 20 other course-type sessions such as directed independent study (DIS) per year. Numbers listed in the dashboard indicators are somewhat misleading since during some semesters, DIS was listed with a single advisor where all students could enroll. Now DIS courses are listed on an individual basis with only one student enrolled per faculty member. The quality of the instruction evaluated by students using the SPOT form is similar to the average in the college and in the university in general for graduate courses with average ratings of 1.8 and 2.0 on the quality of instruction (item 20) and instructor (item 21), respectively. Enrollment in the Center's doctoral program has fluctuated between 15 and 30 students with about 40% non-resident aliens at any given time and 2-4 doctorates awarded per year. The average time to graduation is about 5.5 years.

3.2 Learning Goals

The main goal of our Ph.D. program is to prepare students for the competitive job market in industry and academia. To achieve this goal, students have access to modern experimental and computational equipment and are encouraged to interact with leading professionals in their fields.

Declarative knowledge in the Center's Ph.D. program is assed in the two core courses Neuroscience I+II, and Introduction to Nonlinear Dynamics and Chaos. As these are very different areas, in which most of our incoming students have a background in one of them but not both, they form a ideal basis for monitoring student progress during their first year in the program. At a later stage, the ability of students to complete scientific work is evaluated by point system that monitors the students' activities of making their

work public both orally and written. Each publication of an article in a journal counts as two units and each meeting presentation as one unit. We expect that 75% of students will have achieved at least 1 unit by their 3rd year in the program and 3 units at the time of their defense. We also expect the senior graduate students to present their research in poster form at the Annual Charles E. Schmidt College of Science Research Day.

3.3 Assessment of Student Achievement

Since the point system for evaluation was put in place several years ago, it was met on average by about 70% of our students. As the Science Research Day is relatively new, we only have data from the past year, where four of our graduate students participated successfully.

Over the last five years, 90% of Center graduates were placed within their first year after graduation in either post-doctoral or teaching positions. Student placements included such prestigious institutions as the National Institute of Health (NIH), University of California at San Francisco, New York University, Emory University (Atlanta), Harvard University (Boston), and the Salk Institute (San Diego).

3.4 Continuous Program Improvement

The progress of students while in the program is documented in an annual evaluation form, which is filled out and signed by the students and their major advisor. This form contains the student's achievements in the previous year and lists the goals for the next year. Included are courses taken and grades, all publications and presentations, the dates of committee meetings, the number of achieved units, an S/U rating by the main advisor regarding the student's progress, and, where applicable, the anticipated date of graduation. These forms are submitted to the Chair of the Center's Student Evaluation Committee, which consists of a total of three faculty members, discussed at a meeting and reported to the Center Director and faculty where appropriate.

4. Research and 5. Service

Research and service of the Center's faculty members are evaluated and reported by their respective departments (either Psychology or Physics).

6. Other Program Goals

In addition to competitiveness in the job market, we expect our graduates to be able to communicate orally scientific methods, findings and their importance, and to participate in appropriate academic and social activities. To this end we encourage students to present their work as a poster at the Annual Charles E. Schmidt College of Science Research Day, at conferences and in seminars. As the Science Day is a relatively new activity, we only know that this year four of our students presented a poster there, a number we expect to significantly increase in the future. For a long time most of our senior graduate students have presented their work at the annual meeting of the Society for Neuroscience. Unfortunately, a major source of funding for participation there, the Student Graduate Association, has dried up since the travel freeze at FAU went into effect.

7. Strengths and Opportunities

A major strength of the Center's program is the diversity in the backgrounds, not only of the students, but also of the faculty. Incoming students, with a degree in psychology or the social sciences, have to acquire in-depth mathematics, whereas students with a physics or engineering background have to work hard to pass the Neuroscience requirements. The faculty is proud of our students since they help each other overcome their specific weaknesses.

The Center has access to a state of the art 3-Tesla fMRI scanner but, unfortunately, there is currently nobody who is qualified to coordinate access, train and assist students and faculty in the use of this machine. A major improvement would be the recruitment a post-doctoral fellow to be in charge of all fMRI research and training at the Center.

8. Weaknesses and Threats

The major weakness of our graduate program was the inability to bring in new students for two years in a row due to lack of funding or lack of acceptances by potential students. However, the situation appears to be turning around since two students have just entered our program this Spring (2009) and another three well-qualified students have entered our program in the Fall of 2009.

Due to the current financial situation within the University, our computational equipment is severely outdated and in need of replacement. There is a desperate need to upgrade our computational facilities in order to maintain the high quality of computational mathematics essential for our graduate program.

9. Resource Analysis

The Center is well equipped for research and training that involves EEG. The lack of adequate computers (as mentioned above) is a dire situation and is hindering the Center's ability to train students adequately in Computational Neuroscience. Likewise, there is a grave need for a post-doctoral fellow to train and oversee the fMRI needs of the Center and its students.

10. Major Findings and Recommendations

In summary, the Center faculty is doing an exceptional job of fulfilling their instructional duties of teaching graduate courses for students, both from our program, as well as from other graduate and undergraduate programs in the College of Science and in the College of Engineering. We are proud that the time to degree of students in the Center is similar to other doctoral programs in the College. The Center program is composed of both domestic, as well as about 40% foreign graduate students.

We recommend the purchase of at least ten "state-of-the-art" computers for graduate students in the Center in order for them to meet the computational needs of their research projects. There is also an immediate need for funds to hire a post-doctoral fellow trained in MRI studies, to supervise training and data analysis of projects involving the use of fMRI at the equipment located at the adjacent FAU Research Park.

D. Environmental Sciences Program

1. Mission and purpose of the program

The mission of the Environmental Sciences Program at Florida Atlantic University is to educate and support students who are motivated to reach the highest level of professional achievement in environmental science. Research is focused on issue-driven topics in wetland and coastal systems to capitalize on the research strengths and experience of the FAU faculty and the diverse community of environmental scientists in southern Florida. Faculty and students in the ES Program maintain active research collaborations within FAU and the broader community, and provide science-based leadership and guidance on environmental issues at the local, regional and national level. The program curriculum is built on a flexible framework that gives students a broad understanding of the multidisciplinary field of environmental science while providing in-depth knowledge and training in their specific field of study. By emphasizing experiential learning and faculty mentoring, the ES program prepares students to meet the challenges they will face as environmental scientists in the coming decades.

2. Date and description of last external (i.e., accreditation) review, if applicable, or last review of this program, and major changes made since last review.

The last review of the ESP was done in 2000-2001. At that time, three students had completed their Master of Science degree and the program had grown from an enrollment of 10 in 1998, the year it began, to 32 in 2001. The majority of students were from the South Florida area, but nearly 25% were out-of-state or foreign. Each of the four professors teaching the four required core courses maintained their own research programs in which they actively involved ESP students. A total of eleven professors, representing five Departments and three Colleges, were directing student research in 2001. The cost of the program to the University was minimal, providing a half-time Director and a half-time Program Assistant; in their absence, an Assistant Director performed their duties as needed. The $116,705 budget was allocated to salaries for Graduate Student Teaching Assistants (70%), salaries for the Director and Program Assistant (17%), and expenses (13%). The ESP was one of the fastest growing programs in the Charles E. Schmidt College of Science, and growth was limited mainly by the shortage of professors able to accept new students.

In 2002, when the biological sciences units at the Davie and Boca Raton campuses were merged within the Charles E. Schmidt College of Science, Dr. John Volin became Director of the ESP. From 2002-2005, student enrollment was stable at approximately 20-25 students and new faculty research advisors were recruited. Annual funding of $190,000 was secured for the construction and maintenance of the Environmental Sciences Research and Teaching Greenhouse. This state-of-the-art facility, which opened at the FAU Davie campus in early 2007, includes a teaching laboratory and provides facilities for grant-funded research by FAU Faculty. In 2006, FAU entered into an agreement with the University of Florida/Institute of Food and Agricultural Sciences (UF/IFAS) for a joint use facility at the South Florida Education Center in Davie that is slated for completion in 2010. This facility, which will house scientists from both universities and the USGS, will greatly enhance the teaching and research mission of the ESP.

Since Fall 2007, when Dr. Dale Gawlik became Director of the program, a broad range of important changes to the ESP have been implemented:

- Significant curriculum revisions and the introduction of a non-thesis degree option that have gained approval by the Faculty Senate and are expected to be in place by Fall 2009.
- Establishment of new partnerships and collaborations with several organizations and agencies to provide support for student research, including several paid internship agreements and a $500,000 Fellowship Initiative with the National Park Service.
- Formation of standing Admissions and Program committees.
- Hosting of regular workshops and a seminar series.

- Creation of two new faculty positions in Biological Sciences and Geosciences.

Applications and new admissions to the program, which declined significantly during a transitional period in 2005-2007, are again rising; as of Spring 2009, 13 students were enrolled in the program. A total of 38 faculty, with appointments in five Colleges and more than nine Departments, now provide prospective students with the opportunity to conduct thesis research in diverse areas within an integrated research program that focuses on the human, freshwater, and near shore marine systems that dominate South Florida. The teaching and research facilities of the ESP faculty now comprise locations at four campuses and multiple off-campus sites. The newly created and continuously updated ESP web site facilitates the interaction of prospective and current students with faculty and staff, enabling them to find researchers working in their areas of interest and providing an effective forum for the dissemination and exchange of information. The ESP budget of $55, 971 is allocated for salaries ($47,971) and Expenses ($8,000). The ESP is now entering a period of rapid growth; a strong CESCoS commitment to support for ESP faculty, staff, and facilities, coupled with strong extramural support through partnerships and grant funding for research staff and faculty, ensures its future growth.

3. Instruction

- Establishment of goals for student learning.

The standing Program Committee is currently reviewing the student learning goals, assessment methods and outcome criteria for ESP students in the context of the new curriculum revisions, which expand the range of course topics and research areas and introduce a non-thesis option. An important new addition to the curriculum is the ESP Colloquium Series course offered in the fall semester. All ESP students must be enrolled for a minimum of two semesters in this course, which will provide an instrument for assessing how successfully the ESP is meeting the Program's unique expectations for student learning. The recommendations of the Program Committee will be implemented in 2009-2010.

Student Learning Goals for Program Courses
Student learning goals for ESP courses are under the control of the Departments: Biological Sciences, Chemistry, Geosciences, Mathematics, and Physics in the Charles E. Schmidt College of Science; Urban and Regional Planning in the College of Architecture, Urban and Public Affairs. Substantial changes to the program curriculum which have gained approval from the Faculty Senate, and will be in place for Fall, 2009.

Goal 1: Student Professional Activities
Students will develop substantial familiarity with professional organizations and activities.
Assessment Online surveys are conducted annually to collect information on student participation in University clubs and other activities, research, directed independent study (DIS), interaction with faculty and participation in professional societies.
Outcome Criteria At least 75% of all students will participate in professional activities.

Goal 2: Student Thesis Research
Students will provide an in-depth analysis through research for a thesis in environmental sciences.
Assessment The final written thesis will encompass:
1) A clearly defined objective, hypothesis, and logical reasoning to pursue their particular line of research in the introduction of the thesis.
2) A robust experimental design is presented.
3) The results are clearly presented.
4) The conclusions are logically based on the results.

Assessment is performed by the thesis committee, the departmental graduate coordinator, or the ESP Director. Each of the four criteria will be assessed on a scale of 1 to 5, where 1=not acceptable, 2=marginally acceptable, 3=good, 4=very good, 5=excellent.
Outcome Criteria At least 75% of ESP graduates will score a total of 12 or better on the four assessment criteria.

Goal 3: Student Accomplishments after Graduation
Students will gain employment in industry, government or teaching in the field of environmental sciences.
Assessment: Annual surveys are conducted and a database is kept to track student career paths after graduating from the program.
Outcome Criteria: At least 90% of all students that seek employment in the discipline are able to obtain appropriate employment within one year.

- Assessment of how well students are achieving expected learning outcomes.

Records kept by the staff of the ESP program are current through 2005, but records in the Assessment Database have not been consistently updated since 2003. The duties and procedures related to the maintenance and updating of the Assessment Database are currently being reviewed by the ESP Program Committee. The committee recommendations will be implemented and documented by ESP faculty and staff.

Goal 1: Student Professional Activities
From 2002 through 2005, at least 75% of the students participated in one or more professional activities: clubs and other activities, 21%; research, 97%; Directed Independent Study, 70%; interaction with faculty, 79%; professional societies, 45%.

Goal 2: Student Thesis Research
From 2002 through 2005, 100% of students scored 12 or better on the evaluation of the written graduate thesis. Out of 38 students enrolled, 32 successfully defended their thesis and were awarded a degree within 3 years; 6 withdrew from the program.

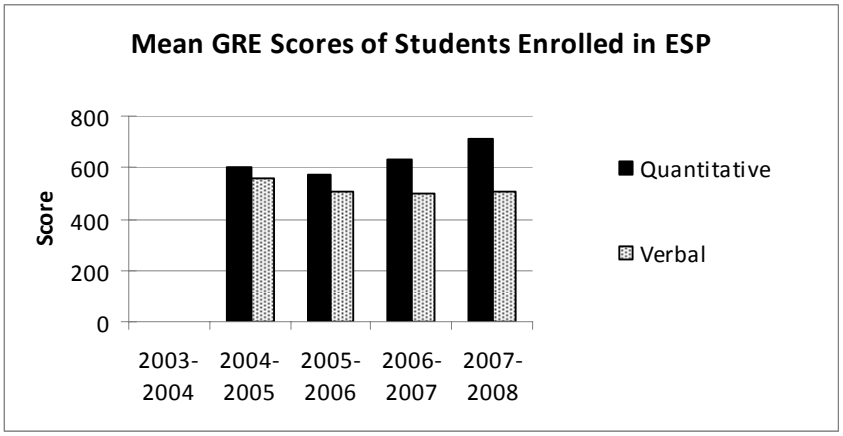
Goal 3: Student Accomplishments After Graduation
As of 2005, 11 ESP Master's students had provided information on their post-graduation employment status. Out of 7 students who sought employment, 100% had obtained appropriate employment within the discipline; 3 students had entered a doctoral program. One student did not seek employment immediately after graduation.

- Description of how results of assessments are used for continuous program improvement.

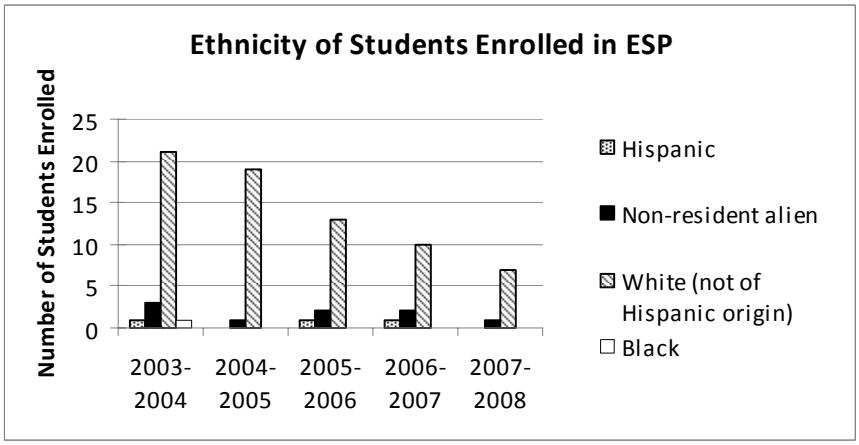
Overall, program assessment results have exceeded expectations, with 100% of students for whom data was available either achieving or exceeding the target outcomes. However, the lack of complete information for all students and periods, particularly during transitions between directors when staff turnover was high, highlights the need to establish standardized procedures and define responsibilities for the program faculty and staff. The Program Committee is currently reviewing the student learning goals, assessment methods and outcome criteria for ESP students in the context of the new curriculum revisions, which expand the range of course topics and research areas and introduce a non-thesis option. Development of clearly defined duties and procedures related to the maintenance and updating of the FAU Assessment Database are also under review by the Program Committee. The standing Program Committee, constituted in 2007, will play a critical role in the ongoing process of developing assessment strategies, evaluating results and recommending measures for program improvement.

- Review of longitudinal trends in student index data.

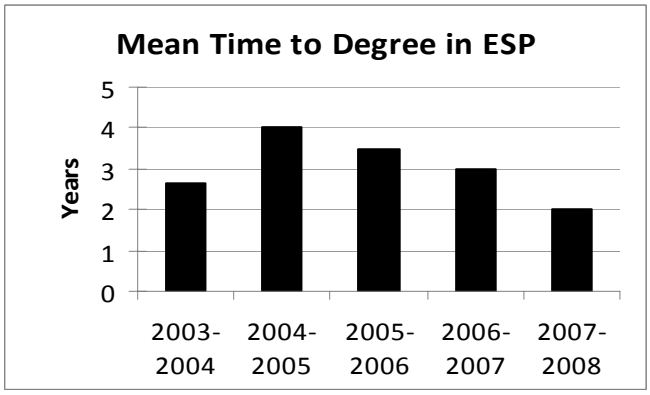
GRE SCORES: The recorded GRE scores of students enrolled in the ESP program are comparable to those of graduate students in other departments of the CESCoS. Scores on the Quantitative GRE appear to rising, but the relatively small sample size (ranging from in 6 in 2006-2007 to 1 in 2008-2009) precludes meaningful statistical analyses of longitudinal trends in GRE scores.



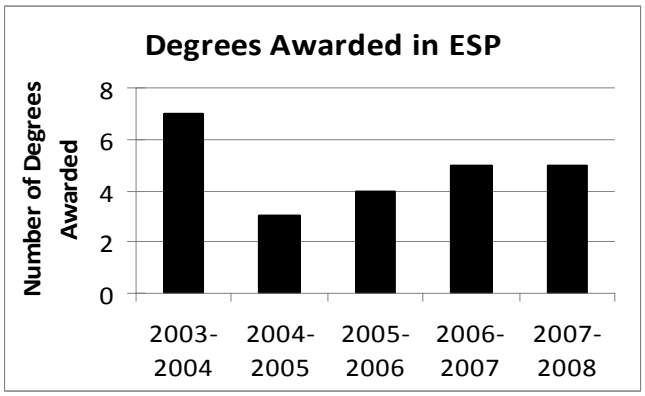
ETHNICITY: The recorded ethnicity data shows that students enrolled in the ESP graduate program are predominately white (of non-Hispanic origin.). The small number of non-white students and the small sample size (ranging from 25 in 2003 to 8 in 2007-2008) precludes meaningful statistical analyses of trends in ethnicity.



MEAN TIME TO DEGREE: The recorded mean time to degree for students awarded the MS degree is comparable to that of MS students in other departments of the CESCoS. The relatively small sample size (ranging from 7 2003-2004 to 3 in 2005-2006) precludes meaningful statistical analyses of longitudinal trends in time to degree.



DEGREES AWARDED: The recorded data for the number of MS degrees awarded in the ESP reflects the drop in enrollment after 2004 that was followed by a period of stagnation through 2007-2008. However, the relatively small sample size (ranging from 7 2003-2004 to 3 in 2005-2006) precludes meaningful statistical analyses of longitudinal trends in degrees awarded.



- Summary

1.Major Changes

o New facilities

- UF/IFAS joint center at the Davie South Florida Education Center (SFEC)
- ES Research and Education Greenhouse
- Harbor Branch

o Academic Program

- Constitution of standing committees: Admissions, Program
- Curriculum revisions, including a non-thesis option, and a broader scope to provide a greater range of options for student coursework
- Initiation of workshops and seminar series
- Fellowship Initiative with National Park Service: $500,000/5 years
- Student Internships with outside agencies

o Research

- FAU membership in US Department of Interior's Cooperative Ecosystems Studies Unit
- ESP Research Initiative to foster increased faculty involvement

2. Strengths

o Faculty

- Strong extramural funding of Faculty research related to environmental science from federal, state and local agencies and private industry
- CESCoS funding support for ESP Director and research facilities at Davie campus for grant-funded ESP Faculty and Research Faculty
- High level of faculty support for student research through ESP research initiative

- Two new faculty positions (Biological Sciences, Geosciences) with emphasis on research programs in environmental science fields

o Students

- Students entering the ESP bring diverse undergraduate academic backgrounds and interests.
- High and increasing level of qualification, as evidenced by high and improving GRE scores
- Increased demand as evidenced by increasing enrollment and post-degree employment
- Increasing recruitment through university and college funding for student incentive programs, outreach efforts, and development of ESP web site

o Impact on the community

- Sponsorship and organization of outreach activities, workshops and public seminar series fosters community understanding and support for Everglades restoration, global climate change responsiveness, sustainable development and other environmental issues that have majors impacts on southern Florida
- Internship and partnership programs with federal, state and local agencies and organizations foster collaborative research within the local community
- Graduates fill a vital community need for professionals in environmental science

o Physical facilities

- Well equipped teaching and research facilities at Boca Raton, Davie, Harbor Branch and Ft. Lauderdale campuses
- Construction of new facility at the Davie SFEC, in partnership with UF/IFAS that will house the FAU Biological Sciences research laboratories and support the research and teaching mission of the ESP.

3. Weaknesses

o Faculty

- The number of faculty positions in all areas related to the ESP has declined through attrition in recent years, reducing student research opportunities and the scope and availability of ESP course offerings.

o Students

- Students enter the ESP with highly diverse undergraduate academic backgrounds and interests. In the past, this strength has also been a weakness, in that some students lacked the basic foundation needed to excel in the core courses in the natural sciences. The current curriculum changes being implemented by the ESP Program Committee specifically address this weakness.
- In the past, students in the ESP program have lacked a context in which to share experiences and interests. The Program Committee is addressing this weakness through revisions in the curriculum, such as colloquium courses, and other activities that will foster student interaction and involvement in the academic community.
- Applications to the ESP from minority students have historically been low.

o Impact on the community

- Outreach and education efforts targeting the larger southern Florida community have not been energetically pursued by the ESP, through efforts such as a speaker's bureau of ESP faculty and informational workshops.

o Physical facilities

- In the past there has been a chronic lack of adequate research facilities for ESP faculty and students; the recently completed ESP greenhouse in Davie and other construction currently underway in Davie, such as the joint FAU/ UF science research center on the Davie campus, will dramatically improve this situation.

4. Recommendations

- Building on current strengths

- Continue to attract faculty with robust, extramurally-funded research programs in the Environmental Sciences through strong funding support for faculty, staff and facilities within the CESCoS and other ESP colleges.
- Continue to attract graduate students with diverse backgrounds and strong academic qualifications through ongoing curriculum revisions and research initiatives that broaden the scope of teaching and research in the ESP.

- Rectifying current weakness

- The standing ESP Program Committee will continue to focus on implementing program-wide improvements aimed at accomplishing the program mission and enhancing the multidisciplinary integration of the program: more effective student recruitment, revisions of the graduate and undergraduate curriculum, including the introduction of a non-thesis option, and enlarging the scope of ESP faculty research.

- Adapting to current trends

- Through inclusion the inclusion of faculty in all department of the CESCoS, as well as faculty in the Dorothy F. Schmidt College of Arts and Letters, the College of Architecture, Urban & Public Affairs, the Harriet L. Wilkes Honors College, and the Barry Kaye College of Business, the ESP will continue to focus on research and education related to environmental issues of major importance in southern Florida, primarily those related to water.

4. Research

● Research by ESP faculty is evaluated within their respective departments. All ESP faculty maintain extramurally funded research programs.

● The ESP director sustains an active research program in freshwater wetland systems, with over $2.3 million in funding since 2004, including $1.76 million in current projects funded by the South Florida Water Management District and the National Park Service. He has authored numerous journal articles in avian conservation ecology. The ESP Research Faculty, who currently serves as director of the greenhouse facility in Davie has obtained $188,000 in funding for current projects.

● Environmental Science Research Initiative: This initiative was launched in 2008 with a series of meetings with prospective agency partners in southern Florida. Three co-hosted workshops promoted the new ES research program within the ecosystem restoration community. A conceptual research model for the initiative was developed with input from faculty and outside scientists**.** Results of this initiative include:

- Enhanced collaboration between ESP faculty and Everglades researchers
- Funding from the National Park Service for a $500,000 Fellowship Program for new post-docs, PhDs, MS students, and interns.
- Funding for SFWMD Intern positions.
- Participation of 8 ESP faculty and 8 students at the Greater Everglades Ecosystem Restoration (GEER) Conference.

5. Service

● Faculty service is evaluated in the respective departments and colleges.
● The ESP Director and faculty provide extensive service toward program development and enhancement, including membership on standing ESP committees, leadership of non-profit organizations and participation in federal, state and local agency committees.

- Jay Baldwin, an ESP faculty member in Biological Sciences, now represents FAU on the Scientific Advisory Committee to the Federal Task Force for Comprehensive Everglades Restoration.
- ESP Research Faculty serve on the FAU Conservation Committee
- ESP Faculty serve on the Broward County Climate Change Task Force

6. Other Program Goals

The ESP Program Committee has constituted a multidisciplinary subcommittee that will review and recommend revisions to the undergraduate Environmental Sciences Certificate program, with the aim of increasing student interest and enrollment, expanding faculty involvement and providing a foundation for graduate recruitment.

7. Resource analysis

Sufficiency of resources to meet program goals

- Current ESP faculty research provides a broad range of choices for student research
- Existing and planned research and teaching facilities provide ample space for ESP research and teaching.
- As the ESP program expands, additional staff positions will be needed.
- Additional faculty positions in environmental science fields will be needed to support the teaching and research mission of the program as it grows.

8. Major findings and recommendations

The Environmental Science Program is poised to grow rapidly in coming years as it capitalizes on the addition of research and teaching facilities, builds on recently established partnerships with federal, state and local agencies, and encourages wider involvement and collaboration of faculty within the framework of the ES Research Initiative, which focuses on water issues. The standing Program Committee should continue the process of revising the graduate and undergraduate curriculum to broaden its scope and draw students with diverse needs and interests. In particular, there should be an effort to identify undergraduates with an interest in the ES at an early stage of their studies so they can be directed toward the many research experiences available to them via ES faculty. The primary limitation will soon be the number of ES faculty that can take on increased numbers of graduate students that are expected to enroll in the ES program. The creation of new ES faculty positions should be the highest priority.

E. Department of Geosciences

1. Mission and purpose of the program

The Mission of the Department is to provide students with a high-quality scientific education and expose them to professional research focused on the Geosciences through excellence in teaching, research and creative activities. Additionally, we will provide service to the university and local and regional communities by regularly offering courses geared towards a broad education in the Geosciences. Moreover, the department will strive for continued growth in our service mission through expansion in the distance-learning environment, through the continued offering of certificate programs in Geo-Information Science, and through the training of students to solve problems in their communities.

2. Date and description of last external (i.e., accreditation) review, if applicable, or last review of this program.

The last review was the 2000-2001 Program review for the Charles E. Schmidt College of Science, and was for the Department of Geography and Geology. It contained almost no recommendations. One of the most important changes since that time is the name change to Department of Geosciences, which supported the goal of unifying the department.

3. Instruction: Department Level

Since the last program review, the number of undergraduate lecture sections taught per year has averaged 56.6 ∀ 2.6. (∀ numbers are 1 standard deviation) The average enrollment was 48.7 ∀ 7.0. The percentage of sections taught by faculty averaged 80.4 ∀ 10.4. Starting in 2002-2003, there was a an increase in the percentage of courses taught by faculty of over 20%, and the average since then is 85.7% ∀ 3.3. The number of undergraduate lab sections taught per year has averaged 24.4 ∀ 2.5, with an average enrollment of 18.4 ∀ 2.0.The percentage of lab sections taught by faculty decreased from an average of 12.3% for the first three years to 3.4% for the last three years, reflecting an increased availability of GTA's. The number of graduate lecture sections taught per year has averaged 16.4 ∀ 4.2, with an average enrollment of 7.7 ∀ 1.6. The percentage of sections taught by regular faculty averaged 92.4 ∀ 6.3.

The average state-fundable FTE for lower-division UG sections per year produced by majors averaged 3.2 ∀ 1.5, for in-college non-majors averaged 15.2 ∀ 4.2, and for out of college students averaged 129.1 ∀ 12.8. The in-college non-majors showed a significant increase to 18.4 in 2006-2007, and a further increase to 23.4 in 2007-2008, although the reason for this is not known. For upper-division UG sections, yearly averages were 24.4 ∀ 6.5 for majors, 9.0 ∀ 3.3 for in-college non-majors, and 26.6 ∀ 8.5 for out-of-college students. The in-college non-majors showed a strong increase from 4.5 FTE's in 2001-02 to 11.6 FTE's in 2007-2008, probably reflecting the increasing popularity of GIS courses. The out-of-college FTE's also showed a strong increase from 13.3 FTE's in 2001-02 to 30.8 FTE's in 2007-2008, again probably reflecting the increasing popularity of GIS courses. For graduate sections, yearly averages were 12.2 ∀ 1.2 for majors, 1.9 ∀ 0.8 for in-college non-majors, and 2.0 ∀ 0.6 for out-of-college students. No trends were apparent. Figures 1, 2, and 3 show plots of the data for geosciences majors, college of science students, and out-of-college students, respectively, versus Academic Year.

Figure 1

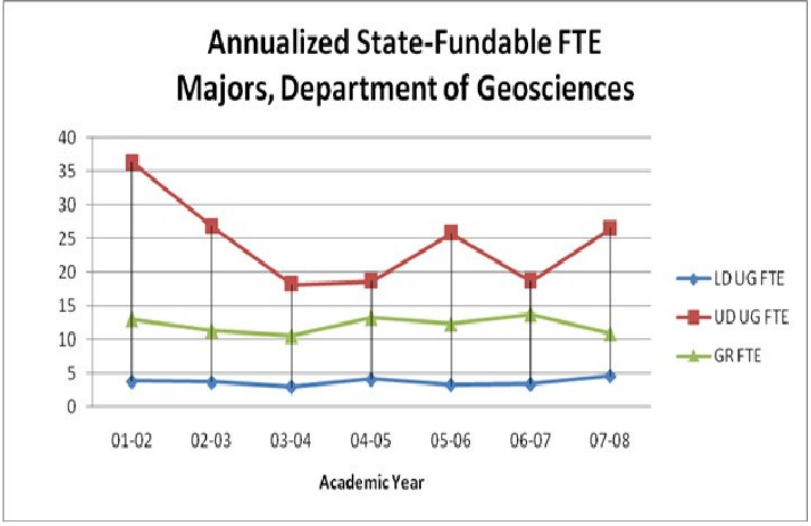


Figure 2

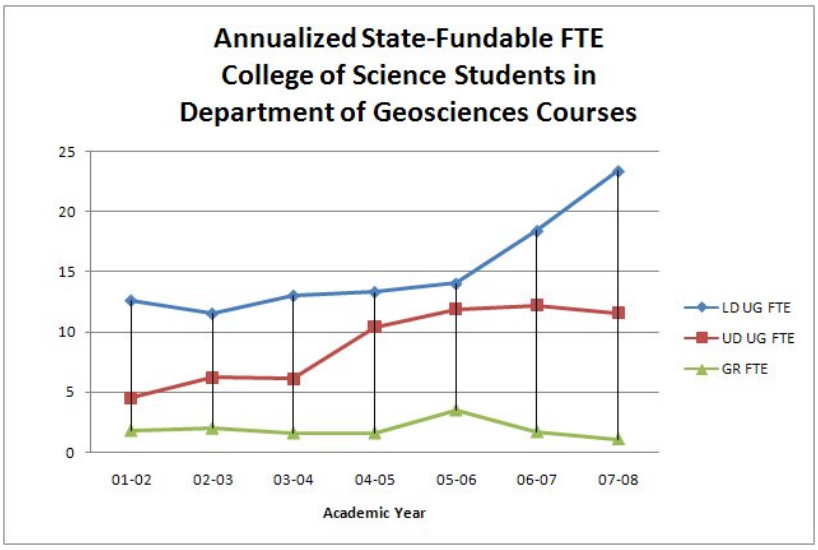
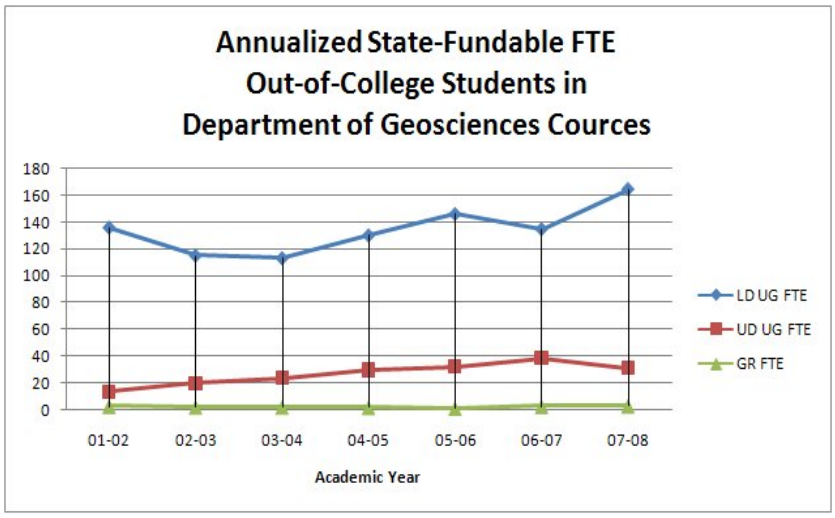


Figure 3



Instructor ratings were measured on SPOT surveys. For 2001-2002 through 2004-2005, question 8, the overall rating of instructor was used, with a scale of 1 = excellent, 5 = poor. Department averages for undergraduate instruction were consistently at or below (by 0.1 units) both college and university averages (lower numbers mean better teaching). At the graduate level, department averages at or below (in 2003-2004, by 0.2 units) college and university averages. This reflects the high quality level of teaching shown by the disproportionate number of teaching awards won by department faculty. Starting in 2005, questions 20 (Quality of Instruction) and 21 (Quality of Instructor) were substituted for question 8. For both 2005-06 and 2006-07, undergraduate department averages on question 20 were 0.2 units below college averages, and equal or below university averages. In 2007-2008, department average remained the same, but 0.1 units better than the college average, and equal to the university average. For both 2005-06, 2006-07, and 2007-2008, department averages on question 21 were equal or below the college average, and slightly below 05-06) or slightly above (06-07 and 07-08) the university average. Graduate department averages on question 20 were equal or below the university averages, and 0.1 unit higher than college average in 2007-2008. . For both 2005-06, 2006-07, and 2007-2008, department averages on question 21 were 0.1 units above the college and university averages.

Student Satisfaction surveys are administered by the university every two years. In most cases, the number of responses was three or less, making statistical comparisons impossible. (UG responses in 2005 were the exception, with either 5 or 6 responses). For the undergraduate program, the "Quality of Instructors in the degree program" was between 3.5 and 4.0 (scale 4 = excellent, 1 = poor). For the graduate program, the "Quality of Instructors in the degree program" was 3.0 in 2001, 2003, and 2005, but increased to 3.6 (3 responses) in 2007. For the undergraduate program, the "Quality of advising by faculty" increased from 3.0 in 2001 to 3.5 in 2005. There were no responses in 2007. For the graduate program, the "Quality of advising by faculty" the numbers ranged from 3.0 to 4.0. Response level is small, but the "trend" is downward, indicating more time may need to be spent on graduate advising.

Program Level

Separate data for B.A. and B.S. are not available, so these programs are combined.

Majors Enrolled by Level

Program	2001-2002	2002-2003	2003-2004	2004-2005	2005-2006	2006-2007	2007-2008
B.A./B.S. Geography	61	49	37	32	44	38	
B.A./B.S. Geology	44	40	32	38	36	32	45
M.A. Geography	35	26	29	24	24	20	20
M.S. Geology	21	19	18	23	18	16	11

At the undergraduate level, the Geography Bachelor's program has had greater enrollment and annual change (mean 43.4 ∀ 9.5) than the Geology program (mean 38.1 ∀ 5.2). The same is true at the Master's level, Geography mean 25.4 ∀ 5.3, Geology mean 18.1 ∀ 3.8.

Majors Enrolled by Ethnicity
Geography - BA/BS

	2001-2002	2002-2003	2003-2004	2004-2005	2005-2006	2006-2007	2007-2008
American Indian/Alaskan Native	1	2	1	0	0	0	0
Asian or Pacific Islander	1	1	1	1	0	0	2
Black (Not of Hispanic Origin)	6	0	0	0	1	2	3
Hispanic	2	3	5	6	7	7	3
White (Not of Hispanic Origin)	48	41	30	25	36	29	33
Non-Resident Alien	3	2	0	0	0	0	2
Not Reported	0	0	0	0	0	0	0
Total	61	49	37	32	44	38	43

The ratio of White (Not of Hispanic Students) to total students ranged from 76.3 to 83.7%, with a mean of 79.5 ∀ 2.8%.

Majors Enrolled by Ethnicity
Geography - MA

	2001-2002	2002-2003	2003-2004	2004-2005	2005-2006	2006-2007	2007-2008
American Indian/Alaskan Native	0	0	0	0	1	1	1
Asian or Pacific Islander	0	0	0	0	0	0	1
Black (Not of Hispanic Origin)	0	0	0	0	0	0	0
Hispanic	4	2	3	2	0	1	3
White (Not of Hispanic Origin)	26	21	23	22	20	15	12
Non-Resident Alien	5	3	3	0	2	2	2
Not Reported	0	0	0	0	1	1	1
Total	35	26	29	24	24	20	20

The ratio of White (Not of Hispanic Students) to total students ranged from 60.0 to 91.7%, with a mean of 77.8 ∀ 9.8%. The number of non-resident aliens is larger for the graduate program than the undergraduate, reflecting the larger number of international students

Majors Enrolled by Ethnicity

Geology - BA/BS

	2001-2002	2002-2003	2003-2004	2004-2005	2005-2006	2006-2007	2007-2008
American Indian/Alaskan Native	1	1	0	0	0	0	
Asian or Pacific Islander	1	0	0	1	1	0	1
Black (Not of Hispanic Origin)	2	2	2	1	1	1	3
Hispanic	2	5	3	0	4	3	6
White (Not of Hispanic Origin)	38	32	27	34	28	27	33
Non-Resident Alien	0	0	0	2	2	1	2
Not Reported	0	0	0	0	0	0	0
Total	44	40	32	38	36	32	45

The ratio of White (Not of Hispanic Origin) to total students ranged from 73.3 to 89.5%, with a mean of 82.2 ∀ 5.5%.

Majors Enrolled by Ethnicity
Geology - MS

	2001-2002	2002-2003	2003-2004	2004-2005	2005-2006	2006-2007	2007-2008
American Indian/Alaskan Native	0	2	2	0	0	0	0
Asian or Pacific Islander	0	0	0	2	0	1	1
Black (Not of Hispanic Origin)	0	0	0	0	0	0	0
Hispanic	1	2	2	2	1	0	0
White (Not of Hispanic Origin)	18	14	14	18	14	15	9
Non-Resident Alien	2	0	0	1	2	2	1
Not Reported	0	1	0	0	0	0	0
Total	21	19	18	23	17	18	11

The ratio of White (Not of Hispanic Students) to total students ranged from 73.7 to 85.7%, with a mean of 80.4 ∀ 4.1%. The number of non-resident aliens is larger for the graduate program than the undergraduate, reflecting the larger number of international students. The international students also increase the ethnic diversity of the graduate program, relative to the undergraduate program.

Degrees by program

	2001-2002	2002-2003	2003-2004	2004-2005	2005-2006	2006-2007	2007-2008
Geography Bachelor's	19.5	17.0	11.0	6.0	11.0	9.0	8.0
Geography Master's	10.0	4.0	11.0	8.0	7.0	5.0	6.0
Geology Bachelor's	16.5	11.0	11.0	4.0	9.0	9.0	8.0
Geology Master's	8.0	5.0	4.0	7.0	7.0	4.0	3.0

The Geography Bachelor's program has a mean degree production of 11.6 ∀ 4.9, and the Master's program has produced 7.3 ∀ 2.6 degrees per year over the review period. The Geology Bachelor's program has a mean degree production of 9.8 ∀ 3.8, and the Master's program has produced 5.4 ∀ 1.9 degrees per year over the review period. All programs show a decrease from the 2001-2002 and 2002-2003 years. This is partly due to poor scheduling under a former department administration, and a shortage of faculty, which made it difficult for students to complete their degree programs in a timely manner. Efforts are being made to stabilize the program, and assure that required courses are offered regularly. Changes are also being made in the advising assignments within the department. A single advisor for each set of undergraduate programs (Geography and Geology) will help to assure that students are aware of course schedules, and what prerequisite courses they need to complete before attempting these courses. This should improve the success rate in courses and overall satisfaction with department programs.

Establishment of goals for student learning

The ALC's for the Geography and Geology Bachelor's programs are attached. Bachelor's degree recipients of the Department of Geosciences are expected to demonstrate knowledge of basic concepts and theories pertinent to their areas of study, which include field techniques for Geology majors. Graduates will be able to use critical thinking to evaluate information, data and problems and will demonstrate their ability to interpret from these sources the geologic record from available evidence and to understand geologic history of a region, or to illustrate the understanding, description and modeling of a geographic problem. Graduates in both disciplines are expected to produce writing that is grammatically correct, well organized, and to deliver clear and well organized oral presentations. The will also effectively illustrate their observations using the best available graphic tools and techniques.

Achievement of Learning Outcomes

For the Geography Bachelor's program, faculty noted students were well versed in advanced geography concepts, but showed weakness in lower division preparation. Geography students were adequate to good in written communication, and very good in graphic presentation. Their oral presentation skills were weak. In group projects, the students showed that they were ready to take leadership roles in applied projects and they learned the skills expected of them. Geology majors were assessed in a capstone course which involves field work, written and oral communication, and individual written reports. A written examination regional geology and field knowledge gave a mean class average of 80.5 in 2009, up from 78.3% in 2008, and 76.8% in 2007. Progress is clearly being made, but room for improvement remains. Field notebooks prepared during two local day trips and a nine day trip to the Appalachians were used to evaluate their observational skills. The mean percentage score for 2008 was 88.6%, which was considered successful for this outcome. It was lower than the 2007 outcome (95.4%) for because several students were ill during the large trip. On their individual reports of a field study site, the 2008 mean grade was 84%, up from 81% in 2007. This is a successful outcome for this type of project.

Use of assessment outcomes for program improvement

In order to address poor lower division preparation in geography, an introductory physical geography course that gives a more intense background of physical systems, such as biogeography and climate, etc. will be introduced. Geology faculty have also noted deficiencies in lower division preparation, and are currently changing the lower division requirements to address this issue. Geography faculty are being encouraged to include more oral presentations in their undergraduate classes to improve oral communication skills. In both programs, advising methods are being changed to utilize a single advisor, with the goal of improving student preparation and focus their course work toward the student's individual goals, such as entry into a graduate program or finding a professional job upon graduation.

Lower level prerequisite courses compliance with State-approved prerequisites

FAU's geography prerequisites include GEA 2000, MET 2010, GEO 2200C, or GLY 2010 and 2010L. The state guidelines are for any two introductory courses with GEO prefixes, so we are not technically in compliance. The Geology prerequisites include CHM X045, but not CHM X046, which the state requires. The 120 hour limit on degree programs forced the department to drop its requirement of 1 year of chemistry to stay within the prescribed limits. Physics prerequisites are in compliance. The Mathematics requirement for the B.S. track is in compliance, but the B.A. requirement does not require calculus. Since the B.A. Geology program is intended for students in areas peripheral to geology, such as earth science education at the middle and high school levels, it is not necessary for these students to take calculus.

A. Longitudinal trends in student index data

GPA's of graduating seniors

The GPA of graduating seniors over the period from 2001 to 2008 was 3.1 ∀ 0.2 for both geography and geology majors. These numbers are very close to those in other departments in the college of science. No trends in GPA are apparent, although there are significant differences from year to year due to the statistically small number of degrees per year (range from 8 to 18 per program over the period). In both programs, students who transferred from other schools had significantly lower GPA's than those who completed their education at FAU. In geography, FAU only graduates averaged a GPA of 3.2 ∀ 0.2, while transfer students averaged 2.7 ∀ 0.3. In geology, FAU only graduates averaged a GPA of 3.2 ∀ 0.2, while transfer students averaged 2.9 ∀ 0.4.

Average length of time to graduation in undergraduate programs

The average time to graduation for students completing their degrees at FAU was 5.4 ∀ 1.3 years in geography, and 4.3 ∀ 1.4 in geology. For transfer students with AA degrees, the figures were 2.6 ∀ 0.9 years in geography, and 2.5 ∀ 0.6 years in geology. For transfer students without AA degrees, the figures were 3.8 ∀ 1.6 years in geography, and 3.3 ∀ 1.1 years in geology. The longer times for non-AA transfers reflects the greater number of deficiencies they enter with. The longer times for geography students compared with geology students may reflect more recruitment into geography from students who entered college intending to major in other disciplines, although no hard figures are available to confirm this idea.

Average GRE's for entering graduate students

For the period 2004 to 2007, the average GRE for entering geography students was 1040 ∀ 46, and for geology majors 1039 ∀ 42. The Quant GRE scores were 553 ∀ 38 for geography, and 586 ∀ 60 for geology majors. The Verbal GRE scores were 489 ∀ 22 for geography, and 453 ∀ 45 for geology majors. These numbers are lower than Master's degree programs for other majors within the College of Science. It

is clear that efforts need to be made to attract better students. The new Ph.D. program, which begins in Fall 2009, should help by making the department more visible to students from other universities and colleges. Finding increased resources for faculty travel to conferences and for advertising would also help. Most importantly, graduate student compensation needs to be increased, especially for Master's students. It has barely changed in a decade, and has resulted in our department losing well qualified candidates to other universities, including those in the State University System.

Average length of time to graduation in graduate programs

For the geography M.A. program, the average time to graduation for the 2001 - 2008 period was 2.0 ∀ 0.25 years. For geology, the average time to graduation for the same period was 2.4 ∀ 0.7 years. These numbers are shorter than most other Master's programs in the College of Science. Graduation times are strongly dependent on part-time vs. full-time status.

B. Summary Data

1. Major changes since last review

- New department chairperson
- New department name
- Hiring seven new faculty
- Significant reformulation of department programs to encourage cooperation between all faculty
- Proposal of an integrated Ph.D. program in geosciences, currently in the final stages of acceptance at the state level, focusing on human interaction with the environment
- Previous review indicated improvement was needed in instruction and advising on the geology side, as measured by student satisfaction surveys. Numbers are now combined for the department, but are high enough to indicate a good to excellent rating for instruction at both the graduate and undergraduate levels, and fair to good in advising.

2. Strengths of the department

- Vibrant young faculty, hired with the goal of cohesively joining the original geography and geology programs together
- Cooperation with the Florida Department of Environmental Protection, the South Florida Water Management District, Broward County and Palm Beach County Planning Agencies, the Army Corp of Engineers, the U.S. Geological Survey, Coastal Planning and Engineering, Inc. and a variety of other local agencies and environmental consulting firms in planning the Ph.D. program to meet the needs of these agencies, as well as municipalities within our service area.
- Planned expansion of the department to include faculty on the Davie campus, to foster interrelations with the Environmental Science program at FAU, and with the United States Geological Survey facility at Davie, which a focus on the Everglades Imitative
- A developing GIS component, which serves to tie geographers and geologists together, and fosters ties with the Environment Science Program, the Department of Biology, and numerous agencies in the service area which require spatial data analysis
- Strong focus on teaching, with a disproportionately high number of teaching awards won by department faculty

3. Weaknesses of the department

- An insufficient number of high quality students in the graduate program, due primarily to inadequate funding of Graduate Teaching Assistantships - we are simply not competitive with other Florida institutions, both public and private
- Insufficient office and laboratory space - this will be rectified by the move to Science/Engineering when the engineering building is completed
- Advising at both the graduate and undergraduate levels needs to be improved.

4. Recommendations

- Building teaching and research programs that complement and enhance the missions of FAU's Charles E. Schmidt College of Science
  The Environmental Science program
  The Center for Environmental Studies
  Harbor Branch Oceanographic Institution
- Continued strengthening of the Department's research Center in Geo-Information Science
- Creation of a Center for Hydrogeology and Water Resources
- Implement the single-advisor system for the geography and geology programs. This will eliminate the advisor-shopping practices that have been going on, and charge the advisors with making an effort to see that all majors are advised at least once per semester.

5. Comments

- Numbers for the geosciences programs are often statistically small. Standard deviations are quoted where possible, but they are less reliable than those of larger departments.
- Student satisfaction surveys, as measured among graduating students, have a very low response rate. Even among large departments, the number of responses is statistically insignificant. Thus, these surveys are not a good measure and need to be changed or abandoned.
- Separate analysis for B.A. and B.S. programs is a good idea, but cannot be done using currently available data. IEA should be encouraged to maintain separate data files for each program.

4. Research

The Office of Institutional Effectiveness at FAU collects productivity on all academic units at the university. The entire document found on the Institutional Effectiveness pages shows the research productivity summary for the Geosciences Department since the 2003-2004 academic years. A review of Part II of the Departmental Dashboard Indicators for the period 2001-2007 shows time devoted to research, including both tenured and tenure-earning faculty at any level, with steady values for Person-Years between 1.3 and 1.7 and FTE between 1.7 and 2.3. Dashboard Indicators also show sponsored research including both tenured and tenure-earning faculty at any level devoted to research with steady values for Person-Years between 0.2 and 0.7 and FTE between 0.3 and 0.9. The research/scholarly productivity for books, peer-reviewed publications, other publications, and presentations have been gradually increasing year by year, but is still below college norms. Other departments in the college have established Ph.D. programs, so it is expected the Geosciences numbers would be lower. As our young faculty mature and develop research groups within the new Ph.D. program, we expect these numbers will increase substantially. The sponsored research and program expenditures were around $100,000/year for the early years but have been steady around $240,000 since 2004-2005.

The department established goals for research described in three outcomes of the latest plan in the FAU Assessment Database. Outcome 1 is defined based on full-time faculty with research assignments, with publication record in refereed journals, books, book chapters, refereed reports and proceedings. Outcome 2 is defined based on full-time faculty with research assignments presenting their research at professional meetings or invited forums. Outcome 3 is defined based on full-time faculty with research assignments obtaining funding to support their research. During the period 2002 to 2006, the criterion for success for the 3 Outcomes was that at least 50% of full time faculty satisfies the goals prescribed in each outcome. During the period 2006 to 2008, the criterion for success for the 3 Outcomes was revamped to 75%. The goals for outcomes 1 and 2 have been met; except for the period 2005-2006, due to two full-time faculty retirements. Outcome 3 has been going from not meeting the goal criteria at all to an estimated 82% during the period 2007-2008, as per the last on record.

Our brand new Ph.D. in Geosciences will allow the Department to expand its overall research presence in environmental conservation and sustainability, and in the work associated with one of the world's largest environmental restoration projects (i.e., Comprehensive Everglades Restoration Plan - CERP). The Department is at the forefront of geosciences research and technologies and encourages fieldwork and the attainment of skills in applied tools such as quantitative and theoretical techniques, geographic information systems, hydrologic modeling and remote sensing. The creation of the Ph.D. program represents a turning point for the Department's main weakness, which was precisely a lack of a Ph.D. program, and this has become the maximum strength of the department. This program will give continuity and support to the achievements of our research goals and the breadth of possibilities post-graduation for our students.

5. Service

Faculty memberships on department, college or university committees per faculty member for the 2003 to 2007 period were 2.8 ∀ 0.6 committees per year. There is a distinct upward trend, reflecting a young, maturing faculty (five of eleven were assistant professors in 2007). The average for the final three years of the period was 3.2 committees per year, with the college average 2.2 and the university average 3.5. . Faculty memberships on community or professional committees per faculty member averaged 0.6 ∀ 0.2 for the period, with no apparent trend. This compares with 0.9 for the college and 1.4 for the university as a whole. Service on these committees is more common for senior faculty, so the lower average is expected, and should increase with time. Faculty serving as editors or referees for professional publications per faculty member averaged 1.0 ∀ 0.4, with an increasing trend in the final three years. These numbers compare to 2.0 for the college, and 1.3 for the university as a whole.

The department goals for service include:

1. Faculty will be active in the service activities of professional organizations and associations. This includes holding office, serving on subcommittees, activity in specialty groups, and review of manuscripts and other scholarly works. For the 2007-2008 year, 5 of the 14 faculty (36%) were engaged in professional service activities of professional organizations and associations. Although this is less than the 50% rate expected for success, as our young faculty matures, this number is expected to increase.
2. Faculty will be active in the service activities of the university and/ or college. Six of the fourteen (43%) regular faculty in geosciences participated in service activities at the college or university level. Since assistant professors rarely participate in committees above the department level, this number will increase with time, and compares well with the goal of 50%.
3. Faculty will be active in the internal and external service activities of the department. This includes public service, service on in-house committees and sub-committees, and working with honor societies and other student groups. A review of the most recent annual evaluation packets, completed in the spring of 2008, indicates that all 14 regular faculty in geosciences participate in the service activities of the Department, meeting the goal of 100% participation.

6. Other Program Goals

The Geosciences Department in the near future will be building a substantial program based on the Davie campus. This program will link with the United States Geologic Survey and the Everglades Initiative. Three new faculty positions are planned for the Davie campus, including Biogeography, environmental applications of Geographic Information System technology, and Hydrogeology. These faculty will work closely with existing faculty based on the Boca Raton campus, both in the Geosciences department and in related departments, to expand current areas of research and develop new lines of investigation. It is anticipated that excellent opportunities for students in the Ph.D. and Masters programs will be developed, and that grant support will be readily available for faculty and graduate student support.

7. Resource analysis

The Department of Geosciences relies a great deal on cutting-edge computing, display and field technologies. As our Ph.D. program will be particularly heavily tied to the professional community, it is vital that we stay on top of the latest technologies and expand the quantity and quality of related instruments in the Department as the program expands through the next few years. Currently, the department has state-of-the-art geospatial equipment in GIS, Remote Sensing and Hydro-Modeling. No new capital expenditure is directly related to the department. Furthermore, Geosciences is expected to benefit from workspace expansions already planned at both the Boca Raton campus and the Davie campus. No additional funding beyond an increase in graduate stipends will be necessary due to the Ph.D. program. No special equipment or increases in library resources were needed to implement the Ph.D. program either. After a few years' time into the Ph.D. program, however, we estimate a need for computing, display, field technology equipment and geosciences-related materials for the library will indeed become necessary to support advanced research to stay competitive in the field at large.

8. Major findings and recommendations

The Department of Geosciences in 2009 is a much improved department compared to its predecessor, the Department of Geography and Geology, which was badly split along discipline boundaries. The department has hired seven new faculty (four replacements for retired or resigned faculty, and three additional faculty) in preparation for a Ph.D. proposal, which has now been accepted, and will commence starting with the Fall, 2009term. The new faculty greatly strengthened the department in the area of Geographic Information Systems, a common area between the disciplines of geography and geology, and enhanced both the geography and geology components of the department. Together, the department wrote a Ph.D. proposal which was accepted on the first attempt, the only time this has been done in the College of Science. Links are being forged with many agencies in South Florida, and promise to increase the supply of professionally trained geosciences students, badly needed in this area. Co-operation with agencies such as USGS, working on the Everglades Initiative, should increase funding for the department, provide important research areas for graduate students, and work to enhance the quality of life for citizens of South Florida.

The major weakness of the department is the lack of high-quality graduate applicants. The visibility of the department will increase substantially because of the new Ph.D. program, which should improve the quality of students in the Master's program as well. One major stumbling block is the very low compensation offered to graduate students, which has cost the department good applicants who chose to go to other universities. Research/scholarly productivity for books, peer-reviewed publications, other publications, and presentations are below college norms for departments with existing Ph.D. programs. As our young professors mature and the Ph.D. program is developed, it is expected that these numbers will increase substantially. A current lack of office and laboratory space will be rectified with the move to the Science/Engineering building in approximately two years.

F. Department of Mathematical Sciences

1. Mission and purpose of the program

Mathematics is an indispensable tool for all sciences, and a body of knowledge of universality and intrinsic value to humanity. Mathematics is constantly pushing its vast frontiers of knowledge, and this new knowledge is eventually used to greatly benefit the world. Noble and very much alive, mathematics is enriching mankind.

The Mission of the Department of Mathematical Sciences at Florida Atlantic University is threefold: 1) To provide excellent undergraduate and graduate mathematics education to all students and to advance the level of mathematical ability of the community at large. We accomplish this goal through the inspired teaching of our faculty and graduate students. 2) To advance the frontiers of mathematical knowledge by engaging in innovative research and by tackling fundamental problems in mathematics. We accomplish this goal by forming research groups of colleagues and involving our graduate students as partners in discovery. 3) To bridge research, education and the application of mathematics to serve the needs of the local community and the larger global society. We accomplish this goal through our active partnerships with schools and industry, in which we share our expertise and enthusiasm for mathematics to help solve real-world problems.

2. Date and description of last external review

- **Findings and recommendations**

There has been no external review since 2000, but there is a six-page Internal Program Review undertaken in 2001. This review was rudimentary, and the report describes some of the facets of the FAU Mathematics program circa 2001, including the form and makeup of the student body, the relationship of the mathematics program to other FAU programs (for example, in the Colleges of Education and Engineering), and the status of the Master's Program in Applied Mathematics and Statistics which was proposed at that time and approved shortly thereafter. Some discussion was also made about the ease with which advanced mathematics graduates could obtain jobs at that time, and there was some brief discussion of the research productivity of the department and the cost of the program, particularly as it related to the delivery of lower division mathematics courses. Classes were very large in these courses and were frequently taught by adjunct lecturers. Recommendations were made to reduce class sizes for these courses and replace adjuncts by permanent instructors. Action has been taken on the recommendation to hire instructors but not on the recommendation dealing with class sizes.

- **Major changes made since last review**

The Master's Program in Applied Mathematics and Statistics was proposed and approved in 2002. The Center for Cryptology and Information Security (CCIS) was inaugurated in 2003. In 2004 we instituted a placement test by means of which entering freshmen were placed in the appropriate mathematics course among College Algebra, Pre-Calculus Algebra, Trigonometry, Methods of Calculus, or Calculus 1. At about the same time six new permanent instructors were hired to help teach the lower division courses. A very low level course in "Intermediate Algebra" was instituted in the fall of 2006, to accommodate students with very little mathematics preparation. Thanks to the support of Dean Gary Perry, as well as his predecessor Nathan Dean, we presently have a robust, high quality graduate program of 45 fully supported Ph.D. students, and the number of Master's and MST students has increased to 32. Since 2001, several faculty members retired or moved to other institutions, and one professor, James Brewer, died. On the other hand, we have been able to hire several excellent new faculty members to support both the teaching and research mission of the department: Markus Schmidmeier, Hongwei Long, Dragan Radulovic, Rainer

Steinwandt and Vincent Naudot. In 2003, Mathematical Sciences and CCIS joined with the College of Engineering to participate in a $3M Department of Defense grant in "Computer networks security". The department has received several NSF research grants since 2001, including one large grant in mathematics education. A joint NSF grant with Computer Science for about $500K was awarded to Jie Wu and Spyros Magliveras to acquire a large scale NUMA type computer system. Finally, the "Journal of Mathematical Cryptology" was inaugurated in 2006, with Magliveras and Steinwandt as two of the three chief editors, and de Gruyter as publisher. Internationally, this journal ranks among the top two scholarly journals in cryptology.

3. Instruction

- **Review of Part I of Departmental Dashboard Indicators**

DEPARTMENTAL LEVEL

A. Looking at the data from 2004/2005 through 2007/2008, at the undergraduate level we find that the average number of courses taught by the Department of Mathematical Sciences increased from 210 to 215 to 230 to 258, representing more than one third of the total for the College of Science. At the same time, the average enrollment per section decreased from 39.2 to 37.4 to 35.5 to 31.7, which was lower than the college average but close to the university average. The percentage taught by fulltime faculty held steady at 71.4% to 71.6% to 71.3% to 73.6%, which was lower than the college average but higher than the university average. During the same period, at the graduate level, the average number of courses taught by the Department of Mathematical Sciences increased from 34 to 50 to 58 to 48, representing approximately one fourth of the total for the College of Science. At the same time, the average enrollment per section decreased from 9.6 to 7.5 to 6.9 to 7.4, which was higher than the college average but lower than the university average. The percentage taught by fulltime faculty decreased from 97.1% to 98.0% to 91.4% to 89.6%, which was comparable to the college average but higher than the university average. During the same period (from 2004/2005 through 2007/2008), the annualized state-fundable FTE's produced in the mathematics department at the lower division undergraduate level decreased from 586.1 to 582.8 to 575.2 to 570.6 representing approximately one third of college total, while at the upper division undergraduate level increased from 41.1 to 31.1 to 49.8 to 58.8, representing barely one twentieth of college total, and at the graduate level increased from 39.7 to 42.5 to 47.1 to 46.9, representing approximately one fifth of college total. Thus, the Department of Mathematical Sciences shoulders a heavy instructional load within the college and university but has managed to avoid excessive reliance on part-time instructors.

For the academic years 2005/2006 through 2007/2008, the evaluation of quality of undergraduate instruction held steady at 2.4 to 2.3 to 2.3, slightly worse than the college and university averages, while the quality of graduate instruction held steady at 1.5 to 1.5 to 1.4, slightly better than the college and university averages. Similarly, the undergraduate rating of instructor (item #21 on the SPOT evaluations) held steady at 2.5 to 2.4 to 2.4, slightly worse than the college and university averages, while the graduate rating of instructor (item #21 on the SPOT evaluations) held steady at 1.7 to 1.6 to 1.5, slightly better than the college and university averages. Thus, students' perception of the quality of instruction in mathematics courses remains comparable to that of the rest of the university.

B. Clearly the mathematics department shoulders a substantial teaching load within the college of science and hence also the university, while at the same time attempting to maintain the low class size and high involvement of fulltime faculty which one expects of a quality university education. By breaking down the undergraduate FTE's into lower division versus upper division, it becomes clear that the mathematics department is heavily skewed toward service courses for non-majors. On the other hand, the data indicate that the FTE's for undergraduate majors and graduate students has increased substantially over the last three years, which bodes well for the future growth of mathematics at FAU. The quality of instruction in

mathematics (as measured by student perception of teaching) appears to be comparable to the rest of the college and university.

PROGRAM LEVEL

Looking at the data from 2004/2005 through 2007/2008, we find that the number of bachelors majors in mathematics decreased from 98 to 101 to 87 to 81, representing approximately one fortieth of the college total, while the number of master's majors in mathematics held relatively steady from 32 to 33 to 18 to 27, representing approximately one sixth of the college total, and the number of doctoral majors in mathematics increased from 37 to 52 to 47 to 53, representing approximately one fifth of the college total. In all categories, ethnicity percentages were comparable to the college averages. During the same period, the number of bachelors degrees awarded in mathematics decreased from 28 to 24 to 20 to 30.5, representing approximately one twentieth of the college total, while the number of master's degrees awarded in mathematics decreased from 16 to 13 to 21 to 11, representing approximately one eighth of the college total, and the number of doctoral degrees awarded in mathematics increased from 0 to 2 to 3 to 1, representing approximately one twentieth of the college total. Consistent with the FTE numbers noted above, the mathematics department holds only a small percentage of the college's undergraduate majors but a proportional share of the college's graduate majors. A decrease in the number of undergraduate majors could reflect a shift in mathematics education students from the mathematics department to the college of education (beginning a couple of years earlier). A decrease in the number of master's majors along with an increase in the number of doctoral majors reflects a shift in emphasis in the mathematics department's graduate program over the last several years.

- **Establishment of Goals for Student Learning**

Assessment of the undergraduate programs in mathematics was formalized two years ago with the adoption of the Academic Learning Compact (ALC) for the BA and BS programs, which we include in this review as an appendix. Prior to adoption of the ALC, the mathematics department had no organized procedure for assessing the overall performance of the undergraduate programs. The current ALC focuses on content knowledge in the core areas of algebra and analysis, which majors study in depth during their senior year, and critical thinking and communication skills in a senior-level problem solving seminar in which students must demonstrate both problem solving skills and the ability to communicate effectively. Achievement of the learning outcomes are assessed by means of embedded questions on exams in the algebra and analysis courses MAS 4301 and MAA 4200, and by means of written assignments and oral presentations in the problem solving course MAT 4937. To date these assessments have been carried out by individual instructors in the classes, with little input from the department, but in the future the department's undergraduate committee will oversee the pool of embedded questions and the scoring rubrics.

Assessment of the graduate programs in mathematics has not been formalized in an Academic Learning Compact, so the goals are less specific and little data has been collected. At the master's level, graduates are expected to be able to construct (or reconstruct) proofs in the literature and solve similar problems, with appropriate use of language and symbols; so far, the department has not set up any assessment tools for these goals. Students who wish to continue in pursuit of a PhD degree are expected to be admitted to an appropriate graduate program, while the rest are expected to find relevant employment. At the PhD level, graduates are expected to write a dissertation which is eventually published in a refereed journal, be competent to teach mathematics at the university level (as measured by student evaluations of their teaching in classes at FAU), and be integrated into the mathematical community at large through participation in professional meetings.

- **Assessment of How Well Students are Achieving Expected Learning Outcomes**

The learning outcome goals for the BA and BS programs are that students average at least 70% on the embedded questions, written assignments, and oral presentations, as determined by scoring rubrics agreed upon by the mathematics department. Results collected over the years 2006/2007 and 2007/2008 range from 30% to 100%, indicating that the mathematics department needs to make some improvements in teaching our undergraduate majors. Available data on master's students from 2007/2008 are quite sketchy and indicate only that 100% of the students were able to construct proofs and solve problems, with no further details about these proofs or problems, and no data has been collected on what degree recipients have done after graduation. In recent years, all graduating doctoral students have published their dissertations, and all graduate teaching assistants had satisfactory teaching evaluations, but no data was available on conference participation among PhD students.

- **Description of How Results of Assessments are Used for Continuous Program Improvement**

The ALC for the BA and BS programs was only implemented two years ago. For the last two years the mathematics department has collected assessment data for these programs, but we have not responded to this data. With the appointment of a new assessment director (Gail Wisan) at FAU and a new undergraduate coordinator (Tomas Schonbek) in the mathematics department, we will begin immediately to analyze the data collected and make the necessary program adjustments. The mathematics department will put more effort into assessment of performance of master's students and into tracking them after graduation, and into encouraging and sponsoring conference participation by PhD students.

- **Compliance with State-approved Prerequisites**

The State-approved prerequisites for the BA and BS programs in mathematics include three semesters of calculus, differential equations, a scientific programming course designed for computer science majors, and a laboratory science course designed for science majors. Our mathematics BA and BS programs are open to all transfer students admitted to FAU.

- **Major Changes**

The most important change in the instructional mission of the mathematics department since the last program review has been an increased focus on the doctoral programs in the college of science in general: Currently there are more than three times as many doctoral students in mathematics as were enrolled at the time of the last program review eight years ago.

- **Strengths**

The growth of the doctoral program has provided an enormous boost to the research program of the department, which in turn has markedly raised faculty morale. If the department can continue to maintain the doctoral program at the current level or higher, it will be able to solidify its gain in stature within the research community and thereby attract more research funding and quality researchers from the mathematical community. The growth of the doctoral program has also benefited the lower-division teaching mission of the mathematics department. Although the number of tenure-track faculty has held steady since the last program review, the increased number of doctoral students has helped the department meet its lower-division teaching obligations without significantly increasing the number of part-time adjuncts. (The increased number of untenured fulltime instructors has also helped in this regard.)

- **Weaknesses**

The data show that the undergraduate mathematics program has not kept pace with the graduate program. Clearly the department needs to recruit more undergraduate mathematics majors, to complement the large graduate and lower-division components.

- **Recommendations**

The large increase in the number of doctoral students has put an increasing strain on the tenure-track faculty in the department. Not only must these faculty teach an increasing number of graduate courses (and supervise and serve on doctoral committees), but the graduate students themselves need supervision in their teaching, to the point where the current fulltime faculty are now swamped by responsibilities and commitments. We find that the situation has reached a critical point: Without an increase in the number of tenure-track faculty, the quality of both the doctoral program and the lower-division instruction could soon begin to suffer from this overload.

Increasing the number of undergraduate mathematics majors will take time, but efforts are already underway. For example, four years ago the mathematics department began a large high school mathematics competition, "Math Day", which has steadily grown in popularity and now attracts hundreds of local high school students to visit FAU each spring. The mathematics department needs to continue to work hard to build connections with the local school districts, to increase its visibility as an option for talented local high school students. It would be worthwhile to try to assess the impact of these efforts on future enrollments in mathematics courses at FAU as well as the quality of students who participated in these activities.

- **Comments Regarding General Education Courses**

Although this review does not specifically address issues of instruction in lower-division mathematics courses, we include a few remarks about efforts to improve the quality of instruction in these courses. Like most universities across the United States, FAU has struggled with a high failure rate in lower-division mathematics courses. For example, in College Algebra, the largest of these lower-division courses, the DFW rate for fall 2006 and spring 2007 stood at 62%, meaning that only 38% of students who began that course that year were able to complete the course with a grade of "C" or better. The university and the mathematics department have taken several steps in the past three years in an attempt to improve the situation.

First, the mathematics department restructured College Algebra last year, by clarifying and simplifying the goals, objectives, and delivery of the course in an effort to keep students focused and on track. The success rate in College Algebra has risen over the past year, as evidenced by the DFW rate in the course, which decreased to 42% in fall 2008 and 39% in spring 2009.

Second, a few years ago the university began implementing supplementary instruction (SI) in several lower-division mathematics courses, including College Algebra. Students who participate in at least six SI sessions do have a higher pass rate than those who never attend (13% higher in fall 2008 and 26% higher in spring 2009), but fewer than 20% of all students in College Algebra attended any SI sessions for fall 2008 and spring 2009, so more effort is needed to increase student participation in SI.

Third, one year ago the university established a mandatory mathematics placement test for all incoming students who have no prior mathematics coursework at a Florida college or university; the goal is to ensure that students do not attempt a class until they are properly prepared. With only one year of data relating student performance to placement test scores, we are still adjusting cutoff scores for individual courses, so it is too early to evaluate the impact of the placement test.

Fourth, the university has recently appointed Roger Goldwyn, a faculty member from the mathematics department, to act as liaison between the department and the provost's office, and to set up a mathematics learning center on campus. The expectation is that, among other duties, Roger will help the mathematics department to set up assessment procedures in lower-division courses, in an effort to improve instruction in these courses and thereby raise the success rate among students. With the success of our efforts in College Algebra, we plan next to begin restructuring Math for Liberal Arts 1 and 2, in 2009/2010 with very similar objectives.

4. Research

The Department of Mathematical Sciences has an internationally recognized research faculty active in pure and applied algebra and analysis, biomathematics, combinatorics, geometry, cryptology and information security, dynamical systems and control theory, foundations of mathematics, mathematics education, and probability and statistics.

- **Expectation and productivity criteria**

The department expects its faculty to maintain an active research program. Research productivity is evaluated by publications in professional refereed journals, refereed conferences, research grant awards, participation in professional conferences, and recognition of scholarly work at the national and international level. The American Mathematical Society defines an active mathematician as one who has at least three publications in the previous five years. The assessment goal of the Department of Mathematical Sciences is that at least 60% of its tenure/track-faculty will meet the AMS criterion. In terms of the stated criterion, the average publication rate in the department was 5.8 papers per faculty over the last five years, and over 80% of the tenure-track faculty achieved the criterion.

- **Current productivity and productivity trend**

The Departmental Dashboard Indicators for the last five years indicate a significant upward trend in the total number of publications, from 99 in 2004/05 to 183 in 2007/08. The same trend holds for peer-refereed publications, from 65 in 2004/05 to 139 in 2007/08. Concurrently, the ratio of peer-refereed publications to all other publications increased from 1.9 to about 3.2. Over the same period, grant productivity showed an upward trend, from $587,759 in 2004/05 to $1,170,456 in 2007/08. A comparison of publications data for 2007/08 shows that Mathematical Sciences had about one third of all refereed publications in the college and about one thirteenth of the total university productivity. The data also show that Mathematical Sciences produced about one fifth of all books in the college and about one twenty-fifth of all books in the university, and Mathematical Sciences produced more than one tenth of the college grant productivity and about one thirtieth of the total university productivity. While not miraculous, this grant productivity is certainly respectable and comparable to that of peer mathematics departments. It is well known that funding of research is much harder to obtain in mathematics than in many other sciences, and the amounts received are generally much smaller. We plan to continue improving our grant acquisition in the future.

- **Classification of research**

Mathematical research can be classified as either pure (fundamental) or applied. Both types of research receive the love, respect and considerable attention of the faculty, and the research productivity of both types is significant and accelerating. Certainly the expanding graduate program has helped add momentum to our efforts and productivity. Over the past several years the department has placed particular emphasis on developing core strengths in *cryptology*, *dynamical systems*, *biomathematics-bioinformatics*, and *mathematics education*, in addition to our traditional mathematical strengths. Emphasis on these areas continues to be

our goals for the future, as we aspire to build on our current strengths and increase productivity in all current areas.

- **Successes**

We have made significant, but partial progress toward the above goals. We were able to establish a strong cryptology program, which has attracted excellent national and international attention (and a significant number of very strong graduate students). The Center for Cryptology and Information Security was established in 2003, and significant collaborative research has taken place between members of the Center, the College of Engineering and other national and international groups. Since 2005 the Center collaborated with the College of Engineering in a $3 million DOD/DISA grant on "Secure telecommunication networks" and a $0.5 million NSF grant for the acquisition of a NUMA-based supercomputer. A new, highly respected journal, the Journal of Mathematical Cryptology, was established by our department and by "Walter de Gruyter" publishers, in 2005. The journal is now in its fourth year of a very successful operation. We hired an excellent researcher, Dr. Rainer Steinwandt in cryptology, and have now a group of several people who work wholly or partially in cryptology. We have also made progress in strengthening our research group in dynamical systems by hiring a new excellent colleague, Dr. Vincent Naudot. This cluster has already established collaborative research with other research groups within the college. We were unsuccessful in hiring a core bioinformatics person two years ago. Nevertheless, in our department we have excellent colleagues working in biostatistics and bioinformatics, who are involved in collaborative efforts with other FAU researchers, and other national groups. This continues to be an area which we want to develop in the future.

5. Service

- **Service components and expectation**

Service is part of the basic responsibilities of any faculty member of the Department. Service activities include: participation in university governance by active membership in departmental, college and university committees; participation in the programs and governance of national and international scientific societies; editing and refereeing of professional publications; peer evaluation of grant proposals to funding agencies; in response to external requests, the evaluation of the aggregate scholarly work of peers in other institutions for tenure and promotion consideration, membership in external Ph.D. committees, and a multitude of other tasks and activities.

- **Other service components**

In addition to thoughtful participation in the regular activities of the university and professional community the mathematics department values initiatives by faculty to form active partnerships with schools, industry, and State and Federal agencies in order to help bridge the gap between the university and the real world.

- **Departmental service data**

Data from 2004/2005 through 2007/2008 reveal that for the Department of Mathematical Sciences service has been maintained at a rate slightly higher than that of the rest of the college and comparable to the university as a whole. This includes total numbers, as well as per faculty averages, of committee memberships, and all other service components, as described above. Committee memberships per faculty member, within the university, increased from 2.1 to 3.0 to 3.2 to 3.1; community and professional memberships per faculty member increased from 0.6 to 1.2 to 1.3 to 1.4; and editor and referee responsibilities per faculty member increased from 1.5 to 2.1 to 2.3 to 2.3.

- **Assigned service**

In the last few years, the chair of the mathematics department has included a substantial service component in the annual assignments of at least half of the tenured faculty members in the department. Recent accomplishments by individual faculty members include editorial work for numerous established refereed journals, memberships in program committees of well established international conferences, memberships in external Ph.D. committees, grant proposal evaluations, the evaluation of certain Research Institutes, continued funding for the Center of Cryptology and Information Security, as well as operation of the "Journal of Mathematical Cryptology" (as noted above); outreach to public school students through the American Mathematics Competition and Math Day (for high school students) and Mini-Math Day (for elementary school students); regular hosting of the International Conference on Combinatorics, Graph Theory and Computing as well as an International Symposium on Artificial Intelligence and Mathematics; and continued funding from the National Science Foundation for a teacher enhancement project in partnership with the Broward County School Board.

- **Outreach and other service**

Certainly the mathematics department is well-represented on committees around the university. We aspire also to increase our professional activities at the national and international level. We are quite proud at our accomplishments at interacting with the local schools, including Math Day and Heinz-Otto Peitgen's NSF-sponsored project in Broward County. But we also have a fifteen-year history of offering a Master of Science in Teaching mathematics degree program which has graduated a myriad of local high school mathematics teachers and thereby had a major impact on mathematics education in south Florida. The major challenge in our mathematics education efforts will be Peitgen's project, with his impending retirement in four years. We must hire a top-notch mathematics educator in the next couple of years. Our interaction with the industrial world includes the Center of Cryptology and Information Security, as well as our development of a program in actuarial science, which has the promise of connections with NCCI (a local insurance rate-setting organization) and Blue Cross Blue Shield of Florida. In addition, we are in definite need of help in our biotechnology efforts, which would help the mathematics department to connect better with other departments in the college as well as biotechnology firms relocating to south Florida.

6. Other program goals

1. Raise perception of department quality and level nationally by one quartile.
2. Double the number of undergraduate mathematics majors.
3. Consolidate, strengthen, and simplify lower division mathematics courses.
4. Maintain strength of the graduate program, increase stipends, and slightly increase numbers. Develop a doctoral program in mathematics education.
5. Double the level of research grant awards, over the next 5 years.
6. Develop interdisciplinary research initiatives with biology: green energy, sustainability, and climate research. Increase existing and external connections and contacts.
7. Hire in cryptology, mathematics education, dynamical systems, and bioinformatics.
8. Strengthen our statistical program and services.
9. Establish a regional conference and forum for our graduates and teachers, in order to better keep in contact with our graduates, and to develop a network of alumni and friends who can help in publicity, recruitment, and fundraising.
10. Increase department space

7. Resource analysis

Any inventory of resources should address both their availability and their necessity for the fulfillment of the department's mission. Resources at our disposal can be categorized as human resources, space resources, labs and equipment, or intangible resources.

- **Human resources**

The Department of Mathematical Sciences consists of *tenure-track faculty*, *instructors*, *graduate students,* and *staff*. For 2007-08, the departmental dashboard indicators show 25 tenure-track faculty members generating 28.6 FTE, 15 instructors generating 16.1 FTE, and 1 visiting scholar generating 1.7 FTE. Of the tenure-track faculty, 17 were full professors, 5 associate professors, and 3 assistant professors. There were also 2 full professors on five year contracts, and 2 research professors, although the latter are actually paid as non tenure-track instructors. Of the above, 2 full professors are on the FAU campus for half of the academic year, and on unpaid leave for the remaining half-year. An additional tenure-track faculty member was hired as Assistant Professor in 2007. We also employ a variable number of adjunct instructors, according to the needs of our instructional program. The number of adjuncts in recent years has been considerably reduced (e.g., for the fall of 2008 there were 3 adjuncts), as an increasing instructional load has been assigned to our graduate students. The practice of seriously involving graduate students in teaching correlates well with what is expected as part of a mathematician's training. Talented graduate students are assigned to more advanced mathematics courses as they accumulate experience. Over the last several years, we have supported between 40 and 45 Ph.D.-level graduate students as graduate teaching assistants. A few graduate students have been supported as graduate research assistants on grants. The staff of the mathematics department consists of one full-time budget manager, one half-time grants coordinator and one full-time senior secretary. In addition, Professor Peitgen's $5M 5-year NSF grant (for middle school teachers) employs one part-time grant coordinator and one part-time project manager.

As the graduate and undergraduate programs develop and increase in quality and enrollments, we will need fewer instructors but more research-level tenure-track faculty to teach and supervise graduate and advanced undergraduate students. This correlates well with an expected trend for community colleges to evolve into 4 year colleges in the near future, and the trend must have a significant impact on our strategies for the future. Thus, we expect the departmental faculty composition to change over the next 5 years away from instructors (and certainly adjuncts) towards more tenure-track personnel.

- **Space resources**

Space resources are quite inadequate for our department's size. Each tenure-track faculty member has an office, but most instructors are forced to share an office, in some cases four to an office. The density of graduate students per office is even higher. In addition to offices, the department has one seminar room and one lounge (which also serves as a seminar room). In an ideal situation, each graduate student pursuing a Ph.D. degree should have an office close to his or her professor's office, and there should not be too many graduate students per office. We currently have an average of 7 graduate students per office, and housing students close to their research supervisors is very difficult. Three years ago, at the Dean's request, we prepared a rough plan for a possible new building dedicated to Mathematics. The acquisition of a "mathematics building" would be an ideal solution to many of our space problems.

- **Labs and Equipment**

The Department of Mathematical Sciences has one teaching lab with 30 workstations and equipped with a whiteboard and a "beamer" projector. The Center for Cryptology and Information Security has a

computing lab equipped with an aging 24 node parallel computing cluster. There is an additional projector in the seminar room, and a small mathematical library in the lounge.

- **Intangible resources**

By intangible resources we mean unexpected provisions, including funds for sponsoring special events such as Math Day, occasional small donations provided by publishers, the prestige and some funding generated by our "Journal of Mathematical Cryptology" and the "International Southeastern Conference on Combinatorics, Graph Theory and Computing", as well as the prestige from "Forum Geometricorum", and similar unexpected resources.

8. Major findings and recommendations

- **Findings**

The Department of Mathematical Sciences has made significant and quantifiable progress in the seven years since the last program review. In 2001 there were exactly 6 graduate students admitted to Ph.D. candidacy. In 2008-09 we have about 45 graduate students in the Ph.D. program, and have graduated 8 Ph.D.'s since 2005. We have also seen significant changes in the undergraduate (major) program, where we have raised standards. We have continued to serve a very large number of lower division, non-math-majors, but the quality of these service courses has increased significantly as permanent instructors have replaced adjuncts. We have instituted an online placement test which is still being calibrated to provide best possible direction to our students. Since 2006 we have been offering a special Calculus for Engineers sequence of courses, and we are using the ALEKS system to retrain and evaluate students who still do not have basic mathematical skills. We have made special efforts to improve College Algebra and Elementary Statistics and are still in the process of measuring the degree of our success in addressing some earlier problems. Our research productivity has doubled over the last four years in refereed publications, books, conference papers, and grant awards. We partner with our graduate students in research and guide them to produce refereed publications in esteemed journals and to participate in conferences. The Center for Cryptology and Information Security has helped bring research funds, has attracted graduate students, and added at least one new excellent faculty. Our new "Journal of Mathematical Cryptology" is highly respected internationally and is probably among the top two journals in cryptology. Our electronic journal "Forum Geometricorum" continues to be a respected active journal in classical geometry.

Service is undertaken by faculty at all levels, including service in departmental, college and university committees, outreach activities in the community, and significant participation in professional service, such as refereeing for professional journals, reviewing grant proposals for granting agencies, serving as external Ph.D. examiners, and reviewing cases of promotion and tenure cases of colleagues in other universities. Our faculty is involved in almost every conceivable professional task.

- **Recommendations**

Our recommendations are pretty well embodied in section 6 above (Other Program Goals). We believe that these goals can be achieved, and with the exception of goal 10, they can be attained at a modest cost.

G. Department of Physics

1. Mission and purpose of the program

The mission of the department is to serve the region, state, and nation by preparing students to make meaningful contributions in an increasingly complex society. This mission is accomplished through the efforts of the physics faculty who, since the founding of Florida Atlantic University, has excelled in research, teaching and service. The Department of Physics enhances FAU's mission primarily by i) providing high-quality programs in physics at the undergraduate and graduate level ii) providing a solid base in physics for students of other disciplines in science and engineering where physics is needed in order to understand the material covered in higher level courses, and iii) providing introductory courses in science for students in disciplines other than science and engineering so that they have a well-rounded education at Florida Atlantic University.

2. Last external review

Since the last review in 2001 we have made significant improvements to our undergraduate and graduate programs. In 2007 we introduced a new curriculum at the undergraduate level to make our students more competitive on the national level by providing them with a better mathematics and physics education.

In 2008 we introduced a Medical Physics Graduate Certificate Program to prepare students who are interested in a career in a health related field and/or continue for an advanced degree in a medical program. The certificate requires 12 credit hours of graduate courses including Radiation Therapy Physics, Radiation Biology, Medical Imaging Physics and the 3 credit prerequisite course Human Morphology and Function I (PCB 3703). This program is currently in its first year.

3. Instruction

3.1 Departmental Dashboard Indicators

During the academic years 2001-02 to 2007-08 the department has offered on average 37 lecture/seminar courses (70% of them taught by faculty) and 77 laboratory session (faculty rate 15%) on the undergraduate level per year. The average enrollment in these courses was 73 and 14 students for the lecture and seminar sessions, respectively. In terms of FTEs these numbers translate into about 255 per year, with 95% from the lower division and about 2/3 of them (166) from majors outside the college reconfirming the department as one of the major providers for service courses at FAU. While FTE production on the undergraduate level has steadily increased by 3-5% per year between 2001-02 and 2004-05, in fact a trend that goes back at least until 1997-98 when it was 215, it has dropped by almost 8% in 2005-06 and by another 15% in 2006-07. Where the former drop was due to an almost equal decrease by majors from within and outside the college, the latter drop was solely due to outside the college students. The reason for these declines is an enrollment cap that was put on for financial reasons. In 2007-08 FTE production has increased back to the 2005-06 level. The quality of the instruction as perceived by students (SPOT) is about the same as the average in the college and in the university for both the graduate and undergraduate level with average ratings of 2.0 and 2.2 on the quality of instruction (item 20) and instructor (item 21), respectively.

Enrollment in the department's bachelor, masters and Ph.D. programs has been steady over the years with slight fluctuations and average headcounts of 40, 6 and 26, respectively. For number of degrees awarded the fluctuations are larger but on average reflect the number of students enrolled with about 6, 1 and 5 annually.

The average GPA of baccalaureate students at the time of their graduation has been steady over the years at an average of 3.1, after about four years in the program. The GRE for students admitted to the Ph.D. program for most years is above 1200. For the Masters program it is slightly lower but the statistics there are quite meaningless, as there was only one student admitted since 2005/06 due to an emphasis placed on the Ph.D. program in the department. Graduating Master students have spent an average of 3.5 years in the program, the average time to earn a Ph.D. in physics is 5.5 years.

3.2 Learning Goals

The learning goals for the undergraduate programs in physics (BA and BS) are content knowledge in terms of a basic understanding of the core areas of physics, written communication and critical thinking through the ability to produce writing that is grammatically correct, well-organized, properly formatted and demonstrates understanding of scientific methodology. Content knowledge has been evaluated by means of exams, term papers and laboratory reports in the core courses General Physics I, II, Modern Physics and Electromagnetism and reflected by a passing grade of C or better in any of these courses. A new evaluation scheme will be put in effect in 2009-2010. We revised the evaluation procedure for declarative knowledge on the undergraduate level such that it is no longer based on final grades in the core courses. From now on, class presentations and target assignment in Modern Physics (PHY 3101C), which contains all core areas of physics, will be evaluated and scored on a scale of 0-4 (bad to excellent). The rubric to be applied has not been worked out yet but will be put in place by the Chair and a focus group of instructors. The writing skills are assessed by the Chair and/or designee by evaluating reports written for the Undergraduate Laboratory using a rubric on a scale of 0-4 (bad to excellent).

Moreover, we encourage our undergraduate students to make first contact with current science and the scientific community by participating in undergraduate research and in appropriate academic and social activities.

As for any graduate education the main goal of our Masters and Ph.D. programs is to put students into a position that they are competitive on the job market in industry and academia. To achieve this goal, students have access to modern experimental and computational equipment and are encouraged to interact with leading professionals in their fields.

Declarative knowledge in the Ph.D. program is assed when students finish their second year and take the qualifying examinations in the four core areas of physics: mechanics, electromagnetism, quantum mechanics and statistical physics. From these exams only a pass or fail is reported to the students but for assessment purposes a score is given to each individual exam and student, which clearly reflects their knowledge or lack of in the core areas. At a later stage, the ability of students to complete scientific work is evaluated by point system that monitors the students' activities of making their work public both orally and written. Each publication of an article in a journal counts as two units and each meeting presentation as one unit. We expect that 75% of students pass their qualifier and will have achieved at least one unit by their 3rd year in the program and three units at the time of their defense.

3.3 Assessment of Student Achievement

Both, the content knowledge and writing skill criteria above were met by about 70% of the undergraduates.

Established success criteria for departmental and social activities on the undergraduate level, e.g. 50% of students attend at least one departmental seminar per semester, have in general also been met over the years, with the exception that we would like to see more undergraduates participating in the Society of Physics Students (SPS).

As our unit system for evaluation of graduate students is newly established, we do not have all report forms back yet. From the data available, the senior graduate students achieved on average 1.7 units and the others an average of 1.5 units. 15 students had a successful poster presentation at the Research Day.

Post-graduation, over 90% of the Ph.D. graduates from the last five years have found post-doctoral or teaching positions within their first year after graduation. The institutions they went to include UMW, ORNL, NIH and colleges in Kansas and Greece.

3.4 Continuous Program Improvements

The two major changes to improve our programs, introducing a new curriculum at the undergraduate level and the Medical Physics Graduate Certificate Program for graduate students have already been described above in sect. 2. Both of then have just been put in place and it is too early to have meaningful results. We also introduced a graduate student evaluation form to be filled out annually by the student together with their major advisor and submitted to the Graduate Coordinator and Chair. This procedure allows us to keep better track of our students' performance and progress towards their degree as it lists the courses taken in the past and those to be take in the next year, shows the dates of committee meetings and expected graduation. The Chair and Graduate Coordinator evaluate these forms and take action where appropriate or needed, either on the level of individual students or the graduate curriculum. A committee is working on changes for the graduate curriculum currently in place.

In order to improve undergraduate participation in research, an undergraduate study lounge was opened in 2005, a faculty member was appointed SPS director in 2006, and graduate students were invited to SPS in 2007. These actions have increased participation but not to the level we would like to see.

4. Research

Assessment of research quality in the Department of Physics is based on pursuing federally funded grants and other outside support, and on the success of publishing substantial work in peer-reviewed journals. Dashboard indicators show an average of 13 grant proposals submitted per year over the last five years, which translates into about one submission per faculty per year, a number that has been set as the criterion for successful pursue of funding by the department. The number of peer-reviewed publications was at a steady level of 25 per year and corresponds to about 2 publications per faculty and year, again meeting the goal established for success by the department. The data summaries in the Assessment database from the last years, which are based on the annual evaluations by the Chair, are in agreement with the DDIs.

5. Service

The physics faculty is actively participating in service to the university and the scientific community. The annual evaluations by the chair showed that 95% of the faculty had at least one major service committee for the department, college or university. In addition substantial service is made by over 65% of the faculty in refereeing for -reviewed journals, federal funding and/or science committee work, or state-level K-12 educational boards.

6. Other Program Goals

In addition to competitiveness in the job market, we expect our graduates to be able to communicate orally scientific methods, findings and their importance, and to participate in appropriate academic and social activities. To this end we encourage students to present their work as a poster at the Annual Charles E. Schmidt College of Science Research Day, at conferences and in seminars. As the Science Day is a relatively new activity, we only know that this year 15 of our students presented a poster there, a participation rate of more than 50% that we are very proud of. We also encourage our graduate students to present their work

at the meeting of the American Physical Society, an opportunity, which is taken up on by 3-4 students annually. Unfortunately, a major source of funding for participation there, the Student Graduate Association, has dried up since the travel freeze at FAU got into effect.

7. Strengths and Opportunities

The strengths of our programs are that our graduate applications have greatly increased on the graduate level due to a substantial revision of the recruitment process and a better integration of undergraduates both academically and socially. Public outreach activity, widely run in part by the SPS, have found great acceptance. These activities include but are not limited to the Annual Pumpkin Drop at Halloween, the Science Olympiad and the Astronomy Observatory program with the "100 Hours of Astronomy" event.

8. Weaknesses and Threats

Weaknesses include poor demonstration equipment, antiquated undergraduate labs with not enough space and equipment.

9. Resource analysis

Given the introduction of multidisciplinary programs such as Biophysics, Medical Physics Certificate etc., we need to hire more faculty to meet the needs of this increasing demand.

10. Major findings and recommendations

Improvements to the programs could be made by upgrading the university's high power computing facilities and the educational and research environment, for instance by funding more post-doctorates in the department, who could also be mentors to graduate students.

We are barely able to keep up with the natural attrition in the faculty ranks in the department, and given the financial sanctions on the state's higher educational system and in particular FAU, we will find it difficult to maintain our expansion rate in education and research in physics.

H. Department of Psychology

1. Mission and Purpose of the Program

The Department of Psychology offers two undergraduate degree programs leading to a B.A. in Psychology and a B.S. in Psychobiology as well as a graduate program leading to the M.A. and Ph.D. degrees in Experimental Psychology. The undergraduate programs are designed to educate students in core areas of the field as well as in research methodology and statistical analysis, to promote critical thinking, and to strengthen written communication skills through participation in didactic courses and directed independent study. The program is offered at the Boca, Davie, and Mac Arthur campuses to facilitate student access. The graduate programs are designed to train students in Experimental Psychology and research methodology through participation in seminars, directed independent study and formal research projects. Areas of research specialization include Behavioral Neuroscience, Cognitive Psychology, Developmental Psychology, Evolutionary Psychology, and Personality/Social Psychology. Graduates of the program are qualified for professional employment in academia, government and the private sector.

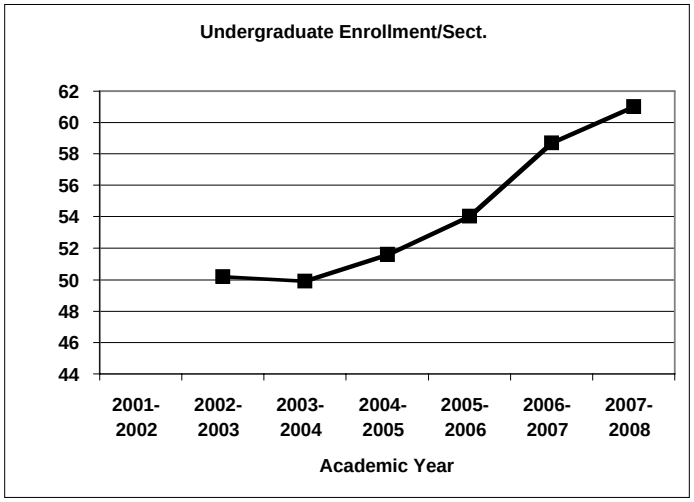
2. Date and Description of Last External Review

The program was last evaluated in May 2001. The review focused on the quality and diversity of the students; the quality of instruction; the success of students in completing the program; the quality of research and service by the faculty; and the relationship of these factors to the cost of the program. At the time of the review there were approximately 800 undergraduate majors, the overwhelming majority of which were Caucasian, with only a small percentage of Hispanics and Blacks. The number of B.A. degree awarded averaged about 214 per year while the number of B.S. degrees averaged about 12 per year. Student satisfaction with the quality of the program was high, with > 90% of graduating seniors responding that they were satisfied or very satisfied with the instruction in their major. One issue of concern, however, was the low graduation rate (<40%) of students who entered the program as freshman. At the graduate level, the program attracted well-qualified students to both the M.A. and Ph.D. programs, with combined verbal and quantitative GRE scores averaging 1060 and 1178, respectively. On average, about six M.A. and three Ph.D. degrees were awarded annually, with most graduates of the doctoral program accepting positions in academia. Faculty productivity during this period was high, with faculty averaging about two peer-reviewed publications per year. However, extramural funding for research was relatively low, with only 20% of the faculty having federal grant support. Faculty service to the university and to the profession was also strong, with all faculty serving on departmental, college or university committees and as ad hoc reviewers for professional journals. In addition, several faculty members served on the editorial boards of prestigious journals.

3. Instruction

3.1 Review of Departmental Dashboard Indicators

The Psychology Department experienced considerable enrollment growth during the past five years. To accommodate this increase, the number of lecture course sections grew steadily during 2002 -- 2005 to about 160 per year, but then decreased to about 130 by 2008. The percentage of these sections taught by faculty remained steady at about 70%. As shown graphically below, undergraduate enrollment per section during this period climbed to over 60, which is clearly not optimal for student learning. At the graduate level, enrollments in seminars averaged about 11 students per class.

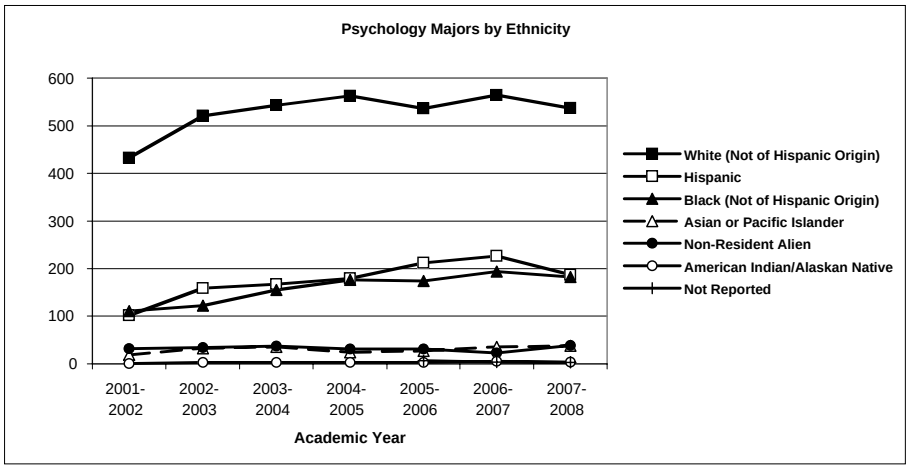


Annualized state-fundable FTE at the lower division came mainly from students outside the College of Science and averaged about 120 per year, with Psychology and other Science majors contributing only about 17 FTE per year. This distribution probably reflects the large number of non-majors taking General Psychology to satisfy Gordon Rule requirements. At the upper division, however, majors produced most of the FTE (250-300 per year), followed by students outside the College (110-130 per year) and non-majors within the College (40-70 per year). Thus, Psychology courses are taken by a wide variety of students across the university. At the graduate level, FTE generated by Psychology students doubled between 2001 and 2008 to about 40 FTE per year, whereas non-majors both within and without the College produced about 5 FTE per year.

Students were generally satisfied with the quality of instruction, with mean SPOT scores of 1.9 for undergraduates and 1.7 for graduate students (1=Excellent, 5=Poor). Student satisfaction with the quality of advising in the department, as assessed by the Student Satisfaction Survey, matched that for the college and university as a whole, with means of 2.8 for undergraduates and 3.1 for graduate students (4=Excellent, 1=Poor). The large number of undergraduate advisees per faculty member at the Boca Campus (> 250 students) is problematic because of the demands it places on faculty time.

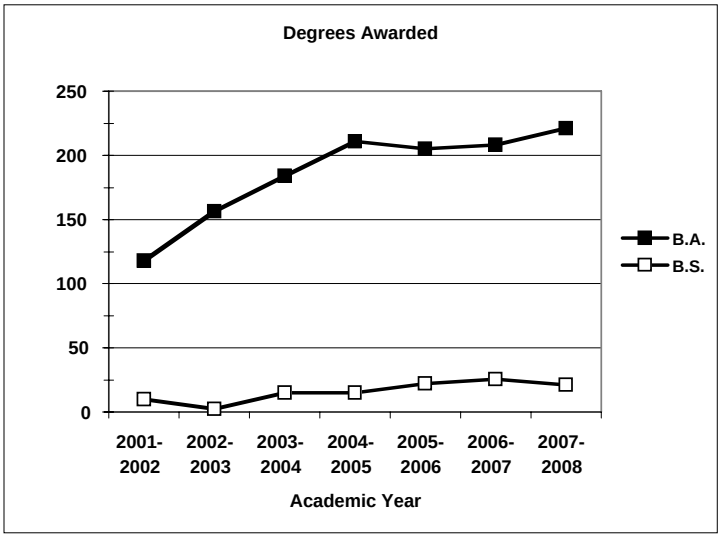
3.2 Trends in Majors Enrolled by Level and Ethnicity and Degrees Awarded

From 2001 - 2008, the number of Psychology majors increased 43%, from 700 to 1,000, while the number of Psychobiology majors increased 74%, from 50 to 87. The ethnic composition of the undergraduate population is shown graphically below.

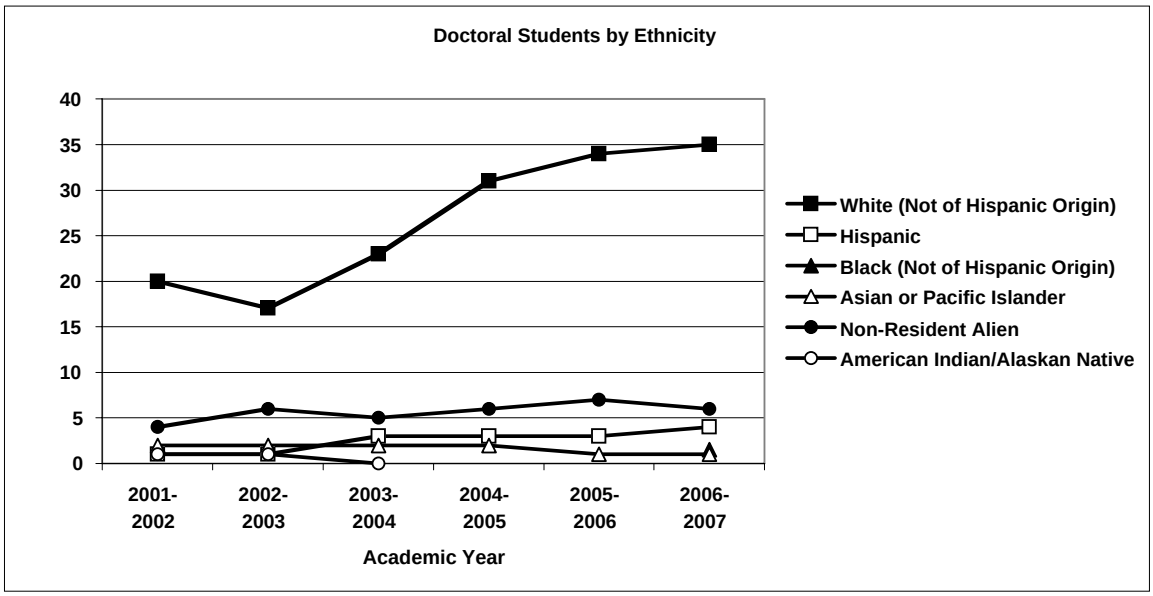


The distribution was similar for Psychobiology majors. Although there were upward trends in the absolute numbers of white, Hispanic and Black students during this period, the relative percentages of these groups remained constant. The overwhelming majority of undergraduate students were female, making up 80% of Psychology majors and 75% of Psychobiology majors. These gender differences held across white, Hispanic, and Black ethnicities.

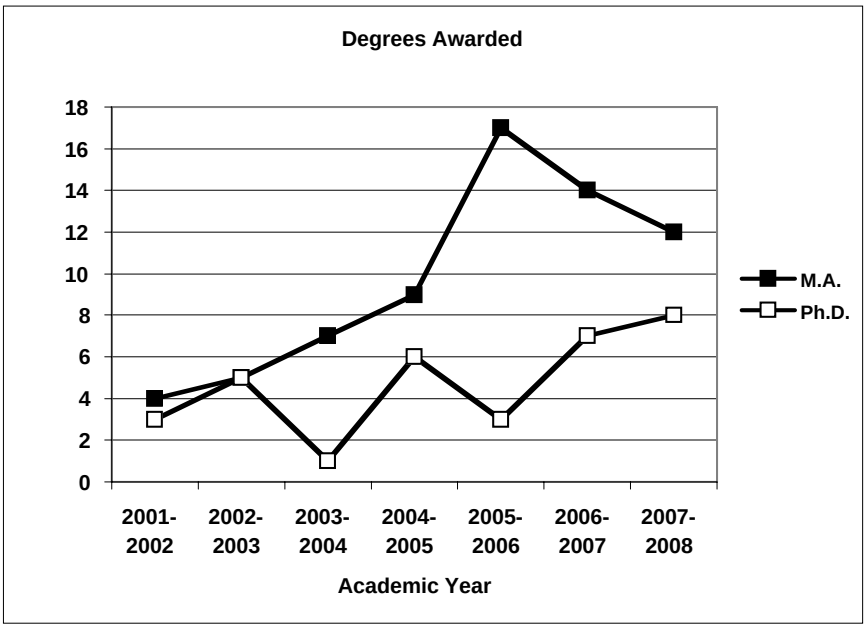
The number of Baccalaureate degrees awarded between 2001 and 2008 is shown below.



At the graduate level, the number of Masters and Doctoral students increased more than 50% between 2001-2007, that is from 48 to 75. The ethnic composition of this population is shown below. The majority of doctoral students were female (68%).



The number of M.A. and Ph.D. degrees awarded between 2001 and 2008 grew steadily, as shown below. (The number of Master's degrees includes both students in the Masters and Doctoral programs.)



3.2 Establishment of Goals for Student Learning and Assessment of Achievement

The Department revised its undergraduate assessment plans in the Fall of 2005. In the B.A. program (Psychology), **declarative knowledge** is tracked in four "core" courses: *DEP 3053 Psychology of Human Development, EXP 3505 Cognition, PSB 3002 Biological Bases of Behavior 1, and SOP 3004 Social Psychology*; in the B.S. program (Psychobiology) it is assessed in one course, *PSB 3002 Biological Bases of Behavior 1*. In both programs, **critical thinking and writing skills** are assessed via *PSY 3213 Research Methods in Psychology*. These courses are included in the Undergraduate Academic Learning Compacts (ALCs) for the B.A. and B.S. degree programs.

For each course, master syllabi created by the faculty outline the student learning outcomes to be addressed. Exams and other assignments in these courses contain embedded questions/items that directly measure student achievement of specific learning outcomes. The percent of students achieving correct responses on the assessment items is submitted to the Department each semester by the faculty teaching these courses and aggregated data are reported annually in the assessment database. The trends are shown in the table below.

Overall Percent Correct on Student Learning Outcomes in Undergraduate Core Courses

	Academic Year				
Course	**2005-06**	**2006-07**	**2007-08**	**2008-09**	**Mean**
DEP 3053	68	81	76	75	75
EXP 3505	69	76	83	78	76
PSB 3002*	68	66	74	68	69
SOP 3004	no data	81	88	75	81
PSY 3213*					
Content	72	71	72	74	72
Writing	88	70	85	75	80

Notes: All of the above courses are included in the ALC for the **B.A. Psychology** program;
* denotes courses included in the ALC for the **B.S. Psychobiology** program.

Although there is some variability in achievement, students have reached, or been slightly above or below, the assessment criterion set for each course (60% for *PSB 3002*, 70% for the others) and there has been a trend toward increased achievement for almost all courses over the past three years.

The department has had several false starts in implementing assessment plans for the M.A. and Ph.D. programs. The latest plan, approved for the 2008-2009 academic year, assesses students' knowledge of the scientific literature in their areas of specialization and their ability to apply the scientific method. Members of thesis and dissertation committees will evaluate the first draft of students' written research proposals using a rubric that evaluates the following items on a three-point scale (1=below expectations; 2=meets expectations; 3=exceeds expectations):

Knowledge of the Scientific Literature

- the student's ability to summarize and evaluate the scientific literature
- the students ability to relate the literature to central conceptual themes in the area
- the potential impact of the proposed research on the field

Application of Scientific Method

- the degree to which research questions have been successfully operationalized
- the appropriateness of the proposed methodology and quality of the data
- the appropriateness and quality of the proposed statistical analyses

At least 70% of students are expected to achieve a mean score of 2 or higher.

3.4 Description of How Results Are Used for Continuous Program Improvement

In addition to the overall results obtained for each course in our undergraduate program assessment plan, the Department annually reviews the results for the specific outcomes targeted in each ALC course. These results are provided to the faculty for the purposes of curriculum review. Changes in course content, pedagogy, or approaches are weighed on the basis of the assessment data and have resulted in changes to the master syllabi for some of these courses. Such discussions have been fruitful, particularly for the DEP 3053 and PSB 3002 courses over the last three years. A copy of the latest review to be presented to the faculty at the August, 2009 departmental retreat is attached as Appendix A.

There are two major challenges to the undergraduate assessment program. One is faculty compliance in collecting and reporting relevant assessment data, which has fallen off in the 2007-2008 academic year. The other is a lack of standardization in the questions that are used to assess individual learning objectives. Different instructors use different questions, but individual faculty also sometimes change from semester to semester which questions they use. These variations undoubtedly affect the validity and reliability of the assessment results. They will be addressed in future assessment efforts. In addition, the Department will consider including additional courses in future assessment plans, namely, *STA 3163L Intermediate Statistics Laboratory* (included in the ALCs for both programs) and CBH 4024 Comparative Animal Behavior (B.S. Psychobiology only).

3.5 Undergraduate Programs: Common Prerequisites Manual

The Common Prerequisites Manual (CPM) maintained by the State of Florida provides the list of community college courses that students must have completed in order to transfer into a four-year baccalaureate program at a state university. For general psychology programs, the required prerequisites include an introductory biology course, a general or introductory psychology course, another lower level psychology course, and introductory statistics.

In general, the department is in compliance with the CPM. However, a state report issued in November 2007 identified two inconsistencies between the CPM and the FAU catalog regarding the B.A. Psychology program. The first is that the catalog does not list all the courses that could be taken at a Community College to substitute for the biology prerequisite listed in the CPM. The Department responded that BSC and ZOO courses at the Community College are acceptable substitutes but that specific courses are not listed because of their large number. The second inconsistency is that the Department does not accept STA level statistics courses in lieu of the Department's statistics course (*PSY 3234 Experimental Design and Statistical Inference*) and it requires two mathematics courses consisting of College Algebra or higher, thus imposing additional math requirements beyond what the CPM calls for. The Department responded that the mathematics requirements were instituted in response to a recommendation from a previous external program review and that the STA level statistics course may be used as an elective and partially satisfies the Gordon Rule in computational skills.

Ultimately, students who transfer to FAU from a community college but have not met the prerequisites delineated in the CPM are able to complete them after transferring to FAU; the student is not denied the opportunity to declare a major in the B.A. Psychology program. The Department believes that it is fully compliant with the CPM.

3.6 Some Trends in Student Index Data

Mean grade point averages (GPA) for Psychology undergraduates:

B.A. 3.1 (range: 3.0—3.1)
B.S. 3.2 (range: 3.0—3.4)

Median time for undergraduates to complete their degrees (range, in years):

B.A. 2.0—2.3 for transfer students; 4.0—4.5 for FTICs
B.S. 1.7—3.8 for transfer students; 4.0—5.6 for FTICs

Median time for graduate students to complete the degree (in years):

M.A. 2.66 (range: 2.3—3.3)
Ph.D. 5.40 (range: 4.7—6.0).

Average GRE scores for students entering the graduate program:

	2004-05	2005-06	2006-07	2007-08
Doctoral				
Total	1280	1180	1184	1234
Quant	730	650	652	651
Verbal	550	530	532	583
Masters				
Total	1110	1122	1070	1231
Quant	596	601	602	663
Verbal	514	521	468	568

3.7 Summary Data for BOG Report

Major Changes Since Last Program Review.

- Renovation of Behavioral Sciences building
- Termination of program at Treasure Coast Campus
- Continuing faculty attrition
- Significant budgetary shortfalls

Strengths.

- Faculty teaching, research and service productivity is high
- Undergraduate students are achieving expected learning outcomes
- Graduate students are finding employment in academia and in both the public and private sector

Weaknesses.

- Faculty attrition compromises student-faculty ratio, student advising load, graduate training
- Budgetary shortfall impacts hiring, research support, faculty morale
- Lack of critical mass at partner campuses for area specializations
- Geographic dispersion of faculty over three campuses dilutes quality of graduate training and faculty interaction; increases commuting costs

Recommendations.

- Consolidate faculty at Boca campus
- Provide office and laboratory space in Behavioral Sciences and Science & Engineering
- Offer evening undergraduate courses at partner campuses, staffed by adjuncts, graduate students and faculty
- Retain space at partner campus for faculty unable to relocate/commute

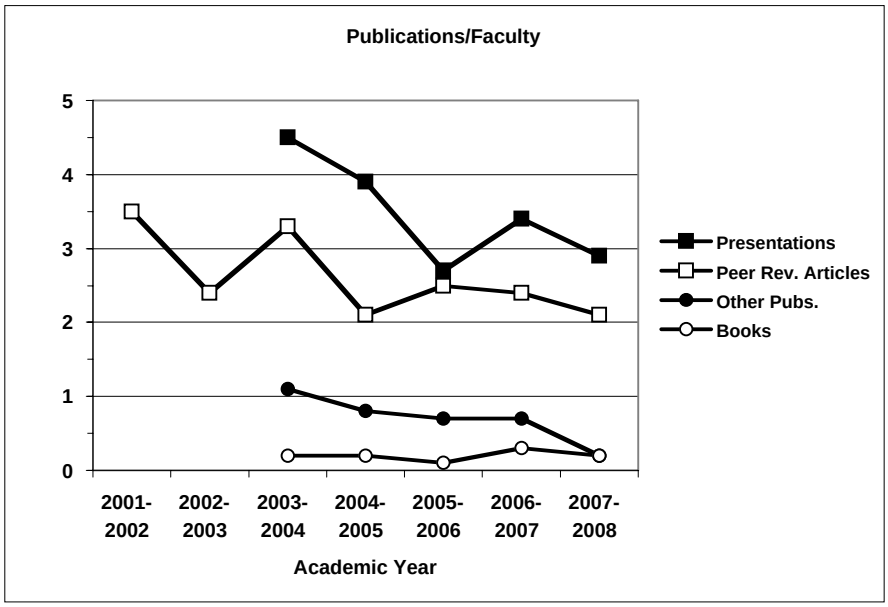
Comments: Benefits of Consolidation

- Unifies the department
- Facilitates faculty interaction (meetings, thesis/dissertation defenses, colloquia, research collaborations)
- Strengthens graduate program
- Maximizes resources in reduced funding environment (more from less)

4. Research

4.1 Review of Dashboard Indicators

Faculty in the Department of Psychology maintained a high level of research productivity, averaging 2--3 peer-reviewed journal articles per year. About 25% of faculty had extramural grants, which generated an average of $680,000 per year in sponsored research, according to the dashboard indicators.



4.2 Research Goals and Assessment of Achievement

The Department's goal for research is that at least 75% of faculty will publish at least one peer-reviewed article per year and that at least 33% of faculty will be awarded extramural grants or contracts to support their research. During the period 2002-2008, about 76% of faculty had at least one publication per year, but only about 25% had been awarded a grant. The relatively low rate of grant funding was not due to lack of effort, however. For example, 36 proposals were submitted to funding agencies during the 2007-08. Faculty are assigned up to 25% FTE in support of research and have adequate laboratory space. However, a number of factors have a negative impact on research productivity (see *Section 3.5, Weaknesses*).

5. Service

The criteria for assessing Service were revised somewhat after 2005-2006, making it difficult to compare the dashboard indicators across the entire period under review. However, data from the past two academic years (2006-2007, 2007-2008) are representative. During this period, 88-96% of faculty served on departmental, college or university committees; about 60% served on community or professional committees (including NIH and NSF study sections); and 77-82% served as editors or reviewers for professional journals. The department's goals for Service are that 100% of faculty serve on at least one FAU committee; 33% participate in community or professional organizations related to the discipline; and 75% serve as editors or reviewers for professional journals. Up to 25% FTE is assigned to Service.

The department has a number of standing committees, the most important of which are the Graduate Committee, the Undergraduate Committee, and the Personnel Committee. These committees contribute importantly to departmental governance. The Graduate Committee advises the department on issues of policy and oversees graduate admissions and evaluations; the Undergraduate Committee oversees requirements for the major and makes recommendations on curricular matters; and the Personnel Committee conducts annual evaluations of the faculty in an advisory capacity to the Chair. In addition, faculty serve as members of the P&T Committee, Honors Committee, IRB, Library Committee, Assessment Committee, Colloquium Committee and others. Faculty also provide service to the profession, including serving as Editors and reviewers for professional journals, as officers of professional societies, and as members of NIH and NSF review panels. Journals for which faculty serve as Editors and Associate Editors include: *Journal of Experimental and Child Psychology, Child Development, Journal of Child Language, Music Perception, Infancy, Development, Psychobiology, Evolutionary Psychology, Journal of Personality, Personality and Individual Differences, and Psychological Inquiry.*

6. Other Program Goals

At a retreat held several years ago, the Department decided to establish an area specialization in Quantitative Psychology at the Davie campus. At the time, there was a small core of faculty in that area and a growing recognition that quantitative methodology was playing an increasingly important role in psychological research and was important for graduate training. In addition, the Department believed that developing a campus specialization would help unify faculty and graduate students at the Davie campus and would help in recruiting new graduate students. To date, attempts to hire a new faculty member in that area has been unsuccessful because the Department could not offer a competitive salary or start up package. More recently, one of the existing faculty members in the quantitative area accepted a higher paying position at another university. The budget shortfall makes it unlikely that this goal can be achieved.

A second departmental goal was to strengthen the undergraduate program at the Mac Arthur campus by establishing a core faculty there. When the program at the Treasure Coast campus was terminated several years ago, faculty assigned to that campus were transferred to the Mac Arthur campus, bringing the total number of faculty there to three. However, since then, one faculty member resigned to take a position at another university and the line for this position has since been lost due to the current budget shortfall. Consequently, it is unlikely that this goal can be achieved.

In response to the problems created by faculty attrition and budgetary constraints, the Department proposes to consolidate the faculty at the Boca campus. Courses at the Davie and Jupiter campuses will continue to be offered by faculty, adjuncts and graduate students to preserve the FTE from those sites. The consolidation will strengthen the program in several ways. It will unify the department; strengthen the graduate program; facilitate faculty and faculty-student collaborations; and maximize resources in a reduced funding environment.

7. Resource Analysis

Current resources are inadequate to meet the program's goals. The greatest impact can be felt in support of teaching and research. Faculty salaries are not competitive with those at other universities, even within the SUS, prompting faculty to seek positions elsewhere. Faculty attrition has already resulted in a loss of critical mass at the branch campuses and even at the Boca campus it has impacted the student-faculty ratio and placed unreasonable demands on faculty time for student advising. There are no institutional funds available to replace faculty, for travel to professional conferences, for start up funds for new faculty, and for the purchase or maintenance of research equipment. Projected budget cutbacks for the coming year will only worsen this situation.

8. Major Findings and Recommendations

Psychology is a popular major, but increases in enrollment growth have not been matched by increased funding especially to recruit new faculty. Psychology majors, both undergraduate and graduate, tend to be predominantly white and female. Students are achieving expected learning outcomes and assessment plans are revised accordingly. Graduate students are finding employment in academia and in the public and private sector. Faculty teaching, research, and service productivity is high; however, Departmental goals and productivity are threatened by faculty attrition and reduced budgets.

A major recommendation is the faculty at the branch campuses should be reassigned to the Boca Raton campus to preserve the core mission of the program. Courses at the branch campuses should then be offered on a rotating basis such that transfer students can complete the major in two years. Additional resources should be allocated to support undergraduate student advising. Increased extramural funding should be sought to support research.

APPENDIX

Academic Learning Compacts