



Item: AS: A-1

Thursday, November 12, 2015

**SUBJECT: APPROVAL OF PROGRAM REVIEW – CHARLES E. SCHMIDT COLLEGE OF SCIENCE**

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#### **PROPOSED BOARD ACTION**

Approve program review for programs in the Charles E. Schmidt College of Science.

#### **BACKGROUND INFORMATION**

Under Florida Board of Governors Regulation 6C-8.015 adopted March 29, 2007, all academic degree programs in State universities must be reviewed at least every seven years. Program reviews ensure that academic programs are administered and delivered effectively, efficiently, and consistent with FAU's mission and the Board of Governors' strategic priorities. The results of program reviews are expected to inform strategic planning, program development, and budgeting decisions at the university level, and, when appropriate, at the state level.

Academic Program Review at FAU includes a few additional steps:

- The self-study prepared by the program's department will be submitted to an independent review committee comprised of 2-5 individuals. The committee will include at least one external reviewer who will serve as a content expert in the discipline. Other members will include nominees of the head of the academic unit in consultation with the unit's faculty.
- The external reviewer will conduct a day and a half site-visit. A written report of the reviewer's findings will be submitted to the program's review committee.
- In addition to self-studies and external reviewer reports, action plans will be submitted to the Board of Trustees for approval.

Academic degree programs in the following departments were reviewed this year:

*Charles E. Schmidt College of Science*

- a) Biology
- b) Chemistry
- c) Complex Systems
- d) Environmental Science
- e) Geosciences
- f) Mathematics
- g) Physics

h) Psychology

**IMPLEMENTATION PLAN/DATE**

Academic Program Review summaries will be submitted to the BOG in November 2015 pending full Board approval.

**FISCAL IMPLICATIONS**

N/A

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**Supporting Documentation: 2015 Academic Program Reviews**

**Presented by: Dr. Janet Blanks, Interim Dean of Charles E. Schmidt College of Science**

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## 2015 Academic Program Review Summary

### Charles E. Schmidt College of Science Department of Biological Sciences

#### Part 1: Overview

#### A. Degree Programs by Level

##### **Undergraduate Programs:**

BA Biology, BS Biology  
Certificate in Biotechnology

##### **Graduate Programs:**

MS Biology (Thesis), MS Biology (Non-Thesis), MST Biology (Non-Thesis)  
PSM Business Biotechnology  
PhD Integrative Biology

#### B. Mission and Purpose

The 21st Century brings 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 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. degrees in biological sciences and environmental sciences; Masters in Teaching degrees (M.S.T.); Professional Science Masters in Business Biotechnology (P.S.M.); as well as Ph.D. degrees in Integrative Biology (IB). Our IB Ph.D. degrees will soon offer the options to focus on neuroscience or environmental sciences (currently pending review by the University Faculty Senate).

#### C. Major changes since the last program review

Since the last Program Review in 2009, several new faculty members have joined the department and established their own research programs. All of these investigators, except those hired this year, have obtained external funding and are engaging in competitive research. In addition, two former administrators joined the department in August, 2013. Unfortunately, we have also lost two faculty members during this period.

*The Davie Environmental Science Initiative* At the time of the last review a new building, called Davie West, was being built on the Davie campus. The building is finished and now houses nine FAU Biology faculty members with research specialization in Environmental Science. The building is shared with scientists engaged in environmental research and Everglades restoration efforts from the University of Florida, the Institute for Food and Agriculture (IFAS) and the US Geological Survey (USGS). The most recent Biology faculty member is a behavioral ecologist who will be based in Davie. A separate administrative unit, The Florida Center for Environmental Studies has recently (2014) moved to Davie and this will add cohesion and focus to the Davie effort. In brief, although it is a multi-departmental endeavor, biologists have led the way in establishing Davie as a focal point for Environmental Science. At the graduate level, we are establishing a track within our Ph.D. program called Integrative Biology and Environmental Science (IB-ES).

*The Jupiter Life Science Initiative* One of the recommendations of the last review was to develop connections to the large research institutes being built in Jupiter, Florida. In order to enhance our interaction with the Scripps Research Institute in Florida and the Max Planck Florida Institute in Jupiter, first, the Center for

Molecular Biology and Biotechnology (CMBB), moved to the Jupiter campus in 2010 and began collaborating with the Scripps, Florida Institute. In 2011, we transferred a group of seven neuroscience faculty members from Boca to the MacArthur campus in Jupiter. We renovated a building adjacent to Scripps and Max Planck on the Jupiter campus to our specifications and it now houses the neuroscience group consisting of six Biology faculty members, and one Psychology faculty member and 40 staff and students, with two more biologists being recruited. At the graduate level, in collaboration with Max Planck and Scripps Florida we are establishing a track within our Ph.D. program called Integrative Biology and Neuroscience (IB-N) and this is attracting attention and beginning to grow.

*Undergraduate Initiatives* The number of majors in Biology has continued to increase at the rate of 5-10% per year and now stands at over 2500 majors. This stresses our resources and we have had to adjust our methods of program delivery to accommodate the growth while continuing to bring innovative pedagogies to the classroom. At the undergraduate level a joint Neuroscience and Behavior program between the Biology and Psychology departments, resulting in a certificate for students, has suddenly gathered momentum on the Boca campus and has grown to 300 majors in three years.

We used an NSF Undergraduate Research and Mentoring grant entitled “Undergraduate Research and Mentoring: Integrative Biology for Future Researchers”, 2008-2013, to design research experiences for undergraduates placing students in research labs, mentoring them toward research careers and helping place them after graduation. Based on the results of this NSF-funded program, we established a research intensive Honors Program. Although the NSF grant has ended, the Biology Honors program continues to operate and has become the model for the entire University in the form of the Quality Enhancement Plan (QEP) program.

Using a grant from the FAU Technology Fee program, we have established two computer teaching labs in the department that are being used for a growing number of courses. We are using simulation studies as a proxy for research projects. This facility has also allowed us to expand bioinformatics beyond a select graduate population to the undergraduate level. Finally, we are reorganizing the curriculum as we try to enhance the student experience to introduce critical thinking and move research-like experiences into the lower level of the curriculum. For instance, we are now offering *Life of a Scientist* to sophomores to expose students early-on to research, why we do it and to encourage them to become actively involved. Recently we have written two educational grants focused on moving research experience to the sophomore year since studies have shown that this enhances retention in the STEM fields. These grants are focused on using simulation and *in silico* experiments to introduce large numbers of students to the research enterprise.

## **Part 2: Findings**

### **A. Strengths**

The Department of Biological Sciences has a strong undergraduate and graduate programs, a large core of research active faculty who are continuously successful in obtaining extramural funding. We also have an amazing set of opportunities, some scientific, some geographic, some political, and we are working to take advantage of them: (1) In environmental science, the natural environment and especially the Everglades and the marine environments are opportunities that our faculty routinely take advantage to enhance their research projects. The political and financial commitment to restoring the Everglades provides an amazing research resource that our faculty utilize to fund their research. (2) In neuroscience, the state of Florida has invested nearly \$1 billion in establishing Scripps, Florida Institute and MPFI on our MacArthur campus. The Department of Biological Sciences led the way in establishing connections to these institutes by moving the CMBB and a group of neuroscience faculty into a building on the MacArthur campus adjacent to Scripps and MPFI.

## **B. Weaknesses**

The distributed faculty between three main sites is a double-edged sword. It allows us to cluster faculty by common interests and common techniques, but it divides our relatively small faculty into even smaller groups. The distributed faculty also handicaps students from several perspectives. In some cases they must spend time and expense to travel in order to enroll in upper division and graduate courses, work in specific research laboratories and take advantage of university facilities and programs. We have made great strides at utilizing new technologies to broadcast courses and meetings to distributed sites, but still find many weaknesses in their application.

Our ethnically diverse student body and urban campuses present unique problems in improving student retention. Most of our students are employed either full- or part-time in order to remain in college. It is difficult to significantly improve our retention rate in light of this situation.

## **C. Recommendations**

***Recommendation 1:*** *To continue to build research and instruction on the Boca Raton, Jupiter and Davie campuses along the lines already established.*

The Dean's office is supportive of this recommendation. The Dean's office also recognizes the need for better transportation options between these campuses and will forward this request to the Office of the Provost as a part of a college-wide need. Lastly, there is a need for technology upgrades in classrooms at all three campuses to facilitate faculty teaching courses simultaneously on two or three campuses. The Dean's office recommends that the Department seek FAU Technology Fee funding and utilize creative e-learning strategies to enable implementation of such courses.

***Recommendation 2:*** *To develop a reliable, efficient transportation system between the different campuses for students and faculty as soon as possible.*

See Dean's office comments above.

***Recommendation 3:*** *To support the sense of community in the Biology Department by developing institutional habits and traditions that support it, such as a monthly departmental day on the Boca Raton campus that all are expected to attend.*

The Dean's office supports monthly departmental meetings of the Department where the campus location is varied. Alternating such meetings between Boca Raton, Jupiter and Davie will encourage collegiality and positive professional interaction between Biology faculty on the three campuses. In addition the biannual retreat is encouraged and could incorporate student research presentations in a competition format (judged by faculty).

***Recommendation 4:*** *To raise the threshold for entry into the B.S. in Biology Program (by considering limiting future University growth in the largest undergraduate major to enable the faculty to plan for orderly instruction in this discipline).*

The newly implemented Bachelor of General Studies degree at FAU offers students more options when they are unable to pass key gate-keeper courses in programs, hence a review of admission standards in Biological Science programs is appropriate.

***Recommendation 5:*** *To develop a first semester, one credit course that introduces first year students to exciting developments in the life sciences, explains the need for tools and concepts from the hard sciences and mathematics, and identifies career pathways in the life sciences other than pre-medicine.*

The Dean's office supports this initiative and encourages the Department to coordinate with FAU's Career Center.

**Recommendation 6:** *To create course sequences and major/minor combinations that lead to degrees in Biology/public policy, Biology/law, Biology/business and finance and non-profits.*

The Dean's office would support this initiative and acknowledges that this is a high-reach and long-term objective. When the Department does decide to pursue such combination programs the Dean's office will help them coordinate with relevant departments and colleges at FAU and other institutions.

**Recommendation 7:** *To hire additional faculty or non-tenure-track instructors to reduce the student/faculty ratio.*

Requests for faculty lines will be considered by the Dean's office. Requests for funding will be prioritized relative to other funding requests from the college, and also depend on the availability of funding.

**Recommendation 8:** *To create a formal faculty mentoring program.*

The Dean's office acknowledges that the Department has an effective faculty mentoring program in place and mentoring teams also pursue FAU-wide funding to help consolidate and accelerate such partnerships.

**Recommendation 9:** *To consider course structures that increase the interaction of students and instructors; the 'recitation section' is one possible model.*

The Dean's office acknowledges that the Department carries a tremendous undergraduate research mentoring load. Implementation of recitation sessions is encouraged but may not be viable at this stage due to stretched resources.

**Recommendation 10:** *To bring advisement for sophomores and upper class students back to the department.*

The Dean's office advises that the Department work closely with University and College advising staff to enhance and streamline advising for Biology majors.

**Recommendation 11:** *To engage the better students in peer-support activities by developing an undergraduate interest/service club.*

The Dean's office recognizes that the Department has such clubs in place.

**Recommendation 12:** *To consult the better graduating seniors about what did and did not work for them, and how it can be improved.*

The Dean's office supports the implementation of an exit interview program for graduating biology majors to gather data on "what works and does not work". This could be essential to program improvement efforts.

**Recommendation 13:** *To strengthen research productivity by encouraging more interdisciplinary ties with other departments and colleges.*

The Dean's office supports this initiative both for basic/wet-lab research as well as science education projects.

**Recommendation 14:** *To strengthen research productivity by improving the graduate student support package offered to Ph.D. and M.A./M.S. students.*

The Dean's office recognizes the need to increase graduate student stipends to regionally competitive levels and offer health insurance to all graduate students in the Charles E. Schmidt College of Science. This recommendation will be forwarded to the Office of the Provost as a college-wide request.



## 2015 Academic Program Review Summary

### Charles E. Schmidt College of Science Department of Chemistry and Biochemistry

#### Part 1: Overview

##### A. Degree Programs by Level

###### **Undergraduate Programs:**

BA Chemistry

BS two tracks: 1) BS Chemistry (ACS-Approved), 2) BS Biochemistry

###### **Graduate Programs:**

MS (Thesis) in Chemistry

PhD in Chemistry

##### B. Mission and Purpose

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 experience in both fundamental and applied research. We will continue to perform basic research that may lead to the discovery of 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.

##### C. Major changes since the last program review

The Committee on Professional Training (CPT) of the American Chemical Society (ACS) reviews undergraduate chemistry programs every five years. The Department's last full review was reported in December 2012. The ACS CPT found our program to be consistent with their guidelines for program certification. Additionally, in accord with the University's Quality Enhancement Plan (QEP), the Department incorporated several research oriented assignments and topics into chemistry courses for Chemistry and Biochemistry majors, including Inorganic Chemistry (CHM 3609), Organic Chemistry Laboratory (CHM 2211L) and both Physical Chemistry Laboratory courses (CHM 3410L and 3411L). Also, a requirement for a third semester of mathematics in the B.S. degree program was instituted to ensure improved student success in the Physical Chemistry and other mathematically intensive courses.

#### Part 2: Findings

##### A. Strengths

***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 developed through the ChemBOND project are

currently instituted in the introductory and organic chemistry courses. 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, Raman spectroscopy and others. This is a direct result of establishing a state of the art core facility in the Department and the acquisition of new instruments through internal and external grants.
- The National Science Foundation (NSF) 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 (ACS) has certified our undergraduate courses and programs.

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

- Strong individual faculty members have good publishing record in superior journals.
- High quality graduate students have gone on to prestigious post-doctoral training and other employment.
- The NSF GK-12 Program, funded at \$2.5 million, enabled graduate students to work with local high school students and teachers.
- Opportunities for collaborative research exist with nearby Scripps Institute, and Max-Planck Institute.
- If approved, construction of the recently proposed Science Building on the Jupiter campus could significantly increase the department's teaching, research, and collaborations there.
- Interdisciplinary 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.
- The return of Professor Gregg Fields and the administration's commitment for hiring three new faculty offers the potential for significant positive change.

**B. Weaknesses**

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

- Increasing class sizes (some now exceeding 300) impedes student success.
- Insufficient numbers of basic laboratory equipment often lead to unpleasant lab experiences and frustration among students.
- Laboratory space for teaching and research is exhausted.
- Inadequate preparation of many freshman students impedes their success in lower division courses.
- Inconsistent DFW rates in introductory and organic chemistry courses needs attention.

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

- Loss of faculty due to resignations and reassignments have led to additional teaching responsibilities on other faculty, including those on tenure-tracks.
- There is little money for recruiting of high-quality graduate students.
- There have been significant problems maintaining our major research equipment, due to inadequate funding and inability to hire support personnel.
- Faculty salaries have not kept up with national norms, which are leading to more losses and failures to attract high quality new faculty.
- Graduate student stipends and benefits have not kept up with peer chemistry graduate programs.



## C. Recommendations

### ***Recommendation 1: Enhance leadership.***

The return of Dr. Gregg Fields as Chair in 2015 has enhanced Departmental leadership.

### ***Recommendation 2: Increase faculty numbers to meet our mission goals.***

As part of his start-up package new Department Chair obtained a commitment for hiring three new faculty in our Department. These faculty, to be added over three consecutive years, will help to fulfill critical needs in the Department's research and teaching missions. Requests for additional faculty lines will be considered by the Dean's office. Requests for funding will be prioritized relative to other funding requests from the college, and also depend on the availability of funding.

***Recommendation 3: Integrate Chemistry and Biochemistry at the Boca Raton and Jupiter campuses.*** The Dean's office supports a full integration of Chemistry and Biochemistry faculty on these two campuses. Combining human and infrastructure resources will serve to strengthen the Department's ability to carry out its teaching and research missions. The Dean's office also recognizes the need for better transportation options between these campuses and will forward this request to the Office of the Provost as a part of a college-wide need. Lastly, there is a need for technology upgrades in classrooms at both campuses to facilitate faculty teaching courses simultaneously on both campuses. The Dean's office recommends that the Department seek FAU Technology Fee funding and utilize creative e-learning strategies to enable implementation of such courses.

### ***Recommendation 4: Increase support for grant submission/development of research programs.***

Dean's office supports this request, pending availability of funding.

### ***Recommendation 5: Increase mentoring for new faculty.***

Dean's office supports this initiative and acknowledges the important role of the new Chair in proactive and ongoing mentoring of junior and mid-career faculty in the Department.

### ***Recommendation 6: Define the Department's research focus.***

The Department's research focus of *Chemical Biology* is an excellent fit as part of the Drug Discovery/Healthy Aging "Pillar" described in the University's 2015-2025 Strategic Plan.

### ***Recommendation 7: Review of the undergraduate program in Chemistry and Biochemistry.***

The Dean's office supports a review and streamlining of undergraduate programs to better utilize faculty expertise, optimize student learning experiences and increase (6 year) student graduation rates.

### ***Recommendation 8: Review of the graduate program in Chemistry and Biochemistry.***

The Dean's office recognizes the need to increase graduate student stipends to regionally competitive levels and offer health insurance to all graduate students in the Charles E. Schmidt College of Science. This recommendation will be forwarded to the Office of the Provost as a college-wide request.

### ***Recommendation 9: Continue Chemical Education innovations.***

Since 2007, the Department of Chemistry and Biochemistry has obtained over \$2.85 million in chemical education funding from NSF and well over \$500k of internal technology and other funding to improve the curriculum and conduct chemical education research. The faculty are commended on their efforts and have full support from the Dean's office to continue these initiatives.



## 2015 Academic Program Review Summary

### Charles E. Schmidt College of Science Center for Complex Systems and Brain Science (CCSBS)

#### Part 1: Overview

##### A. Degree Programs by Level

###### **Undergraduate Programs:**

Certificate in Neuroscience

###### **Graduate Programs:**

PhD in Complex Systems & Brain Sciences

##### B. Mission and Purpose

The Center for Complex Systems and Brain Sciences at FAU seeks to serve the University, professional communities, and local surrounding community with instructional, research, and extracurricular activities that enhance the understanding and appreciation of all issues related to the complexity of the human brain, mind, and behavior. The Center is unique at FAU in maintaining a research-oriented Ph.D. program that enhances the academic atmosphere of the university, and promotes the awarding of much-needed research funding. The Center is also unique internationally as one of the only programs in the world that is solely dedicated to promoting the study and exposition of the brain as a complex, spatiotemporal dynamical system.

##### C. Major changes since the last program review

The CCSBS had an External Review in Spring 2005 and participated in a college-wide Program Review in 2009. Since 2005, a number of CCSBS faculty have left for positions elsewhere and most have not been replaced. Most notably Dr. Ed Large recently left to join the Dept. of Psychology at University of Connecticut. In this case, a search is currently underway for an Assistant/Associate Professor in the field of Cognitive Neuroscience to replace him.

At the recommendation of the last External Review Committee (2009), CCSBS has attracted neuroscientists from other parts of the campus to join CCSBS to bolster depleted faculty numbers. These additions to CCSBS include: Drs. Barenholtz, Hong, and Stackman from Dept. of Psychology, Drs. Prentice, Shen and Wu from the Dept. of Biomedicine in College of Medicine (COM) and Dr. Pandya from the College of Engineering. Also, Dr. Claiborne, former Provost, now Professor of Biology located on the Jupiter campus is an Associate member of the Center.

#### Part 2: Findings

##### A. Strengths

The CCSBS is FAU's foremost entity in the area of Neuroscience and a world-renowned leader in Complex Systems and Brain Sciences, with its faculty members participating in numerous invited lectures worldwide, in the publication of research in prestigious journals and with the accomplishment of a large volume of sponsored research that advances knowledge and helps society. It also has tremendous impact on training the future leaders of academia and industry.

Moving forward, the CCSBS has a unique opportunity to help FAU to broaden its contribution to state education and revenue. CCSBS faculty propose to develop an undergraduate degree in Complex Systems. A draft curriculum for this undergraduate program has already been outlined and discussed. This undergraduate major

would provide the concepts, methods and tools for a variety of disciplines (social sciences, economics, neuroscience, physics, psychology, engineering, medical and environmental science, etc.) and problems (climate change, water management, diseases of the nervous system, health care management etc.) to prepare the workforce for the complex challenges of today's world, with emphasis on Florida's needs and unique challenges. There is a strong suggestion from the business community that undergraduates with such knowledge and skills would be in high demand (similar to our Ph.D. graduates).

## **B. Weaknesses**

- Longstanding lack of infrastructure in the area of human brain imaging, especially a Human Brain Imaging Facility in which key imaging modalities are integrated (including a research-dedicated MRI scanner to tackle the important matter of brain health and disease, Obama's grand challenge and an important stake for the State of Florida).
- Aging of the faculty in the Center.
- Loss of key faculty (leaving at the height of their scientific careers), especially in the area of Computational Neuroscience.
- Reduced success rate at Federal Agencies for support of research across the board is a growing concern, though to date, Center faculty have done well in maintaining their sponsored efforts.
- For the last two years, we have met with high quality students interested in joining our Ph.D. Program, but who turned down our offer due to uncompetitive student stipends and lack of health insurance. Loss of first class researchers in key areas of computational neuroscience is also a factor.
- Dwindling infrastructure and equipment.
- Need for full-time support positions in the CCSBS, as follows: 1) Administrative Assistant 2) Program Assistant, and 3) Technical/Engineering support

## **C. Recommendations**

### ***Recommendation 1: Smooth Leadership transition.***

Dean's office supports the Centers request for an external search for a new Director, this request has been forwarded to the office of the Provost.

### ***Recommendation 2: Define the Department's research focus.***

The Center's focus on *quantitative analysis in human neuroscience*, thereby emphasizing computational neuroscience is an excellent fit with the expertise of the current CCSBS faculty, available infrastructure and facilities, and the Neuroscience "Pillar" described in the University's 2015-2025 Strategic Plan.

### ***Recommendation 3: Increase faculty numbers to meet mission goals.***

Requests for faculty lines within the Center will be considered by the Dean's office. Requests for funding will be prioritized relative to other funding requests from the college, and also depend on the availability of funding.

### ***Recommendation 4: Increase support for Graduate Assistantships.***

The Dean's office recognizes the need to increase graduate student stipends to regionally competitive levels and offer health insurance to all graduate students in the Charles E. Schmidt College of Science. This recommendation will be forwarded to the Office of the Provost as a college-wide request.

***Recommendation 5: Increase interaction among Neuroscientists from FAU's Jupiter campus and Max Planck Neuroscience Institute, as well as the newly formed Marcus Neuroscience Institute at Boca Raton Regional Hospital (BRRH).*** The Dean's office supports such inter-institutional collaborative initiatives. These partnerships will offer our students more exciting research opportunities and access to cutting-edge technology. The Dean's

office also acknowledges the importance of the financial support by FAU's President John Kelley, at \$300K per year for 5 years, for the acquisition of the MRI 3T MR scanner, to be located on the Boca Raton Campus at University MRI. The CCSBS faculty and students will use this MRI at no cost to generate pilot data for future NIH grant applications.

***Recommendation 6: Increase collaborations with other colleges within FAU.***

The Dean's office supports inter-disciplinary collaborative initiatives. The Center's request for these initiatives of \$5000/year for 3 years will be considered pending availability of funding.

***Recommendation 7: Undergraduate initiative in Complex Systems.***

The Dean's office supports the Center's proposed feasibility study and possible implementation of an undergraduate program in complex systems and a "Certificate in Complex Systems".

***Recommendation 8: Rebuilding infrastructure and support staff.***

Dean's office supports this request, pending availability of funding.



## 2015 Academic Program Review Summary

### Charles E. Schmidt College of Science Environmental Sciences Program

#### Part 1: Overview

##### A. Degree Programs by Level

###### **Undergraduate Programs:**

Undergraduate Certificate in Environmental Science

###### **Graduate Programs:**

MS Environmental Science

##### B. Mission and Purpose

The Environmental Science (ES) Program at Florida Atlantic University is a university-wide interdisciplinary program administered by the Charles E. Schmidt College of Science. A standing Program Committee composed of faculty representing colleges across the university is responsible for academic oversight of the ES Program. Courses in the ES Program curriculum are taught by faculty from multiple departments in every college of the university. Undergraduate ES students earn the Environmental Science Certificate in conjunction with a baccalaureate degree from any FAU college. Graduate students earn the Master of Science in Environmental Science degree under the supervision of ES Graduate Faculty appointed in a wide range of departments. The ES Program also administers a graduate certificate in Environmental Restoration, and the Environmental Science concentration of the Integrative Biology PhD degree.

The mission of the Environmental Science 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, and to facilitate a robust research climate for faculty and students. The undergraduate program promotes a broad, integrated understanding of the interdependencies of humans and their environment and prepares students for diverse career paths related to environmental science. At the graduate level, the ES Program fosters leadership and provides students with in-depth knowledge and training in the natural and social sciences, preparing them to develop and implement solutions to complex environmental problems.

##### C. Major changes since the last program review

The last self-study and review of the Environmental Science Program was completed in Spring 2009. At that time a total of 13 students were enrolled in the ES Master's Program and the ES Program was entering a phase of rapid growth spurred by a broad range of important changes that had been recently implemented by Dr. Dale Gawlik, who became Director of the ES program in 2007. These changes included: significant revisions of the graduate curriculum and the introduction of a non-thesis degree option; establishment of new partnerships and collaborations with outside organizations and agencies to provide support for student research, including a \$500,000 Fellowship Initiative with the National Park Service; broadening faculty participation in governance through the formation of standing Admissions and Program committees; broadening the range of academic units from which faculty participating in the program are drawn, hosting of regular workshops and a seminar series; expanding and updating the ES web site to disseminate timely information and facilitate interaction of faculty and staff with prospective and current students. Beginning in 2009, the ES Program took on the additional responsibility for oversight and assessment of the undergraduate Environmental Science Certificate Program.

## Part 2: Findings

### A. Strengths

#### **Overall:**

- Faculty has considerable academic and research experience with the aquatic ecosystems in the Greater Everglades region, including Florida Bay, Caloosahatchee Estuary, Indian River Lagoon, the freshwater Everglades and the human interactions with these ecosystems.
- A close connection to agencies involved in the restoration and management of the Greater Everglades ecosystem, including the estuaries and water quality issues.
- Growing interest of undergraduate and graduate students in environmental issues.
- Large and diverse urban population with interest in environmental issues.
- Interdisciplinary curriculum of core courses at both undergraduate and graduate level.
- Participation of faculty from a broad range of academic units (currently 11 colleges, centers, and institutes).
- Flexible curriculum allows for broad range of backgrounds and interests in natural and social sciences.
- Wide variety of courses, including traditional, e-learning, and distance learning classroom and lab; seminar series, and courses with extensive field components.
- Experiential learning through MS thesis research and directed independent study (DIS), including an emphasis on undergraduate research (Office of Undergraduate Research and Inquiry, FAU-OURI).
- Already established relationships with local, state, and national governing bodies, including Water Management Districts, National and State Parks, and the US Geological Society.
- Well-developed infrastructural support for research and education in environmental science at FAU facilities: Boca Raton and Davie Campus Research Greenhouses, Boca Raton Campus Environmental Monitoring Field Sites used for teaching, Davie Everglades Research Center, Davie Water Quality Laboratory, DuPuis Environmental Management Area, Gumbo Limbo Environmental Complex, Harbor Branch Oceanographic Institute, Pine Jog Environmental Education Center, and Riverwoods Field Laboratory.

#### **Also, opportunities for the Program are:**

- FAU strategic plan to increase research in environmental and coastal science.
- FAU is reaching a critical mass of environmental activities in many academic units that could be reorganized to more effectively market its' considerable, but currently diffuse, environmental research and education capabilities.
- Desire by federal and state agencies involved in restoration and management of wetlands and estuaries in the greater Everglades ecosystem for local universities to increase research expertise and workforce development that meets their needs.
- Expanding human population in South Florida generating need for more environmental professionals
- Unique opportunities for the study of coupled natural-human systems research in South Florida's extensive wetland, estuary and coral reef ecosystems.
- Opportunities to study aspects of restoration and management of aquatic ecosystems, including oceanography, water quality, hydrology, biogeochemical cycling, invasive species, harmful algal blooms, GIS, environmental chemistry, hydrology, urban and regional planning.
- Cooperation with local, state and federal agencies and NGOs in addressing environmental issues and policy development.
- Education and outreach to public through various media in South Florida.
- Collaboration with researchers at other universities and institutions in South Florida, e.g. University of Miami, Florida International University, University of South Florida, Nova, Smithsonian Institution, as well as the wider Caribbean region (Bonaire, Bahamas, Bermuda, Martinique).
- Developing global collaborations including the Tropical Forestry Research Institute (TFRI) in Guangzhou, China, which will provide funds for students to conduct a portion of their research at the TFRI and a recently developed agreement with the Universidade Federal de Mato Grosso do Sul, Brazil.

- Approval of Integrative Biology ES (IBES) track for doctoral students to emphasize environmental sciences within the FAU IB program will allow us to conduct more in depth, longer term research as well as attract high caliber students.

## **B. Weaknesses**

- Small graduate stipends and lack of benefits (weak support) relative to the south Florida cost of living and compared to other Universities in the region make it difficult to attract and matriculate top graduate students.
- The relatively small number of ES faculty and breadth of expertise is a limitation to further growth and the ability of the program to build and maintain research relationships with non-university partners.
- The lack of input/authority over faculty hires in participating departments (e.g., Biology, Geosciences) limits the growth and research capacities of the ES Program; faculty are awarded to, and chosen by, departments rather than interdisciplinary programs.
- The dispersed campus structure and the dispersion of ES students from Fort Pierce to Davie limit interactions among students and do not allow for effective peer to peer mentoring.
- Upper division courses with labs (i.e., research/field experiences) for undergraduates interested in environmental science are lacking. Courses are often limited to summer sessions because the primarily tenure-track research faculty members offering the courses are teaching larger required lectures for their home department during their 9-month appointment. As a result, these course offerings are often unpredictable and fluctuate depending on faculty research obligations during the summer session.
- Insufficient number of administrative, research, and teaching support personnel. These limited positions are often shared among multiple departments with individual job descriptions that would more appropriately be allocated to multiple personnel.
- Excessive administrative burden placed on faculty.
- No administrative support or physical presence at central Boca Raton campus.
- Lack of understanding in Sponsored Research of funding modes and agencies other than major federal funding programs (e.g., NSF and NIH).
- The lack of proximate research facilities (especially experimental) limits the breadth of research avenues.
- Limited research facilities and faculty restricts availability and range of advanced course offerings, limiting opportunities for hands-on coursework for graduate and undergraduate students (*especially in Davie*).
- Lack of program-specific recurring funds to support preliminary studies in the development of larger research projects or programs.
- Lack of integration at the level of the University with other regional universities, research agencies, or educational venues.
- Lack of marketing of FAU as a destination for students interested in a career in environmental science at the BS, MS, and PhD levels, as well as the expertise at FAU as a resource for regional and national stakeholders.
- No undergraduate degree in Environmental Science that would meet the growing demand and could provide a conduit of top students into the ES graduate program.

## C. Recommendations

***Recommendation 1: Build interdisciplinary faculty expertise in Environmental Science.***

The Dean's office supports the Program's goals to build interdisciplinary expertise in Environmental Science. Program Director and faculty should work closely with Departments during future recruiting and hiring of new faculty to optimize the prospects of securing hires that fulfill this goal.

***Recommendation 2: Capitalize on the multi-campus structure of the ES Program.***

The Dean's office is supportive of this goal, particularly: (1) the expansion of the pool of Affiliate ES Graduate Faculty based at different campuses and (2) a biannual ES retreat to be held at alternating campuses.

***Recommendation 3: Improve and strengthen scholarship and research and build a sense of community in the ES Graduate Program.***

The Dean's office supports the Program's aims for community building through the implementation of a weekly Environmental Science colloquium or seminar series on a year-around basis, to serve as the venue for student thesis presentations, faculty research talks, job candidate presentations, and visiting speakers. Additionally, the Dean's office recognizes the need to increase graduate student stipends to regionally competitive levels and offer health insurance to all graduate students in the Charles E. Schmidt College of Science. This recommendation will be forwarded to the Office of the Provost as a college-wide request.

***Recommendation 4: Improve and expand undergraduate scholarship and research in Environmental Science.***

The Dean's office is supportive of the Program evaluating (1) the need and feasibility of a BS degree in Environmental Science, and (2) the demand for a stand-alone certificate in Environmental Science that is not attached to an academic degree from FAU.

***Recommendation 5: Increase visibility and outside funding of environmental research and scholarship.***

The Environmental Sciences has been designated as an institutional pillar in FAU's Strategic Plan and the Dean's office fully supports and encourages efforts by the Program to increase its' visibility and external funding.





## 2015 Academic Program Review Summary

### Charles E. Schmidt College of Science Department of Geosciences

#### Part 1: Overview

#### A. Degree Programs by Level

##### **Undergraduate Programs:**

BA and BS in Geography

BA and BS in Geology

Certificate in Geographic Information Systems

##### **Graduate Programs:**

MA in Geography, MS in Geology

*(note: both the MA in Geography and MS in Geology are soon to be replaced by the MS in Geoscience)*

Advanced Geographic Information Systems Certificate

PhD in Geoscience

#### B. Mission and Purpose

The Mission of the Department is to provide students with a high quality scientific education and expose them to professional practices and research centered on Earth Systems Science, Human-Environmental Interactions, and Geospatial Information Sciences. The Department aims for excellence in teaching, research and creative activity, and strives to service the university, local, regional, and global communities through its research, degree programs, certificates, course offerings, professional training, mentoring, outreach, and creativity.

#### C. Major changes since the last program review

Since the last program review in 2009, the Department moved to a new building that has improved the office and lab space situation. However, the Department seems to have reached maximum capacity both on the Boca Raton and Davie campuses, with all labs and offices filled by Fall 2014. We have inadequate “dirty” labs and facilities to house field equipment and stage field work.

Advising at both the undergraduate and graduate levels has improved and continues to improve, with single advisors assigned for each degree program, except for thesis and dissertation producing students, who are advised by individual faculty members. Ph.D. students must identify a dissertation advisor prior to being admitted to the program. Overall, a Single Advisor system, suggested by 2009 review team, has been implemented and seems to be working. There is one advisor for each non-thesis degree program.

Additionally, and consistent with reviewer recommendations from the last program review, full-time faculty with research assignment in the Department have improved their productivity with respect to: (1) peer-reviewed publications, (2) professional presentations and (3) obtaining funding for their research.

The Department has strengthened its links and collaborations with the Center for Environmental Sciences and other Departments in the college. Geosciences faculty have worked with Biology faculty and the Harbor Branch faculty to develop and implement a Coastal and Marine Science MS degree program. It is expected that the new degree program will be in the catalog by the Fall 2015.

The Center for GIS was never strengthened per reviewer recommendations, since its directors were drawn into college and university committees and eventually promoted to associate deans. There is now a

pronounced shortage of GIS faculty that is somewhat masked by the large number of GIS online courses and certificates that have been developed.

## **Part 2: Findings**

### **A. Strengths**

Department strengths are outlined below as they align with the Charles E. Schmidt College of Science strategic plan goals.

#### *College Goal 1: Enrich the Educational Experience*

- The Department has a markedly improved advising system in place, with synergistic advising available to students both at the Department and College level.
- The Department's online course offerings have increased by 5% a year over the last few years. The Department is working in conjunction with e-learning, and is currently averaging two course conversions per semester.

#### *College Goal 2: Inspire Research, Scholarship and Creative Activity*

- The Department is successfully providing increased access for students to be engaged in Undergraduate Research. The Department has successfully participated in the largest multidisciplinary QEP Distinction through Discovery (DtD) multidisciplinary undergraduate research curriculum project with Civil Engineering, developing one new research course and enhancing three existing Geoscience courses with advanced undergraduate research projects. Some student success has been noted with one student winning second place at a professional conference five months after completing the courses. An honors college student won the Broward undergraduate research award for his work in the Geophysics lab in Davie.
- Other efforts from the Geophysics lab have involved undergraduates in NSF funded projects, working with environmental geophysics in northern peatlands in Maine in the summer term.
- The Department has strengthened its collaborative research, teaching and administrative links with other units in the college including: Environmental Science Program, The Center for Environmental Studies, and Harbor Branch Oceanographic Institution. This will enhance research, scholarship and creative activity in the college.

### **B. Weaknesses**

Enrollment targets for undergraduate courses are usually 24 students. We are frequently called upon to close courses with 48+ students due to lack of funding for instructors. With three faculty moved completely or partially out of the department and into the Dean's and Provost's offices we are critically understaffed, particularly in the Geography and GIS areas. Lack of funding for Masters-level TA positions has significantly reduced our graduate programs. Our graduate courses are often difficult to fill. The funding that exists for both the Masters and Ph.D. program is so non-competitive that we routinely lose the top-tiered applicants to other state universities. Less than 50 miles away is another state university that can offer a Masters student \$19,000 a year, plus medical benefits plus a full waiver of tuition and fees. We can offer no medical benefits, a partial waiver of tuition and fees and slightly more than half that stipend.

## C. Recommendations

### ***Recommendation 1: Defining and Positioning the Geoscience Program***

The Department's three research themes of *Earth Systems Science*, *Human-Environmental Interactions*, and *Geo-Information Science* are an excellent fit as part of the Ocean Science and Environmental Science, and Sensing and Smart Systems "Pillar" described in the University's 2015-2025 Strategic Plan. The Department also makes strong contributions to the Environmental Science program, and the Coastal side of the Marine Science program that is emerging from the affiliation with Harbor Branch.

### ***Recommendation 2: Streamlining the Geoscience Programs***

#### ***a) Developing the B.S. in Geoscience Degree***

The Dean's office supports a review, restructure and streamlining of undergraduate programs to better utilize faculty expertise, optimize student learning, and field and research experiences. These efforts will also collectively help increase (6 year) student graduation rates. To date the Department has effectively used creative e-learning approaches to offer a wider range of courses, enrich student learning and help keep students on track for timely progression through their degrees and graduation.

#### ***b) Developing the M.S. in Geoscience Degree: 2015-2016***

The Dean's office supports the Department's decision to terminate admissions to the M.A. in Geography and the M.S. in Geology once the proposed M.S. in Geoscience is an approved degree and can admit students. This degree will streamline the pipeline into graduate geoscience programs and will be attractive to students in the former Geography M.A. degree because it is a science degree. Market surveys also suggest it will be attractive to students in the former M.S. in Geology degree. It will also draw new students that could not enter the M.S. in Geology program in the past because of overly stringent requirements of such M.S. in Geology degrees. The Dean's office supports the implementation of this new multidisciplinary earth science degree, M.S. in Geoscience, as it is especially suitable for students aspiring to careers in the South Florida workplace. Additionally, the Dean's office recognizes the need to increase graduate student stipends to regionally competitive levels and offer health insurance to all graduate students in the Charles E. Schmidt College of Science. This recommendation will be forwarded to the Office of the Provost as a college-wide request.

### ***Recommendation 3: Marketing the Geoscience Programs***

The Dean's office supports this initiative and acknowledges the importance of comprehensive marketing of the Department of Geosciences to potential students and the broader community. The Dean's office encourages the Department to seek external funding (e.g. NSF Geopaths IUSE program) to help recruit students into the geosciences pipeline especially at the undergraduate level.



## 2015 Academic Program Review Summary

### Charles E. Schmidt College of Science Department of Mathematical Sciences

#### Part 1: Overview

##### A. Degree Programs by Level

###### **Undergraduate Programs:**

BA Mathematics, BS Mathematics

###### **Graduate Programs:**

MS Mathematics, MST Mathematics

PhD Mathematics

##### B. Mission and Purpose

The mission of the Department of Mathematical Sciences at Florida Atlantic University is to foster understanding of the mathematical sciences, including both pure and applied aspects of the discipline. We strive to provide first-rate undergraduate and graduate education in the mathematical sciences to our students and to increase mathematical ability in the community at large. We seek to advance the frontiers of mathematical knowledge by engaging in innovative research and tackling fundamental problems in the mathematical sciences. We work to bridge research, education, and applications of the mathematical sciences to serve the needs of the local community and the larger global society.

##### C. Major changes since the last program review

The Department of Mathematical Sciences was last reviewed in 2009. Positive changes were noted to have been made in the undergraduate degree programs, with respect to standards, quality of instruction in lower-division service courses, and implementation of innovative learning support mechanisms such as the "Math Learning Center". Research publications by mathematics faculty steadily increased during that period, which also saw the formation of the "Center for Cryptology and Information Security" and the creation of two mathematics research journals originating in the mathematics department. Community outreach focused on "Math Day", the annual high school mathematics competition hosted by FAU's mathematics department, begun in 2005.

The 2009 program review came at the start of a sharp downturn in the national economy and a series of yearly budget cuts to the university. The mathematics department struggled to maintain the innovations and progress noted in the 2009 program review. Nevertheless, progress has been made:

- Using funds from FAU technology fee grants, the department outfitted three instructional computer labs primarily for use in lower-division mathematics service courses. The department also hires undergraduate students as tutors to work in these labs helping other students with homework.
- The number of PhD stipends available for mathematics graduate students increased from 41 to 46.
- The department attempted to hire an established researcher in mathematics education but was not successful. Instead, the department expanded its outreach efforts through expansion of Math Day to middle school and elementary school events, and by establishing both a Math Students' Circle and a Math Teachers' Circle.
- With the hiring this year of a researcher in dynamical systems with interests in biological modeling, as well as a biostatistician, we have hopes of interdisciplinary research collaborations specifically with biology.

- Besides this year's hiring of two researchers in dynamical systems and one biostatistician, last year the mathematics department hired another researcher in cryptology, with special interest in biometric security. Again, with the aim of fostering interdisciplinary research collaborations.
- The mathematics department remains committed to expanding its efforts in mathematical statistics, with current discussions of adding a bachelor's degree program in statistics (Bachelor of Science in Statistics), which should enhance the opportunities for our graduates to compete in the job market.
- With the completion of the Engineering East building a few years ago, the mathematics department inherited some space in the Science and Engineering building vacated by the College of Engineering. Much of this space was used to construct instructional computer labs; the rest went to faculty and graduate student offices. Space remains a serious concern.

## **Part 2: Findings**

### **A. Strengths**

A primary strength of the Department of Mathematical Sciences is its dedicated and hard-working faculty and staff. Despite the heavy burden from repeated budget cuts coupled with massive enrollment growth over the last few years, the faculty and staff have maintained a positive attitude and friendly working environment.

The department has several strong research groups. Foremost, perhaps, is the cryptology group, who have numerous publications, regularly submit research grant proposals (with periodic success), and direct a sizable fraction of the doctoral dissertations. Moreover, the NSA/DHS designation of FAU as a National Center of Academic Excellence in Information Assurance/Cyber Defense Research (spearheaded by the Center for Cryptology and Information Security) offers the department the opportunity to obtain much-needed externally funded GTA positions through CyberCorps (Scholarship for Service). Another strong research group in analysis, dynamical systems, and control theory was invigorated by three new hires this year and is currently very active with weekly seminars and two long-term visiting researchers. This group has recently submitted several research grant proposals and has more on the way. The hiring of a second statistician this year (in biostatistics) establishes statistics as a "group" in the department, with the expectation that the statistics group will expand its influence on campus and beyond. The research groups in algebra, combinatorics, and probability look forward to their turn to strengthen by hiring in the next couple of years, and the department will seek to hire in important currently unrepresented areas (e.g., topology and algebraic geometry).

While some faculty in the department carry out joint research projects with other departments and colleges, there are nevertheless many more interdisciplinary research opportunities for the future, and the department will continue to encourage its faculty to engage in collaborative work with researchers in other disciplines. Special attention will be paid to bioinformatics (with the Jupiter Life Science initiative), environmental science (with the Florida Center for Environmental Studies, whose director has a background in mathematics), the Center for Complex Systems and Brain Sciences (which until recently maintained a joint seminar in dynamical systems with the mathematics department and formerly had a mathematician on staff), and of course the Research Park at FAU.

The graduate program is a strength of the mathematics department. The department has averaged 6 doctoral degrees granted per year over the last 5 years, which indicates that the doctoral program in mathematics is currently at a sustainable level. The graduate program will play a vital role in the future of the department, both by stimulating research activity and by providing a large pool of teaching assistants for staffing the Math Learning Center (MLC) and helping to cover the department's large lower-division teaching load.

A number of current initiatives within BA/BS in Mathematics programs help serve undergraduate students at FAU. Over the last six years, the department has slowly grown an actuarial mathematics program which now enrolls approximately 20 students in a certificate program. Recently the department's undergraduate committee has begun work on a proposal to introduce a BS degree program in statistics. By giving students the

opportunity to study actuarial mathematics and statistics, the department hopes to provide more options in applied mathematics to strengthen the undergraduate program while better serving the needs of the students. The mathematics department has also recently overhauled its undergraduate honors program, both “honors in the major” and the “honors compact” policy for university honors students. Moreover, mathematics faculty have been active in (1) incorporating project-based learning in calculus classes, and (2) adapting the “Moore Method” of guided discovery to three upper-division mathematics courses required of all undergraduate mathematics majors, funded by a grant from the Office of Undergraduate Research and Inquiry. By challenging students with honors options and, active learning and learning by discovery, the Department of Mathematical Sciences hopes to increase undergraduate students’ opportunities for learning while deepening their educational experience.

Lastly, the mathematics department has instigated several pedagogical innovations over the last six years in an effort to improve student success in lower-division mathematics courses:

- In 2008, a mandatory placement test (using “ALEKS”) was implemented for undergraduate students entering the university without prerequisite mathematics classes from another university. This has lowered DFW rates by preventing students from registering in courses for which they are not prepared.

- In 2008-2009, College Algebra course was restructured to ensure students work through homework under supervision of teaching assistants. College Algebra is a gateway to the undergraduate mathematics curriculum and as a result of the restructure has much improved DFW rates.

- In 2009, the “Math Learning Center” (MLC) was formed. Staffed by graduate teaching assistants from the mathematics department and housed in the Center for Teaching and Learning, the MLC performs the majority of the mathematics tutoring on campus. The MLC receives between 6000 and 7000 visits per semester. The MLC also provides reviews for exams in large lower-division courses and group tutoring for select “at risk” classes.

- Inspired by the successful restructuring of College Algebra, a “2+2” model of instruction was adopted in several lower-division mathematics courses, including Trigonometry and Precalculus Algebra (beginning spring 2011), Intermediate Algebra and College Algebra (beginning fall 2011), and Introductory Statistics (beginning fall 2012). In this model, students attend two one-hour lectures per week plus one two-hour homework session in a computer lab, in which students work on online homework problems, under supervision of the instructor (and, in large classes, undergraduate tutors). Although DFW rates have not been significantly affected as yet, preliminary (and informal) data seems to indicate that students who pass the courses average higher grades than in prior semesters before the 2+2 model was implemented.

- In order to improve student preparation for calculus, last year the mathematics department and the College of Engineering jointly offered a precalculus boot camp for engineering students. The undergraduate studies office has taken an interest and is seeking outside funding to expand this precalculus boot camp university-wide.

- In Fall 2014, a Learning Assistant (LA) program was piloted, with two LA’s in Calculus 1. LA’s are undergraduates who have done very well in mathematics and work closely with the students in the class, answering questions, providing tutoring, and motivating the students to learn. An expansion to include Calculus 2 and 3 is planned.

## **B. Weaknesses**

The increased workload imposed on the faculty and staff over the last few years must rank as a primary threat to the department’s future. This threat is compounded by the fact that, despite hiring 5 new assistant professors in the last couple of years, the average age in the department stands at 54, and 7 of the 39 faculty members in the department are over 70. Thus, with a number of retirements imminent, additional tenure-track faculty hiring over the next few years will be crucial our continued success. Additionally, there is a continuing threat of losing our most productive faculty due to low salaries.

The mathematics department has relatively low number and amounts of external research grants. Research grant funding in the discipline of mathematics tends to be rather less than that of the other sciences, mainly due to the general lack of need for expensive equipment, but increasing the level of research funding in the Department of Mathematical Sciences has to be a high priority in the years ahead.

The mathematics department has a small undergraduate programs. The Department is focusing on active recruiting through outreach to strengthen its bachelor's degree programs in the years ahead. This year one of the new assistant professors in the department has taken over leadership of the Math Club, and he has infused the club with renewed energy, in an attempt to bring an esprit de corps to the undergraduate mathematics majors. Attendance at Math Club meetings has increased, and the department is optimistic about the future.

Undergraduate retention and graduation rates are a serious issue for the Department. Numerous innovations and initiatives by the department directed at improving student performance in mathematics classes are underway and have already been discussed in above section.

### **C. Recommendations**

***Recommendation 1:*** *The mathematics department will increase the number of tenured and tenure-track faculty to 35 in the next five years.*

Requests for faculty lines from the department will be considered by the Dean's office. Requests for funding will be prioritized relative to other funding requests from the college, and also depend on the availability of funding.

***Recommendation 2:*** *The mathematics department will pursue new initiatives to increase student success in mathematics classes.*

The Dean's office supports and commends curricular initiatives that aim to utilize evidenced-based best practices for improving learning in STEM and which enrich student learning, and increase (6 year) student graduation rates.

***Recommendation 3:*** *The mathematics department will expand its undergraduate and graduate recruitment activities.*

The Dean's office supports this initiative and acknowledges the importance of comprehensive marketing of the Department of Mathematical Sciences to potential students and the broader community.

***Recommendation 4:*** *The mathematics department will restructure its degree programs in order to provide more interdisciplinary opportunities, secure more internship positions, and enhance the career options of its majors.*

The Dean's office supports the department's review, restructure and enhancement (through internships etc.) of its' programs to better utilize faculty expertise, optimize student learning, and give students industry and research experiences. These efforts will also collectively help increase (6 year) student graduation rates for undergraduate programs.

***Recommendation 5:*** *The mathematics department will encourage its faculty to attempt to obtain more research funding.*

The Dean's office supports this effort and a suggestion is that faculty already externally funded in the department mentor or team-up with more junior faculty to apply for new research grants.

***Recommendation 6:*** *The mathematics department will encourage integration of mathematics into the teaching and research of other areas of the university, in order to stimulate more interdisciplinary activity in the department.*

The Dean's office supports interdisciplinary initiatives throughout the college and university.



## 2015 Academic Program Review Summary

### Charles E. Schmidt College of Science Department of Physics

#### Part 1: Overview

#### A. Degree Programs by Level

##### **Undergraduate Programs:**

BA Physics, BS Physics

##### **Graduate Programs:**

MS Physics, MST Physics

PSM Medical Physics

PhD Physics

#### B. Mission and Purpose

The mission of the Department of Physics at Florida Atlantic University is to foster a deeper and more holistic understanding of the fundamental interactions in nature, and apply this knowledge to both pure and applied aspects of the discipline. We strive to provide first-rate undergraduate and graduate education in physics to our students and to increase scientific knowledge in the community at large. We seek to advance the frontiers of scientific knowledge by engaging in innovative research and tackling fundamental problems in physics. We work to bridge research, education, and applications of the physics to serve the needs of the local community and the larger global society.

#### C. Major changes since the last program review

The Department of Physics was last reviewed in 2009. That program review came at the start of a sharp downturn in the national economy and a series of yearly budget cuts to the university. Since the last review the Department of Physics lost 25% of their tenure and tenure track (T/TT) faculty lines and was reduced to 9 T/TT faculty. Nevertheless, some progress has been made:

- We built and obtained provisional accreditation for our Professional Masters in Science in Medical Physics (PSMMP).
- We hired a Visiting Assistant Professor in Medical Physics and have the approval to replace this Visiting Professor with a permanent line.
- Using funds from four internal FAU Technology Fee grants, the department outfitted the astronomy dome, purchased a GP-GPU computer for HPC training and research, outfitted the Medical Physics Laboratory, and Updated computers for the undergraduate Laboratory.
- The department also hires undergraduate students as tutors and graders for our introductory courses.
- Graduate stipends have not increased since the last program review, and the number of PhD stipends available for physics graduate students decreased from 34 to 28.
- The department hired one Assistant Professor in the area of Loop Quantum Gravity, who will start Fall 2015.
- We have substantially increased our undergraduate enrollment in Physics. We established the Owl's Burrow (research and study room for undergraduate physics majors); however, most importantly we have appointed two staff members to work closely with our undergraduate's in order to provide a more stimulating educational and interactive environment.
- Recently, two postdoctoral fellows were hired under faculty federal grants.
- With the completion of the Engineering East building a few years ago, the physics department inherited



some space on the 3rd floor in the SE building vacated by the College of Engineering, but lost much space on the 4th floor to the Geoscience Department. Much of this space was used to construct seminar/colloquia/tutoring space, space for the new Medical Physics program; the rest went to graduate student offices.

- We are in the process of recruiting a Bio-photonics group here to FAU in collaboration between CESCOS and the College of Engineering and Computer Science. This initiative would support the strategic plan of the university as well as bring a needed experimental component to our department. We have had to send to of our PhD students out of state for their dissertation research due to the lack of experimental opportunities in physics. We view this as our top priority.

## **Part 2: Findings**

### **A. Strengths**

A primary strength of the Department of Physics is its dedicated and hard-working faculty and staff. Despite the heavy burden from repeated budget cuts coupled with massive enrollment growth over the last few years, the faculty and staff have maintained a positive attitude and friendly working environment. The faculty and staff spend many hours volunteering in community outreach activities, including the numerous Astronomy-related events and the Annual Pumpkin Drop and Physics Carnival. The numerous pedagogical innovations implemented by various faculty members show a genuine interest toward students and their education. The faculty let their passion for science drive their research interests, and regularly obtain federal funding from NSF and the DoD. The future of the physics department will be built on its current faculty, which must be its strength.

At the undergraduate level, due to a coordinated and proactive faculty outreach, physics majors are starting to increase in number over the last couple of years. At the graduate level, the PSMMP is a distinctive program that offers opportunities for learning medical physics with a primary strength in Radiation Therapy Physics. The program's uniqueness lies in the partnerships between FAU and four major Hospitals/Cancer Centers in the area. Well-recognized medical physicists in the field of radiation therapy who are appointed as Adjunct/Research Affiliate Professors in the Physics Department provide the students with the opportunity of clinical training and research on one-to-one basis. Our young program has produced several journal papers, presentations and papers at AAPM and ASTRO meetings. Interdisciplinary education offered by three Colleges at FAU such as the Charles E. Schmidt College of Science with participation of Faculty from three departments (Physics, Biology, Math), the Charles E. Schmidt College of Medicine, and the College of Engineering is another strength of the program. PSMMP students take their required and/or elective courses in the regular classes of those courses, which assures the program's sustainability.

### **B. Weaknesses**

Perhaps the single weakest and largest threat to our department is our substantial 25% reduction in the number of T/TT faculty in our department while we had steady growth in numbers of our graduate and undergraduate students. In addition to the substantial increases in internal student enrollment in physics, we also have seen a steady increase in non-physics majors enrolled in our lower-level classes. The increased workload imposed on the faculty and staff over the last few years must rank as a primary threat to the department's future. Additionally, the average age of the T/TT professors in the department is 52, and ~25% of the faculty members in the department are over 65. Thus, with a number of retirements imminent, additional tenure-track faculty hiring over the next few years will be crucial to the continued improvement of the physics department. Undergraduate retention and graduation rates are a serious concern in the major. The physics department recognizes this problem as a priority and is working on innovative ways to address this. Also, office space and tutoring space remains a serious concern.

## C. Recommendations

***Recommendation 1:*** *To increase undergraduate enrollment through recruitment and retention.*

The Dean's office supports the Department's sustained proactive outreach and recruitment efforts.

***Recommendation 2:*** *To increase graduation rate and improve time to graduation.*

The Dean's office supports the Department taking a proactive approach in the advising of its students, providing them with curriculum maps and ensuring that essential classes are offered in a timely manner. Flexibility in accepting substitutions or alternative courses, is recommended. The Dean's office also advises that the Department work closely with College advising staff to enhance advising for Physics majors. For the PhD program streamlining of the process and timing for students to qualifying exam is recommended.

***Recommendation 3:*** *To enhance the undergraduate experience through mentoring, curriculum changes, and research experience.*

The Dean's office encourages the Department to leverage OURI and FAU's Mentoring Program (through CLASS) initiatives to enhance mentoring and research experiences. The Dean's office also supports a review and streamlining of undergraduate programs to better utilize faculty expertise, optimize student learning experiences and increase (6 year) student graduation rates.

***Recommendation 4:*** *To grow the medical physics program (PSMMP).*

The Dean's office encourages the Department to explore the feasibility of establishing: (1) an undergraduate program in Medical Dosimetry, possibly leading to a double major, (2) a five-year dual BS/MS degree, and (3) a Ph.D. program in Medical Physics.

***Recommendation 5:*** *To add a faculty line through a strategic hire in medical physics.*

Requests for faculty lines will be considered by the Dean's office. Requests for funding will be prioritized relative to other funding requests from the college, and also depend on the availability of funding.

***Recommendation 6:*** *To add a faculty line in experimental physics.*

See Dean's office comments in Recommendation 5.

***Recommendation 7:*** *To contribute to FAU's strategic plan, and to enhance the department's visibility within FAU and outside.*

The Dean's office encourages the Department to contribute to FAU's strategic plan by pursuing further interdisciplinary research and hires, building in particular on current active collaborations with the College of Engineering and the Center for Complex Systems and Brain Sciences. The Dean's office encourages the Department to leverage FAU infrastructure already in place, such as OURI, CLASS and Career Center, to further enhance its visibility.



## 2015 Academic Program Review Summary

### Charles E. Schmidt College of Science Department of Psychology

#### Part 1: Overview

#### A. Degree Programs by Level

##### **Undergraduate Programs:**

BA Psychology, BS Neuroscience and Behavior

##### **Graduate Programs:**

MA Psychology

PhD Psychology

#### B. Mission and Purpose

The undergraduate programs in Psychology 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 oral and written communication skills through participation in didactic courses and directed independent study. The program is offered at the Boca Raton, Davie, and Jupiter 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, and Personality/Social Psychology. Graduates of the program are qualified for professional employment in academia, government and the private sector.

#### C. Major changes since the last program review

The program was last evaluated in 2009. That review contained the following findings:

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

In response to these findings, the following recommendations were made:

- Faculty at the partner campuses should be reassigned to the Boca campus to preserve the core mission of the program.
- Courses at the partner campuses should be offered on a rotating basis such that transfer students can complete the major in two years.
- To address increased enrollment growth, additional resources should be allocated to support undergraduate student advising.
- To address decreased university budgetary support, increased extramural funding should be sought to support research.

Major changes since the last review:

a) Although a Consolidation Plan was developed by the Department and approved by the Dean, the plan was not implemented because laboratory space on the Boca Raton campus for reassigned faculty could not be committed at that time. More recently, the University proposed creating campus-specific areas of specialization,

spearheaded by the Jupiter Neuroscience Initiative. A senior PI in the Department, his graduate students and staff were relocated to the Jupiter campus to participate in this endeavor. At the administration's invitation, the Department proposed a campus specialization at the Davie campus in Successful Aging to take advantage of the developmental interests of the faculty at that campus. So far that proposal has not been approved.

b) Additional advisors were hired by the College of Science to service Psychology majors.

c) The percentage of faculty awarded extramural funding has increased from 31% in 2009 to 44% in 2014.

## **Part 2: Findings**

### **A. Strengths**

1. Psychology is a popular major that has enjoyed enormous enrollment growth over the past six years. This is a program that generates substantial FTE for the College. The joint program in Neuroscience and Behavior has enormous growth potential, given the emphasis on developing Neuroscience at FAU.
2. The Department has a very productive faculty in all four of its core areas. They publish in high quality peer reviewed journals and are successful in competing for extramural funds.
3. The proximity of Scripps Florida and Max Planck, world-class research institutes in Neuroscience, on the Jupiter campus is a unique resource for attracting faculty and students interested in brain science.
4. Population demographics for the South Florida region provide a rich resource for a campus specialization in Healthy Aging.
5. The Ph.D. program continues to attract high quality students who acquire excellent research training and co-author papers with their mentors in peer-reviewed journals.
6. The university has a new president who has articulated a clear vision for promoting excellence at FAU. He has expressed support for the Department's strategic plan.

### **B. Weaknesses**

1. Faculty attrition and explosive enrollment growth have created problems in delivering the undergraduate and graduate programs, resulting in increased reliance on adjuncts and graduate teaching assistants. In addition, the loss of senior faculty has reduced the breadth of research expertise, including in the quantitative area.
2. Budgetary shortfalls have limited hiring, faculty raises, and research support, leading to decreased faculty morale.
3. Budgetary shortfalls have limited the number of graduate student teaching assistantships, with the result that some courses cannot be assigned teaching assistants. In addition, the limited number of assistantships constrains the growth of the graduate program and research output.
4. Geographic distance between campuses limits faculty interactions and student access to resources. For example, students at the Boca and Davie campuses cannot readily participate in Neuroscience research or courses offered at the Jupiter campus.
5. The Department has not been included in planning the Jupiter Neuroscience Initiative, even though it is a stakeholder. This has created problems in course delivery, supervision of undergraduate and graduate research, and fragmentation within the program.

## C. Recommendations

***Recommendation 1: Develop a 5-year hiring plan to meet programmatic needs.***

The Dean's office supports this planning strategy. Requests for faculty lines will be considered by the Dean's office. Requests for funding will be prioritized relative to other funding requests from the college, and also depend on the availability of funding.

***Recommendation 2: Review and revise the undergraduate program to address enrollment growth.***

The Dean's office supports a review and streamlining of undergraduate programs to better utilize faculty expertise, optimize student learning experiences and increase (6 year) student graduation rates.

***Recommendation 3: Improve graduate student recruitment.***

The Dean's office recognizes the need to increase graduate student stipends to regionally competitive levels and offer health insurance to all graduate students in the Charles E. Schmidt College of Science. This recommendation will be forwarded to the Office of the Provost as a college-wide request.

***Recommendation 4: Create a greater sense of community among faculty and graduate students.***

The Dean's office supports this initiative and recognizes that an enhanced sense of community, and a feeling of connection to a science department by students, is a high impact practice for improving student retention and overall academic success.

***Recommendation 5: Create a graduate student handbook containing policies and benchmarks for successfully completing degree requirements.***

The Dean's office supports this initiative, it will help graduate students be better informed about, and hence more quickly achieve, the benchmarks and requirements of their degrees.

***Recommendation 6: Hire a Program Assistant to oversee various undergraduate and graduate issues.***

Dean's office supports this request, pending availability of funding.

***Recommendation 7: Develop a strategy to coordinate the program across multiple campuses.***

The Dean's office recognizes the need for better transportation options between FAU's multiple campuses and will forward this request to the Office of the Provost as a part of a college-wide need. There is also a need for technology upgrades in classrooms at all three campuses to facilitate faculty teaching courses simultaneously on all campuses. The Dean's office recommends that the Department seek FAU Technology Fee funding and utilize creative e-learning strategies to enable implementation of such courses.