FAU Ph.D. IN INTEGRATIVE BIOLOGY
Division of Colleges and Universities Staff Analysis

Recommended Action: **Approve Implementation**
Implementation Date: Fall 2003

Estimated Costs:

	Total	% & $ Current	% & $ New	% & $ C&G	Cost per FTE
Year 1	$309,991	82% $252,732	13% $40,000	5% $17,259	$27,852.71
Year 5	$1,294,725	51% $655,576	19% $251,725	30% $387,424	$19,685.42

Projected FTE and headcount are:

	Projected Headcount	**Student FTE**
First Year	16	10.51
Second Year	32	20.75
Third Year	46	29.88
Fourth Year	60	39.44
Fifth Year	73	46.09

Criteria / Success Indicators			
Total Met With Strength	**Total Met**	**Total Partially Met**	**Total Unmet**
3	19	0	0

Abstract

This program is on the SUS Master Plan as a Ph.D. in Biology and aligned with the mission of the University. The Integrative Biology program builds on successful undergraduate and masters degrees in Biological Sciences already offered at FAU. It focuses on the relationship between cell/molecular functions and experimental biology in the very broad sense, but with a view to providing a connection between levels of biological organization as a central unifying theme. It is especially tailored to the changing needs of the University's service region and features a curriculum that includes cross-disciplinary coursework in the biological sciences. Opportunities are provided for students wishing to take advantage of the learning and training experiences through College of Science programs in the Department of Biological Sciences, the Center for Molecular Biology and Biotechnology, and the new Department of Biomedical Science.

There has been substantial monetary investment to develop modern science facilities at FAU.

1. Successful capital campaign that raised $35 million dollars
2. Building program that exceeds $40 million to enhance the infrastructure of the College of Science
3. A newly renovated Sanson Science building
4. Approval of initiatives by the State of Florida totaling $11.75 million to support the FAU/Harbor Branch Partnership in Marine Sciences

The focus is timely, addresses serious concerns and specific regional issues, restoration of the Everglades, integrity of marine and terrestrial environments, an aging human population, and speaks to a need for a highly skilled workforce. Programs in six out-of-state institutions, the National Science Foundation, the Wellcome Trust and the International Union of Biological Sciences were evaluated with the goal of bringing together, in this proposed doctoral program, ongoing efforts in environmental, population, and comparative biology and coupling these to take advantage of recent advances in developmental biology and molecular genetics.

A record of achievements spanning 6 ½ years portray the vision, laid the groundwork, provided overall direction and scope, and created space and affiliate faculty making a truly unique proposed program with the opportunity to address human and environmental health. The combination of the assembled university biologists, biomedical investigators, and ecologists plus their space and equipment with additional support by and interaction with the Harbor Branch Oceanographic Institution and the U.S. Horticultural Research Laboratory, engenders strong enthusiasm that the goals will be realized for this program.

1. The proposed program is listed in the current State University System Master Plan, and the goals of the proposed program relate to the institutional mission statement as contained in the Master Plan.
MET. The proposed program is listed in the 1998-2003 Master Plan and is aligned with the mission of the University. This program reinforces ongoing efforts to strengthen the research mission of the University

2. The proposed program does not duplicate other SUS offerings or, otherwise, provides an adequate rationale for doing so.
MET. There are three public institutions and one private institution that have Ph.D.s in Biology: Florida International University, Florida State University, and the University of South Florida. The proposal states that the degrees at these institutions are organized according to biological sub-disciplines as research specializations or tracks within departmental graduate programs. The University of Miami doctoral program in the Department of Biology is centered on matching individual student interests with the research interests of individual faculty members. The program at FAU is designed to foster connectivity across biological sub-disciplines through multidisciplinary instruction and research perspectives for students and collaboration among program faculty with diverse backgrounds in the biological sciences.

3. There is evidence that planning for the proposed program has been a collaborative process involving academic units and offices of planning and budgeting at the institutional level, as well as external consultants, representatives of the community, etc.
MET. The institution has solicited support from the community and received letters supporting the degree. The letters of support indicate that the degree will bring companies into the area. The restoration project on the Everglades will span 30 years and will need employees trained in this type of degree. Various of the University's academic departments are in support of the interdisciplinary degree, and there are professors from these disciplines and the Harbor Research who will participate in the program.

4. The proposal provides a reasonable timetable of events leading to the implementation of the proposed program.
MET. The timetable at FAU began in 1997 to enhance the science facilities and initiate campaigns for monetary contributions as well as to hire faculty in various science areas. In 2000 the Department of Biological Sciences conducted a faculty retreat to discuss support for the Integrative Biology PhD. Searches for positions in molecular biology, marine biology and environmental science were initiated so that appointments could be made for Fall 2001. In 2002 a Program Committee for the PhD program was constituted with representation from the academic units participating in the program. Faculty recruitment will continue through August 2007 if the program is approved for implementation for Fall 2003.

5.The proposal provides evidence that there is a need for more people to be educated in this program at this level.
MET. The proposal indicates that the National Science Foundation (NSF) has researched employment in science and engineering occupations and discovered that during the 2000 to 2010 period there is an expectation of an increase of almost three times the rate for all occupations. Employment opportunities in these two areas are expected to increase by approximately 47

percent (2.7 million jobs driven mainly by the computer industry). In the life sciences occupations, job opportunities are projected to grow by 33,000 new jobs (18%). At the national level there is an indication that there will be a continued demand for biological scientists for at least the next decade. According to NSF, employment opportunities at the national level are expected to increase for PhDs in biological sciences by 35% between 1998 and 2008.

The proposal states that Florida should produce 380 PhDs in biology to maintain position with the country as a whole. South Florida counties should produce 119 PhDs to keep up with national production. In 2000-2001 a total of 13 PhDs in Biological/Life Sciences were granted by two institutions – Florida International University and the University of Miami. The University has provided evidence that this is not sufficient to achieve the level of doctoral training in the life sciences needed to make the South Florida region attractive to biotechnology and pharmaceutical industries.

The most comprehensive review of the situation in FAU's service area was undertaken by the Business Development Board of Palm Beach County, Inc. The BDB/PBC retained the services of the Center for Economic Competitiveness of SRB International in Arlington, VA. SRI issued a report: An Industry Cluster Development Strategy for Palm Beach County (1998), that analyzed current regional economic trends and made recommendations to strengthen and diversify Palm Beach County's economic base.
Key findings of the report as it relates to education include:

1. The county ranks at the bottom in number of graduate students enrolled among the 8 metropolitan areas included in the benchmarking exercise. Only three universities offer post-graduate students. This puts Palm Beach County at a disadvantage in meeting the recruiting needs of high-tech sectors needing a pool of talented research scientists, engineers, and specialists.
2. Lack of research-quality programs in the core sciences to support a cluster of biomedical and pharmaceutical industries was highlighted in the strategic analysis of the region's weaknesses and strengths.
3. Failure to provide a supply of trained personnel for the biomedical industry in the county could have serious economic consequences. There has been expansion in the mid-1990's in the areas of medical and pharmaceutical (250%). The proposal states that salaries for this sector accounted for a payroll in 1995 in excess of $1.5 billion in Palm Beach County alone; thus it is stated in the proposal that in the entire FAU service area, the impact would be higher ($10 billion by the end of the current decade if there is an adequate supply of highly trained personnel to meet the needs).
4. The SRI report listed several specific objectives that are being undertaken by FAU:
    1. Attracting a biomedical park development (underway in the FAU Research & Development Park)
    2. Attracting a satellite campus of a medical school to Palm Beach County (UMSM/FAU Partnership for Medical Education)
    3. Attracting or raising funds for a medical research institute (May 2000 groundbreaking for the Charles E. Schmidt Biomedical Science Center which is completed and occupied)

The Comprehensive Everglades Restoration Plan is a part of a larger effort to restore the

ecosystem and provide for a sustainable south Florida. The US Department of Interior is in the process of recruiting for over one hundred new technical positions in south Florida to provide support for the restoration program.

6. The proposal contains reasonable estimates of headcount and FTE students who will major in the proposed program. The proposal also provides a signed EEO statement that indicates steps to be taken to achieve a diverse student body.
MET. The EEO statement has been signed and states that a diverse population of students will be targeted for recruitment through the use of recruitment teams, brochures, contacts with specific departments in universities in the region, faculty recruitment emphasizing identification of qualified minority candidates. This is expected to attract minority students who will identify with faculty members as potential role models and mentors. In the second year, the proposal states that there is an expectation of doubling the enrollment from 16 to 32 and by the fifth year having 73 students. Data provided indicated that student demand for graduate training in the biological sciences has grown at FAU. Enrollment in the Master of Science in Biological Sciences increased from 47 to 76 during the period 1992-2001. With the new emphasis in Biomedical Science added in 2001 and the 30 students currently enrolled, there is a demand for further graduate education; thus an immediate pool of applicants exists for the proposed doctoral program.

7. The proposal provides an appropriate, sequenced, and described course of study.
MET. A total of 90 credits are required for the program. The degree requirements are outlined not by a sequence of specific courses but rather by the number of credits, level of courses and seminars, dissertation research time and doctoral dissertation credits, as well as the comprehensive examination requirements. There are course descriptions that accompany the required or elective courses.

8. The proposed program relates to specific institutional strengths such as programs of emphasis, other academic programs and/or institutes and centers.
MET. The proposed program partners with other programs within the University and with external regional partners that could enhance graduate programs. Participants in the proposed programs are the Harbor Branch Oceanographic Institution, Center for Molecular Biology and Biotechnology, Departments of Biomedical Science and Biological Sciences and the U.S. Horticultural Research Laboratory.

9. If there have been program reviews or accreditation activities in the discipline pertinent to the proposed program, or in related disciplines, the proposal provides evidence that progress has been made in implementing the recommendations from those reviews.
MET. The Department of Biological Sciences was a participant in a College-level review in 2001 and a University-wide 10 year Reaffirmation of Accreditation Review by the Southern Association of Colleges in 2002. No specific recommendations were conveyed to the Department of Biological Sciences as a result of these reviews.

10. The proposal provides evidence that the institution has analyzed the feasibility of providing all or a portion of the proposed program through distance learning technologies via its own technological capabilities as well as through collaboration with other

universities.
MET. The program will be delivered using a combination of methods, including traditional delivery on the main campus; traditional delivery at branches or centers; and distance learning instruction technology to fully maximize the human resources at geographically distant units. Interactive video teleconferencing technology will be available for offering lecture courses and holding meetings across the multi-campus, distributed university. Additionally, Internet 2 capabilities to connect FAU to Harbor Branch and the USDA Horticulture Research Laboratory are currently under development. These will also be a part of the University's telecommunications system.

11. The proposal provides evidence that there is a critical mass of faculty available to initiate the program based on estimated enrollments.
MET WITH STRENGTH. There are presently a total of 30 tenure/tenure-track faculty members appointed to the Departments of Biological Sciences and Biomedical Science, 2 nontenure-track Research Professors, and an additional 17 affiliate professors with primary appointments with either Harbor Branch Oceanographic Institution or the U. S. Horticultural Research Laboratory, thus make a total of 49 existing faculty members expected to make up the founding faculty. If the new hires expected for the first year are included that will bring the total to 60 faculty members available for implementation of the program.

12. For doctoral programs, the proposal provides evidence that the faculty in aggregate have the necessary experience and research activity to sustain the program.
MET WITH STRENGTH. The program will be initiated by faculty members who, in aggregate, have already advised a total of 99 PhD and 172 Masters level students; published a total of 3,102 scientific papers; and between 1997 to present, generated $49,206,453 in extramural research funding at FAU and other institutions.

13.The proposal provides evidence that, if appropriate, there is a commitment to hire additional faculty in later years, based on estimated enrollments.
MET. There will be a total of 21 faculty hired on new lines and a total of 9 faculty hired on contracts and grants from 2004 through 2007.

14. The proposal provides evidence that library volumes and serials are sufficient to initiate the program.
MET. Library titles for holdings in the life science at FAU number 23,904 volumes, 143 print journals, and 750 electronic journals in fields ranging from molecular biology to ecology. Additionally, 76 electronic databases in the life sciences are available at FAU. The library also offers a subscription service linked to facilities at the National Library of Medicine in Bethesda, MD, that makes available within 24 hours virtually any article published in most of the biomedical and biological disciplines.

15. The proposal provides evidence that classroom, teaching laboratory, research laboratory, office, and any other type of space, which is necessary for the proposed program, is sufficient to initiate the program.
MET WITH STRENGTH. The Departments of Biological Science and Biomedical Science have recently occupied new or newly renovated facilities on the Boca Raton campus during 2002. The resources at Harbor Branch Oceanographic Institution and the U.S. Horticultural Research Laboratory will be available through existing partnerships. A newly constructed wing of the Science and engineering building, General Classroom East, adds a modern lecture hall and

classrooms to the resources of the College. Also, construction of a vivarium to house animals for research is underway.

Biomedical Sciences is in the newly constructed Charles E. Schmidt Biomedical Science Center. This Center has 93,000 square feet that houses departmental administration, offices and teaching facilities including case-based classrooms with distance learning capabilities and a large lecture theater for graduate education. There are two central shared core laboratories (2800 sq. ft. per lab). Each of these is surrounded by six individual laboratories (645 sq. ft.) that house faculty members. Each of the 4 stories has a cold room and dark room and offices for faculty and postdoctoral fellows and graduate students. A vivarium, containment facility and other shared resources are located on the fourth floor of the building.

The Sanson Science building provides 33,645 square feet in Boca Raton and the Senator James A. Scott Education and Science Building provides 12,655 sq. ft. at Davie. Together they provide 38 research laboratories.

The FAU campus at Harbor Branch received state appropriations of $11 M for construction of a modern facility for teaching and research in the marine sciences. This facility is slated for occupancy in 2005. The Harbor Branch Oceanographic Institution is located on 615 acres and has a staff of approximately 250 scientists, engineers, technicians, mariners, and support personnel. Harbor Branch is internationally known for its ship and submersible operations and research.

The U.S. Horticultural Research laboratory has almost 170,000 sq. ft. in offices, labs, greenhouses, support buildings, etc. to work on citrus production problems.

16. The proposal provides evidence that necessary and sufficient equipment to initiate the program is available.
MET. A detailed list of equipment is listed in Appendix III. Also the resources at the Harbor Branch Oceanographic Institution and the U.S. Horticultural Research Laboratory will be available through existing partnerships with FAU. There are research vessels and submersibles that will be used for teaching and research at Harbor Branch.

17. The proposal provides evidence that, if appropriate, fellowships, scholarships, and graduate assistantships are sufficient to initiate the program.
MET. Students will be supported by teaching assistantships in the Department of Biological Sciences and research assistantships from grants of participating faculty members. The 50 Teaching Assistant slots currently in the masters program will be redirected to doctoral students in the proposed program. For new PhD students entering in 2003, the stipend is planned to increase to $12,000 for the academic year.

18. The proposal provides evidence that, if appropriate, clinical and internship sites have been arranged.
MET. Internship sites will be at Harbor Branch Oceanographic Institution and U.S. Horticultural Research Laboratory.

19. The proposal provides evidence that, in the event that resources within the institution are redirected to support the new program, such a redirection will not have a negative impact on undergraduate education.

MET. The primary shift of resources to initiate the new program will be the redirection of faculty efforts from mentoring Masters students to mentoring PhD students and the reallocation of teaching assistantships from Masters degree students to PhD students. Once the doctoral program is implemented, the Masters program will be redirected to greater emphasis on professional enhancement and training. The proposal states that this should be of special interest to students seeking higher-level technical training for the job market (i.e. biotechnology and marine sciences).

20. The proposal provides a complete and reasonable budget for the program, which reflects the text of the proposal. Costs for the program reflect costs associated with similar programs at other SUS institutions.

MET. Costs were described for a five-year period with the total cost estimated at 1.2 million dollars. Since the proposed doctoral program will extend from an existing master's program in Biological Sciences, costs are lower in the initial years. Four of the five participating units in the proposed program already have a history of interactive partnership in academics and will not require new funds to establish interaction. The primary shift of resources to get the program started will be from redirection of faculty efforts that are now involved in mentoring of master's students. Currently 50 teaching assistantships are supported in the Biological Sciences Masters Program. Growth of the undergraduate biology program will not only support teaching assistantships in the doctoral program but will be used to drive faculty numbers in the Department of Biological Sciences. It is expected that a portion of their time will be devoted to the doctoral program providing additional resources. For the first year 82% of total costs for the program will be derived from current general revenue funds. New general revenue funds for year 01 are only 13% of the total cost. By year 05, new general revenue costs are anticipated at 19% of total. The balance in each case is expected from Contracts and Grants. In the 01 year, new general costs (40 thousand) are to be devoted exclusively to cover increasing 16 TA stipends from the master's level ($9,500) to the PhD level ($12,000). In the 05 year, new general revenue request will be used to: increase TA stipends from $12,000 to $13,500 by year 03, increase the number of doctoral students supported by teaching assistantships, full participation by program faculty, and the salary of the program coordinator that starts in year 02. Care has been taken to minimize costs while reflecting the need of the program to grow to the anticipated end of 05-year level of doctoral students. The budget reflects an extensive effort to: utilize funds from an anticipated increased number of Contracts and Grants, The Schmidt Endowment (startup costs for faculty, maintenance and new equipment costs), institutional resources from the Harbor Branch Oceanographic Institution and the U.S. Horticultural Research Laboratory (funds for collaborative research projects and the support of space and in-house funds for student involved in their Grant and Contract supported research). In addition, program faculty will be involved in securing graduate training grants. The Integrative Biology program director will work with a new director of development at the college to secure private funding sources to enhance the program.

21. The proposal contains evidence that, if appropriate, the institution anticipates seeking accreditation for the proposed program.

MET. Accreditation is not an issue for this doctoral-level program.

22. The proposal provides evidence that the academic unit(s) associated with this new degree have been productive in teaching, research, and service.

MET. The chart on page 42 on the faculty productivity indicates that the faculty has published a total of 3,102 scientific papers, advised a total of 271 masters and Ph.D. students in their degrees

and generated $49.2M in research funding at FAU and other institutions they were associated with from 1997 to the present.