

**Thomas Harriot College of Arts and Sciences**  
**Department of Biology Strategic Framework**

Approved by faculty, March 8, 2007, version 1.0

**Vision Statement:** The Department of Biology educates students about the fundamental basis of life, their interdependencies with the environment, and applications of biology to basic science- or health related-careers.

**Mission Statement:** The mission of the Department of Biology is to achieve excellence in life science education, research, and service to meet the developing needs of North Carolina. The department will provide stimulating and challenging educational experiences in fundamental skills for biology research, for environmental sciences, for biotechnology initiatives attracting industry and educating students for human health-related areas for all students. Further development of access and distance education courses will reach more students. Expansion of health-related professional courses and strengthening of doctoral and masters programs will emphasize leadership roles. Faculty will encourage creative activity to solve significant human and environmental problems, both health- and coastal-related. Outreach initiatives include improving science and career education in the eastern region of North Carolina for both middle schools and high schools. Leadership and partnerships to other units, institutions, and public/community organizations will be pursued for public outreach, regional development, and enhancement of the quality of life.

**Strategic Directions:** The Department of Biology contributes to the basic Liberal Arts foundation and purposes of the Thomas Harriot College of Arts and Sciences through the development and expansion of human knowledge and skill.

**Narrative:** The Department of Biology is one of 15 academic units in the *Thomas Harriot College of Arts & Sciences*. As faculty members of the Harriot College, the Biology faculty embraces the importance of a liberal arts education. In fact, they strive to make their respective teaching, advisement, research and service relevant to the College's important philosophy of integrated life-long learning. The undergraduate academic program has a strong thrust toward serving the needs of the health professions and meeting the general science requirements of other units and other curricula. Clearly, the Biology faculty has an important goal of providing various levels and content of life science instruction to all ECU undergraduates. In fact, an overwhelming large portion of the grades assigned each academic year by our faculty are given to non-majors. For this reason, the Biology faculty has a significant commitment to the education of nearly all ECU undergraduate students. Because of this commitment, the student credit hours generated by enrollment in biology courses has increased significantly with the University's expanded enrollment over the last five years, and is now one of the highest in the Harriot College.

The Departmental academic and research programs are currently organized around three major areas or sub-disciplines: coastal ecology/fisheries, evolution/biodiversity, and cell and molecular biology/biotechnology. Forty-two faculty members, with support from ten technical staff and five clerical staff persons teach more than 470 intended biology majors, more than 280 declared biology undergraduate majors, more than 70 master's students, and 20 doctoral students. The Department is administered by the chair and by the directors of undergraduate and graduate programs. The Department currently is conducting a search for a Chair, and also has a greenhouse manager position, one clerical

staff position, and two scientific technical positions vacant, including an electron microscopy technical position. The Department anticipates receiving a number of tenure-track positions from the college in 2007-2008 to meet student enrollment and research needs. There is one fixed-term faculty position in introductory biology to be filled in 2007. Searches are ongoing for two tenure-track molecular genetics and one microbiologist faculty. An additional Department of Biology tenure-track faculty position in quantitative ecology will be available, in memory of Dr. Raymond O'Connor and his academic interests.

Increased enrollment at ECU has been in part attributed to the offering of distance education (DE) opportunities to off-campus students. The Department of Biology offers three DE courses in the areas of introductory biology (BIOL 1050/51), environmental biology (BIOL 1060/61), anatomy/ physiology (BIOL 2130), and advances in ecology (BIOL 6850). Introductory and environmental biology have an on-line laboratory course associated with them whereby students conduct laboratory experiments in their homes and take local field trips.

The Department has embarked on a student-learning assessment program, designed to evaluate student learning in both our undergraduate biology majors' curriculum as well as learning by those students taking biology to satisfy the general education science requirement. For biology majors, our approach is to use a course-embedded examination process, whereby pre- and post-tests are given with questions designed to assess student understanding in a variety of areas including evolutionary and ecological studies in biodiversity, genetics, developmental and cellular biology, molecular genetics/biotechnology and ecology. These tests are composed by faculty and are administered in our required majors' courses. Student learning is also assessed using a standardized examination given to biology majors during their senior year at ECU. For non-majors, similar pre- and post-tests are administered in introductory and environmental biology in an attempt to assess student learning in biology and basic science methods.

**Undergraduate Program.** Greater than 10% of the ECU incoming freshmen in 2006 were intended undergraduate Biology majors, the highest of any academic unit within the *Thomas Harriot College of Arts and Sciences*. Coupled with this are the 286 declared majors, a total of over 750 undergraduates under the Department's advisement. However, our attrition rate is significant with about 40% opting to leave Biology, resulting in about 150 graduates receiving bachelor's degrees each year.

The Department offers nine service courses, three of which are offered on-line as distance education courses. Seven core courses are provided for biology majors. Twenty-six upper division courses are offered in ecology, 29 in evolution/biodiversity biology, and 22 in cell and molecular biology/biotechnology. An additional 15 courses are interface courses between the three broad curriculum areas. These course offerings, totaling 108, are available to undergraduate majors and non-majors. Fourteen courses in ecology, 16 in evolution/diversity biology, ten in cell & molecular biology/biotechnology, and ten interface courses are offered at the 5000 level, allowing both undergraduates and master's students to enroll in a total of 50 courses.

Training undergraduates for pre-professional careers in the health sciences has been a hallmark of the undergraduate program since the early 1960's. A decade later, programs in ecology and the environmental sciences became a viable part of the curriculum, and in the 1980's courses and training in the areas of biotechnology and molecular biology were included. Through new faculty hires in

the 1990's, expertise was added to broaden and strengthen the curriculum in the areas of molecular genetics/biotechnology, evolution and animal behavior.

**Graduate Program.** The goal of the graduate program in the Department is to provide a diverse education and training in the biological sciences using a hands-on, inquiry-based approach to scientific discovery. At the same time, a second goal is to develop proficient public speaking and communication skills by teaching experiences primarily in undergraduate instructional laboratories.

The *Coastal Resources Management (CRM)* Doctoral program provides an area of emphasis in coastal and estuarine ecology for Ph.D. students that focuses on near-shore and estuarine processes important for living marine resources and environmental quality. The curriculum requires 65 semester hours of course work beyond a bachelor's degree. General requirements of 22 semester hours are taken by all students and comprise the core curriculum of the integrative design of the CRM program. Doctoral students can focus on ecology, while developing a fundamental understanding of basic principles and methodology in two of three other areas; geosciences, social science and maritime studies. Students also take courses in research ethics, coastal problems, statistics and research design, and are provided an understanding of the commonalities among the science disciplines as well as the knowledge advances in coastal studies. Presently, we have six doctoral students being mentored by Department of Biology faculty.

The *Interdisciplinary Doctoral Program in the Biological Sciences (IDPBS)* requires 58 semester hours beyond the bachelor's degree, and students take core curriculum courses in bio-molecular structure, molecular genetics, cell biology, ethics and research, biostatistics, research, and seminar topics. They also take qualifying and comprehensive examinations, and write a dissertation on their research investigations. At the present time, the IDPBS program has an experimental biology concentration which is the venue for doctoral students interested in evolution, molecular and cellular biology, and ecology. We now have 14 doctoral students in IDPBS being mentored by Department of Biology faculty.

In addition to the aforementioned doctoral programs, there are 70 graduate students in the Department of Biology's two masters degree programs, the MS in Biology and the MS in Molecular Biology/Biotechnology. One-half of these students are supported on teaching assistants allocated to the Department; 20 are supported on research assistantships in the Department of Biology and in the BSOM; 15 are self-supported. The entering students have a grade point average of 3.0 and a GRE total of slightly more than 1000. Students in the MS in biology degree program must show a competency in cell biology, ecology, genetics, and organic chemistry. Those in the molecular biology/biotechnology degree program must show a competency in biochemistry, genetics, microbiology and basic laboratory methods in biotechnology.

Ten of our faculty are members of the CRM interdisciplinary faculty and are eligible to mentor doctoral students in the program. Fifteen other faculty are members of the IDPBS program, which is now under further development with additional resources provided by the Harriot College and with more equitable representation provided by participants involved with the concentrations of biochemistry, molecular genetics/biotechnology neuroscience, experimental biology, and biomedical science.

**Research Program.** The research program can be categorized into three major arenas: ecology, evolution/biodiversity, and cell and molecular biology/biotechnology. The research strengths in these three categories are

substantial and include activities at all levels of the biological hierarchy and a diverse array of organisms, though development of future directions includes coastal initiatives, biotechnology, and potential health initiatives. More than 80% of the faculty have active research programs. During the last five years, Biology faculty were awarded more than one million dollars/year as principal investigators with external grants.

The overall research output and productivity by the faculty has demonstrably increased over the last five years. In the 1999-2004 period, the number of peer reviewed journal articles for the Department averaged 35. More than ever before, more faculty are presenting their data and progress at professional meetings. Presentations by faculty and students have increased from about 80 in 1999 to more than 90 in 2004. Leadership roles in professional organizations and service on professional panels have also increased. This acceleration in research productivity is attributable in part to the activity in the laboratories of new faculty whose accomplishments are now being realized.

Research fronts of excellence have been established in wetlands ecology, estuarine ecology, and nutrient cycling. Master's graduates in biotechnology and molecular biology are sought after for entrance into industrial positions or academic/professional schools. Expertise needs in ecology are associated with computation, modeling, molecular research, and quantitative ecology. The Department has additional needs in behavioral biology, population genetics, and physiological ecology. Tenure-track individuals with research expertise in cell and molecular biology/biotechnology, specifically molecular genetics and microbiology, are currently being sought.

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### **Strategic Directions:**

#### **21<sup>st</sup> Century Education**

**Initiative 1.** Develop new courses in coastal biology, molecular biology/biotechnology, and evolution/biodiversity biology. These are three strengths of the Department of Biology that fit with future interests of East Carolina University. The department currently has excellent researchers dealing with coastal issues and interfacing with other departments and interdisciplinary units. The molecular biology/biotechnology area has significant impact on human health and agriculture, which is a major focal area for East Carolina University and the eastern region of North Carolina. Also, faculty members with expertise in evolutionary and ecological aspects of biodiversity are one of the strongest such contingent in the state of North Carolina.

**Access:** Our objective with this initiative will be to have at least one new course in each of the three areas of strategic strength, and for over half of these new courses to be applicable to interdisciplinary areas, which increases access by reaching larger target student audiences. We will also plan on developing two or more of these new courses to be taught by either distance education or face-to-face, but with a significant internet component.

**Economic Development:** New courses in coastal biology will impact economic development along the coast of North Carolina by educating the public to scientific methods for sustainable coastal development. A recent initiative to bolster the recruitment of biotechnology industry companies to eastern NC will be addressed through the revision of the biotechnology curriculum. Other courses will enhance understanding of environmental impacts of international initiatives such as global warming and other environmental preservation concerns.

**Partnerships/Engagement:** Many of the new courses will be offered with an interdisciplinary theme.

**Timeline:** We plan to offer at least one new course per year; therefore we will have at least five new courses available by 2012.

**Resource Needs:** Additional faculty members. Also, the new courses will use internet resources and we anticipate that several will have laboratory components, requiring new computers and laboratory equipment.

**Evaluation/Assessment:** The number of new courses, student and faculty assessment of new courses, and enrollment demands for the new courses will all be used to evaluate the success of the courses.

**Initiative 2.** Develop and integrate new instructional technologies and strategies into programmatic strengths.

**Access:** The updates to our program will be made available to students and to the community through distance education, outreach programs to regional middle and high schools, as well as to face-to-face students enrolled in our on-campus lectures and laboratories, where we have demanding equipment needs for educating students on the fundamentals of research-active learning. Enrollment increases will also create opportunities for the Department of Biology to reach more students, both majors and through Foundation Curriculum courses, non-Biology majors. The department currently has access to large numbers of non-major students through general biology and general environmental courses such as BIOL 1050 and BIOL 1060.

**Partnerships Engagement.** The Department of Biology will work with granting agencies for the most current equipment and computer resources in rapidly changing biological fields.

**Timeline.** Summer 2008, to be reviewed and updated.

**Resource Needs.** ECU, state of NC, and national funding are needed to update equipment as new teaching technologies are adapted to use.

**Evaluation/Assessment.** Pre- and post-testing assessment in each of the aforementioned three areas, and tracking the creation of new teaching initiatives focused on these three areas.

**Initiative 3.** Develop new interdisciplinary programs, modeled on Biology's new BS-Biology/MBA program and the Aquaculture Technology/Marine Biology program with Carteret Community College, such as partnering with engineering or with departments in the Brody Medical School. These programs will include new interdisciplinary efforts in biotechnology, which has been the focus of specific new courses and programs within the College of Industry and Technology and the Department of Chemistry.

**Access:** These initiatives will reach more students in various departments, and will attract students as programs are developed that combine subjects in a novel fashion.

**Economic Development:** Students with interdisciplinary experience usually have higher job success. A diverse background will make students more aware of subjects outside of a single discipline.

**Partnerships/Engagement:** College of Business, College of Industry and Technology, Department of Engineering, Brody Medical School. Community Colleges, such as the Aquaculture/Marine Biology agreement between Carteret Community College and ECU, will educate individuals for positions in fisheries and other coastal-related occupations.

**Timeline:** 2011, with yearly assessment.

**Resource Needs:** Jointly funded faculty with departments based on partnering.

**Evaluation/Assessment:** Review of collaboration by tracking numbers of students enrolled in new programs, and employment success of new graduates.

**Initiative 4.** Increase faculty outreach contributions and visibility in the eastern region of NC and throughout the state, also increasing enrollment in Biology.

**Access:** The department will build on initiatives in biotechnology, which have enabled collaboration between departmental faculty and community college biotechnology education programs through the recently developed Bionetwork.

**Economic Development:** These collaborations provide educational opportunities for students and a source of educated workers for the growing regional biotechnology industry. They also create an environment conducive to the recruitment of high technology industry to the region.

**Partnerships/Engagement:** Existing partnerships include 10 regional community colleges and local area high schools. Initial efforts to expand biotechnology partnerships to Elizabeth State University and Pembroke State University are ongoing.

**Timeline:** 2011, with yearly assessment of progress.

**Resource Needs:** New tenure-track faculty that are jointly funded with the partnered departments/institutions.

**Evaluation/Assessment:** Review of collaboration by tracking numbers of students who participate in outreach programs and through discussions with regional industry developers and recruiters.

**Initiative 5.** Submit educational proposals to acquire teaching laboratory equipment that maximizes institutional resource input matched to those of the funding agency.

**Access:** Increased numbers of face-to-face students that will take advantage of state-of-the-art technology.

**Economic Development:** Students must learn to use the equipment that exists in top research, industrial, and health-related professions, with increased salaries and job satisfaction.

**Partnerships/Engagement:** Interdisciplinary partnerships with other departments.

**Timeline:** 2011, with yearly review

**Resource Needs:** Assistance/support for submitting and management of proposals and grants.

**Evaluation/Assessment:** Track number and amounts of educational proposals and grants.

### 21<sup>st</sup> Century Research

**Initiative 1.** Recruit new faculty with a focus on research in coastal issues, molecular biology/biotechnology, and evolution/biodiversity. These are three strengths of the Department of Biology. The department currently has excellent researchers dealing with coastal issues and interfacing with other departments and interdisciplinary units. The molecular biology/biotechnology area has significant impact on human health, including a number of breast cancer research initiatives, and will develop a technologically competent workforce, a major focus of East Carolina University and the eastern region of North Carolina. Also, faculty members with expertise in evolutionary and ecological aspects of biodiversity are one of the strongest such contingent in the state of North Carolina.

**Access:** New faculty will teach and mentor new undergraduate and graduate students and engage in regional outreach activities.

**Economic Development:** New faculty will submit proposals for additional research and educational funding, increasing the direct and indirect costs that return to East Carolina University and to Biology.

**Partnerships/Engagement:** Partnerships among Biology faculty and between departments and other universities and industry in an interdisciplinary fashion will enhance visibility of Biology and lead to greater recruitment of students.

**Timeline:** Each year over the next five years, recruit two faculty per year.

**Resource Needs:** Additional faculty positions, also justified by enrollment increases and outreach activities.

**Evaluation/Assessment:** Evaluations of individual faculty members and of programs.

**Initiative 2.** Organize the department's strength in molecular evolutionary biology for recruitment and external recognition to enhance funding prospects.

**Access:** Undergraduate and graduate students with an interest in evolution and biodiversity, including systematics and evolutionary ecology.

**Economic Development:** Enhanced funding, which will enhance student education, and enhanced recruitment and enhanced state/national recognition.

**Partnerships/Engagement:** Enhanced interactions with the other major evolution/biodiversity researchers and research centers in North Carolina

**Timeline:** 2008-2011.

**Resource Needs:** Two new tenure-track faculty positions

**Evaluation/Assessment:** Number of publications and grant income, including indirect cost money.

### The Region's Health

**Initiative 1.** Increase faculty outreach contributions and visibility in the eastern region of NC and throughout the state.

**Access:** Faculty will engage in interdisciplinary activities with other units and with partners (community colleges, universities, and industry) outside the university.

**Economic Development:** The activities of faculty will contribute to the growth of regional economic activity by demonstrating that we can provide versatile educated employees with specific abilities in technologically related fields.

**Partnerships/Engagement:** Faculty will be engaged with regional community colleges, universities, and economic developers both to provide educated employees and to recruit qualified students interested in careers in biology-related high technology industry, including health care.

**Timeline:** 2011, with yearly assessment of progress.

**Resource Needs:** Additional faculty positions and liaison personnel to provide a conduit for collaboration and dissemination of information.

**Evaluation/Assessment:** Notation of significant increases by analyses of annual report data.

**Initiative 2.** Develop scientific models and resource utilization plans for most efficient use and conservation of coastal resources.

**Access:** Faculty at ECU, including Departments of Biology, Geological Sciences, and Sociology, and coastal research units, such as IICSP.

**Economic Development:** Guide coastal development in a scientific and therefore productive manner.

**Partnerships/Engagement:** Partner with the Department of Geological Sciences, Anthropology, Economics, Coastal Resource Management, and the new Interdisciplinary Institute for Coastal Science Policy (IICSP) as well as other departments having such interests.

**Timeline:** 2009

**Resource Needs:** Two new faculty members

**Evaluation/Assessment:** Collaboration numbers and research monies.

### The Region's Prosperity

**Initiative 1.** Increase the number of students employed in biotechnology companies by partnering with those biotechnology companies, and attracting new companies to eastern NC.

**Access:** Students in the region.

**Economic Development:** The shift from agricultural to technological employment has been shown to increase economic development and overall standard of living.

**Partnerships/Engagement:** Develop a closer relationship with biotechnology companies with outreach programs.

**Timeline:** 2009.

**Resource Needs:** Closer relationship and an additional interactive position in the Eastern NC Biotechnology program.

**Evaluation/Assessment:** Track the number of individuals produced by the program and the positions they obtain.

### **The Leadership University**

**Initiative 1.** Develop programs that will enhance leadership training, similar to the BS-Biology/MBA, that emphasize leadership qualities. Also, adapt content from leadership courses into coastal management, biotechnology company involvement, and human health-related courses.

**Access:** Undergraduate and graduate students in face-to-face programs in the Department of Biology.

**Economic Development:** Generating more effective leaders will lead to higher productivity and a significant improvement in the overall quality of life.

**Partnerships/Engagement:** Partner with programs that offer leadership or management courses.

**Timeline:** 2011

**Resource Needs:** faculty release time.

**Evaluation/Assessment:** Yearly assessment on programmatic development.

**Initiative 2.** Develop new program content for CRM and IDPBS PhD programs that emphasize research laboratory management, grant budgeting, and proposal writing.

**Access:** PhD program students.

**Economic Development:** This initiative will increase the effectiveness in applying for proposals.

**Partnerships/Engagement:** This initiative will be interdisciplinary by its very nature, as it involves interdisciplinary PhD programs.

**Timeline:** 2011, with yearly assessment.

**Resource Needs:** faculty release time.

**Evaluation/Assessment:** Track numbers of graduate students applying for proposals, including current PhD students applying for predoctoral grants, and success rates.