

Department of Chemistry and Physics
Academic Plan
2005 – 2010

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I. INTRODUCTION

A. Background

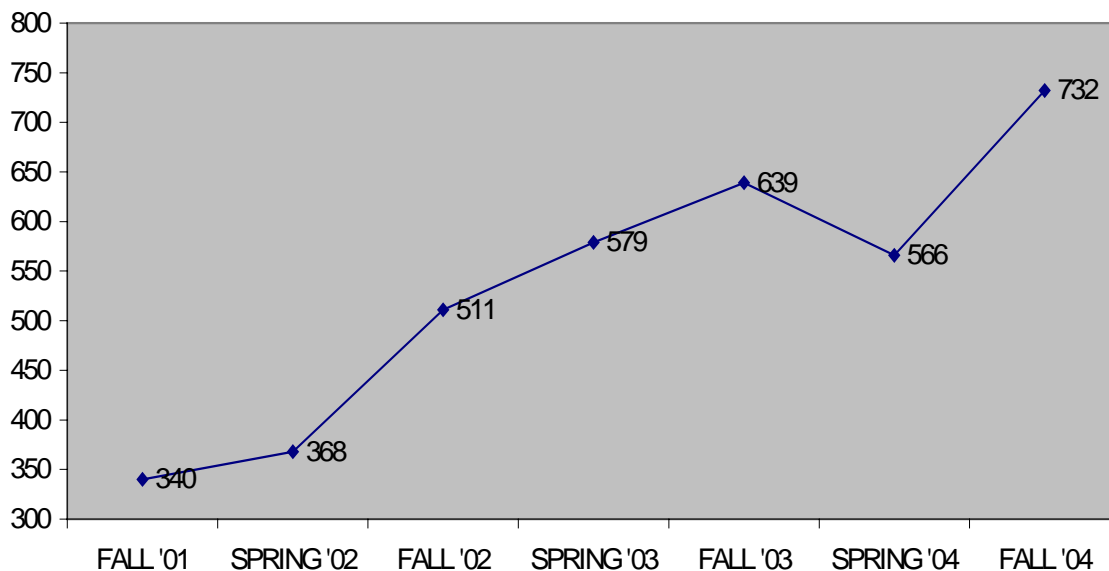
The UNCP Chemistry and Physics Department offers the B.S. degree with majors in (1) Chemistry, (2) Applied Physics, and, jointly with the Biology Department, (3) Biotechnology. The Department also offers a pre-engineering curriculum for students planning subsequent transfer to another University. The Chemistry program maintains approval by the American Chemical Society (effective Fall 2000 Semester), a long-pursued goal that provides external validation of the program's quality and offers accreditation to its graduates.

The Department is presently comprised of one full time administrative secretary and one laboratory manager in support of twelve full-time teaching faculty distributed among disciplines as follows:

- Chemistry (5 full-time tenure track, 4 full-time temporary)
- Physics (3 full-time tenure track)

Student enrollment in Department programs has climbed steadily and more rapidly than total University enrollment over the past decade. For example, the number of declared Chemistry majors has more than tripled from about 40 in 1990 to approximately 130 in 2005, with the number of Chemistry graduates likewise increasing from an average of ca. 5-8 to ca. 12-18 annually over the same time period. Such growth in the Chemistry program, coupled with the fairly recent addition of the B.S. in Applied Physics, a new pre-licensure B.S. in Nursing (Nursing Department), a new B.S. in Environmental Science (Biology Department) and the new interdepartmental B.S. in Biotechnology (see above), has resulted in significant increases in the Department's student audience with the likelihood that growth in CHM course enrollments will continue (see the figure below).

TOTAL ENROLLMENT IN CHM COURSES, FALL 2001 TO FALL 2004



The Department is housed in the newly renovated and expanded Oxendine Science Building. Faculty and staff offices, classrooms, the chemical stockroom, and five laboratories are located on the third floor; three additional laboratories (one of these presently unfinished) are on the first floor. An external structure on the north side of the building is home to a small observatory that was built during the 2003-4 renovation/expansion.

B. Executive Summary of Department Plan

1. New Programs and Initiatives

Chemistry. For the 2005-10 period, the Chemistry & Physics Department will begin implementation (jointly with the Biology Department) of a B.S. degree program with a major in Biotechnology. This new interdepartmental degree will draw from the strengths of the Biology Department and the Department of Chemistry and Physics. The degree offers a balanced curriculum that has a sound foundation in mathematics and chemistry. The “theory-into-practice” curriculum has been designed to be relevant to contemporary challenges and issues in Biotechnology.

Physics. For the 2005-10 period, the Chemistry & Physics Department will begin investigating the feasibility of joint program in physics between UNCP and FSU. Presently UNCP has a BS in Applied Physics and FSU does not have a BS in Physics. Historical, degree programs in physics have low enrollments, and a joint program would allow students at both schools the opportunity to

pursue a degree in physics with the excellent resources available at each school. This initiative would be an example of dual programs as recently proposed by the Office of the President. The Department will also seek permission to consider additional tracks beyond its present computational science track. Areas such as nanotechnology and optical physics are becoming important fields during the next 10 years.

2. Related Themes

Our Department's established, new and planned programs are relevant to all of the six planning themes identified by the University, most directly to those listed below:

--Preparing knowledgeable managers and professionals for the future to ensure economic development.

--Understanding the impact of science and its relationship to ethics, the environment, everyday life, public health, public policy, religion, and technology.

--Viewing the Liberal Arts as the basis for both critical thinking and life-long learning skills.

3. Required Resources

The phased retirement of our organic chemist will be complete in the 2006/7 academic year. This, in addition to the recent retirement of our physical chemist and the substantial enrollment increases in general education and major courses, will necessitate the addition of a minimum of two new full-time, tenure track faculty in Chemistry (one in organic, one in physical chemistry) in the coming 2005-2010 period. These new faculty will be critical to the successful

continuation and expansion of Department activities during the 2005-2010 period. The estimated annual cost for these two positions is approximately \$140,000 (salary and fringe benefits). Additionally, the expansion of our Department's instrumentation holdings has continued to the point of requiring a staff position (e.g., "Instrumentation Specialist") whose primary duties would include the maintenance and operation of lab equipment and instruments. Such duties have to date been delegated to our lab manager and various faculty members as "overload", and more recently to our jointly funded laboratory teaching associate, but the combined impacts of enrollment and inventory growth make this arrangement increasingly unacceptable. We anticipate this position to require a master's degree in a physical science or related field, or a bachelor's degree with extensive relevant experience, and estimate the annual cost to be approximately \$60,000 (salary and fringe benefits).

Reliable supply and equipment budgets will become increasingly important to the effective implementation of the Department's expanded program activities, reasonable estimates being approximately \$50,000 for equipment (including ongoing maintenance and repair service costs for major equipment) and \$25,000 for supplies annually. Further in this regard, the need exists to update equipment holdings for upper level physics laboratories associated with B.S. in Applied Physics degree program. For this purpose, an estimated \$40,000 one-time equipment expenditure and a continuing \$5000 annual supply budget are needed.

An expanded faculty development budget will be required to permit professional growth of Department faculty appropriate to the expanded Departmental programs and activities. A realistic estimate for these funds would be \$1000 per faculty member per year, for a total of \$13,000 annually.

Finally, the continued expansion of programs and faculty resulting from enrollment growth will require additional office and laboratory space. Though the Oxendine Science Building was just renovated and expanded, it is important to note that three laboratory spaces designated for research were left unfinished due to unforeseen budgetary overruns. Subsequent to reoccupation of the building, two of these three spaces (SCI 1108 and 3121) were reallocated to other departments and programs (math/science education and geology/geography, respectively). The remaining unfinished space, SCI 1103, remains unfinished despite a Special Project Request filed in the Fall 2004 semester. It is essential to the continuation and expansion of our faculty and undergraduate research effort that this space be completed immediately. Further, the addition of new faculty (see above) will require additional research and office space. Chairs of our Department and the Biology Department have agreed that the space presently occupied by University Computing and Information Services would be an ideal area to share between departments for this purpose, and we will petition for such reallocation of this space when UCIS relocates.

4. New Structure or Organizational Changes

The beginning of the 2005/6 academic year will see two changes in the organizational structure of the Chemistry & Physics Department, i.e.:

- a) a separate Department of Geology & Geography will be established, hence the associated faculty, curricula, and programs will no longer reside within the Chemistry & Physics Department; and
- b) science education curricula and programs will be officially transferred to the Biology Department.

5. Anticipated Student Demand.

The number of students majoring in degrees offered by our Department has more than doubled during the past decade, outpacing the overall university enrollment growth of approximately 65% over the same time period. Considering this trend, the predicted enrollment growth for UNCP, the addition of new programs that require service courses through our department (see section I.A. above), and the current status of the economy, a prudent assumption would be that our Department's enrollment will continue to grow at the same or perhaps a slightly lesser rate over the next five years. If these assumptions are accurate, enrollment in courses offered by our Department may increase by approximately 25% during the 2005-2010 period.

6. Interdisciplinary Collaboration

The interdisciplinary B.S. program in Biotechnology that is being implemented in the Fall 2005 semester (see section B.1 above) entails extensive collaboration

with both the UNCP Biology Department and several off-campus organizations (NC Biotechnology Center, various biotechnological industries, etc.).

II. PROCESS

The Chair of the Chemistry and Physics Department notified all Department faculty of the call for an updated academic plan covering the 2005-2010 period in the spring of 2005 and solicited input from all those willing to provide. The previous version of the plan (2004-2009) was revised accordingly and submitted to the Dean of the College of Arts & Sciences at the end of the Spring 2005 semester.

III. ASSUMPTIONS

More than a dozen statements of various social, political and economic factors expected to impact the University (“assumptions”) were provided as Attachment D of a January 5, 2001 memorandum from the Provost. In short, these assumptions predict continued growth and further diversification of the student body, increasingly tight budgets, and a subsequent need to increase the cost effectiveness of University programs without jeopardizing academic quality. Also noted in the listed assumptions were additional challenges that the University would face in keeping up with instructional technology advancements, as well as a need for increased emphasis on public relations issues, particularly with the local community. All these assumptions were considered in developing our Department’s academic plan.

Additional assumptions of particular relevance to our Department were also considered. The percentage of the total undergraduate enrollment majoring in degrees offered by our Department has increased steadily over the past decade (*vide supra*), hence we assume the impacts of the projected enrollment growth will be even more significant for our curriculum. Tighter state budgets and reduced, more competitive federal funding programs will compound the challenges posed by rising costs for the tools and materials necessary for quality undergraduate instruction in the physical sciences.

IV. UNIT MISSION AND VISION

The Department of Chemistry and Physics is dedicated to its mission of (1) instilling an appreciation of and a literate knowledge of the physical sciences in all its students; (2) affording a solid foundation in the theory and practice of chemistry, physics, and science education to its majors; (3) supporting the professional and scholarly development of its faculty; and (4) providing professional service based on faculty expertise to the local and regional communities. The Department aims to fulfill this mission through a thoughtfully balanced program of curricular and extracurricular activities consistent with the University's commitment to academic excellence. Beyond the fulfillment of its mission, the Department earnestly pursues a vision of providing local, regional and national leadership in the development and implementation of effective instructional practices for undergraduate science education.

V. PROPOSED GOALS AND OBJECTIVES

Descriptions of the Department's goals, objectives, planned actions, and evaluation procedures are presented here and in subsequent sections of this document. Appropriate to the distinct programs offered by the Department (see Section I above), these descriptions will be presented separately for the areas of Chemistry, Applied Physics, Biotechnology and Pre-Engineering.

Chemistry

The primary educational goal of the Department's Chemistry Program is to produce B.S. graduates qualified for a wide variety of relevant post graduation pursuits. Specific objectives germane to this goal include the following:

- to graduate B.S. students that are successful in securing and maintaining immediate, postgraduate employment;
- to graduate B.S. students that are successful in gaining admission to and completing graduate programs in Chemistry and related fields; and,
- to graduate B.S. students that are successful in gaining entrance to and completing relevant professional degree programs (medicine, law, etc.).

The Chemistry Program further aims to pursue the goal of providing and supporting faculty scholarship and promoting service to the University and the off-campus community. Specific objectives related to this goal include the following:

- to maintain an atmosphere conducive to the professional development of its faculty;

- to facilitate the conduct of scientific research and the dissemination of resulting knowledge; and,
- to encourage and support the application of faculty expertise to service activities for the University, the Chemistry profession, and the local, state, national and global communities.

Applied Physics

The educational objectives of the Applied Physics program are to:

- Provide a fundamental understanding of the laws of physics.
- Provide the knowledge, skills, and abilities needed to effectively use technology to solve real world problems.
- Provide the knowledge, skills, and abilities needed in solving problems across interdisciplinary scientific fields.
- Provide the skills in data collection, critical thinking and application of these skills to solving problems related to society in many diverse areas.
- Provide prospective physics teachers with a strong foundation in the application of physics principles that will enhance the quality of science teaching provided to schools in the region and state.
- Provide programs and workshops for educators in the region to enhance their skills in physics and technology education.
- Provide the knowledge, skills, and abilities needed to enter the technical workplace, graduate school, or a career in engineering.

The specialized knowledge, skills and abilities students will be expected to demonstrate include:

- understanding of the various stages and substages of problem solving.
- skills in laboratory techniques, experiment design, measurements and electronic interfacing.
- skill in data collection, data analysis and modeling.
- skills in mathematics and statistics.
- skills in computer programming.
- skills in the use of computers and related technology
- knowledge and skills in working collaboratively.
- knowledge of and skills in applying physics principles to solving problems in society.
- positive attitudes toward science and society, and a strong commitment in helping to solve problems across multidisciplinary fields.

The versatile nature of a B.S. degree in Applied Physics provides the graduate with an opportunity to choose from a number of fields. Bureau of Labor Statistics indicate that students who possess the skills an Applied Physics program develops will be "useful for entry into many other occupations". With 55% of graduating physics college students attending graduate school and another 32% obtaining immediate employment, close to 90% of those students with a B.S. degree in physics will be employed or headed to higher education.

It is clear from the evidence cited that a person with a degree in physics is indeed a marketable commodity. This degree is a path to various opportunities

within the physics community as well as providing a solid background for entrance into many other high demand fields outside of physics. The projected demand is initially small, but expected to increase each year as the program becomes established and our first class of students graduate.

Biotechnology

The biotechnology degree is comprehensive in scope. The degree corresponds with the major institutional goals of (1) Maintaining a diverse and up-to-date curriculum that accurately reflects the current state of major areas of biological science; (2) graduating students who are prepared for careers as biological professionals, educators or for post-graduate study; (3) maintaining an excellent faculty who engage in enhanced scholarship, research and professional activities. The Biotechnology degree has the following specific objectives:

1. Offer students a unique opportunity to choose a course of study rich in biological science that is supported by a sound foundation of mathematics and chemistry.
2. Provide a “theory-into-practice” curriculum supported by course work relevant to contemporary challenges and issues in biotechnology.
3. Provide industrial biotechnology experience through an internship/co-op program.
4. Provide an increasing pipeline for the anticipated growing numbers of community college students who wish to transition into a baccalaureate degree program before entering the biotechnology workforce.

5. Teach students the important technologies currently used in the biotechnology industry for research, bio-manufacturing, biological and chemical analysis and the business of biotechnology.
6. Facilitate the building of partnerships with the biotechnology sector leading to research and professional opportunities for UNCP faculty.
7. Create mechanisms for technology transfer between UNCP and the biotechnology industry and other educational institutions.
8. Expand possibilities for UNCP faculty and administration to capture funding to expand and sustain existing programs.

Pre-Engineering

The primary educational goal of the Department's Pre-Engineering Program is to produce undergraduate students who are qualified for direct transfer into one of the three UNC engineering campuses, UNC Charlotte, NC State and NC A&T.

Specific, objectives related to this goal include the following:

- To place all students who enter the pre-engineering program into the UNC engineering campus of their choice
- To ensure that the education received by these students meets with the standards established by all three engineering campuses.
- To recruit more students from the surrounding area into the pre-engineering program as well as enhance retention of those students in the program.
- To have a signed agreement between the three engineering campuses and UNCP. This agreement will be more specific in what is required of the

student by each campus and goes beyond the verbal understanding that is now in place.

VI. PROPOSED ACTIONS

Chemistry

The goals and objectives of the Chemistry Program will be achieved through the concerted efforts of the Department chair and the Chemistry faculty. The approval of the Department's Chemistry Program by the American Chemical Society (ACS) represents external validation of our earnest pursuit of the previously cited educational goals, and maintaining ACS approval will require continued diligence in this regard. The Department plans to continue its practice of dynamic curriculum revision, making changes, additions and deletions to its instructional offerings as appropriate to the advancement of the discipline and related educational approaches. To the extent permitted by budgetary constraints (*vide supra*), the Department will support faculty in their efforts to improve the Chemistry curriculum.

The Department plans to further its efforts to provide opportunities for faculty research, particularly in conjunction with undergraduate assistants, as this activity is well suited for achieving both faculty development and student learning. An established campus leader in the area of undergraduate research, the Department will continue to encourage its faculty to pursue all available sources for support of research activities, particularly external funding agencies.

Finally, faculty service to the University, the Chemistry profession, and the off-campus community will remain a focus of the Department. The long history of coordinating the State Region IV Annual Science Fair is perhaps the most visible example of such service, and the Department plans to continue furnishing the considerable effort required for this event. Other less conspicuous actions in this regard (consulting, public school outreach, etc.) will likewise continue, encouraged and supported by the Department through recognition and, when possible, physical resources.

Applied Physics

The Department will seek approval for a joint program in physics with FSU, as a means of increasing the numbers of students who wish to pursue a degree in physics and as a way of making use of the resources at both universities. We will also investigate the possibilities of new tracks in physics.

Biotechnology

The goals of the Biotechnology Degree are directly relevant to the other degree programs in the Department of Chemistry and Physics. Continuing and deliberate collaboration with the Biology Department will be a main aim. The Degree program has a director and coordinator who are rotated between the Biology Department and the Department of Chemistry and Physics. The Department of Chemistry and Physics has a faculty member with responsibility to build and maintain relationships with universities, community colleges and the biotechnology industry. The Biotechnology degree will be promoted statewide so to attract the best students possible. Undergraduate research will continue to

be emphasized. Collaborations will be sought with universities, community colleges and the private sector. Degree articulations with community colleges will be actively sought. Activity to capture funding will continue which will strengthen the Biotechnology Degree and the Department of Chemistry and Physics.

Pre-Engineering

The goals and objectives of the Pre-Engineering Program will be achieved through earnest application of the relevant curricula by the Program coordinator. The coordinator will maintain contact with the UNC engineering campuses to ensure that pre-engineering students are being accepted into their engineering programs and that those students are succeeding in their goal of a degree in engineering. The Program coordinator will take specific actions, including:

- to guarantee transfer of specialized engineering courses such as Statics to each of the engineering campuses.
- to seek out a contact in each engineering campus and produce a signed agreement with each engineering campus. At present there is a newly signed agreement with UNC Charlotte for entrance into their Mechanical, Electrical and Civil Engineering programs. These agreements will provide a more secure and concrete program for the pre-engineering student to follow.
- to recruit students from the surrounding area into the program through advertisement and talks at the local schools.

- to create distance education courses from a UNC engineering campus, which would guarantee transfer of higher level engineering courses to all UNC campuses.

VII. EVALUATION

Chemistry & Applied Physics

Internal Evaluations. Achievement of the Chemistry and Applied Physics degree programs' educational goals and objectives will be evaluated primarily through the regular assessment of appropriate performance indicators, including:

- the number of B.S. graduates obtaining and maintaining immediate postgraduate employment;
- the number of B.S. graduates gaining admission to and completing graduate programs in Chemistry, Physics and related fields; and,
- the number of B.S. students that are successful in gaining entrance to and completing relevant professional degree programs (medicine, law, etc.).

Data relevant to these performance indicators have to date been obtained annually through the graduate tracking efforts of the Department, with all faculty sharing the responsibility of gathering relevant information on graduates and passing it on to the Department secretary for archiving. This approach was modified in the Fall 2004 semester by assigning two department members the task of coordinating all graduate tracking efforts. To date, these faculty have combined all presently available data on our graduates for the past two decades and are presently developing plans to improve our data collection process (e.g.,

telephone solicitations, web-based form submissions, postal mailings, etc.). The Department will meet each Fall Semester to discuss details and assign faculty to the various evaluation tasks, and to review the evaluation results from the previous academic year (see “Use of Evaluation Results” section below).

Evaluation of the scholarship and service goals and objectives of the Chemistry and Physics programs will involve primarily the assessment procedures outlined in the UNCP Faculty Evaluation Model. The information provided in annual faculty self-evaluations will be most useful in this regard, hence the Department chair will be the person responsible for gathering these data.

Evaluation by External Agencies. UNCP policy for evaluation of programs is to have all departments undergo an extensive review every five years with the aid of off campus evaluators. The American Chemical Society requires a comparable evaluation process for its approved programs; this external review will be a valuable means of assessing our Chemistry program’s status. Though a similar approval/review process does not exist for academic programs in Physics, our Department will solicit an external review of its Applied Physics program from appropriate individuals or agencies such as the American Institute of Physics.

Use of Evaluation Results. A compilation of the evaluation data described above will be prepared annually by the designated faculty members(s) and presented at a Department meeting for all to consider. Should the data show cause for concern in any of the areas addressed, the Chair will confer with appropriate faculty members to investigate the point(s) of concern and formulate

plans of corrective action.

Pre-Engineering

Internal Evaluations. The extent to which the Pre-Engineering Program's goals and objectives are being achieved will be evaluated through regular assessment of appropriate performance indicators, including:

- Updated statistics on which students and the percentage of students who are accepted into a UNC engineering program
- Updated statistics on the percentage of accepted students that go on to graduate from a UNC engineering program

Use of Evaluation Results. A compilation of the evaluation data described above will be prepared annually by the designated faculty member and presented at a Department meeting for all to consider. Should the data show cause for concern in any of the areas addressed, the Chair will confer with appropriate faculty members to investigate the point(s) of concern and formulate plans of corrective action.

Biotechnology

The performance and effectiveness of the Biotechnology Degree will be assessed as follows:

1. monitoring growth of the B.S. degree in terms of numbers of majors.
2. recording the numbers of community college students who transition into the degree program.

3. tracking majors to record the number that enter the biotechnology industry or advanced study.
4. documenting undergraduate research, including student and faculty presentations and publications.
5. meeting annually with the UNCP Biotechnology Advisory Board for feedback and guidance.

Use of Evaluation Results. The Department of Chemistry will coordinate with the Biology Department to review the assessment data outlined above in order to refine and improve on areas as required.