SENATE

OCT 22

PROPOSAL SCC #99/00- 221 (2)

CURRICULUM PROPOSAL FORM 1999-2000

RECEIVED

NEW PROGRAMS, MAJOR PROGRAM REVISIONS, AND PROGRAM NAME CHANGES PROCESS C

DEADLINES Deadline dates for 1999/2000 submissions: Regular proposals: October 22, 1999 to be implemented in Fall 2000; Short-Term proposals: December 10, 1999 to be implemented in Fall, 2000; Regular proposals February 18, 2000 to be implemented in Spring, 2001; March 24, 2000 for short-term courses to be implemented in Spring 2001.

PROPOSAL TITLE: A New Major in Biochemistry, B.S. Degree 1907

SPONSOR(S): Drs. Schultz, Chary, Naidoo, Yang

DEPARTMENT: Chemistry and Physics

COLLEGE: Liberal Arts and Sciences

IF LAS CHECK ONE: ____History/Humanities __X__Math/Sciences ___Social/Behavioral Sciences

Check One: __X__ **Undergraduate** _____**Graduate**

CHECK ALL THAT APPLY:

_____UNDERGRADUATE COLLEGE: _____

IF LAS:

__X__ UNDERGRADUATE _____History/Humanities __X__Math/Sciences _____Social/behavioral Sciences

The attached *NEW PROGRAM/MAJOR PROGRAM REVISION/PROGRAM NAME CHANGE* proposal is best described by the item(s) checked.

__X__ New degree program

__X__ New major

_____New minor

_____New concentration, specialization, or track

_____Major changes to degree requirements, major, minor, or certificate program

_____Changes to name of college, school, or department

OFFICE OF THE PROVOST
OCT 30 2000
ROWAN UNIVERSITY

DEPARTMENT
(Signature indicates approval)

Dept. Curriculum Chair / Date Charles W. Schultz Oct 7, 1999

Dept. Chairperson / Date [signature] 10/19/99

ACADEMIC DEAN (& Graduate Dean, for New Graduate Programs Only)

Approved ✓ Not Approved _____ Comments:

Academic Dean's Signature/Date [signature] 11/2/01

Graduate Dean's Signature/Date _____

COLLEGE CURRICULUM COMMITTEE 11/27/00

Approved X Not Approved _____

Comments: Make pre-requisites consistent between 721 and 722 proposals
- Appropriate library resources should be provided

Signature of College Chair/Date: [signature]

UNIVERSITY CURRICULUM COMMITTEE

Date of Open Hearing (if necessary) 3/9/01 Approved ✓ Not Approved _____

Comments:

Curriculum Chair Signature/Date [signature] 3/27/01

Date voted upon at Senate (if necessary) _____ Approved _____ Not Approved _____

EXECUTIVE VICE PRESIDENT/PROVOST

Approved ✓ Not Approved _____ If no, reasons are as follows:

Approved by the UCC Academic Liaisons Committee 10/13/00 and by the President's Council on 3/00

Student Credit Hours _____ Faculty Load Hours _____ Equalized Credit Hours _____

Official Copy & Approval Sheet Filed (Date): _____ Executive VP/Provost Signature/Date [signature] 10/26/01

REGISTRAR

Date Approved Course Description Received _____ Hegis Taxonomy & Course Number Assigned _____

Registrar Signature/Date Edwin C Englehardt 10/27/00

NOTIFICATION FORWARD

_____Senate Curriculum Committee Chairperson _____Academic Dean(s)

_____Department Chairpersons _____Registrar _____Sponsor(s)

PROPOSAL for BIOCHEMISTRY MAJOR

Abstract

The Department of Chemistry and Physics in the College of Liberal Arts and Sciences, wishes to offer a major in Biochemistry leading to the BS degree.

The demand by industry for individuals educated in biochemistry is strong and growth potential in these industries is high. The pharmaceutical industry in the tri-state area continues to expand and seeks to hire large numbers of biochemists at all levels; major corporations once seen strictly as chemical companies have redirected their growth into biochemistry. In response to this increasing demand for biochemists, many New Jersey colleges and universities have established undergraduate programs in Biochemistry; undergraduate and graduate level programs at the major research universities in the tri-state area have seen major expansion. Survey data from our own students, both in biology and chemistry, indicate a significant demand for a Biochemistry program at Rowan University.

The Biochemistry major will be located within the Department of Chemistry and Physics and will be based largely upon existing courses in Chemistry, Biology and Mathematics. Requirements for the major, as presented in this proposal, exceed those required or recommended by the American Society of Biochemistry and Molecular Biology. Further, the proposed major will have a strong student research component.

Faculty needed to teach in this program are already in the Department. Support personnel i.e. instrument coordinator, laboratory technician will be able to support the new biochemistry program. Laboratories and other teaching spaces are, today, limited but the new science building will make truly excellent space available. Library resources must be augmented. Instrumentation needs are already being met through a number of internal and extramural grants and future needs will be met in the same fashion.

We wish to have the Biochemistry major available for freshmen, sophomores and juniors effective with the Fall semester, 2000.

Details

a. Title of the Proposal: Major in Biochemistry, B.S. degree

b. Sponsor: Department of Chemistry and Physics

c. Scope and Size of the Program:

Currently, the biology program at Rowan has about 350 majors and the chemistry program about 63 majors. Experience at neighboring Stockton State College and the University of Delaware clearly indicates that the demand for a biochemistry major will be high. In order to attract only the better students to this program, we will for the first five years at least, limit each class to 16 students.

d. Need for the Program:

Industrial interest in biochemistry is already strong and is growing. A survey published by the American Chemical Society states that "In 1993 biochemistry accounted for 43% of all papers and patents" (in all areas of chemistry). Further "The increase in biochemistry was significantly higher than in other fields and this pattern has been observed for the past 10 years". The New Jersey, Philadelphia and Delaware area is a major center for pharmaceutical (biochemical) research and manufacturing. The growing interest in biochemistry is also evident in the recent determination by such chemical companies as DuPont to emphasize future growth in biochemistry.

This movement towards increasing industrial emphasis on biochemistry and biotechnology has affected the college/university community. For example, Stockton State College had 10 chemistry and 14 biochemistry graduates in the 1997/1998 year. The University of Delaware reports that their number of B.S. chemistry graduates decreased from 31 to 19 from 1994 to 1998 but that the number of biochemistry graduates increased from 11 to 20 over the same period. Even within our Department the demand for biochemistry courses has required multiple section offerings.

A recent survey (February 1999) of biology and chemistry classes at Rowan also indicates a very strong interest in biochemistry. Of the 164 biology majors responding to the survey, 77.4% definitely believe and 20.1 % probably believe that a biochemistry major should be available at this University. The corresponding responses from the 26 chemistry majors was 80.8% definitely and 15.4 % probably should be available. Further, were these students to start their university careers now, 28.7% of the biology and 34.6% of the chemistry majors would definitely be interested in declaring biochemistry as a major. Another 30.0% of the biology and 34.6% of the chemistry majors would probably consider declaring the biochemistry major.

A questionnaire was also distributed to senior scientists at the major pharmaceutical companies in the area: Wyeth-Ayerst Research, Bristol-Myers Squibb Company, Shering-Plough Research Institute and DuPont Pharmaceuticals Company. Respondents were unanimous or nearly unanimous in perceiving that (1) the future of biochemistry as we enter the next millennium looks bright; (2) definitely think that students with biochemistry background will be needed in their

companies; (3) believe that it is a good idea to have a biochemistry major at Rowan University and (4) would consider undergraduate students majoring in biochemistry at Rowan University for employment in their organizations.

e. Requirements for admission and graduation

Initially each class will be limited to a maximum of 16 students. We will do this at the onset of the program because of limited space in the current science building. We expect the demand for this major to be high and so this cap will be lifted when we have adequate lab space in the new science building. We will develop an application process for all students who wish to become biochemistry majors. Details have to be worked out with the Admissions office and the CAP Center. Freshman will need to present a strong background in chemistry, mathematics and biology and have above average SAT scores. Graduation requirements are at least 2.00 average in both major courses and all courses.

f. Suggested time and scale

Every course in the program (except biophysical chemistry) is presently being offered. We wish to begin the program at the freshman, sophomore and junior level in the fall of 2000.

g. Recommended Library Resources

The program will require library support. Rowan Library has increased its biochemical collection in the last few years, but additions must be made to the biochemical and biotechnology collection and technical periodicals will be required to support teaching and research. Computer access to additional data bases will also be required.

h. Staffing

Drs. Catherine Yang and Nirinjini Naidoo are currently on the faculty and are biochemists. They will be responsible for the upper level biochemistry courses within the degree. Rowan University currently has a well established program in biology and an ACS accredited chemistry program from which the biochemistry program will draw. There are presently nine chemistry faculty who would teach the lower level courses in the program and eleven biology faculty who will teach the biology courses specified in the program. No new additional faculty will be needed to launch this major.

3. Rationale

Biochemistry is an important and emerging area of chemistry. It is consistent with the institutional priority of the Rowan mission that: "... Rowan combines liberal education with professional preparation..." and meets the goal of "commitment of

all members of the community to a comprehensive educational program designed to prepare the whole student for an integrated life in a continuously changing, rapidly advancing, and ever-shrinking world." The biochemistry degree fits perfectly with the focus of the Rowan Plan "(t)o promote the development of multidisciplinary programs reflective of the inter-relatedness and increasing complexity of societal challenges. "

4. Essence of the program.

a. Major goals of the Program.

Biochemical knowledge continues to expand at an exponential rate and is setting the pace for advances in medicine, dentistry, genetics, immunology, microbiology, pharmacology, agriculture, nutrition, psychology, exercise science, and related disciplines. It is projected that in the next several decades, biochemistry will have a greater impact on our lives and our society than any other area of the natural sciences. Recombinant DNA technology, protein chemistry, and structural biology all of which are major components of biochemistry, have greatly enriched our understanding of the molecular mechanisms governing fundamental biological processes. Biochemistry has emerged as a unique science that provides a coherent and accurate view of living processes.

Students with a biochemical background are actively sought in the pharmaceutical and biotechnology industries. Preparation for careers in these fields not only requires a solid background in chemistry and biology, but more importantly in biochemistry. The combination of chemistry, molecular biology, structure biology, enzymology, and genetic engineering found in biochemistry provides the foundation to contribute to the rapidly expanding field of biotechnology. We hope to prepare our students at the baccalaureate level for initial work or research in the pharmaceutical and medical fields as well as preparation for graduate study in related fields. This training would also be ideal for advanced study in medicine, dentistry or veterinary science.

Rowan University emphasizes the value of a liberal education that provides an all important background for a broad, technical education concentrating on a molecular approach to life science. Rowan's Biochemistry program will also provide the student with great flexibility. The Biochemistry student has the option to study in a related field, i.e., Molecular Biology, Structural Biology, Molecular Genetics, by simply choosing the appropriate courses from the list of Biology electives. Completion of these electives in combination with the Biochemistry requirements will provide the student with a solid preparation for advanced studies in Biochemistry and/or the elected disciplines.

b. Specific objectives of the program

The proposed Bachelor's Degree program will enable students to:

1. have a general knowledge of the field of biochemistry and have the ability to apply this knowledge in a problem-solving environment;

2. be proficient in basic chemical, biochemical, and physical laboratory skills; to have conducted a research project as part of an upper level course or as a participant in an active laboratory research program within the university or in an appropriate cooperative education assignment;

3. have an understanding of the principles and and applications of modern instrumentation, computation, experimental design, and data analysis;

4. have the ability to formulate and carry out strategies for solving scientific problems.

c. Structure of the program

i. The specific math and science requirements of our biochemistry program are:

(1) mathematics/computer science
- (a) Calculus I
- (b) Calculus II
- (c) Introduction to Programming or Computing Environments

(2) physics
- (a) Physics I (w/calc)
- (b) Physics 11 (w/calc)

(3) chemistry/biochemistry
- (a) Chemistry I (or Advanced Chemistry I)
- (b) Chemistry II (or Advanced Chemistry II)
- (c) Organic Chemistry I
- (d) Organic Chemistry II
- (e) Quantitative Analysis
- (f) Biochemistry I
- (g) Advanced Biochemistry
- (h) Biophysical Chemistry
- (i) Seminar I

(4) chemistry/biochemistry electives: choose two courses from a list of eight existing advanced chemistry courses.

(5) biology
- (a) Biology I
- (b) Biology II

(6) biology electives

Choose three courses from the following:

(a) Genetics
(b) Microbiology
(c) Cell Biology
(d) other appropriate courses offered by the biology department

(7) research - Introduction to Research I or II

ii. Sequence of courses A typical four year program for a full time student is given below

Fall, Freshman	Spring Freshman
Chemistry I, 4 (No prereq.)	Chemistry II, 4 hrs. (Chemistry I)
Biology I, 4 hrs. (No prereq)	Biology II, 4 hrs.; (Biology I)
Calculus I, 4hrs. (No prereq.)	Calculus II, 4 hrs.; (Calculus I)
Fall, Sophomore	**Spring Sophomore**
Organic Chem. I, 4hrs. (Chemistry II)	Organic Chem. II, 4 hrs (Org. I)
Physics I,4 hrs (Calculus I)	Physics II, 4 hrs (Physics I)
Quantitative Anal., 4 hrs. (Chem. II)	Microbiology, 4 hrs (Biology II)
Fall, Junior	**Spring, Junior**
Biophysical Chem. 4 hrs (Calc II, Quant. Org II, Bio II & Physics II)	Biochemistry 1, 4 hrs (Org. II)
Cell Biology, 4 hrs (Biology II)	Genetics, 4 hrs ((Bio II)
Intro to Programming (3 hrs) or Computing Environments (3 hrs)	
Fall, Senior Year	**Spring, Senior Year**
Advanced Biochem., 4 hrs (Intro to biochem.)	Introduction to Research I, 3 hrs
Biochemistry Elective, 3-4 hrs	Biochemistry Elective, 3-4 hrs
Seminar I, 1 hrs. (senior)	

d. Compare and contrast the program with similar programs of high quality

Twelve other institutions of higher learning offer biochemistry programs in the state of New Jersey. The closest schools that offer similar programs are Rutgers University at Camden and Stockton State College. The program announcement from Ramapo stated: "The major is offered ubiquitously throughout the United States and internationally." Two organizations offer recommendations for courses in programs of biochemistry. The American Chemical Society's (ACS) program recommends a full chemistry major with the additions of biochemistry courses. Relatively few institutions follow this model. Most of the biochemistry programs in the state of New Jersey and the nation follow the recommendations of the American Society of Biochemistry and Molecular Biology (ASBMB).

Our proposed major in biochemistry meets or exceeds the recommendations of the ASBMB. The course requirements in the areas of chemistry, biology, biochemistry and elective sciences for several New Jersey and area schools and the Rowan Model are given below:

Required Courses

	Chemistry	Biology	Biochemistry	Electives chem/biochem	Research
ASBMB Model	6	4	2 (with lab)		1
Montclair State	8	4	2 +2 labs		
Fairleigh Dickinson	10	4	2		1
Rider University	8	electives	2 +2 labs		
St. Peters College	6	1	2	1	
Rutgers Univ.	7	1	3	1	1
Univ. of Penn.	6	0	4	2	
Rowan University	7	5	2 w/ 2 labs	2	1

e. Administration

The new biochemistry major will be administrated through the Department of Chemistry and Physics. One of the biochemists will be assigned as the program coordinator with 2 load hours of compensation. These hours will come from administrative hours already available. No extra overload will be necessary for this requirement. Students in the Introduction to Research course (1909.440) may be mentored by faculty in either the Department of Biological Sciences or Department of Chemistry and Physics on appropriate projects. Advising of all students in the Biochemistry program will be done by faculty of the Department of Chemistry and Physics.

f. Program Evaluation

We have established an Advisory Board consisting of ten industrial biochemists holding the Ph.D degree in biochemistry and representing seven different large corporations to help us in our assessment of the program and to ensure that our program stays consistent with developments in the biochemistry/biotechnology industry.

We also have an external consultant, Dr. Roberta Coleman, Director of the Biological Chemistry Division of the American Chemical Society and Professor at the University of Delaware, to assist in evaluating our program.

A Program Announcement was sent to all colleges and universities in New Jersey and we received a unanimous positive response to this proposal.

ROWAN UNIVERSITY

TO: Dr. Robert Newland, Chairperson, Chemistry & Physics

FROM: Andy Prieto, Chair, Biological Science

RE: Biophysical Chemistry Course

DATE: February 4, 2000

The Biological Sciences department fully endorses the Biophysical Chemistry course as proposed by the Chemistry department.

201 Mullica Hill Road • Glassboro, New Jersey • 08028-1701

Memo To: Charles Schulz, Chemistry & Physics

From: Seth Bergmann, Computer Science

Date: October 11, 1999

Subject: Biochemistry Major

Thank you for the opportunity to review your proposal for a biochemistry major here at Rowan. I think this program will play a significant role in establishing our reputation as a comprehensive university.

In regard to the computer science component of the major, I have a few suggestions. We offer courses in the use of computer applications, and we offer courses in programming (the development of new applications). I believe that biochemistry students could benefit from coursework in either (or both) of these areas.

In the area of using computer applications, all students are now required to possess basic computer competency (by either passing a test, or taking Computer Literacy). I believe that biochemistry students will need more than this basic competency or Computer Literacy; therefore, I am recommending Computing Environments. This course involves the use of sophisticated applications and tools, such as Photoshop, desktop publishing, image processing, digital cameras, etc.

In the area of programming, many researchers in biochemistry are using unix workstations to model complex molecular structures. We offer a course called Computer Lab Techniques, which teaches unix (for programmers). The prerequisite for this course is Computer Science & Programming, and the prerequisite for CS&P is Intro to Programming.

In summary, any or all of the following would benefit the biochemistry major [prerequisites shown in brackets]:

Computing Environments [Computer Literacy or Competency]
Intro to Programming
Computer Science and Programming [Intro to Programming]
Computer Lab Techniques [Computer Science & Programming]

Best wishes for your new major program!

ROWAN UNIVERSITY

Mathematics Department

MEMO

TO: Charles Schultz,
Chemistry & Physics

FROM: Ron Czochor, Chair
Mathematics Dept

DATE: October 19, 1999

RE: B. S. in Biochemistry

Thank you for the opportunity to comment on your proposed major in Biochemistry. I have read the proposal and find it to be a strong proposal designed to provide a needed option for those students interested in an applied science valuable in the medical and life sciences.

Biochemistry is an exciting discipline with high growth potential that would complement the well respected majors we already have in biology and chemistry. Since most of the necessary courses are already in place, it will cost the college very little to implement this state of the art curriculum. I strongly support the development of this major.

From the standpoint of the Mathematics Department, this new major should not require more than what we are currently offering. If all the students in the program come from the current chemistry majors there would be no effect since they currently take Calculus I and II. If, in the most extreme case, all of the students were to come from the biology major, at most 16 students would need Calculus II once a year. These students could be accommodated by the 11 sections of Calculus II we offer every year, since our class size in that course averages less than 31 students per class.