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Biological Sciences: Changes to the Curriculum of the Major in Biological Sciences

The College at Brockport, College Senate

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SUNY BROCKPORT

College Senate
State University of New York
College at Brockport
[illegible] Campus Drive
B[illegible]port, NY 14420-2925
(585) 395-2586 (Fax) 395-2246

Resolution # 21
2005-2006
COLLEGE SENATE

TO: Dr. John R. Halstead, College President

FROM: The College Senate Meeting on: ***March 20, 2006***

RE: ⇨ I. Formal Resolution *(Act of Determination)*
II. Recommendation *(Urging the Fitness of)*
III. Other, For Your Information *(Notice, Request, Report, etc.)*

SUBJ: ***Biological Sciences: Changes to the Curriculum of the Major in Biological Sciences*** *#25 05-06 UC*

Signed: _____ Date: 3/21/06
(Dr. Mark Noll, 2005-2006 College Senate President)

Please fill out the bottom portion and return document to the College Senate Office.

TO: The College Senate

FROM: College President

RE: ⇨ I. Decision and Action Taken on Formal Resolution (circle)
a. Accepted. Resolution Effective Date: ____/____/____
b. Deferred for discussion with the Faculty Senate on ____/____/____
c. Unacceptable for the reasons contained in the attached explanation

II, III. Response to Recommendation or Other/FYI
a. Received and acknowledged ____/____/____
b. Comment: _____

DISTRIBUTED BY PRESIDENT'S OFFICE TO: _____

DISTRIBUTE ALSO TO: Originator, Academic Advisement, Registrar (as appropriate)

Signed: _____ Date: _____
(Dr. John R. Halstead, College President, SUNY College at Brockport)

Page 1 of 11
College Senate 1/26/06
2005-2006-21.res.doc

COLLEGE SENATE OFFICE RESOLUTION PROPOSAL COVER PAGE

Routing Number	#25 05-06 UC

ROUTING NUMBER TO BE ASSIGNED BY SENATE OFFICE

DEADLINE FOR SUBMISSIONS: FEBRUARY 23

Proposals received after the deadline may not be reviewed until next semester.

INSTRUCTIONS:

- Submit proposals individually rather than packets including multiple documents.
- Complete this cover page for each proposal (available online at www.brockport.edu/collegesenate)
- Prepare proposal in Word format using committee guidelines (available online)
- Submit proposal electronically with this cover page to senate@brockport.edu, facprez@brockport.edu
- All updates must be resubmitted to the Senate office with an updated cover page, use routing number
- Questions? Call the Senate office at 395-2586 or the appropriate committee chairperson.

1. PROPOSAL TITLE:

Please be somewhat descriptive, for example, *Graduate Probation/Dismissal Proposal* rather than *Graduate Proposal.*

Changes to the Curriculum of the Major in Biological Sciences

2. BRIEF DESCRIPTION OF PROPOSAL:

Mathematics, chemistry, and physics have become more and more important for the field of biology, particularly in the areas of cellular and molecular biology which is the major focus of our department. As such, biology curricula in universities must reflect the increased need of biology majors to receive course work in these areas. An examination of university biology programs in the Rochester area and at the other SUNY campuses reveals that we require much less math, chemistry, and physics than these programs and that our majors are in danger of being ill-equipped to compete on the job market in areas that require a background in biology. To bring our major up to the level of most university biology programs and thereby enhancing the education in biology for our majors, we have proposed some major changes in our requirements in the areas of mathematics, chemistry, and physics. In addition we have redesigned our curriculum to include an extra required laboratory experience. We see these changes as a major improvement over our current curriculum.

3. SUBMISSION & REVISION DATES: PLEASE DATE ALL UPDATED DOCUMENTS

First Submission	Updated on	Updated on	Updated on
January 23, 2006			

4. SUBMITTED BY: (contact person)

Name	*Department*	*Phone*	*Email*
Stuart Tsubota	Biological Sciences	395-5745	stsubota@brockport.edu

5. COMMITTEES TO COPY: (Senate office use only)

Standing Committee	*Forwarded To*	Date
__ Enrollment Planning & Policies	Committee Chair	**1/26/06**
__ Faculty & Professional Staff Policies	Executive Committee	**2/20/06**
__ General Education & Curriculum Policies	Senate Floor	**2/27/06 with revision***
__ Graduate Curriculum & Policies		vote 3/20/06
__ Student Policies	College President	**3/22/06**
XX Undergraduate Curriculum & Policies	Other	

**(ROUTING NUMBER WILL BE A CHRONOLOGICAL NUMBER SEQUENCE FOLLOWED BY COMMITTEE INITIALS)*

* Per 2/20/06 executive committee meeting, the last two lines on page 2 regarding general education are removed.

PROPOSED NEW CURRICULUM FOR A MAJOR IN BIOLOGICAL SCIENCES (B.S.) SIDE BY SIDE COMPARISON WITH CURRENT CURRICULUM

Biological Sciences Requirements

Course Number	Title	Current Curriculum	New Curriculum
BIO 201	Biology I	4	4
BIO 202	Biology II	4	4
BIO 301	Cell Biology	3	4 - increased from 3-4 with the addition of a lab
BIO 302	Genetics	3	4 - increased from 3-4 with the addition of a lab
BIO 306	Cell & Genetics Techniques	3	0 - dropped requirement
BIO 300-level	Electives	4-8	4-8
BIO 400-level	Electives	16-12	16-12
BIO 498	Seminar	1	1
	Minimum Total credits	**38**	**37**

Related Sciences Requirements

Course Number	Title	Current Curriculum	New Curriculum
MTH 201 or 221 or 243	Calculus I Calculus for Business, Social, and Life sciences Elementary Statistics	0	3 - added requirement
CHM 205-206	College Chemistry I and II	8	8
CHM 305	Organic Chemistry I	4	4
CHM 306 or CHM 303	Organic Chemistry II Analytical Chemistry I	0	4 - added requirement
PHY 115-116 or PHY 201-202	General Physics I and II with lab College Physics I and II with lab	0	8 - added requirement
	Minimum Total credits	**12**	**27**
	TOTAL REQUIRED CREDITS FOR MAJOR	**50**	**64**

RATIONALE FOR CURRICULAR CHANGES

A recent report by the Committee on Undergraduate Biology Education to Prepare research Scientists for the 21st Century, National Research Council of the National Academies, strongly recommended revamping current college curricula in the Biological Sciences to better reflect the changing field of biology and to better prepare the students for future careers in biology.[1] Their proposed curricular changes reflected the growing roles of mathematics, computer sciences, and the physical sciences in biological research and biological instruction. We have decided to institute their recommendations into our curriculum revisions. They are as follow:

1) Increased inclusion of mathematics, computer sciences, and the physical sciences in biology curriculum

2) Increased laboratory experiences as part of the curriculum.

A third recommendation was to integrate math, computer sciences, the physical sciences, and biology into course revision. Many of our courses have already made this integration and we recently made a concerted step in that direction with the creation of a Bioinformatics course that has been offered the last two years.

A second reason for our proposed curriculum revision is a comparison of our program with those of other institutions. I drew from my own experience with other programs, first as a biology major (University of Notre Dame) and later as a faculty member (University of Michigan and Saint Louis University) and, more importantly, compared our program with those from other SUNY campuses, the University of Rochester, and the California State University (CSU) campuses. I chose the CSU campuses, because the CSU system is very similar in scope and mission to the SUNY system. In addition the CSU system recently held a workshop to discuss curriculum revision in biology departments.[2] I examined the curriculum in biology at four of the CSU campuses, 14 of the SUNY campuses (Brockport included), and the B.S. program at the University of Rochester. I specifically examined their requirements in mathematics, chemistry, and physics. I will summarize these comparisons, which are included as Appendix A. Brockport requires chemistry through Organic I. The 18 other institutions have the same requirement, but 17 of them also require either Organic II or Biochemistry. Brockport requires College Mathematics of its students and our department does not have any additional math requirement. All 18 of the other institutions require math beyond College Mathematics and most require Calculus I or Statistics. We currently have no physics requirement. Of the 18 other institutions, 15 require one semester of physics and of these, 14 require two semesters of physics. Of the three programs that do not require physics, Binghamton requires three courses in statistics, mathematics, or physics, Oneonta requires four courses in math, physics, statistics, or computer science, and Plattsburgh requires two semesters of calculus and one semester of statistics.. The bottom line is that all of the other programs have incorporated more chemistry, math, and physics into their biology curricula than we have.

In order to come in line with the recommendations of the National Academies and with the curricula of similar programs in the SUNY and CSU systems, we have decided to increase our requirements for a B.S. in Biological Sciences in the areas of math, chemistry, and physics. These changes are necessary to enable our students to handle the changes in biological research and biological pedagogy. These changes are absolutely necessary if we are to prepare our students for the workforce in biology after graduation. It should be noted that our students are currently competing with students from neighboring institutions, which have already instituted the improvements that we propose.

The second major change that we are proposing is changing BIO 301 Cell Biology and BIO 302 Genetics from 3-credit courses 4-credit courses. This change will involve the addition of a 3-hour laboratory to the three hours of lecture. In conjunction with these added labs, we are no longer requiring BIO 306 Cell and Genetics Laboratory of our majors. This course will be dropped from the curriculum. The end result is that our students will receive an additional laboratory experience and an expanded exposure to research procedures in cell biology and genetics. The expansion from seven weeks of lab to fourteen for both Cell Biology and

Genetics will also allow for the development of more research-oriented and experiment-oriented labs. We see this as a very important enhancement in our biology instruction. The 4-credit format is by no means a new format for science courses. On the contrary, it is a fairly standard way that science courses are taught. This means that we anticipate very few problems in the transfer of credits from other institutions.

Two of the missions of SUNY Brockport are to increase academic excellence and to increase the academic standing of our entering students. These two missions go hand in hand. Our proposed curricular changes are in line with and fully support these academic missions. The curricular changes, while increasing the rigor of our program, will improve the education of our majors, enhance their ability to continue their education in biological and heath-related areas, and improve their ability to compete in the job market after graduation. The proposed changes not only will improve our instruction in Biological Sciences, but will make us more attractive to students who will be comparing biology curricula between different institutions. We currently do not compare well with other SUNY campuses (See Appendix A.). The new curriculum will rectify this situation, improve the academic reputation of our department and the university, will attract better students, and will support the academic missions of the university.

1 *BI2010: Transforming Undergraduate Education for Future Research Biologists*. (Washington, DC: The National Academies Press, 2003) http://www.nap.edu/books/0309085357/html/

2 *Summary Report of the CSU Biology Workshop on Revising the Biology Major Core/Foundational Curricula - May 1-2, 2004* http://www.calstate.edu/ITL/proposals/2004_Bio.pdf

DESCRIPTION OF NEW COURSES

The proposed curriculum revisions will require the modification of two required courses in Biological Sciences. These courses are BIO 301, Cell Biology, and BIO 302, Genetics. These courses are part of our core and are usually taken in the sophomore year. Both courses are currently 3-credit lecture courses without associated laboratories. We are proposing to change both courses to 4-credit courses with associated 3-hour laboratories. The addition of the laboratories is the reason for the increase in credits. These changes will provide the students with valuable laboratory experience in areas of biology that are seminal for their education. College Course Registration Forms for both courses will be submitted separately. As compensation for the addition of the two laboratory experiences, we are dropping the requirement for BIO 306, Cell and Genetics Techniques. The curriculum covered in this course has been duplicated and expanded upon in the laboratory sections of BIO 301 and BIO 302.

STAFFING ISSUES

The revamped BIO 301 and 302 will be taught by the faculty currently teaching these courses. Additional staffing will be necessary to handle the increased number of laboratory sections. This problem would be most easily handled by using a graduate TA to help out. The TA would teach two laboratory sections of BIO 301 in the fall and two laboratory sections of BIO 302 in the spring. Alternatively, another faculty member could be assigned to help out in the instruction of the laboratory. This will not be a problem, since we have gained one faculty member in the past year.

The added course requirements in math, chemistry, and physics will have an impact on the departments teaching these courses. As an indication of the increased load these changes may have, we examined the records of 79 of our majors that have senior status (≥86 hours), to determine how many had taken MTH 201 (Calculus I), CHM 306 (Organic Chemistry II), PHY 115, 116, 201, 202 (General or College Physics I and II). The results indicated that about 40% of the seniors had taken Calc I (29), Organic II (35), and Physics 115 or 201 (29). This could mean an increase of about 40-50 students per year in courses in each of these departments. I have contacted the chairs of the Departments of Mathematics, Chemistry, and Physics about our proposed changes and have discussed the implications of these changes with them. They are all in favor of the changes and are aware of the increased load these changes will have on their instructional faculty. I have attached copies of their letters of support (See Appendix B).

RESOURCES, FACILITIES THAT MAY BE NEEDED TO IMPLEMENT THE PROGRAM

Within the Dept. of Biological Sciences, the programmatic changes will result in increasing the laboratory course requirement by one. This essentially means that we will be teaching one additional laboratory course every year. Funds for laboratory supplies will need to be available to support this increase. Although the funds available in our current budget will probably support these changes at a minimal level, we will ask for increased funds to support these changes at a more manageable level. No new laboratory space will be needed for the extra laboratory class. Lennon 206 will be used for the labs for both BIO 301 and 302.

Within the supporting science departments, increases in resources will likely be necessary to accommodate the increased enrollment in some of their courses. The chairs of these departments are aware of these needs.

APPENDIX A: Table comparing SUNY Brockport Department of Biological Sciences with similar departments in other SUNY campuses and select California State University campuses

Institution	Department	Chemistry Requirement	Physics Requirement	Math Requirement
SUNY Brockport	Biol Sci	Chem I, II; Org I	None	College Math
SUNY Albany	Biol Sci B.S.	Chem I, II; Org I, II	2 semesters w/o calc	6 credits above College Math
SUNY Binghamton	Biol Sci	Chem I, II; Org I, II	None	Stats plus 8 credits in Math and Physics
SUNY Buffalo	Biol Sci	Chem I, II; Org I, II	2 semesters w/o calc	Calc I, II
SUNY Cortland	Biol Sci	Chem I, II; Org I; Org II or Bioch	2 semesters w/o calc	Calc I; Calc II or Stats
SUNY Fredonia	Biology B.S.	Chem I, II, Org I, II	2 semesters w/o calc	Calc I
SUNY Geneseo	Biology	Chem I, II; Org I, II	2 semesters w/o calc	College Math; Calc I or Probability & Stats
SUNY New Paltz	Biology	Chem I, II; Org I; Org II or Bioch	1 semester w/o calc	Calc I; Stats
SUNY Old Westbury	Biology B.S.	Chem I, II, Org I, II	2 semesters w/o calc	Calc I
SUNY Oneonta	Biology	Chem I, II; Org I, II or Elem. Org & Bioch	See Math Requirement	four math/physics/stats/ computer courses
SUNY Oswego	Biology	Chem I, II; Org I; Org II or Bioch	2 semesters w/o calc	Calc I, II; or Stats I, II; or Stats I, Calc I
SUNY Plattsburgh	Biol Sci	Chem I plus 8 credits including Bioch	None	Calc I, II; Stats
SUNY Potsdam	Biology B.S.	Chem I, II, Org I	2 semesters w/o calc	Calc I and Stats or Calc II
SUNY Stony Brook	Biology B.S.	Chem I, II, Org I, II	2 semesters w/o calc	Calc I, II; Stats
U of Rochester	B.S. Biology	Chem I, II; Org I, II	2 semesters with calc	Calc I, II; one additional course
Cal State Fullerton	B.S. Biol Sci	Chem I, II; Org I, II	2 semesters with calc	Calc I or Stats
Cal Poly Pomona	B.S. Biology	Chem I, II; Org I, II	2 semesters with calc	Trigonometry or Calc I
Cal Poly San Louis Obispo	B.S. Biol Sci	Chem I, II; Org I, II	2 semesters with calc	2 math courses plus 1 stats course
San Francisco State	B.S. Biology	Chem I, II; Org I, II	2 semesters w/o calc	Calc I plus one more math course

Oswego - Chemistry offers a one-semester organic and a one-semester biochemistry for Biology majors.
Plattsburgh - Chemistry offers a one-semester Organic and a one-semester Biochemistry as well as the usual two-semester sequences.
New Paltz - Biology offers a one-semester Biochemistry; Chemistry offers a two-semester Biochemistry.
Oneonta - Chemistry offers a one-semester Biochemistry for Biology majors and a two-semester Biochemistry for Chemistry majors.

APPENDIX B: Letters of support from chairs of contributing departments

Subject: Biological Sciences curriculum changes have the strong support of physics.
From: rmancuso@brockport.edu
Date: 11/8/2005 10:06 AM
To: sappelle@brockport.edu
Cc: stsubota@brockport.edu, plista@brockport.edu

Dear Stu,

I am writing to give my strongest support to the curricular changes proposed by the Department of Biological Sciences. The requirements of two semesters of physics plus the other proposed courses support the core of the college's mission statement, that "student success is our highest priority." These changes will have an impact on the Department of Physics' course offerings.

Stuart Tsubota estimates that forty additional students will be taking either General Physics I & II or College Physics I & II. This translates into offering two additional laboratory sections per semester. The extra students will take the same lecture so the impact there will be in more time spent grading. With only three tenure-track faculty for the fall 2006 semester, the Department of Physics is woefully understaffed.

I wrote to you earlier with a plan to staff the department with four tenure-track people or with three tenure-trackers and one QAR, with both scenarios requiring two adjuncts. With the addition of two laboratory sections, we would need two additional adjuncts. As you know, I am very leery of adjuncts because we have been burned before. The two adjuncts we have now are exceptional; finding two more like them will be a challenge.

With only three tenure-trackers, the department would have to staff eight courses per semester with adjuncts. Two of those courses each semester are upper division laboratories, which are anathema to adjuncts.

In my studies in non-linear dynamics and chaos I have encountered several interesting problems biology. One of them is the dynamical model of a genetic switch. The mathematics needed to understand the model is that of differential and integral calculus. Biological Science majors who have taken the required physics and mathematics courses could easily work on such a problem.

Once again, I give the proposal my strongest support.

Dick

Richard V. Mancuso, Chair
Department of Physics
SUNY Brockport
Brockport, NY, 14420
585-395-5576

November 12, 2005

To: Stuart Tsubota
Chair, Biological Sciences

Fr: Michael Barbosu
Chair, Department of Mathematics

Re: Program Proposal, Impact on our Program

Dear Dr. Tsubota,

The mathematics faculty had reviewed the documents that you forwarded about your proposed curriculum changes, which include the Calculus I course to be offered by our department.
As we recognize the importance of your initiative, we support the curricular changes to the Biological Sciences degree program and feel that the decision to add mathematics requirements to it is a very good one.

Sincerely,
Michael Barbosu

TO: Stuart Tsubota, Chairman
Department of Biological Sciences

FROM: Thomas W. Kallen, Chairman
Department of Chemistry

DATE: January 11, 2006

RE: Support for Your Proposal to Revise the Biology Major Curriculum

The Faculty of the Department of Chemistry is unanimous in their support of your proposal to the College Senate to revise the Biology Major curriculum to include the requirement of an additional semester of chemistry. Furthermore, we agree that your students should be given the option of fulfilling this requirement by taking either CHM 306 (Organic Chemistry II) or CHM 303 (Analytical Chemistry).

CHM 306, of course, is a non-quantitative course and builds upon the experience gained by the student in your current external chemistry course requirement of CHM 205, College Chemistry I, CHM 206, College Chemistry II, and CHM 305, Organic Chemistry I. The focus of this course and its laboratories is not only upon the synthesis, properties and reactions of organic compounds by class, but also includes searching the scientific literature (***SciFinder Scholar***) and laboratory report writing, as well as practice in the interpretation of infrared spectra, mass spectra and NMR spectra of organic compounds. It is also the prerequisite course for BIO/CHM467, Biochemistry I, and BIO/CHM 468, Biochemistry II, cross-listed 400-level elective courses that lead to a minor in chemistry and would also be sound additions to any Biology major's academic program.

CHM 303, in contrast, is a quantitative course and builds directly upon the skills gained by the student in CHM 205 and CHM 206. The focus of this course and its associated laboratory is upon analytical skills ranging from classical titrimetric methods of analysis to instrumental analytical methods, such as atomic absorption spectrometry, gas chromatography, high performance liquid chromatography, and UV-visible spectrometry.

We would also note that a Biology major who completed a minor in chemistry by taking ***both*** CHM 303 and CHM 306 would not only have the training equivalent to that of a Chemical Technology Associate's degree holder, a definite "plus" for the first-time job seeker, but would have hands-on experience with a rich mixture of the common qualitative and quantitative instrumental methods of examination of chemical and biochemical compounds.

We are enthusiastic about collaborating with the Department of Biological Sciences to assemble a first-rate program in cellular and molecular biology!

Our only real concern about the proposed changes to the Biology major program lies, of course, with resources. We do not see that the number of Biology majors taking CHM 306 will increase immediately by more than 20%, since most Biology majors who take CHM 305 here now continue on into CHM 306; and many Biology majors already include CHM 303 as part of their Chemistry minor program. However, our faculty resources and laboratory space have already been taxed almost to the limit by growth in the number of your majors and the recent creation of the major program in Environmental Sciences. Recent increases in enrollments in CHM 305 (up ~60%), CHM 306 (up ~60%) and CHM 303 (up ~150%) [See the attached graph of Analytical and Organic Enrollments.] have been such that we must now either be allowed to increase the number of our full-time faculty by one member or we must consider withdrawing General Education courses, such as CHM 121, Chemistry and Scientists (L, W and X), CHM

171, Forensic Science (N), CHM 372, Environmental Issues (I), and CHM373, American Women Scientists in Contemporary Society (I, W), from our regular offerings.

We are naturally quite hesitant about withdrawing our "general population courses" from the General Education Program, since we have found a niche among the non-science student population only with great difficulty. However, we will do so if we must, and do so willingly. We consider that supporting the chemistry major program and supporting the major programs of the other physical, environmental and biological sciences to be coequal in importance and of the highest priority to the Department.

XC: Stuart Appelle, Dean
School of Letters and Sciences