

LSC Use Only
Number: _____
Submission Date: _____
Action Date: _____



UWUCC USE ONLY *02-13a*
Number: *01-43a*
Submission Date: _____
Action-Date: *Withdrawn*

CURRICULUM PROPOSAL COVER SHEET
University-Wide Undergraduate Curriculum Committee

I. CONTACT

Contact Persons Dr. Carl S. Luciano Phone 357-2427, (luciano@grove.iup.edu)
Dr. A. Andrew (72750), Dr. N. Bharathan (72584), Dr. B. Butler (72352),
Dr. W. Dietrich (7-2625), Dr. R. Hinrichsen (72706)
Department Biology

II. PROPOSAL TYPE (Check All Appropriate Lines)

- COURSE _____
Suggested 20 character title
- New Course* _____
Course Number and Full Title
- Course Revision _____
Course Number and Full Title
- Liberal Studies Approval _____
for new or existing course Course Number and Full Title
- Course Deletion _____
Course Number and Full Title
- Number and /or Title Change _____
Old Number and/or Full Old Title
New Number and/or Full New Title
- Course or Catalog Description Change _____
Course Number and Full Title

XXX PROGRAM: _____ Major _____ Minor XXX Track

XXX New Program* Cell and Molecular Biology Track

_____ Program Revision* _____

_____ Program Deletion * _____

_____ Title Change _____

III. Approvals (Signatures and date)

Arch... Na 30, 2001
Department Curriculum Committee
[Signature]
College Curriculum Committee

Director of Liberal Studies (where applicable)

W. Bg Bot 11/30/01
Department Chair
[Signature] 11/30/01
College Dean
[Signature] 12/5/01
* Provost (where applicable)

Part II: Complete Catalog Description of Curriculum Change

1. Complete Catalog Description for New Track

Bachelor of Arts in Biology: Cell and Molecular Biology Track

Students electing the Bachelor of Arts degree with an emphasis in Cell and Molecular Biology will take all the core Biology courses and, in addition, a collection of upper-division courses that focus collectively on important aspects of modern cell and molecular biology. This track prepares students for employment in technical positions or for graduate studies in cell biology, molecular biology, biotechnology or related biomedical disciplines. Proper choice of free electives provides suitable training for pre-medical students with an interest in cell and molecular Biology. A substantial emphasis on organismal and population-level Biology is also included.

Bachelor of Arts in Biology with an Emphasis in Cell and Molecular Biology

Liberal Studies Courses: As outlined in the Liberal Studies section 55-56
with the following specifications:
Mathematics: MATH 121
Natural Sciences: CHEM 111-112
Liberal Studies Courses: no courses with BIOL prefix

Majors: 42

Required Courses (27 s. h.):

BIOL 111	Principles of Biology I	4 s.h.
BIOL 112	Principles of Biology II	4 s.h.
BIOL 109	Perspectives in Cell and Molecular Biology	1 s.h.
BIOL 210	Botany	3 s.h.
BIOL 220	General Zoology	3 s.h.
BIOL 250	Principles of Microbiology	3 s.h.
BIOL 263	Genetics	3 s.h.

BIOL 410	Topics in Molecular Biology	3 s.h.
BIOL 401	Laboratory Methods in Biology and Biotechnology	3 s.h.
Controlled Electives (9 s. h.): ⁽¹⁾		
BIOL 151	Human Physiology	4 s.h.
BIOL 281	Special Topics	1-3 s. h. ⁽²⁾
BIOL 331	Animal Developmental Biology	3 s.h.
BIOL 350	Cellular Physiology	3 s.h.
BIOL 352	Comparative Animal Physiology	3 s.h.
BIOL 363	Medical MicroBiology	3 s.h.
BIOL 364	Immunology	3 s.h.
BIOL 453	Plant Physiology	3 s.h.
BIOL 466	Principles of Virology	3 s.h.
BIOL 481	Special Topics	1-3 s.h. ⁽²⁾
BIOL 482	Independent Study	1-3 s.h. ^(2,3)
BIOL 493	Biology Internship	1-12 s.h. ^(2,3)
Biology Electives (6 s. h.): ^(1,4)		
BIOL 251	Field Botany	3 s.h.
BIOL 252	Field Zoology	3 s.h.
BIOL 261	Ornithology	3 s.h.
BIOL 262	General Entomology	3 s.h.
BIOL 269	Bioethics and Coevolution	3 s.h.
BIOL 271	Evolution	3 s.h.
BIOL 272	Conservation of Plant and Animal Resources	3 s.h.
BIOL 281	Special Topics	1-3 s.h. ⁽²⁾
BIOL 310	Applied Entomology and Zoonoses	3 s.h.
BIOL 362	Ecology	3 s.h.
BIOL 420	Biology of Higher Invertebrates	3 s.h.
BIOL 425	Herpetology	3 s.h.
BIOL 432	Comparative Vertebrate Anatomy	3 s.h.
BIOL 450	Pymatuning Field Studies	3 s.h.
BIOL 463	Limnology	3 s.h.
BIOL 471	Dendrology	3 s.h.
BIOL 475	Mammalogy	3 s.h.
BIOL 476	Parasitology	3 s.h.
BIOL 481	Special Topics	1-3 s.h. ⁽²⁾
BIOL 482	Independent Study	1-3 s.h. ^(2,3)
BIOL 493	Biology Internship	1-12 s.h. ^(2,3)

Other Requirements: 16

Organic Chemistry Sequence:

CHEM 231	Organic Chemistry I	4 s.h.
CHEM 232	Organic Chemistry II	4 s.h.

Biochemistry Sequence:

BIOC 301	Biochemistry I	3 s.h.
BIOC 302	Biochemistry II	3 s.h.
BIOC 311	Biochemistry Laboratory I	1 s.h.
BIOC 312	Biochemistry Laboratory II	1 s.h.

Foreign Language Intermediate Level: 0-8 s.h. ⁽⁵⁾

Free Electives: 10-11

Total Degree Requirements: 124

- (1) No more than 6 s.h. total from independent Study, Special Topics, Internship applies to major; excess applied as free electives
- (2) May count as either Controlled Elective or Biology Elective depending on course content.
- (3) No more than 3 s.h. may count toward Controlled Elective requirements.
- (4) May include Marine Science Consortium or Pymatuning courses approved for Biology credit.
- (5) See Biology Department Foreign Language requirement.

2. Detailed Description for the Track

Rationale and Justification

The Department of Biology proposes a new academic track leading to a Bachelor of Arts degree with an emphasis in Cell and Molecular Biology (CMB Track). We believe the Bachelor of Arts is more appropriate for the interdisciplinary philosophy and broad interdepartmental (Biology-Biochemistry-Chemistry) emphasis of the proposed program than the Bachelor of Science degree.

The primary justification for the new CMB Track is to provide a formal, well-defined and directed curriculum that will aid in the preparation of students for employment in biotechnology laboratories or for graduate programs in biotechnology or the biomedical sciences. The following examples illustrate the expanding need for well-trained personnel in this rapidly-growing part of the national economy.

The first example is provided by the web site of the American Association for the Advancement of Science (<http://recruit.sciencemag.org/>). This site includes a "Focus on Careers" section that details the spectrum of employment opportunities for those entering the marketplace. Although this feature is designed to provide career and employment information for all areas of science, mathematics and engineering, the majority of the installments over the last three years describe jobs in the biotechnology sector, emphasizing the number and diversity of opportunities in this area. An August 11, 2000 supplement to the site outlines employment prospects in biotechnology for individuals with a bachelor's or master's degree. In this supplement, representatives of various biotechnology companies describe types of opportunities that are too numerous to describe here. In summary, these representatives stress a strong need for non-Ph. D. employees with solid laboratory experience, broad, cross-disciplinary training and the ability to work with a team without sacrificing an "entrepreneurial" outlook.

Quotes from other organizations further illustrate the current outlook for careers in biotechnology. The November 15, 1999 issue of *Chemical and Engineering News*, a newsmagazine published by the American Chemical Society, commented "...universities will be challenged to keep enough graduate students in the pipeline while training students for emerging positions in the biotech and pharmaceutical industries". In the December, 1999 issue, *Genetic Engineering News* echoes the viewpoint that the "job market will reflect rising opportunities in the worldwide biotech industries."

A final example is based on our own personal experiences at the regional level. Over the last few years the Biology Department has graduated several individuals with bachelor's level training, a background in cell and molecular biology and no intent to pursue post-graduate studies. As a rule, these students found employment almost immediately upon graduation, primarily but not exclusively in the Pittsburgh market. This example persuades us of the demand for well-educated, well-trained individuals at the baccalaureate level.

The proposed CMB Track will provide more options to students interested in attending IUP and thus should aid Departmental recruiting efforts. Currently, eight of the 14 SSHE institutions offer an “option”, “track”, “concentration” or regular degree program in Cell/Molecular Biology or Biotechnology. Only IUP, California, Cheyney, Edinboro, Mansfield and Slippery Rock have no such program. Thus, the adoption of the proposed CMB Track will allow IUP to compete more effectively with SSHE institutions or others in Western Pennsylvania.

As disciplines and programs outside the Biology Department increasingly rely upon molecular methodology, a working knowledge of these methods and their technology assumes growing importance. Thus the proposed CMB Track may become a resource for IUP programs in allied areas such as anthropology, archeology, food science and forensics.

The sciences today employ a much more interdisciplinary approach than in the past. Nowhere is this modern development more apparent than in the broad area of cell and molecular biology, which today encompasses and integrates time-honored disciplines such as biochemistry, cytology, embryology, endocrinology, genetics, immunology, microbiology, physiology and others. Because the structure of the academy has not everywhere adjusted to the blurring of traditional boundaries, all of the content courses appropriate for a track in cell and molecular biology are not generally taught in a single academic department. This is clearly the case at IUP, where courses with cell and molecular content are taught by Biochemistry, Biology and Chemistry. The proposed CMB Track is strongly interdisciplinary in character and this is reflected by its reliance on courses in all three academic units.

The proposed CMB Track requires two semesters of Organic Chemistry rather than the single semester currently required by the existing B. A. in Biology. Instead of the one-semester, lecture-only Biochemistry course CHEM 351 required currently, the proposed CMB Track requires a two-semester Biochemistry sequence that includes two lab courses.

The proposed CMB Track requires seven more BIOL credits than the existing B. A. and for that reason has a stronger emphasis on Biology. Finally, unlike the existing B. A., the proposed CMB Track defines a clear area of specialization. Thus, the proposed CMB Track differs substantially from the existing B. A. in Biology.

Students in the CMB Track will have different Biochemistry, Chemistry and Physics requirements compared to students in the B. S. in Biochemistry degree program. Unlike the Biochemistry B. S., the proposed CMB Track does not require Analytical Chemistry, Physical Chemistry, Calculus II or Physics. Additionally, it has no requirement for Biochemistry Seminars or Biochemistry Special Topics. Finally, the proposed CMB Track requires the CHEM 111-112 sequence taken by Biology majors instead of the CHEM 113-114 sequence taken by Biochemistry and Chemistry majors. Thus, the

proposed CMB Track differs significantly from the existing B. S. in Biochemistry degree program.

The existing Biology B. A. program does not have a heavy requirement in the biological sciences and provides extensive opportunities to take free elective courses. The existing Biochemistry B. S. has a strong emphasis on the physical sciences. We expect the proposed CMB Track to occupy a niche between these two existing programs.

The complete catalog description for the proposed CMB Track shows that it includes all six of the core Biology courses taken by Biology majors. Above and beyond the regular Biology core, it includes three Required Biology Courses (BIOL 109, BIOL 410 and BIOL 401) and 9 s. h. of Controlled Biology Electives, all in the cell/molecular area. In short, the proposed CMB Track includes core courses in the major as well as advanced courses in the area of specialization. Thus it meets the IUP-UWUCC definition of a new curricular track rather than that of a new degree.

The content of the Biochemistry, Biology and Chemistry courses required by the proposed CMB Track includes a substantial emphasis on theory and abstract concepts. Success in these courses demands that students understand this material and integrate it into their way of thinking. Furthermore, many of the courses include a component that stresses the history of the discipline and traces the development of its major intellectual currents. The lab courses, particularly the Biology core courses, emphasize the logical structure of the scientific method of inquiry. Thus, in spite of its emphasis on the preparation of students for employment, the proposed CMB Track is not a "technical" or "vocational" program.

Credit Requirements

Overview

The Biology Department introduced a new core curriculum for majors in 1996. The new core includes introductory courses (BIOL 111 Principles of Biology I and BIOL 112 Principles of Biology II), intermediate-level diversity courses in Botany (BIOL 210), Zoology (BIOL 220) and Microbiology (BIOL 250) and a junior/senior level writing-intensive course in Genetics (BIOL 263). The philosophy of the new core curriculum is to encourage hands-on experiential science. Thus, all of the core courses have a laboratory component that provides students with opportunities for semi-independent investigative work. Two of the core courses (Principles I and Genetics) have received financial support from the National Science Foundation. The six core courses of the new Biology curriculum provide a basic learning experience in all major areas of Biology and background sufficient to allow specialization in any area of emphasis within the biological sciences. Thus they are included as requirements in the proposed CMB Track.

The IUP Biochemistry Program is an interdisciplinary degree program administered jointly by Biology and Chemistry. The Biochemistry Program received SSHE approval in 1984 and graduated its first class in 1996. Biochemistry majors at IUP are essentially double majors in Biology and Chemistry, with a set of seven Biochemistry courses included in their curriculum as well. The key feature of the Biochemistry curriculum is a sequence of two lecture (BIOC 301, 302) and two lab (BIOC 311, 312) courses, taken in the junior year. The lecture courses provide students with conceptual and factual background in structural biochemistry, reaction mechanisms, enzyme kinetics, cell and organelle composition and intermediary metabolism. The laboratory courses acquaint students with the theory and operation of common instruments, with cell fractionation, separation techniques and modern analytical methods for biomolecules. The topics and methodology covered in these four courses is essential for a solid understanding of modern cell and molecular biology even though they are taught in a course with a Biochemistry number. Thus, the four Biochemistry courses are requirements for students in the proposed CMB Track.

As much as possible, the curriculum for the CMB Track relies upon existing courses in Biochemistry and Biology. We propose only two new courses, BIOL 109 Perspectives in Cell and Molecular Biology and BIOL 410 Topics in Molecular Biology, designed to expose students to content material not included in current Biology course offerings. Neither of these new courses have a laboratory component. Although primarily intended to serve the needs of students in the CMB Track, these new courses will be open to all students who meet the prerequisites. For the most part, the proposed CMB Track represents a new way of packaging existing courses rather than a *de novo* program.

Since its main purpose is to prepare students for employment or for graduate studies in cell and molecular laboratories, the proposed CMB Track has a strong laboratory component. It includes a total of thirteen Biology, Biochemistry and Chemistry laboratories among its required courses, and students may choose additional labs from among the Controlled Biology Elective or Biology Elective courses. Six of the required laboratories come from the Biology core curriculum and teach basic biological techniques, the scientific method and the skills needed to work flexibly as a team member or as an independent problem-solver, in addition to more discipline-specific methodology. In the three upper-division courses Biochemistry Lab I, Biochemistry Lab II (BIOC 311, 312) and Laboratory Methods in Biology and Biotechnology (BIOL 401), CMB Track students will acquire the bulk of the laboratory training that will be immediately helpful in the workplace or in a graduate program. The strong laboratory component of the proposed CMB Track is consistent with the Biology Department's long-standing emphasis on hands-on learning through course-related laboratory experiences.

Required Majors Courses

In the proposed CMB Track curriculum, the total Biology course requirement is 42 s.h., as compared to the 30-38 s. h. required by existing degree programs. In the proposed

curriculum, required Biology courses are divided into three groups: Required Majors Courses, Controlled Biology Electives and Biology Electives.

Among the Required Majors Courses, the proposed CMB Track curriculum includes the six previously-described core courses currently required of all Biology majors. The core contains introductory and diversity courses as well as a writing-intensive course to meet the IUP-LS requirement for one (W) course in the major.

In addition to the core courses there are three other Required Majors Courses in the CMB Track curriculum. We briefly describe these courses below. Two of these (BIOL 109 and BIOL 410) are new courses with full proposals attached to this document and the third (BIOL 401) is an existing course.

The first of the new courses, BIOL 109 Perspectives in Cell and Molecular Biology is designed to introduce students to the scope of cell and molecular biology and to career opportunities in the field. This course will also acquaint students with the use of disciplinary literature, including electronic resources. Students will take this course during their first year in the program and so it will also be used to help instill a sense of professionalism and community among each new cohort as well as to provide motivation to individual students. Based on their catalog descriptions, similar courses at IUP include FDNT, 110, LIBR 151, NURS 280 and RESP101.

The second new course, BIOL 410 Topics in Molecular Biology, is designed to cover advanced and up-to-date material. Topics will naturally vary somewhat from year to year, depending upon advances in the field, but will include human gene therapy, genetic engineering, stem cell genetics, cancer biology and molecular developmental biology among others. Integrating many ideas and coming near the end of a four-year program, this course will serve as a capstone to the CMB experience.

Building upon the basics provided by the four courses of the Biochemistry sequence, the advanced laboratory course BIOL 401 teaches the applied techniques and the instrumentation used most commonly in the modern molecular laboratory. The course provides in-depth coverage of techniques used in analyses of the structure and function of proteins and nucleic acids (DNA and RNA) as well as the production and sequencing of recombinant DNAs. These skills are highly useful in the workplace and thus this course will provide CMB students with a key laboratory experience.

Controlled Biology Electives

The proposed CMB Track curriculum includes 9 s.h. of Controlled Biology Electives. To satisfy this requirement students may choose from among a group of existing courses whose content is primarily in cell and molecular biology.

Biology Electives

The proposed CMB Track curriculum also includes a requirement for 6 additional s.h. of Biology Electives to be chosen from a list of field biology, organismal biology, evolutionary biology and ecology courses. The purpose of this requirement is to ensure breadth within the major as well as background in some of the areas of biology now being affected by molecular technology.

Biochemistry Sequence

The existing B. A. in Biology program requires a one-semester non-majors course in Biochemistry without a lab (CHEM 351) The CMB Track substitutes two semesters of Biochemistry Lecture (BIOC 301 and 302) and two accompanying Biochemistry Labs (BIOC 311, 312), the same sequence taken by Biochemistry majors at IUP.

Chemistry Sequence

The content of the introductory and organic Chemistry courses is needed in its own right for a complete understanding of the structure and function of biological systems. Moreover, these Chemistry courses are prerequisites for the required courses of the Biochemistry sequence.

Sequencing of the CMB Curriculum

The Biology Department schedules required courses semi-annually, annually or biennially, depending upon demand. Over the years this policy has proved adequate for existing programs since it gives each student at least one chance to take every specialized, upper-division course and several chances to schedule introductory and intermediate-level courses in a four-year program. Since the proposed CMB Track relies heavily on existing courses, this policy should prove adequate.

One possible sequence of courses for Biology majors electing the CMB Track is outlined below.

First Semester		Second semester	
BIOL 111 - Principles of Biology I	4	BIOL 112 - Principles of Biology II	4
CHEM 111 - Gen. Chem. I	4	BIOL 109 - Perspectives in Molecular Biology	1
HPED 143/FN143 - Hlth & Wellness ¹	3	CHEM 112 - Gen. Chem. II	4
Two courses each semester from the following (depending on availability)			
ENGL 101 – Coll. Writing <u>or</u>	4	ARHI 101 Intro. to Art <u>or</u>	
Soc. Science Elective ² <u>or</u>	3	MUHI 101 Intro. to Music <u>or</u>	
HIST 195 – The Modern Era	3	THTR 101 Intro. to Theater <u>or</u>	
		THTR 102 Intro. To Dance	3

TOTAL CREDITS FRESHMAN YEAR – 33

Third Semester		Fourth Semester	
BIOL 210 - Principles of Botany <u>or</u>		BIOL 210 - Principles of Botany <u>or</u>	
BIOL 220 - Principles of Zoology <u>or</u>		BIOL 220 - Principles of Zoology <u>or</u>	
BIOL 250 - Principles of Microbiology	3	BIOL 250 - Principles of Microbiology	3
CHEM 231 - Organic Chem I	4	BIOL ____ - Biology or Controlled Biology Elective ⁵	3
MATH 121 – Calc I	4	CHEM 232 - Organic Chem II	4
(Nat & Soc. Sci.) ³		ENGL 202 – Research Writing	3
____ - Foreign Language or LS Elective	3-4	____ - Foreign Language ⁴ or Free Elective	3

Fifth Semester		Sixth Semester	
BIOL 210 - Principles of Botany <u>or</u>		BIOL 263 – Genetics (W)	3
BIOL 220 - Principles of Zoology <u>or</u>		BIOL ___ - Biology or Controlled	
BIOL 250 - Principles of		Biology Elective	3
Microbiology	3		
BIOL ___ - Biology or Controlled		BIOC 302 – Biochemistry II	3
Biology Elective	3	BIOC 312 - Biochemistry Lab II	1
BIOC 301 - Biochemistry I	3	___ - Free Elective	3
BIOC 311 - Biochemistry Lab I	1	___ - LS Elective	3
___ - Free Elective	3		
___ - Hum: Phil/Rel.St.	3		
Seventh Semester		Eighth Semester	
BIOL 401 - Laboratory Methods in		BIOL XXX – Molecular Biology	3
Biology and		BIOL ___ - Biology or Controlled	
Biotechnology	3	Biology Elective	3
BIOL ___ - Biology or Controlled	3	___ - Synthesis	3
Biology Elective	3	___ - Free Elective or	
		LS Elective	3-6
___ - Hum: Literature	3		
___ - Free Elective or			
LS Elective	3-6		

¹ MLSC 101 and 102 (World and Am. Mil. Hist.) may be substituted for the Health & Wellness Course

² One of these should be a non-Western culture course

³ Your summer testing program will determine whether or not you should take MATH 110 (El. Functions) prior to Calculus I. MATH 110 will count as a free elective.

⁴ Two courses beyond placement or intermediate level. Spanish 201; French 201, 202, 203 (6 hrs.); German 251, 252. Intermediate-level Foreign Language may be included in Liberal Studies elective. Introductory-level Foreign Language courses are counted as free electives.

⁵ The following courses are not acceptable toward the Biology major: BIOL 150, 153, 155, 232, 241, 265, 311, 321, 322.

Restrictions

Provided they meet the appropriate prerequisites, students from other departments and programs may enroll in courses of the CMB Track.

Part III Implementation

1. Effect on students already in the existing program

We expect that the introduction of the proposed CMB Track will have minimal negative impact on students already in the existing Biology programs because the CMB Track will not divert significant resources away from existing programs. The CMB Track will provide all students in the Biology Department with a more intellectually diverse learning community, opportunities to enroll in new and revised courses and an additional degree option, should they choose it.

2. Effect on teaching loads

We expect the CMB Track to have minimal impact on teaching loads for two reasons. First, the CMB Track relies upon existing courses whenever possible. Teaching load for these courses is already factored into the Departmental schedule and should not have to be reallocated. Rearranging the Department's teaching schedule to accommodate the two new courses of the CMB Track (one of which is a one-credit course) should not be problematic. Second, we expect an initial enrollment of only about ten students and this number can be merged into the existent student population without strain. If the CMB Track proves to be highly successful, with rapidly increasing enrollments, we would then have to consider reallocating teaching load, using regular Department mechanisms for dealing with enrollment Change.

3. Adequacy of other resources

Space: Existing laboratory space in the Biology Department and in the Biochemistry Program will be adequate for the proposed CMB Track.

Equipment: Equipment currently on hand will be adequate for the proposed track. We may have to replace and/or upgrade equipment more frequently than usual if a large number of students enroll in the program.

Supplies: Since no new lab courses are proposed, current supply budgets are adequate for the CMB track. We may need to address additional funding for supplies should enrollments go up.

Travel Funds: not applicable

Library: Library resources are currently inadequate for the proposed program. We expect to supplement library resources with internet materials and with our personal journal collections.

4. Effect on number of students enrolled

Since we plan to use the CMB Track as a recruiting tool, we expect overall enrollment in the Department to increase after the track is implemented. Based on conversations with students and on experience with the implementation of the Biochemistry Program, we expect an initial enrollment of 10-12 students with a gradual increase to be 25-30 students within a four-year period.

Part IV. Course Proposals

1. BIOL 109 Perspectives in Cell and Molecular Biology (attached)
2. BIOL 410 Topics in Molecular Biology (attached)

Part V. Letters of Support

Letters from the IUP Biochemistry Program, the Chair of the IUP Department of Chemistry and from the University of Pittsburgh are attached.

**Revision of Catalog Description of B.A. in Biology for Cell/Molecular Track
October 15, 2001**

Present Descriptions:

The program leading to a B.S. in Biology is designed to provide maximum depth in the sciences and mathematics with less opportunity for free electives. Students who plan to attend graduate school or professional schools, such as those in human or veterinary medicine, most often choose this program of studies.

Further, the B.S. in Biology automatically qualifies a student for a minor in chemistry and thus represents more than adequate preparation for employment opportunities that require expertise in both biology and chemistry.

The program leading to the B.A. in Biology is designed to allow greater opportunity for free electives. This freedom could be used to pursue interests in areas outside of biology, allowing for a more broadly based Liberal Arts education. Alternatively, the B.A. degree student would have the flexibility to pursue in depth (to minor in or perhaps even to double major in) another discipline. A Biology major combined with other sciences such as Biochemistry, Computer Science, Chemistry, Physics, Geoscience, Mathematics, or Psychology, or disciplines such as Art, English, Business, or a foreign language can make attractive packages for the student and for potential future employers.

Revised Descriptions: (~~Deletions crossed-out.~~ Additions in Bold)

The program leading to a B.S. in Biology is designed to provide maximum depth in the sciences and mathematics with less opportunity for free electives. Students who plan to attend ~~graduate school or~~ professional schools, such as those in human or veterinary medicine, most often choose this program of studies **and it provides a strong preparation for graduate school.**

Further, the B.S. in Biology automatically qualifies a student for a minor in chemistry and thus represents more than adequate preparation for employment opportunities that require expertise in both biology and chemistry.

The program leading to the B.A. in Biology is designed to allow greater opportunity for free electives. This freedom could be used to pursue interests in areas outside of biology, allowing for a more broadly based Liberal Arts education.

Alternatively, the B.A. degree student would have the flexibility to pursue in depth (to minor in or perhaps even to double major in) another discipline ~~A Biology major combined with another science~~ such as Biochemistry, Computer Science, Chemistry, Physics, Geoscience, Mathematics, or Psychology. **Like the B.S., the B.A. provides good preparation for graduate school. Finally, when combined with disciplines** such as Art, English, Business, or a foreign language, a B.A. in Biology can make an attractive package for the student and for **a wide variety of potential future employers.**

Revised Descriptions – Clean Copy

The program leading to a B.S. in Biology is designed to provide maximum depth in the sciences and mathematics with less opportunity for free electives. Students who plan to attend professional schools, such as those in human or veterinary medicine, most often choose this program of studies and it provides a strong preparation for graduate school.

Further, the B.S. in Biology automatically qualifies a student for a minor in chemistry and thus represents more than adequate preparation for employment opportunities that require expertise in both biology and chemistry.

The program leading to the B.A. in Biology is designed to allow greater opportunity for free electives. This freedom could be used to pursue interests in areas outside of biology, allowing for a more broadly based Liberal Arts education.

Alternatively, the B.A. degree student would have the flexibility to pursue in depth (to minor in or perhaps even to double major in) another discipline such as Biochemistry, Computer Science, Chemistry, Physics, Geoscience, Mathematics, or Psychology. Like the B.S., the B.A. provides good preparation for graduate school. Finally, when combined with disciplines such as Art, English, Business, or a foreign language, a B.A. in Biology can make an attractive package for the student and for a wide variety of potential employers.