

Fiscal Unit/Academic Org Introductory Biology - D0326
Administering College/Academic Group Biological Sciences
Co-administering College/Academic Group Biological Sciences
 Arts And Sciences
Semester Conversion Designation Re-envisioned with significant changes to program goals and/or curricular requirements (e.g., degree/major name changes, changes in program goals, changes in core requirements, structural changes to tracks/options/courses)
Current Program/Plan Name Biology
Proposed Program/Plan Name Biology
Program/Plan Code Abbreviation BIOLOGY-BS
Current Degree Title Bachelor of Science

Credit Hour Explanation

Program credit hour requirements		A) Number of credit hours in current program (Quarter credit hours)	B) Calculated result for 2/3rds of current (Semester credit hours)	C) Number of credit hours required for proposed program (Semester credit hours)	D) Change in credit hours
Total minimum credit hours required for completion of program		45	30.0	32	2.0
Required credit hours offered by the unit	Minimum	10	6.7	4	2.7
	Maximum	10	6.7	4	2.7
Required credit hours offered outside of the unit	Minimum	35	23.3	28	4.7
	Maximum	35	23.3	28	4.7
Required prerequisite credit hours not included above	Minimum	62	41.3	50	8.7
	Maximum	64	42.7	50	7.3

Explain any change in credit hours if the difference is more than 4 semester credit hours between the values listed in columns B and C for any row in the above table

No new requirements are added to the semester program. The differences in units in required prerequisites result from biology going to 4 units per offering (x2), with physics going to 5 units per offering (for a total of 10 in two semesters v. 15 in three quarters), and with the units for chemistry remaining the same. We do not know what chemistry's offerings will be.

Program Learning Goals

Note: these are required for all undergraduate degree programs and majors now, and will be required for all graduate and professional degree programs in 2012. Nonetheless, all programs are encouraged to complete these now.

Program Learning Goals

- Goal #1: Explain major biological concepts and discuss how these are connected with various areas of the biological and physical sciences.
 - 1.1 Describe the hierarchical relationship between structure and function at all levels: molecular, cellular, and organismic.
 - 1.2 Diagram, explain, and contrast the major cellular processes in Archaea, bacteria, and eukaryotes.
 - 1.3 Differentiate types of biological macromolecules and compare their contributions to cellular structure and function.
 - 1.4 Apply the principles of genetics and describe the flow of genetic information.
 - 1.5 Explain changes in organisms through time by applying the principles of evolutionary biology.
 - 1.6 Demonstrate how relationships among living things are understood through taxonomy and phylogenetic analysis.
 - 1.7 Describe ecological relationships between organisms and their environment.
- Goal #2: Demonstrate problem solving, analytical, and communication skills that will provide the foundation for lifelong learning and career development.
 - 2.1 Apply the scientific process, including designing and conducting experiments and testing hypotheses.
 - 2.2 Use laboratory equipment, employ safe laboratory practices, and adapt tools such as laboratory notebooks and spreadsheets to organize and analyze data associated with scientific processes.
 - 2.3 Retrieve information from the life sciences literature; read, understand, and critically review scientific papers.
 - 2.4 Prepare oral and written reports following a recognized scientific format.
 - 2.5 Develop an awareness of the careers and professions that rely on knowledge of biological sciences.
- Goal #3: Value biology as an integral part of society and everyday life.
 - 3.1 Integrate biological knowledge in discussions of society and everyday life

Assessment

Assessment plan includes student learning goals, how those goals are evaluated, and how the information collected is used to improve student learning. An assessment plan is required for undergraduate majors and degrees. Graduate and professional degree programs are encouraged to complete this now, but will not be required to do so until 2012.

Is this a degree program (undergraduate, graduate, or professional) or major proposal? Yes

Does the degree program or major have an assessment plan on file with the university Office of Academic Affairs? Yes

Summarize how the program's current quarter-based assessment practices will be modified, if necessary, to fit the semester calendar.
No modification will be necessary.

Program Specializations/Sub-Plans

If you do not specify a program specialization/sub-plan it will be assumed you are submitting this program for all program specializations/sub-plans.

Program Specialization/Sub-Plan Name	Pre-Health Professions (Existing)
Program Specialization/Sub-Plan Goals	<ul style="list-style-type: none"> • This specialization provides a broad preparation in the biological sciences and ensures that graduates are prepared to enter doctoral programs at most professional school.
Program Specialization/Sub-Plan Name	Life Sciences Education (Existing)
Program Specialization/Sub-Plan Goals	<ul style="list-style-type: none"> • This specialization provides a broad exposure to biological sciences and coincides with the recommended coursework for students entering Ohio State's Masters in Education Program in science and technology.
Program Specialization/Sub-Plan Name	Forensic Biology (Existing)

Program Specialization/Sub-Plan Goals

- This specialization provides a diverse preparation in biological sciences with special attention to genetics, molecular biology, and human biology.

Pre-Major

Does this Program have a Pre-Major? No

Attachments

- semester conversion directors letter.pages.pdf
(Letter from Program-offering Unit. Owner: Stetson,David Leete)
- ProgRationale_TransitionPol_BiologyBS.pdf: includes transition
(Program Rationale Statement. Owner: Stetson,David Leete)
- 11BiologyReq_Old&New.pdf
(List of Semester Courses. Owner: Stetson,David Leete)
- BioBSBingo_Sem.pdf
(Semester Advising Sheet(s). Owner: Stetson,David Leete)
- BioBSBABingo_Quart.pdf
(Quarter Advising Sheet(s). Owner: Stetson,David Leete)
- 15BiologyBS curriculum map.pdf
(Curricular Map(s). Owner: Stetson,David Leete)

Comments

Workflow Information

Status	User(s)	Date/Time	Step
Submitted	Stetson,David Leete	04/25/2011 04:47 PM	Submitted for Approval
Pending Approval	Stetson,David Leete Misicka,Matthew Alan	04/25/2011 04:47 PM	Unit Approval



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April 25, 2011

Assoc. Dean Dave Andereck
Natural and Mathematical Sciences

Dear Dean Andereck:

The Center for Life Sciences Education (CLSE) is pleased to present materials supporting our plans for converting our undergraduate degree programs from quarters to semesters.

The CLSE offers two degree programs:

BS in Biology

BA in Biology

In addition, we are proposing a new undergraduate minor in biology.

The biology major (BS and BA) were reviewed in 2007. The 2007 review sought student feedback and involved faculty input from the Columbus and regional campuses. This semester conversion proposal is based on that review, with the additional changes noted in the program rationale. The changes we propose and the addition of the new biology minor are in response to:

- Student feedback obtained in the course of outcomes assessment
- Advisor feedback solicited during regular meetings as well as one meeting called just to discuss the biology major
- Biology 401 and 402 faculty feedback
- Recent reports that have proposed major changes in the way we structure courses and curricula in biology

As you know, Dr. Stetson and I are the only tenure-track faculty associated with the CLSE, with our tenure residing in Biochemistry and EEOB, respectively. As such, we do not have a faculty to whom we can turn for a vote on the proposed conversion. We are submitting the attached plans to the faculty members who reviewed and proposed revisions to the biology in 2007.

CB will insert outcome of that review – here

I recommend approval of the attached semester conversion plans.

Regards,

Caroline Breitenberger
Director, Center for Life Sciences Education

Dave Stetson
Associate Director, CLSE

Program Rationale (Biology BS).

The biology major was last reviewed and extensively revised in 2007. The key features of the revised biology major, an Integrated Biology core followed by discrete specialization areas and student-selected electives, have been retained in the major as we transition to semesters. The changes in the re-envisioned BS program under semesters include added biology-specific training in mathematics, a reduction in the length of the Integrated Biology course, and a small increase in the total number of hours required for the major.

Added Math prerequisite. In the report "Vision and Change in Undergraduate Biology Education: A Call to Action," the American Association for the Advancement of Science and the National Science Foundation call for "a certain level of quantitative competency... students should also have experience with modeling, simulation, and computational and systems-level approaches to biological discovery and analysis." In "A New Biology for the 21st Century," scientists convened by the National Research Council discuss the revolutionary changes that are sweeping through biological research. This panel provided specific recommendations for preparing future scientists studying complex biological systems. Among their recommendations is that "priority be given to the development of the information technologies and sciences that will be critical to the success of the New Biology." Specifically, they call for "genuinely interdisciplinary undergraduate courses and curricula" and "highly developed quantitative skills." Finally, the Howard Hughes Medical Institute and the American Association of Medical Colleges have issued a report, "Scientific Foundations for Future Physicians" which lists the competencies they expect medical students to acquire through their undergraduate training. The competencies listed (with a few minor additions) would provide a solid foundation for any future life scientist, not just premedical students.

Vision and Change report: <http://visionandchange.org/files/2011/03/VC-Brochure-V6-3.pdf>

A New Biology for the 21st Century: http://www.nap.edu/catalog.php?record_id=12764

Scientific Foundations for Future Physicians: http://www.hhmi.org/grants/pdf/08-209_AAMC-HHMI_report.pdf

In response to the reports mentioned above, suggesting the need for more quantitative skills in undergraduate biology training, as well as our own assessment results suggesting a need for more training in mathematical and statistical reasoning, we have added an additional mathematics prerequisite to the Biology BS. We will allow students to choose between two courses: Math 1157, "Mathematical Modeling for the Biological Sciences," or Statistics 2480, "Statistics for the Life Sciences" to satisfy this prerequisite. Math 1157 was developed by Tony Nance and others in the Department of Mathematics using the HHMI/AAMC competencies as a scaffolding for the course content and design. Both of these interdisciplinary courses focus on applications of mathematics (or statistics) to a broad spectrum of problems in the life sciences, making them very attractive to biology majors. We will continue our assessment of student quantitative reasoning skills and we will track students through their undergraduate curriculum to determine whether adding the extra mathematics prerequisite increases their higher level quantitative skills.

Reduction in length of Integrated Biology course. The Integrated Biology core courses in the biology major have been offered as a 2-course sequence (Biology 401 and 402) ever since the revised major was approved. Student assessment data indicate that students in this sequence feel that two courses are too much – they think they "get it" after the first course in the series. Faculty input and some assessment data suggest that a single quarter course is not enough, that students are just beginning to understand the interconnectedness between mathematics, chemistry, physics, and the overarching concepts in biology that are the focus of this sequence. A one-semester course might provide the happy middle. We

will continue to monitor student attitudes and student learning outcomes to track the success of this slight reduction in the Integrated Biology core of the biology major.

The apparent reduction of credit hours is necessary because of the difference in credit hour definitions under quarters and semesters. In actuality, the semester course, Biology 3401 will be equivalent to Biology 401 plus half of Biology 402. Under quarters, Biology 401 and 402 were offered as two 5 credit courses because of the extensive out-of-class work that is required. Given the hours spent in class, the semester course meets the definition of a 4-unit course, and will be offered as such

Increase in number of hours required for the major. Biology majors are expected to acquire a breadth of experience in different areas of the life sciences (partly through the Integrated Biology core course and partly through their selection of elective courses), as well as depth in one particular area (through the specialization). In reviewing student course selections under the current Biology BS, it is clear that students who have exceeded the current 45 credit minimum often add experiences and breadth that are not evident in students who just reach the 45 hour minimum. To encourage this broader experience, we have added two more semester units to the minimum hours required for the major. The additional coursework would come exclusively from departments outside the Center for Life Sciences Education, where the biology major is housed.

Rationale for change in credit hours (Biology BS).

The number of credit hours offered outside the unit and required for the Biology major increased by 4.7 units. The 4.7 increase is the sum of the reduction of credit hours (2.7 units) in the Integrated Biology core courses and the increase in units required for the degree (an increase of 2 units compared with the calculations based on the quarter program). The reduction in courses offered by the unit has to be offset by an increase in courses taken outside the unit.

The number of credit hours in prerequisite courses (offered outside the unit) increased by 7.3-8.7 units. This increase is due in large part to the requirement for an additional 5-unit Math or Statistics course (Mathematical Modeling for the Biological Sciences or Statistics for Life Sciences). This additional requirement is justified in the Program Rationale. The next largest contribution to the increase in prerequisite hours comes from the organic chemistry lecture and lab. Under quarters, biology majors had the option to take just two of the three quarters, but one semester of organic chemistry is really too little for the BS in Biology, thus they are now required to take 2 full semesters. (Most of our BS students probably did take the third quarter of organic chemistry, because it is required for most graduate and professional schools.)

Transition Policy for the Biology BS semester conversion.

As indicated in the letter from the Director of the Center for Life Sciences Education, steps will be taken to ensure that the transition to semesters does not disrupt the academic progress of students who began their undergraduate studies under quarters. Special consideration will be given to appropriate and timely advising to ensure that Biology students can work with their advisor to develop efficient transition plans. In addition, the CLSE is developing a web site for biology major advising which will address semester conversion issues, notify students when bridge courses will be offered, and address the most frequent "what course should I take next?" questions.

Potential transition issues. The obvious concerns that need to be addressed in the transition from quarter to semesters are:

- Prerequisite course sequences that span the quarter-to-semester transition

- Changes in prerequisites (for BS students specifically: the added math prerequisite)
- Reduction in the Biology major core from a 2-course sequence to a single semester course
- An increase in total hours required for the degree (32 semester hours instead of 45 quarter hours)
- A need for increased access to advising resources by students as they develop individualized transition plans

There are likely to be relatively few transition issues related to the specialization areas, since many of the specializations rely on single courses that are being directly converted to semester versions. For any transition concerns that do arise in the specializations, we will depend on units outside CLSE to develop appropriate transition solutions, including bridge courses. The flexibility of the biology major allows for appropriate substitutions even under normal circumstances; biology advisors will continue to evaluate student plans individually and identify and recommend appropriate substitutions when deemed necessary to ensure a student's progress to degree.

Prerequisite course sequences. Chemistry and Physics 3-quarter sequences are transitioning to 2-semester sequences. We will rely on those departments to establish transition plans and offer appropriate bridge courses to those students who might be affected.

Changes in prerequisites. The new Math 1157 or Stat 2480 requirement will not be enforced for students with credit for Math 151 taken at Ohio State. Students who have taken Math 151 under quarters but not Math 152 will be offered the choice of taking Math 1152 to complete the Math prerequisites, or Math 1156 (or the appropriate bridge courses) and the new required Math 1157 / Stat 2480 course. Students who have completed both Math 151 and Math 152 under quarters will be considered to have fulfilled the Math prerequisite and will be exempted from the Math 1157 / Stat 2480 requirement. Biology majors who have not taken Math 151 or 152 before the switch to semesters will be required to take Math 1156 and 1157 (or Stat 2480).

Reduction in biology core. For students who have taken Biology 401 but not 402 under quarters, a 1-unit bridge course is being developed that will be required of those students and provide an experience comparable to the one-semester Biology 3401.

Hours required for the degree. We will evaluate the hours in the major on a case-by-case basis. For a student who started under quarters and has the equivalent of at least 30 semester units in the Biology major when he/she applies for graduation, advisors may use their discretion in deciding whether the student needs to reach the full 32 semester units. The 32 unit minimum will be enforced for students who started the Biology major under semesters.

Biology major advising. Currently there are about 2000 students majoring in Biology, nearly a third of whom are Honors students. Biology majors are advised in the CLSE by 1 full-time staff advisor, one staff advisor who also coordinates the Biological Sciences Scholars program, and 4 faculty advisors, most of whom focus on Honors student advising. A new staff advisor has been requested to help with the increased advising demand during the transition to semesters.

Biology Major

	Courses required under quarters	Hours	Courses required under semesters	Units
Required supportive courses (do not count towards hours in the major)				
Bachelor of Science				
Introductory Biology	Biology 113 & 114, or 115H & 116H	10	Biology 1113 & 1114	8
Mathematics	Math 151 & 152 or 161	10	Math 1156 or 1161.01	5
Math/Stat for Biological Sciences	<i>not previously required</i>		Math 1157 or Stat 2480	5
General Chemistry	Chem 121, 122, & 123	15	Chem 1210 & 1220	10
Organic Chemistry	Chem 251 & 252	8	Chem 2510 & 2520	8
Organic Chemistry Lab	Chem 245 & 246, or 254 & 255	4 or 6	Chem 2540 & 2550	4
Physics	Physics 111-113, or 131-133	15	Physics 1200 & 1201, or 1250 & 1251	10
Total Prereqs for BS:		62 - 64		50
Bachelor of Arts				
Introductory Biology	Biology 113 & 114, or 115H & 116H	10	Bio 1113 & 1114	8
Mathematics	Math 150 & 151	10	Math 1150	5
General Chemistry	Chem 121-123	15	Chem 1210 & 1220	10
Organic Chemistry	Chem 251 & 252	8	Chem 2310	4
Organic Chemistry Lab	Chem 245 & 246, or 254 & 255	4 or 6	<i>will no longer be required</i>	0
Physics	Physics 112-113	15	Physics 1200 or 1250	5
Total Prereqs for BA:		62 - 64		32
Courses in the major				
Core Course				
Integrated Biology	Biology 401 and 402	10	Biology 3401	4
Specializations				
Education in Life Sciences				
Required Courses				
Biochemistry	Biochem 511 or 613 & 614	5 or 8	Biochem 4511 or 5613 & 5614	4 or 6
General Genetics	MolGen 500 or 605, 606	5 or 6	MolGen 4500 or 5606	3 or 4
Evolution	EEOB 400	5	EEOB 3310	4
Microbiology	Micro 509 or 520 & 521	5 or 10	Micro 4090 or 4100	4 or 5
Plant Biology	PCMB 300	5	MolGen 3300	3
Additional Coursework (any 2)				
General Entomology	Entomol 500	5	Entomology 3000	3
Introduction to Ornithology	EEOB 322	5	EEOB 2220	2
Diversity and Systematics	EEOB 405.01	5	EEOB 3320	3
Ichthyology	EEOB 621	5	EEOB 5430 or 5930	1.5 or 3
Vertebrate Biology	Not listed	0	EEOB 4210	2 or 4
Mammalogy	EEOB 625	5	EEOB 4220	2 or 4
Invertebrates	Not offered	0	EEOB 4230	1 or 2
DNA Fingerprinting Workshop in CPS	MolGen 591	2	MolGen 4591S	1
Forensic Biology				
Recommended Additional Prerequisite				
Intro Physical Anthropology	Anthro 200	5	Anthro 2200	4
Required Courses				
Biochemistry	Biochem 511 or 613 & 614	5 or 8	Biochem 4511 or 5613 & 5614	4 or 6
Genetics	MolGen 500 or 605 & 606	5 or 6	MolGen 4500 or 5606	3 or 4
Additional Coursework (any 3)				
	Anthropology 603.01	5	Anthropology 5607	3
Biological Anthropology of the Human Skeleton	Anthropology 603.02	5	Anthropology 5608	3
	Anthropology 603.03	5	Anthropology 5609	3
	Anthropology 603.04	5	Anthropology 5610	3
Forensic Anthropology	Anthropology 640.04	5	Anthropology 5644	3
Biochemistry	Biochem 615	4	Biochem 5615	3
Molecular Lab	MolGen 601	5	MolGen 5601	4
Cellular Biology	MolGen 607	3	MolGen 5607	3
Molecular Biology	MolGen 701	3	MolGen 6701	4
Microbiology	Micro 509 or 520 & 521	5 or 10	Micro 4090 or 4100	4 or 5
DNA Fingerprinting	MolGen 591	2	MolGen 4591S	1
Pre-Health Professions				
Recommended Additional Prerequisite				
Organic Chemistry	Chem 253	4		0
Required Course(s)				
Genetics	MolGen 500 or 605 & 606	5 or 6	MolGen 4500 or 5606	3 or 4
Additional Coursework (any 4)				
Biochemistry	Biochem 511 or 613 & 614	5 or 8	Biochem 4511 or 5613 & 5614	4 or 6
Evolution	EEOB 400	5	EEOB 3310	4
Microbiology	Micro 509 or 520 & 521	5 or 10	Micro 4090 or 4100	4 or 5
Cellular Biology	EEOB 415	4	EEOB 3510 or MolGen 5607	3
Vertebrate Histology	EEOB 630	5	EEOB 3520	1.5
Human Anatomy	Anat 200	6	Anat 2199 or 200, or EEOB 2510	3
Comparative Anatomy	EEOB 512	2	EEOB 4510	3
Physiology	PhysioCB 311 & 312 or 601 & 602 or EEOB 410	10	PhysioCB 311 & 312, or 601 & 602, or EEOB 2520, or 4520	3
Elective Courses				
Core, specialization, and elective courses must total 45 credit hours, and must include three laboratory courses. At least 35 of the 45 hours must be courses in Biochemistry, Biology, EEOB, Microbiology, or Molecular Genetics			Core, specialization, and elective courses must total 32 semester units, and must include three laboratory courses. At least 25 of the 32 semester units must be courses in Biochemistry, Biology, EEOB, Microbiology, or Molecular Genetics	
Minimum total hours/units in major				
		45		
Honors versions of courses may be substituted in all cases; no more than 5 hours of S/U credit can count toward the major			32	
			Honors versions of courses may be substituted in all cases; no more than 3 units of S/U credit can count toward the major	

Biology Major Program
Bachelor of Science
Pre-Health Professions

Name _____
Semester of Graduation _____

Required Supporting Courses

<p>Biology (2 courses)</p> <p>Biology 1113</p> <p>Biology 1114</p> <p style="text-align: right;">Substitution</p> <hr/> <p>Waived</p>	<p>Chemistry (2 courses)</p> <p>Chemistry 1210 or 1610 or 1910H</p> <p>Chemistry 1220 or 1620 or 1920H</p> <p style="text-align: right;">Substitution</p> <hr/> <p>Waived</p>
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<p>Mathematics (2 courses)</p> <p>Math 1156</p> <p>Math 1157 or Stat 2480</p> <p style="text-align: right;">Substitution</p> <hr/> <p>Waived</p>	<p>Organic Chemistry (2 lectures, 2 labs)</p> <p>Chemistry 2510 or 2610 or 2910H</p> <p>Chemistry 2520 or 2620 or 2920H</p> <p>Chemistry 2540 or 2940H</p> <p>Chemistry 2550 or 2950H</p> <p style="text-align: right;">Substitution</p> <hr/> <p>Waived</p>
<p>Physics (2 courses)</p> <p>Physics 1200 or 1250</p> <p>Physics 1201 or 1251</p> <p style="text-align: right;">Substitution</p> <hr/> <p>Waived</p>	

Core Course

Biology 3401

Pre-Health Professions Specialization

<p>Required</p> <p>MolGen 4500 or 5606</p>	<p>Additional Coursework (any 4)</p> <p>Biochem 4511, or 5613 and 5614</p> <p>EEOB 3310</p> <p>Micro 4090 or 4100</p> <p>EEOB 3510 or MolGen 5607</p> <p>EEOB 3520</p> <p>Anatomy 2199 or 200, or EEOB 2510</p> <p>EEOB 4510</p> <p>PhysioCB 311 and 312, or 601 and 602, or EEOB 2520 or 4520</p>
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Electives

Core, specialization, and elective courses must total 32 semester units, and must include three laboratory courses. Honors versions of courses substitute freely. *Note: At least 25 of the 32 semester units must be courses in Biochemistry, Biology, EEOB, Microbiology, or Molecular Genetics, and all courses in the major must be approved by a Biology advisor.

Advisor (Printed) _____

Advisor (Signature) _____

Date _____

Biology Major Program
Bachelor of Science
Forensic Biology

Name _____
Semester of Graduation _____

Required Supporting Courses

<p>Biology (2 courses)</p> <p style="padding-left: 20px;">Biology 1113 Biology 1114</p> <hr style="width: 50%; margin-left: 0;"/> <p style="text-align: right; margin-right: 20px;">Substitution</p> <p>Waived</p>	<p>Chemistry (2 courses)</p> <p style="padding-left: 20px;">Chemistry 1210 or 1610 or 1910H Chemistry 1220 or 1620 or 1920H</p> <hr style="width: 50%; margin-left: 0;"/> <p style="text-align: right; margin-right: 20px;">Substitution</p> <p>Waived</p>
<p>Mathematics (2 courses)</p> <p style="padding-left: 20px;">Math 1156 Math 1157 or Stat 2480</p> <hr style="width: 50%; margin-left: 0;"/> <p style="text-align: right; margin-right: 20px;">Substitution</p> <p>Waived</p>	<p>Organic Chemistry (2 lectures, 2 labs)</p> <p style="padding-left: 20px;">Chemistry 2510 or 2610 or 2910H Chemistry 2520 or 2620 or 2920H Chemistry 2540 or 2940H Chemistry 2550 or 2950H</p> <hr style="width: 50%; margin-left: 0;"/> <p style="text-align: right; margin-right: 20px;">Substitution</p> <p>Waived</p>
<p>Physics (2 courses)</p> <p style="padding-left: 20px;">Physics 1200 or 1250 Physics 1201 or 1251</p> <hr style="width: 50%; margin-left: 0;"/> <p style="text-align: right; margin-right: 20px;">Substitution</p> <p>Waived</p>	<p>Additional Prerequisite (1 course)</p> <p style="padding-left: 20px;">Anthropology 2200</p>

Core Course

Biology 3401

Forensic Biology Specialization

<p>Required</p> <p style="padding-left: 20px;">MolGen 4500 or 5606 Biochem 4511, or 5613 and 5614</p>	<p>Additional Coursework (any 3)</p> <p style="padding-left: 20px;">Anthropology 5607 Anthropology 5608 Anthropology 5609 Anthropology 5610 Anthropology 5644 Biochem 5615 MolGen 5601 MolGen 5607 MolGen 6701 Micro 4090 or 4100 MolGen 4591S or equivalent</p>
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* See note below - at most 7 units from Anthropology may be counted towards the Biology major

Electives

Core, specialization, and elective courses must total 32 semester units, and must include three laboratory courses. Honors versions of courses substitute freely. *Note: At least 25 of the 32 semester units must be courses in Biochemistry, Biology, EEOB, Microbiology, or Molecular Genetics, and all courses in the major must be approved by a Biology advisor.

Advisor (Printed) _____

Advisor (Signature) _____

Date _____

Biology Major Program
Bachelor of Science
Education in Life Sciences

Name _____
Semester of Graduation _____

Required Supporting Courses

<p>Biology (2 courses)</p> <p>Biology 1113</p> <p>Biology 1114</p> <p style="text-align: right;">Substitution</p> <hr/> <p>Waived</p>	<p>Chemistry (2 courses)</p> <p>Chemistry 1210 or 1610 or 1910H</p> <p>Chemistry 1220 or 1620 or 1920H</p> <p style="text-align: right;">Substitution</p> <hr/> <p>Waived</p>
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<p>Mathematics (2 courses)</p> <p>Math 1156</p> <p>Math 1157 or Stat 2480</p> <p style="text-align: right;">Substitution</p> <hr/> <p>Waived</p>	<p>Organic Chemistry (2 lectures, 2 labs)</p> <p>Chemistry 2510 or 2610 or 2910H</p> <p>Chemistry 2520 or 2620 or 2920H</p> <p>Chemistry 2540 or 2940H</p> <p>Chemistry 2550 or 2950H</p> <p style="text-align: right;">Substitution</p> <hr/> <p>Waived</p>
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<p>Physics (2 courses)</p> <p>Physics 1200 or 1250</p> <p>Physics 1201 or 1251</p> <p style="text-align: right;">Substitution</p> <hr/> <p>Waived</p>	
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Core Course

Biology 3401

Education in Life Sciences Specialization

<p>Required (5 courses)</p> <p>Biochem 4511, or 5613 and 5614</p> <p>MolGen 4500 or 5606</p> <p>EEOB 3310</p> <p>Micro 4090 or 4100</p> <p>MolGen 3300</p>	<p>Additional Coursework (any 2)</p> <p>EEOB 2220</p> <p>EEOB 3320 (<i>strongly recommended</i>)</p> <p>EEOB 4210</p> <p>EEOB 4220</p> <p>EEOB 4230</p> <p>EEOB 5430 or 5930</p> <p>Entomology 3000</p> <p>MolGen 4591S or equiv.</p>
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Electives

Core, specialization, and elective courses must total 32 semester units, and must include three laboratory courses. Honors versions of courses substitute freely. *Note: At least 25 of the 32 semester units must be courses in Biochemistry, Biology, EEOB, Microbiology, or Molecular Genetics, and all courses in the major must be approved by a Biology advisor.

Advisor (Printed) _____

Advisor (Signature) _____

Date _____

**BIOLOGY MAJOR PROGRAM APPROVAL FORM
PRE-HEALTH SPECIALIZATION**

Name _____ BS _____ BA _____

Quarter to Graduate _____

REQUIRED PREREQUISITES

BIOLOGY - ONE SEQUENCE

- ___ Biology 113 & 114
- ___ Biology H115 & H116
- ___ Substitution _____
- ___ Waived

CHEMISTRY - TAKE ALL 3 COURSES

- ___ Chem 121 & 122 & 123
- ___ Chem H201 & H202 & H203
- ___ Substitution _____
- ___ Waived

MATHEMATICS

- ___ Math 152
- ___ Substitution _____
- ___ Waived

ADVANCED CHEMISTRY - COMPLETE 4 COURSES

- ___ Chem 251
- ___ Chem 252
- ___ Chem 245 OR 254
- ___ Chem 246 OR 255
- ___ Substitution _____
- ___ Waived

PHYSICS - COMPLETE 1 SEQUENCE

- ___ Physics 111 & 112 & 113
- ___ Physics 131 & 132 & 133
- ___ Substitution _____
- ___ Waived

Suggested prerequisite (not required).

- ___ Chem 253

CORE COURSES:

INTEGRATED BIOLOGY

- | | Hours | |
|-----|-----------------|-------|
| ___ | Biology 401 and | _____ |
| ___ | Biology 402 | |
| ___ | Substitution | _____ |
| ___ | Waived | |

SOPHOMORE COLLOQUIUM

- | | Hours | |
|-----|-----------------|-------|
| ___ | Biology 320 or | _____ |
| ___ | Biochem H200 or | |
| ___ | Mol Gen H220 | |
| ___ | Substitution | _____ |
| ___ | Waived | |

PRE-HEALTH PROFESSIONS SPECIALIZATION

REQUIRED:

- ___ Mol Gen 500 or
- ___ Mol Gen 605 and 606.

ELECTIVES: Complete at least 4 courses from the following list:

- | | | | |
|-----|------------------------------|-----|--------------------------------|
| ___ | Biochem 511 or Biochem 613 | ___ | EEOB 630 |
| ___ | Biochem 614 | ___ | EEOB 410 or Anatomy 200 |
| ___ | EEOB 400 | ___ | Physiocrb 311 or Physiocrb 601 |
| ___ | Micrbiol 509 or Micrbiol 520 | ___ | Physiocrb 312 or Physiocrb 602 |
| ___ | Micrbiol 521 | | |
| ___ | EEOB 415 | | |

A minimum of 45 hours or upper division (300 level or above, not including 591 or 597) biological sciences are required for the major, with at least 35 hrs from the following areas:

- Biology
- Biochemistry
- EEOB
- Microbiology
- Molecular Genetics
- Plant Biology

Independent Study, e.g. Biol 699 or H783, can be included to a maximum of 5 hours, and may be counted towards the laboratory/data analysis component.

Five courses in the major must have a laboratory or data analysis component (circle).

- ANATOMY 200
- BIOCHEM 521, 693, 699, 706, 708, 710, H783
- BIOLOGY 693, 699, H783
- CHEM 245, 246, 254, 255
- EEOB 322, 405.02, 413.03, 440, 470, 503.02, 505, 510, 512, 611, 620, 621, 622, 625, 626, 630, 647, 651, 652, 653, 655, 657, 661, 671, 672, 674, 693, 699, 713, 714.02, 720, 730, 741.02, H783
- ENTOMOL H444, 460, 462, 500, 611, 612, 621, 623, 631, 641, 650, 660, 661, 662, 670, 693, 699, H783
- MICRBIOL 509, 520, 521, 522, 524.02, 581, 610, 629 (AU90-WI08), 636.02, 655, 693, 699, 723.02, 750, H783
- MOL GEN H500, 601, 602, 650, 693, 699, H783
- PLNT BIO 300, 402, 604, 608.02, 643, 693, 699, H783
- Substitution _____
- Waived _____

Comments:

Major GPA _____

Total Major Hours _____

ADVISOR APPROVAL

FOR EXCEPTIONS FROM MAJOR:

Signature

CLSE Director or Assoc. Director

Date

Date

Last updated 4/1/2009

**BIOLOGY MAJOR PROGRAM APPROVAL FORM
FORENSIC BIOLOGY SPECIALIZATION**

Name _____ BS _____ BA _____
Quarter to Graduate _____

REQUIRED PREREQUISITES

BIOLOGY - ONE SEQUENCE

- ___ Biology 113 & 114
- ___ Biology H115 & H116
- ___ Substitution _____
- ___ Waived

CHEMISTRY - TAKE ALL 3 COURSES

- ___ Chem 121 & 122 & 123
- ___ Chem H201 & H202 & H203
- ___ Substitution _____
- ___ Waived

MATHEMATICS

- ___ Math 152
- ___ Substitution _____
- ___ Waived

ADVANCED CHEMISTRY - COMPLETE 4 COURSES

- ___ Chem 251
- ___ Chem 252
- ___ Chem 245 OR 254
- ___ Chem 246 OR 255
- ___ Substitution _____
- ___ Waived

PHYSICS - COMPLETE 1 SEQUENCE

- ___ Physics 111 & 112 & 113
- ___ Physics 131 & 132 & 133
- ___ Substitution _____
- ___ Waived

Suggested prerequisite (not required).
___ Anthrop 200

CORE COURSES:

INTEGRATED BIOLOGY

- | | | |
|-----|-----------------|-------|
| | Hours | _____ |
| ___ | Biology 401 and | |
| ___ | Biology 402 | |
| ___ | Substitution | _____ |
| ___ | Waived | |

SOPHOMORE COLLOQUIUM

- | | | |
|-----|-----------------|-------|
| | Hours | _____ |
| ___ | Biology 320 or | |
| ___ | Biochem H200 or | |
| ___ | Mol Gen H220 | |
| ___ | Substitution | _____ |
| ___ | Waived | |

FORENSIC BIOLOGY SPECIALIZATION

Required:

- ___ Biochem 511 or 613 & 614
- ___ Mol Gen 500, or 605 & 606

Electives: Complete at least three additional courses from the following list:

- | | | | |
|-----|--|-----|--------------------------------|
| ___ | Anthrop 603.01 or 603.02 or 603.03 or 603.04 | | |
| ___ | Anthrop 640.04 | ___ | Mol Gen 607 |
| ___ | Biochem 615 | ___ | Mol Gen 701 |
| ___ | Micrbiol 509 or 520 & 521 | ___ | Biochem 591 or Micrbiol 591 or |
| ___ | Mol Gen 601 | | Mol Gen 591 |

A minimum of 45 hours or upper division (300 level or above, not including 591 or 597) biological sciences are required for the major, with at least 35 hrs from the following areas:

- Biology
- Biochemistry
- EEOB
- Microbiology
- Molecular Genetics
- Plant Biology

Independent Study, e.g. Biol 699 or H783, can be included to a maximum of 5 hours, and may be counted towards the laboratory/data analysis component.

Five courses in the major must have a laboratory or data analysis component (circle).

- ANATOMY 200
- BIOCHEM 521, 693, 699, 706, 708, 710, H783
- BIOLOGY 693, 699, H783
- CHEM 245, 246, 254, 255
- EEOB 322, 405.02, 413.03, 440, 470, 503.02, 505, 510, 512, 611, 620, 621, 622, 625, 626, 630, 647, 651, 652, 653, 655, 657, 661, 671, 672, 674, 693, 699, 713, 714.02, 720, 730, 741.02, H783
- ENTOMOL H444, 460, 462, 500, 611, 612, 621, 623, 631, 641, 650, 660, 661, 662, 670, 693, 699, H783
- MICRBIOL 509, 520, 521, 522, 524.02, 581, 610, 629 (AU90-WI08), 636.02, 655, 693, 699, 723.02, 750, H783
- MOL GEN H500, 601, 602, 650, 693, 699, H783
- PLNT BIO 300, 402, 604, 608.02, 643, 693, 699, H783
- Substitution _____
- Waived _____

Comments:

Major GPA _____

Total Major Hours _____

ADVISOR APPROVAL

FOR EXCEPTIONS FROM MAJOR:

Signature

CLSE Director or Assoc. Director

Date

Date

**BIOLOGY MAJOR PROGRAM APPROVAL FORM
LIFE SCIENCES EDUCATION SPECIALIZATION**

Name _____ BS _____ BA _____

Quarter to Graduate _____

REQUIRED PREREQUISITES

BIOLOGY - ONE SEQUENCE

- Biology 113 & 114
- Biology H115 & H116
- Substitution _____
- Waived

CHEMISTRY - TAKE ALL 3 COURSES

- Chem 121 & 122 & 123
- Chem H201 & H202 & H203
- Substitution _____
- Waived

MATHEMATICS

- Math 152
- Substitution _____
- Waived

ADVANCED CHEMISTRY - COMPLETE 4 COURSES

- Chem 251
- Chem 252
- Chem 245 OR 254
- Chem 246 OR 255
- Substitution _____
- Waived

PHYSICS - COMPLETE 1 SEQUENCE

- Physics 111 & 112 & 113
- Physics 131 & 132 & 133
- Substitution _____
- Waived

CORE COURSES:

INTEGRATED BIOLOGY

- | | | |
|--------------------------|-----------------|-------|
| | Hours | _____ |
| <input type="checkbox"/> | Biology 401 and | |
| <input type="checkbox"/> | Biology 402 | |
| <input type="checkbox"/> | Substitution | _____ |
| <input type="checkbox"/> | Waived | |

SOPHOMORE COLLOQUIUM

- | | | |
|--------------------------|-----------------|-------|
| | Hours | _____ |
| <input type="checkbox"/> | Biology 320 or | |
| <input type="checkbox"/> | Biochem H200 or | |
| <input type="checkbox"/> | Mol Gen H220 | |
| <input type="checkbox"/> | Substitution | _____ |
| <input type="checkbox"/> | Waived | |

LIFE SCIENCES EDUCATION SPECIALIZATION

Required:

- | | | | |
|--------------------------|--------------|--------------------------|--------------|
| <input type="checkbox"/> | BIOCHEM 511 | <input type="checkbox"/> | MOL GEN 500 |
| <input type="checkbox"/> | EEOB 400 | <input type="checkbox"/> | PLNT BIO 300 |
| <input type="checkbox"/> | MICRBIOL 509 | | |

Electives: Complete at least two courses from the following list:

- | | | | |
|--------------------------|-------------|--------------------------|--------------|
| <input type="checkbox"/> | EEOB 322 | <input type="checkbox"/> | ENTOMOL 500 |
| <input type="checkbox"/> | EEOB 405.01 | <input type="checkbox"/> | BIOCHEM 591 |
| <input type="checkbox"/> | EEOB 621 | <input type="checkbox"/> | MICRBIOL 591 |
| <input type="checkbox"/> | EEOB 625 | <input type="checkbox"/> | MOL GEN 591 |

A minimum of 45 hours or upper division (300 level or above, not including 591 or 597) biological sciences are required for the major, with at least 35 hrs from the following areas:

- Biology
- Biochemistry
- EEOB
- Microbiology
- Molecular Genetics
- Plant Biology

Independent Study, e.g. Biol 699 or H783, can be included to a maximum of 5 hours, and may be counted towards the laboratory/data analysis component.

Five courses in the major must have a laboratory or data analysis component (circle).

- ANATOMY 200
- BIOCHEM 521, 693, 699, 706, 708, 710, H783
- BIOLOGY 693, 699, H783
- CHEM 245, 246, 254, 255
- EEOB 322, 405.02, 413.03, 440, 470, 503.02, 505, 510, 512, 611, 620, 621, 622, 625, 626, 630, 647, 651, 652, 653, 655, 657, 661, 671, 672, 674, 693, 699, 713, 714.02, 720, 730, 741.02, H783
- ENTOMOL H444, 460, 462, 500, 611, 612, 621, 623, 631, 641, 650, 660, 661, 662, 670, 693, 699, H783
- MICRBIOL 509, 520, 521, 522, 524.02, 581, 610, 629 (AU90-WI08), 636.02, 655, 693, 699, 723.02, 750, H783
- MOL GEN H500, 601, 602, 650, 693, 699, H783
- PLNT BIO 300, 402, 604, 608.02, 643, 693, 699, H783
- Substitution _____
- Waived _____

Comments:

Major GPA _____

Total Major Hours _____

ADVISOR APPROVAL

FOR EXCEPTIONS FROM MAJOR:

Signature

CLSE Director or Assoc. Director

Date

Date

Last updated 4/1/2009

S Course S cr hr Course Title Comments 1.1 1.2 1.3 1.4 1.5 1.6 1.7 2.1 2.2 2.3 2.4 2.5 3.1

Education in Life Sciences Specialization																
S Course	S cr hr	Course Title	Comments	1.1	1.2	1.3	1.4	1.5	1.6	1.7	2.1	2.2	2.3	2.4	2.5	3.1
Courses comprising specializations (offered outside the unit)																
Biochem 4511	4	General Biochemistry		***	**	***		**					**		**	**
MolGen 4500	3	General Genetics		***	**	***	***	**					**		**	**
EEOB 3000	4	Evolution		***	**	***	**	***	**	**			**		**	**
Micro 4090	4	Basic and Practical Microbiology		***	**	**	**	**	**	**	***	***	**	***	**	**
MolGen 3300	4	General Plant Biology		***	**	**	**	**	**	**	***	***	**	***	**	**
Additional coursework, including lab requirement	9			***	***	***	***	***	***	***	***	***	***	***	***	***
Forensic Biology Specialization																
Anthro 2200	4	Physical	Additional prerequisite				*	*	*	*	*	*	*	*	*	*
Biochem 4511	4	General Biochemistry		**	**	***		**				**	**	**	**	**
MolGen 4500	3	General Genetics		***	**	***	***	**	**	**	**	**	**	**	**	**
Additional coursework, including lab requirement	17			***	***	***	***	***	***	***	***	***	***	***	***	***
Pre-Health Professions Specialization																
MolGen 4500	3	General Genetics		***	**	***	***	**	**	**	**	**	**	**	**	**
Additional coursework, including lab requirement	25			***	***	***	***	***	***	***	***	***	***	***	***	***

* beginning, ** intermediate, *** advanced