

The University Senate of Michigan Technological University

Proposal 20-20

(Voting Units: Full Senate)

Proposal for a Bachelor of Science Degree Program in Human Biology

(Human Biology, SHB, College of Sciences and Arts)

Developed by the Department of Biological Sciences (SBL)

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Latest Revision – 11/13/2019

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I. General description and characteristics of the program

A. Mission:

To provide students with a broad understanding of human biology from the chemical through organismal level, and how humans impact and interact with their surrounding environment. It is our mission to prepare Human Biology graduates to be resilient critical thinkers that are holistically prepared for hands-on contributions in educational, industry, research, and healthcare settings.

B. Goals:

The undergraduate degree in Human Biology (SHB) at Michigan Tech is grounded in these motivations and programmatic goals:

- Provide disciplinary knowledge and education for undergraduate students in human biology, focusing on health, molecular biology, and evolution/ecology (the three major foci within the Department of Biological Sciences).
- Provide students hands-on experiences through laboratory courses and internships in research, teaching, and/or industry.
- Prepare students to create the future of human health while considering proactive preventative approaches, clinical treatments, environmental interactions, and social factors.
- Recruit highly competitive incoming undergraduate students who may have otherwise overlooked Michigan Tech due to a lack of a stand-alone major in human health.
- Prepare graduates from this program to be highly competitive for professional medical programs, traditional graduate education, or employment in positions including research, teaching, healthcare, and industry.

C.Objectives: This proposal will implement an undergraduate Bachelor of Science Degree in Human Biology (hereafter referred to as SHB) that attracts and retains students interested in human biology who seek a deeper understanding of fundamental sciences and the scientific method. It will provide a broad-based curriculum that will allow students to obtain the knowledge and develop the skills necessary to study, understand, and apply human biology concepts in the real world. Within each of the eight Michigan Tech Undergraduate Student Learning Goals, students in the program will demonstrate success as illustrated in the Degree Areas of Focus in the table below:

Undergraduate Student Learning Goals	Degree Areas of Focus: Where and how SHB students will demonstrate USLG Mastery in their coursework
<p>1: Disciplinary Knowledge - Students demonstrate a depth of knowledge in one area/ discipline, as well as a breadth of knowledge that (1) enables adaptability and flexibility as knowledge grows and changes, and (2) recognizes linkages/complementarity to other areas/disciplines.</p>	<ul style="list-style-type: none"> • Students will develop knowledge of biology principles, including evolution, structure and function, information flow, exchange, and storage, pathways and transformations of energy and matter, and systems. • Students will investigate the biological processes of the human body at the chemical, molecular, and cellular levels.

	<ul style="list-style-type: none"> • Students will explore advanced concepts in human physiology at the cellular, tissue, systems, and organismal levels. • Students will examine the impacts and implications of human activity at the ecosystem and societal levels. • Students will apply their knowledge during applied experience in research, industry, or education. <p><i>Major requirements; Upper Level Biology Elective Requirements; Ecology & Evolutionary Biology Elective requirements; Advanced Human Physiology Elective Requirements; Human/Environment Interactions Elective Requirements; Professional Development requirements</i></p>
<p>2: Knowledge of the Physical and Natural World - Students demonstrate knowledge of the physical and natural world. This is accomplished by studying science and mathematics.</p>	<ul style="list-style-type: none"> • Students will develop knowledge of biology principles, including evolution, structure and function, information flow, exchange, and storage, pathways and transformations of energy and matter, and systems. • Students will investigate the biological processes of the human body at the chemical, molecular, and cellular levels. • Students will explore advanced concepts in human physiology at the cellular, tissue, systems, and organismal levels. <p><i>Major requirements; Upper Level Biology Elective Requirements; Ecology & Evolutionary Biology Elective requirements; Advanced Human Physiology Elective Requirements</i></p>
<p>3: Global Literacy - A globally literate student will demonstrate the ability to understand and analyze issues on multiple scales and from diverse perspectives, acknowledging interconnectivity and complexity. As globally literate, students should 1) become informed and open-minded people who are attentive to diversity across the spectrum of differences, 2) seek to understand how their actions affect the human and natural world on multiple scales, and 3) address the world's most pressing and enduring issues while considering context, complexity, and interconnectivity.</p>	<ul style="list-style-type: none"> • Students will examine the impacts and implications of human activity at the ecosystem and societal levels. <p><i>Ecology & Evolutionary Biology Elective requirements; Human/Environment Interactions Elective Requirements</i></p>
<p>4: Critical and Creative Thinking - Students will be able to think critically and creatively, as demonstrated by their broad, adaptable and versatile use of reasoning, logic, and evidence, to access and evaluate information and solve complex problems both independently and in groups.</p>	<ul style="list-style-type: none"> • Students will investigate the biological processes of the human body at the chemical, molecular, and cellular levels. • Students will explore advanced concepts in human physiology at the cellular, tissue, systems, and organismal levels. • Students will examine the impacts and implications of human activity at the ecosystem and societal levels. • Students will apply their knowledge during applied experience in research, industry, or education. • Students will employ the scientific method to address questions, formulate hypotheses, design basic studies, and synthesize and report results. <p><i>Major requirements; Upper Level Biology Elective Requirements; Ecology & Evolutionary Biology Elective requirements; Advanced Human Physiology Elective Requirements; Human/Environment</i></p>

	<i>Interactions Elective Requirements; Professional Development requirements</i>
5: Communication - Students will be able to communicate effectively, orally, in writing and in new media, to a wide variety of audiences.	<ul style="list-style-type: none"> • Students will apply their knowledge during applied experience in research, industry, or education. • Students will communicate effectively (orally and in writing) about issues related to human biology and science, in general. <i>Professional Development requirements</i>
6: Information Literacy - Students will be able to analyze the need for, strategically access, critically evaluate, and use information effectively, ethically, and legally.	<ul style="list-style-type: none"> • Students will examine the impacts and implications of human activity at the ecosystem and societal levels. • Students will apply their knowledge during applied capstone experience in research, industry, or education. <i>Major requirements; Professional Development requirements</i>
7: Technology - Students will demonstrate knowledge of technology and its implications in society, and be able to design and/or use technology for creative activities or innovative solutions to problems.	<ul style="list-style-type: none"> • Students will examine the impacts and implications of human activity at the ecosystem and societal levels. • Students will apply their knowledge during applied experience in research, industry, or education. <i>Major requirements; Upper Level Biology Elective Requirements; Advanced Human Physiology Elective Requirements; Professional Development requirements</i>
8: Social Responsibility and Ethical Reasoning - Students will be able to identify and address conflicting ethical values and develop a sense of responsibility for the broad impacts of individual actions and social institutions. They will understand their role as citizens and their responsibility to work with others in promoting quality of life and sustainable society.	<ul style="list-style-type: none"> • Students will examine the impacts and implications of human activity at the ecosystem and societal levels. <i>Ecology & Evolutionary Biology Elective requirements; Human/Environment Interactions Elective Requirements</i>

D. Administration:

The SHB degree will be overseen by the Chair of Biological Sciences and the Curriculum Committee. The curriculum committee meets every 2-4 weeks during the academic year to discuss degree requirements, course offerings, university assessment, and to resolve any issues with degree administration within the Department of Biological Sciences. Degree program assessment is ongoing following university policies, and external review will be conducted every 6 years. SBL was externally reviewed in 2018, suggesting the SHB BS will undergo its initial formal review in 2024.

Students matriculated into the SHB BS will be advised by the SBL advisor. The advisor, with support from the Curriculum Committee and other SBL staff, will also coordinate advertising and outreach to new potential students, communicate successes and programmatic highlights, and track existing students during their education and after graduation, as they do for the other degree programs in Biological Sciences. Students within the Human Biology program can also

elect to get advising assistance from the Pre-Health Professions coordinator, who is administratively located in the College of Sciences and Arts and physically located in the Department of Biological Sciences.

II. Rationale

According to biologydictionary.net, Human Biology is “the branch of biology that focuses on human beings and human populations; it encompasses all aspects of the human organism including genetics, ecology, anatomy and physiology, anthropology, and nutrition, among others.” The Department of Biological Sciences at Michigan Tech has a rich teaching and research history within all of these sub-disciplines that are part of undergraduate education in Human Biology. Development of a degree program in Human Biology will help to realize one of our long-term departmental goals to foster interdisciplinary research, education, and training partnerships in human health-related fields, and increase visibility as Michigan Tech continues to promote and invest in human health education and research.

The Department of Biological Sciences has offered a pre-professional concentration option (SBL5) within our Biological Sciences BS for decades. This concentration option has historically had the highest enrollment in the department, but was surpassed in the last year by enrollment in our Medical Laboratory Science (MLS) program, which offers strong post-graduate employment and graduate school options. Although SBL5 remains the largest concentration in SBL and continues to attract students interested in medical professions, it is overly structured towards medical and professional school requirements and exclusive of students who are interested in human biology but may not desire to follow this employment pathway. The success of the MLS program along with national trends for undergraduate, graduate, and professional programs have prompted us to consider how we can build upon Michigan Tech’s continued investment in human health education and research to improve the quality and enrollment of our pre-professional concentration option.

Restructuring the existing SBL5 program into a stand-alone SHB BS will attract students who are broadly interested in Human Biology, including those who want to pursue medical professions as well as those who wish to pursue careers in industry, education, or graduate degrees in the Biological Sciences, health or other areas. This program will better prepare students for continued education or employment with a focus on real-world experiences and skills through a series of capstone options. Finally, this new program will offer increased course options and flexibility within the degree to improve retention, time to graduation, transferability for incoming students, and student satisfaction, all of which were key areas for improvement identified in our 2018 external department review. It is important to note that this program was structured such that pre-professional students can easily complete the degree requirements as well as the coursework required for admission to their desired professional program, while also increasing flexibility for all students. This will allow students to tailor their undergraduate degree to their graduate and professional goals.

III. Related Programs in the Region

Related programs in the Upper Great-Lakes region include:

- Northern Michigan University – Biology Department, B.S. Degree in Physiology Concentration. <https://www.nmu.edu/biology/programs>
- University of Wisconsin, Green Bay – Interdisciplinary Program, B.S. Degree in Human Biology. <https://www.uwgb.edu/human-biology/>
- Michigan State University – College of Natural Science Interdepartmental Degree Program, B.S. Degree in Human Biology. <https://natsci.msu.edu/about/departments-and-programs/human-biology-program/>
- University of Michigan-Flint – Biology Department, B.A. Degree in Human Biology. <https://www.umflint.edu/biology/human-biology-program-ba>
- Marquette University – Department of Biological Sciences, B.S. Degree in Physiological Sciences. <https://www.marquette.edu/explore/major-physiological-sciences.php>

IV. Projected Enrollment

The Biological Sciences department's enrollment in the SBL5 concentration has varied over the past ten years but typically has about 80 to 100 students. We expect that the improved visibility of our excellence in human health education and research will draw additional enrollment to this new program. Finally, the curriculum changes from the existing SBL5 option will result in a vastly improved retention, time to graduation, and satisfaction with the degree.

V. Scheduling Plans (Extension, Evening, Regular)

Regular

VI. Curriculum Design

To earn a BS degree in Human Biology, students will be required to take 58 credits of named requirements in foundational biology, chemistry, mathematics, and physics coursework. An additional 18-23 credits of directed elective requirements, 12 credits of General Education, and 12 credits of HASS courses, as well as 11-17 credits of free electives, bring the total credits required for the degree to 120.

1. Major Requirements: Human Biology Core (26 Credits)

- BL 1580: First-Year Experience in Biological Sciences (1)
- BL 1010: General Biology I (4)
- BL 1020: General Biology II (4)
- BL 2010/2011: Anatomy & Physiology I & Lab (3/1)
- BL 2020/2021: Anatomy & Physiology II & Lab (3/1)
- BL 2200: Genetics (3)
- BL 2210: Genetics Laboratory (1)
- BL 2940: Human Nutrition (3)
- BL 3782: Writing Practicum in Biological Sciences (2)

2. Major Requirement: Core Chemistry, Mathematics, and Physics (32 credits)

CH 1150/1151: University Chemistry I & Lab (3/1)
CH 1160/1161: University Chemistry II & Lab (3/1)
CH 2410/2411: Organic Chemistry I & Lab (3/1)
CH 2420/2421: Organic Chemistry II & Lab (3/1)
MA 1135: Calculus for Life Sciences (4)
MA 3715: Biostatistics (4)
PH 1110/1111: College Physics I & Lab (3/1)
PH 1210/1200: College Physics II & Physics by Inquiry II (3/1)

3. Upper-Level Biology Electives (Choose at least 9 Credits)

BL 3012: Essential Cell Biology (3)
BL 3020: Biochemistry I (3)
BL 3210: General Microbiology (4)
BL 3220: Medical Mycology & Virology (3)
BL 3230: Medical Bacteriology (4)
BL 3300 - Introduction to Genomics (3)
BL 3640: General Immunology (3)
BL 3820: Biochemical Lab Techniques (2)
BL 4020: Biochemistry II (3)
BL 4030: Molecular Biology (3)
BL 4038: Epigenetics (3)
BL 4070: Environmental Toxicology (3)
BL 4200: Microbial Physiology (3)
BL 4370: Advanced Cell Biology (3)
BL 4550: Clinical Chemistry (3)
BL 4720/4730: Hematology & Hemostasis/Immunohematology Techniques (3/1)
BL 4752: Cancer Biology (3)
BL 4800: Molecular Diagnostics (5)
BL 4840: Molecular Biology Techniques (3)

4. Ecology & Evolutionary Biology Elective (Choose 1 course: 3-4 Credits)

BL 3190: Evolution (3)
BL 3400: Ecology (4)
BL 4400: Developmental Biology (3) – course proposal and number pending
SS 3250: Biological Anthropology (3)

5. Advanced Physiology Elective (Choose 1 course: 3-4 Credits)

BL 3044: Advanced Human Physiology (3)
BL 4044: Human Pathophysiology (3)
BL 4380: Cardiopulmonary Physiology (3)
KIP 4100/4110: Exercise Physiology & Lab (3/1)
PSY 3060: Physiological Psychology (3)

6. Human/Environment Interactions (Choose 1 course: 3 Credits)

KIP 4740: Epidemiology (3)
SS 2100: Introduction to Cultural Anthropology (3)
SS 2300: Environment and Society (3)
SS 2400: Introduction to Human Geography (3)
SS 2700: Introduction to Sociology (3)

7. Capstone Requirement (Choose 1 of the following options; 3 Credits)

Research capstone:

BL 4000: Research in Biological Sciences (2) *or*
BL 4001: Honors Research in Biological Sciences (2) *or*
BL 4995: Research in Biochemistry (2)
BL 4530: Senior Research Capstone Experience (1)

Healthcare or Industry Internship Capstone:

BL 4999: Biological Sciences Internship (2)
BL 4530: Senior Research Capstone Experience (1)

Teaching Experience Capstone:

BL 3990: Biological Sciences Teaching Experience (1)
BL 4510: Senior Capstone Experience (2)

8. Core and HASS (24 Credits)

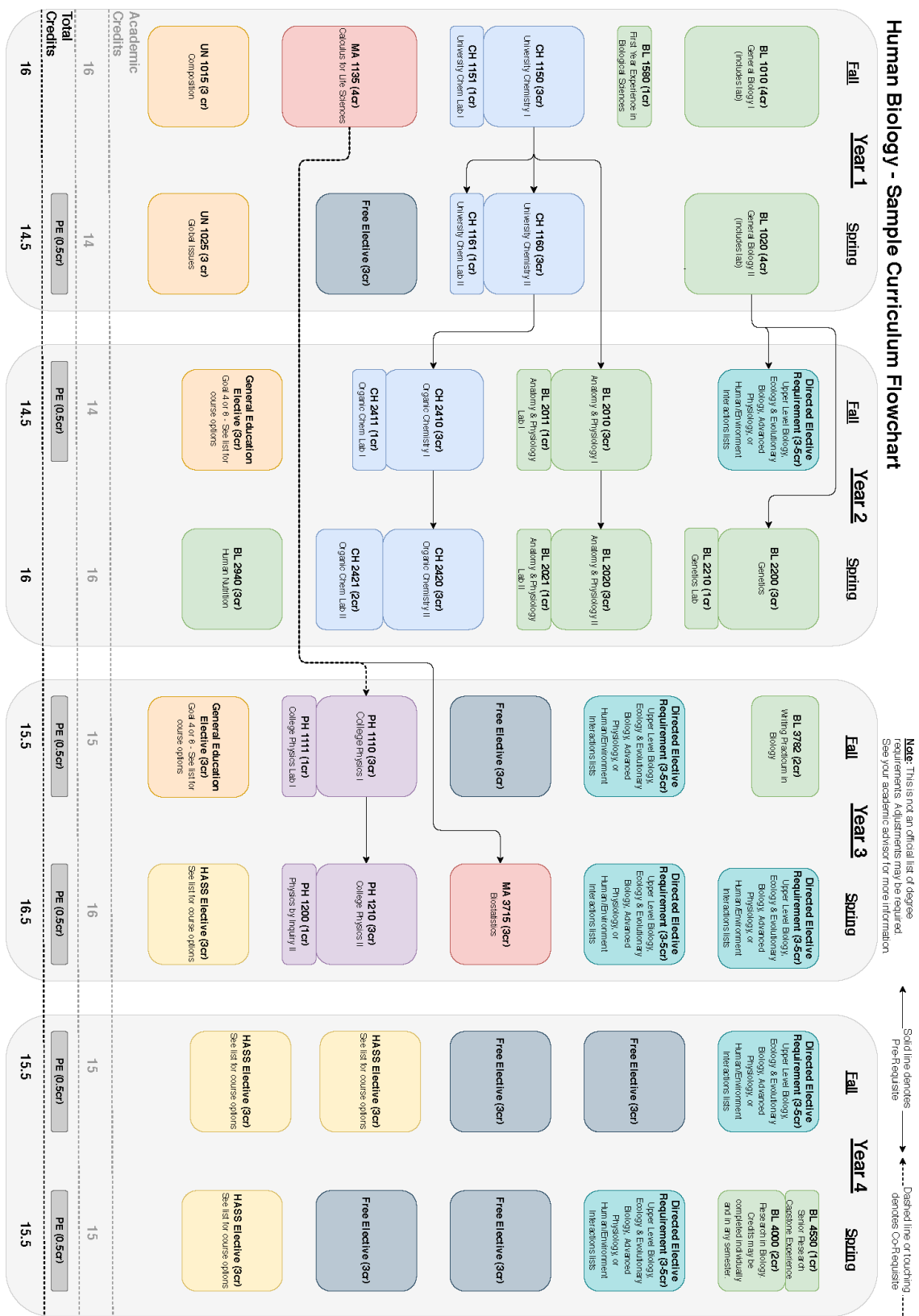
UN 1015 (3)
UN 1025 (or upper-level modern language course) (3)
Goal 4 elective (3)
Goal 8 elective (3)
HASS electives (12)

9. Free Electives (11-17 Credits)

VII. New Course Descriptions

No new courses will be required for this degree program.

VIII. Model Schedule



IX. Existing Learning Resources, Equipment, and Space

No new equipment, space, or other resources will be required for this degree program.

X. Program Administration, policies, regulations, and rules

The responsibility for the administration of this program will reside with the Department of Biological Sciences within the College of Sciences and Arts.

XI. Accreditation requirements

There are no accreditation requirements for this program.

XII. Planned implementation date

We are designing this degree program to be available in Fall 2020.

XIII. Program costs, years 1, 2, and 3

The implementation of a new Human Biology undergraduate degree program at Michigan Tech with its interdisciplinary educational plan will be fully consistent with the Michigan Tech's Strategic Plan (https://www.banweb.mtu.edu/pls/owa/strategic_plan2.p_display). The financial benefit of this program is that it will better attract and retain high-quality students.

Impact on Resources:

To address criteria as outlined in Senate Procedures 108.1.1 (IIIa,b), we are requesting no additional faculty lines or space to implement the Human Biology program. The Biological Sciences department will develop recruiting and advancement material for the Human Biology program, as well as provide information to university level recruiters. New scholarship opportunities (in addition to existing scholarships for SBL5 students) for the Human Biology program will be developed as part of this program and will be headed by the chair of the Department of Biological Sciences. There will be additional advising time and potential additional time for student meetings and prospective student visits if enrollment increases.

Appendix A: New Course Proposals

No new courses will be proposed for this degree program.

Appendix B: Financial Documentation

I. Relation to the University Strategic Plan

a. Relation of the program to the University's educational and research goals.

The proposed major fits with the Education portion of the strategic plan “Provide a distinctive and rigorous action-based learning experience grounded in science, engineering, technology, sustainability, business, and an understanding of the social and cultural contexts of our contemporary world.” Specifically, the proposed major is a science-based major with ecology and evolutionary biology at the core.

b. Consistency with the university's resource allocation criteria.

We are requesting no additional salary or resources to establish this degree, as described above in section XIII. Program costs, Years 1, 2, and 3.

II. Impact on University Enrollment

a. Projected number of students in the program.

We project an annual enrollment of ~40 new students per year in this program. This number is only modestly higher than the existing yearly enrollment of incoming SBL5 students, but we expect that retention and thus total program enrollment will be considerably stronger. As the program becomes established we expect yearly enrollment to improve as well.

b. Source of new students; in particular, will the students be drawn from existing programs, or will they be students who would otherwise not have come to Michigan Tech?

We expect that most of the students who choose this program would have traditionally chosen the biological sciences degree with a pre-professional concentration (SBL5). In conjunction with University-wide advances in graduate health program preparation, we also expect to draw students who would not have previously considered Michigan Tech.

c. What is the likely correlation between demand for the new program and existing enrollment patterns at Michigan Tech?

The combination of improved post-graduation educational and employment options is the single most important improvement that this degree offers over the existing SBL5 option. The decreasing enrollment and retention in SBL5 over the past ~10 years echoes nationwide patterns of undergraduates moving away from traditional pre-health bachelor's degree programs in favor of degrees that offer strong employment options without the necessity of additional graduate education. This program seeks to remedy these decreases by providing strongly applicable skill-sets in teaching, research, industry, and healthcare suitable for all students.

d. What is the current enrollment in the unit?

Current enrollment in Biological Sciences in 2019-2020 is 221 undergraduate and 44 graduate

students.

III. Impact on Resources Required by Department in Which the Program is housed. This would include, but not be limited to:

a. Faculty lines.

No new faculty lines are requested. The current student: faculty ratio in Biological Sciences is 11.52, suggesting we have capacity to grow our undergraduate enrollment and stay close to the university-wide ratio of 12:1.

b. Faculty and student labs, including ongoing maintenance.

No new faculty, labs, or maintenance are requested.

c. Advising.

Advising will be conducted by the Biological Sciences department advisor.

d. Assessment.

This program will be assessed as part of the ongoing University assessment program. All of the University learning goals will be addressed by one or more classes in the proposed program. Courses that are outside of the general education requirements will address disciplinary knowledge as well as other university learning goals. Assessment of this program will be conducted by the Department of Biological Sciences, alongside the existing degree programs in the department.

IV. Impact on Resources Required by other Units Within the University. This analysis would include, but not necessarily be limited to, the impacts on:

a. Other academic (e.g., Gen Ed) units with regard to faculty, labs and assessment. (NOTE: The current Student to Faculty ratio for the university as a whole is approximately 12:1 per Institutional Analysis.)

Because the most classes in the proposed major will be taught in Biological Sciences, we do not anticipate any significant impact of this program on other units. Any required classes in other academic units will be reviewed by those units to confirm that the capacity is available to serve the students in the new major.

b. Information Technology, the Library, central administration, and career planning with respect to the impact on the need for computing services, library resources, advising, record keeping, development of employer relations, etc.

Existing IT, library and central administration resources are sufficient to support the new major.

V. Assessment of the ability to obtain the necessary resources assuming requested funds are obtained

a. For high demand fields (e.g., business fields, etc.), will it be possible to fill allocated lines?

No lines are requested at the initiation of this degree program

VI. Past proposals. Has the department initiated any other new degree programs in the last five years? If so:

Biological Sciences has not initiated any new degree programs in the past five years. Concurrent with this proposal, the department is proposing a new BS in Ecology and Evolutionary Biology. The development of both of these proposals resulted from the ongoing process of assessment, improvement and refocusing of our Biology degree offerings, in part motivated by recommendations from our external department review in 2018.

VII. Departmental Budget contribution**a. What is the department's total general fund budget?**

For FY 2019-2020, the department's total general fund budget is \$2,004,463.80

b. How much tuition does the department generate? This information should be provided for both the credit hours taught by the department and the number of credit hours taken by the department's majors.

In FY 2017-2018, the Biology department generated \$4,302,539 in tuition for credit hours taught by the Biological Sciences department, and \$4,742,692 in tuition by the number of credit hours taken by Biological Sciences enrolled students.

Appendix C- Sample Degree Audit

Michigan Technological University
Registrar's Office

Academic Year 2020-21
Bachelor of Science in Human Biology
SHB

Student Name and ID Number

Estimated Graduation Date

Major Requirements: 58 Credits		
Course Number	Credits	Course Status Code M, R, P, WVD, SUB*
Biology Requirements (26 Credits)		
BL 1580	1	
BL 1010	4	
BL 1020	4	
BL 2010 and BL 2011	3	
BL 2020 and BL 2021	3	
BL 2200 and BL 2210	3	
BL 2940	3	
BL 3782	2	
Chemistry Requirements (17 Credits)		
CH 1150 and CH 1151	3	
CH 1160 and CH 1161	3	
CH 2410 and CH 2411	3	
CH 2420 and CH 2421	3	
Mathematics Requirements (7 Credits)		
MA 1135	4	
MA 3715	3	
Physics Requirements (8 Credits)		
PH 1110 and PH 1111	3	
PH 1210 and PH 1200	3	
Credit Subtotal:		

Elective Requirements: 18-25 Credits		
Course Number	Credits	Course Status Code M, R, P, WVD, SUB*
Biology Elective Requirements (9-14 Credits) <i>Choose at least 9 credits from the following:</i>		
BL 3012, 3020, 3210, 3230, 3300, 3640, 3820, 4020, 4030, 4038, 4070, 4200, 2370, 4550, 4720 & 4730, 4752, 4800, 4840		
Evolution Elective Requirement (3-4 Credits) <i>Choose 1 of the following:</i>		
BL 3190, BL 3400, BL 4400, SS 3250		
Advanced Physiology Requirement (3-4 Credits) <i>Choose 1 of the following courses or combinations:</i>		
BL 3044, 4044, 4380, KIP 4100 & 4110, PSY 3060		
Human/Environment Interactions Requirement (3 Credits) <i>Choose 1 of the following:</i>		
KIP 4740, SS 2100, 2300, 2400, 2700		
Credit Subtotal:		

Capstone Requirement: 3 Credits		
Course Number	Credits	Course Status Code M, R, P, WVD, SUB*
<i>Choose 1 of the following capstone options:</i>		
Research Capstone:		
BL 4000 or 4001 or 4995	2	
BL 4530	1	
Healthcare or Industry Internship Capstone:		
BL 4999	2	
BL 4530	1	
Teaching Experience Capstone:		
BL 3990	1	
BL 4510	2	
Credit Subtotal:		

SHBUG AY2020/21 1

General Education Requirements: 24 Credits		
Course Number	Credits	Course Status Code M, R, P, WVD, SUB*
<i>Courses used to complete General Education may not be used to complete other degree requirements.</i>		
Core (12 Credits)		
UN 1015	3	
UN 1025 or upper level modern language	3	
Critical and Creative Thinking	3	
Social Responsibility and Ethical Reasoning	3	
HASS (12 Credits)		
<ul style="list-style-type: none"> ✓ Students must complete 12 credits of HASS course work ✓ Six of the 12 credits must be at the 3000- or 4000- level* ✓ At least three credits each in the following: Communication/Comp, Humanities and Fine Arts, and Social and Behavioral Sciences. ✓ No more than three credits may come from the Restricted List 		
Communication/Composition	minimum 3	
Humanities and Fine Arts	minimum 3	
Social and Behavioral Sciences	minimum 3	
Course from any list above or Restricted List	0-3	

*an upper division language course in place of UN 1025 does not meet this requirement.

Co-Curricular Activities: 3 Credits		
Required for graduation, but not included in the GPA calculation or in the overall credits required for the degree.		

Free Electives: 10-17 credits		
Course Number	Credits	Course Status Code M, R, P, WVD, SUB*
Credit Subtotal:		

*M-Passed with valid grade, transfer, or Advance Placement credit; Registered in course; Plan to take in future, WVD-Waived course or credit (does not reduce total degree credits required), SUB-Petitioned as substitute course.

Advisor Use Only	
Total Credits Required	120
Total Credits Completed	
Total Credits Needed	

Student Signature _____ Date _____

Departmental Approval _____ Date _____

Appendix D- Complete List of Required Courses and Directed Electives**Course Descriptions for Major Requirements: Human Biology Core**

BL 1580 - First-Year Experience in Biological Sciences Introduction to fields and career opportunities in the biological sciences. Credits: 1.0 Lec-Rec-Lab: (0-1-0) Semesters Offered: Fall Restrictions: Must be enrolled in one of the following Major(s): Biological Sciences, Biochem & Molec Biology-Bio Sc, Bioinformatics; Must be enrolled in one of the following Class(es): Freshman, Sophomore

BL 1010 – General Biology I: Introduction to Organismal Biology, Ecology, and Evolution

A discussion of the principles of ecology and organismal biology, using the theme of physiological ecology and adaptations. This course will emphasize biodiversity, scientific method, experimental design and written and oral presentation of results. Credits: 4.0 Lec-Rec-Lab: (3-0-3) Semesters Offered: Fall

BL 1020- General Biology II: Introduction to Cellular and Molecular Biology

Discussion of the major principles by which life is organized. Topics include scientific methods, biological chemistry, cell structure and organization, multicellular organization, diversity of organisms, energetics and photosynthesis, cellular reproduction genetics, gene structure and expression, and recombinant DNA. Credits: 4.0 Lec-Rec-Lab: (3-0-3) Semesters Offered: Spring, Summer

BL 2010 - Anatomy & Physiology I

Comprehensive introductory course in vertebrate anatomy and physiology with emphasis on the human body. Interrelates structure with function in regard to maintaining homeostasis and normal functioning of the body. Covers the integument, skeletal system, muscles, the nervous system, and special senses. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Fall, Summer Pre-Requisite(s): CH 1000 or (CH 1150 and CH 1151)

BL 2011 - Anatomy & Physiology I Lab

The laboratory to accompany BL2010. Examines embryology, muscle and skeletal anatomy, and neuroanatomy. Explores the physiology of the nervous system, including vision and reflexes and muscle physiology. A student-designed lab project is used to teach experimental design. Credits: 1.0 Lec-Rec-Lab: (0-0-3) Semesters Offered: Fall, Summer Pre-Requisite(s): BL 2010(C)

BL 2020 - Anatomy & Physiology II

Continuation of BL2010. Covers the cardiovascular, respiratory, digestive, renal, and reproductive systems. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Spring, Summer Pre-Requisite(s): BL 2010

BL 2021 - Anatomy & Physiology II Lab

The laboratory to accompany BL2020. Examines the structure and function of the digestive, respiratory, cardiovascular, and renal systems. A student-designed lab project is used to teach experimental design. Credits: 1.0 Lec-Rec-Lab: (0-0-3) Semesters Offered: Spring, Summer Pre-Requisite(s): BL 2011 and BL 2020(C)

BL 2200 – Genetics

A study of classical and molecular genetics. Topics include one- and two-locus genetics, recombination, gene structure, regulation and function, quantitative and population genetics, and genetic engineering. Covers both prokaryotes and eukaryotes. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Spring, Summer Pre-Requisite(s): (BL 1020 or BL 1040 or BE 2400) and (BL 2100 or CH 4710)

BL 2210 - Genetics Laboratory A laboratory to complement BL2200. Covers applications of techniques used in genetics, including Mendelian analysis, tetrad analysis, karyotyping, DNA and protein electrophoresis, DNA and plasmid purification, transformation and restriction mapping, and PCR amplification of DNA. Credits: 1.0 Lec-Rec-Lab: (0-0-3) Semesters Offered: Spring Pre-Requisite(s): BL 2200(C)

BL 2940 - Human Nutrition Covers basic and applied chemistry and biology of human nutrition. Includes practical information on planning and adopting a healthy diet as well as maintaining acceptable weight. Emphasizes social, global, and environmental issues pertinent to use of the world food supply. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Spring, Summer Restrictions: May not be enrolled in one of the following Class(es): Freshman

BL 3782 - Writing Practicum in Biology Students will develop and improve their skill level in searching for scientific literature, incorporating that into scientific writing, evaluating and incorporating the work of others, and develop critique skills for review of scientific source material and basic statistical methods. Credits: 2.0 Lec-Rec-Lab: (0-2-0) Semesters Offered: Fall, Spring Restrictions: Must be enrolled in one of the following Major(s): Biological Sciences, Biochem & Molec Biology-Bio Sc, Bioinformatics; May not be enrolled in one of the following Class(es): Freshman

Course Descriptions for Major Requirement: Core Chemistry, Mathematics and Physics

CH 1150 - University Chemistry I Introduces the foundations of chemistry, including electronic structure of atoms and molecules, intermolecular forces, states of matter, chemical reactions, organic chemistry, chemical equilibria, kinetics, and acid-base chemistry. Includes laboratory component that emphasizes lecture components. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Fall, Spring, Summer Co-Requisite(s): CH 1151 Pre-Requisite(s): MA 1031(C) or MA 1032(C) or MA 1160(C) or MA 1161(C) or MA 1135(C) or ALEKS Math Placement ≥ 56 or CEEB Calculus AB ≥ 2 or CEEB Calculus BC ≥ 2 or CEEB Calculus AB Subscore ≥ 2

CH 1151 - University Chemistry Lab I Laboratory to accompany CH1150. Credits: 1.0 Lec-Rec-Lab: (0-0-3) Semesters Offered: Fall, Spring, Summer Co-Requisite(s): CH 1150 Pre-Requisite(s): MA 1031(C) or MA 1032(C) or MA 1160(C) or MA 1161(C) or MA 1135(C) or ALEKS Math Placement ≥ 56 or CEEB Calculus AB ≥ 2 or CEEB Calculus BC ≥ 2 or CEEB Calculus AB Subscore ≥ 2

CH 1160 - University Chemistry II A continuation of CH 1150. Introduces more complex concepts in chemistry, including kinetics, chemical equilibria, acid-base equilibria, thermodynamics, electrochemistry, and chemical analysis. Additional topics may include chemistry of the metals and non-metals, biochemical systems, and nuclear chemistry. Includes laboratory component that emphasizes lecture concepts. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Fall, Spring, Summer Co-Requisite(s): CH 1161 Pre-Requisite(s): CH 1112 or (CH 1150 and CH 1151)

CH 1161 - University Chemistry Laboratory II Laboratory to accompany CH1160. Credits: 1.0 Lec-Rec-Lab: (0-0-3) Semesters Offered: Fall, Spring, Summer Co-Requisite(s): CH 1160 Pre-Requisite(s): CH 1112 or (CH 1150 and CH 1151)

CH 2410 - Organic Chemistry I A study of the chemistry of carbon compounds. Review of hybrid orbitals, covalent bonding, and resonance. Introduction to nomenclature, stereochemistry, mass spectrometry and infrared spectroscopy, functional group chemistry based on reaction mechanisms, and multi-step synthesis. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Fall, Summer Pre-Requisite(s): CH 1122 or (CH 1160 and CH 1161)

CH 2411 - Organic Chemistry Lab I Laboratory to accompany CH2410. Credits: 1.0 Lec-Rec-Lab: (0-0-3) Semesters Offered: Fall, Summer Pre-Requisite(s): CH 2410(C) and CH 1122 or (CH 1160 and CH 1161)

CH 2420 - Organic Chemistry II Covers more functional group chemistry based on reaction mechanisms; more involved multi-step synthesis; introduction to nuclear magnetic resonance spectroscopy; introduction to carbohydrates, amino acids, proteins, nucleic acids; and topics of specialized interest. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Spring, Summer Pre-Requisite(s): CH 2410

CH 2421 - Organic Chemistry Lab II Laboratory to accompany CH2420. Credits: 2.0 Lec-Rec-Lab: (0-0-4) Semesters Offered: Spring, Summer Pre-Requisite(s): CH 2411 and CH 2420(C)

MA 1135 - Calculus for Life Sciences Topics include analytic geometry, limits, continuity of functions, transcendental functions, derivatives, integrals, and applications of the derivative in the fields of economics, biological sciences, and social sciences. Extensive use of graphing calculator. (See mathematical sciences department for recommended calculator). Credit applicable only to those curricula specifying this course. Credits: 4.0 Lec-Rec-Lab: (0-4-0), Semesters Offered: Fall, Spring, Summer Restrictions: May not be enrolled in one of the following College(s): College of Engineering Pre-Requisite(s): MA 1032 or MA 1031 or ALEKS Math Placement ≥ 70 or CEEB Calculus AB ≥ 2 or CEEB Calculus BC ≥ 2 or CEEB Calculus AB Subscore ≥ 2

MA 3715 – Biostatistics Introduction to the design and analysis of statistical studies in the health and life sciences. Topics include study design, descriptive and graphical methods, probability, inference on means, categorical data analysis, and linear regression. Not open to students with credit in MA2710, MA2720, or MA3710. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Spring Pre-Requisite(s): MA 1135 or MA 1160 or MA 1161

PH 1010- College Physics I An overview of basic principles of kinematics, dynamics, elasticity, fluids, heat, thermodynamics, mechanical waves, and interference and diffraction of mechanical waves. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Fall, Summer Restrictions: May not be enrolled in one of the following College(s): School of Technology, College of Engineering; May not be enrolled in one of the following Major(s): Physics, Applied Physics Co-Requisite(s): PH 1111 Pre-Requisite(s): MA 1031 or MA 1032 or MA 1135(C) or MA

1160(C) or MA 1161(C) or ALEKS Math Placement ≥ 56 or CEEB Calculus AB ≥ 2 or CEEB Calculus BC ≥ 2 or CEEB Calculus AB Subscore ≥ 2

PH 1111 - College Physics I Laboratory Experiments covering kinematics, forces, conservation of momentum and energy, waves, and thermodynamics are explored through guided construction. The course provides inquiry-based laboratory experiences for concepts explored in PH1110. Credits: 1.0 Lec-Rec-Lab: (0-0-2) Semesters Offered: Fall, Summer Restrictions: May not be enrolled in one of the following College(s): School of Technology, College of Engineering; May not be enrolled in one of the following Major(s): Physics, Applied Physics Co-Requisite(s): PH 1110

PH 1210 - College Physics II An overview of basic principles of static and dynamic electricity and magnetism, electromagnetic waves, reflection and refraction of light, interference and diffraction of light, special theory of relativity, wave theory of matter, particle theory of electromagnetic waves, theory of the atom, the nucleus, and elementary particles. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Spring, Summer Restrictions: May not be enrolled in one of the following College(s): School of Technology, College of Engineering; May not be enrolled in one of the following Major(s): Physics, Applied Physics Pre-Requisite(s): PH 1200(C) and (PH 1110 or PH 1100)

PH 1200 - Physics by Inquiry II Experiments covering Coulomb's law, electric and magnetic fields, circuits, induction, and geometric optics are explored through guided construction. The course emphasizes understanding physical concepts through inquiry and the scientific method. Credits: 1.0 Lec-Rec-Lab: (0-0-2) Semesters Offered: Fall, Spring, Summer Pre-Requisite(s): PH 1100 or PH 1111 or PH 1141 or PH 1161

Course Descriptions for Upper Level Biology Electives

BL 3012 - Essential Cell Biology This course will provide an understanding of cell structure and function with emphasis on eukaryotic cells. Topics include macromolecules, membranes, organelles, cytoskeleton, division, differentiation, cell-cell interactions, intracellular trafficking, protein sorting, cell signaling, and motility. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Spring Restrictions: May not be enrolled in one of the following Class(es): Freshman Pre-Requisite(s): BL 1020 or BL 1040 and BL 2100

BL 3020 – Biochemistry I Introductory overview to biochemistry. Topics include the biochemistry of amino acids, proteins, coenzymes, carbohydrates, nucleotides, nucleic acids, lipids, and water, as well as bioenergetics and photosynthesis. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Fall Pre-Requisite(s): (BL 1020 or BL 1040 or BE 2400) and CH 1112 or (CH 1150 and CH 1151)

BL 3210 - General Microbiology Introduction to the general principles and techniques involved in the study of microorganisms, including bacteria, fungi, and viruses. Topics include cell structure and function, growth, metabolism, biodiversity, and interaction. Not open to students with credit in BL3310. Credits: 4.0 Lec-Rec-Lab: (3-0-3) Semesters Offered: Fall, Summer Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore Pre-Requisite(s): (BL 1020 or BL 1040) and (BL 2100 or CH 4710)

BL 3220 - Medical Mycology and Virology Study of clinically important fungi and viruses. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Spring Restrictions: Must be enrolled in one of the following Major(s): Medical Laboratory Science, Biological Sciences; May not be enrolled in one of the following Class(es): Freshman, Sophomore Pre-Requisite(s): BL 3210

BL 3230 - Medical Bacteriology Study of pathology, identification, isolation and antimicrobial susceptibility testing of clinically important bacteria. Credits: 4.0 Lec-Rec-Lab: (2-0-5) Semesters Offered: Spring Pre-Requisite(s): BL 3210

BL 3300 - Introduction to Genomics Introduction to Genomics. Genome organization, mapping and characterization from humans and related organisms. Topics include hierarchical arrangement of genes, genome mapping, molecular markers of physical genome maps, genome sequencing, comparative genomics, analysis of important human genes and their products, and ethical and legal aspects of genomics. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Fall, Summer Restrictions: May not be enrolled in one of the following Class(es): Freshman Pre-Requisite(s): BL 2200 or FW 3320

BL 3640 - General Immunology Investigates the immune defense system that has evolved to protect vertebrates from invading pathogens and cancer. Covers general principals of innate and acquired immunity, immunodeficiency and autoimmune diseases, as well as transplantation immunology, and the role of apoptosis in lymphocyte maturation. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Fall, Summer Restrictions: Must be enrolled in one of the following Major(s): Bioinformatics, Medical Laboratory Science, Pharmaceutical Chemistry, Biochem & Molec Biology-Bio Sc, Biomedical Engineering, Biological Sciences; May not be enrolled in one of the following Class(es): Freshman, Sophomore Pre-Requisite(s): BL 1020 or BL 1040 or BL 2020 or BE 2400

BL 3820 – Biochemical Lab Techniques Laboratory techniques basic to biochemistry and molecular biology with emphasis on protein isolation, characterization and kinetics. Credits: 2.0 Lec-Rec-Lab: (0-1-3) Semesters Offered: Spring, Summer Pre-Requisite(s): BL 4010(C) or CH 4710(C)

BL 4020 - Biochemistry II Dynamic aspects of living systems. Broad exposure to cellular metabolic pathways, intermediary metabolism and its regulation and bioenergetics. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Spring, Summer Pre-Requisite(s): BL 3020

BL 4030 - Molecular Biology Molecular biology of gene structure, expression and regulation. Also topics covering various molecular techniques and applications of these techniques and biotechnology. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Fall, Summer Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore Pre-Requisite(s): (BL 1020 or BL 1040) and (BL 2100 or CH 4710)

BL 4038 – Epigenetics An introduction to the fundamentals of epigenetic control that is not encoded by genomic DNA sequences of an organism. Topics include major regulatory mechanisms including DNA methylation, histone modification, and non-coding RNA (ncRNA) mediated gene regulation. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Fall

Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore Pre-Requisite(s): BL 3300 or BL 4030

BL 4070 - Environmental Toxicology Introduction to the range of anthropogenic pollutants released into the environment. Concepts of bioaccumulation, biomagnification and environmental persistence, modes of toxicity and detoxification, transport and fate in aquatic and terrestrial ecosystems. Toxic equivalent factors and quotients, regulatory guidelines and practices. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Spring Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore Pre-Requisite(s): (BL 1020 or BL 1040) and CH 1150 and CH 1160

BL 4200 - Microbial Physiology Structure and function of microorganisms, with emphasis on mechanisms for responding to changing environmental and nutritional conditions. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Fall - Offered alternate years beginning with the 2018-2019 academic year Restrictions: May not be enrolled in one of the following Level(s): Graduate Pre-Requisite(s): BL 3210 or BL 3310

BL 4370 - Advanced Cell Biology Celebration of the commonalities of life as exhibited in the basic building block of organisms - the cell. Course topics include details of basic genetic mechanisms, cell structure and function, and an examination of cells in their social context. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Spring Pre-Requisite(s): BL 2200 and CH 2420

BL 4550 - Clinical Chemistry A study of clinical biochemistry of the human body. Theory and practical applications used in routine analysis of body fluids. Includes the study of electrolyte balance, acid base balance, and the functions of major organs and systems. Credits: 3.0 Lec-Rec-Lab: (2-0-3) Semesters Offered: Spring Restrictions: Must be enrolled in one of the following Major(s): Clinical Laboratory Science, Medical Laboratory Science, Biological Sciences; May not be enrolled in one of the following Class(es): Freshman, Sophomore Pre-Requisite(s): BL 2020 and BL 3640

BL 4720 - Hematology and Hemostasis Theory and laboratory applications. Emphasis will be placed on hematopoiesis, normal and disease states affecting blood cells and coagulation processes. The lab will focus on cell morphology and practical testing applications. Credits: 3.0 Lec-Rec-Lab: (2-0-3) Semesters Offered: Fall Restrictions: Must be enrolled in one of the following Major(s): Medical Laboratory Science, Biological Sciences; Must be enrolled in one of the following Class(es): Junior, Senior Pre-Requisite(s): BL 4730(C)

BL 4730 - Immunohematology Techniques Theory and practical applications. Emphasis will be placed on blood antigens and antibodies, compatibility testing techniques, blood component therapy and safety issues. Credits: 1.0 Lec-Rec-Lab: (0-0-3) Semesters Offered: Fall Restrictions: Must be enrolled in one of the following Major(s): Medical Laboratory Science, Biological Sciences; Must be enrolled in one of the following Class(es): Junior, Senior Pre-Requisite(s): BL 4720(C)

BL 4752 - Cancer Biology Emphasis on characteristic genetic, molecular, and cellular changes leading to cancer. Topics will include the role of tumor viruses, oncogenes, tumor suppressors, immortalization, apoptosis, and angiogenesis in cancer initiation and/or progression. Consideration of current therapies and future directions for treatment. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Spring Pre-Requisite(s): BL 3012 or BL 4370 or BE 2400

BL 4800 - Molecular Diagnostics This course provides the scientific background behind modern molecular techniques applies in the diagnosis of human diseases. Topics to be covered include nucleic acid structure and function as well as introduction to nucleic acid characterization techniques used in disease diagnosis and genetic disorders. Credits: 5.0 Lec-Rec-Lab: (3-0-2) Semesters Offered: Spring Pre-Requisite(s): BL 2200

BL 4840 - Molecular Biology Techniques Laboratory techniques in molecular biology, including methods of recombinant DNA technology for identification, cloning, and characterization of genes. Credits: 3.0 Lec-Rec-Lab: (1-0-3) Semesters Offered: Fall Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore Pre-Requisite(s): BL 2200 and BL 4030(C)

Course Descriptions for Ecology & Evolutionary Biology Elective

BL 3190 – Evolution A study of the patterns and processes of organic evolution. Topics include genetics of populations, mechanisms of deterministic and stochastic genetic change, history of life on earth, biogeography, molecular evolution, units of selection, sexual selection, speciation, and human evolution. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Spring Pre-Requisite(s): BL 1010 or BL 1040

BL 3400 - Principles of Ecology Study of both accepted and currently debated principles that describe ecological relationships at the organism, population, community, and ecosystem levels. Credits: 4.0 Lec-Rec-Lab: (3-0-3) Semesters Offered: Fall Pre-Requisite(s): BL 1010 or BL 1040

BL 4400 – Developmental Biology The course will cover developmental biology topics from gametogenesis over fertilization, embryonic development to postembryonic development, including aging. Developmental genetics and the evolution of development (evo-devo) are an important component of this course. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Spring Pre-Requisite(s): (BL 1020 or BL 1040) and BL 2200

SS 3250 – Biological Anthropology A human evolution course focusing upon a summary of general bio-anthropological principles of evolutionary change, the current fossil record evidencing human evolution, and the consequences of human evolutionary change for modern human variability, health, and behavior. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Fall - Offered alternate years beginning with the 2007-2008 academic year Restrictions: Must be enrolled in one of the following Class(es): Junior, Senior Pre-Requisite(s): UN 1015 and (UN 1025 or Modern Language - 3000 level or higher)

Course Descriptions for Advanced Human Physiology Elective

BL 3044 - Advanced Human Physiology A course for students interested in health careers or human biology. This course will cover advanced topics in the human circulatory, digestive,

endocrine, integumentary, lymphatic, muscular, nervous, renal, reproductive, respiratory, and skeletal systems. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Spring - Offered alternate years beginning with the 2019-2020 academic year Restrictions: May not be enrolled in one of the following Class(es): Freshman Pre-Requisite(s): BL 2020

BL 4044 - Human Pathophysiology Course will cover abnormal function (physiology) and investigate the signs and symptoms of major diseases in humans. Extension of Anatomy & Physiology by working through the systems of the human body. Course will include a clinical focus and case-study approach. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Spring - Offered alternate years beginning with the 2020-2021 academic year Restrictions: May not be enrolled in one of the following Class(es): Freshman Pre-Requisite(s): BL 2010 and BL 2020

BL 4380 - Cardiopulmonary Physiology Using a problem-based learning approach, course examines the physiology of the human body. In-class case-study analyses provide in-depth learning about the cardiovascular and pulmonary systems and their relationship with other organ systems. Promotes development of problem-solving skills. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Fall Pre-Requisite(s): BL 2020

KIP 4100 - Exercise Physiology Focuses on the functional changes brought by acute and chronic exercise sessions. Topics include muscle structure and function, bioenergetics, cardiovascular and respiratory adaptations, exercise training for sport, sport nutrition, ergogenic aids, and other health and fitness topics. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Spring Co-Requisite(s): KIP 4110 Pre-Requisite(s): BL 2020 and BL 2021

KIP 4110 - Exercise Physiology Laboratory A companion course to EH4210. Hands-on experience in making physiological measurements as related to exercise. Cardiovascular and respiratory changes during exercise will be monitored. A virtual lab is used to simulate changes in physiological measurements that cannot be performed on live subjects. A student designed laboratory project is required. Credits: 1.0 Lec-Rec-Lab: (0-0-3) Semesters Offered: Spring Co-Requisite(s): KIP 4100

PSY 3060 – Physiological Psychology Study of the relations between psychological manipulations and resulting physiological responses to promote understanding of mind/body interaction. Will examine psychophysiological measurement methods, research, and the application of psychophysiology. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Spring Pre-Requisite(s): PSY 2000 and (BL 1020 or BL 1040 or BL 2010)

Course Descriptions for Human/Environment Interactions Directed Electives

KIP 4740 – Epidemiology An introduction to the principles and methods of epidemiology to understand the distribution and determinants of health in a population. Topics include basic epidemiological statistics, study design, and sources/impact of bias and error. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Spring

SS 2100 – Introduction to Cultural Anthropology Introduction to the field of cultural anthropology with a focus on human diversity, patterns of culture and human organization, globalization, and social change. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Fall

SS 2300 - Environment and Society Examines social approaches to understanding why environmental problems happen and how environmental problems are resolved. Includes concepts such as sustainability, market-based environmental policies, property systems, and environmental justice. Case studies may include biodiversity, deforestation, climate change, water quality, and toxics. Credits: 3.0 Lec-Rec-Lab: (2-1-0) Semesters Offered: Spring

SS 2400 - Introduction to Human Geography This course introduces students to concepts, problems, and case studies that make up the study of human geography: the spatial differentiation and organization of human activity, environmental sustainability, and the role of space and place in our everyday lives. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Fall, Summer

SS 2700 – Introduction to Sociology Introduces students to the way that sociologists think about different components of society. Topics include the family, religion, markets, organizations, political systems, and educational systems. Also covers the source of individual values, beliefs, and attitudes. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Fall, Spring

Course Descriptions for Capstone Requirement

BL 3990 - Biological Sciences Teaching Experience Development of teaching skills through assisting in the instruction of a section of biological sciences laboratory. Students gain experience in leadership, group work, organization skills, laboratory preparation, and laboratory instruction. Credits: variable to 4.0; Repeatable to a Max of 4 Semesters Offered: Fall, Spring, Summer Restrictions: Permission of instructor required

BL 4000 - Research in Biology A literature and laboratory research problem that culminates in a written report on the work performed. Credits: variable to 9.0; Repeatable to a Max of 9 Semesters Offered: Fall, Spring, Summer Restrictions: Permission of instructor required

BL 4001 - Honors Research in Biology A laboratory-based research problem that culminates in a written report and a seminar presentation on the work performed. Open only to biological sciences and clinical laboratory sciences majors accepted into the Honors in Biological Sciences program. Credits: variable to 9.0; Repeatable to a Max of 9 Semesters Offered: Fall, Spring, Summer Restrictions: Permission of instructor required

BL 4510 - Senior Capstone Experience Reading, interpreting, and integrating information from the primary literature of biological sciences. Emphasizes oral and written presentation skills. Credits: 2.0 Lec-Rec-Lab: (0-2-0) Semesters Offered: Fall, Spring Restrictions: Must be enrolled in one of the following Major(s): Biological Sciences, Biochem & Molec Biology-Bio Sc, Bioinformatics; May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior

BL 4530 - Senior Research Capstone Experience Reading, interpreting, and integrating information from the primary literature and research project data. Emphasizes oral and written presentations as well as peer review. Credits: 1.0 Lec-Rec-Lab: (0-1-0) Semesters Offered: Fall, Spring Restrictions: Must be enrolled in one of the following Major(s): Biological Sciences, Biochem & Molec Biology-Bio Sc, Bioinformatics; Must be enrolled in one of the following Class(es): Senior Pre-Requisite(s): BL 4000(C) or BL 4001(C) or BL 4995(C)

BL 4995 – Research in Biochemistry A literature and laboratory research problem in biochemistry that culminates in a written report on the work performed. Credits: variable to 6.0; Repeatable to a Max of 9 Semesters Offered: Fall, Spring, Summer Restrictions: Permission of instructor required

BL 4999 – Biological Sciences Internship Practical and didactic internship experience directly related to student's course of study in biochemistry and molecular biology, bioinformatics, biological sciences, or ecology. Students conduct work at an approved internship site in addition to academic assignments that encourage them to connect their professional and academic experience. Credits: variable to 9.0; Repeatable to a Max of 9 Semesters Offered: Fall, Spring, Summer Restrictions: Permission of instructor required

Course Descriptions for Required General Education Courses

UN 1015 – Composition Provides direct instruction in composition. Students examine and interpret communication practices and apply what they learn to their own written, aural, and visual compositions. Class projects ask students to communicate in a variety of modes and to attend to audience, purpose, and context. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Fall, Spring, Summer Restrictions: Must be enrolled in one of the following Class(es): Freshman

UN 1025 - Global Issues Study of contemporary global issues, their origins, impacts, and solutions through the thematic and comparative exploration of worldview and culture, population, globalization, development, politics and global governance, environment, and sustainability. Emphasis on global literacy and information literacy. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Fall, Spring, Summer Restrictions: Must be enrolled in one of the following Class(es): Freshman