Section 1 - Approvals

[See the separate document entitled “BYU Hawaii Curriculum Proposal Instructions” for instructions. Reminder: delete or replace all text in square brackets. Retain all other text.]

**Approvals**

Name of Proposal: BIOL Spring/First Term Support Courses

Submitted by: Roger Goodwill  
Signature:  
Date: 10/27/010

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Recommendation/Signature</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Faculty Vote: For 6, Against 0, Abstain 0, Absent 0</td>
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<td></td>
</tr>
<tr>
<td>1. Approved by Department [separate block for each dept]</td>
<td>Signature: [Handwritten]</td>
<td>10/27/010</td>
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<tr>
<td></td>
<td>Chair: Roger Goodwill</td>
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<td>2. Approved by College [separate block for each college]</td>
<td>Signature: [Handwritten]</td>
<td>11/4/10</td>
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<td></td>
<td>Dean: Jeff Burroughs</td>
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<td>3. Reviewed by LAS (if new resources are requested)</td>
<td>Signature:</td>
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<td></td>
<td>LAS: Matt Kester</td>
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<td>4. Approved by General Education (if any GE course is affected)</td>
<td>Signature:</td>
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<td></td>
<td>GE: David Beus</td>
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<td>5. Approved by University Curriculum Committee</td>
<td>Signature:</td>
<td>12/15/10</td>
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<tr>
<td></td>
<td>UCC: Jennifer Lane</td>
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<tr>
<td>6. Approved by Academic Council</td>
<td>Signature:</td>
<td>17 Dec 2010</td>
</tr>
<tr>
<td></td>
<td>AVP: Max Checketts</td>
<td></td>
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<tr>
<td>7. Approved by the President's Council (for new programs)</td>
<td>Signature:</td>
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<td>Pres: Steven Wheelwright</td>
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</tbody>
</table>
Section 2 – Overview (Support)

Summary:

The Biology Department is requesting that the following courses be added to our list of offerings:

1. Bio. 320/L Pathogenic Microbiology with lab (3+1 cr) - Dr. Shane Gold
2. Bio. 330/L Bioinformatics with lab (3+1 cr) - Dr. Shane Gold.
3. Bio. 340 Experimental Design and Analysis (3 cr) - Dr. Randy Day
4. Bio. 475 Pathophysiology (3 cr) - Dr. Randy Day

The Biology Department proposes four new courses as a way to strengthen our preprofessional and molecular biology options. Our basic courses require a full semester in order to cover the material adequately. This is especially true of the laboratories where techniques are taught that take time to learn and where the culturing of microorganisms take as long as they take regardless of administrative dictates. We, therefore, have no professional courses in the preprofessional or molecular biology areas offered during the spring and 1st terms. The requested four courses are specifically designed for the shorter spring and summer sessions in support of the University’s desire to offer courses during the terms and thus facilitate a three year graduation plan.

Pathophysiology and Pathogenic Microbiology were chosen specifically as a result of faculty experience and student interest. Experimental Design and Analysis was suggested as a way of augmenting our student research program which has proven to be a vehicle for post-graduate employment and acceptance into graduate and professional school. All of biology is becoming computerized and this is especially true of molecular biology. As pointed out by the Biology Department review team, Bioinformatics is the one course in the molecular biology sequence that is really missing.

The addition of these courses also support the 36 hour load requirement for the faculty members on an augmented contract.

Both Dr. Day & Dr. Gold are eminently qualified to teach their respective courses. Dr. Day is a comparative physiologist who has specialized in human physiology and Dr. Gold is a molecular microbiologist whose doctorate was heavily dependent on bioinformatics.

The Biology Department is also requesting that Biol 465R be changed to Biol 465LR. This change better reflects the actual nature of the research experience in the sciences.
Section 2 – Overview (Support)

Summary:

This proposal seeks to create an elective course and laboratory (BIOL 320 and BIOL 320L) intended to provide students with focused exposure to the study of pathogenic microbiology. This course is intended to be offered every other year to better prepare natural sciences students for careers in the medical fields, and to facilitate the goal of graduating students in three years by providing natural sciences majors with upper division course offerings during the summer terms.

The Biology department currently teaches an introductory microbiology course (BIOL 220/220L, Microbiology) that prepares students well for a basic understanding of microbial diversity, identification, metabolism, and general bacteriological techniques. The impetus for an advanced course in pathogenic/medical microbiology originally came from interviews with former students who are currently enrolled in professional medical and nursing programs. While acknowledging the usefulness of the BIOL 220 course, they expressed the need for a course that focuses specifically on disease-causing microorganisms, including their identification, modes of pathogenesis, diagnosis, and treatment. This class is expected to appeal primarily to those students interested in microbiology, molecular biology, and the medical professions. This course will add to the number of courses offered during the summer terms thereby giving upper level students in biology and biochemistry further options for course enrollment during a period when very few upper division courses are currently offered; accordingly this offering should help facilitate the three year graduation plan. This course supports the existing Immunology course (BIOL 445/445L) helping to more fully explore the host/pathogen interactions that result in tolerance or disease states.

Because this is an elective course, no changes to student course load would result.

This course has been taught twice as BIOL 390R. Student reviews have been strongly positive.

This course will be taught by Dr Roger Shane Gold whose undergraduate, masters, and doctoral training have been centered on the field of microbiology. Dr Gold is currently serving under the augmented contract; his 2010 teaching schedule was as follows:

Winter Semester 2010:

- BIOL 100H (Honors General Biology) (3)
- BIOL 441/441L (Advanced Molecular Biology + Lab) (6)
- BIOL 492 (Research and Thesis [Team taught]) (1)
- BIOL 496R (Student Research) (1)

Spring Term 2010:

- BIOL 265/265L (Molecular and Cellular Biology + Lab) (6)

First Term 2010

- BIOL 390R/390RL (Pathogenic Microbiology + Lab) (6)

Fall Semester 2010:

- BIOL 265/265L (Molecular and Cellular Biology + Lab) (6)
- BIOL 445/445L (Immunology + Lab) (6)
- BIOL 492 (Research and Thesis [Team taught]) (1)

Total: (36)
In addition to the creation of BIOL 320/320L (Pathogenic Microbiology), covered by the current proposal, a number of additional changes are planned that will change Dr Gold’s teaching schedule while maintaining the same overall teaching load:

1. BIOL 265/265L, previously offered in the Spring Term, will be moved to Winter Semester beginning in Winter 2011. The main goal of this change is to help ensure that this required core course is taught under the same syllabus twice per year (Fall Semester and Winter Semester, annually, instead of Fall Semester and Spring Term).

2. BIOL 100H will be taught annually in Spring Term rather than in Winter Semester. This change is made to accommodate the move of BIOL 265 to the Winter Semester.

3. Approval is being sought for the creation of BIOL 330/330L (Bioinformatics), to alternate annually with BIOL 320/320L during First Term. This change is desired to further increase the courses available to students during the summer terms and to meet the needs of natural sciences majors for exposure to the databases and software used in biological research.

With the approval of these changes, Dr Gold’s teaching schedule will appear as follows, retaining essentially the same number of hours:

**Winter Semester 2011:**
- BIOL 265/265L (Molecular and Cellular Biology + Lab) (6)
- BIOL 441/441L (Advanced Molecular Biology + Lab) (6)
- BIOL 492 (Research and Thesis [Team]) (1)
- BIOL 496R (Student Research) (1)

**Spring Term 2011:**
- BIOL 100H (Honors General Biology) (3)

**First Term 2011 (Alternating years):**
- BIOL 320R/320RL (Pathogenic Microbiology + Lab) (6)
- BIOL 330/330L (Bioinformatics + Lab)

**Fall Semester 2011:**
- BIOL 265/265L (Molecular and Cellular Biology + Lab) (6)
- BIOL 445/445L (Immunology + Lab) (6)
- BIOL 492 (Research and Thesis [Team]) (1)

**Total:** (36)

The creation of BIOL 320/320L (Pathogenic Microbiology) does not affect graduation requirements as it is an elective course that students may choose to help enhance their experience with the study of pathogenic microorganisms. This course would provide upper level Biology and Biochemistry students greater choices for enrollment during the First Term.

The costs associated with the creation of this course are expected to be minor. The bacterial strains required for the laboratory section of this course are currently in our microbiology collection, and all other supplies and equipment are shared in common with our current microbiology and molecular biology laboratories. The laboratory manual for this class has been written by Dr. Gold and will be printed through BYU-Hawaii Print Services and sold to the students at cost through the BYU-Hawaii Bookstore. No new acquisitions will be required by the library.

Pathogenic Microbiology has been taught twice as a BIOL 390R Special Topics course and was well received by the students who enrolled. The vote by the biology faculty was unanimous for the formal adoption of this course.
Section 4 - Course Proposal (core)

Upon approval, the information presented on this course proposal sheet will become binding on the department and the university. Any material changes require a new course proposal.

Effective Date: Immediately upon approval
College: Math and Sciences
Course Prefix: BIOL
Course Number: 320

NEW COURSE.

Full Title: Pathogenic Microbiology
Short Title (for Transcript, 30-char max): Pathogenic Microbiology
Catalog Entry (50-word recommended maximum): (1st – even years) The role of medically-important microorganisms in disease progression; their identification, pathogenesises, clinical features, epidemiology, laboratory diagnosis, treatment and control. Mechanisms of host defense. Concurrent registration in BIOL 320L required. (Prerequisite: Science Core and BIOL 220/L).
Prerequisites: Science Core and BIOL 220/L
Credit Hours: 3
Grading Method: Letter grade
Course Fees: n/a

Learning Objectives: Each student who passes this course will be able to do the following:
1. Describe the microbiological and pathological basis of historical human epidemics.
2. Explain the major historical events that led to our understanding of immunity.
3. Explain the likely sources of emerging diseases within human populations.
4. Describe efforts to prevent the spread of disease through all likely sources of infection.
5. List, explain, and describe the importance and problems with Koch’s postulates in determining the causative agent of disease.
6. Describe the various assays used to compare the pathogenicity of various disease-causing agents, including ID50, LD50, Competition assays, and the various molecular-based techniques of discovery.
7. Explain the benefits and limitations of studying disease using human volunteers and involunteers, non-human animal models, tissue models and organ models.
8. Explain the various components of the innate and adaptive immune systems in protecting the body against infection.
9. Describe the role of vaccines in protecting the body from disease and the controversies centered around them.
10. Describe the issue of antibiotic resistance and explain seriousness of the problem, and explain the steps that must be taken to maintain the effectiveness of these drugs.
11. Be able to list the most common disease-causing bacteria, explain how they are transmitted between hosts, and how their special abilities (virulence factors) gain them access to the body to result in a disease state.

Assessment Methods: The course grade will be based on a point system with points earned through exams, quizzes, and projects. The laboratory projects will give students hands-on experience working with pathogenic bacteria and with the methods used for their isolation, culturing, differentiation and identification.
Section 4 - Course Proposal (core)

Upon approval, the information presented on this course proposal sheet will become binding on the department and the university. Any material changes require a new course proposal.

Effective Date: Immediately upon approval

College: Math and Sciences

Course Prefix: BIOL

Course Number: 320L

NEW COURSE.

Full Title: Pathogenic Microbiology Laboratory

Short Title (for Transcript, 30-char max): Pathogenic Micro Lab

Catalog Entry (50-word recommended maximum): Laboratory for Pathogenic Microbiology. To be taken concurrently with BIOL 320.

Prerequisites: n/a

Credit Hours: 1

Grading Method: Letter grade

Course Fees: n/a

Learning Objectives: Each student who passes this course will be able to do the following:

1. Use proper aseptic technique to isolate and culture common pathogenic microorganisms.

2. Use and explain the basic techniques for pathogenic bacterial strain enrichment and differentiation.


4. Be able to describe the virulence factors and diseases caused by the most common groups of pathogenic microorganisms.

5. Recognize the critical importance of proper hygiene, including hand washing and dental care, in promoting good health and in preventing the spread of disease.

Assessment Methods: The course grade will be based on a point system with points earned through exams, quizzes, and projects. The laboratory projects will give students hands-on experience working with pathogenic bacteria and with the methods used for their isolation, culturing, differentiation and identification.

A sample syllabus is attached as is a copy of the online catalog web pages that should change as a result of this proposal.
Instructor: Roger Shane Gold
Office: McKay 140B
Telephone: (808) 675-3681
e-mail: goldr@byuh.edu

Class Information:
Lecture: Tuesdays and Thursdays 7:40 - 10:50 AM [MCK 133]
Lab: Tuesdays and Thursdays 12:10 - 3:20 PM [MCK 118]

Pre-requisites
Successful completion of Science Core and BIOL 220/L (C minus or better).

Required Text:

Course Description:
This course will review mechanisms of host defense and discuss the role of medically-important microorganisms in causing disease with a focus on their identification, pathogeneses, clinical features, epidemiology, laboratory diagnosis, treatment and control.

Instructional methods:
Learning will be promoted through lectures, presentations, case studies, research papers and laboratory exercises.

Course Objectives:

Upon completion of this course each student should be able to:
1. Describe the microbiological and pathological basis of historical human epidemics.
2. Explain the major historical events that led to our understanding of immunity.
3. Define and give examples of new-new, new-old, old-new, and old-old emerging diseases.
4. Explain the likely sources of emerging diseases within human populations.
5. Describe efforts to prevent the spread of disease through all likely sources of infection.
6. List, explain, and describe the importance and problems with Koch’s postulates in determining the causative agent of disease.
7. Be able to argue the different concepts of microbe-host interactions leading to infectious disease.
8. Describe the various assays used to compare the pathogenicity of various disease-causing agents, including ID50, LD50, Competition assays, and the various molecular-based techniques of discovery.
9. Explain the benefits and limitations of studying disease using human volunteers and volunteers, non-human animal models, tissue models and organ models.
10. Explain the various components of the innate immune system, including anatomic barriers, physiologic barriers, phagocytic barriers, and inflammatory barriers to pathogen entry, and their roles in protecting the body against infection.
11. Describe the various components of the adaptive immune response, including the cells that specifically mediate and remember the adaptive response and the mechanisms they use to fight infection.
12. Describe the role of vaccines in protecting the body from disease and the controversies centered around them.
13. Explain the basis mechanisms of common antibiotics.
14. Describe the issue of antibiotic resistance and explain seriousness of the problem, and explain the steps that must be taken to maintain the effectiveness of these drugs.
15. Describe the function of virulence factors in allowing bacterial pathogens to breach the barriers of the immune system in order to cause disease.
16. Be able to list the most common disease-causing bacteria, explain how they are transmitted between hosts, and how their special abilities (virulence factors) gain them access to the body to result in a disease state.

**Departmental Objectives**

<table>
<thead>
<tr>
<th>Departmental Objective</th>
<th>Degree to which addressed in course</th>
<th>How addressed in course</th>
</tr>
</thead>
<tbody>
<tr>
<td>Understand what makes life unique</td>
<td>Practiced with feedback</td>
<td>All lectures, discussions, quizzes and research papers.</td>
</tr>
<tr>
<td>Be able to describe the history of life from a biological perspective</td>
<td>Practiced with feedback</td>
<td>All lectures, discussions, quizzes and research papers.</td>
</tr>
<tr>
<td>Understand the unifying principles of biology</td>
<td>Practiced with feedback</td>
<td>All lectures, discussions, quizzes and research papers.</td>
</tr>
<tr>
<td>Recognize and discuss current biological issues and their impact on society</td>
<td>Practiced with feedback</td>
<td>Both the lecture and lab components will discuss current events coupled with classical experiments.</td>
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<tr>
<td>Demonstrate content knowledge of the discipline</td>
<td>Practiced with feedback</td>
<td>All lectures, research papers and exams.</td>
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<tr>
<td>Read, write, and understand biological literature</td>
<td>Practiced with feedback</td>
<td>Exposure to primary source literature in understanding pathogenicity.</td>
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<tr>
<td>Learn how to conduct research through use of the scientific method</td>
<td>Practiced with feedback</td>
<td>Laboratory experience is based on exposure to, and practice with, clinical methodology in current use.</td>
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<tr>
<td>Have the opportunity to prepare for graduate or professional school and/or success in the</td>
<td>Practiced with feedback</td>
<td>The laboratory experience teaches and reinforces the basic skill set required for success in graduate school and molecular</td>
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<tr>
<td>biological job market</td>
<td>biology research laboratories.</td>
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<td>Realize appropriate stewardship</td>
<td>Practiced with</td>
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<td>accountabilities and the need to</td>
<td>feedback</td>
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<td>help improve society</td>
<td>All lectures, discussions, quizzes and</td>
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<td>research papers.</td>
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Grades:

The course grade will be based on a point system with points earned through exams, quizzes, and laboratory notebook projects, as outlined below:

<table>
<thead>
<tr>
<th>Contribution</th>
<th>Point Value</th>
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<tbody>
<tr>
<td>Exams (3 exams @ ~100 points)$^a$</td>
<td>300</td>
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<tr>
<td>Daily Writing Assignments (10 assignments @ 15 points)$^b$</td>
<td>150</td>
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<tr>
<td>Lab reports (11 @ 20 points)$^c$</td>
<td>220</td>
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<tr>
<td>Lab final exam$^d$</td>
<td>100</td>
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<tr>
<td>Microbe presentations (Chapter report) 2 @ 50 points$^e$</td>
<td>100</td>
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<tr>
<td>Special assignments and mini-presentations$^f$</td>
<td>50</td>
</tr>
</tbody>
</table>

920 points

Grading Scale

92.5 - 100%  A
90.0 - 92.4%  A-
87.5 - 89.9%  B+
82.5 - 87.4%  B
80.0 - 82.4%  B-
77.5 - 79.9%  C+
72.5 - 77.4%  C
70.0 - 72.4%  C-
67.5 - 69.9%  D+
62.5 - 67.4%  D
60.0 - 62.4%  D-
0 - 59.9%    F

$^a$Exams. Three unit exams will be administered throughout this course. The unit exams will be administered in the Testing Center on XXXXX and on XXXXX, and the final exam will be administered during our regularly scheduled lab time on XXXXX. Each exam will be comprehensive. Thorough note-taking and thoughtful answers to the questions associated with the Daily Writing Assignments should prepare students well for these exams. Students must take each exam at the indicated time and place unless a prior agreement can be reached with the instructor. Each exam will be worth 100 points.
Daily Writing Assignments. A set of 5-10 questions will be provided at the end of each day's lecture; the type-written answers to these questions will be due at the beginning of the next lecture period and you must be prepared to discuss these in class. These questions require thoughtful answers based on your reading assignment for that day and must be typed and answered in your own words. Three points will be provided for each thoughtful answer, 2 points for partially correct or rote answers, and 1 point for incorrect answers. No credit will be given for late work. These questions are intended to help you stay current with the material and to discover critical concepts from the lectures and reading assignments.

Lab reports. A lab protocol will be provided for each laboratory period. A series of questions, designed to help you discover and explore important concepts will be provided with each protocol. The answers to these questions constitute the lab report for this class; the answers should be typed, answered fully, and written in complete sentences; no formal lab report structure is required. Each lab report is worth 20 points and is due 1 week from the date of the lab, unless otherwise instructed.

Lab final exam. A laboratory final exam is scheduled for XXXXX in MCK 118 during our regularly scheduled lab time. This exam will be comprehensive for the laboratory portion of this class and will focus on the assays (mechanisms and expected results) explored throughout this course. Thoughtful answers to the questions associated with each lab protocol should prepare students well for this exam. Students must take this exam at the indicated time and place unless a prior agreement can be reached with the instructor. This exam is worth 100 points.

Microbe presentations. Each student will be asked to deliver two lectures during the second unit (12 August – 02 September) of this term. A list of possible pathogenic bacteria will be provided and students will be given the opportunity to choose which two organisms to present. Lectures should seek to address the following core questions:

1. What is the nature of the pathogen and what disease(s) does it cause?
2. How does the pathogen gain access to the body?
3. What cells of the body are infected by the pathogen and how does the pathogen spread?
4. What are the host defense mechanisms against the pathogen and how is the disease caused?
5. What are the typical manifestations of the infection?
6. How is the infection diagnosed?
7. How is the infection managed, and what preventative measures can be taken to avoid infection?

Special assignments and mini-presentations. Throughout the semester brief assignments will be made, some of which will require the student to make mini-presentations (5 to 10 minutes) on specific, pre-assigned topics. Specific instructions will be given for each assignment.
Blackboard

A variety of materials will be placed on Blackboard throughout the semester, including assignments, study guides, laboratory procedures, and lecture materials. Please make certain you have access to our class material on the Blackboard system (http://blackboard.byu.edu) and that your email address, listed in Blackboard, works properly. If you have any difficulties accessing our class material, please contact Blackboard Support (bboard@byu.edu or 808-675-3847).

Policies:

Attendance and Participation. We will be covering an extensive amount of material in a very short period of time with each subsequent topic building upon a thorough understanding of the last. Accordingly, attendance in class and lab is critical and required. To reinforce this, attendance and participation will be recorded in every class and will be taken into account when calculating final grades. Attendance will be taken at the beginning of class; if a student arrives after attendance has been taken they will be counted as absent.

Preventing Sexual Harassment. Title IX of the education amendments of 1972 prohibits sex discrimination against any participant in an educational program or activity that receives federal funds, including Federal loans and grants. Title IX also covers student-to-student sexual harassment. If you encounter unlawful sexual harassment or gender-based discrimination, please contact the Human Resource Service at 808-780-8875 (24 hours).

Special Needs. Brigham Young University-Hawaii is committed to providing a working and learning atmosphere, which reasonably accommodates qualified person with disabilities. If you have any disability that may impair your ability to complete this course successfully, please contact the students with Special Needs Counselor Leilani Auna at 808-675-3999 or 808-675-3518. Reasonable academic accommodations are reviewed for all students who have qualified documented disabilities. If you need assistance or if you feel you have been unlawfully discriminated against on the basis of disability, you may seek resolution through established grievance policy and procedures. You should contact the Human Resource Services at 808-780-8875.

Honor code. Honor code standards will be strictly enforced in this class. This includes the Dress and Grooming Standards (http://services.byu.edu/honorcode/Dress_and_Grooming) and the Academic Honesty Policy (http://services.byu.edu/honorcode/Academic_Honesty_Policy). Any student who arrives to class out of standards will be asked to leave and will be permitted to return only when properly attired. Any student who violates the Academic Honesty Policy, including, but not limited to, plagiarism, fabrication or falsification, and cheating, will receive no credit for the assignment and may be reported to the Office of Honor; any repetition will result in a failing grade for the class. In addition, all students have a right to be treated with respect and courtesy and to study in a safe and supportive environment while enrolled at BYU-Hawaii, and any student who violates these rights for another will be asked to correct their behavior or to leave the classroom; appropriate action, including a failing grade and/or a report filed with the Office of Honor will be taken against any student who repeatedly shows a lack of respect, or who creates an unsafe environment, for any other student or faculty member of this university.

Suggestions for doing well in this course
1. Attend all classes; do not arrive late or leave early
2. Prepare for each lecture by reading assigned book chapters before class and putting a sincere and thoughtful effort into answering each question associated with the Daily Writing Assignment.
3. Actively participate in discussions by asking relevant questions and contributing answers and opinions
4. Allocate at least 3 or 4 hours of study outside of the classroom for each lecture throughout the course; do not be tempted to rely on cramming techniques.
<table>
<thead>
<tr>
<th>Date</th>
<th>Tentative Lecture Schedule</th>
<th>Chapter</th>
</tr>
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<tbody>
<tr>
<td>Day 1</td>
<td>Syllabus, Historical epidemics, Bioterrorist attacks, Emerging diseases</td>
<td>1</td>
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<tr>
<td>Day 2</td>
<td>Studying disease: Koch's postulates, traditional and molecular approaches to studying disease</td>
<td>2, 3</td>
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<td>Day 3</td>
<td>Innate immune barriers</td>
<td>4, 5</td>
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<td>Day 4</td>
<td>Adaptive immune barriers and Vaccinations</td>
<td>6, 7</td>
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<tr>
<td>Day 5</td>
<td>Antibiotics and Resistance</td>
<td>10, 11</td>
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<tr>
<td>Day 6</td>
<td>Bacterial strategies for evading host defenses</td>
<td>8, 9</td>
</tr>
</tbody>
</table>
| Day 7 | Presentations:  
- The *Spirochetes*  
- *Yersinia pestis*  
- *Staphylococcus* species | 12, 13, 14 |
| Day 8 | Presentations:  
- *Streptococcus* species  
- *Pseudomonas aeruginosa*  
- *Bordetella pertussis* | 15, 16, 17 |
| Day 9 | Presentations:  
- *Streptococcus pneumonia*  
- *Mycobacterium tuberculosis*  
- *Legionella pneumophila* | 18, 19, 20 |
| Day 10 | Presentations:  
- *Mycoplasma pneumonia* and  
*Chlamydia pneumonia*  
- *Bacillus anthracis*  
- *Helicobacter pylori* | 21, 22, 23 |
| Day 11 | Presentations:  
- *Clostridium difficile*  
- *Vibrio cholera*  
- *Salmonella* species | 24, 25, 26 |
| Day 12 | Presentations:  
- *Listeria monocytogenes*  
- Diarrheagenic *Escherichia coli*  
- *Neisseria* species | 27, 28, 30 |
<p>| Day 13 | Review |</p>
<table>
<thead>
<tr>
<th>Date</th>
<th>Laboratory Exercise</th>
</tr>
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<tbody>
<tr>
<td>Day 1</td>
<td>I. Review Streak plating, Selective and Differential Media, Gram Stain, Microscopy</td>
</tr>
<tr>
<td>Day 2</td>
<td>II. Handwashing: Soaps and Disinfectants</td>
</tr>
<tr>
<td>Day 3</td>
<td>III. Dental Caries Susceptibility Test</td>
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<tr>
<td>Day 4</td>
<td>IV. Enteric Bacteria</td>
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<tr>
<td>Day 5</td>
<td>V. Antibiotic Susceptibility Testing</td>
</tr>
<tr>
<td>Day 6</td>
<td>VI. Identification of unknown bacteria via RAPD analysis</td>
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<tr>
<td>Day 7</td>
<td>VII. Identification of unknown bacteria via AFLP analysis, I</td>
</tr>
<tr>
<td>Day 8</td>
<td>VIII. <em>Staphylococcus</em></td>
</tr>
<tr>
<td>Day 9</td>
<td>IX. Identification of unknown bacteria via AFLP analysis, II</td>
</tr>
<tr>
<td>Day 10</td>
<td>X. <em>Bacillus</em></td>
</tr>
<tr>
<td>Day 11</td>
<td>XI. <em>Neisseria</em></td>
</tr>
<tr>
<td>Day 12</td>
<td>XII. Lab Final exam</td>
</tr>
<tr>
<td>Day 13</td>
<td>XIII. Lecture Final exam</td>
</tr>
</tbody>
</table>
265. Molecular and Cellular Biology (3) (F, Sp) A course in the molecular activities of living cells, including protein structure and function, DNA replication and repair, gene expression, cell division, membrane physiology, metabolism and molecular genetics. Concurrent registration in or completion of BIOL 265L required. (Prerequisites: Successful completion with a C- or better in CHEM 105).

265L. Molecular and Cellular Biology Laboratory (1) (F, Sp) Laboratory for Molecular and Cellular Biology. To be taken concurrently with BIOL 265. Fee required.

300. Animal Behavior (3) (W—odd years) The study of behavior from an evolutionary perspective. Emphasis on social patterns of behavior including: altruism, optimality, reproduction, parental investment, aggression, and spatial relationships. Concurrent registration in or completion of BIOL 300L required. (Prerequisite: Science Core).

300L. Animal Behavior Laboratory (1) (W—odd years) Laboratory for Animal Behavior. Concurrent registration in or completion of BIOL 300 required. Fee required.

350. General Ecology (3) (F) A study of plant and animal interactions that determine the distribution and abundance of organisms. Concurrent registration in or completion of BIOL 350L required. (Prerequisite: Science Core and BIOL 201/L or BIOL 206/L)

350L. General Ecology Laboratory (1) (F) Laboratory for General Ecology. Concurrent registration in or completion of BIOL 350 required. Fee required.

374. Evolution and Human Prehistory (3) (W—even years) This course explores the biological process of evolution as well as the field of human paleontology and the co-evolution of human culture and the physical type. Course is cross listed (see ANTH 374). (Prerequisite: BIOL 100 for non-science majors and Science Core for science majors)

376. Genetics (3) (F) A general course in the principles of Mendelian and evolutionary genetics. Concurrent registration in or completion of BIOL 376L required. (Prerequisite: Science Core)

376L. Genetics Laboratory (1) (F) Laboratory for Genetics. Concurrent registration in or completion of BIOL 376 required. Fee required.

The following should be inserted at the location indicated by the arrow, above:

320. Pathogenic Microbiology (3) (1st – even years) The role of medically-important microorganisms in disease progression: their identification, pathogeneses, clinical features, epidemiology, laboratory diagnosis, treatment and control. Mechanisms of host defense. Concurrent registration in BIOL 320L required. (Prerequisite: Science Core and BIOL 220/L).

320L. Pathogenic Microbiology Laboratory (1) (1st – even years) Laboratory for Pathogenic Microbiology. Concurrent registration of BIOL 320 required.
Online Catalog web page (Undergraduate majors) [http://catalog.byuh.edu/node/93]

3. Molecular Biology

Students interested in pursuing employment or graduate studies in Molecular Biology should enroll in the following:

- Science Core (15 Hours)
- Pre-Professional Biology Core (12 Hours)
- Chemistry Core (8 Hours)
- Electives (25 Hours Minimum)

Molecular Biology Courses

- BIOL 201/L General Botany (4) or BIOL 206/L General Zoology (4)
- BIOL 220/L Microbiology (4)
- BIOL 383/L Histology & Developmental Biology (4)
- BIOL 441/L Molecular Biology (4)
- BIOL 442/L Cellular Biology (4)
- BIOL 445/L Immunology (4)
- CHEM 381/L Biochemistry I (4)

Other Recommended Biology Courses

- BIOL 248/L Conservation Biology (4)
- BIOL 350/L General Ecology (4)
- BIOL 374 Evolion & Human Prehistory (3)
- CHEM 382/L Biochemistry II (4)

Other recommended Non-Elective Physical Science Courses

- PHYS 121/L General Physics I (4)
- PHYS 221/L General Physics III (4)

4. PRE-PROFESSIONAL PROGRAM

Students interested in continuing their education at professional schools (medicine, dentistry, pharmacy, optometry, etc.) should consult with the preprofessional faculty advisor early in their undergraduate career to prepare a proper course of study. Students should enroll in the following courses:

- Science Core (15 Hours)
- Pre-Professional Biology Core (12 Hours)
- Chemistry Core (8 Hours)
- Electives (25 Hours Minimum)

Pre-Professional Courses

- BIOL 260/L Elementary Human Anatomy (3)
- BIOL 261/L Elementary Human Physiology (4)
- BIOL 383/L Histology and Developmental Biology (4)
- BIOL 441/L Molecular Biology (4)
- BIOL 442/L Cellular Biology (4)
- BIOL 445/L Immunology (4)
- BIOL 460/ Advanced Human Anatomy (3)
- BIOL 465/L Principles of Physiology Laboratory (4)

Other Recommended Biology Courses

- BIOL 248/L Conservation Biology (4)
- BIOL 350/L General Ecology (4)
- BIOL 374 Evolution & Human Prehistory (3)
Summary:
This proposal seeks to create an elective course and laboratory (BIOL 330 and BIOL 330L) intended to introduce students to the study of bioinformatics. Bioinformatics is the application of information technology and computer science to the field of molecular biology and is increasingly becoming a central and essential aspect of modern biological research. This course is intended to be offered every other year, alternating with BIOL 320/320L and seeks to better prepare natural sciences students for modern, computer-based, biological research. This course should also facilitate the goal of graduating students in three years by providing natural sciences majors with upper-division courses during the summer terms.

The creation of a course in bioinformatics in needed to correct a deficiency noted by the BYUH Department of Biology On-Site Assessment Committee (08-09 June 2008). In their final report the assessment committee noted that while we offer a range of courses that are representative of most undergraduate programs in biology, the department fails to offer a course in bioinformatics. The Assessment Committee strongly encouraged the department to create a course in bioinformatics in order to better prepare our students with the computer skills necessary to access the databases and use software that are increasingly becoming a core component of modern biological research. This class is expected to appeal primarily to those students interested in graduate studies in biology, molecular biology, genetics, and biochemistry and those striving for employment in biotechnology-oriented fields. This course will add to the number of courses offered during the summer terms thereby giving upper level students in biology and biochemistry further options for course enrollment during a period when very few upper division courses are currently offered; accordingly, this offering should help facilitate the three year graduation plan. This course supports the existing Molecular Biology courses (BIOL 265/L and BIOL 441/L) helping students to more fully explore the relationships between DNA sequence and protein structure/function.

Because this is an elective course, no changes to student course load would result.

This course will be taught by Dr Roger Shane Gold whose doctoral work relied heavily on bioinformatics and who is well prepared to introduce students to this essential topic. Dr Gold is currently serving under the augmented contract; his 2010 teaching schedule was as follows:

Winter Semester 2010:
- BIOL 100H (Honors General Biology) (3)
- BIOL 441/441L (Advanced Molecular Biology + Lab) (6)
- BIOL 492 (Research and Thesis [Team taught]) (1)
- BIOL 496R (Student Research) (1)

Spring Term 2010:
- BIOL 265/265L (Molecular and Cellular Biology + Lab) (6)

First Term 2010
- BIOL 390R/390RL (Pathogenic Microbiology + Lab) (6)

Fall Semester 2010:
- BIOL 265/265L (Molecular and Cellular Biology + Lab) (6)
- BIOL 445/445L (Immunology + Lab) (6)
- BIOL 492 (Research and Thesis [Team taught]) (1)

Total: (36)
In addition to the creation of BIOL 330/330L (Bioinformatics), covered by the current proposal, a number of additional changes are planned that will change Dr. Gold’s teaching schedule while maintaining the same overall teaching load:

1. BIOL 265/265L, previously offered in the Spring Term, will be moved to Winter Semester beginning in Winter 2011. The main goal of this change is to help ensure that this required core course is taught under the same syllabus twice per year (Fall Semester and Winter Semester, annually, instead of Fall Semester and Spring Term).

2. BIOL 100H will be taught annually in Spring Term rather than in Winter Semester. This change is made to accommodate the move of BIOL 265 to the Winter Semester.

3. A formal course number will be sought for the course currently taught as BIOL 390R (Pathogenic Microbiology) to alternate annually with BIOL 330/L during First Term. This change is desired to further increase the courses available to students during the summer terms and to meet the demand of pre-professional students seeking further exposure to the principles and techniques of pathogenic microbiology; this course will be taught on alternating years during First Term.

With the approval of these changes, Dr. Gold’s teaching schedule will appear as follows, retaining essentially the same number of hours:

**Winter Semester 2011:**
- BIOL 265/265L (Molecular and Cellular Biology + Lab) (6)
- BIOL 441/441L (Advanced Molecular Biology + Lab) (6)
- BIOL 492 (Research and Thesis [Team]) (1)
- BIOL 496R (Student Research) (1)

**Spring Term 2011:**
- BIOL 100H (Honors General Biology) (3)

**First Term 2011 (Alternating years):**
- BIOL 320R/320RL (Pathogenic Microbiology + Lab) [Even years] (6)
- BIOL 330/330L (Bioinformatics + Lab) [Odd years]

**Fall Semester 2011:**
- BIOL 265/265L (Molecular and Cellular Biology + Lab) (6)
- BIOL 445/445L (Immunology + Lab) (6)
- BIOL 492 (Research and Thesis [Team]) (1)

**Total:** (36)

The creation of BIOL 330 (Bioinformatics) does not affect graduation requirements as it is an elective course that students may choose to help enhance their focus in biological research. This course would provide upper level Biology and Biochemistry students greater choices for enrollment during the First Term.

The costs associated with the creation of this course are expected to be inconsequential. All the computer programs used for this course are available at no charge through government-sponsored web sites (such as the National Center for Biotechnology Information [NCBI]) and via special academic licenses from private software vendors. No new computers or special equipment will be needed. No new library acquisitions will be required.

The biology faculty were in general agreement that this course should be adopted. There is some concern that the addition of new courses will decrease enrollment in our existing elective courses; however, the faculty agree that in order to attract more upper division students to the summer terms, we need to offer more upper division courses during these periods. This course will be taught on an alternating basis (even years) with BIOL 320/L Pathogenic
Microbiology (odd years); Pathogenic Microbiology has been taught twice (2009 and 2010) as a BIOL 390R Special Topics course without effecting a decrease in enrollment in our current elective courses. There is consensus that this Bioinformatics course, which has been strongly recommended by the On-site Assessment Committee (June 2008), is a necessary and desirable course for our students.
Section 4 - Course Proposal (core)

Upon approval, the information presented on this course proposal sheet will become binding on the department and the university. Any material changes require a new course proposal.

Effective Date: Immediately upon approval

College: Math and Sciences

Course Prefix: BIOL

Course Number: 330

NEW COURSE.

Full Title: Bioinformatics

Short Title (for Transcript, 30-char max): Bioinformatics

Catalog Entry (50-word recommended maximum): (1st – odd years) Computational methods for the study of biological sequence data. Techniques for searching sequence databases, sequence alignments, phylogenetics, pattern recognition and functional inference from sequence data. Concurrent registration in BIOL 330L required. (Prerequisite: Science Core).

Prerequisites: Science Core

Credit Hours: 3

Grading Method: Letter grade

Course Fees: n/a

Learning Objectives: Each student who passes this course will be able to do the following:

1. Explain the historical foundation of the field of bioinformatics
2. Access and use the key databases and software of bioinformatics
3. Perform pairwise and multiple sequence alignments and be able to interpret the results
4. Create phylogenetic trees and explain their significance as it relates to gene relationships and protein function
5. Be able to use the tools of bioinformatics in their own research
6. Understand and use the key vocabulary required to communicate with others who use the tools of bioinformatics

Assessment Methods: The course grade will be based on a point system with points earned through exams, quizzes, and projects. The projects will introduce students to the actual software and databases that are routinely used for bioinformatics research and analysis. These projects will guide students through their use and will require careful analysis of the output according to accepted scientific and statistical standards.

A sample syllabus is attached as is a copy of the online catalog web pages that should change as a result of this proposal.
Section 4 - Course Proposal (core)

Upon approval, the information presented on this course proposal sheet will become binding on the department and the university. Any material changes require a new course proposal.

Effective Date: Immediately upon approval

College: Math and Sciences

Course Prefix: BIOL

Course Number: 330L

NEW COURSE.

Full Title: Bioinformatics Laboratory

Short Title (for Transcript, 30-char max): Bioinformatics Lab

Catalog Entry (50-word recommended maximum): Laboratory for Bioinformatics. To be taken concurrently with BIOL 330.

Prerequisites: n/a

Credit Hours: 1

Grading Method: Letter grade

Course Fees: n/a

Learning Objectives: Each student who passes this course will be able to do the following:

1. Explain the historical foundation of the field of bioinformatics
2. Access and use the key databases and software of bioinformatics
3. Perform pairwise and multiple sequence alignments and be able to interpret the results
4. Create phylogenetic trees and explain their significance as it relates to gene relationships and protein function
5. Be able to use the tools of bioinformatics in their own research
6. Understand and use the key vocabulary required to communicate with others who use the tools of bioinformatics

Assessment Methods: The course grade will be based on a point system with points earned through exams, quizzes, and projects. The projects will introduce students to the actual software and databases that are routinely used for bioinformatics research and analysis. These projects will guide students through their use and will require careful analysis of the output according to accepted scientific and statistical standards.

A sample syllabus is attached as is a copy of the online catalog web pages that should change as a result of this proposal.
Syllabus
Biology 330/L: Bioinformatics (4 CR)
First Term 2011

Instructor: Roger Shane Gold
Office: McKay 140B
Telephone: (808) 675-3681
e-mail: goldr@byuh.edu

Class Information:
Lecture: Tuesdays and Thursdays 7:40 - 10:50 AM [MCK 133]
Lab: Tuesdays and Thursdays 12:10 - 3:20 PM [MCK 118]

Pre-requisites
Successful completion of Science Core.

Required Text:

Catalog Description:
An introduction to computational methods used for the study of biological sequence data including techniques for searching sequence databases, pairwise and multiple sequence alignment, phylogenetic methods, and methods for pattern recognition and functional inference from sequence data.

Instructional methods:
Learning will be promoted through lectures, presentations, case studies, research papers and laboratory exercises.

Course Objectives:

Each student who passes this course will be able to do the following:

1. Explain the historical foundation of the field of bioinformatics
2. Access and use the key databases and software of bioinformatics
3. Perform pairwise and multiple sequence alignments and be able to interpret the results
4. Create phylogenetic trees and explain their significance as it relates to gene relationships and protein function
5. Be able to use the tools of bioinformatics in their own research
6. Understand and use the key vocabulary required to communicate with others who use the tools of bioinformatics
### Departmental Objectives

<table>
<thead>
<tr>
<th>Departmental Objective</th>
<th>Degree to which addressed in course</th>
<th>How addressed in course</th>
</tr>
</thead>
<tbody>
<tr>
<td>Understand what makes life unique</td>
<td>Practiced with feedback</td>
<td>All lectures, discussions, quizzes and research papers.</td>
</tr>
<tr>
<td>Be able to describe the history of life from a biological perspective</td>
<td>Practiced with feedback</td>
<td>All lectures, discussions, quizzes and research papers.</td>
</tr>
<tr>
<td>Understand the unifying principles of biology</td>
<td>Practiced with feedback</td>
<td>All lectures, discussions, quizzes and research papers.</td>
</tr>
<tr>
<td>Recognize and discuss current biological issues and their impact on society</td>
<td>Practiced with feedback</td>
<td>Both the lecture and lab components will discuss current events coupled with classical experiments.</td>
</tr>
<tr>
<td>Demonstrate content knowledge of the discipline</td>
<td>Practiced with feedback</td>
<td>All lectures, research papers and exams.</td>
</tr>
<tr>
<td>Read, write, and understand biological literature</td>
<td>Practiced with feedback</td>
<td>Exposure to primary source literature in understanding pathogenicity.</td>
</tr>
<tr>
<td>Learn how to conduct research through use of the scientific method</td>
<td>Practiced with feedback</td>
<td>Laboratory experience is based on exposure to, and practice with, clinical methodology in current use.</td>
</tr>
<tr>
<td>Have the opportunity to prepare for graduate or professional school and/or success in the biological job market</td>
<td>Practiced with feedback</td>
<td>The laboratory experience teaches and reinforces the basic skill set required for success in graduate school and molecular biology research laboratories.</td>
</tr>
<tr>
<td>Realize appropriate stewardship accountabilities and the need to help improve society</td>
<td>Practiced with feedback</td>
<td>All lectures, discussions, quizzes and research papers.</td>
</tr>
</tbody>
</table>

### Grades:

The course grade will be based on a point system with points earned through exams, quizzes, and projects, as outlined below:

<table>
<thead>
<tr>
<th>Contribution</th>
<th>Point Value</th>
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</thead>
<tbody>
<tr>
<td>Exams (3 exams @ ~100 points)</td>
<td>300</td>
</tr>
<tr>
<td>Daily Writing Assignments (10 assignments @ 15 points)</td>
<td>150</td>
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<tr>
<td>Lab projects (11 @ 20 points)</td>
<td>220</td>
</tr>
<tr>
<td></td>
<td>670 points</td>
</tr>
</tbody>
</table>
Grading Scale

92.5 - 100%  A
90.0 - 92.4%  A-
87.5 - 89.9%  B+
82.5 - 87.4%  B
80.0 - 82.4%  B-
77.5 - 79.9%  C+
72.5 - 77.4%  C
70.0 - 72.4%  C-
67.5 - 69.9%  D+
62.5 - 67.4%  D
60.0 - 62.4%  D-
0 - 59.9%  F

Exams. Three unit exams will be administered throughout this course. The unit exams will be administered in the Testing Center on XXXXX and on XXXXX, and the final exam will be administered during our regularly scheduled lab time on XXXXX. Each exam will be comprehensive. Thorough note-taking and thoughtful answers to the questions associated with the Daily Writing Assignments should prepare students well for these exams. Students must take each exam at the indicated time and place unless a prior agreement can be reached with the instructor. Each exam will be worth 100 points.

Daily Writing Assignments. A set of 5-10 questions will be provided at the end of each day’s lecture; the type-written answers to these questions will be due at the beginning of the next lecture period and you must be prepared to discuss these in class. These questions require thoughtful answers based on your reading assignment for that day and must be typed and answered in your own words. Three points will be provided for each thoughtful answer; 2 points for partially correct or rote answers, and 1 point for incorrect answers. Because your answers to these questions form the basis for our in-class discussions, no credit will be given for late work. These questions are intended to help you stay current with the material and to discover critical concepts from the lectures and reading assignments.

Lab projects. A lab protocol will be provided for each laboratory period. A series of questions, designed to help you discover and explore important concepts will be provided with each protocol. The answers to these questions constitute the lab report for this class; the answers should be typed, answered fully, and written in complete sentences. Each lab report is worth 20 points and is due 1 week from the date of the lab, unless otherwise instructed.

Lab final exam. A laboratory final exam is scheduled for XXXX in MCK 118 during our regularly scheduled lab time. This exam will be comprehensive for the laboratory portion of this class and will focus on the assays (mechanisms and expected results) explored throughout this course. Thoughtful answers to the questions associated with each lab protocol should prepare students well for this exam. Students must take this exam at the indicated time and place unless a prior agreement can be reached with the instructor. This exam is worth 100 points.

Policies:

Attendance and Participation. We will be covering an extensive amount of material in a very short period of time with each subsequent topic building upon a thorough understanding of the last. Accordingly, attendance in class and lab is critical and required. To reinforce this, attendance and participation will be recorded in every class and will be taken into account when calculating final grades. Attendance will be
taken at the beginning of class; if a student arrives after attendance has been taken they will be counted as absent.

Preventing Sexual Harassment. Title IX of the education amendments of 1972 prohibits sex discrimination against any participant in an educational program or activity that receives federal funds, including Federal loans and grants. Title IX also covers student-to-student sexual harassment. If you encounter unlawful sexual harassment or gender-based discrimination, please contact the Human Resource Service at 808-780-8875 (24 hours).

Special Needs. Brigham Young University-Hawaii is committed to providing a working and learning atmosphere, which reasonably accommodates qualified person with disabilities. If you have any disability that may impair your ability to complete this course successfully, please contact the students with Special Needs Counselor Leilani Auna at 808-675-3999 or 808-675-3518. Reasonable academic accommodations are reviewed for all students who have qualified documented disabilities. If you need assistance or if you feel you have been unlawfully discriminated against on the basis of disability, you may seek resolution through established grievance policy and procedures. You should contact the Human Resource Services at 808-780-8875.

Honor code. Honor code standards will be strictly enforced in this class. This includes the Dress and Grooming Standards (http://services.byuh.edu/honorcode/Dress_and_Grooming) and the Academic Honesty Policy (http://services.byuh.edu/honorcode/Academic_Honesty_Policy). Any student who arrives to class out of standards will be asked to leave and will be permitted to return only when properly attired. Any student who violates the Academic Honesty Policy, including, but not limited to, plagiarism, fabrication or falsification, and cheating, will receive no credit for the assignment and may be reported to the Office of Honor; any repetition will result in a failing grade for the class. In addition, all students have a right to be treated with respect and courtesy and to study in a safe and supportive environment while enrolled at BYU-Hawaii, and any student who violates these rights for another will be asked to correct their behavior or to leave the classroom; appropriate action, including a failing grade and/or a report filed with the Office of Honor will be taken against any student who repeatedly shows a lack of respect, or who creates an unsafe environment, for any other member of our university community.

Blackboard

A variety of materials will be placed on Blackboard throughout the semester, including assignments, study guides, laboratory procedures, and lecture materials. Please make certain you have access to our class material on the Blackboard system (http://blackboard.byu.edu). If you have any difficulties accessing our class material, please contact Blackboard Support (bboard@byuh.edu or 808-675-3847)

Suggestions for doing well in this course
1. Attend all classes; do not arrive late or leave early
2. Prepare for each lecture by reading assigned book chapters before class and putting a sincere and thoughtful effort into answering each question associated with the Daily Writing Assignment.
3. Actively participate in discussions by asking relevant questions and contributing answers and opinions
4. Allocate at least 3 or 4 hours of study outside of the classroom for each lecture throughout the course; do not be tempted to rely on cramming techniques.
### Tentative Lecture Schedule

<table>
<thead>
<tr>
<th>Date</th>
<th>Chapter</th>
</tr>
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<tbody>
<tr>
<td>Day 1</td>
<td>Historical Perspective</td>
</tr>
<tr>
<td>Day 2</td>
<td>Biological sequence databases: storage and retrieval</td>
</tr>
<tr>
<td>Day 3</td>
<td>Pairwise sequence alignments</td>
</tr>
<tr>
<td>Day 4</td>
<td>Probability and Statistical Analysis</td>
</tr>
<tr>
<td>Day 5</td>
<td>Multiple sequence alignments</td>
</tr>
<tr>
<td>Day 6</td>
<td>Predictive models: Proteins function I</td>
</tr>
<tr>
<td>Day 7</td>
<td>Predictive models: Proteins function II</td>
</tr>
<tr>
<td>Day 8</td>
<td>Phylogenetic Prediction</td>
</tr>
<tr>
<td>Day 9</td>
<td>Phylogenetic Analysis</td>
</tr>
<tr>
<td>Day 10</td>
<td>Predictive models: Protein structure I</td>
</tr>
<tr>
<td>Day 11</td>
<td>Predictive models: Protein structure II</td>
</tr>
<tr>
<td>Day 12</td>
<td>Predictive models: RNA secondary structure</td>
</tr>
<tr>
<td>Day 13</td>
<td>Predictive models: Gene regulation</td>
</tr>
<tr>
<td>Day 14</td>
<td>Genome analysis</td>
</tr>
</tbody>
</table>

### Tentative Laboratory Schedule

<table>
<thead>
<tr>
<th>Date</th>
<th>Laboratory Exercise</th>
</tr>
</thead>
<tbody>
<tr>
<td>Day 1</td>
<td>I. Molecular sequence databases; NCBI, NBIF, &amp; Biology Workbench interfaces; Key word, taxonomic, and BLAST searches</td>
</tr>
<tr>
<td>Day 2</td>
<td>II. Analysis of search results; Refining searches</td>
</tr>
<tr>
<td>Day 3</td>
<td>III. Analysis of raw sequence data</td>
</tr>
<tr>
<td>Day 4</td>
<td>IV. Gene finding &amp; annotation</td>
</tr>
<tr>
<td>Day 5</td>
<td>V. Plasmid mapping; Primer design</td>
</tr>
<tr>
<td>Day 6</td>
<td>VI. Laboratory Exam I</td>
</tr>
<tr>
<td>Day 7</td>
<td>VII. Multiple sequence alignment</td>
</tr>
<tr>
<td>Day 8</td>
<td>VIII. Tree building by parsimony &amp; maximum likelihood</td>
</tr>
<tr>
<td>Day 9</td>
<td>IX. SwissProt &amp; PDB databases; Motifs &amp; profile analysis</td>
</tr>
<tr>
<td>Day 10</td>
<td>X. 3D structure viewers</td>
</tr>
<tr>
<td>Day 11</td>
<td>XI. Secondary structure analysis</td>
</tr>
<tr>
<td>Day 12</td>
<td>XII. Laboratory Exam II</td>
</tr>
<tr>
<td>Day 13</td>
<td>XIII. Lecture Final Exam</td>
</tr>
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</table>
265. Molecular and Cellular Biology (3) (F, Sp) A course in the molecular activities of living cells, including protein structure and function, DNA replication and repair, gene expression, cell division, membrane physiology, metabolism and molecular genetics. Concurrent registration in or completion of BIOL 265L required. (Prerequisites: Successful completion with a C- or better in CHEM 103).

265L. Molecular and Cellular Biology Laboratory (1) (F, Sp) Laboratory for Molecular and Cellular Biology. To be taken concurrently with BIOL 265. Fee required.

300. Animal Behavior (3) (W—odd years) The study of behavior from an evolutionary perspective. Emphasis on social patterns of behavior including: altruism, optimality, reproduction, parental investment, aggression, and spatial relationships. Concurrent registration in or completion of BIOL 300L required. (Prerequisite: Science Core).

300L. Animal Behavior Laboratory (1) (W—odd years) Laboratory for Animal Behavior. Concurrent registration in or completion of BIOL 300 required. Fee required.

350. General Ecology (3) (F) A study of plant and animal interactions that determine the distribution and abundance of organisms. Concurrent registration in or completion of BIOL 350L required. (Prerequisite: Science Core and BIOL 201/L or BIOL 206/L)

350L. General Ecology Laboratory (1) (F) Laboratory for General Ecology. Concurrent registration in or completion of BIOL 350 required. Fee required.

374. Evolution and Human Prehistory (3) (W—even years) This course explores the biological process of evolution as well as the field of human paleontology and the co-evolution of human culture and the physical type. Course is cross listed (see ANTH 374). (Prerequisite: BIOL 100 for non-science majors and Science Core for science majors)

376. Genetics (3) (F) A general course in the principles of Mendelian and evolutionary genetics. Concurrent registration in or completion of BIOL 376L required. (Prerequisite: Science Core)

376L. Genetics Laboratory (1) (F) Laboratory for Genetics. Concurrent registration in or completion of BIOL 376 required. Fee required.

The following should be inserted at the location indicated by the arrow, above:

330. Bioinformatics (3) (1st – odd years) Computational methods for the study of biological sequence data. Techniques for searching sequence databases, sequence alignments, phylogenetics, pattern recognition and functional inference from sequence data. Concurrent registration in BIOL 330L required. (Prerequisite: Science Core).

330L. Bioinformatics Laboratory (1) (1st – odd years) Laboratory for Bioinformatics. Concurrent registration of BIOL 330 required.
1. Molecular Biology

Students interested in pursuing employment or graduate studies in Molecular Biology should enroll in the following:

- Science Core (15 Hours)
- Pre-Professional Biology Core (12 Hours)
- Chemistry Core (8 Hours)
- Electives (25 Hours Minimum)

Molecular Biology Courses

- BIOL 201/L General Botany (4) or BIOL 206/L General Zoology (4)
- BIOL 220/L Microbiology (4)
- BIOL 383/L History and Developmental Biology (4)
- BIOL 441/L Molecular Biology (4)
- BIOL 442/L Cellular Biology (4)
- BIOL 443/L Immunology (4)
- CHEM 381/L Biochemistry I (4)

Other Recommended Biology Courses

- BIOL 248/L Conservation Biology (4)
- BIOL 350/L General Ecology (4)
- BIOL 374/L Evolution & Human Prehistory (3)
- CHEM 382/L Biochemistry II (4)

Other Recommended Non-Elective Physical Science Courses

- PHYS 121/L General Physics I (4)
- PHYS 221/L General Physics III (4)

2. Pre-professional Program

Students interested in continuing their education at professional schools (medicine, dentistry, pharmacy, optometry, etc.) should consult with the preprofessional faculty advisor early in their undergraduate career to prepare a proper course of study. Students should enroll in the following courses:

- Science Core (15 Hours)
- Pre-Professional Biology Core (12 Hours)
- Chemistry Core (8 Hours)
- Electives (25 Hours Minimum)

Pre-Professional Courses

- BIOL 260/L Elementary Human Anatomy (3)
- BIOL 261/L Elementary Human Physiology (4)
- BIOL 383/L Histology and Developmental Biology (4)
- BIOL 441/L Molecular Biology (4)
- BIOL 442/L Cellular Biology (4)
- BIOL 445/L Immunology (4)
- BIOL 447/L Advanced Human Anatomy (3)
- BIOL 445/L Principles of Physiology Laboratory (4)

Other Recommended Biology Courses

- BIOL 248/L Conservation Biology (4)
- BIOL 350/L General Ecology (4)
- BIOL 374/L Evolution & Human Prehistory (3)
Summary:
The purpose of this proposal is to create an elective course (BIOL 340) for students interested in the design and analysis of experiments, an integral part of science. This course is intended to be offered every spring session. This course will prepare students for careers in all fields of biology, and will provide the circular resources necessary to facilitate the goal of graduating students in three years.

The Biology department currently teaches a number of research courses that prepare students well for a basic understanding of the scientific process but do not focus on the design of experiments. This advanced course will extend a student’s understanding into not only design but also proper scientific analysis. This class is expected to appeal to all biology students. This course will add to the number of courses offered during the spring terms thereby giving upper level students in biology and biochemistry further options for course enrollment during a period when very few upper division courses are currently offered; accordingly this offering should help facilitate the three year graduation plan. Because this is an elective course, no changes to student course load would result.

This course has been taught twice as BIOL 390R. Thirteen student enrolled last spring. Reviews of the course were positive.

This course will be taught by Dr Randy Day whose undergraduate, masters, and doctoral training is in experimental physiology. Dr Day is currently serving under the augmented contract; his 2010 teaching schedule was as follows: (reduced load for Associate Dean)

<table>
<thead>
<tr>
<th>Winter Semester 2010:</th>
<th>Contact Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOL 112 (General Biology for Majors)</td>
<td>(3)</td>
</tr>
<tr>
<td>BIOL 465/465L (Principles of Physiology + Lab)</td>
<td>(6)</td>
</tr>
<tr>
<td>BIOL 493 (Research and Thesis [Team taught])</td>
<td>(1)</td>
</tr>
<tr>
<td>BIOL 496R (Student Research)</td>
<td>(1)</td>
</tr>
<tr>
<td>Spring Term 2010:</td>
<td></td>
</tr>
<tr>
<td>BIOL 390R (Experimental Design and Analysis)</td>
<td>(3)</td>
</tr>
<tr>
<td>BIOL 493 (Research and Thesis [Team taught])</td>
<td>(1)</td>
</tr>
<tr>
<td>First Term 2010</td>
<td></td>
</tr>
<tr>
<td>BIOL 390R/390RL (Pathophysiology)</td>
<td>(3)</td>
</tr>
<tr>
<td>Fall Semester 2010:</td>
<td></td>
</tr>
<tr>
<td>BIOL 112 (General Biology for Majors)</td>
<td>(3)</td>
</tr>
<tr>
<td>BIOL 376/376L (Genetics + Lab)</td>
<td>(6)</td>
</tr>
<tr>
<td>BIOL 493 (Research and Thesis [Team taught])</td>
<td>(1)</td>
</tr>
<tr>
<td>BIOL 496R (Student Research)</td>
<td>(1)</td>
</tr>
</tbody>
</table>

Total: (29)
The creation of BIOL 340 (Experimental Design and Analysis) does not affect graduation requirements, it is an elective. This course would provide upper level Biology and Biochemistry students greater choices for enrollment during the Summer Term.

There are associated costs with the creation of this course are expected to be minor. No new acquisitions will be required by the library. The vote by the biology faculty was unanimous for the formal adoption of this course.
Section 4 - Course Proposal (core)

Upon approval, the information presented on this course proposal sheet will become binding on the department and the university. Any material changes require a new course proposal.

Effective Date: Immediately upon approval

College: Math and Sciences

Course Prefix: BIOL

Course Number: 340

NEW COURSE.

Full Title: Experimental Design and Analysis

Short Title (for Transcript, 30-char max): Experimental Design and Analysis

Catalog Entry (50-word recommended maximum): (Spring Session) A course which explains how to determine objectives of an experiment and how to select process factors for the selected study and how to choose the appropriate statistical test. (Prerequisite: Science Core).

Prerequisites: Science Core

Credit Hours: 3

Grading Method: Letter grade

Course Fees: n/a

Learning Objectives: Each student who passes this course will be able to do the following:
1. Describe the underlying principles of experimental design.
2. Understand the strengths and weakness of different designs.
3. Understand the role of controls, sample size and power on design choice.
4. Understand the differences of parametric and nonparametric analysis.
5. Describe the proper uses of different statistical tests.

Assessment Methods: The course grade will be based on a point system with points earned through exams and case studies.
Syllabus  
Biology 340: Experimental Design and Analysis (3 CR)

Instructor:  Randy Day  
Office:  McKay 108A  
Telephone:  (808) 675-3809  
e-mail:  dayr@byuh.edu

Pre-requisites  
Successful completion of Science Core (C minus or better).

Required Text:  

Course Description:  
This course will review the requirements necessary to implement standard designs for scientific experimentation and the application of appropriate statistical tests.

Instructional methods:  
Learning will be promoted through lectures, presentations, and case studies.

Course Objectives:

Upon completion of this course each student should be able to:  
1. Describe the underlying principles of experimental design.  
2. Understand the strengths and weakness of different designs.  
3. Understand the role of controls, sample size and power on design choice.  
4. Understand the differences of parametric and nonparametric analysis.  
5. Describe the proper uses of different statistical tests.
Departmental Objectives

<table>
<thead>
<tr>
<th>Departmental Objective</th>
<th>Degree to which addressed in course</th>
<th>How addressed in course</th>
</tr>
</thead>
<tbody>
<tr>
<td>Understand what makes life unique</td>
<td>Limited</td>
<td></td>
</tr>
<tr>
<td>Be able to describe the history of life from a biological perspective</td>
<td>Limited</td>
<td></td>
</tr>
<tr>
<td>Understand the unifying principles of biology</td>
<td>Limited</td>
<td></td>
</tr>
<tr>
<td>Recognize and discuss current biological issues and their impact on society</td>
<td>Practiced with feedback</td>
<td>Both the lecture and case studies.</td>
</tr>
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<td>Demonstrate content knowledge of the discipline</td>
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</tr>
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<td>Read, write, and understand biological literature</td>
<td>Practiced with feedback</td>
<td>Central to all lectures and case studies.</td>
</tr>
<tr>
<td>Learn how to conduct research through use of the scientific method</td>
<td>Practiced with feedback</td>
<td>Central to all lectures and case studies.</td>
</tr>
<tr>
<td>Have the opportunity to prepare for graduate or professional school and/or success in the biological job market</td>
<td>Practiced with feedback</td>
<td>Central to all lectures and case studies.</td>
</tr>
<tr>
<td>Realize appropriate stewardship accountabilities and the need to help improve society</td>
<td>Limited</td>
<td></td>
</tr>
</tbody>
</table>

Grades:

The course grade will be based on a point system with points earned through exams and case studies as outlined below:

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<tr>
<th>Exercise</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exams (2 exams @ ~100 points)</td>
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</tr>
<tr>
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<tr>
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<td>50</td>
</tr>
<tr>
<td></td>
<td>350</td>
</tr>
</tbody>
</table>
Grading Scale
90 - 100%  A
80 - 89%   B
70 - 79%   C
60 - 69%   D
0 - 59%    F

Blackboard
A variety of materials will be placed on Blackboard throughout the semester, including assignments, study guides, laboratory procedures, and lecture materials. Please make certain you have access to our class material on the Blackboard system (http://blackboard.byu.edu) and that your email address, listed in Blackboard, works properly. If you have any difficulties accessing our class material, please contact Blackboard Support (bboard@byuh.edu or 808-675-3847).

Policies:

Preventing Sexual Harassment. Title IX of the education amendments of 1972 prohibits sex discrimination against any participant in an educational program or activity that receives federal funds, including Federal loans and grants. Title IX also covers student-to-student sexual harassment. If you encounter unlawful sexual harassment or gender-based discrimination, please contact the Human Resource Service at 808-780-8875 (24 hours).

Special Needs. Brigham Young University-Hawai‘i is committed to providing a working and learning atmosphere, which reasonably accommodates qualified person with disabilities. If you have any disability that may impair your ability to complete this course successfully, please contact the students with Special Needs Counselor Leilani Auna at 808-675-3999 or 808-675-3518. Reasonable academic accommodations are reviewed for all students who have qualified documented disabilities. If you need assistance or if you feel you have been unlawfully discriminated against on the basis of disability, you may seek resolution through established grievance policy and procedures. You should contact the Human Resource Services at 808-780-8875.

Honor code. Honor code standards will be strictly enforced in this class. This includes the Dress and Grooming Standards (http://services.byuh.edu/honorcode/Dress_and_Grooming) and the Academic Honesty Policy (http://services.byuh.edu/honorcode/Academic_Honesty_Policy). Any student who arrives to class out of standards will be asked to leave and will be permitted to return only when properly attired. Any student who violates the Academic Honesty Policy, including, but not limited to, plagiarism, fabrication or falsification, and cheating, will receive no credit for the assignment and may be reported to the Office of Honor; any repetition will result in
a failing grade for the class. In addition, all students have a right to be treated with respect and courtesy and to study in a safe and supportive environment while enrolled at BYU-Hawaii, and any student who violates these rights for another will be asked to correct their behavior or to leave the classroom; appropriate action, including a failing grade and/or a report filed with the Office of Honor will be taken against any student who repeatedly shows a lack of respect, or who creates an unsafe environment, for any other student or faculty member of this university.

Suggestions: You should plan on at least two productive hours of study for each hour of in class time. This study may include group discussions, reviewing notes, reading in advance and follow up reading. If you have questions or something you do not understand please come and talk to me.

<table>
<thead>
<tr>
<th>Tentative Lecture Schedule</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Date</strong></td>
</tr>
<tr>
<td>Day 1</td>
</tr>
<tr>
<td>Day 2,3</td>
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<tr>
<td>Day 4</td>
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<td>Day 5,6</td>
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<td>Day 7,8</td>
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<td>Day 9</td>
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<tr>
<td>Day 10</td>
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<tr>
<td>Day 11,12</td>
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<tr>
<td>Day 13</td>
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<tr>
<td>Day 14, 15</td>
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<tr>
<td>Day 16,17,18</td>
</tr>
<tr>
<td>Day 19,20</td>
</tr>
<tr>
<td>Day 21</td>
</tr>
</tbody>
</table>
300. Animal Behavior (3) (W—odd years) The study of behavior from an evolutionary perspective. Emphasis on social patterns of behavior including: altruism, optimality, reproduction, parental investment, aggression, and spatial relationships. Concurrent registration in or completion of BIOL 300L required. (Prerequisite: Science Core).

300L. Animal Behavior Laboratory (1) (W—odd years) Laboratory for Animal Behavior. Concurrent registration in or completion of BIOL 300 required. Fee required.

→

350. General Ecology (3) (F) A study of plant and animal interactions that determine the distribution and abundance of organisms. Concurrent registration in or completion of BIOL 350L required. (Prerequisite: Science Core and BIOL 201/L or BIOL 206/L)

350L. General Ecology Laboratory (1) (F) Laboratory for General Ecology. Concurrent registration in or completion of BIOL 350 required. Fee required.

374. Evolution and Human Prehistory (3) (W—even years) This course explores the biological process of evolution as well as the field of human paleontology and the co-evolution of human culture and the physical type. Course is cross listed (see ANTH 374). (Prerequisite: BIOL 100 for non-science majors and Science Core for science majors)

376. Genetics (3) (F) A general course in the principles of Mendelian and evolutionary genetics. Concurrent registration in or completion of BIOL 376L required. (Prerequisite: Science Core)

376L. Genetics Laboratory (1) (F) Laboratory for Genetics. Concurrent registration in or completion of BIOL 376 required. Fee required.

383. Histology and Developmental Biology (3) (W) This course emphasizes cell anatomy, histology and embryology. Concurrent registration in or completion of BIOL 383L required. (Prerequisite: Science Core)

383L. Histology and Developmental Biology Laboratory (1) (W) Laboratory for Histology and Developmental Biology. Concurrent registration in or completion of BIOL 383 required. Fee required.

390R. Special Topics in Biology (1-4) (Variable).

399R. Internship in Biology (1-12) (1st, F, W, Sp, Su) Credit for applied experience in biology. This course cannot count toward the 41-44 hours of Biology Major requirements. (Prerequisite: Department Consent.)

The following should be inserted at the location indicated by the arrow, above:

340. Experimental Design and Analysis (3) (Spring Session) A course which explains how to determine objectives of an experiment and how to select process factors for the selected study and how to choose the appropriate statistical test. (Prerequisite: Science Core).
Online Catalog web page (Undergraduate majors) [http://catalog.byuh.edu/node/93]

1. General Biology
   - Science Core (15 Hours)
   - General Biology Core (12 Hours)
   - Chemistry Core (8 Hours)
   - Electives (25 Hours Minimum)
     - General Biology Courses
       - BIOL 204/L Pacific Natural History (4)
       - BIOL 212/L Marine Biology (4)
       - BIOL 220/L Microbiology (4)
       - BIOL 248/L Conservation Biology (4)
       - BIOL 300/L Animal Behavior (4)
       - BIOL 340 Experimental Design and Analysis (3)
       - BIOL 350/L General Ecology (4)
       - BIOL 374 Evolution & Human Prehistory (3)
     - Other recommended Biology Courses
       - BIOL 260/L Elementary Human Anatomy (4)
       - BIOL 261/L Elementary Human Physiology (4)
       - BIOL 376/L Genetics (4)
       - BIOL 383/L History & Developmental Biology (4)
       - BIOL 412/L Marine Ecology (4)
       - BIOL 441/L Molecular Ecology (4)
       - BIOL 445/L Immunology (4)
       - BIOL 465/L Principles of Physiology (3)
     - Other recommended Non-Elective Physical Science Courses
       - PHYS 121/L General Physics I (4)
       - PHYS 221/L General Physics III (4)

2. Marine Biology
   - Science Core (15 Hours)
   - General Biology Core (12 Hours)
   - Chemistry Core (8 Hours)
   - Electives (25 Hours Minimum)
     - Marine Biology Courses
       - BIOL 204/L Pacific Natural History (4)
       - BIOL 212/L Marine Biology (4)
       - BIOL 248/L Conservation Biology (4)
       - BIOL 300/L Animal Behavior (4)
       - BIOL 340 Experimental Design and Analysis (3)
       - BIOL 350/L General Ecology (4)
       - BIOL 412/L Marine Ecology (4)
       - OCEN 201 Science of the Sea (3)
     - Other recommended Biology Courses
       - BIOL 220/L Microbiology (4)
       - BIOL 261/L Elementary Human Physiology (4)
       - BIOL 374 Evolution & Human Prehistory (3)
       - BIOL 376/L Genetics (4)
• Other recommended Non-Elective Physical Science Courses
  • PHYS 121/L General Physics I (4)
  • PHYS 221/L General Physics III (4)
  • GEOL 101 Geology of the Pacific Basin (3)

3. Molecular Biology
   • Science Core (15 Hours)
   • Pre-Professional Biology Core (12 Hours)
   • Chemistry Core (8 Hours)
   • Electives (25 Hours Minimum)
     • Molecular Biology Courses
       • BIOL 201/L General Botany (4) or BIOL 206/L General Zoology (4)
       • BIOL 220/L Microbiology (4)
       • BIOL 383/L History & Developmental Biology (4)
       • BIOL 441/L Molecular Biology (4)
       • BIOL 442/L Cellular Biology (4)
       • BIOL 445/L Immunology (4)
       • CHEM 381/L Biochemistry I (4)
     • Other Recommended Biology Courses
       • BIOL 248/L Conservation Biology (4)
       • BIOL 340 Experimental Design and Anyalysis (3)
       • BIOL 350/L General Ecology (4)
       • BIOL 374 Evolution & Human Prehistory (3)
       • CHEM 382/L Biochemistry II (4)
     • Other recommended Non-Elective Physical Science Courses
       • PHYS 121/L General Physics I (4)
       • PHYS 221/L General Physics III (4)

4. PRE-PROFESSIONAL PROGRAM
   • Pre-Professional Biology Core (12 Hours)
   • Chemistry Core (8 Hours)
   • Electives (25 Hours Minimum)
     • Pre-Professional Courses
       • BIOL 260/L Elementary Human Anatomy (3)
       • BIOL 261/L Elementary Human Physiology (4)
       • BIOL 383/L Histology and Developmental Biology (4)
       • BIOL 441/L Molecular Biology (4)
       • BIOL 442/L Cellular Biology (4)
       • BIOL 445/L Immunology (4)
       • BIOL 460/ Advanced Human Anatomy (3)
       • BIOL 465/L Principles of Physiology Laboratory (4)
     • Other Recommended Biology Courses
       • BIOL 248/L Conservation Biology (4)
       • BIOL 340 Experimental Design and Anyalysis (3)
Summary:
The purpose of this proposal is to create an elective course (BIOL 475) for students interested in the study of physiology. This course is intended to be offered every in the summer term. This course will prepare students for careers in the medical fields, and will provide the circular resources necessary to facilitate the goal of graduating students in three years.

The Biology department currently teaches introductory physiology courses that prepare students well for a basic understanding of normal physiological process. This advanced course in pathophysiology will extend a student's understanding into important medically related topics. This class is expected to appeal primarily to those students interested in preprofessional biology, and the medical professions. This course will add to the number of courses offered during the summer terms thereby giving upper level students in biology and biochemistry further options for course enrollment during a period when very few upper division courses are currently offered; accordingly this offering should help facilitate the three year graduation plan. Because this is an elective course, no changes to student course load would result.

This course has been taught once as BIOL 390R. Twelve student enrolled and reviews were positive.

This course will be taught by Dr Randy Day whose undergraduate, masters, and doctoral training is in physiology. Dr Day is currently serving under the augmented contract; his 2010 teaching schedule was as follows: (reduced load for Associate Dean)

 **Winter Semester 2010:**
- BIOL 112 (General Biology for Majors) (3)
- BIOL 465/465L (Principles of Physiology + Lab) (6)
- BIOL 493 (Research and Thesis [Team taught]) (1)
- BIOL 496R (Student Research) (1)

 **Spring Term 2010:**
- BIOL 390R (Experimental Design and Analysis) (3)

 **First Term 2010:**
- BIOL 390R/390RL (Pathophysiology) (3)

 **Fall Semester 2010:**
- BIOL 112 (General Biology for Majors) (3)
- BIOL 376/376L (Genetics + Lab) (6)
- BIOL 493 (Research and Thesis [Team taught]) (1)
- BIOL 496R (Student Research) (1)

**Total:** (28)

The creation of BIOL 475 (Pathophysiology) does not affect graduation requirements, it is an elective. This course would provide upper level Biology and Biochemistry students greater choices for enrollment during the Summer Term.

There are no associated costs with the creation of this course, are expected to be minor. No new acquisitions will be required by the library. The vote by the biology faculty was unanimous for the formal adoption of this course.
Section 4 - Course Proposal (core)

Upon approval, the information presented on this course proposal sheet will become binding on the department and the university. Any material changes require a new course proposal.

Effective Date: Immediately upon approval
College: Math and Sciences
Course Prefix: BIOL
Course Number: 475

- NEW COURSE.

Full Title: Pathophysiology
Short Title (for Transcript, 30-char max): Pathophysiology
Catalog Entry (50-word recommended maximum): (Summer Session) The study of physiological processes within the body that results in the signs and symptoms of disease. (Prerequisite: Science Core and either BIOL 261/L or 465/L).
Prerequisites: Science Core and BIOL 262/L or 465/L
Credit Hours: 3
Grading Method: Letter grade
Course Fees: n/a
Learning Objectives: Each student who passes this course will be able to do the following:
1. Describe the underlying principles of cellular physiology.
2. Explain the function of the major organ systems: neuro, cardiovascular, respiratory, renal, gastrointestinal, endocrine and reproductive.
3. Understand the relationships between organ systems and the integrative mechanisms for homeostasis.
4. Explain the likely sources of emerging diseases within human populations.
5. Describe the drug and other interventions used to treat disease.

Assessment Methods: The course grade will be based on a point system with points earned through exams and case studies.
Syllabus

Biology 475: Pathophysiology (3 CR)

Instructor: Randy Day
Office: McKay 108A
Telephone: (808) 675-3809
e-mail: dayr@byuh.edu

Pre-requisites
Successful completion of Science Core and BIOL 261/L or 465/L (C minus or better).

Required Text:

Course Description:
This course will review the function of the major organ systems of humans and explore the changes that occur due to disease.

Instructional methods:
Learning will be promoted through lectures, presentations, and case studies.

Course Objectives:

Upon completion of this course each student should be able to:
1. Describe the underlying principles of cellular physiology.
2. Explain the function of the major organ systems: neuro, cardiovascular, respiratory, renal, gastrointestinal, endocrine and reproductive.
3. Understand the relationships between organ systems and the integrative mechanisms for homeostasis.
4. Explain the likely sources of emerging diseases within human populations.

Departmental Objectives

<table>
<thead>
<tr>
<th>Departmental Objective</th>
<th>Degree to which addressed in course</th>
<th>How addressed in course</th>
</tr>
</thead>
<tbody>
<tr>
<td>Understand what makes life unique</td>
<td>Practiced with feedback</td>
<td>All lectures, discussions.</td>
</tr>
<tr>
<td>Be able to describe the history of life from a biological perspective</td>
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<td>All lectures and exams.</td>
</tr>
<tr>
<td>Read, write, and understand biological literature</td>
<td>Practiced with feedback</td>
<td>Exposure to primary source literature in understanding pathophysiology.</td>
</tr>
<tr>
<td>Learn how to conduct research through use of the scientific method</td>
<td>Practiced with feedback</td>
<td>Case study interpretations</td>
</tr>
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<td>Have the opportunity to prepare for graduate or professional school and/or success in the biological job market</td>
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<td>Case study interpretations model professional school instruction.</td>
</tr>
<tr>
<td>Realize appropriate stewardship accountabilities and the need to help improve society</td>
<td>Practiced with feedback</td>
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</tr>
</tbody>
</table>

Grades:

The course grade will be based on a point system with points earned through exams and case studies as outlined below:

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<th>Points</th>
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</thead>
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<td>100</td>
</tr>
<tr>
<td>Case Studies (5 oral presentations @ 10 points)</td>
<td>50</td>
</tr>
</tbody>
</table>

Total: 350
Grading Scale

90 – 100%  A
80 – 89%   B
70 – 79%   C
60 – 69%   D
0 – 59%    F

Blackboard

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Special Needs. Brigham Young University-Hawaii is committed to providing a working and learning atmosphere, which reasonably accommodates qualified person with disabilities. If you have any disability that may impair your ability to complete this course successfully, please contact the students with Special Needs Counselor Leilani Auna at 808-675-3999 or 808-675-3518. Reasonable academic accommodations are reviewed for all students who have qualified documented disabilities. If you need assistance or if you feel you have been unlawfully discriminated against on the basis of disability, you may seek resolution through established grievance policy and procedures. You should contact the Human Resource Services at 808-780-8875.

Honor code. Honor code standards will be strictly enforced in this class. This includes the Dress and Grooming Standards (http://services.byuh.edu/honorcode/Dress_and_Grooming) and the Academic Honesty Policy (http://services.byuh.edu/honorcode/Academic_Honesty_Policy). Any student who arrives to class out of standards will be asked to leave and will be permitted to return only when properly attired. Any student who violates the Academic Honesty Policy, including, but not limited to, plagiarism, fabrication or falsification, and cheating, will receive no credit for the assignment and may be reported to the Office of Honor; any repetition will result in a failing grade for the class. In addition, all students have a right to be treated with respect and courtesy and to study in a safe and supportive environment while enrolled at BYU-Hawaii, and any student who violates these rights for another will be asked to correct their behavior or to leave the classroom; appropriate action, including a failing grade and/or a report filed with the Office of Honor will be taken against any student who repeatedly shows a lack of respect, or who creates an unsafe environment, for any other student or faculty member of this university.
Suggestions: You should plan on at least two productive hours of study for each hour of in class time. This study may include group discussions, reviewing notes, reading in advance and follow up reading. If you have questions or something you do not understand please come and talk to me.

**Tentative Lecture Schedule**

<table>
<thead>
<tr>
<th>Date</th>
<th>Topic</th>
<th>Chapter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Day 1</td>
<td>Syllabus,</td>
<td>Chapter 1</td>
</tr>
<tr>
<td>Day 2, 3</td>
<td>Cell Physiology</td>
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<td>Day 4</td>
<td>Autonomic Nervous System</td>
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<td>Day 5, 6</td>
<td>Neurophysiology</td>
<td>Chapter 3</td>
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<td>Day 7, 8</td>
<td>Cardiovascular Physiology</td>
<td>Chapter 4</td>
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<tr>
<td>Day 9</td>
<td>Respiratory Physiology</td>
<td>Chapter 5</td>
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<td>Day 10</td>
<td>Exam</td>
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<tr>
<td>Day 11, 12</td>
<td>Renal Physiology</td>
<td>Chapter 6</td>
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<td>Day 13</td>
<td>Acid-Base Physiology</td>
<td>Chapter 7</td>
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<tr>
<td>Day 14, 15</td>
<td>Gastrointestinal Physiology</td>
<td>Chapter 8</td>
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<tr>
<td>Day 16, 17, 18</td>
<td>Endocrine Physiology</td>
<td>Chapter 9</td>
</tr>
<tr>
<td>Day 19, 20</td>
<td>Reproductive Physiology</td>
<td>Chapter 10</td>
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<tr>
<td>Day 21</td>
<td>Final Exam</td>
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</table>
Online Catalog Web page (http://catalog.byuh.edu/node/216):

445. Immunology (3) (F) A study of the basic principles and theories of immune mechanisms. Concurrent registration in or completion of BIOL 445L required. (Prerequisites: Science Core)

445L. Immunology Laboratory (1) (F) Laboratory for Immunology. Lab includes traditional assays for antibody/antigen interactions as well as newer methods of immune diagnostics. Concurrent registration in or completion of BIOL 445 required. Fee required.

460. Advanced Human Anatomy (3) (F) A course in the dissection of the human cadaver. Biology majors only. (Prerequisites: BIOL 260/L or equivalent and consent of instructor)

465. Principles of Physiology (3) (W) General principles of chemical and physical processes of living organisms. Concurrent registration in or completion of BIOL 465L required. (Prerequisites: Science Core)

465L. Principles of Physiology Laboratory (1) (W) Laboratory for Principles of Physiology. Concurrent registration in or completion of BIOL 465 required. Fee required.

491L-492L-493L-494L Research and Thesis (1-1-1) (F, W) (P/NP) After a review of the literature, the student will conduct original research and report it in a scientific format. Sequence begins in junior years with BIOL 491L followed by BIOL 492L (requires consent of instructor), followed by BIOL 493L followed by BIOL 494L.

495R. Independent Study (1-4) (1st, F, W, Sp, Su) Supervised individual study, work experience, and/or research in biology. Permission of instructor required before registration. Only one credit can count toward the 44 hours of Biology Major requirements. (Prerequisite: Department consent.)

496R. Student Research (1-3) (1st, F, W, Sp, Su) Supervised individual research for students who have been granted a student research and development associateship or mentored research position. Required for all associates and mentored research students. This course cannot count toward the 41-44 hours of Biology Major requirements. (Prerequisite: Department Consent.)

The following should be inserted at the location indicated by the arrow, above:

475. Pathophysiology (3) (Summer Session) The study of physiological processes within the body that results in the signs and symptoms of disease. (Prerequisite: Science Core and BIOL 261/L or 465/L).
Online Catalog web page (Undergraduate majors) [http://catalog.byuh.edu/node/93]

1. Molecular Biology

Students interested in pursuing employment or graduate studies in Molecular Biology should enroll in the following:

- Science Core (15 Hours)
- Pre-Professional Biology Core (12 Hours)
- Chemistry Core (8 Hours)
- Electives (25 Hours Minimum)

- **Molecular Biology Courses**
  - BIOL 201/L General Botany (4) or BIOL 206/L General Zoology (4)
  - BIOL 220/L Microbiology (4)
  - BIOL 383/L History & Developmental Biology (4)
  - BIOL 441/L Molecular Biology (4)
  - BIOL 442/L Cellular Biology (4)
  - BIOL 445/L Immunology (4)
  - CHEM 381/L Biochemistry I (4)

- **Other Recommended Biology Courses**
  - BIOL 248/L Conservation Biology (4)
  - BIOL 350/L General Ecology (4)
  - BIOL 374 Evolution & Human Prehistory (3)
  - CHEM 382/L Biochemistry II (4)
  - BIOL 475 Pathophysiology (3)

- **Other recommended Non-Elective Physical Science Courses**
  - PHYS 121/L General Physics I (4)
  - PHYS 221/L General Physics III (4)

2. PRE-PROFESSIONAL PROGRAM

Students interested in continuing their education at professional schools (medicine, dentistry, pharmacy, optometry, etc.) should consult with the preprofessional faculty advisor early in their undergraduate career to prepare a proper course of study. Students should enroll in the following courses:

- Science Core (15 Hours)
- Pre-Professional Biology Core (12 Hours)
- Chemistry Core (8 Hours)
- Electives (25 Hours Minimum)

- **Pre-Professional Courses**
  - BIOL 260/L Elementary Human Anatomy (3)
  - BIOL 261/L Elementary Human Physiology (4)
  - BIOL 383/L Histology and Developmental Biology (4)
  - BIOL 441/L Molecular Biology (4)
  - BIOL 442/L Cellular Biology (4)
  - BIOL 445/L Immunology (4)
  - BIOL 460/L Advanced Human Anatomy (3)
  - BIOL 465/L Principles of Physiology Laboratory (4)
  - BIOL 475 Pathophysiology (3)

**Other Recommended Biology Courses**

- BIOL 248/L Conservation Biology (4)
- BIOL 350/L General Ecology (4)
- BIOL 374 Evolution & Human Prehistory (3)
Summary:
It is proposed that the course number for BIOL 496R (Student Research) be changed to BIOL 496LR.

Science students who have been awarded a university Student Associateship Research Grant or a natural science Mentored Research Grant are required to enroll in BIOL 496R (Student Research). Credit hours can range from 1-3 and the course can be repeated. The course as labeled would indicate a lecture classroom setting. However, biological research is always conducted in the laboratory or field not the classroom and, therefore, the course number as currently listed does not reflect the actual nature of the course.

As it now stands, anyone reading the transcript would assume a lecture based course where the student is engaged in the classroom one-three hours per week depending on the number of credits enrolled for. In biological research students spend a minimum of three hours/week engaged in their research. To reflect the time spent the comparable number of credit hours would be three. However, meaningful biological research requires months of effort which for students translates into multiple semester enrollments. If a student began an Associateship/Mentored Program as either a freshman or sophomore this would add an additional 18-24 credit hours to their transcript and would eventually push them into excessive hours. The problem is solved if BIOL 496R is changed to BIOL 496LR. As a lab designated course one credit hour equals three hours per week in the laboratory or field. A student would then only accumulate no more than 6-8 credit hours over their stay at BYUH. Anyone reading the transcript would recognize that a lab hour translates into 3 hours of research minimum. By changing the course number we limit the number of credits a student has to enroll in yet the transcript would reflect the number of hours required per week.

We currently only let students register for one hour of BIOL 496R except on rare occasions. Therefore, there would be no effect on student load. Changing the course number to BIOL 496LR would allow students to register for one hour of credit while the transcript would be interpreted as three hours of research work per week.

There would be no change in faculty load.

No changes in graduation requirements.
Section 4 - Course Proposal (core)

Upon approval, the information presented on this course proposal sheet will become binding on the department and the university. Any material changes require a new course proposal.

Effective Date: Winter 2011

College: Math and Sciences

Course Prefix: BIOL

Course Number: 496LR

------------------------------------------------------------------------------------------------------------------------

**Changed Course Number:** Old Number: BIOL 496R  New Number: BIOL 496LR

BIOL 496 (Student Research) This course is not required nor does it count for graduation. It is a course that allows students to get credit for biological research experience much as an internship course does.

**Catalog Entry (50-word recommended maximum):**

**496LR. Student Research (1-3) (1st, F, W, Sp, Su)** Supervised individual research for students who have been granted a student research and development associateship or mentored research position. **Required for all associates and mentored research students.** This course cannot count toward the 41-44 hours of Biology Major requirements. (Prerequisite: Department Consent.)
442. Advanced Cellular Biology (3) (F) An advance study of cellular organization, mechanisms and functions, including cell communication, cell movement, cell division and protein location. Concurrent registration in or completion of BIOL 442L required. (Prerequisites: Science Core)

442L. Advanced Cellular Biology Laboratory (1) (F) Laboratory for Advanced Cellular Biology. Concurrent registration in or completion of BIOL 442 required. Fee required.

445. Immunology (3) (F) A study of the basic principles and theories of immune mechanisms. Concurrent registration in or completion of BIOL 445L required. (Prerequisites: Science Core)

445L. Immunology Laboratory (1) (F) Laboratory for Immunology. Lab includes traditional assays for antibody/antigen interactions as well as newer methods of immune diagnostics. Concurrent registration in or completion of BIOL 445 required. Fee required.

460. Advanced Human Anatomy (3) (F) A course in the dissection of the human cadaver. Biology majors only. (Prerequisites: BIOL 260/L or equivalent and consent of instructor)

465. Principles of Physiology (3) (W) General principles of chemical and physical processes of living organisms. Concurrent registration in or completion of BIOL 465L required. (Prerequisites: Science Core)

465L. Principles of Physiology Laboratory (1) (W) Laboratory for Principles of Physiology. Concurrent registration in or completion of BIOL 465 required. Fee required.

491L-492L-493L-494L Research and Thesis (1-1-1) (F, W) (P/NP) After a review of the literature, the student will conduct original research and report it in a scientific format. Sequence begins in junior years with BIOL 491L followed by BIOL 492L (requires consent of instructor), followed by BIOL 493L followed by BIOL 494L.

495R. Independent Study (1-4) (1st, F, W, Sp, Su) Supervised individual study, work experience, and/or research in biology. Permission of instructor required before registration. Only one credit can count toward the 44 hours of Biology Major requirements. (Prerequisite: Department consent.)

496R. Student Research (1-3) (1st, F, W, Sp, Su) Supervised individual research for students who have been granted a student research and development associateship or mentored research position. Required for all associates and mentored research students. This course cannot count toward the 41-44 hours of Biology Major requirements. (Prerequisite: Department Consent.)
### GENERAL BIOLOGICAL SCIENCES CORE

***No credit of less than C- in any BIOL/CHEM course is counted toward graduation***

<table>
<thead>
<tr>
<th>COURSE#</th>
<th>CR</th>
<th>DESCRIPTION</th>
<th>PREREQUISITES</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOL 112</td>
<td>3</td>
<td>General Biology (Science Majors)</td>
<td>none</td>
</tr>
<tr>
<td>CHEM 105, 105L</td>
<td>4</td>
<td>General Chemistry I / Lab</td>
<td>Math 110</td>
</tr>
<tr>
<td>CHEM 106, 106L</td>
<td>4</td>
<td>General Chemistry II / Lab</td>
<td>CHEM 105L</td>
</tr>
<tr>
<td>BIOL 265, 265L</td>
<td>4</td>
<td>Molecular &amp; Cellular Biology/Lab</td>
<td>BIOL 112, CHEM 105L</td>
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### SCIENCE CORE (15 Credit Hours)

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<th>CR</th>
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<th>PREREQUISITES</th>
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</thead>
<tbody>
<tr>
<td>BIOL 201, 201L</td>
<td>4</td>
<td>General Botany/Lab</td>
<td>BIOL 112</td>
</tr>
<tr>
<td>BIOL 202, 202L</td>
<td>4</td>
<td>General Zoology/Lab</td>
<td>BIOL 112</td>
</tr>
<tr>
<td>BIOL 491</td>
<td>1</td>
<td>Research &amp; Thesis</td>
<td>Science Core; Jr/Sr status</td>
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<tr>
<td>BIOL 492</td>
<td>1</td>
<td>Research &amp; Thesis</td>
<td>BIOL 491</td>
</tr>
<tr>
<td>BIOL 493</td>
<td>1</td>
<td>Research &amp; Thesis</td>
<td>BIOL 492</td>
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<tr>
<td>BIOL 494</td>
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<td>Research &amp; Thesis</td>
<td>BIOL 493</td>
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### GENERAL BIOLOGY MAJOR CORE REQUIREMENTS (12 CREDIT HOURS)

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<th>PREREQUISITES</th>
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</thead>
<tbody>
<tr>
<td>CHEM 251, 251L</td>
<td>4</td>
<td>Organic Chemistry I/Lab</td>
<td>CHEM 106L</td>
</tr>
<tr>
<td>CHEM 252, 252L</td>
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<td>Organic Chemistry II/Lab</td>
<td>CHEM 251L</td>
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### CHEMISTRY REQUIREMENTS (8 CREDIT HOURS)

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<tbody>
<tr>
<td>BIOL 204, 204L</td>
<td>4</td>
<td>Pacific Natural History/Lab</td>
<td>BIOL 112</td>
</tr>
<tr>
<td>BIOL 212, 212L</td>
<td>4</td>
<td>Marine Biology/Lab</td>
<td>BIOL 112</td>
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<tr>
<td>BIOL 220, 220L</td>
<td>4</td>
<td>Micro Biology/Lab</td>
<td>⅞ Science Core</td>
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<tr>
<td>BIOL 248, 248L</td>
<td>4</td>
<td>Conservation Biology/Lab</td>
<td>BIOL 112</td>
</tr>
<tr>
<td>BIOL 260, 260L</td>
<td>3</td>
<td>Elem. Human Anatomy/Lab</td>
<td>⅞ Science Core</td>
</tr>
<tr>
<td>BIOL 261, 261L</td>
<td>4</td>
<td>Elem. Human Physiology/Lab</td>
<td>⅞ Science Core</td>
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</table>

### RECOMMENDED ELECTIVES (25 CREDIT HOURS REQUIRED)

Minimum of 1 class from 200 level AND a minimum of 4 classes from the 300 & 400 levels to end with total of 25 elective credits. *Only 1 credit of BIOL 495R counted toward Biology elective credits.*

<table>
<thead>
<tr>
<th>COURSE#</th>
<th>CR</th>
<th>DESCRIPTION</th>
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<tbody>
<tr>
<td>BIOL 300, 300L</td>
<td>4</td>
<td>Animal Behavior/Lab</td>
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<tr>
<td>BIOL 320, 320L</td>
<td>4</td>
<td>Pathological Microbiology</td>
<td>⅞ Science Core</td>
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<tr>
<td>BIOL 350, 350L</td>
<td>4</td>
<td>Biometrics</td>
<td>⅞ Science Core</td>
</tr>
<tr>
<td>BIOL 374</td>
<td>3</td>
<td>Evolution &amp; Human Prehistory</td>
<td>⅞ Science Core</td>
</tr>
<tr>
<td>BIOL 376, 376L</td>
<td>4</td>
<td>Genetics/Lab</td>
<td>⅞ Science Core</td>
</tr>
<tr>
<td>BIOL 383, 383L</td>
<td>4</td>
<td>Histology &amp; Dev. Biology / Lab</td>
<td>Science Core</td>
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<tr>
<td>BIOL 412, 412L</td>
<td>4</td>
<td>Marine Ecology</td>
<td>⅞ Science Core &amp; BIOL 212/L</td>
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<tr>
<td>BIOL 441, 441L</td>
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<td>Molecular Biology/Lab</td>
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<td>BIOL 442, 442L</td>
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<td>Advanced Cellular Biology/Lab</td>
<td>Science Core</td>
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<td>BIOL 445, 445L</td>
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<td>Immunology</td>
<td>Science Core</td>
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<td>BIOL 460</td>
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<td>Advanced Human Anatomy</td>
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<td>BIOL 465, 465L</td>
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<td>Principles of Physiology/Lab</td>
<td>Science Core</td>
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<td>BIOL 475</td>
<td>5</td>
<td>Pathophysiology</td>
<td>Science Core &amp; BIOL 212/L</td>
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<tr>
<td>BIOL 390R</td>
<td>1-4</td>
<td>Special Topics</td>
<td>Science Core for majors</td>
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<tr>
<td>BIOL 399R</td>
<td>1-3</td>
<td>Cooperative Education in Biol.</td>
<td>PERMISSION ONLY</td>
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<td>BIOL 495R</td>
<td>1</td>
<td>Independent Study</td>
<td>PERMISSION ONLY</td>
</tr>
<tr>
<td>CHEM 381/381L</td>
<td>4</td>
<td>Biochemistry and Lab</td>
<td>CHEM 252, 252L</td>
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Revised 8/10
## GENERAL BIOLOGICAL SCIENCES CORE

No credit of less than C- in any BIOL/CHM course is counted toward graduation.

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<tr>
<th>COURSES</th>
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<th>TAKEN</th>
<th>GR</th>
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<tr>
<td>BIOL 112</td>
<td>3</td>
<td>Biology for Majors</td>
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<td>CHEM 105, 105L</td>
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<td>CHEM 106, 106L</td>
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<td>General Chemistry II and Lab</td>
<td>CHEM 105, 105L</td>
<td>W, Sp</td>
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### BIOLGY CORE: 12 Credit Hours

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<tr>
<td>BIOL 220, 220L</td>
<td>4</td>
<td>Microbiology/Lab</td>
<td>Science Core</td>
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<tr>
<td>BIOL 376, 376L</td>
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<td>Genetics/Lab</td>
<td>Science Core</td>
<td>F</td>
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<td>BIOL 491L</td>
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<td>BIOL 492L</td>
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<td>F,W</td>
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<td>BIOL 493L</td>
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<td>BIOL 494L</td>
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<td>Research &amp; Thesis OR **</td>
<td>BIOL 494</td>
<td>F,W</td>
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### BIOLOGY ELECTIVES (25 CREDIT HOURS REQUIRED)

Minimum of 1 class from 200 level AND a Minimum of 4 classes from the 300 & 400 levels to end with total of 25 elective credit. Only 1 credit of BIOL 465R counted toward Biology elective credits. (Electives recommended for MCAT Preparation started.)

#### Min. 1 Class in 200 Level

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<th>TAKEN</th>
<th>GR</th>
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<tbody>
<tr>
<td>BIOL 248, 248L</td>
<td>4</td>
<td>Conservation Biology and Lab</td>
<td>Science Core for majors</td>
<td>Even W</td>
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<tr>
<td>BIOL 260, 260L</td>
<td>3</td>
<td>Elem. Hum. Anatomy and Lab</td>
<td>Science Core</td>
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<tr>
<td>BIOL 261, 261L</td>
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<td>Elem. Hum. Physiol. and Lab</td>
<td>Science Core</td>
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#### Min. 4 Classes in 300-400 Level

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<th>TAKEN</th>
<th>GR</th>
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</thead>
<tbody>
<tr>
<td>BIOL 350, 350L</td>
<td>4</td>
<td>Patho-Biologic Microbiology</td>
<td>Science Core &amp; BIOL 248/EVEN Summer</td>
<td>Odd Summer</td>
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<td>BIOL 340</td>
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<td>Experimental Design</td>
<td>Science Core</td>
<td>Spring</td>
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<td>BIOL 350, 350L</td>
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<td>General Ecology and Lab</td>
<td>Science Core</td>
<td>F</td>
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<tr>
<td>BIOL 374</td>
<td>3</td>
<td>Evolution &amp; Human Prehistory</td>
<td>Science Core</td>
<td>Even W</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BIOL 383, 383L</td>
<td>4</td>
<td>Hist. &amp; Dev. Biology and Lab</td>
<td>Science Core</td>
<td>W</td>
<td></td>
<td></td>
</tr>
<tr>
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### REQUIRED CHEMISTRY: 8 Credit Hours

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Recommended for Graduate School Pre-requirements and Entrance Exams Preparation

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