Bachelor of Arts in Biology
University of Alaska Southeast

Submitted by the UAS Natural Sciences Department, Brian Blitz, Ph.D., Chair

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Degree or Certificate Title
Bachelor of Arts in Biology, University of Alaska Southeast

Educational Objectives and Rationale
The proposed Bachelor of Arts in Biology curriculum provides a solid foundation for students in biology with a liberal arts focus. It is a curriculum that will produce graduates ready to gain employment in secondary school education, natural resources, or tourism. This degree allows for focused study in Biology, and yet allows for flexibility for breadth of study in other areas. The degree is appealing to those with interest in human dimensions of biological sciences and with an interest in teaching, policy, management, or administration (natural resource or health). For example, the degree is ideal for middle-school and secondary-school teachers who require a content degree in addition to broad training in other liberal arts and sciences. These teachers will be well-prepared to teach Biology as well as be versatile in other classes, a need that well serves rural Alaska. The degree is well suited for individuals who wish to pursue an advanced degree in social science, humanities, or business, such as marine policy, natural resource management, fishery economics, public health administration, etc. Students with this degree would be excellent candidates for entry-level careers in or eco-tourism or natural resources, such as park ranger, forest ranger, wildlife law enforcement, hatchery technician, to name a few careers in this discipline. Students may wish to combine a minor, certificate program, A.A.S. or double major in order to suit their interests. For example, students interested in eco-tourism may wish to pursue an Outdoor Skills and Leadership certificate in combination with the B.A. in Biology, whereas someone who wants to work in a hatchery may wish to combine the A.A.S. in Fisheries Technology with the B.A. in Biology. The B.A. in Biology has greater flexibility than the B.S. in Biology and is intended for students who do not plan to continue graduate studies specifically in Biology.

UAS currently has two life science degrees: a B.S. in Biology and a B.S. in Marine Biology. Both are rigorous programs that involve extended coursework in Mathematics, Physics, and Chemistry and are directed towards students who wish to pursue research and graduate studies in related fields. The proposed B.A. in Biology degree will help recruit and retain students in the Biology program at UAS. Many students leave these degree programs and some leave UAS as a result of the difficulty of the coursework in existing life science degrees. The B.A. may feel more approachable to some students and may help them to consider coming to school in the first place, and therefore, this new degree will assist with recruitment. The proposed B.A. in Biology will replace the B.L.A. General Studies for local students who are interested in Biology and want a liberal arts degree with flexibility. The first two years of study for the B.S. in Biology, the B.S. in Marine Biology, and the proposed B.A. in Biology are similar and would allow students to easily transition between them. As of Fall 2005, there are 51 active majors (upper division students) in the B.S. in Biology and Marine Biology and 143 pre-majors (lower division students), totaling almost 200 majors and pre-majors in Biology and Marine Biology at UAS. While UAS is a small school, its enrollment in Biology programs rivals that found at a much larger school, such as UAF which has 300 students enrolled in biological sciences programs. The B.A. in Biology diversifies training opportunities for students at UAS without requiring additional new resources.

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Many universities offer both a B.S. and a B.A. in Biology, because they serve different groups of students. A B.S. provides a foundation in science in combination with general education courses and Biology courses. The B.A., in contrast, provides less science and mathematics, greater breadth in liberal arts, and flexibility to pursue a minor, certificate, or double major. The proposed B.A. in Biology is designed to serve the needs of three groups of undergraduate students. First, it is designed to serve students preparing to enter graduate school in teaching, humanities, social science, or business. The degree reflects the requirements for teaching certification in secondary-school Biology. Second, it is designed to serve students seeking entry-level employment in the fields related to biology, including positions at state and federal agencies. Third, it is designed for students who are interested in biology but want greater breadth in their liberal arts education and may seek employment in the tourism industry or other biologically-related areas.

The B.A. in Biology is similar to the B.S. in Biology and the B.S. in Marine Biology in that it is designed to capitalize on the unique natural setting and natural resources in Southeast Alaska. Many of the courses involve hands-on field and laboratory exercises.

**Relevance to the University Mission**

The Biology program has long been one of the flagship programs of UAS. Creating a second degree in Biology reinforces this position and reaches a broader audience of students. The B.A. in Biology furthers the following core values of the UAS mission:

- *Achieving distinction as a learning community*
  
  This new degree will help UAS to achieve distinction as a learning community by increasing the number of Bachelor’s degrees granted from UAS.

- *Developing programs rooted in its unique natural setting*
  
  UAS Biology courses take advantage of the “outdoor” classroom by providing field trips and outdoor laboratories in almost every course. Alaska is home to rich natural resources and has ample employment opportunities for students trained in natural resource fields.

- *Contributing to the economic development of the region and the state through basic and applied research and public service*
  
  UAS Biology students can participate in faculty research, both basic and applied.

- *Forging dynamic partnerships with other academic institutions, governmental agencies and private industry*
  
  UAS Biology students are employed as interns while enrolled at UAS and as employees after graduation.

**Collaboration with Other Universities within University of Alaska**

We will continue to collaborate with UAA and UAF Biology programs to ensure that courses are easily transferable within the university system. Within the state of Alaska, UAF offers both a B.A. and a B.S. in Biology and UAA offers a B.S. in Biology. We have modeled our proposed B.A. in Biology after that offered at UAF. We plan to collaborate with faculty at the Center for Teacher Education at UAS and with other Education programs throughout the state to ensure that our graduates are fully prepared to pursue teacher certification at the secondary school level and graduate programs such as the M.A.T.

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Other Universities with Similar Programs
Almost all universities offer a Biology degree. Typically, when both a B.S. and a B.A. in Biology are offered, they share a common lower-division core. Hence, beginning students need not immediately decide on which track to take. The B.A. program often leaves more flexibility for choosing electives, for adding a minor or, for having a double major. The B.S. degrees require more physical science, mathematics, and biology. Some schools offer only a B.A. or a B.S., and the degree offered is often a function of the orientation of the school. For example, many four-year liberal arts colleges offer only a B.A. degree, regardless of the major. We have reviewed the curriculum at the following universities that offer both a B.A. and B.S. in Biology:

- Sonoma State University, Rohnert Park, CA
- San Francisco State University, San Francisco, CA
- Western Washington University, Bellingham, WA
- University of Washington, Seattle, WA.

Our proposed B.A. in Biology degree is similar to the B.A. in Biology degrees at the universities above in several ways. In non-Biology areas, most require one mathematics course in addition to a general education mathematics course, 2 semesters of General Chemistry, and 1-2 semesters of a physical science. All require 2 semesters of Introductory Biology. Most have a core of Biology courses, similar to our requirements for Ecology, Physiology, Genetics, and Evolution.

Demand for Program
There is demand for this program from the student perspective and from the community and state perspective. The continued success of the Marine Biology and Biology degrees at UAS demonstrate strong student interest in these fields at UAS. It is anticipated that UAS will be able to recruit additional students and increase the retention rate of current students with this new degree in Biology because it requires fewer rigorous Mathematics and Chemistry courses. This new degree offers more flexibility to include study in other disciplines with a minor, certificate, or double major. Students enrolled in the B.L.A. general studies degree with an emphasis in Biology at UAS often express interest in a more-broadly focused Biology degree.

Within the state of Alaska, there is a need for students to be broadly trained in natural resources because the majority of the income in the state is derived from natural resources. One-sixth of the state’s economy comes from traditional natural resources, such as fishing, timber, mining, and agriculture, while two-thirds is dependent on oil and the federal government. Note that many federal government jobs are in natural resource fields. Many disciplines, such as marine policy, natural resource economics, science writing, public health administration, to name a few, require a solid foundation in Biology and advanced study in social science, humanities or business. Jobs in many natural resource-related fields do not require the rigor of a B.S. degree and are better suited to a B.A. degree in Biology with breadth in other areas. Positions in eco-tourism, nature photography, or other natural resources fields, such as park ranger, forest ranger, wildlife law enforcement, hatchery technician are abundant in Alaska.
The creation of a B.A. in Biology at UAS is responsive to nationwide and statewide demands for science teachers at the secondary level. Within the state of Alaska, there is a need for broadly trained teachers. *No Child Left Behind* legislation calls for “Highly Qualified” middle and high school science teachers who can teach in more than one field. "Highly Qualified Teachers” must have a bachelor’s degree with credits equivalent to a major in the subject they teach, and in rural settings common in Alaska, science teachers often must be able to teach in multiple subjects. The flexibility within the B.A. program allows students to be trained broadly in liberal arts and science, yet still have a content degree in Biology and, therefore, meet the demand for rural educators to teach in more than one field.

**Schedule of Implementation**

**AY 2005-2006**: The Natural Sciences department approves the degree and obtains approval from the UAS Faculty Senate, the UAS Curriculum Committee, and the Board of Regents.

**AY 2006-2007**: The first class of students is admitted to the B.A. in Biology degree program. Existing B.S. in Biology students have the option to select this new degree. Because required courses for the first two years are almost identical in the B.S. and B.A. tracks, it will be easy for existing students to switch to this degree.

**AY 2007-2008**: Assuming that in 2006, some of the existing students in their third year of either the B.S. in Marine Biology or Biology switch to the B.A. degree, the first group of students will graduate with a B.A. in Biology from UAS.

**Projection of Enrollments**

Presented in the tables below are estimates of program enrollment, biology program students, and graduated students. In 2003-2004, 92 Bachelor’s degrees were awarded at UAS and 13 (14.1%) of these were in Biology and Marine Biology. We anticipate that students will be able to convert from the existing B.S. in Biology to this new degree in their sophomore or junior year and therefore graduate with this degree the year after it is instituted. However, we do not anticipate seeing increases in the total number of Bachelor’s degrees in Biology until the degree has been in place long enough for a new cohort to complete the program in 4-5 years.

| Table 1. Current and projected enrollments at UAS (Juneau campus only) |
|---|---|---|---|---|---|---|
| Full-Time | 786 | 868 | 844 | 886 | 931 | 977 |
| Part-Time | 1,338 | 1,337 | 1,304 | 1,369 | 1,438 | 1,510 |
| Total | 2,124 | 2,205 | 2,148 | 2,255 | 2,368 | 2,487 |

\(^1\)Based on reports of fall opening enrollment by campus prepared by Statewide Institutional Research  
[http://www.alaska.edu/swoir/students/opening/fall%202005%20opening%20enrollment.pdf](http://www.alaska.edu/swoir/students/opening/fall%202005%20opening%20enrollment.pdf)

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Projections based on increases of 5%. Percent change in total enrollment from 2001-2005 was 4.7%.

Table 2. Current and projected degrees awarded in Biology programs at UAS (Juneau campus).
Note that projections are conservative

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<td>Bachelor's Degrees awarded</td>
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<td>94</td>
<td>97</td>
<td>102</td>
<td>107</td>
<td>113</td>
</tr>
<tr>
<td>B.S. Marine Biology Degree</td>
<td>n/a²</td>
<td>1²,3</td>
<td>7</td>
<td>8</td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td>B.S. Biology Degree</td>
<td>13</td>
<td>4³</td>
<td>7</td>
<td>7</td>
<td>7</td>
<td>7</td>
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<tr>
<td>B.A. Biology degree</td>
<td></td>
<td></td>
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²Degree received BOR approval in 2004 and was not in place until 2005/2006.
³Data from the UAS Biology program database.

**Faculty Resources**

Faculty resources are currently sufficient for delivering the proposed B.A. program. Existing faculty all have strong teaching and research credentials within the field of Biology. In addition, several faculty at the Juneau Center of the School of Fisheries and Ocean Sciences, University of Alaska Fairbanks teach UAS undergraduate biology courses. Successful growth of the program may require additional faculty and teaching assistants in the future to fulfill student demand for courses. The following UAS faculty are currently available to the program:

- Ginny L. Eckert, Ph.D., University of California, Santa Barbara, Assistant Professor of Biology, specializes in ecology.
- Elizabeth Mathews, M.S. University of California, Santa Cruz, Assistant Research Professor of Biology, specializes in marine mammals.
- Michael S. Stekoll, Ph.D., University of California, Los Angeles, Professor of Biochemistry and Chemistry, specializes in physiological ecology of seaweeds and pollution biology.
- David Tallmon, Ph.D., University of Montana, Assistant Professor of Biology, specializes in evolutionary biology and population genetics.
- Sherry Tamone, Ph.D., University of California, Davis, Assistant Professor of Biology, specializes in comparative physiology.

**Library and Other Equipment Needs**

Egan Library resources, including serials, books, online databases and other electronic media, are sufficient to support the scholarly resource requirements of the B.A. in Biology degree. The library’s book holdings include approximately 6650 titles in the principal discipline of biology. Book collections in related life and environmental sciences are extensive. Licenses for

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netLibrary and ebrary collections provide full-text searching for more than 600 e-books in the life sciences and policymaking and many more in related subjects.

There are 18 current periodical titles specifically dealing biology and 54 related titles in the environmental and physical sciences. In addition, extensive archival access is available for 46 biological science journals and 9 history of science titles through a JSTOR subscription.

In order to provide access to the journal literature, the library maintains subscriptions to 11 bibliographic databases in biological science and 22 related scientific databases. For articles not available in its print or electronic collections, the library provides exceptional service in processing inter-library loan requests.

**New Facilities Needed**
No new facilities are needed to implement the program.

**Projected Costs**
No major additional costs are projected for implementing the B.A. in Biology degree program. As enrollments increase over time additional faculty may be needed.

**Consultant Reviews**
The following individuals have been requested to review the UAS B.A. in Biology proposal. Considerations already received from consultant reviews have been incorporated or accounted for in the current proposal.

- Kate Sullivan, Assistant Professor of Fisheries Technology, UAS Ketchikan
- Dave Marvel, Center for Teacher Education, UAS
- Brendan Kelly, Dean of Liberal Arts and Science, UAS
- Outside consultant,

**Executive Summary**
The proposed B.A. degree in Biology provides a core curriculum in Biology with a breadth in liberal arts and sciences. It is anticipated that this new degree will improve the recruitment and retention of UAS students. The B.A. in Biology diversifies training opportunities for students at UAS without requiring additional new resources. The existing faculty, library, and other resources are sufficient to deliver this program, and it is anticipated that students could graduate with this new degree in 2008. The target audience is threefold and includes students interested in graduate school in teaching, humanities, social science, or business; students interested in working in entry-level positions in government and the private sector; and students interested in natural resources related careers such as tourism or photography.

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Proposed Curriculum

Bachelor of Arts in Biology
The B.A. degree in Biology provides students with the opportunity to learn biological principles and skills in lecture, laboratory and field courses with a breadth in liberal arts and sciences.

Admission Requirements: Applicants enter as pre-majors and will be considered for full admission to the B.A. in Biology after completion of the following:
1. MATH S107 (may be met by placement examination)
2. ENGL S111.
3. BIOL S105 and BIOL S106
4. High school chemistry, or a C or higher in either CHEM S103 or CHEM S105.

When a student becomes a major in Biology, he or she is assigned a faculty advisor. The student and faculty advisor plan the student’s curriculum, and the advisor’s signature is required on registration documents.

Degree Requirements: Candidates must complete the General Education Requirements (GERs) as well as the specific program requirements listed below for a minimum of 120 credit hours. Courses in a degree program may be counted only once. Courses used to fulfill the major requirements cannot be used to fulfill the GERs. Specific requirements for GERs are listed below. The degree must include 48 credits of upper-division (300 or above) courses. To satisfy the residency requirement, 30 credits must be completed at UAS, including 24 upper division credits. Candidates who expect to teach in public secondary schools must be sure that they meet education requirements**.

General Education Requirements 36
The following courses must be included in the GERs for a B.A. in Biology: MATH 107, BIOL 105 and BIOL 106.

Major Requirements 36
CHEM 105 General Chemistry I 4
CHEM 106 General Chemistry II 4
Two courses from the following: 6-8
   PHYS, ASTR, GEOL, ENVS, upper division STAT
STAT 273 Elementary Statistics 3
MATH 108 or higher 3-4
BIOL 271 Ecology 4
BIOL 310 Animal Physiology 4
BIOL 362 Genetics 4
BIOL 482 Evolution 4

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### Biology Electives
10 credits from the following

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<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>BIOL 215</td>
<td>Intro to Marine Biology</td>
<td>3</td>
</tr>
<tr>
<td>BIOL 239</td>
<td>Intro to Plant Biology</td>
<td>4</td>
</tr>
<tr>
<td>BIOL 300</td>
<td>Vertebrate Zoology</td>
<td>4</td>
</tr>
<tr>
<td>BIOL 305</td>
<td>Invertebrate Zoology</td>
<td>4</td>
</tr>
<tr>
<td>BIOL 375</td>
<td>Current Topics in Biology</td>
<td>2</td>
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<tr>
<td>BIOL 382</td>
<td>Wetlands Ecology</td>
<td>4</td>
</tr>
<tr>
<td>BIOL 384</td>
<td>Marine Mammalogy</td>
<td>4</td>
</tr>
<tr>
<td>BIOL 401</td>
<td>Phycology</td>
<td>4</td>
</tr>
<tr>
<td>BIOL 415</td>
<td>Physiology of Marine Animals</td>
<td>4</td>
</tr>
<tr>
<td>BIOL 426</td>
<td>Ornithology</td>
<td>4</td>
</tr>
<tr>
<td>BIOL 427</td>
<td>Introduction to Ichthyology</td>
<td>4</td>
</tr>
<tr>
<td>BIOL 441</td>
<td>Animal Behavior</td>
<td>4</td>
</tr>
<tr>
<td>BIOL 445</td>
<td>Vascular Plants of Southeast Alaska</td>
<td>3</td>
</tr>
<tr>
<td>BIOL 480</td>
<td>Aquatic Pollution</td>
<td>3</td>
</tr>
<tr>
<td>BIOL 481</td>
<td>Marine Ecology</td>
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<tr>
<td>BIOL 492</td>
<td>Biology Seminar</td>
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<tr>
<td>BIOL 495</td>
<td>Behavioral Ecology</td>
<td>3</td>
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### Breadth Electives
38 credits

To include upper-division courses as needed.
Students are encouraged to include a minor or double major.

### Minimum Credit Hours
120 credits

**To fulfill teacher education requirements, seek advising from the UAS School of Education and include the following:**

1. **Major Requirements**
   - PHYS 102 Survey of Physics.
   - A course in earth and/or space sciences.

2. **Breadth Electives**
   - CHEM 341 Organic and Biological Chemistry I
   - CHEM 342 Organic and Biological Chemistry II
   - BIOL 240 Introductory Microbiology

### Learning Outcomes Assessment

**Entrance Assessment**
All students at UAS are required to take placement tests or otherwise demonstrate proficiency in reading, writing, and mathematics. Developmental courses are available for students who score below the college level in these areas. The Fundamentals of Biology (BIOL S105, S106) course sequence required of all pre-majors provides the basic concepts common to all biological fields.

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in addition to an initial exposure to the scientific method, scientific writing, and the peer-reviewed scientific literature.

Learning Outcomes by Course Level
The following descriptions serve as learning outcomes for sophomore-, junior-, and senior-level courses in the B.A. program in Biology. These guidelines will serve as a rubric for developing and implementing the program curriculum.

Sophomore-Level Courses
Sophomore-level courses introduce the content area within Biology and do not require advanced knowledge from other scientific areas (e.g. Chemistry). Course content includes terminology specific to Biology as well as techniques employed in the field.

Students who pass a sophomore-level course will have a basic foundation of knowledge in the course topic. They will have begun to acquire familiarity with library resources, both print and electronic.

Junior-Level Courses
In junior-level courses, course content assumes an increasing level of prior knowledge about the field of Biology. In this respect, course content may be more specific than that offered on the sophomore level. Course content may require advanced study in Biology or other scientific areas (e.g. Chemistry).

Students who pass a junior-level course have demonstrated an ability to master both theoretical and practical concepts in Biology. Students should be able to demonstrate an increasingly sophisticated use of library resources and should be able to access the primary scientific literature independently. Students take on increasing responsibility for contributing to and shaping class discussions. Students will have had practice in verbally presenting their work to an audience of peers.

Senior-Level Courses
Senior-level courses are specific in content, assuming a base of prior knowledge in the field that is both broad and fairly detailed.

Students who pass a senior-level course have demonstrated an ability to master detailed information as well as the ability to think critically and evaluate scientific information. Students at this level will demonstrate the highest level of proficiency in utilizing library resources; their work will include proper and sophisticated use of documentation and references for research and documentation. They will have taken a leadership role when contributing to class discussion and in presenting their work orally to their peers.

Program Assessment
The Biology Student Assessment Coordinator will facilitate program assessment based on the following:
- Surveying graduating seniors.

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• Tracking student retention.
• Tracking student success through graduate employment or graduate school.
• Reassessment of program needs/improvements on a regular basis, including an annual review of curricular and pedagogical concerns.

**Course Descriptions**
The following are course descriptions for all courses listed in the above degree program. No new courses are proposed for this new degree.

**Biology Courses**

**BIOL S105 Fundamentals of Biology I**
4 credits (3+3) J, K, GER
Introduction to basic principles of cell biology and evolution. Topics include cell structure, metabolism and genetics. Co–requisite: MATH S105.

**BIOL S106 Fundamentals of Biology II**
4 credits (3+3) J, K, GER
Continuation of basic principles of plants and animal anatomy and physiology. Topics include evolution, behavior, ecology, and groups of plants and animals. Prerequisite: BIOL S105; co–requisite: MATH S107.

**BIOL S215 Introduction to Marine Biology**
4 credits (3+3) J
An introduction to the major characteristics of ocean ecosystems and the organisms that inhabit them. Includes physical, chemical, and biological principles that affect marine biodiversity. Prerequisite: BIOL S105 and S106.

**BIOL S239 Introduction to Plant Biology**
4 credits (3+3) J, K
Structure, function, ecology, and evolutionary patterns of the major groups of plants. Prerequisite: BIOL S105 and S106.

**BIOL S240 Introductory Microbiology**
4 credits (3+3) J, K, S
General introductory microbiology with emphasis on microorganisms as disease causing agents. Fundamentals of microbial biology and diversity including host microbe interactions and epidemiology. Prerequisite: 8 credits in biology or chemistry. BIOL S112 and CHEM S104 recommended. Note: not accepted for Biology major credit. Recommended for health science students.

**BIOL S271 Ecology**
4 credits (3+3) J, K
Overview of the principles of ecology with emphasis on the organismal, population, community, ecosystem and biome levels. Aspects of the physical environment are included in the organismal

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ecology discussions. Laboratory sessions mainly are field exercises in biological sampling and analyses. Prerequisites: BIOL S105 & S106. Co–requisite: STAT 273.

BIOL S300 Vertebrate Zoology
4 credits (4+0) J
Evolution, classification, functional anatomy and general biology of vertebrates. Alaskan species will be highlighted. Prerequisite: BIOL S105 AND S106. No lab.

BIOL S305 Invertebrate Zoology
4 credits (3+3) J
Structure, function, classification, evolution and life histories of invertebrate animals. Marine invertebrate animals. Marine invertebrates are emphasized. Prerequisite: BIOL S105 and S106.

BIOL S310 Animal Physiology
4 credits (3+3) J
Chemical and physical principles underlying living processes, and the integration of these principles into the physiology of cells and whole organisms. Prerequisites: BIOL S105 and S106, MATH S107, CHEM 106.

BIOL S362 Genetics
4 credits (3+2) J
Principles of inheritance; physiochemical properties of genetic systems. Prerequisites: BIOL S105 and S106, CHEM S106, MATH S107.

BIOL S375 Current Topics in Biology
2 credits (2+0) J
Discussion of a book or series of papers on a current topic in biology. Students will lead discussions and be graded on both their presentation and their participation in discussions. May be repeated. Prerequisites: completion of 3 science credits.

BIOL S382 Wetlands Ecology
4 credits (3+3) J
All of the major aspects of wetlands from ice fields, alpine bogs, tarns, lakes, streams, deltas to the marine shores, emphasis is on: 1) identification of wetland categories based on aquatic plants, hydrology and soil types; 2) value, preservation, protection and restoration of wetlands; 3) federal and state regulations and 4) management, economics and mitigated use of wetlands. Laboratories will be based on local Alaskan and Northwest regional case studies and accepted regional case studies and accepted wetlands research techniques. Prerequisite: BIOL S271.

BIOL S384 Marine Mammalogy
4 credits (3+3) J
The evolution and classification of marine mammals will be presented as a framework for understanding their adaptations, physiology, anatomy, behavior, ecology, reproduction, and mating systems. Current research techniques and conservation issues will also be reviewed.

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Students will write and present a paper on a special topic. Two field trips (dates TBA). Prerequisite: BIOL S105 and S106, S271 and permission.

**BIOL S396 Field Studies in Behavior and Ecology**  
1–6 credits (Variable) J  
This course provides intensive field study in selected topics in behavior and ecology with emphasis on field methods. Each student will conduct an individual research project. Field topics may entail a deferred grade. Projects may be associated with on–going research projects or new projects developed by the instructor and student. Letter grades or Pass/Fail may be arranged by permission of instructor. Number of credits will be determined by the scope of the project. May be repeated for up to 12 credits. Prerequisites: BIOL S105, S106, S271 and permission of instructor.

**BIOL S401 Phycology**  
4 credits (2+4) J  
Survey of freshwater and marine algae with emphasis on Alaskan species. Topics include: taxonomy, physiology, life histories, and ecology of the algae. Introduction to Plant Biology (BIOL S239) recommended before taking this course. Prerequisite: BIOL S105, S106.

**BIOL S415 Physiology of Marine Animals**  
4 credits (3+3) J  
An integration of physiological concepts with ecology and evolution to examine how organisms adapt within a diversity of marine environments including the intertidal, subtidal and the deep sea. The course will emphasize biochemical adaptations within the processes of respiration, osmoregulation, thermoregulation, and metabolism of marine invertebrates, fishes, and marine mammals. Prerequisites: BIOL 310 and CHEM 341.

**BIOL S426 Ornithology**  
4 credits (3+3) J  
Evolution, classification, adaptations, distribution, behavior, breeding biology, population dynamics, and migration of birds. Several field trips. Prerequisite: BIOL S105 and S106.

**BIOL S427 Introduction to Ichthyology**  
4 credits (3+2) J  
Major groups of fishes, emphasizing the fishes northwestern North America. Classification, structure, evolution, general biology and importance to man the major groups. Prerequisite: BIOL S105 and S106.

**BIOL S441 Animal Behavior**  
4 credits (3+3) J  
The mechanisms and adaptive nature of individual and social behaviors will be explored in lectures, readings, and laboratory and field exercises. Proximal and ultimate explanations for behavior are studied terms of genetics, ecology, and modern evolutionary theory. Laboratory and field exercises emphasize hypothesis testing through observation and analysis of behavior. BIOL  

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S362 (Genetics) is highly recommended before taking this course. Prerequisite: BIOL S105, S106, S271 or consent of instructor.

**BIOL S445 Vascular Plants of Southeast Alaska**
3 credits (2+2) J
Vascular plants from all habitats (forest, alpine, muskeg, meadow, intertidal wetland, disturbed areas, etc.) will be collected and identified. Lab sessions will emphasize floral dissections and use of keys for identification. Students will make individual plant collections and prepare herbarium sheets which will be incorporated into the University Herbarium. Prerequisite: BIOL S239.

**BIOL S480 Aquatic Pollution**
3 credits (3+0) J
Discusses all major kinds of aquatic pollution including oil, heavy metals, organic wastes, pulp mill effluent, PCBs, pesticides, ocean dumping, radioactive wastes, thermal pollution, and marine litter. Effects on biological systems are emphasized. Emphasis is on Marine Systems. Prerequisites: BIOL S105 and S106, CHEM S106.

**BIOL S481 Marine Ecology**
4 credits (3+3) J
In-depth study of the paradigms regarding the distribution and abundance of marine organisms including analysis and discussion of current primary literature. Major emphasis on how physical-biological interactions structure populations, communities, and ecosystems in the oceans. Students will complete a research project. Prerequisites: BIOL 271 and STAT 273.

**BIOL S482 Evolution**
4 credits (3+3) J
This course entails in-depth study of the mechanisms of evolution. The roles of genetic variation, natural selection, and adaptation, in speciation and other evolutionary processes will be examined in an historical content. Competing schools of thought from the era of The Origin of the Species to recent advances in molecular evolution will be considered. Prerequisites: BIOL S105, S106 and co-requisite: BIOL S362.

**BIOL S492 Biology Seminar**
1 credits (1+0) J
Provides students with first-hand accounts of current research in the biological sciences. Seminar speakers will present research results in a variety of subdisciplines, and students will discuss the significance with presenters and instructor. May be repeated. Prerequisite: BIOL S106.

**BIOL S495 Behavioral Ecology**
3 credits (3+0) J
This course will teach research skills in the area of behavioral ecology and examine current issues in the study of behavior. Emphasis will be on developing testable hypotheses pertaining to the adaptive nature of behavior. Each student, in consultation with the instructor, will develop a

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specific project and reading list. Readings will be discussed in classroom sessions. Students will be required to prepare a research proposal including a full literature review. Animal Behavior (BIOL S441) is strongly recommended before taking this course. Prerequisites: BIOL S105, S106, S271 or permission.

**BIOL S498 Research in Biology**
(1-6 Variable credit) J
Individual research in the biological sciences undertaken by a student in consultation with a member of the Biology Program faculty. Students may submit research ideas to faculty and develop them into project with faculty input. Requires consent of advisor and appropriate faculty supervisor.

**Chemistry Courses**

**CHEM S105 General Chemistry I**
4 credits (3+4) J, K, S GER
Introduction to chemistry, including atomic and molecular structure; the principles of chemical change and related energy changes. Four hours lab per week required. Prerequisites: high school chemistry and MATH S107.

**CHEM S106 General Chemistry II**
4 credits (3+4) J, K, S GER
Introduction to chemistry, including atomic and molecular structure; the principles of chemical change and related energy changes. CHEM S106 includes the chemistry of the elements. Four hours lab per week required. Prerequisite: CHEM S105 with a “C” or better.

**CHEM S341 Organic and Biological Chemistry I**
4 credits (3+4) J
Theory and laboratory covering the fundamentals of organic chemistry including functional group reactivities, stereochemistry and spectroscopy. The laboratory provides practical experience with emphasis on organic synthesis, natural products and structure identification. Four hours lab per week required. Prerequisite: CHEM S106 with a “C” or better.

**CHEM S342 Organic and Biological Chemistry II**
4 credits (3+4) J
Lecture and laboratory which introduce the fundamental principles of biochemistry. Topics include structure and function of biological molecules, properties of enzymes, kinetics, bioenergetics, metabolism and molecular biology. Four hours lab per week required. Prerequisite: CHEM S341 with a “C” or better.

**CHEM S350 Environmental Chemistry**
4 credits (3+4) J
This course provides a general overview of chemical processes in the natural environment. Subjects include the chemistry of natural and anthropogenically influenced processes in air, soil, and water. Energy production and its impact will be explored. Laboratory focuses on the

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analytical tools and methods used in chemical analyses of environmental samples. Prerequisite: CHEM S106 with a “C” or better.

**Physics Courses**

**PHYS S102 Survey of Physics**
4 credits (3+3) J, K, S GER
Concepts and methods of physics for students lacking prior physics study. The course introduces ideas selected from motion, properties of matter, electricity and heat with laboratory experiences. Emphasis is on the reasoning and techniques used in physics. Prerequisite: MATH S107 or equivalent.

**PHYS S103 College Physics I**
4 credits (3+3) J, K GER
Classical mechanics including mechanical energy, waves, sound and fluids. Prerequisite: high school physics and MATH S107 and MATH S108.

**PHYS S104 College Physics II**
4 credits (3+3) J, K GER
Electricity, magnetism, optics and an introduction to modern physics. Prerequisite: PHYS S103.

**PHYS S211 General Physics I**
4 credits (3+3) J GER
Calculus based study of principles of mechanics. Topics include energy, oscillations, sound and fluids. Prerequisites: high school physics and MATH 200.

**PHYS S212 General Physics II**
4 credits (3+3) J GER
Continuation of PHYS S211. Topics include electricity, magnetism, and optics. Prerequisite: PHYS S211.

**Statistics Courses**

**STAT S273 Elementary Statistics**
3 credits (3+0) J, K, S
Introduction to data analysis, least–squares regression, data production, sampling distributions, probability, confidence intervals, hypothesis testing. Detection and analysis of patterns in data. Prerequisite: Math S107 or equivalent.

**STAT S373 Probability and Statistics**
3 credits (3+0) J
A calculus-based course emphasizing theory and applications. Continuous and discrete random variables and their probability distributions, including joint distributions; functions of random variables, including moment-generators; estimation, including Bayesian methods and maximum
likelihood; introduction to the study and the power and significance of hypothesis tests. Prerequisite: Math S200.

**STAT S401 Regression and Analysis of Variance**
3 credits (3+0) J
A thorough study of multiple regression including multiple and partial correlation, the extra sum of square principle, indicator variables, and model selection techniques. Prerequisite: Math S107 or equivalent.
### Appendix A: Course Sequencing for Biology courses in the B.A. Biology Degree

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Appendix B: Example Four-Year Plans of Study for the B.A. in Biology

4 year program
Advanced students that have completed Math 107

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Note that 36 credits of Biol elect or Elect must be upper-division.

4 year program
Students with little math background but who have had high school chemistry and physics

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