**BS in Biology Assessment Plan**

**1. Learning Objective 1 – Breadth and depth of knowledge:**

Students will develop knowledge common to the liberal arts and sciences in the fields of arts, humanities, natural sciences, and social sciences. Students will also develop specialized knowledge and disciplinary expertise (CWEO 4.1.)

**ULO 2. Breadth and depth of knowledge** Develop knowledge common to the liberal arts and sciences in the fields of arts, humanities, natural sciences, and social sciences. Students will also develop specialized knowledge and disciplinary expertise

**Learning Objectives (Outcomes)**

1. Understand the nature of science, biological molecules, cell structure and function, enzymes, metabolism, and classical and molecular genetics.
2. Understand the diversity of animal life; comparative aspects of development, physiology, morphology; life history, behavioral ecology, and evolutionary biology of animals.
3. Understand the diversity of plants; flowering plant anatomy, physiology, reproduction, and ecology; distribution of major plant communities with global climate patterns; biogeochemical cycles.
4. Understand hereditary mechanisms: linkage, gene interactions and regulation, molecular genetics, mutations, and development.
5. Understand interactions of organisms at the species, community, and

ecosystem levels; evidences for modern evolutionary thought in the context of a Christian world view.

1. Appreciate historical, philosophical, and ethical aspects of the natural sciences.

**Courses/Programs Designed to Achieve Learning Objectives**

Planned, hierarchical first-two-year curriculum (BIOL 160, 161, 162, 260, 262) followed by Junior and Senior year electives and culminating in a Senior Capstone course (BIOL 495).

1. BIOL 160; BIOL 382, 412, 413, CHEM 410
2. BIOL 161; BIOL 313, 385, 386, 387, 418
3. BIOL 162; BIOL 321, 332, 334, 335
4. BIOL 260
5. BIOL 262
6. BIOL 260, 495

|  |  |  |
| --- | --- | --- |
| **Assessment Strategies (Measures)** | **Results (Targets)** | **Timeline** |
| a) Internal exam taken in BIOL 260. | a) 75% of majors will achieve a grade of70% or higher. | a) Collect every year, analyze in even years. |
| b) ETS exam taken in BIOL 495. | b) 70% of majors will score at or above the national mean | b) Collect every year, analyze in even years. |

**2. Learning Objective 2 – Specialized skills and scholarship**

Students will become proficient in the scholarship of their discipline and demonstrate specialized skills required for employment (CWEO 4.2.)

**ULO 4.2 Specialized scholarship.** Become proficient in the scholarship of their discipline and demonstrate specialized skills needed to pursue a career and/or graduate school

**Learning Objectives (Outcomes)**

1. Participate in investigative-style laboratory experiences.
2. Learn to work as teams in conducting laboratory and field research.
3. Compose lab reports in format appropriate for scientific journals.
4. Application and extension of basic laboratory and field skills.
5. Learn the skills needed to make a professional oral research presentation using Powerpoint or similar software.

**Courses/Programs Designed to Achieve Learning Objectives**

Investigative laboratory experiences in selected courses throughout the major (BIOL 162, 260, 262). Intentional writing skills development within the major (BIOL 160, 262). Some students involved in faculty mentored student research program (BIOL 393, 422).

1. BIOL 260, 262
2. BIOL 160, 260, 262
3. BIOL 262
4. Option 1: upper level lab courses; Option 2: BIOL 393, 422
5. BIOL 162

|  |  |  |
| --- | --- | --- |
| **Assessment Strategies (Measures)** | **Results (Targets)** | **Timeline** |
| BIOL 162 ethnobotany oral presentation | 90% of majors will score a 75% or higher on the grading rubric | Collect every year, analyze in odd years. |

**3. Learning Objective 3 - Specialized skills and scholarship**

Students will become proficient in the scholarship of their discipline and demonstrate specialized skills required for employment (CWEO 4.3.)

**ULO 4.3 Specialized skills** Become proficient in the scholarship of their discipline and demonstrate specialized skills needed to pursue a career and/or graduate school

**Learning Objectives (Outcomes)**

1. Proficient in basic laboratory techniques (e.g., microscopy, dissection, slide preparation, pipetting, restriction analysis).
2. Familiar with essential laboratory and field safety protocols.
3. Skilled in use of spreadsheet software such as Excel for data analysis and graphing.

**Courses/Programs Designed to Achieve Learning Objectives**

Planned series of lab-based courses in the first-two-year curriculum (BIOL 160,

161, 162, 260, 262), followed by lab-based Junior and Senior year electives with some students involved in faculty mentored student research program (BIOL 393, 422).

1. BIOL 160, 161, 162, 260
2. All lab and field courses
3. BIOL 262

|  |  |  |
| --- | --- | --- |
| **Assessment Strategies (Measures)** | **Results (Targets)** | **Timeline** |
| a) Lab skills achieved by second year (microscopy, restriction analysis, basic dissection, pipetting) | a) For each skill, 75% of majors will demonstrate proficiency | a) Collect every year, analyze in odd years. |
| b) Excel assignment for graphing (BIOL 162) | b) 90% of majors will earn a score of75% or higher on rubric. | b) Collect every year, analyze in odd years |

**4. Learning Objective 4 – Intrapersonal awareness**

Students will gain self-awareness of identity, character, and vocational calling (CWEO 4.4.)

**ULO 5. Self-Awareness** Gain awareness of identity, character, and vocational calling

**Learning Objectives (Outcomes)**

Be familiar with options for employment, voluntary service, and/or graduate education in biology.

**Courses/Programs Designed to Achieve Learning Objectives**

Informal: departmental advising, departmental seminars, health careers advisor, associated student organizations (e.g., Sigma Zeta, Earthkeepers, Med-Aware)

Formal: BIOL 495, faculty-mentored student research (BIOL 393, 422)

|  |  |  |
| --- | --- | --- |
| **Assessment Strategies (Measures)** | **Results (Targets)** | **Timeline** |
| Vocation assignment response | 75% of majors will score 4.5 or above (out of 6) on the grading rubric | Collect every year, analyze in even years. |

**5. Learning Objective 5 - Faith knowledge & application**

Students will develop informed and mature convictions about Christian faith and practice (CWEO 4.5.)

**ULO 3. Faith knowledge & application** Develop informed and mature convictions about Christian faith and practice

**Learning Objectives (Outcomes)**

1. Understand the inter-relatedness of living organisms & humanity’s calling to creation stewardship.
2. Understand various models that relate science and Christian faith.

**Courses/Programs Designed to Achieve Learning Objectives**

Introductory material on science/faith integration in first-two-year courses (BIOL

160, 161, 162, 262) culminating in capstone course (BIOL 495) in senior year.

1. BIOL 161,162, 262
2. BIOL 160, 161, 262, 495

|  |  |  |
| --- | --- | --- |
| **Assessment Strategies (Measures)** | **Results (Targets)** | **Timeline** |
| BIOL 495 integration paper. | 70% of students will score “satisfactory” (2 out of 4) or better in all categories | Collect every year, analyze in even years. |

**BIOL 162 Ethnobotany presentation rubric**

**Names of presenters \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Topic \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

1. **Content coverage** (25pts)

|  |  |  |  |
| --- | --- | --- | --- |
| Creative title **slide** (presenters names, date)  Reason(s) for choosing plant topic Herbaceous/Woody  Perennial/biennial/annual  Deciduous or evergreen  Average size at maturity  Vegetative characters  Leaves (arrangement, complexity, margin)  Stems (unusual features?)  Roots (unusual features?)  Floral characters  Complete/incomplete  Perfect/imperfect  Corolla symmetry  Color of corolla  Number sepals, petals, stamens, pistils  Fusion of parts  Manner of pollination  Type of fruit  Distribution  Historic/current – **slide** with world map  Old World/New World  Biome | 1  1  1  1  1  1  1  1  1  1  1  1 | Taxonomy  Classification **slide** ((APG III clade name)  Nomenclature  Formatting of binomial  Authority  Pronunciation and meaning of name  Common name  Related species  Ethnobotanical Significance  Historic  Current  Name/structure molecules (if needed)  Summary **slide**  References **slide** – minimum ten references  References  One primary science research article  Electronic sources of recognized quality  Recognized citation style  Citations on slides for photographs, quotes,  primary research data/info | 1  1  1  1  1  1  1  1  1  1  1  1  1 |

2. **Communication skills** (25pts)

Was “excessive” reading of notes/slides avoided? 1 2 3 4 5

Did the speakers make good eye contact? 1 2 3 4 5

Did the speakers speak clearly with good volume? 1 2 3 4 5

Were topics presented in an orderly manner? 1 2 3 4 5

Did the speakers clearly answer questions? 1 2 3 4 5

3. **Effectiveness of visual material** (25pts)

Appropriate font size & slide backgrounds 1 2 3 4 5

Slides easy to read and understand 1 2 3 4 5

Adequate number of illustrations/pictures 1 2 3 4 5

Quality of pictures and diagrams, spelling 1 2 3 4 5

Evidence of care and creativity in crafting talk 1 2 3 4 5

4. **Overall effectiveness of presentation** (25pts)

Informative, engaging, well-researched? 1 2 3 4 5

Equal participation/professional attire? 1 2 3 4 5

Finish within 16-18 minute window? Time\_\_\_\_\_\_ 1 2 3 4 5

Meaningful use of primary research article? 1 2 3 4 5

One half presentation time for Ethnobotany? 1 2 3 4 5

Total score\_\_\_\_\_\_\_/100

**Learning Objective 3 – Technical Competency**

**Lab skills achieved by the second year**

Target: 75% of majors will demonstrate proficiency

BIOL 160 Microscopy – use oil immersion to locate and focus on a specified item

Restriction analysis – use results from question on final exam

BIOL 161 Basic dissection skills

BIOL 162 Taxonomy – create a taxonomic key to identify tree species

BIOL 260 Pipetting

BIOL 160 Restriction analysis exam question

15. The DNA circle shown below (left) was cleaved at the locations indicated by the short lines. Which

pattern on the gel (right) best corresponds to the pattern of fragments generated by cleavage of the circle

at those locations?

A. 1

B. 2

C. 3

D. 4

E. M

 

**BIOL 162 Expressing Data in Graphic Format – Excel exercise**

Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

|  |  |  |  |
| --- | --- | --- | --- |
|  | Relative Basal Area | Relative Density | Actual Density |
| 2-D Clustered Column Graph | 1 | 1 | 1 |
| All species abbreviations present and in vertical orientation to each bar | 1 | 1 | 1 |
| Net change, title box and horizontal lines removed | 1 | 1 | 1 |
| Outer border removed | 1 | 1 | 1 |
| Correct horizontal axis title and placement | 1 | 1 | 1 |
| Correct vertical axis title and placement | 1 | 1 | 1 |
| Correct figure legend properly positioned below figure | 1 | 1 | 1 |
| Each figure with legend on its own page in portrait orientation | 1 | 1 | 1 |
| Subtotals |  |  |  |
|  |  | Total |  |

| **Vocational Essay** | | |
| --- | --- | --- |
| **Criteria** | **Ratings** | **Pts** |
| Identifies 3 or more career opportunities in major  [view longer description](https://messiah.instructure.com/courses/1393902/assignments/7477431) | |  |  |  |  | | --- | --- | --- | --- | | Good  2 pts | Fair  1 pts | Poor  0.5 pts | Not Done  0 pts | | 2 pts |
| Identifies 3 or more on/off campus opportunities to develop career skills during college.  [view longer description](https://messiah.instructure.com/courses/1393902/assignments/7477431) | |  |  |  |  | | --- | --- | --- | --- | | Good  2 pts | Fair  1 pts | Poor  0.5 pts | Not Done  0 pts | | 2 pts |
| Identification of 3 or more Career Skills Gained in Major  [view longer description](https://messiah.instructure.com/courses/1393902/assignments/7477431) | |  |  |  |  | | --- | --- | --- | --- | | Good  2 pts | Fair  1 pts | Poor  0.5 pts | Not Done  0 pts | | 2 pts |
| Total Points: 6 | | | |