

## **Biology - Health Sciences Program Assessment Report 2012-2013**

### **I. Introduction**

The Biology – Health Sciences program, offered on the Klamath Falls campus, serves all Oregon Tech students wishing to major in a course of study that prepares for entry into professional programs in medicine, dentistry, pharmacy, veterinary medicine, physical therapy, physician assistant, optometry, clinical laboratory sciences, and related health fields. Last year we combined the Premedical Professions emphasis in Biology with the Health Sciences program since their curriculum maps were identical. This was done in order to reduce confusion for students.

The Health Sciences program was implemented in 1996. The number of students graduating in past years were 8 (1999-2000), 2 (2000-2001), 9 (2001-2002), 10 (2002-2003), 10 (2003-2004), 11 (2004-2005), 7 (2005-2006), 1 (2006-2007), 3 (2007-2008), 2 (2008-2009), 2 (2009-2010), 1 (2010-2011), 6 (2011-2012), and 13 (2012-2013).

The Biology program with its two emphasis areas was implemented in 2006. The number of students graduating in past years were 10 (2006-2007), 8 (2007-2008), 18 (2008-2009), 14 (2009-2010), 12 (2010-2011), 13 (2011-2012), and 2 (2012-2013). These include students from both the Biological Sciences and Premedical Professions emphasis areas. There were 15 graduates in the “new” Biology-Health Sciences programs in 2012-2013.

### **II. Program Purpose, Objectives and Student Learning Outcomes**

The purpose, goals, and objectives of the Biological – Health Sciences program were discussed by the program faculty during fall convocation 2012 with a recommendation to update this assessment report. This final report incorporates these recommendations.

#### **Biology - Health Sciences Program Purpose**

The Bachelor of Science program in Biology – Health Sciences prepares undergraduate students for professional schools in the medical sciences (medicine, dentistry, pharmacy, veterinary sciences, physical therapy, clinical laboratory sciences, etc.).

#### **Biology - Health Sciences Program Objectives**

- Provide an integrated foundation of knowledge in biological disciplines that includes morphological, cellular, molecular, physiological, developmental, and evolutionary principles.
- Present information on the life sciences that utilize the scientific method and emphasize skills in analysis, evaluation, and critical thinking.
- Prepare students for entrance into graduate schools and professional health schools, including preparation for national admissions examination, such as the Graduate Record Examination (GRE), Medical College Admission Test (MCAT) and similar examinations, or provide students with practical skills that can qualify them for entry level positions in biology and health-related occupations.

#### **Biology - Health Sciences Program Student Learning Outcomes (PSLOs)**

1. Students will demonstrate scientific knowledge and skills in scientific reasoning.
2. Students will be able to apply scientific principles to biology based problems.
3. Students will be able to effectively find and use resources from the literature.
4. Students will demonstrate effective oral, written and visual communication.
5. Students will demonstrate mathematical knowledge and skills in the biological sciences.

### III. Three Year Cycle for Assessment for Student Learning Outcomes

The Natural Sciences faculty agreed to designate five program student learning outcomes (PSLOs) with one or two to be assessed each year in a rotating three-year cycle, as shown in Table 1 below.

#### Biology – Health Sciences Assessment Cycle

Program Student Learning Outcomes	2007-2008	2008-2009	2009-2010	2010-2011	2011-2012	2012-2013	2013-2014	2014-2015
1. Students will demonstrate scientific knowledge and skills in scientific reasoning.	✓	✓		✓			✓	
2. Students will be able to apply scientific principles to biology based problems.			✓			✓		
3. Students will be able to effectively find and use resources from the literature.			✓			✓		
4. Students will demonstrate effective oral, written and visual communication.				✓			✓	
5. Students will demonstrate mathematical knowledge and skills in the biological sciences.	✓	✓			✓			✓

Table 1. Biology - Health Sciences Program Assessment Cycle.

### IV. Summary of 2012–2013 Assessment Activities

The faculty of the Biology – Health Sciences program conducted the following assessments during the 2012-2013 academic year as indicated in Table 2.

Program Student Learning Outcome	Fall	Winter	Spring
PSLO 2 Students will be able to apply scientific principles to biology based problems.			✓ Bio 436
PSLO 3 Students will be able to effectively find and use resources from the literature.		✓ Bio 409	

Table 2. Biology – Health Sciences Program Assessment Activities for Academic Year 2012-2013.

## PSLO 2: Apply biological principles to solving biology-based problems.

This PSLO is mapped to the curriculum as shown in appendix A1.

### Direct Assessment #1

The faculty conducted an assessment of this PSLO in BIO 436 during the spring 2012-2013 term using quiz questions clustered around the three performance criteria. Twenty-nine upper division students were involved in the assessment. The results are shown in Table 3 below.

Criteria	Assessment Method	Measurement Scale	Minimum Acceptable Performance	Results (percent correct)
Students can use biological principles to solve applied problems	6 Exam questions	1= correct 0 = incorrect	70 % per question	1-91% 2-61% 3-87% 4-70% 5-91% 6-65%
Students are able to relate scientific methods to problems in biology and/or interpret experimental results in relation to biological problems	6 Exam questions	1= correct 0 = incorrect	70% per question	1-43% 2-39% 3-70% 4-78% 5-83% 6-78%
Students will be able to perform laboratory methods associated with course content	8 Exam questions	1= correct 0 = incorrect	70% per question	1-83% 2-100% 3-100% 4-72% 5-86% 6-83% 7-79% 8-86%

Table 3. Assessment results for PSLO 2 in BIO 436, spring term, 2012-2013

Based on the results above, students met performance criteria for the majority of the questions for this learning outcome. This was the first year the faculty member taught BIO 436. While performance was very satisfactory on some questions, others were below 70%. The faculty member did not have time to cover all topics.

### Indirect Assessment #1

We asked all graduating students of the Biology-Health Sciences program the following question: Please indicate how well the Biology/Health Sciences program prepared you in applying scientific principles to biology-based problems? Eight of thirteen graduating students responded. Their responses are shown in Table 4 below.

Question	Highly prepared	Prepared	Inadequately prepared	Responses	Mean
Apply scientific principles to biology based problems?	5.00	1.00	2.00	8.00	1.63

Table 4. Responses of Biology-Health Sciences graduates to how well the Biology/Health Sciences program prepared them in applying scientific principles to biology-based problems.

Discussion: This indirect assessment indicates that 75% of our responding graduates feel the Biology-Health Sciences program either highly prepares them or prepares them to apply scientific principles to biology-based problems. Twenty-five percent feel they were inadequately prepared.

**PSLO 3: Students will be able to effectively find and use resources from the literature.**

This PSLO is mapped to the curriculum as shown in appendix A2.

**Direct Assessment #1**

The faculty conducted an assessment of PSLO 3 based on research papers scored in BIO 409 in winter 2012-2013 with 20 seniors in Biology - Health Sciences involved in the assessment. The student prompt for the assignment was: You will be required to write a 7-10 page research paper on the same topic as your oral presentation. This article should utilize at least six referenced sources, including at least two primary research articles, and should describe an area of current research, explain its context and importance, and suggest the possible direction of further developments in the field. It should be written in the third person, and illustrations or figures should only be included if they help explain the topic and are referred to within the text of the paper.

The combined results for the two sections of BIO 409 are shown in Table 5 below.

Performance Criteria	Assessment Method	Measurement Scale	Minimum Acceptable Performance	Results
1. Search and acquire resources a. identify and locate appropriate sources b. use library and online technologies to locate references	Research paper	3= high proficiency 2= proficiency 1=no/limited proficiency	85% at 2 or 3	1a: 95% 1b: 100%
2. Utilize data bases a. recognize appropriate data bases and their limitations b. extract information from data bases	Research paper	3= high proficiency 2= proficiency 1=no/limited proficiency	85% at 2 or 3	2a: 100% 2b: 90%
3. Evaluate reference sources a. recognize different levels of information authority b. power of conclusions	Research paper	3= high proficiency 2=proficiency 1=no/limited proficiency	85% at 2 or 3	3a: 95% 3b: 90%

Table 5. Assessment results for PSLO 3 in BIO 409, winter term 2012-2013

Discussion: This assessment suggests students in this course demonstrate satisfactory performance in searching and acquiring resources, utilizing data bases, and evaluating reference sources, while showing somewhat limited proficiency in justifying confidence levels to conclusions stated in reference sources.

Students participating in the assessment are seniors and have taken several courses which contained a writing component in course evaluation. Students are equipped with the ability to utilize available database and search literature. However, students are weak in evaluating the results and conclusions presented in the papers and references. The instructor felt that students should be exposed to more scientific reading such as peer-reviewed articles, and should be taught with the skills of scientific readings.

From the Faculty:

Several students in the “overall proficiency” group scored higher in area 1 (4/9, “Search and acquire resources”), and no student was marginal in this area. The course instructor did steer them all towards a particular range of online databases during in-class sessions early in the term, which may have somewhat discouraged most students from searching even more broadly, but the instructor feels that this is not needed, since the available online resources are quite rich, with full text available either directly or via inter-library loan.

Students did an effective job searching within the range of resources suggested, and some went beyond this as well.

The rubric used for PSLO 3 is presented in Appendix B. Data collected for this PSLO is presented in Appendices C1 & C2.

### Indirect Assessment #1

Faculty asked all graduating students of the Biology-Health Sciences program the following question: Please indicate how well the Biology/Health Sciences program prepared you in effectively find and use resources from the literature? Eight of thirteen graduating students responded. Their responses are shown in Table 6 below.

Question	Highly prepared	Prepared	Inadequately prepared	Responses	Mean
Effectively find and use resources from the literature?	4.00	3.00	1.00	8.00	1.63

Table 6. Responses of Biology-Health Sciences graduates to how well the Biology/Health Sciences program prepared them in effectively find and use resources from the literature.

Discussion: This indirect assessment indicates that 87.5% of our responding graduates feel the Biology-Health Sciences program either highly prepares them or prepares them to effectively find and use resources from the literature.

## V. Summary of Student Learning

### PSLO 2: Apply biological principles to solving biology-based problems.

Strengths: Students met performance criteria for using biological principles to solve biological problems, relating scientific methods to problems in biology and/or interpreting experimental results in relation to biological problems, and performing laboratory methods associated with course content

Weaknesses: None identified.

Actions: None at this time.

### PSLO 3: Students will be able to effectively find and use resources from the literature.

Strengths: This assessment suggests students in this course demonstrate satisfactory performance in searching and acquiring resources, utilizing data bases, and evaluating reference sources.

Weaknesses: Students demonstrated somewhat limited proficiency in justifying confidence levels to conclusions stated in reference sources.

Actions: the faculty felt that the skills involved in assigning and justifying confidence levels to conclusions stated in reference sources is primarily a graduate level skill. The faculty, however, will continue to place emphasis on this skill and will reassess this in the next regularly scheduled assessment cycle. At that time, the faculty will decide whether this skill should remain as a performance criterion for this outcome.

While all students' demonstrated overall proficiency or higher in PSLO 3, five of them were on the borderline to limited proficiency in one particular area, category 3b ("Does not distinguish between the power of conclusions presented in different sources"). However, two other students demonstrated "high proficiency" in this. This continues to be a challenging area for students, since there is not one straightforward formula for evaluating sources. Proficiency in this area was overall about the same as when this same assessment was conducted previously, in winter 2010-2011. Students might benefit from additional opportunities to practice this skill throughout other courses in the major, or from more focus on this aspect in existing research assignments.

## Appendix A1. Curriculum Map for Biology - Health Sciences

### PSLO 2 Apply biological principles to solving biology-based problems.

Year	Fall	Outcome*	Winter	Outcome*	Spring	Outcome*
<b>F 1</b>						
	BIO 211 Principles of Biology	I	BIO 109 Intro to Medical Sciences		BIO 213 Principles of Biology	I
	MATH 111 College Algebra		BIO 212 Principles of Biology	I	MATH 361 Statistical Methods I	
	WRI 121 English Composition		MATH 112 Trigonometry		Health Biology Elective (lower division)	
	Social Science Elective		WRI 122 English Composition		Humanities Elective	
			Social Science Elective			
<b>S 2</b>						
	BIO 345 Medical Microbiology	I	BIO 209 Current Research Topics in Medical Sciences I		CHE 223 General Chemistry	
	CHE 221 General Chemistry		CHE 222 General Chemistry		WRI 227 Technical Report Writing	
	MATH 251 Differential Calculus		MATH 252 Integral Calculus		Health Biology Elective (upper division)	R
	SPE 111 Fundamental of Speech		SPE 321 Small Group Communication		Humanities Elective	
			† Health Biology Elective (upper division)	R		
<b>J 3</b>						
	BIO 331 Human Anatomy & Physiology I	R	BIO 332 Human Anatomy & Physiology II	R	BIO 333 Human Anatomy & Physiology III	R
	CHE 331 Organic Chemistry I		CHE 332 Organic Chemistry II		CHE 333 Organic Chemistry III	R
	PHY 221 General Physics with Calculus		PHY 222 General Physics with Calculus		PHY 223 General Physics with Calculus	
			Humanities Elective		WRI 327 Advanced Technical Writing	
<b>S 4</b>						
I	CHE 450 Biochemistry I	R	BIO 346 Pathophysiology I	E	BIO436 Immunology	E
	Health Biology Elective (upper division)	R	BIO 409 Current Research Topics in Medical Sciences II		Health Biology Elective (upper division)	R
	Social Science Elective		CHE 451 Biochemistry II	R	Health Biology Elective (upper division)	R
	Elective		Social Science Elective		Health Biology Elective (upper division)	R
	Elective				Elective	

\* In these columns, the outcome is either introduced (I), reinforced (R), or emphasized (E) in each course. It is left blank if not applicable.

† Outcomes applicable to Health Biology Electives (upper division) are: BIO 341 (R), BIO 342 (R), BIO 347 (E), BIO 357 (R), BIO 426 (R), BIO 436 (E), and CHE 452 (R).

## Appendix A2. Curriculum Map for Biology – Health Sciences

**PSLO 3 Students will be able to effectively find and use resources from the literature.**

Year	Fall	Outcome*	Winter	Outcome*	Spring	Outcome*
<b>F 1</b>						
	BIO 211 Principles of Biology		BIO 109 Intro to Medical Sciences		BIO 213 Principles of Biology	I
	MATH 111 College Algebra		BIO 212 Principles of Biology		MATH 361 Statistical Methods I	
	WRI 121 English Composition		MATH 112 Trigonometry		Health Biology Elective (lower division)	
	Social Science Elective		WRI 122 English Composition Social Science Elective		Humanities Elective	
<b>S 2</b>						
	BIO 345 Medical Microbiology		BIO 209 Current Research Topics in Medical Sciences I	I	CHE 223 General Chemistry	
	CHE 221 General Chemistry		CHE 222 General Chemistry		WRI 227 Technical Report Writing	R
	MATH 251 Differential Calculus		MATH 252 Integral Calculus		Health Biology Elective (upper division)	
	SPE 111 Fundamental of Speech		SPE 321 Small Group Communication		Humanities Elective	
			‡ Health Biology Elective (upper division)	R		
<b>J 3</b>						
	BIO 331 Human Anatomy & Physiology I		BIO 332 Human Anatomy & Physiology II		BIO 333 Human Anatomy & Physiology III	
	CHE 331 Organic Chemistry I		CHE 332 Organic Chemistry II		CHE 333 Organic Chemistry III	
	PHY 221 General Physics with Calculus		PHY 222 General Physics with Calculus		PHY 223 General Physics with Calculus	
			Humanities Elective		WRI 327 Advanced Technical Writing	R
<b>S 4</b>						
	CHE 450 Biochemistry I	R	BIO 346 Pathophysiology I		Health Biology Elective (upper division)	R
	Health Biology Elective (upper division)	R	BIO 409 Current Research Topics in Medical Sciences II	E	Health Biology Elective (upper division)	R
	Social Science Elective		CHE 451 Biochemistry II	R	Health Biology Elective (upper division)	R
	Elective		Social Science Elective		Elective	
	Elective					

\* In these columns, the outcome is either introduced (I), reinforced (R), or emphasized (E) in each course. It is left blank if not applicable.

‡ Outcomes applicable to Health Biology Electives (upper division) are: BIO 341 (E), BIO 342 (R), BIO 436 (R), and CHE 452 (R).

## Appendix B. Performance Criteria Rubric PSLO 3

**PSLO 3 Students will be able to effectively find and use resources from the literature.**

Criteria	High Proficiency (3)	Proficiency (2)	No/Limited Proficiency (1)
<b>1. Search and acquire resources:</b>			
a. Identifies and locates appropriate sources for reference citation in presentations, papers, and research reports	<ul style="list-style-type: none"> <li>Literature search is systematic, conducted efficiently; reference sources are highly appropriate to project</li> </ul>	<ul style="list-style-type: none"> <li>Most citations are appropriate to the project; search method is moderately efficient</li> </ul>	<ul style="list-style-type: none"> <li>Literature searches demonstrate poor understanding of subject matter</li> <li>Search appears to be random; no systematic method employed</li> </ul>
b. Uses library and online technologies to locate and acquire reference materials	<ul style="list-style-type: none"> <li>Employs a wide variety of search methods, catalogs, and technologies to obtain appropriate references</li> </ul>	<ul style="list-style-type: none"> <li>Utilizes library and online resources, including different search engines and catalogs</li> </ul>	<ul style="list-style-type: none"> <li>Displays little familiarity with library or online methods for searches</li> </ul>
<b>2. Utilize data bases:</b>			
a. Recognizes appropriate data bases for biological information and their limitations	<ul style="list-style-type: none"> <li>Demonstrates advanced ability to select appropriate data bases</li> <li>Explains limitations of data within project applications</li> </ul>	<ul style="list-style-type: none"> <li>Identifies most data sources and explains appropriateness and limitations of information with regard to project</li> </ul>	<ul style="list-style-type: none"> <li>Demonstrates little or poor understanding of data limitations</li> <li>Does not identify appropriate application of data</li> </ul>
b. Demonstrates ability to extract information from diverse data bases	<ul style="list-style-type: none"> <li>Demonstrates advanced competence in selecting data for project</li> </ul>	<ul style="list-style-type: none"> <li>Utilizes most of the data appropriate to a presentation or paper</li> </ul>	<ul style="list-style-type: none"> <li>Unable to utilize information from a data source for presentation or paper</li> </ul>
<b>3. Evaluate reference sources</b>			
a. Recognizes different levels of information authority and selects reference material appropriate to intended audience	<ul style="list-style-type: none"> <li>Uses a variety of reference source levels, identifying appropriate applications for different audiences</li> </ul>	<ul style="list-style-type: none"> <li>Recognizes levels of information within primary, secondary, and tertiary reference sources</li> </ul>	<ul style="list-style-type: none"> <li>Demonstrates little or no knowledge of differences between reference sources and their application</li> </ul>
b. Assigns and justifies confidence levels to conclusions stated in reference sources	<ul style="list-style-type: none"> <li>Displays advanced knowledge of reference sources and applicability of conclusions</li> </ul>	<ul style="list-style-type: none"> <li>Recognizes strong and weak conclusions based on type of study and authorship</li> </ul>	<ul style="list-style-type: none"> <li>Does not distinguish between the power of conclusions presented in different sources</li> </ul>

## Appendix C1. Data Collected in Section 1 of BIO 409 for PSLO 3 for 2012-2013

**PSLO 3 Students will be able to effectively find and use resources from the literature.**

	1a	1b	2a	2b	3a	3b
Student #1	3	3	2	2	2	2
Student #2	3	3	3	2	2	2
Student #3	1	2	2	1	1	1
Student #4	2	3	2	2	2	2
Student #5	3	3	3	3	2	2
Student #6	3	3	3	3	3	3
Student #7	3	3	3	3	2	2
Student #8	2	3	2	2	2	2
Student #9	3	3	3	3	3	3
Student #10	3	3	3	3	2	2
Student #11	2	3	2	1	2	1

### 1. Search and acquire resources

- a. Identify and locate appropriate sources
  
- b. Use library and online technologies to locate references

### 2. Utilize data bases

- a. Recognize appropriate data bases and their limitations
- b. extract information from data bases

### 3. Evaluate reference sources

- a. recognize different levels of information authority
- b. power of conclusions

	1a	1b	2a	2b	3a	3b
3= high proficiency	63.6	90.9	54.5	45.5	18.2	18.2
2= proficiency	27.3	9.1	45.5	54.5	72.7	63.6
1=no/limited proficiency	9.1				9.1	18.2

**Appendix C2. Data Collected in Section 2 of BIO 409 for PSLO 3 for 2012-2013**

**PSLO 3 Students will be able to effectively find and use resources from the literature.**

category	OVERALL	1a	1b	2a	2b	3a	3b
Student #1	2.2	2	2	2.5	2	2	2.5
Student #2	1.9	2	2.5	1.5	2	2	1.5
Student #3	1.9	2	2	2	2	2	1.5
Student #4	1.9	2	2	2	1.8	2	1.5
Student #5	2.1	2	3	2	2	2	1.5
Student #6	2.3	2.5	2	3	2	2	2.5
Student #7	1.9	2	2	2	2	2	1.5
Student #8	2.1	2.5	2	2	2	2	2
Student #9	2.2	2	2.5	2.5	2	2	2
average		2.1	2.2	2.2	2.0	2.0	1.8

1=no/limited proficiency

2=proficiency

3=high proficiency