WILLIAM WOODS
UNIVERSITY

Biology BA Annual Assessment 2021-2022

Table of Contents

Annual Assessment 2021-2022

Biology BA

Program Profile

Program Mission Statement
Please insert your program mission statement here

A program designed to both educate students and prepare them for immediate careers in the biological sciences (especially those in ecology or conservation), or for acceptance into graduate programs.

Program Data

Delivery Method

Traditional On Campus (selected)
Online
Hybrid

	Student Majors	Student Minors
2020-2021	**16**	**6**
2021-2022	**14**	**6**

Concentrations 2020-2021
If your program contains concentrations, please list the concentrations and the number of students identified within each concentration.

N/A

Concentrations 2021-2022
If your program contains concentrations, please list the concentrations and the number of students identified with each concentration.

N/A

Student Demographics
What are the program goals for student retention, persistence and degree completion? What do the persistence numbers mean to the faculty in the program? Are the persistence numbers what the program expected? If not, how could the numbers improve?

The Biology Department has a program goal of 75% retention between freshman and sophomores, a 90% persistence per year, and with a 100% completing the program that enter their senior year. By our program goal mentioned above, we would expect a graduation rate ~60%.
Our department's approach to the 75% retention is through multiple factors:

- As much interaction with the full-time biology faculty as possible through the freshman Biology Core courses (lecture and lab)
- Easy access to not only the Biology Faculty, but those teaching Chemistry, Math, and Physics
- Having an event sponsored by the department in early fall to help them generate a 4-year degree plan
- Specifically planned interactions with upper class majors
- Getting students involved in university Clubs

The retention data for the Biology BA degree plan shows that we had a retnetion rate of 100%, way above our benchmark as well as the retention rate for the University (71%). By our program goal mentioned above, we would then expect a graduation rate ~60%. The current data shows a graduation rate of 100% for new students who entered during 2015/2016, with a 0% graduation rate for those students that transferred during the same 2015/2016 academic year. Many transfer students are told they can finish their degree in one year, which is not the case since nearly all of our upper division Biology courses have General Biology II (BIO124/125) and General Chemistry II (CHM124/125). So completion of a Biology degree is at least a two year process, and if they transfer in January, that could mean 2.5 years.

While the Biology BA degree has low enrollment numbers, since the 2018/2019 academic year there is a trend consistent numbers of student enter as Biology BA and so the overall enrollment in the BA program has been growing. The Biology faculty feel more students are understanding the advantages and flexibility of the Biology BA program as well as having a slightly higher number of students interested in ecology/conservation. We do feel better marketing of this major would lead to an increase in the number of students in the program. Larger enrollment could also help with the retention number as students would be selecting that program and be more likely to stay enrolled and Biology BA majors.

Optimal Enrollment
Considering current human and physical resources, what is the optimal enrollment for the program?
25

Is the Program Externally Accredited

Yes
No (selected)

External Accreditation
Name the Accrediting Agency or entity including the last review/approval. Is there an accrediting body for the field of study? If yes, what is the name of the group. Is the program seeking accreditation?If no, why?

N/A

Admissions and Marketing Materials
Reflect on the current marketing materials used for the program. Please attach screen shots of the website or any material you are referencing in this section. What changes, if any, should be made to the material? Are there recommendations on how to modify the current material?

The Biology faculty helped marketing develop a new page sheet in 2018-2019 and we were sure to include the BA in the marketing sheet. With a change in the head of Marketing and the head of Admissions, the Biology faculty are optimistically hopeful about better marketing and enrollment in the BA program. We have previous indicated recruiting for the BA through conservation, wildlife, and hunting clubs, as well as through 4-H clubs and FFA chapters would be a plan of action for increasing interest in this Degree plan. We hope to meet with the new Director of Admission and the new head of Marketing to ensure the BA Biology Degree is being recruited to it fullest.

Marketing Material

Program Assessment

Standard/Outcome

Identifier	Description
WWU2021.1	Knowledge and Scholarship: Demonstrate current knowledge and educational expertise in an academic or professional discipline engaging students in the process of academic discovery.

Additional Standards/Outcomes

Identifier	Description
BIO	Information and Energy: Demonstrate knowledge of major conserved metabolic, signaling, heritable, and

2019.4	molecular processes of all life on Earth.
BIO.1	Evolution: Articulate knowledge that life evolved over time via mechanisms of mutation, natural selection, and genetic drift, and that there is concrete evidence for this fundamental concept _ evolution from common ancestry _ in the unity of numerous biological processes among species.
BIO.2	Interdisciplinary: Demonstrate that fundamental principles and laws of chemistry and physics are also underpinnings that govern complex living systems.
BIO.3	Diversity in structures, functions, and systems: Demonstrate and model, through reductionist and holistic approaches, the interconnectedness of life along a continuum from molecular structures to interactions among organisms and with ecosystems.
BIO.4	Information and Engergy: Demonstrate knowledge of major conserved metabolic, signaling, heritable, and molecular processes of all life on Earth.

Alignment to the University Objectives
Please discuss the Program alignment to the University Objectives. Specific evidence is not to be uploaded, but discussion is expected of the assignment, and intentionality of how the objective is met with program curriculum.

WWU2016.1 Major Field Competence: Students will demonstrate excellence in an academic or professional discipline, and engage in the process of academic discovery.

Students are strongly encouraged to get shadowing hours and/or internships, as well as relevant professional jobs as well, during the school year, but primarily over the breaks. This is accomplished through formal and informal advising. The faculty all help with this process, as well as have classes specific to enable them to prepare for their future career (i.e. BIO 450).

WWU2016.2 Ethics: Students will exhibit values and behaviors that address self- respect and respect for others that will enable success and participation in the larger society.

Much of our curriculum includes writing scientific papers, which has an ethical culture to itself. Students learn how to appropriately use other people's work, while giving them credit, and not plagiarizing. Additionally we do lots of group-work in and outside of the labs and classes that ensure our students develop the skills to respectfully and successfully work with others.

WWU2016.3 Self-Liberation: Students will develop an honest understanding and appreciation of themselves and others resulting in an ability to make individual decisions.

Though we help students get and find internships, shadowing hours, and professional work, we do not hold their hand. They must do much of the work themselves, knowing they have us as support. This allows them to safely, and autonomously, make important career and life decisions, building their self-confidence and awareness that they can do it.

WWU2016.4 Lifelong Education: Students will possess an intellectual curiosity and desire for continual learning both within and beyond formal education in preparation for participation in a global society.

Our program has a strong push towards intellectual curiosity and continual learning that goes beyond information that should be learned for a test. From ethics discussions and having interesting speakers from a variety of biology backgrounds that our students are strongly encouraged to attend, to the self-designed experiments that are required in many of the biology courses (all biology students will have at least three major self-designed projects, many will have six) students have lots of opportunities to see how biology fits into the broader world. This preparation prepares our students to participate in the global society with an understanding that biology is relevant in today's world and impacts choices and policies. Furthermore, by experiencing a broad range of biological topics and having experiencing researching topics for themselves, students will be better able to understand how they can find information out for themselves and will have the tools needed to pursuing continual learning even after they graduate.

General Education Alignment to Program
How do the General Education criteria align with Program Objectives? What courses within the program build upon skills learned from general education courses (please list the program course and the general education criteria)? The General

Education clusters are attached to the document below.

Critical Analysis: (9 credit hours) – Students apply logical and analytical reasoning skills to diverse source materials in the interest of discerning and debating aesthetic, thematic, and ethical content.

In all biology coursework, students are expected to integrate sound logical arguments with the scientific method. Students are expected to analyze and interpret general textbooks, primary scientific literature, and data. Throughout biology courses, students are expected to articulate the ethical interface of scientific practice and general societal issues, as well demonstrate integrity in their own scientific communications (oral and written).

Creative Expression: (12 credit hours) – Students develop the ability to express ideas and concepts, both logically and creatively, through written, oral, reflective, and aesthetic practices utilizing various media forms.

In all biology coursework, students are expected to demonstrate creative and independent generation of ideas based upon scientific parameters that they are presented, e.g. independently generating novel hypotheses regarding specific issues that they might be given. Students are expected to prepare and perform presentations on content-specific topics, in addition to extensive written technical papers and essays.

Quantitative Inquiry: (10 credit hours) – Students will develop and practice quantitative problem-solving skills in order to analyze and critically evaluate information in a larger context.

Quantitative inquiry is the foundation of the entire biology program. In all biology coursework students are expected to analyze data, evaluate it critically, and to be able to generate and interpret statistics. Math courses provide students with the quantitative background to perform these activities.

Society & the Individual: (12 credit hours) – Students integrate knowledge to articulate an understanding of diverse cultures, historical contexts, and human behaviors.

In all biology coursework students are expected to apply their knowledge of human behavior in the context of molecular to organismal processes (e.g. how the human body works and thinks) in addition to the formation of new scientific ideas. Students are expected to be able to articulate that there are variable correct interpretations of authoritative scientific principles and demonstrate competency with the historical development of scientific principles – that the natural process of scientific development involves building upon the ideas of scientific progenitors.

GE_Cluster_Descriptions_FINAL_Version_Approved.docx

NSSE Objectives Discussed Fall 2019

Program Alignment to NSSE Objectives
How did the program integrate the three NSSE objectives determined by the faculty in the fall of 2019? The objectives were to 1) integrate more interdisciplinary work within the curriculum, 2) to connect learning to societal problems or issues, and 3) to examine the strengths and weaknesses of their (students) own views on a topic or issue. Please articulate which courses, and what assignments were assigned and how the work was assessed. Were the assignments successful? What could have made them more successful?

Our program integrated the three NSSE objectives into individual courses at the discretion of the professor. Illustrative examples of these integrative activities and their assessments are included below. The Biology Faculty will have a discussion prior to the start of the Fall 2021 semester to determine if addressing these NSSE objectives will be best served by continuing to address these individually, or if a program-wide approach to these objectives would better meet the needs of the students.

1) integrate more interdisciplinary work within the curriculum

Dr. Kimberly Keller had a strong push for interdisciplinary work in her classes. Unfortunately, due to COVID, the annual project between her Genetics class (Bio 231/232) with Dr. Antje Heese (Associate Professor) from the Biochemistry Department at the University of Missouri to participating in their research by trying to identify a mutant in the plant, Arabidopsis thaliana, using PCR genotyping. The work is cross-disciplinary and real-life, both aspects that the students found meaningful. The students' work was assessed via lab-report (and questions on the lab exam). This activity is extremely successful both in students' perceptions, and in what they learned from the activities. Dr. Keller plans to re-instate this collaborative learning activity in the 2021-2022.

Similarly, in Dr. Keller's Microbiology class (BIO303/304), our students learn about the "One Health Initiative" through a collaborative lab with Dr. Paul Schiltz and the Equestrian Department learning to do fecal Egg counts on samples from the University equine herd. As above, the interdisciplinary work was exciting to the students who got to see how biology knowledge translates into health initiatives. Dr. Keller's Molecular Biotechnology (BIO414/415) also worked with Dr. Schiltz on a Platlet-Rich Plasma protocol comparison and our students also attempted to identify a antibiotic bacteria from wound on one of the horses that would not heal.

2) to connect learning to societal problems or issues

All of our biology classes connect with societal problems or issues—these range from environmental and conservation issues (strongly addressed in Environmental Science BIO 209, Ecology BIO 330/331) to human medical and ethical challenges (strongly addressed in Genetics BIO 231/232, Microbiology Bio 303/304, Human Anatomy and Physiology BIO 314/314, and Molecular Biotechnology BIO414/415).

While many of these issues are addressed as the naturally arise from the material being learned (e.g. the ethical implications of altering DNA, the role of antibiotic overuse contributing to "superbugs", the interactions of species on each others' survival) we did seek to explicitly connect learning to societal problems or issues.

3) to examine the strengths and weaknesses of their (students) own views on a topic or issue

All of the upper-level biology classes, and many of the lower-level ones, including Gen Bio 1 and Gen BIO 2 (BIO 114/115, BIO 124/125) include a research paper or project. These projects and/or papers are assessed part-way through the course, giving the students feedback on the strength of their mastery and understanding of the topic as well as providing them information about their weaknesses in the area. This method allows students to build on their strengths and address their weaknesses prior to completing their final projects.

This feedback is given by the instructor.

A new activity that directly examined students' own views on topics was done in Human Anatomy and Physiology 2 lab (BIO 324). The students had a whole lab period where they were given a list of anatomical misconceptions, and were required to find at least one that they thought was true, and figure out why it wasn't. Similarly, they needed to explain away at least one misconception that a lab-mate had, as well as explain the reason that certain misconceptions are so prevalent. This was assessed as a lab assignment and was successful as it had students evaluate their own assumptions and investigate the strengths and weaknesses of their ideas. In the future, we anticipate using this direct method of "examine the ideas you have and explain the common errors that are made in this area" could be a valuable teaching method in numerous biology courses.

Curriculum Map

A - Assessed
R - Reinforced
I - Introduced
M - Master

Biology BA Curriculum Map

	BIO 114	**BIO 115**	**BIO 124**	**BIO 231**	**BIO 310**	**BIO 330**	**BIO 313**	**BIO 317**	**BIO 401**
BIO 2019.4 Information and Energy: Demonstrate knowledge of major conserved metabolic, signaling, heritable, and molecular processes of all life on Earth.	I	A	R	A, R	R	R	R	R	R
BIO.1 Evolution: Articulate knowledge that life evolved over time via mechanisms of mutation, natural selection, and genetic drift, and that there is concrete evidence for this fundamental concept _ evolution from common ancestry _ in the unity of numerous biological processes among species.	I	A	R	R	R	R	R	R	M, A
BIO.2 Interdisciplinary: Demonstrate that fundamental principles and laws of chemistry and physics are also underpinnings that govern complex living systems.	I, A	A	R	R	R	R	R	R	R
BIO.3 Diversity in structures, functions, and systems: Demonstrate and model, through reductionist and holistic approaches, the interconnectedness of life along a continuum from molecular structures to interactions among organisms and with ecosystems.	I	A	R, A	R	R	R	R	R	M

	BIO 450	**CHM 114**	**CHM 124**	**CHM 314**	**MAT 124**	**MAT 304**	**SPR**
BIO 2019.4 Information and Energy: Demonstrate knowledge of major conserved metabolic, signaling, heritable, and molecular processes of all life on Earth.		I	R	R	R	R	A
BIO.1 Evolution: Articulate knowledge that life evolved over time via mechanisms of mutation, natural selection, and genetic drift, and that there is concrete evidence for this fundamental concept _ evolution from common ancestry _ in the unity of numerous biological processes among species.							A
BIO.2 Interdisciplinary: Demonstrate that fundamental principles and laws of chemistry and physics are also underpinnings that govern complex living systems.		I	R	R	R	R	A
BIO.3 Diversity in structures, functions, and systems: Demonstrate and model, through reductionist and holistic approaches, the interconnectedness of life along a continuum from molecular structures to interactions among organisms and with ecosystems.			R	R			A

Changes to Curriculum
Are there any changes made to the curriculum map for this academic year? If so, please describe the program changes made along with the rationale for why and the impact the change should have on student learning?

Slight changes were made to the curriculum map to align the curriculum map to our current concentration checklists; however, none of the changes to the curriculum map affected the Assessment Map.

Biology Faculty will have a discussion before the start of the Fall 2021 semester about Assessment and to determine if any of our required upper division courses should be used for Assessment.

Assessment Findings

Assessment Findings for the Assessment Measure level for Biology BA Curriculum Map

Standard/Outcome
BIO 2019.4 Information and Energy: Demonstrate knowledge of major conserved metabolic, signaling, heritable, and molecular processes of all life on Earth.

Assessment Measures

BIO 115				
Assessment Measure	**Criterion**	**Summary**	**Attachments of the Assessments**	**Improvement Narratives**
Direct - External Testing	Has the criterion Major Field Test - Percentile Rank (This scores students in all 4 sections of the MFT) There is no score Benchmark = this test is given to our incoming Biology majors to determine the baseline for each student for the exam. Biology Majors will retake the Major Field Test exam as exiting seniors and scores will be compared in order to determine “knowledge gained” from completion of the program. Benchmark = 100% of the declared Biology Majors will take the exam (those declared at the time of test administration). Been met yet? Met	As 100% of the incoming Biology Major students took the MFT this fall (n=24) (24 students = 18 declared and 6 more "want to be Biology majors")		

BIO 231				
Assessment Measure	**Criterion**	**Summary**	**Attachments of the Assessments**	**Improvement Narratives**
Direct - Quiz/Exam	Has the criterion An assessment specific quiz (BIO231) will be used to ensure that assessment questions are direct and relevant to objective 4. The benchmark is 70% of the students at Proficient or better. Proficient is defined as 70% or better on the assessed questions. Been met yet? Not met	Only 47% of the students received a Proficient (70%) or higher on the Assessment Quiz (n=15)	BIO231_Assessment_data.docx	

SPR				
Assessment Measure	**Criterion**	**Summary**	**Attachments of the Assessments**	**Improvement Narratives**
Direct - External Testing	Has the criterion Major Field Test - Percentile Rank (This scores students in all 4 sections of the MFT) Benchmark = 50% of students scoring in the 50th percentile or higher. Been met yet? Not met	The Benchmark was not met as only 25% (one individual) scored in the 50th Percentile or higher. (n= 4)	2022_MFT_Data_and_Comparison_for_Knowledge_Gained_REPORT_DATA.xlsx	
	Has the criterion Major Field Test - Percentile Rank (This scores students in all 4 sections of the MFT) Benchmark = 100% of our students will show an increase in their over Percentile Rank when we compare their MFT Percentile Rank as an Incoming Biology Major to their MFT Percentile Rank taken as a graduating Senior been met yet? Met	The Benchmark was Met as 100% of the students who took the exam as an Incoming and Outgoing Biology Major improved their overall Percentile Rank (n=2)		

Standard/Outcome

BIO.1 Evolution: Articulate knowledge that life evolved over time via mechanisms of mutation, natural selection, and genetic drift, and that there is concrete evidence for this fundamental concept _ evolution from common ancestry _ in the unity of numerous biological processes among species.

Assessment Measures

BIO 115				
Assessment Measure	**Criterion**	**Summary**	**Attachments of the Assessments**	**Improvement Narratives**
Direct - External Testing	Has the criterion Major Field Test - Section: III There is no score Benchmark = this test is given to our incoming Biology majors to determine the baseline for each student for the exam. Biology Majors will retake the Major Field Test exam as exiting seniors and scores will be compared in order to determine “knowledge gained” from completion of the program. Benchmark = 100% of the declared Biology Majors will take the exam (those declared at the time of test administration). Been met yet? Met	As 100% of the incoming Biology Major students took the MFT this fall (n=24) (24 students = 18 declared and 6 more "want to be Biology majors")		
Direct - External Testing	Has the criterion Major Field Test - Section: IV There is no score Benchmark = this test is given to our incoming Biology majors to determine the baseline for each student for the exam. Biology Majors will retake the Major Field Test exam as exiting seniors and scores will be compared in order to determine	As 100% of the incoming Biology Major students took the MFT this fall (n=24) (24 students = 18 declared and 6 more "want to be Biology majors")		

	"knowledge gained" from completion of the program. Benchmark = 100% of the declared Biology Majors will take the exam (those declared at the time of test administration). Been met yet? Met			

BIO 401				
Assessment Measure	**Criterion**	**Summary**	**Attachments of the Assessments**	**Improvement Narratives**
Direct - Quiz/Exam	Has the criterion An assessment specific quiz (BIO401) will be used to ensure that assessment questions are direct and relevant to objective 1. The benchmark is 70% of the students at Proficient or better. Proficient is defined as 70% or better on the assessed questions. Been met yet? Met	The benchmark was Met as 100% of the students were proficient or better (n = 12)	BIO401_Quiz_scores.docx	

SPR				
Assessment Measure	**Criterion**	**Summary**	**Attachments of the Assessments**	**Improvement Narratives**
Direct - Research Paper	Has the criterion Two weeks prior to assessment, students will be emailed a peer-reviewed journal article about research in the field of Ecology. On Assessment Day, students will be asked to analyze a specific figure from the article and given 15 minutes to complete the assignment in VIA. Benchmark: 70% of students scoring an average of 3/5 or higher on the response questions been met yet? Met	The benchmark was Met as 80% of the students had an average score of 3/5 or higher on the data analysis questions	Tweener_Paper_Analysis_Scores___AVG_Scores_DATA_for_Report.xlsx	- : We did not give our majors 2 weeks to read the articles. We chose two short articles and gave the students a minimum of 2 hours to read the articles and answer 7 specific questions about the figures and the data. We plan to move this Assessment to Objective 5 to give more latitude in choosing articles.
Direct - External Testing	Has the criterion Major Field Test - Section: III Benchmark = Average score of 53 or higher on section, with 60% of students scoring a 46 or higher. Been met yet? Not met	Both benchmarks were Not Met as the Average Score for the group was 47 and only 50% of the students scored a 46 or higher. (n=4)		
Direct - External Testing	Has the criterion Major Field Test - Section: IV Benchmark = Average score of 53 or higher on section, with 60% of students scoring a 51 or higher. Been met yet? Not met	Both benchmarks were Not Met as the Average Score for the group was		

		48and only 25% of the students scored a 51 or higher. (n=4)		

Standard/Outcome

BIO.2 Interdisciplinary: Demonstrate that fundamental principles and laws of chemistry and physics are also underpinnings that govern complex living systems.

Assessment Measures

BIO 114				
Assessment Measure	**Criterion**	**Summary**	**Attachments of the Assessments**	**Improvement Narratives**
Direct - Quiz/Exam	Has the criterion Questions from the First lecture Exam (BIO114) that were relevant to objective 2 were selected for assessment. The benchmark is 70% of the students at Proficient or better. Proficient is defined as 70% or better on the assessed questions. been met yet? Met	As 92.9% of the students received a Proficient (70%) or higher on the designated questions on Exam 1 (n=52)		

BIO 115				
Assessment Measure	**Criterion**	**Summary**	**Attachments of the Assessments**	**Improvement Narratives**
Direct - External Testing	Has the criterion Biology Major Field Test - Section: I There is no score Benchmark = this test is given to our incoming Biology majors to determine the baseline for each student for the exam. Biology Majors will retake the Major Field Test exam as exiting seniors and scores will be compared in order to determine “knowledge gained” from completion of the program. Benchmark = 100% of the declared Biology Majors will take the exam (those declared at the time of test administration). Been met yet? Met	As 100% of the incoming Biology Major students took the MFT this fall (n=24) (24 students = 18 declared and 6 more "want to be Biology majors")		
Direct - External Testing	Has the criterion Major Field Test - Section: II There is no score Benchmark = this test is given to our incoming Biology majors to determine the baseline for each student for the exam. Biology Majors will retake the Major Field Test exam as exiting seniors and scores will be compared in order to determine “knowledge gained” from completion of the program. Benchmark = 100% of the declared Biology Majors will take the exam	As 100% of the incoming Biology Major students took the MFT this fall (n=24) (24 students = 18 declared and 6 more "want to be Biology majors")		

	(those declared at the time of test administration). Been met yet? Met			

SPR				
Assessment Measure	**Criterion**	**Summary**	**Attachments of the Assessments**	**Improvement Narratives**
Direct - External Testing	Has the criterion Major Field Test - Section: I Benchmark = Average score of 53 or higher on section, with 60% of students scoring at or above 51. Been met yet? Not met	Both benchmarks were Not Met as the Average Score for the group was 45 and only 25% of the students scored a 51 or higher. (n=4)		- Revise Program Benchmark: Biology Faculty will verify the material covered in this section of the MFT is covered in our courses and determine if the benchmark needs adjusted. It may, because when we look at the Senior Cohort as a whole, only 36% scored a 51 or higher and the average was a 48.
Direct - External Testing	Has the criterion Major Field Test - Section: II Benchmark = Average score of 53 or higher on section, with 60% of students scoring at or above 51. Been met yet? Not met	Both benchmarks were Not Met as the Average Score for the group was 45 and only 25% of the students scored a 51 or higher. (n=4)		

Standard/Outcome

BIO.3 Diversity in structures, functions, and systems: Demonstrate and model, through reductionist and holistic approaches, the interconnectedness of life along a continuum from molecular structures to interactions among organisms and with ecosystems.

Assessment Measures

BIO 115				
Assessment Measure	**Criterion**	**Summary**	**Attachments of the Assessments**	**Improvement Narratives**
Direct - External Testing	Has the criterion Biology Major Field Test - Section: I There is no score Benchmark = this test is given to our incoming Biology majors to determine the baseline for each student for the exam. Biology Majors will retake the Major Field Test exam as exiting seniors and scores will be compared in order to determine “knowledge gained” from completion of the program. Benchmark = 100% of the declared Biology Majors will take the exam (those declared at the time of test administration). been met yet? Met	As 100% of the incoming Biology Major students took the MFT this fall (n=24) (24 students = 18 declared and 6 more "want to be Biology majors")		

Direct - External Testing	Has the criterion Major Field Test - Section: II There is no score Benchmark = this test is given to our incoming Biology majors to determine the baseline for each student for the exam. Biology Majors will retake the Major Field Test exam as exiting seniors and scores will be compared in order to determine “knowledge gained” from completion of the program. Benchmark = 100% of the declared Biology Majors will take the exam (those declared at the time of test administration). been met yet? Met	As 100% of the incoming Biology Major students took the MFT this fall (n=24) (24 students = 18 declared and 6 more "want to be Biology majors")		
Direct - External Testing	Has the criterion Major Field Test - Section: III There is no score Benchmark = this test is given to our incoming Biology majors to determine the baseline for each student for the exam. Biology Majors will retake the Major Field Test exam as exiting seniors and scores will be compared in order to determine “knowledge gained” from completion of the program. Benchmark = 100% of the declared Biology Majors will take the exam (those declared at the time of test administration). been met yet? Met	As 100% of the incoming Biology Major students took the MFT this fall (n=24) (24 students = 18 declared and 6 more "want to be Biology majors")		

BIO 124				
Assessment Measure	**Criterion**	**Summary**	**Attachments of the Assessments**	**Improvement Narratives**
Direct - Quiz/Exam	Has the criterion An assessment specific quiz (BIO124) will be used to ensure that assessment questions are direct and relevant to objective 3. The benchmark is 70% of the students at Proficient or better. Proficient is defined as 70% or better on the assessed questions. Been met yet? Not met	The Benchmark was Not Met as only 67% of the students received a Proficient (70%) or higher on the Assessment Quiz (n=21)	BIO124_Quiz_scores.docx	

SPR				
Assessment Measure	**Criterion**	**Summary**	**Attachments of the Assessments**	**Improvement Narratives**
Direct - Research Paper	Has the criterion Two weeks prior to assessment, students will be emailed a peer-reviewed journal research article in the field of Molecular Structure. On Assessment Day, students will be asked to analyze a specific figure from that article and given 15 minutes to	The benchmark was Met as 77% of the students scored an average of 3/5 or higher on the data analysis questions (n=22)	Rubric___Tweener_Response_Gut_microbiota_Answer_Key.docx Tweener_Paper_Analysis_Scores___AVG	- : We did not give our majors 2 weeks to read the articles. We chose two short articles and gave the students a minimum of 2 hours to read the articles and answer 7 specific

	complete the assignment in VIA. Benchmark: 70% of students scoring an average of 3/5 or higher on the response questions been met yet? Met		_Scores_DATA_for_Report.xlsx	questions about the figures and the data. We plan to move this Assessment to Objective 5 to give more latitude in choosing articles.
Direct - External Testing	Has the criterion Major Field Test - Section: I Benchmark = Average score of 53 or higher on section, with 60% of students scoring at or above 51. Been met yet? Not met	Both benchmarks were Not Met as the Average Score for the group was 45 and only 25% of the students scored a 51 or higher. (n=4)		
Direct - External Testing	Has the criterion Major Field Test - Section: II Benchmark = Average score of 53 or higher on section, with 60% of students scoring at or above 51. Been met yet?	Both benchmarks were Not Met as the Average Score for the group was 45 and only 25% of the students scored a 51 or higher. (n=4)		
Direct - External Testing	Has the criterion Major Field Test - Section: III Benchmark = Average score of 53 or higher on section, with 60% of students scoring at or above 46. Been met yet? Not met	Both benchmarks were Not Met as the Average Score for the group was 47 and only 50% of the students scored a 46 or higher. (n=4)		

Analysis of the Assessment Process

Describe your assessment process; clearly articulate how the program uses coursework and or Student Performance Review for program wide assessment. Note any changes that occurred to the process since the previous year. Discuss what activities were successful and which ones were not as helpful and why. Please include who met to discuss the changes (unless you are a program of one person) and when you met. – Include a discussion on the process for collection and analysis of program data.

The three Biology faculty compiled this report: Dr. Kimberly L. Keller, Dr. Robin Hirsch-Jacobson, and Dr. Sarah Greenland-White.

In each freshman class, we have a few students actively choose the Biology B.A program because this degree option gives the most flexibility in scheduling and this degree track is well suited for those pursuing ecology and conservation orientated careers. Throughout their time here at WWU, students wanting more control in developing their own Biology Degree or students who transfer into the program are now opting into this program due to its flexibility. Unfortunately, the BA degree has also become a safety net for students who are struggling with some of the upper-division requirements in the BS degree and the flexibility gives them an out of those particular courses. The Biology Department has based our Assessment of our program around three main areas: (1) our core Biology courses; (2) direct Data Analysis related to two Objectives; and (3) the Biology Major Field Test. Our core Biology courses include General Biology I & II (BIO114 & BIO124), Genetics (BIO231), and Evolution (BIO401). There were areas in which our BA Biology majors did not meet the benchmark for our Objectives. Half of the benchmarks for the core Biology courses were Met (BIO124 and BIO401);

however, the benchmark for BIO124 and BIO231 were “Not Met”, as only 67% and 47% of the students in those courses, respectively, scored a 70% or better on the assessment questions. The areas where our BA students did not meet the criterion were all of the benchmarks for the Biology Major Field Test (MFT) taken by our graduating seniors; however, the primary reason was due to the extremely small size of the cohort (n=4). Summaries and improvement narratives are included under each assessment field within this report where we feel action is required.

The Major Field Test (MFT) was given to our graduating seniors during Student Performance Days in February. Unfortunately, all of the benchmarks associated with the Major Field Test were “Not Met”, mainly due to the incredibly low cohort size (n=4). For sections I, II, and IV of the MFT the benchmark was an average score of 53 or higher on section, with 60% of students scoring 51 or higher; while for section III the benchmark was an average score of 53 or higher, with 60% of students scoring a 46 or higher.

For sections I and II of the MFT, both sections were “Not Met” as the average score for both sections was 45, and only one student (25%) score a 51 or higher. For section III, both benchmarks were “Not Met” as the average Score for the group was 47 and only 50% of the students scored a 46 or higher. Both benchmarks in section IV were “Not Met” as the average Score for the group was 48 and only 25% of the students scored a 51 or higher.

For Section I, both of the benchmarks for the criterion were “not Met” as the average score was a 49 (benchmark was 53) and only 40% of the BA students score a 51 or above (benchmark was 60%). of the students scoring a 51 or higher on the section was also not met. This is the second consecutive year that both of the criterions were Not Met on Section I of the MFT. In 2021, average score this year score was 51 for the students (benchmark 53) and only 59% (benchmark 60%) of the students scored a 51 or higher (n=17). The Biology Faculty will take a two-fold approach as our plan of action. We will (1) specifically look at the content in Section and determine if the benchmarks for this may need adjusted and (2) considering is using a “median score” of 53 instead of the “average score” of 53 as our overall cohort tend to be small (< 20 students of graduating seniors, both BA and BS) often with a single outlier.

The benchmark of 50% of students scoring at the 50th percentile rank or higher (Objective 4) was “Not Met” as only one of our BA students (25%) reached that benchmark this year (n=4). In looking at past years, there does not seem to be much consistency in our students scoring well enough in all sections of the MFT as it fluctuates each year between Met and Not Met. Therefore, we will definitely have discussions regarding the MFT content, as we now have a few years of MFT since ET made changes to Biology MFT so we can now determine if the sections still align with our program objectives and our curriculum. We will take a hard look at the MFT to determine if we need to change any benchmarks for any of the Objectives for the 2022 – 2023 academic year. While we may or may not make changes to our benchmark, the Biology Faculty will continue to use the MFT to assess student knowledge and the effectiveness of the program.

Even with 14 Seniors taking the MFT (10 BS and 4 BA), that number still is a relatively small cohort size in statistical terms. The problem of a small cohort for statistical significance will always exist at a university the size of William Woods, and strongly supports the usefulness of determining “knowledge added” assessment by determining “value added” to their score on the MFT. This was the first year that all of our graduating seniors ***should have*** taken the MFT as a freshman (Fall 2018 or Fall 2019) and as a senior (Spring 2022); however, we still only had 9 out 14 (7 BS and 2 BA) in which we had two MFT scores. Therefore, while this should have been our first complete cohort to truly look at the “knowledge added” by the curriculum in our program, we had three students transfer into the program and two senior somehow did not take it as a freshman. Even though we only had two 2022 Biology BA graduating seniors with two data sets, we are still excited that these 2022 seniors had an average percentile rank change of 23 percentile ranks and the average percent gain from their freshman score was 68%. Our graduating Biology seniors (n=9) showed an average improvement in percentile rank of 36 and 78% of them had a percent gain of 102% or higher. This means the majority of our students more than doubled their percentile ranking. All of our graduating seniors 100% showed at least some knowledge gained. The student with the biggest change in percentile rank went from a percentile rank of 3 as a freshman, to a percentile rank of 63 as a senior, that is a percent gain of 2000%. The same student had percent gains in the four sections of the MFT ranging from 14.3% to 133.3%. The BA student with the biggest change in percentile rank went from a percentile rank of 41 as a freshman, to a percentile rank of 83 as a senior, that is a percent gain of 102%. The same student had percent gains in the four sections of the MFT ranging from 10.7% to 44.4%. The Biology Faculty feel this truly indicates the strength of our Biology Degree curriculum and our courses are actually adding to the scientific knowledge-base of all our Biology majors. Using the data comparison data from 2019-2020, 2020-2021, and now 2021-2022, the Biology faculty now feel we have sufficient data to assess “knowledge gained” or “value added” for our program and will making a benchmark for the this for the 2022-2023 academic year.

Over the past several years, the Biology faculty have changed our interviews and direct Objective questions for the second- and third-year Biology Majors (“tweeners”) level students to a Data Analysis assessment activity. This is the third year using a data analysis assessment tool, and the Biology Faculty redesigned this portion of the University’s Student Performance Review Days (SPR Days), again. We wanted this portion to be more of a data analysis component. During

the SPR Days, our tweener students were given two hours to read two short peer-reviewed article and then answer the subset of specific questions regarding the figures and the data for those two articles. While we feel this was definitely a worthwhile activity, we do feel there are still some modifications required to use this as a learning tool for data analysis. In addition, we may remove this from Objective 1 and Objective 3 and place it under Objective 5 to broaden the subject matter of the articles we use for this in the future. This year each faculty wrote seven questions for the article they chose and so the questions varied in type of question and rigor. Next year we plan to stay with only two article two articles, and more consistency of question type for each article to ensure the questions are more similar. This change/refinement of our assessment tools will provide help ensure our students are assessed on a more individual level of ability to analyze data and assessed equally by each faculty. This change will come at the expense of Direct Written Questions portion of assessment for Objective 1 and Objective 3. As those two objectives are already assessed twice, and we are extremely satisfied with this change.

This is the fifth year we have had our incoming Biology Majors take the MFT; however, this is the four year we had them take the exam literally as they are entering the program. All incoming Biology Majors took the MFT during the third week of classes in the fall semester in BIO115, the laboratory associated with BIO114. As the data are for collection purposes only at this point, there is no benchmark attached to the scores for our "freshman." Our long-term assessment plan for the program will occur when these same students take the MFT as an outgoing senior and then we will be able use the scores on the two exams to determine "value added" of each graduating student in the Biology Program at William Woods University. The Biology faculty are excited about adding this new level of assessment of our seniors (as stated above). These data could show that while an outgoing senior may not meet the benchmarks of the MFT when comparing it to the national scores (our current assessment), the same student may improvement in their score, showing the program was successful as a whole as there would be a definite "value added" assessment.

All three of the Biology faculty have noticed the students in our classes often struggle with data analysis, so we devised a means to assess their data analysis abilities, because being able to analyze data is a required skill in a Biology/Science career. While there are definitely some changes to the assessment needed, overall we were very pleased and will be including this as part of our Student Performance Review Days, and probably incorporate it as part of assessment of Biology BS Objective 5.

This is the second year we gave a short self-reporting survey their Shadowing experiences as part of the assessment for Objective 5A and 5B to every Biology major except our graduating students (first – third year majors). This year we asked our BA students for any shadowing/volunteering/research/work experience outside of curriculum for the previous summer (Summer 2021), the Academic Year/Winter Break (2021), and any plans they are working on for Summer (2022). The Biology Faculty liked this change and plan to keep the survey of shadowing to all of our non-graduating Biology majors. As shadowing is not as common with our BA students, we were not surprised to see 0% had experience last summer and 9% have any over the academic and/or Winter break. We are pleased though that 18% of our Biology BA students report having shadowing experience arranged for this summer, with an additional 55% of our Biology BA students working on getting some type of shadowing experience this summer. The Biology Faculty are actually quite pleased with these percentages for the summer.

While Biology Objective 5 is also truly for assessing the Bachelor of Science Program, our BA students still benefit from the assignments in BIO450 as 100% of our Juniors in BIO450 generated of a professional CV/Resume. In addition, during our practice Mock interviews, 75% of the BA students provided interview responses that were satisfactory 3/5 or better. This is the first time in a couple years we were able to have the Mock interviews in person and we were excited to engage in face-to-face interactions.

In terms of class assessment, the faculty have been making a concerted effort to have a specific quiz or wrote specific exam questions that more specifically addressed assessing the objective. As a whole, writing specific objective-based questions made it more of a true assessment of the Objective. However, Only BIO114 and BIO401 "Met" their benchmark, with 92.9% and 100%, respectively, scoring 70% or better on the assessment for those two courses. Unfortunately, BIO124 and BIO23 benchmarks were "Not Met" as only 47% and 67% of the students in those two courses scored a 70% or better on the assessment quizzes used, respectively. While BIO124 was just shy of the 70% of students scoring a 70% or better on the assessment, the students in BIO231 fell incredibly short of the benchmark. We are hoping this may be post COVID-19 fallout and that our numbers will approve in the upcoming years.

With lightened COVID restrictions, we were able to bring back "Impartation of Wisdom" lunch event for just our new/incoming students and our outgoing graduating seniors. The Biology Faculty gave the "new" students a set of questions as conversation starters and we definitely feel this helped make it a very successful event as the faculty could hear the buzz of conversation from down the hallway. While this event is not necessary for any assessment, this is definitely important in the retention of our students and will definitely have this event each year.

Due to some major conflicts with our teaching schedules, weekly department meetings with all three Biology faculty took place much less frequently throughout the academic year than in years past. We mainly use of 100- and 200-level classes and the MFT for our assessment and have very few upper division courses as part of our assessment of the Biology Program. Current discussions during the generation of this report were based around whether we should begin to assess at least one of our objectives (possibly Objective 3) using the required Field courses and now that we have a full-time faculty teaching the required Anatomy & Physiology courses, Physics courses, and Chemistry courses, we may want to consider assessing those as well. A comprehensive review of our Curriculum and Assessment maps will occur prior to the Fall 2022 semester to make some possible changes to ensure everyone is satisfied with their respective course-specific components of the assessment of the program.

For a professions-oriented mission statement, we are satisfied with current preparation of our students, especially when you look at where our students are matriculating following graduation. Therefore, we feel only minor changes in our assessment are needed to accurately measure success of the Biology Program.

The Biology Faculty feel strongly that writing one Assessment Report and combining the B.A. and B.S. students would be a much truer assessment of the **Biology Program** as a whole since the core course requirements between the degree programs only differ in that BA majors are required to take two semesters of Physics (with lab). In addition, we teach our Biology Students as a whole, to be able to understand all the various aspects of Biology. We do not teach them as just a BA major, or just a BS PreMed major, or just a BS PreVet major – we teach them as a **Biology Major**. Therefore, it would be so nice not to keep separating these reports and begin truly assessing the "Biology Program" – especially since you can only get a Biology BA or a Biology BS degree and the University only recognizes the "Biology" program as a whole in terms of programs and award ceremonies. Combining our Assessment into one, single report would have eliminated at least some of the "not met" benchmarks that were solely due to the extremely low sample sizes assessed when we split Biology into BA and BS, and then further split the BS into PreMed and PreVet students.

Improvement Narrative List

Assessment Findings for the Assessment Measure level

Standard/Outcome	BIO.1 Evolution: Articulate knowledge that life evolved over time via mechanisms of mutation, natural selection, and genetic drift, and that there is concrete evidence for this fundamental concept _ evolution from common ancestry _ in the unity of numerous biological processes among species.
Legend	A
Course/Event	Student Performance Review
Assessment Measure	Direct - Research Paper
Assessment Findings	Met
Improvement Narrative	

Improvement Type	Summary
	We did not give our majors 2 weeks to read the articles. We chose two short articles and gave the students a minimum of 2 hours to read the articles and answer 7 specific questions about the figures and the data. We plan to move this Assessment to Objective 5 to give more latitude in choosing articles.

Standard/Outcome	BIO.2 Interdisciplinary: Demonstrate that fundamental principles and laws of chemistry and physics are also underpinnings that govern complex living systems.
Legend	A
Course/Event	Student Performance Review
Assessment	Direct - External Testing

Measure	
Assessment Findings	Not met
Improvement Narrative	<table><tr><th>Improvement Type</th><th>Summary</th></tr><tr><td>Revise Program Benchmark</td><td>Biology Faculty will verify the material covered in this section of the MFT is covered in our courses and determine if the benchmark needs adjusted. It may, because when we look at the Senior Cohort as a whole, only 36% scored a 51 or higher and the average was a 48.</td></tr></table>

Standard/Outcome	BIO.3 Diversity in structures, functions, and systems: Demonstrate and model, through reductionist and holistic approaches, the interconnectedness of life along a continuum from molecular structures to interactions among organisms and with ecosystems.
Legend	A
Course/Event	Student Performance Review
Assessment Measure	Direct - Research Paper
Assessment Findings	Met
Improvement Narrative	<table><tr><th>Improvement Type</th><th>Summary</th></tr><tr><td></td><td>We did not give our majors 2 weeks to read the articles. We chose two short articles and gave the students a minimum of 2 hours to read the articles and answer 7 specific questions about the figures and the data. We plan to move this Assessment to Objective 5 to give more latitude in choosing articles.</td></tr></table>

Program Activities

Student Performance Review

Describe the department Student Performance Review activities if not already articulated. Please describe the nature of the assessments conducted as well as the process of assessment happening on these two days. Include the schedule of assessment day for your program. What does the data and outcomes tell you? What changes will you make as a result of the data? What areas are successful for the program?

Student Performance Review (SPR) days were back to two consecutive days as they have been in the past. Our Student Performance Schedule include the following events: (1) Biology MFT for our Graduating Seniors, (2) Figure Analysis of Research Articles for our second- and third-year Biology Majors (“tweeners”), (3) a survey of students self-reporting their Shadowing experiences (Summer 2020, Winter Break, plan for Summer 2021) for everyone except our graduating students (first – third years), (4) a Research Talk followed by a Meet & Greet Session, and (5) an “Impartation of Wisdom” luncheon with our new/incoming majors and our graduating seniors.

We always use the SPR Days to have our senior students take the Major Field Test (MFT) in Biology. Fourteen Biology Seniors (4 BA and 10 BS Majors) took the MFT this past February. The Biology Faculty are considering changing some of

our benchmark from the “average score” to the median score” to help eliminate some of the issues when a single student in the cohort does poorly on the MFT.

This academic year, we were able to administer the MFT to the incoming class of Biology Majors in the fall by doing it the second week of classes in the fall semester in BIO115, the laboratory associated with BIO114. This change was made in order to truly capture the entry level knowledge base of each of our incoming students majoring in Biology.

Of our 14 Biology graduating senior students who took the MFT this February, only 9 also took the MFT their first year in the program (7/10 BS students and 2/4 BA students). For those two BA students, we were able to determine “knowledge gained” while attending WWU. This is the second academic year of a large amount of entering MFT data and exiting MFT data of our seniors, therefore our current Benchmark is only 100% of the students will show a gain in knowledge between the two exams - and we achieved that benchmark. After three to four years of data, the biology faculty will determine what Benchmarks we want to use for this “knowledge-gained” portion of our assessment. This data will be a valuable assessment in addition to our current use of the MFT to evaluate the knowledge of our exiting seniors compared to other Biology majors on a national level. Since the data generated in BIO115 is being used simply as an entry-level baseline there is no specific benchmark for the scores on this exam, “Met” simply implies all students declared as majors at that time took the MFT.

The second- and third-year Biology Majors (“tweeners”) students are required to complete a Data Analysis Assessment activity. This is the third year using a Data Analysis Assessment activity, and the Biology Faculty **again** redesigned this portion of the University’s Student Performance Review. This year we provided our students with two short, peer-reviewed journal articles. These students were given two hours and asked to read those two journal articles and answer the subset of specific questions regarding the figures and the data for each article. This year each faculty wrote questions for the article they chose, and the types of questions varied greatly between the faculty. Next year we plan to write a single question (possibly with multiple parts or prompts) for each article to ensure the types of questions are more similar. This change will provide us the ability to truly assess each student’s ability to read, comprehend, and analyze data and to be able to assess each student on a more equal level. This assessment activity is currently under Objective 1 and Objective 3; however, we feel it is better to move the assessment to Objective 5 in order to widen the content area of the journal articles we can use for this assessment. We know we need to refine our assessment tools to help ensure our students are assessed on a more individual level and equally by each faculty.

This is the second year we decided to have everyone except our graduating students (first – third years) complete a short survey self-reporting their Shadowing experiences for the previous summer (Summer 2021), the Academic Year/Winter Break, and plans they are working on for Summer (2022). For our Biology BA Majors, very few had any type of experience outside of the curriculum, with only 18% of the majors having any type of shadowing, wolunterring, or research experience - so as faculty we may need to stress this more with these majors. The Biology Faculty liked this change of including the freshman/new majors in this survey and plan to keep the survey of shadowing to all of our non-graduating Biology majors.

Every year during Student Performance Days we bring a speaker who gives research-based talk to the entire department and all of our Biology Majors. Fortunately, we were able to hold the research talk in person in the Library Auditorium on campus. The Speaker was Preston Wolfe, a 2017 WWU Biology BS PreMed alum working on his Ph.D. at the University of Missouri, who gave a talk titled: “Evaluation of Serum and Urine Biomarkers for Developmental Dysplasia of the Hip.” The faculty were both excited and nervous to have an alum come back and talk; however, and it was clear to all that Preston has truly found his niche and is going to make significant contributions to his field. He actually related well to all three of the Biology degree majors. We also were able to hold an in-person Meet & Greet/Question & Answer reception after the seminar for students to interact with the speaker. We feel it is extremely valuable for our students to witness such talks and we attempt to alternate the area of research presented each year in order to expose our students to the variety of sub-disciplines within Biology during their 4-years here at William Woods. Our students continually provide positive feedback about the speakers and it is common to hear them discussing the talk amongst themselves for the next several days. Therefore, this event is definitely something we will continue to incorporate that into our Student Performance Day schedule.

With lighten COVID restrictions, we were able to bring back “Impartation of Wisdom” lunch event for just our new/incoming students and our outgoing graduating seniors. The Biology Faculty gave the “new” students a set of questions as a conversation starter and we definitely feel this helped make it a very successful event as you could hear the buzz of conversation down the hall. While this event is not necessary for any assessment, this is definitely important in the retention of our students and will definitely have this event each year.

Overall, we are very pleased with our Student Performance Days and feel we have a schedule that allows us to assess our students in a variety of manners, and the small changes mentioned above will only serve to better our assessment efforts of the Biology Program.

Student Performance Review Schedule
Upload the program schedule for students during Performance Reviews.
Biology_Department_Schedule_for_SPR_Days___2022.pdf
Presenter_Flyer.pptx

Senior Showcase/Symposium
Describe program activities used to highlight Senior achievement. What benefit does the program gain from the activities? What if any assessment of students happens during this event?

Our entire cohort of 13 graduating Biology Seniors (3 BA seniors and 10 BS seniors) did their Senior Showcase as a poster session on Thursday, April 21 as part of an interdisciplinary Senior Showcase event with the Equestrian Department, Psychology Department, and the Social Work Department. Our students did not produce original work, but presented a Science-quality poster as a literature review for their chosen Biology topic of interest.

Tools used for Assessment
Upload rubrics or other Assessment based tools used by the program that are important to the assessment process.

Service Learning
Does the Program include projects/ course content that uses the philosophy of service learning?
Yes
No (selected)

Service Learning Component
If so, how is service learning infused in the coursework within your department? Is service or community engagement in the program mission? Describe the Service Learning Activities that your students and department engaged in this past year. How did the activities improve student learning? How did the activities benefit the community?

N/A

Co-Curriculuar and LEAD Events
Describe Co-Curricular and LEAD events sponsored by program faculty. This includes LEAD and other events meant to engage students and foster learning outside of the classroom.

Robin Hirsch-Jacobson LEAD EVENTS

Tweets and Treats - Join Conservation Club in a discussion about Missouri's native birds! We will have pinecones, peanut butter, and bird seed to make DIY bird treats. This is an outside event so please bring a chair or blanket to sit on.

MDC Scavenger Hunt - Habitats of Missouri - Conservation Club has come up with a series of scavenger hunts for you to investigate. In order to begin, you will need to download the response sheet, head to the MDC website (Habitat section for this event) here: https://mdc.mo.gov/discover-nature/habitats. Event runs from October 4 through October 18.

MDC Scavenger Hunt - Conservation Club has come up with a series of scavenger hunts for you to investigate. In order to begin, you will need to download the response sheet, head to the MDC website (reptiles section for this event) here: https://mdc.mo.gov/field-guide/search?fgSpeciesType=1008 . Complete event November 1 to November 30.

Cowspiracy - Join Conservation Club as we watch a shortened version of Cowspiracy, the award winning documentary that highlights a hidden cause of global warming. Participants will engage in a discussion about how humans can adapt an unrecognized approach to sustainability. Limited to the first twenty students. Active participation in discussion is required for LEAD credit.

The Fun of Biology! - Come join the Biology Club for a super fun trivia night. It will be laid back, yet educational. Come and hopefully learn something new and have fun!

MDC Scavenger Hunt-Invasive and Nuisance Species of Missouri - Conservation Club has come up with a series of scavenger hunts for you to investigate. In order to begin, you will need to download the Reflection Form, head to the MDC website (Invasive and Nuisance Species) here: https://mdc.mo.gov/discover-nature/invasive-nuisance-species

Nature Boost: Black Bears - Join the Conservation Club in learning more about Missouri wildlife through an episode of the Nature Boost Podcast. Season 2, Episode 1 covers the black bear, including information on their history in Missouri and current state of hibernation. This event is available until February 28th. Here is a link to the podcast: https://mdc.mo.gov/contact-engage/nature-boost Please complete the attached reflection sheet for LEAD credit.

Ecology of Costa Rica - Twelve Biology majors went to Costa Rica over Spring Break and learned a ton about Tropical Ecology. Grab your lunch and head to the Ivy Room to see their fantastic pictures (monkeys, toucans, and more!), hear their stories, and learn a bit about the plants and animals in the tropics. This event will start at noon so please already have your lunch and your seat by noon so we can start promptly.

Kimberly L. Keller LEAD Events

Mythbusters: COVID Vaccine Edition - Join Dr. Kimberly Keller and Student Life to learn about the COVID vaccine, how vaccines really work, common myths and misconceptions, and more! We will discuss how you can help slow the spread of COVID-19 by getting the vaccine!! (Held twice – once in person and once virtual)

Choo Choo: Here Comes The Flu - Hop on the science train, and learn more about the Flu and Flu shots. Dr. Keller and Student Life will be discussing how you can help slow the roll of the Flu this season. After Dr. Keller's presentation, there will be a fun game of Kahoot! to test out your knowledge of the Flu and the shot! (Held twice – once in person and once virtual)

Student Accomplishments
Highlight special examples of student successes in the field (academic: mentor-mentee, conference presentations, competitive internship, journal acceptance; extra-curricular: horse show championship, art exhibit). This is for any accomplishment a student achieved outside of course work or the normal expectation of student success.

Grace Korhammer was nominated by the Biology Faculty for the Faculty Award

Grace Korhammer graduated with the designation of Honors after successfully completing her Honor Research titled: ***"The Effect of Human Density Levels on North American Bird Species Assemblages"***

Grace Korhammer was selected to present at the Woods Talks **-** A Symposium for Scholarship and Creative Activity, the title of her talk was: ***"The effect of human disturbance on wildlife."***

Rukshika Wijesooriya has been nominated for the Dr. LeRoy Walker Champions of Character Award for student-athletes, this is one of the most prestigious awards in the NAIA and was created in association with National Sports Foundation.

Alumni Accomplishments
Please highlight special examples of any successes of recently graduated alumni (acceptance or graduation graduate school, employment or professional milestones).

Graduating Class of 2022

Grace Korhammer – Accepted a position with the Missouri Department of Conservation.

Rukshika Wijesooriya – Accepted a GA position at William Woods University and will pursue a Master's in

Previous Graduates:

Tatum Redmond (**2021**) Assistant Natural History Biologist at Missouri Department of Conservation. Ashland, Missouri

Leah Easley (**2020**) – Resource Science Aide for the Resource Assessment and Monitoring Program (RAM) field team at Missouri Department of Conservation

Brittney Engelbrecht (**2018**) Behavioral Therapist at Emerald Coast Autism Center. Niceville, Florida.

Drew Olson (2017) – Accepted into the Plant Pathology program at the University of Georgia and will start Fall 2022 and he plans for his dissertation to involve studying the population genetics of a toxic fungal plant pathogen. He is currently employed in the Fungal Genomics/Toxicology lab with the USDA in Athens, Georgia and his employer is paying for his graduate degree.

Faculty Accomplishments
Highlight special examples of faculty success in the profession/field/content area. This is for any accomplishment of a faculty member that is research or professional in nature.

Kimberly L. Keller – Co-author of a Manuscript Accepted for Publication in the Journal of Microbiology and Biology Education ***Student attitudes contribute to the effectiveness of a genomics CURE***. Acceptance date: March 2022, Publication Date – Fall edition

Appendix

Annual Assessment Rubric 2022 — 44.000 pts 91.67%

	3.000 Exceeds	2.000 Meets	1.000 Fails Below Expectations	N/A
Mission Statement Clearly Articulated weight: 1.000	The mission statement for the program is insightful and forward thinking. It aligns with the University Mission and learning objectives showing a clear alignment between the University and the program.	✓ The mission statement for the program clearly articulated and aligned with the University mission.	The mission statement is minimal at best.	N/A
Comment:				
Reflection on Student Demographics, Retention, and Degree Completion Data weight: 1.000	✓ The program provides a detailed description on the enrollment, retention, persistence and degree completion numbers. The program provides new ideas on how to improve retention of their program students or articulates what they are currently doing to keep students in their program.	The program provides a basic reflection on enrollment, retention, persistence, and degree completion data provided.	The program does not reflect on enrollment, retention, persistence, and degree completion data in a detailed way.	N/A
Comment:				
Marketing Materials weight: 1.000	✓ The program outlines the successes and needs in regards to marketing. Detailed suggestions on how to market the program and what niche areas that are program specific would benefit the marketing strategy.	The program discussed the general marketing strategy for the program.	The program provided little to no discussion on the marketing materials or approach to how to market the program.	N/A
Comment:				
Alignment to University Objectives weight: 1.000	The program provides a detailed explanation of how program courses align to the Institutional Objectives. This explanation details specific courses, or activities that coordinate with the intent of the Institutional Objectives.	✓ The program provides a basic explanation of how program courses align to the Institutional Objectives. This explanation provides a minimal understanding of how the program is aligned to the Institutional Objectives.	The program provides little to no explanation of how program courses align to the Institutional Objectives.	N/A
Comment:	The report is aligned to the old mission			
General Education alignment clearly explained weight: 1.000	✓ The program provides a detailed explanation of the General Education criterial and how the basic skills learned are expanded upon in the program. Details include but are not limited to: specific courses, or activities that stretch the knowledge of the specific areas.	The program provides a basic explanation of the General Education curriculum and how the skills learned are expanded in program courses.	The program provides a minimal explanation of the General Education curriculum and how the skills learned are expanded in program courses.	N/A
Comment:				
NSSE Objectives weight: 1.000	✓ The program provided a detailed listing of activities and assessments used within the program that focused on the identified NSSE objectives. The activities and assessments were divided out within the curriculum and impacted different cohort groups.	The program provided a basic explanation of the activities and assessments used within the program that focused on the identified NSSE objectives.	The program provided minimal explanation of the activities and assessments used within the program that focused on the identified NSSE objectives.	N/A
Comment:				
Curriculum Map alignment and changes weight: 1.000	✓ The curriculum map is detailed and complete. All Changs made to the curriculum map are detailed with supporting rationale for the decision..	The curriculum map is complete. Changes made to the curriculum map are explained with some explanation as to why the changes were implemented.	The curriculum map is not complete and little to no explanation on curricular changes was provided.	N/A
Comment:				
Assessment Map weight: 1.000	Assessment of objectives are spread out across the curriculum with a variety of assessment measures and each program objective is assessed a minimum of twice a year.	✓ Each objective is assessed a minimum of 2 times a year or an assessment rotation is explained so that all objectives are assessed. The assessments are not concentrated in one class.	The assessment map is not complete or much of the assessment happens in only one course. Not all objectives are assessed annually, nor is a plan provided on assessment.	N/A
Comment:				

Data Driven Decision-making is explained weight: 1.000	✓ An overview of program assessment is provided with details on the specific successes and challenges from the year. A detailed review of how assessment was administered over the academic year is clearly outlined.	A basic overview of program assessment is provided with some details on the successes and challenges from the year. A basic review of how assessment was administered over the academic year is outlined.	A basic overview of program assessment is not provided with little to no discussion on the administration of assessment over the academic year.	N/A
Comment:				
Documentation provided on assessment findings weight: 1.000	✓ The program uploads all rubric and support information to support the claims in the assessment findings along with detailed instructions on the assessment process and data analysis.	The program uploads all rubric and support information to support the claims in assessment findings.	The program did not upload the data to support assessment claims in the assessment findings.	N/A
Comment:				
Analysis of Assessment weight: 1.000	✓ The program completed assessment findings for each component identified, and provided a comprehensive summary of each assessment measure identified in the report.	The program completed the assessment findings for each component and provided a summary for each assessment measure.	The program did not provide a completed assessment findings for each component, nor did they complete the summary for each measure.	N/A
Comment:				
Improvement narratives are selected with intentionality weight: 1.000	✓ The program identified Improvement Narratives that appear to move the program forward and see the bigger picture than only the specific program curriculum options	The program used the provided Improvement Narratives and selected options that made sense to the objectives and issues within the assessment.	The program did not use any improvement narratives, or the ones chosen are not aligned with assessment results.	N/A
Comment:				
Student Performance Review weight: 1.000	✓ The program described and provided a detailed account of Student performance Review activities. Data evidence provided and detailed.	The program provided the schedule and a brief description of Student Performance Review with data of the results.	The program did not provide complete explanation on Student Performance Review nor did they provide data results.	N/A
Comment:				
Senior Showcase weight: 1.000	The program had all senior students participate in Senior Showcase and provided a detailed explanation of their expectation and the presentations presented.	✓ The program described the Senior showcase activities and provided some evidence of what was presented.	Little to no content of Senior showcase was provided.	N/A
Comment:				
Co Curricular and LEAD activities weight: 1.000	✓ The program detailed the activities of LEAD and other co-curricular programing that was provided throughout the year. They provided numerous events for students.	The program provided a listing of LEAD events and activities provided.	The program provided little to no description of the Co-curricular activities provided throughout the year.	N/A
Comment:				
Faculty, alumni, and Student accomplishments weight: 1.000	✓ The program provided detail updates on successes on Students, Alumni and Faculty with added information explaining the kinds of success that were experienced.	The program provided a listing of information on Students, Alumni, and faculty accomplishments.	The program provided little to no data on students, alumni, faculty accomplishments.	N/A
Comment:				

Appendix Data:

				SUBSCORES			
STUDENT NAME	Senior Major	TOTAL SCORE	Percentile	1 = Cell Biology	2 = Molecular Biology & Genetics	3 = Organismal Biology	4 = Population Biology, Evolution and Ecology
1	BS PreMed	154	55	48	50	60	54
2	Biology BA	134	9	35	41	35	36
3	BS PreMed	165	83	65	58	63	65
4	BS PreVet	158	67	57	53	54	65
5	BS PreMed	157	63	48	55	56	61
6	BS PreMed	153	52	51	58	48	54
7	BS PreMed	162	76	54	63	60	63
8	BS PreVet	142	22	42	38	54	36
9	BS PreVet	147	35	35	55	42	54
10	Biology BA	165	83	65	65	62	61
11	Biology BA	139	16	45	34	39	43
12	BS PreVet	145	29	48	44	44	48
13	BS PreVet	137	12	42	44	37	33
14	Biology BA	145	29	35	41	50	50
	AVERAGE	150	45	48	50	50	52

Biology BS PreMed Students

STUDENT NAME	Senior Major	TOTAL SCORE	Percentile	1 = Cell Biology	2 = Molecular Biology & Genetics	3 = Organismal Biology	4 = Population Biology, Evolution and Ecology
1	BS PreMed	154	55	48	50	60	54
2	BS PreMed	158	67	57	53	54	65
3	BS PreMed	153	52	51	58	48	54
4	BS PreMed	162	76	54	63	60	63
5	BS PreMed	142	22	42	38	54	36
		154	54	50	52	55	54

Biology BS PreVet Students

STUDENT NAME	Senior Major	TOTAL SCORE	Percentile	1 = Cell Biology	2 = Molecular Biology & Genetics	3 = Organismal Biology	4 = Population Biology, Evolution and Ecology
1	BS PreVet	165	83	65	58	63	65
2	BS PreVet	157	63	48	55	56	61
3	BS PreVet	147	35	35	55	42	54
4	BS PreVet	145	29	48	44	44	48
5	BS PreVet	137	12	42	44	37	33
		150	44	48	51	48	52

Biology BA Students

STUDENT NAME	Senior Major	TOTAL SCORE	Percentile	1 = Cell Biology	2 = Molecular Biology & Genetics	3 = Organismal Biology	4 = Population Biology, Evolution and Ecology
1	Biology BA	134	9	35	41	35	36
2	Biology BA	165	83	65	65	62	61
3	Biology BA	139	16	45	34	39	43
4	Biology BA	145	29	35	41	50	50
		146	34	45	45	47	48

1/4 = 25%

ALL Biology BS Students

STUDENT NAME	Senior Major	TOTAL SCORE	Percentile	1 = Cell Biology	2 = Molecular Biology & Genetics	3 = Organismal Biology	4 = Population Biology, Evolution and Ecology
1	BS PreMed	154	55	48	50	60	54
2	BS PreMed	158	67	57	53	54	65
3	BS PreMed	153	52	51	58	48	54
4	BS PreMed	162	76	54	63	60	63
5	BS PreMed	142	22	42	38	54	36
6	BS PreVet	165	83	65	58	63	65
7	BS PreVet	157	63	48	55	56	61
8	BS PreVet	147	35	35	55	42	54
9	BS PreVet	145	29	48	44	44	48
10	BS PreVet	137	12	42	44	37	33
		152	49	49	52	52	53

6/10 = 60%

BIO124 – General Biology II: Assessment Quiz Scores

Student	Score (%)
A	100
B	60
C	80
D	100
E	100
F	60
G	80
H	80
I	80
J	60
K	100
L	100
M	80
N	80
O	60
P	60
Q	100
R	100
S	60
T	40
U	100

			Points Missed							
Student	**Grade**	**%**	**Q1**	**Q2**	**Q3**	**Q4**	**Q5**	**Q6**	**Q7**	**Total**
A	15.5	77.5	0	1	1	1	0	1	0.5	4.5
B	15.5	77.5	0	1	1	1	0	1	0.5	4.5
C	11	55	0	0	2	2	1	3	1	9
D	11	55	0	1	2	2	1	1	2	9
E	19	95	0	0	1	0	0	0	0	1
F	9.5	47.5	0.5	1	1	3	0	3	2	10.5
G	19	95	0	0	1	0	0	0	0	1
H	13	65	0	0	1	2	0	3	1	7
I	9.5	47.5	0	0.5	2	3	0	3	2	10.5
J	15	75	0	0.5	1	3	0	0	0.5	5
K	15	75	0	0.5	0	3	0	1	0.5	5
L	9	45	0	2	1	1.5	0.5	3	3	11
M	11	55	0	0.5	2	1.5	0	2	3	9
N	8	40	0.5	0.5	2	2	2	3	2	12
O	14	70	0	0.5	1	1	0	3	0.5	6
AVERAGE	**13.0**	7 of 15								
Percentage	**65%**	47%								

The benchmark is 70% of the students at Proficient or better. Proficient is defined as 70% or better on the assessed questions.

Fall 2021: **Not Met** Only 47% of the students received a Proficient (70%) or higher on the Assessment Quiz (n=15).

BIO401 – Evolution: Assessment Quiz Scores

Student	Score (%)
A	100
B	100
C	85
D	100
E	85
F	90
G	95
H	85
I	100
J	70
K	80
L	85

All Student Performance Review Activities for the Biology Department will be held on Tuesday, February 22 and Wednesday, February 23!!!

Remember the Biology Department Student Performance Review Activities are required as part of your degree.
Please refer to the schedule on the next page.
If you have a problem attending or completing any of the requirements, please email or talk to one of the three Biology Faculty as soon as possible.

Group Explanations:

Graduating Seniors = Those Biology Majors that are graduating in 2022 (April or December) and currently enrolled in BIO401 [evolution]
2nd and 3rd year Students = Those Biology Majors who have completed BIO231/ 2332 [Genetics] but are **NOT enrolled in BIO401**
1st year Students = Those Biology Majors who are currently enrolled in BIO124/125 [Gen Biology II] but NOT completed BIO231/ 2332 [Genetics]
Seniors (by status/credit hours) = Those Biology Majors who have completed over 90 credit hours may have been selected by University Assessment to reach the required numbers for the CLA

Information and Questions:

- **Graduating Seniors** – Dr. Hirsch-Jacobson will provide details of MFT in BIO401
- **1st years** – Dr. Hirsch-Jacobson will provide details in BIO124 about Student Performance Review Activities
- **2nd and 3rd years** – Expect an email from Dr. Greenland-White regarding sign-up and details of the Journal Article Reviews = Data Interpretation
- **Seniors** (**by status/credit hours**) – Expect an email from Dr. Keller about taking the CLA
- **All Biology Majors** - Expect an email from Dr. Keller with links regarding the surveys - those should take ~5 – 10 minutes, so please try and have them completed in the time slot allotted.

Tuesday – February 22, 2022			
Time	**Group**	**Assessment**	**Faculty in Charge**
10:00am – 12:00pm	**Graduating Seniors** - **Required**	**Biology Major Field Test** Cox200 – Computer lab	Dr. Robin Hirsch-Jacobson
12:00 – 12:30pm	**Graduating Seniors** - **Required**	**On-line Survey** about Shadowing/ Internships and Life plans	Dr. Kimberly Keller
10:00am – 5:00pm	**2nd and 3rd Biology Majors** - **Required**	**Journal Article Review/Data Interpretation** Students will sign-up for a 2-3 hour block during the day – more details to come. Cox209 10:00am – 5:00pm and Cox200 (after 12:00pm)	Dr. Sarah Greenland-White
6:00 – 7:00pm	**ALL BIOLOGY MAJORS** **Required**	**Research Talk by: Preston Wolfe** **Doctoral Candidate University of Missouri** "Evaluation of Serum and Urine Biomarkers for Developmental Dysplasia of the Hip"	Dr. Kimberly Keller
7:00 – 8:00pm	**All Biology Majors are Welcome - Optional**	**Meet & Greet with Presenter** Ask more questions about his talk or his journey Cox300	Dr. Kimberly Keller
Wednesday – February 23, 2022			
10:00am – 12:00pm	**Seniors** (**by status/credit hours**) – **Required**	**University Assessment - CLA** Cox200 – Computer lab	Dr. Kimberly Keller
10:00am – 12:00pm	**1st, 2nd and 3rd years** - **Required**	**On-line Survey** about Shadowing/Internships	Dr. Kimberly Keller
12:00 – 1:30pm	**Graduating Seniors** and **First years** - **Required**	**Impartation of Wisdom Lunch** Cox300	Dr. Robin Hirsch-Jacobson Dr. Sarah Greenland-White

Student Performance Review Event

When: Tuesday, February 22

Where: Library Auditorium

Biology Department Research Talk:

Preston Wolfe

"Evaluation of Serum and Urine Biomarkers for Developmental Dysplasia of the Hip"

Doctoral Candidate University of Missouri

Department of Orthopaedic Surgery

School of Medicine
University of Missouri

WILLIAM WOODS
UNIVERSITY

Preston Wolfe graduated from William Woods University with a Bachelor of Science as a Biology Pre-Med Concentration Major in May of 2017 and was a student-athlete on the Track & Field Team. Preston has completed his doctoral coursework at the University of Missouri (Department of Orthopaedic Surgery) and will soon be defending his dissertation research and completing his Ph.D.

Shen, S., Lim, G., You, Z. et al. Gut microbiota is critical for the induction of chemotherapy-induced pain. Nat Neurosci 20, 1213–1216 (2017). https://doi.org/10.1038/nn.4606

Name	Reviewer 1	Reviewer 2	Reviewer 3	AVG of 3 Scores
Student 1	3.5	3.4	3	3.30
Student 2	3.5	2.8	2.5	2.93
Student 3	4	4	4	4.00
Student 4	5	4.8	5	4.93
Student 5	4	4.7	4.5	4.40
Student 6	3	3.6	3.5	3.37
Student 7	4	3.8	3.5	3.77
Student 8	3	2.6	3	2.87
Student 9	3.5	3.8	3.5	3.60
Student 10	3.5	3.7	3.5	3.57
Student 11	4.5	4.4	4.5	4.47
Student 12	3	3.2	3	3.07
Student 13	3.5	4.1	3.5	3.70
Student 14	5	3.7	4	4.23
Student 15	3	3.2	3	3.07
Student 16	1	1.1	1	1.03
Student 17	2	2.7	2	2.23
Student 18	5	4.5	5	4.83
Student 19	5	5	5	5.00
Student 20	2	3.3	2.5	2.60
Student 21	4.5	4.4	4	4.30
Student 22	5	4.1	4	4.37

77%

17/22 scored an average of 3/5 or higher

Igea, J., Tanentzap, A.J. Global topographic uplift has elevated speciation in mammals and birds over the last 3 million years. Nat Ecol Evol 5, 1530–1535 (2021). https://doi.org/10.1038/s41559-021-01545-6

Name	Reviewer 1	Reviewer 2	Reviewer 3	AVG of 3 Scores
Student 1	3.7	4.5	4	4.07
Student 2	4.6	3.5	3.5	3.87
Student 3	4.4	3.5	4	3.97
Student 4	4.5	5	4.5	4.67
Student 5	4.6	4.5	4.5	4.53
Student 6	3.4	4	3.5	3.63
Student 7	4.5	5	5	4.83
Student 8	4.4	5	5	4.80
Student 9	4.1	3.5	4	3.87
Student 10	3.9	3.5	3.5	3.63
Student 11	4.2	4	4	4.07
Student 12	3.5	3.5	3.5	3.50
Student 13	4.1	4	4	4.03
Student 14	4.6	5	5	4.87
Student 15	3.1	1.5	2	2.20
Student 16	3.1	3	3	3.03
Student 17	3.2	2	2.5	2.57
Student 18	3.9	4	4	3.97
Student 19	4.2	4.5	4.5	4.40
Student 20	3.4	2.5	3	2.97
Student 21	2.9	3	3	2.97
Student 22	3.9	4	4	3.97

80%

18/22 AVG a 3/5 or higher on the questions

Shen, S., Lim, G., You, Z. *et al.* **Gut microbiota is critical for the induction of chemotherapy-induced pain.** *Nat Neurosci* **20,** 1213–1216 (2017). https://doi.org/10.1038/nn.4606

*Notes: Figure 1 is the most relevant to this activity, though figure 2 is also used. Figure 3 is interesting, but there are no questions about it here. The **3** pages of the article are all you need to answer any of these, the last 14 pages are supplemental figures and citations.*

Answer the following questions regarding the article.

1. What were the authors mainly interested in?
   a. If having lots of good gut microbes could make chemotherapy patients less likely to experience chemotherapy-induced peripheral neuropathy
   b. If getting rid of gut microbes could make chemotherapy patients less likely to experience chemotherapy-induced peripheral neuropathy
   c. If having lots of good gut microbe could increase the effectiveness of Oxaliplatin (chemotherapy drug) at reducing tumors
   d. If getting rid of gut microbes could increase the effectiveness of Oxaliplatin (chemotherapy drug) at reducing tumors

2. What's the basic design?
   a. Some mice got water with antibiotics mixed in, other mice got regular water. Mice that were fed antibiotics were then given either Oxaliplatin or saline. Mice that were given regular water were also either given either Oxaliplatin or saline. All mice were then tested with hindpaw mechanical withdrawal threshold (HWT).
   b. All mice got water with antibiotics mixed in. Mice were then given either Oxaliplatin or saline. All mice were then tested with hindpaw mechanical withdrawal threshold (HWT).
   c. Some mice got Oxaliplatin, other mice got saline. Mice that were given Oxaliplatin were then either given water with antibiotics mixed in, or regular water. Mice that were given saline were also either given water with antibiotics mixed in or regular water. All mice were then tested with hindpaw mechanical withdrawal threshold (HWT).

3. What is figure 1a and 1b showing?

1a. Abx mice (those fed antibiotics) had significantly less bacteria in their feces than H2O mice (those not fed antibiotics)
1b. Abx mice (those fed antibiotics) had significantly less diversity of bacteria than H2O mice (those not fed antibiotics)
The big idea being that the antibiotics worked and took out a significant amount of the gut microbes in the mice.

4. What is figure 1d showing?

Oxaliplatin-induced mechanical hyperalgesia is reduced in mice that have been treated with antibiotics. Or Oxaliplatin makes the withdraw threshold lower for mice with lots of bacteria in their gut, but mice without bacteria do not show the same sensitization to pain following Oxaliplatin treatment.

5. Figure 1.f shows that if you have germ-free mice (ones that are similar to the antibiotic-treated mice in that they don't have a lot of gut microbes) and you put gut microbes into them (making them "conventionalized")
   a. They are in a lot more pain than the germ-free mice regardless of what else happens
   b. They are in less pain than the germ-free mice if they are given Oxaliplatin
   c. They are in more pain than the germ-free mice if they are given Oxaliplatin
   d. They are in much less pain than the germ-free mice regardless of what else happens

6. The main point of figure 2 is to:
   a. Suggest a mechanism/location that could explain why gut microbes are related to chemotherapy-induced peripheral neuropathy
   b. Suggest a mechanism/location that could explain why Oxaliplatin is related to reduced tumor growth
   c. Suggest a mechanism/location that could explain why gut microbes respond to antibiotic treatment
   d. Suggest a mechanism/location that could explain why Oxaliplatin is related to gut microbe prevalence (bacterial fecal load)

7. What's the overall take-home result of the paper?
   Oxaliplatin (a chemotherapy drug) makes mice more sensitive to pain <u>BUT</u> if the mice are germ-free or pretreated with antibiotics than Oxaliplatin does NOT increase sensitivity to pain.
   This result may be mediated by the immune system's response to gut bacteria.