



IUP DEPARTMENT OF BIOLOGY

Department Writing Plan

Compiled by

Dr. David Janetski, Associate Professor, Department of Biology
with consultation by Dr. Bryna Siegel Finer, Director of Writing Across the Curriculum

Submitted to:

Dr. Narayanaswamy Bharathan, Department Chair
the Faculty of the Department of Biology
Dr. Steven Hovan, (interim) College of Natural Science and Mathematics
Dr. Lara Luetkehans, (interim) Provost
Dr. Edel Reilly, Director of Liberal Studies
Dr. Karen Rose Cercone, Provost's Associate

Table of Contents

<u>SUMMARY AND GOALS</u>	3
<u>ACTION ITEMS</u>	3
<u>SCIENTIFIC WRITING IN BIOLOGY</u>	5
<u>OVERARCHING GOALS</u>	5
<u>INTEGRATION OF WRITING INTO UNDERGRADUATE CURRICULUM</u>	5
<u>COMMUNICATING WRITING EXPECTATIONS TO STUDENTS</u>	6
SUGGESTED SYLLABUS STATEMENT	7
<u>IMPLEMENTATION AND ASSESSMENT OF DEPARTMENT WRITING PLAN</u>	7
SUGGESTED SYLLABUS STATEMENT FOR WRITING ASSESSMENT:	8
<u>WRITING OUTCOMES CURRICULUM MAP</u>	9
<u>APPENDIX A – ASSESSMENT PROTOCOL AND RUBRIC</u>	21
<u>APPENDIX B – BASELINE ASSESSMENT RESULTS AND DISCUSSION</u>	24

Summary and Goals

The purpose of this updated Fall 2021 Department Writing Plan is to describe the current use of writing as a teaching tool in the Biology curriculum, raise awareness among faculty about ways to better integrate writing into teaching, and establish a framework for assessing student writing skills. The Biology Department has two overarching goals related to student writing: 1) improve scientific writing proficiency through the use of writing-to-communicate activities, and 2) increase use of writing-to-learn activities across Biology courses to improve student engagement with Biology content knowledge.

Currently across the Biology curriculum, 69% of courses display some level of writing enrichment (44 out of 64 courses, updated Spring 2021). This compares to 39% of courses with writing enrichment in 2016 (although the 2016 value is likely driven by low faculty response to initial surveys). The Biology Department seeks to build on this level of writing integration by more thoroughly assimilating Writing-to-Communicate (WTC) and Writing-to-Learn (WTL) activities into undergraduate biology courses. Increased discussion of writing and opportunities for instruction are intended to shift the culture in the Biology Department in order to more strongly emphasize to students the importance of scientific writing. Since we have not yet met our goals outlined in the first version of our plan, we will continue to work toward completing the following measurable goals within one year of publication of this report: 1) increase faculty participation in the writing survey to 100%, 2) achieve 50% completion by Biology faculty of the annual liberal studies writing workshop, 3) hold at least one guest workshop by WAC Director Bryna Siegel Finer at a Biology faculty meeting, and 4) once a semester, email an instructional online video (or other pertinent information as may be deemed more appropriate) to all Biology faculty about teaching scientific writing.

To assess student writing in the Biology program, we have created a framework that will permit Biology faculty to identify strengths and weaknesses in student writing. In short, students will assemble a “portfolio” of sample writing assignments, of which one assignment will be assessed by the Biology Writing Committee using a standard rubric. Assessment scores are being used to adapt the Writing Plan and Biology course curriculum as appropriate to improve student writing proficiency. We have introduced writing expectations to freshmen students in BIOL 201, including the portfolio concept and assessment procedures. In Spring 2021, the Writing Committee conducted its biennial assessment of 20 senior writing samples. While participation in writing portfolios was low, 65-90% of students met each of the seven assessment criteria.

At a Biology faculty meeting on October 1, 2021, the second version of this writing plan was adopted with a vote of 16-0, in addition to the WAC Director’s recommendations for continual DWP development below and on page 28 of this document.

Action Items

To achieve our goals, the WAC Director recommends the following action items for continuing program facilitation:

- Elect at least one faculty member to continue to be the WAC/BIOL liaison.
- Provide all newly hired faculty a copy of the DWP, and recommend attendance at WAC workshops or the two-day writing workshop for Liberal Studies faculty.
- Add “Department Commitment to Writing” statement to department syllabi as appropriate.
- Share biennial assessment results with the WAC Director as part of the 5-year program review process.

Last Updated October, 2021

- Add areas for the teaching and assessment of writing as goals on department and faculty five-year review documents.
- Continue to update the Writing Outcomes Curriculum Map as courses are added, removed, and revised in the Biology curriculum (and communicate these changes to the WAC Director).

BIOLOGY Department Writing Plan Spring 2021

Scientific Writing in Biology

Writing is an essential skill for professional scientists. In Biology, designing and carrying out experiments are often thought of as the essence of the discipline, but the work of scientists has little meaning if it isn't communicated effectively to peers and other interest groups through writing. The importance of writing skills is well understood by potential employers, but students in Biology often lack an appreciation for the role of writing across scientific disciplines and its significance for obtaining employment. The IUP Biology Department is committed to helping students see why writing is meaningful in the sciences, including emphasizing the critical importance of writing for successful job applications, grant proposals, scientific reports, literature reviews, abstracts, poster presentations, oral presentations, and scientific journal articles. Scientific writing includes not only mastery of basic grammar and syntax, but a clear understanding about how to compose a research paper (including introduction, methods, results, and discussion). Scientists also must be skilled at engaging readers through effective use of narrative, logical flow, language, and style, as well as synthesizing information and evidence from appropriate sources to create a persuasive argument. These higher-level writing skills are critical for obtaining research funding and publishing in high-impact scientific journals. Our department aims to improve student proficiency (see proficiency criteria below) in scientific writing through the use of professional writing assignments and writing-to-learn activities.

Overarching Goals

The Biology Department writing plan has two primary goals:

1. *Improve student proficiency in professional scientific communication (writing-to-communicate)* – Student expression of scientific knowledge and analysis through writing and other means should be evidence-centered, insightful, concise, accurate, objective, and structured using typical scientific formats.
2. *Increase the use of writing-to-learn activities across the biology curriculum* – Encourage faculty to assign writing activities that enhance student engagement and improve critical thinking, introspection, and development of informed opinions in order to reinforce course concepts and provide consistent messaging to students of the value of writing in the discipline.

Integration of Writing into Undergraduate Curriculum

Biology faculty currently use writing as an indispensable teaching tool and work hard to improve student proficiency in scientific writing by giving students a variety of opportunities to develop their writing skills. A faculty survey in Spring 2021 indicated that the proportion of Biology courses that are writing-enriched with WTC and/or WTL is 69% (44 out of 64 courses). Specifically, 57% of the 44 writing-enriched courses implement both WTC and WTL, 25% use only WTL, and 18% use only WTC. We seek to build upon this level of writing integration by more thoroughly assimilating WTC and WTL activities into undergraduate biology courses. Specifically, we will increase opportunities for faculty to obtain tools for more effective use of writing in course curricula. A number of department faculty have participated in writing workshops

and meetings with the WAC director and professionals from other institutions, but true integration of WAC will be more effective with a commitment from all department faculty to share in these activities. Additional training opportunities therefore may help improve faculty use of WTC and WTL, such as:

- Liberal studies writing workshops
- Seminars from writing professionals in the sciences
- WAC director visits to department faculty meetings; potential topics include:
 - Strategies for providing efficient and instructive feedback on student writing
 - Emphasizing higher order writing skills and providing effective sentence-level support
- Online instructional videos and other best practices about WTC and WTL (e.g., <https://wac.colostate.edu/resources/wac/intro/>)

Writing-to-communicate assignments are used in biology courses to assess student proficiency at scientific writing and understanding of course content. These activities typically involve direct communication about scientific topics and/or independent research projects, such as writing a scientific report or manuscript, but may also include research posters and oral presentations. Specifically, students use WTC to develop the following discipline-specific skills:

- Express ideas in a clear, concise manner, including logical flow from one point to the next.
- Basic proof-reading and peer review, such as identifying thesis statements and arguments, as well as editing paragraph and sentence construction, flow, word choice, and citation format.
- Correct grammar, appropriate word choice, and cohesive sentence and paragraph structure.
- Understanding of the basic components of a scientific paper, including Introduction, Methods, Results, and Discussion, including appropriately formatted tables and graphs.
- Inform and persuade varied audiences (e.g., peers, academic, public, policy) about scientific topics in an engaging, reader-friendly manner.
- Critical thinking and appropriate application of findings to other systems, acknowledging levels of variability inherent in nature.
- Synthesis of data and evidence contributed by themselves and/or the scientific literature to build arguments and draw conclusions about biological concepts.

Writing-to-learn activities help students think about new ideas and ultimately improve understanding of course concepts. These activities permit students to explore their thoughts and develop opinions and arguments in a low-stakes setting. Examples of WTL activities include reading responses, free-writes, and journaling. Students use informal WTL assignments to:

- Develop thinking skills
- Assess their own understanding and identify misconceptions
- Discover connections between course content and everyday life
- Express complicated concepts
- Develop viewpoints and describe evidence that supports those viewpoints
- Evaluate and interpret data presented in scientific journal articles
- Practice forming conclusions about scientific datasets

Communicating Writing Expectations to Students

The importance of writing skills to biology is communicated both in and out of the classroom. For writing-enriched courses, writing activities and assignments are described in the course syllabi. Instructors often use rubrics tailored for specific assignments, and discuss their expectations about good writing with students. In addition to WTL activities in class, some instructors devote class time to peer review and to class discussion of writing projects and the writing process. Instructors also provide individual feedback

to students on their writing assignments and often require revised drafts of major writing activities. Students are encouraged to utilize the Writing Center for extra assistance with writing assignments.

Overall, students are provided with opportunities to develop writing skills as a central component to their education in Biology. We consider all students to be capable of strong writing and all writing to have room for improvement. Students enter the program with widely varying levels of writing proficiency. However, our goal is to ensure that all students are challenged and encouraged to develop excellent writing skills, to learn and think about biological science through the process of writing, and to articulate their passions and skills through writing that will allow them to excel professionally and academically. This may also include extra-curricular activities where scientific communication is critical, such as independent research projects with faculty mentors.

Suggested Syllabus Statement

The Department of Biology is committed to developing student writing throughout the curriculum. In this class, as in almost every class in the department, you will complete writing assignments and activities designed to improve your communication skills in this course, other courses, and in the profession. You are encouraged or may be required to add assignments that best illustrate your writing skills to your online writing portfolio.

Implementation and Assessment of Department Writing Plan

Writing is currently assessed in the Biology department using a variety of methods, nearly all of which occur within individual courses (see Writing Outcomes Curriculum Map below). For instance, WTC is evaluated through lab reports, written research papers, posters, oral presentations, and essay questions on exams. Written research projects often involve a process for revision based on instructor feedback. Also, low-stakes WTL assignments are used by many biology faculty to encourage self-reflection and deepen understanding of course concepts.

The current writing strategy in the department provides a variety of course-specific writing experiences to students, but lacks a broader framework for measuring student proficiency toward the end of program completion. Also lacking is a method for tracking the degree to which biology faculty use WTL activities in their teaching.

We plan two new strategies for assessing WTC and WTL in the Biology department:

- 1) *Writing-to-Communicate Assessment* – A committee of four Biology faculty has been assembled (a.k.a. the “Writing Committee”) to assess proficiency in scientific writing by senior biology majors. The outline below explains the steps in the assessment process, concerning both students and faculty.
 - i. First, expectations for writing and the assessment process are introduced to Biology students in their opening biology course (BIOL 201 or 202).
 - ii. Second, in BIOL 201 and 202, students are instructed about how to create a Writing Portfolio to contribute to as they complete their major coursework (see Appendix A). The portfolio is to include a sample writing assignment or research paper (required), and students may wish to add other products from courses or independent research, such as: (1) poster presentation, (2) oral presentation, and/or (3) grant proposal. Students may add items to their portfolio from any Biology major courses they wish; i.e., they are free to choose whatever they feel is their best

work. Students may also be asked to add self-reflection writing assignments to their portfolios. In addition to facilitating writing assessment, portfolio development provides students with a useful collection of work to showcase to potential employers following graduation.

More work needs to be done to encourage faculty of major courses (e.g., BIOL 201, 202, 203, 362, etc.) to have students add assignments to their portfolios as part of the required work for their courses or for extra credit. For our Spring 2021 assessment, only five students had successfully uploaded writing samples to their portfolios. Participation was verified by email, and responses to the email were very limited (hence the small sample size). The process needs to be modified to increase student participation and ease of writing sample retrieval.

- iii. The writing committee consists of four biology faculty as of Spring 2021 (Cuong Diep, Sarah Emel, David Janetski, and Bob Major). Assessment is carried out by randomly selecting a representative sample (n=20 out of a pool of 102 writing samples in 2021) of student writing samples and assessing each sample using a standard rubric (Appendix A). Averages were computed for each of the seven rubric criteria. In the future, we may divide the samples by subdiscipline rather than each committee members assessing each writing sample.
 - iv. The writing committee reports results to the biology department and the WAC director for discussion and feedback. Modifications to the Writing Plan and to the Biology course curriculum will be made as appropriate based on feedback and implemented the following year. All results, meeting minutes, and discussion notes will be archived on the O drive. This database will allow for analysis of long-term trends and inform faculty about areas in need of improvement (based on scores for individual rubric categories).
- 2) *Writing-to-Learn Assessment* – Trends in faculty implementation of WTL activities will be tracked using annual surveys of both students and faculty.
- i. Faculty will be asked annually to update their courses on the Writing Outcomes Curriculum Map (last request was Spring 2021). Responses will be summarized by the writing committee and archived on the O Drive.
 - ii. Student perceptions about writing will be surveyed by asking senior biology students for feedback. The survey may include questions about attitudes toward writing, use of writing as a learning tool, perceived importance of writing in scientific professions, how often writing was emphasized in courses, self-perceived proficiency in writing, etc.

For transparency and ethics, this statement will be included on syllabi of courses in which students will be submitting writing to their portfolios:

Suggested syllabus statement for Writing Assessment:

The Biology Program is undergoing programmatic evaluation. Please be advised that your writing assignments may be randomly chosen for program assessment purposes. Program assessment activities will have no bearing on your course grade and, should your work be selected, your name will not be attached to it. If you have any questions about program assessment or wish to withdraw permission for use of your work, please contact the Biology Writing Coordinator, Dr. David Janetski (janetski@iup.edu).

Writing Outcomes Curriculum Map

The Writing Outcomes Curriculum Map demonstrates:

- Conscious effort on the part of department faculty at placing core disciplinary genres at appropriate levels of the curriculum, scaffolding and reinforcing the writing skills necessary for students to succeed in writing those genres (For example, in BIOL 201 students learn the basic elements of a scientific paper, i.e., Introduction, Methods, Results, and Discussion. In BIOL 362 students carry out a simple experiment and write a research paper describing their findings, with focus on higher-level writing skills).
- Integration of writing-to-learn activities in a number of courses in the curriculum; includes use of writing as a tool to reinforce concepts, organize thoughts, and assess one’s own understanding.
- Professional scientific writing skills are also taught and evaluated in a sequential manner (For example, the basic conventions of scientific writing are taught in BIOL 201 and 203 and synthesize their own research, both individually and with groups, in BIOL 362 and BIOL 490).
- Information below was acquired from a Biology faculty survey in Spring 2021.
- **44 out of 64 courses use WTL and/or WTC = 69% of courses are writing-enriched**

Course	Title	Expected Writing Skills	Writing Activities (Write to Learn [WTL] and Writing to Communicate [WTC])	Introduced, Reinforced, or Emphasized
101	Basic Biology	The ability to synthesize and represent thoughts/responses to scientific thinking; building of critical thinking skills	Discussion board responses on D2L in response to a scientific editorial piece or journal article (WTL)	Introduced
			Essay questions on exams (WTC)	Reinforced
103	Life on Earth	Lab - Students read non-fiction "Year in the Life of the Pronghorn" (Byers, J., 2003), online download through library (or other similar book). Ability to analyze and respond to questions posed about the dominance study.	"Science in the News" students are frequently required to write a 1page summary of a science story that has taken place in the last 7 days (WTL). Lab - students write about what they've learned in their book, such as "Year in the Life of the Pronghorn."	Reinforced
104	Human Biology	Student will learn to communicate knowledge and exchange ideas in written and graphical/tabular form, based on answers to laboratory questions and the liberal studies assignment. Students will be able to state a thesis topic at the beginning of an expository paper and develop their arguments citing evidence from their primary sources (liberal studies book)	Upon completing laboratory exercises, students answer questions related to concepts behind the human biology experiments completed that day and interpretation of the data. As an instructor, I check on the students while they are answering the questions and give feedback and guidance about their answers. We also frequently have group discussions about the answers to	In the context of a liberal studies course, students are encouraged to think critically about presentation of scientific data in popular press through examples of proper use of scientific method and examples of improper use of scientific methods.

		and other sources found in researching their topic.	the questions. These questions are graded. (WTL)	
			Lab - Read a non-fiction, book and other related sources, that addresses scientific questions relevant to the course (human biology) such as influence of diet, exercise, physiology and genetics on obesity and health. Students will identify two major controversies (ethical issues) of interest and write a critique of key chapters of the book. Students will define and analyze problems related to their topic, and then communicate their analyses and conclusions in a short (>1000 word) paper and 5-minute presentation/discussion with the class. (WTC)	
		Ability to analyze and respond to questions posed about the topics discussed in the course. Introduce the idea of scientific thinking.	Discussion board responses on D2L in response to a scientific editorial piece or journal article (WTL)	Introduced
			Essay questions on exams (WTC)	
			8-10 short-answer quizzes, 2-4 sentences per question, 2-3 questions per quiz (WTL)	
			3-4 short-answer quizzes per term, 5-6 questions per quiz (WTL); 6-12 questions each week (done as group-work) (WTC)	
105	Cell Biology	Ability to analyze information to answer application questions presented in lecture	Worksheets with MC, fill-in-the-blank, short answers. No essay questions on worksheets or on exams. (WTL)	
106	Human Genetics and Health	Critically assess and respond to scientific editorial pieces in relation to genetics.	Selection of relevant articles (from things like Time or Newsweek) and writing a response to the article and relating relevant concepts to the genetics discusses in lab (WTL)	Introduced
			3-4 short-answer quizzes per term, 5-6 questions per quiz (WTL); 6-12 questions each week (done as group-work) (WTC)	
107	Introduction to Forensic Biology			

115	Biotic Diversity of North America	Ability to assess scientific information in public print sources for validity and bias.	Students locate, summarize, and evaluate the scientific value of an article from a public news source (newspaper, news website) (WTL)	Introduced
116	Human Genetics and Health Laboratory			
117	Understanding HIV Biology and AIDS			
118	The History of Pain			
119	Emerging Diseases			
150	Human Anatomy	This lab is designed to have students learn anatomical structure and no writing is done in the laboratory sections.	Occasional "think-pair-share" type activities with limited writing in lecture. (WTL)	
200	Medical Terminology	Students participate in online forums requiring written communication about complex medical terms.	Written responses ask students to convert complex medical terms into colloquialisms to assist in retaining a large volume of information. This is accomplished through graded D2L discussion forums. (WTL)	Introduced
201	Principles of Ecology and Evolution	Students communicate in writing (prose, graphs and tables) their experimental methods, results, and conclusions using appropriate format for scientific papers.	Written responses to lab manual questions, occasional written responses to questions/topics presented in lecture (usually graded by peers); intended to encourage introspection and critical thinking (WTL).	Reinforced
			Lab - Some sections require three full lab reports emphasizing components of a scientific paper (Introduction, methods, results, tables, figures, discussion, and literature cited). (WTC)	Introduced, emphasized
202	Principles of Cell and Molecular Biology	Students learn to organize and present data in scientific formats.	Written responses to lab manual questions, and to lab manual activities. Proper formatting of scientific tables and figures. Two lab reports with scientific sections: title, authors, abstract, introduction, methods, results, discussion, references. Poster presentations of class projects (WTC)	Introduced, reinforced

203	Principles of Genetics and Development	Students are expected to effectively communicate their lab data, demonstrating that they understand the lab activity and interpretation of the data	At the end of each lecture, students write a Minute Paper in which they describe the most important thing they learned, and also what is still unclear to them (WTL)	Reinforced, emphasized
			Three complete lab reports, each containing a Title, Authors, Abstract, Introduction, Methods, Results, Discussion, and References. Also three review papers on research articles. Lecture exams are also mainly short answers and discussions (WTC)	Reinforced, emphasized
205	Ecological Methods	Report and interpret the results of basic statistical analyses in ecology.	Essay questions on exams and written answers to homework problems Introduce and reinforce scientific writing skills (WTL, WTC).	Introduced, reinforced
210	Plant Biology	Students learn how to communicate their findings in the format of a presentation.	Short answer exams	Reinforced
211	Investigative Biological Forensics			
220	General Zoology	Synthesis of information into coherent statements of concepts	Homework assignments (WTL)	Reinforced
			term project written in scientific format; 4 exams each of which are at least 50% essay (WTC)	Reinforced
221	Environmental Health and Protection			
240	Human Physiology	Students learn to communicate scientific results in the form of written questions.	8-10 short-answer quizzes, 2-4 sentences per question, 2-3 questions per quiz; 10-12 short-essay lab write-ups, 8-12 questions each, 3-6 sentences per question (done as group work) (WTL, WTC)	Introduced
			Short essay problem set (quantitative, with written interpretation; 4-8 sentences per question), 3-4 sets per term, 6-8 problems per set (done as group work) (WTC)	
241	Introductory Medical Microbiology	Writing assignments in lecture (Irani section)	Writing activity in my lab sections involve a one-page report for each of the two assignments. All lab quizzes have a short essay/answer format (WTL)	Introduced

			BIOL241 is the only Microbiology course for majors and non majors. Writing skills in my lab sections are focused on data analyses, data communication and interpersonal skills in form of reports, quizzes and an essay portion of lab and lecture final exam. (WTC)	
261	Ornithology	Summaries of peer-reviewed manuscripts that focus on avian ecology and conservation. Additionally, summaries of guest speaker presentations	Peer-reviewed article summaries (n=10); Guest Speaker summaries (n=7-10) No more than 1 page each..	
272	Conservation of Plant and Animal Resources	Students are asked to prepare and deliver scientifically accurate methods and results in accordance with professional examples provided in the course	Written responses to lab materials designed to prepare students for a career in wildlife management conservation by the end of the semester (WTL, WTC)	Reinforced, Emphasized
			Prepare a professionally accurate species management plan (WTC)	
300	Genetics and Medicine and Nutrition		Write 2 papers on topics related to medical genetics and nutrigenomics	Reinforced, emphasized
301	Fundamentals of Epidemiology			
310	Applied Entomology and Zoonoses			
313	Forensic Analysis of DNA			
323	Introduction to Toxicology and Risk Assessment	Students will develop skills needed for developing and writing a review article (e.g., outlining, writing abstract, developing a list of relevant references). Students will be able to critically assess strength and weaknesses of basic toxicology studies.	Bonus opportunity on lethal injection: answering questions from primary sources about the pharmacology and toxicology of the components, differences in practices of human execution from animal euthanasia, problems with the practice of lethal injection and how tox principles can explain these. Short answer study guide to help prepare for exam (WTL)	Introduced, reinforced
			Toxicology project paper: Students will write an outline using Guidelines for Outlines (a WTL experience), then and abstract and finally literature review on a toxicology topic of	

			<p>interest. Short answer exam questions: Students will be able to read toxicology literature and provide concise, well-thought, answers to objective questions and those requiring interpretation of data/information (WTC)</p>	
			<p>Students work in teams of 3 on toxicology project (paper and presentation). The presentations were given as a "mini-symposium". Toxicology review papers had to cite primary references (WTC)</p>	
331	Developmental Biology	<p>Synthesis of literature information and the construction of an organized flow of topic with clarity. The ability to construct a lab report with an engaging introduction and clear understanding of how to convey the significance of a scientific topic.</p>	<p>Students are required to compose two literature reviews on two separate developmental topics. They are then required to provide a concise, few minute description of their study to members of the lab portion of the course. I emphasize clarity, organization, and the ability to point out the significance of the topic and to allow them to reinforce this focus by presenting to their peers. Students are required to complete one lab report based on the laboratory project. Students focus primarily on the Introduction section in order to reinforce their understanding of their scientific method.</p>	Reinforced, emphasized
342	Comparative Vertebrate Anatomy		<p>Ungraded writing assignments, to help organize thoughts (WTL) Summaries of peer-reviewed manuscripts that focus on functional morphology, adaptation, and macroevolution.</p>	Reinforced
			<p>Short essay questions (WTC)</p>	
352	Comparative Animal Physiology	<p>Communicate effectively in writing (prose, graphs and tables) the background and key questions/hypotheses to answer, any experimental designs and research methodologies, results, interpretations and conclusions.</p>	<p>Assignments include: 1) writing critiques of lab reports and short papers including comments on what worked well and constructive feedback on what could be improved (WTL); 2) Building on knowledge and skills gained in critiques, students write lab reports on several labs including review of relevant literature and discussion (WTC). Peer reviews are also</p>	

			used to provide constructive feedback to other students (WTL).	
362	Ecology	Write and properly format an engaging, 6-8 page research paper about a completed research project (using data generated independently or from an online database); critically evaluate and respond to peers' writing	Daily quizzes with short answer "thought and interpretation" questions; 2-3 one-page responses to scientific articles; 4 exams with both short (1-2 paragraphs) and long (1-page) essay questions (WTL, WTC) Research paper consisting of Intro, Methods, Results, Discussion, and Lit Cited, 6-8 pages in length, includes multiple peer-reviews and one instructor review before final draft is submitted; writing activities are accompanied by student reading of "Writing Science" by Joshua Schimel (WTC)	Reinforced - structure and organization of scientific paper; Introduced, emphasized - advanced skills of scientific communication through writing, such as targeting a specific audience, making a compelling argument, engaging the reader, clear and concise language, etc.
364	Immunology	In addition to essay exams and quizzes, writing assignments for lecture (Irani section)	Writing activity in lecture and lab involve essay exams and quizzes (WTL) In labs, in addition to essay quizzes, writing activity involves two two-page lab reports (WTC) BIOL364 is a majors course which by some would be described as writing intensive. Lecture and lab exams, quizzes are in essay format.	Reinforced?
401	Laboratory Methods in Biology and Biotechnology			
402	Advanced Human Anatomy		Weekly short descriptions of the area dissected (WTL). Culminating short literature review paper tying anatomy to a clinical topic (WTC).	
405	Biology of the Cell		BIOL405 is a required course for those in the CMB track. Students are provided weekly articles from the primary literature on advanced cell biological topics and are required to submit a 2 page summary of each article. These assignments assess student understanding of the scientific flow of logic taken by the investigators as well as the techniques used for the study.	Reinforced, emphasized

409	Pharmacology Principles and Applications	Students will learn to pharmacological principles and then apply those to readings from primary literature for writing short review articles. Students will also get experience and coaching in providing concise, thoughtful answers to short-answer questions.	BIOL 409 - Pharmacology Principles & Applications - Virtual labs: students were given pharmacology data sets asked to short answer/essay answer questions about the data, their interpretations and conclusions about the data. They were also asked for one assignment to describe what additional data they would like to generate a contract research lab and the justification for this. Short answer/essay questions on exams: students read scientific articles and then answered objective questions about the introduction, methods and results as well as questions about interpretation of the data (WTL)	
			BIOL 409 - Pharmacology Principles & Applications: Assuming the role of a new research or clinical scientist on a team, students were required to write 2 short literature review papers, one on the chemistry and pharmacology of a recently approved drug, the other on a molecular target or mechanism of action. Students selected a drug or mechanism of interest, read one or more scientific articles and then wrote an informative review that could be shared with their new lab group (WTC). Another assignment is to write a 2 page fact sheet on a particular molecular target for a drug class to communicate with other researchers/students in the field (WTL/WTC).	
410	Molecular Biology Topics			
411	Forensic Biology Laboratory Operations			
420	Entomology			
425	Herpetology		Weekly short answer quizzes and online discussion topics (WTL); each student prepares a 3-5 page literature review summary of a	

			species of amphibian or reptile of their choice, in the format of a Catalogue of American Amphibians & Reptiles account (WTL/WTC); final group project results in a 10-15 page coauthored paper in format of a journal review article (WTL/WTC), and is presented as either an oral presentation or poster presentation	
430	Gene Editing Tools in Medicine and Biotechnology			
431	Ichthyology	Synthesize research findings through writing, including proper interpretation of data analyses	Short answer quizzes about once per week designed to introduce lecture topics and encourage critical thinking; 2-3 lab reports with Intro, Methods, Results, Discussion (WTL, WTC)	Reinforced, emphasized
			6-8 page "life history report" about a fish taxon of the student's choosing (individual), oral presentations about chosen fish taxon (group) (WTC)	Reinforced
450	Pymatuning (Field Techniques)		Students work in groups to compose a 10-15 page management plan or research project centered around a topic of their choosing; groups create a plan, collect data, analyze and interpret the data, then synthesize the information into a comprehensive management plan/report for a landowner or interested party (WTC)	Reinforced, introduced
451	Evolutionary Biology		Weekly written discussion questions and responses (WTL); two of the three exams consist of 10-12 short-to-medium length essay questions that require synthesis of multiple topics/concepts to answer (WTL); third exam includes designing and writing a methodology section for a phylogenetic study; final group project results in a 10-15 page coauthored paper in format of a journal review article (WTL/WTC), and is presented as either an oral presentation or poster presentation	

455	Animal Behavior		5 short-answer quizzes per term, 2-3 questions per quiz; 3-4 short-essay problem sets per term, 6-8 problems per set (done as group work); 4 exams, 15–25 questions per exam; 555 students: 2x 1 pg essays for peer audience, 1x peer critique of essays, 1x 1pg essay for public audience (WTL, WTC)	Reinforced
456	Ecological Toxicology			
462	Vertebrate Endocrinology	Analyze and critique research papers in written and oral presentations.	Students are assigned a research article to evaluate and develop a short written summary. Students are also assigned short quizzes which require concise written answers.	Reinforced
463	Limnology	Synthesis of information into coherent statements of concepts	Term projects in scientific paper format; two exams, 100% essay (WTC)	Reinforced
466	Principles of Virology			
469	Circadian Rhythms and Sleep	Students will be able to integrate knowledge of circadian rhythms/sleep with scientific methodology by designing and writing scientific questions based upon discoveries from primary literature.	"Thought experiments" (midterm) - students are given a hypothetical situation that requires them to apply their knowledge and problem-solve. Intended to develop critical thinking and scientific writing skills (WTL)	
			Article presentation - students write and present slides summarizing/analyzing a research article. Feedback includes assessment of ability to clearly communicate scientific concepts and methodology (WTC)	
			"Next best question" (final) - students write a scientific question based upon topic(s) related to primary literature read in class. Similar to assignments in 479, but more detail on justification, methods, predicted results, and significance expected. Intended to develop critical thinking, experimental design, and scientific writing skills (WTL)	
471	Dendrology of the Eastern US	Students accurately summarize methods and results from field	Plot Study Report- students describe ecological survey	Reinforced

		activities using appropriate content, style, and resource citations.	protocols, and analyze impacts of forest composition and potential management practices using appropriate reference materials.	
473	Seedless Vascular Plants: Ferns and Allied Flora	Students accurately summarize methods and results from field activities using appropriate content, style, and resource citations.	Forest Fern Composition Report- students describe ecological survey protocols for determination of fern populations, and analyze impacts of forest composition, wildlife populations, and potential management practices using appropriate reference materials.	Reinforced
474	Spring Flora of the Northeastern US			
475	Mammalogy	Clearly convey methods and results in writing. Learning appropriate content for each section for scientific writing. Organize an informative paper on topic chosen, find and synthesize information for peer-reviewed literature using proper citations.	4 lab write-ups methods, results, and conclusions. 1 literature review on topic students choose. (WTC)	Lab write ups should reinforce writing skills from previous courses, while learning new research techniques in course. Literature review is an introduced writing component emphasizing the synthesis of information.
476	Parasitology			
477	Neurobiology		8-10 short-answer quizzes, 2-4 sentences per question, 2-3 questions per quiz (WTL) Full-length topic paper, 7 pages in length for undergrads, 15 pages for grads; written short-essay exams, 4 exams, 15-25 questions per exam, 4-8 sentences per question (WTC)	
478	Mycology and Plant Pathology			
479	Neurobiology of Addiction	Students will be able to communicate scientific discoveries, describe advanced methods, and pose research questions in writing and orally.	"Next best question" assignments - students write a scientific question based upon an original research or review article, including methods and predicted results. Intended to develop critical thinking, experimental design, and scientific writing skills (WTL)	Emphasized

			Article presentation - students write and present slides summarizing/analyzing a research article. Feedback includes assessment of ability to clearly communicate scientific concepts and methodology (WTC)	
480	Biology Seminar	Students research multiple sides of controversial topics in science using appropriate resources and websites.	Weekly reflection papers related to the topic discussed in class.	Introduced, reinforced
481	Endocrinology		Weekly short essay response or free-writing exercises related to lecture topics (WTL)	Reinforced, introduced
			Literature review of scientific papers (WTC)	
490	Field Studies in Biology		Students work in groups to compose a 10-15 page management plan or research project centered around a topic of their choosing; groups create a plan, collect data, analyze and interpret the data, then synthesize the information into a comprehensive management plan/report for a landowner or interested party (WTC)	Reinforced, introduced

Appendix A – Assessment Protocol and Rubric

Assessment is planned for writing samples (i.e., research papers) presented in student portfolios as part of their regular coursework as described above (see “Implementation and Assessment of Department Writing Plan”). All students enrolled in BIOL 201 or 202 are given instructions similar to these:

Welcome to the IUP Biology Program! Your success in science depends in large part on your ability to communicate effectively through writing. Therefore, you will find that the development of writing skills is a top priority of your biology instructors. This handout will instruct you how to set up a **Writing Portfolio**, which is a personal, online website for archiving and displaying your writing achievements as you progress through the Biology Program. The goals of your portfolio are to 1) showcase your accomplishments to potential employers, and 2) aid the Biology Department in writing assessment.

We recommend you use **Weebly.com** to set up your writing portfolio. The website is free and relatively user-friendly. If you prefer to use a different website, please ask your instructor for approval. Follow these instructions to set up your portfolio:

1. Go to Weebly.com
2. Create an account by clicking the “Sign Up” option on the Weebly home page
3. Fill in the required information and click “Create Your Site”
4. Answer the questions and select a theme for your website
5. Select your domain name (we suggest using a combination of your name and a few numbers of your choosing; for example, johnsmith3633.weebly.com)
6. You should now be at the Weebly website building interface. Spend a few moments to familiarize yourself with the options. Here are a few prompts to get you started:
 - From the options on the left-hand side, you can click and drag elements, such as Title, Text, or Image, to the desired location on your webpage
 - You can delete the default text and images by hovering over the item and clicking the “X” at the top right-hand corner of the box
 - To modify the various pages/links embedded in your website, select “Pages” at the top, then edit by selecting from the options on the left-hand side of the screen

You might organize pages by topic (Ecology, Cell Biology, Molecular Biology, etc.) or by communication style (research papers, posters, oral presentations, etc.). You may also wish to add photos of yourself in class or in other professional settings, such as attending conferences or conducting research. Do not include items that distract from the goal of your portfolio (impressing potential employers), such as photos of sports or other recreational activities. In short, make it your own, but be professional!

While you may create pages and organize your portfolio as you wish, **you MUST include a page titled “Writing Sample”**. Here you will upload what you consider to be your “best” piece of writing from your college career. It must come from a biology course and be a research or term

paper at least five pages in length. Your writing sample will be used for assessment purposes during your senior year.

After you set up your portfolio, you should regularly add new material as you progress through the Biology Program. As a Biology major, you are **required** to include the following documents (in pdf format) in your portfolio: A) one substantial (>5-page) writing assignment or research paper (again, under the “Writing Sample” page on your website), and B) two of the following three items: (1) poster presentation, (2) oral presentation, and/or (3) grant proposal. Each item should come from either a Biology course assignment or an independent research project. You are encouraged to include additional items in your portfolio from any Biology major course or from your independent research; feel free to choose whatever you consider to be your best and most relevant work for the job you seek.

Samples will be rated on a four-level scale for six individual criteria. Rubric criteria were tested twice by the Biology Department Writing Committee, each time using three student writing samples. These trials were important for fine tuning the rubric to better fit the types of assignments commonly assigned in Biology classes. (Updated Spring 2021)

Criterion	Below Expectations = 1	Emerging = 2	Meets Expectations = 3	Exceeds Expectations = 4
1) Grammar and mechanics	<input type="checkbox"/> Serious grammatical errors are common; proofreading is not evident	<input type="checkbox"/> Some serious grammatical errors are present; some level of proof-reading is evident	<input type="checkbox"/> Paper is mostly free of serious grammatical errors and has clearly been proof-read	<input type="checkbox"/> Paper is free of serious grammatical errors
2) Language, clarity, and flow	<input type="checkbox"/> Paper lacks logical flow; appears to be mainly stream-of-consciousness writing; language is unclear	<input type="checkbox"/> Some paragraphs have clear topics, others do not; some tangential information is included; language is unclear	<input type="checkbox"/> Most paragraphs have clear topic sentences and generally flow from one to the next; language is mostly clear	<input type="checkbox"/> Paragraphs have clear topic sentences and are organized to flow from one to the next; language is clear and concise
3) Introduction (e.g., purpose, objectives, and/or hypotheses, as appropriate for assignment)	<input type="checkbox"/> Objectives and/or hypotheses are not mentioned; Introduction does not attempt to set up or preview the rest of the paper	<input type="checkbox"/> Objectives and/or hypotheses are mentioned but unclear; Introduction attempts to set up or preview the rest of the paper, but does so ineffectively	<input type="checkbox"/> Objectives and/or hypotheses are clear, but are not appropriately matched to the main body of the paper; Introduction sets up the rest of the paper reasonably well	<input type="checkbox"/> Study objectives and/or hypotheses are present and appropriately match the rest of the paper; Introduction effectively sets up/previews the rest of the paper
4) Appropriate format and structure for assignment (IMRD, literature review, etc.)	<input type="checkbox"/> Not all format components are present; paper lacks an overall structure	<input type="checkbox"/> All components are present, but much of the information is in the incorrect section(s); paper has an overall structure, but is done in an illogical manner	<input type="checkbox"/> All components are present and mostly contain the appropriate information; paper is mostly structured clearly and logically	<input type="checkbox"/> All components are present and contain the appropriate information; paper follows a clear, logical structure
5) Literature cited	<input type="checkbox"/> Literature cited section is either absent or, if present, has serious formatting errors or references are not cited in the narrative	<input type="checkbox"/> Literature cited section is present, but with serious formatting errors and incorrect or incomplete reference in the narrative	<input type="checkbox"/> Literature cited section is present, mostly formatted correctly, and references are mostly correctly cited in the narrative	<input type="checkbox"/> Literature cited section is formatted correctly and references are correctly cited in the narrative
6) Accomplishes purpose (persuasive, engaging, and/or informative)	<input type="checkbox"/> Narrative is not particularly engaging, persuasive, or informative	<input type="checkbox"/> Narrative is somewhat engaging, persuasive, and/or informative	<input type="checkbox"/> Narrative is mostly engaging, persuasive, and/or informative	<input type="checkbox"/> Informs and persuades audience in an engaging, reader-friendly manner
7) Critical thinking and conclusion (discussion)	<input type="checkbox"/> Narrative lacks critical thinking and is limited to the topic at hand; does not discuss possible explanations; conclusions are absent or not supported by evidence	<input type="checkbox"/> Narrative attempts to move beyond the results at hand, but does so in an illogical manner; attempts to offer possible explanations for findings; conclusions are somewhat supported by evidence	<input type="checkbox"/> Findings are appropriately interpreted; writer attempts to apply results to other systems; appropriate possible explanations are discussed; conclusions are mostly supported by evidence	<input type="checkbox"/> Demonstrates critical thinking and appropriately applies findings to other systems; possible explanations are thoroughly explored; conclusions are well supported by evidence

Holistic Score: _____

Appendix B – Baseline Assessment Results and Discussion

SPRING 2021: The results below summarize average scores (of the four Writing Committee members) assigned to 20 junior/senior student writing samples (out of a pool of 102 samples) compared to pilot data collected in 2018. Writing samples were obtained from instructors of predominantly senior courses in Fall 2020 and Spring 2021 (BIOL 240, 331, 362, 405, 451, and two Biology Honors Theses). Five samples from Writing ePortfolios were also included in the sample.

1. High Achievement Criteria: 80-100% of samples met or exceeded expectations:

<i>Criterion 1: Grammar and mechanics</i>		
Year (sample size)	Exceeds/meets expectations	Emerging/below expectations
2017-18 (n=12)	91.7% (11 of 12)	8.3% (1 of 12)
2020-21 (n=20)	80% (16 of 20)	20% (4 of 20)

<i>Criterion 2: Language, clarity, and flow</i>		
Year (sample size)	Exceeds/meets expectations	Emerging/below expectations
2017-18 (n=12)	66.7% (8 of 12)	33.3% (4 of 12)
2020-21 (n=20)	90% (18 of 20)	10% (2 of 20)

<i>Criterion 3: Introduction (e.g., purpose, objectives, and/or hypotheses, as appropriate for assignment)</i>		
Year (sample size)	Exceeds/meets expectations	Emerging/below expectations
2017-18 (n=12)	50% (6 of 12)	50% (6 of 12)
2020-21 (n=20)	80% (16 of 20)	20% (4 of 20)

<i>Criterion 4: Appropriate format and structure for assignment (IMRD, literature review, etc.)</i>		
Year (sample size)	Exceeds/meets expectations	Emerging/below expectations
2017-18 (n=12)	58.3% (7 of 12)	41.7% (5 of 12)
2020-21 (n=20)	80% (16 of 20)	20% (4 of 20)

<i>Criterion 6: Accomplishes purpose (persuasive, engaging, and/or informative)</i>		
Year (sample size)	Exceeds/meets expectations	Emerging/below expectations
2017-18 (n=12)	66.7% (8 of 12)	33.3% (4 of 12)
2020-21 (n=20)	85% (17 of 20)	15% (3 of 20)

<i>Criterion 7: Critical thinking and conclusion (discussion)</i>		
Year (sample size)	Exceeds/meets expectations	Emerging/below expectations
2017-18 (n=12)	66.7% (8 of 12)	33.3% (4 of 12)
2020-21 (n=20)	80% (16 of 20)	20% (4 of 20)

2. Moderate Achievement Criteria: 60-80% of samples met or exceeded expectations:

<i>Criterion 5: Literature Cited</i>		
<i>Year (sample size)</i>	<i>Exceeds/meets expectations</i>	<i>Emerging/below expectations</i>
2017-18 (n=12)	75% (9 of 12)	25% (3 of 12)
2020-21 (n=20)	65% (13 of 20)	35% (7 of 20)

3. Average score and standard deviation (SD) for each of the seven rubric criteria (n=20):

<i>Criterion</i>	<i>Average Score</i>	<i>Standard deviation</i>
1	3.36	0.23
2	3.33	0.53
3	3.21	0.70
4	3.35	0.51
5	2.81	0.40
6	3.25	0.58
7	3.24	0.61

SPRING 2019: The results below summarize average scores (of the three Writing Committee members) assigned to 12 senior student writing samples. Writing samples were volunteered by seniors in Spring 2018 and scored in Spring 2019. This first formal assessment is considered a “baseline” for comparison with future writing assessments.

4. High Achievement Criteria: 80-100% of samples met or exceeded expectations:

<i>Criterion 1: Grammar and mechanics</i>		
Year (sample size)	Exceeds/meets expectations	Emerging/below expectations
2017-18 (n=12)	91.7% (11 of 12)	8.3% (1 of 12)

5. Moderate Achievement Criteria: 60-80% of samples met or exceeded expectations:

<i>Criterion 2: Language, clarity, and flow</i>		
Year (sample size)	Exceeds/meets expectations	Emerging/below expectations
2017-18 (n=12)	66.7% (8 of 12)	33.3% (4 of 12)

<i>Criterion 5: Literature Cited</i>		
Year (sample size)	Exceeds/meets expectations	Emerging/below expectations
2017-18 (n=12)	75% (9 of 12)	25% (3 of 12)

<i>Criterion 6: Accomplishes purpose (persuasive, engaging, and/or informative)</i>		
Year (sample size)	Exceeds/meets expectations	Emerging/below expectations
2017-18 (n=12)	66.7% (8 of 12)	33.3% (4 of 12)

<i>Criterion 7: Critical thinking and conclusion (discussion)</i>		
Year (sample size)	Exceeds/meets expectations	Emerging/below expectations
2017-18 (n=12)	66.7% (8 of 12)	33.3% (4 of 12)

6. Low Achievement Criteria: Less than 60% of samples met or exceeded expectations:

<i>Criterion 3: Introduction (e.g., purpose, objectives, and/or hypotheses, as appropriate for assignment)</i>		
Year (sample size)	Exceeds/meets expectations	Emerging/below expectations
2017-18 (n=12)	50% (6 of 12)	50% (6 of 12)

<i>Criterion 4: Appropriate format and structure for assignment (IMRD, literature review, etc.)</i>		
Year (sample size)	Exceeds/meets expectations	Emerging/below expectations
2017-18 (n=12)	58.3% (7 of 12)	41.7% (5 of 12)

7. Averages score and standard deviation (SD) for each of the seven rubric criteria (n=12):

<i>Criterion</i>	<i>Average Score (SD)</i>
1	3.25 (0.43)
2	3.11 (0.46)
3	3.11 (0.66)
4	2.81 (0.67)
5	3.08 (0.95)
6	3.03 (0.70)
7	3.06 (0.60)

Discussion and Recommendations by the WAC Director

The majority of students in the 2021 sample are meeting or exceeding expectations in all but one criteria in the Biology DWP rubric: Literature Cited. Literature Cited levels mostly describe formatting errors. Therefore, the fact that students are struggling in this area is not hugely surprising; it is consistent with many other departments at IUP and with assessment results from English 202. As with the 2019 results, it is important to note that formatting skills are not rhetorical – that is, they do not necessarily speak to students’ choices or abilities in critical thinking, content knowledge, or using evidence to make arguments. Instead, they speak more to process awareness – what should a properly formatted document look like and in what way should certain information be organized. This bodes well for the Biology department, as typically, this kind of awareness is easier to teach and learn than rhetorical skill.

To “close the loop” – make these results actionable – I recommend the following:

- Consider professional development within the department specifically regarding citation format and integration of sources (signal phrases, parenthetical citations, etc). Make sure all faculty members know this is a weak area for students and are thinking of ways to infuse their own courses (all the way up and down the curriculum) with more instruction and attention to these areas.
- Encourage student use of the Writing Center in drafting and revising. The Writing Center is a great place for students to enhance knowledge of citation style; they also provide workshops for students on this topic.