

Biol 515 Term-Paper Assignment Table of Contents

General Overview of the Biol 515 Term Paper	1
All due dates and times are firm, with very few exceptions.....	2
Selection and description of the topic (10 pts max. Due Sep 28 at 13:00).....	2
Discussion of outstanding term papers written by previous students (10 pts max. Sep 21).....	3
Outline and Initial Literature References (50 pts max. Due Oct 19 at 13:00).....	3
Complete Rough Draft of Term Paper (20 pts max. Due Nov 16 at 13:00).....	5
Written Term Paper (200 pts max. Due Nov 23 at 13:00).....	6
Peer Reviews of two other students' first drafts (2 at 25 pts each. Due Dec 5 at 13:00)	7
Final Version of Term Paper (200 pts max. Due Dec 19 at 13:00)	8
Literature Cited.....	9
Appendix I: Scoring Rubric for Term-Paper Outlines.....	10
Appendix II: Example of an outstanding outline by a student from Fall 2001.....	11
Appendix III: Scoring Rubric for Written Term Papers	14

General Overview of the Biol 515 Term Paper

To gain and demonstrate expertise in one facet of marine-invertebrate biology, each student will compose a term paper discussing some detailed aspect of the ecology, physiology, functional morphology, or evolutionary biology of an invertebrate taxon that interests the student. Depending on the exact topic, the paper might focus on a single species, a single family, a single phylum, etc. Alternatively, the paper might focus on a single biological process, comparing among different invertebrate taxa. The paper should review present knowledge about the topic (i.e., what's in the literature) *and* discuss the student's original ideas and views concerning future avenues of research relating to the topic. Examples of outstanding Biol 515 term papers from Fall 2001-2004, are posted online: <http://www.sci.sdsu.edu/classes/biology/bio515/hentschel/index.html>

In general, the paper's length should be about 12-15 double-spaced pages of text (no more than 16 pages) plus literature citations, figures, and tables. The exact length that will be required to adequately address a given topic will vary depending on the topic. Throughout the semester, Dr. Hentschel is available to help each student refine and focus his/her topic appropriately. To ensure that all students practice sound library and writing skills, as well as distributing their effort throughout the semester, the assignment is divided into six components:

- 1) Selection and description of the topic (10 pts max. Due Sep 28 at 13:00)
- 2) Discussion of exemplary papers written by previous students (10 pts max. Sep 21)
- 3) Outline and initial literature references (50 pts max. Due Oct 19 at 13:00)
- 4) Complete rough draft of term paper (20 pts max. Due Nov 16 at 13:00)
- 5) Written term paper (200 pts max. Due Nov 23 at 13:00, but see * below)
- 6) Peer Reviews of two other students' term papers (2 at 25 pts each. Due Dec 5 at 13:00)

* Graded term papers will be returned to students Dec 12. Students who want to improve their grade (i.e., most students!) can revise their paper and have it re-graded; only the last grade earned on the term paper will count toward a student's final course grade. The last opportunity to turn in a revised term paper is Dec 19 at 13:00.

All due dates and times are firm, with very few exceptions.

To be fair to students who work hard to meet deadlines, late assignments will earn *zero* pts (13:01 is late!). There are only three unusual circumstances in which late assignments *might* earn credit:

- 1) A student can *e-mail* Dr. Hentschel (*hentsche@sunstroke.sdsu.edu*) no less than 72 h before a deadline, requesting an extension and stating the reasons why an extension is required. Dr. Hentschel will reply to the e-mail no less than 24 h before the original deadline, stating whether an extension has been granted (this depends on the merits of the student's reason), the student's revised deadline, and any documentation of the student's reason for an extension that might be required to earn credit.
- 2) A student experiences a *documented* medical emergency within 72 h of the deadline. (An e-mail or phone call to Dr. Hentschel is not needed during an emergency.)
- 3) A student experiences a *documented* transportation emergency or problem (e.g., an automobile accident) within 1 h of the deadline.

Selection and description of the topic (10 pts max. Due Sep 28 at 13:00)

Students are expected to generate their own topics. Dr. Hentschel is happy to discuss each student's ideas individually (some ideas might be more amenable to a 12-page paper than will others), but students must demonstrate original thought to earn the full 10 points. Pechenik (2005) is an especially good resource for identifying potential term paper topics; each chapter ends with several topics worthy of further discussion. Other invertebrate-biology texts (e.g., Pearse et al. 1987, Brusca and Brusca 1990, 2003, Rupert and Barnes 1994) also are good resources to spark ideas. Browsing scientific journals that publish review articles (e.g., *Annual Review of Ecology and Systematics*; *Oceanography and Marine Biology: An Annual Review*) and scientific magazines aimed at a more general audience (e.g., *Bioscience*; *Scientific American*; *American Scientist*; *Discover*) also is a good way to help peak one's curiosity.

To earn full credit (10 pts), students must turn in a short paragraph (4-7 sentences) describing their topic. A single sentence or statement of the general topic will earn no more than 5 points. This component of the assignment must be submitted by e-mail (*hentsche@sunstroke.sdsu.edu*) and *received* by Dr. Hentschel no later than 1:00pm on Wednesday, 28 September 2005.

- This initial step in the term-paper process ensures a solid start. Dr. Hentschel will approve all topics and offer general advice on how to either narrow or broaden an initial topic so it is amenable to a 12-15 page term paper. For example, "The biology of arthropods" will lead to a 500-page book, not a 12-page term paper; "the functional morphology of pycnogonids' ovigerous legs" is probably too narrow.
- No two students can chose exactly the same topic! Discuss your possible idea(s) with Dr. Hentschel early to make sure it's your's for the taking.
- Any student who does not select a topic and turn in his/her descriptive paragraph by the deadline will be assigned a topic by Dr. Hentschel and will earn 0/10 points.

Can students change topics?

With the exception of students who are assigned a topic by Dr. Hentschel, students can completely change their topic at any time during the semester. This flexibility is provided in case a student gets very excited about an invertebrate taxon or process that is covered later in the semester.

There is, however, some risk to changing topics after Sep 28

If a student changes topics, s/he *must* complete all prior components of the assignment (i.e., the paragraph describing the topic and the outline) for the new topic. In addition to requiring that all earlier components be completed for the new topic, students also should be aware that their to-date point totals cannot be improved by switching topics: points earned for a given component associated with the original topic will form a maximum-point cap for the component associated with the student's new topic. For example, a student who switches from topic A to B after earning 8 pts for the topic paragraph and 30 pts for the outline cannot improve those scores. Furthermore, the student might earn lower scores on the topic paragraph and outline for topic B. The reasons for this maximum-point cap are to encourage students to put thought and effort into the assignment early in the process and to deter students from disrespecting the deadlines.

Discussion of outstanding term papers written by previous Biol-515 students (Sep 21, 10 pts)

Each year, Dr. Hentschel invites any student who writes an outstanding term paper (earning at least 180 pts on the scoring rubric: Appendix III) to have his/her paper posted on the Biol-515 website. To help current Biol-515 students begin thinking about their term-paper topics and recognize the qualities of outstanding papers, students will participate in several small-group discussions focused on the exemplary Biol-515 term papers posted on the class website.

The discussions will occur on Wednesday, 21 September 2005 and will be set up in a "jigsaw" format. Each team of 4 students will be assigned one term paper to read and a few pages of background reading in Pechenik (2005). Before participating in the discussion, each student will complete a brief questionnaire about the paper she/he read. The questionnaire will be on the Blackboard site, and students who complete it by 12:30pm Sep 21 and then participate in the discussions will earn 5 pts. In class, each team of 4 students will spend 30 minutes discussing their assigned paper and their responses to the questionnaire. Following these initial discussions, one member of each team will be assigned to a new, second group of ~ 6 members. Every one of the second groups will contain at least one member who read and discussed each of the six different papers in the earlier discussions. In the second group, each member will briefly describe the paper he/she read and discussed earlier. *By the end of the second set of small-group discussions, every student will have a basic familiarity with all of the exemplary papers posted on the Biol-515 website and insight into the characteristics of high-quality papers.* At the end of the discussion period, each of the second groups will collectively complete a questionnaire about all of the exemplary papers. These questionnaires will be worth 5 points for each group member.

Outline and Initial Literature References (50 pts max. Due Oct 19 at 13:00)

Deciding on an interesting and manageable topic is just the beginning! To eventually produce a scholarly paper, the general topic must be refined. That process involves a continual interplay between research in the library and organizing that knowledge into some sort of hierarchical, conceptual framework: essentially developing a skeleton of the paper. Early in the process, an outline can be used to direct one's efforts in the library (e.g., identifying gaps in your knowledge). Later, soon before one starts composing a fully worded paper, an outline serves two key functions:

- 1) Organizing all of the details that have been learned from the literature review
- 2) Providing a map for acquiring the remaining details that must be explored in the literature.

A good outline makes writing easy: the author just needs to add some meat (i.e., complete sentences) to the skeleton's bones! Furthermore, a good outline makes the remaining time in the library very directed and efficient. With a clear view of the big picture and most of the details, one searches for just a few resources that provide insight on just a few nagging details.

Effective outlines can follow one of many formats. The important thing is simply that the author uses some method to organize his/her thoughts and knowledge before composing the paper. The following hierarchical-outline format is suggested, but not necessarily required for Biol 515:

Main Topic (or title)

1. *Section 1*

1.1 *Subsections with parenthetical literature citation (3-6 per "Section")*

1.2 *Subsection 2 (Hentschel and Emlet 2000)*

1.3 *Subsection 3 (Twombly 1996, Hentschel and Emlet 2000)*

2. *Section 2*

2.1 *Subsection 1 (Wilbur and Collins 1973)*

2.2 *Subsection 2 (Leips and Travis 1994)*

2.3 *Subsection 3 (Pechenik et al. 1998, Pechenik 1999)*

2.4 *Subsection 4 (Thorson 1950, Strathmann 1993, Wilbur 1996)*

3. *Section 3*

3.1 *Subsection 1 (Brusca and Brusca 1990)*

3.2 *Subsection 2 (Pearse et al 1987, Rupert and Barnes 1994, Pechenik 2005)*

3.3 *Subsection 3 (Alford and Harris 1988)*

Although there is flexibility in the exact formats of the outlines for Biol 515 term papers, four features must exist to ensure that students' progress is adequate:

- 1) The main topic must be divided into at least 2 hierarchical levels
- 2) The first division (e.g., "Sections" in the example above) must have at least 3 members
- 3) More detailed divisions (e.g., "Subsections") must be accompanied by literature citations
- 4) A list of all of the cited literature (students should follow formats in the journal *Ecology*)

Why are these features required in whatever outline format the student chooses to use?

Early in the process of composing a term paper, it is important for authors to learn many details from the literature *and* to place those many details into a coherent "big picture". A hierarchical outline that includes specific literature references accomplishes both goals.

Generally, the 3-6 main "Sections" of an outline will remain in the fully written paper as section headings that aid the reader (e.g., "Introduction", "Present Knowledge", "Future Directions"). It is very common for scholarly papers to be subdivided by hierarchical headings; this is especially true in scientific papers. Early in the process of writing a term paper, students should think carefully about how to divide the topic into 3-6 "Sections".

In most cases, the more detailed "Subsections" within each of the 3-6 "Sections" of an outline will be expanded into paragraphs in the fully written paper. Specific literature should be cited (Author Year) to ensure that library research into every "Subsection" has begun. In general, every "Subsection" should include *at least* one literature citation unless the "Subsection" pertains exclusively to the author's original idea. If the author recognizes that literature is still needed to

support a "Subsection", a citation of "(Searching for Lit.)" can be used to indicate that the lack of a citation is not an oversight. If an author finds many details in the literature about a specific "Subsection", s/he can add an additional, more detailed level to the hierarchy (i.e., 1.1a, 1.1b, etc).

All literature cited in the outline should be included in a List of Literature Cited.

Only literature that is actually *cited* should be listed. Students should follow the formats of the journal *Ecology*. Formats for most types of scientific literature are listed below; additional examples can be found in any recent issue of *Ecology*. As specified in *Ecology*, the list of cited literature should be arranged alphabetically and by year of publication (see examples on p. 9).

An article in a journal

Hentschel, B. T., and R. B. Emlet. 2000. Metamorphosis of barnacle nauplii: effects of food variability and a comparison with amphibian models. *Ecology*. **81**:3495-3508.

A chapter in an edited book

Wilbur, H. M. 1996. Multistage life cycles. Pages 177-219 in O. E. Rhodes, Jr., R. K. Chesser, and M. H. Smith, editors. *Spatial and temporal aspects of population processes*. University of Chicago Press, Chicago, Illinois, USA.

A book

Pearse, V., J. Pearse, M. Buchsbaum, and R. Buchsbaum. 1987. *Living invertebrates*. Blackwell Scientific, Boston, Massachusetts, USA.

In most cases, websites are not considered scholarly literature!

Some websites will, however, include citations of scientific literature that students might find helpful (read that literature and cite *it*, not the website!). There are some rare websites that stand alone as primary sources of scientific information (e.g., databases and unpublished manuscripts). If such a website needs to be cited, students should consult Dr. Hentschel on the proper method.

Outlines will be graded according to the *Scoring Rubric for Term-paper Outlines* (Appendix I). An outstanding outline from Fall 2001 is provided as an example (Appendix II. Note, however, that this example outline is not perfect; the student's list of Literature Cited has some errors).

Complete Rough Draft of Term Paper (20 pts max. Due Nov 16 at 13:00)

In previous years Dr. Hentschel has noticed that many Biol 515 students underestimate the time required to write the first draft of their term paper. To encourage students to assemble a complete draft several days before the real due date, Dr. Hentschel expects each student to turn in a complete rough draft (printed) by 1:00pm on Wednesday, 16 November 2005. These drafts will be assigned either 20, 10, or 0 points based on the draft's degree of completeness. Dr. Hentschel will not make detailed written comments on these drafts (he will spend 5-10 min evaluating each draft: 3-4 h total for 24 papers). Scores of either 10 or 0 pts will be assigned if a draft is obviously incomplete or sloppy. Drafts will earn 20 pts if they conform to the general guidelines described below and in the *Scoring Rubric for Term Papers* (Appendix III) and represent solid progress toward a well-written paper that will be turned in Nov 23. If any student is unclear about what

constitutes a "complete rough draft", he/she should ask Dr. Hentschel for clarification before Nov 14. Dr. Hentschel will not return these drafts to students, but any student who wants to discuss his/her Nov-16 draft can meet with Dr. Hentschel during special office hours 1-3pm Thursday, 17 November 2005 or by making an e-mail appointment to meet Friday, 18 November 2005.

Written Term Paper (200 pts max. Due Nov 23 at 13:00)

Term papers are due Wednesday, 23 November 2005 at 1:00pm. Late papers will receive *zero* points. In addition, students who do not turn in a term paper by the Nov-23 deadline will not participate in the peer review of other students' papers (see below; a loss of 50 pts). Papers must conform to the following general format (not adhering to these basic directions will result in losing up to 50 pts!):

- The cover page must include the paper's title, the author's name, the author's e-mail address, the date, and Biol 515. *Do not* include other material, such as illustrations, in the cover page.
- Papers must be stapled in the upper-left corner. *Do not* use binders or plastic covers.
- All text, except the list of Literature Cited, must be double-spaced, 12-pt type. Margins must be 1 inch on all sides.
- All pages, including the cover page, must be numbered.
- If figures or tables are included, they must be individually numbered (e.g., "Fig. 1") and include a brief legend. See Dr. Hentschel for specific advice on including figures or tables.
- Each student must turn in *four copies* of his/her term paper. Two of the copies must include the student's name and e-mail, but the other *two must have the author's name and e-mail omitted* (these copies will be distributed for peer review, see below).
- Each student also must submit an electronic version of his/her term paper to the Blackboard *Digital Drop Box* (in the "Tools" menu). Be sure that the cover page of the electronic version includes the student's name and e-mail. Electronic versions must be submitted as either an MS Word Document or a Text file. Files must be named with the student's last name followed by an underscore, v1, and the file extension ".doc" or ".txt" (e.g., *smith_v1.doc*).

How to Cite Literature

Literature citations must follow the formats in the journal *Ecology*. Formats for the list of Literature Cited are discussed in the guidance on preparing outlines (p. 4). Within the text of the term paper, there are generally two ways to cite specific literature sources; both are used in the journal *Ecology*. The most common is to include a parenthetical citation at the end of a sentence:

"Benthic marine invertebrates typically have complex life cycles, most commonly with a pelagic larval phase (Thorson 1950, Strathmann 1993, Pechenik et al. 1998, Pechenik 1999, Hentschel and Emlet 2000)." (The latin "et al." is an abbreviation for more than two authors.)

Instead of citing literature at the end of a sentence, sometimes the phrasing is better if papers by specific authors are cited directly within the sentence:

"Although Alford and Harris (1988) argued that their results support the model of Wilbur and Collins (1973), I agree with Leips and Travis (1994); the accumulated data show that the timing of metamorphosis becomes fixed during the late portion of the larval phase."

Occasionally, there are some unusual circumstances that arise when citing literature in scholarly papers. The general rule is to cite literature for *everything* that is not the author's original idea, data, or phrasing; failure to do this is considered plagiarism! Students are encouraged to consult Dr. Hentschel if they have any questions about citing literature properly. A variety of tools exist to aid in the detection of blatant plagiarism, including software such as *TurnItIn.com*, and Dr. Hentschel reserves the right to use any means to identify examples of blatant plagiarism.

Grading of the term papers

Term papers will be graded according to the *Scoring Rubric for Term Papers* (Appendix III). Students are advised to pay very close attention to the directions in this handout and the Scoring Rubric; do not be surprised when points are deducted! Graded term papers will be returned to students Dec 12. Copies of peer reviews written anonymously by two other students (see below) also will be distributed to authors Dec 12.

The best way to write well is to revise your writing multiple times.

In addition to turning in a complete draft on Nov 16 (earning 20, 10, or 0 pts), students are strongly encouraged to show preliminary drafts of their papers to Dr. Hentschel prior to Nov 16. Dr. Hentschel will guarantee that helpful, detailed feedback will be provided on any draft that is submitted by Wednesday, 9 November 2005. Dr. Hentschel will return these drafts with detailed written comments by Nov 14. Students are advised, however, that Dr. Hentschel cannot guarantee detailed written feedback on any draft submitted after Nov 9 (If 20 students submit drafts on Nov 10, not all can be read by Nov 14 and returned to students with time for revision prior to Nov 16).

Students can request a full re-grade of their revised term paper between Dec 12-19.

All students will have the opportunity to have revised term papers re-graded after Dec 12. Students will find the comments by Dr. Hentschel and the two peer reviewers helpful in revising their papers. One important rule of thumb, however: Dr. Hentschel and peer reviewers will have an easy time providing detailed comments on well written papers, but a very difficult time providing detailed feedback on poorly written papers. Students' revisions will be less extensive if they put serious effort into the Nov-23 version of the paper, as well as earlier drafts.

The last opportunity to turn in a revised term paper is Dec 19 at 1:00pm.

- The original, graded term paper with Dr. Hentschel's comments and copies of the two peer reviews must be paper clipped to *two copies* of the revised term paper.
- Any term paper that does not have these items attached will not be re-graded.

Peer Reviews of two other students' first drafts (2 at 25 pts each. Due Dec 5 at 13:00)

Peer review is a hallmark of the process by which scholarly papers are published. Before a paper is published in a scientific journal, it usually is reviewed by two of the author's peers (scientists who have similar expertise) and the journal's editor. Reviews serve two functions: 1) to help the author improve the paper and 2) to maintain the journal's standards by rejecting sub-par papers.

On 30 November 2005, each student will receive two term papers written by other students. The authors' names will not be listed (reviewers should focus on the work, not the person who wrote

it!). Reviews of each paper should be concisely written and 1-2 pages in length. Peer reviews will be anonymous unless the reviewer chooses to sign his/her review. Peer reviewers will *not* assign grades; they will provide constructive criticism to assist the author in improving his/her paper. Reviews should note both the strengths and weaknesses of the paper (even a horrible paper has some good aspects worth mentioning, and even a great paper has some aspects that could be improved). The general tone of the review should be positive and helpful. Additional guidance on writing good, constructive reviews will be provided to students when first drafts are distributed for review. Each written review will be graded for its intellectual content, tone, clarity, and grammar.

First drafts, along with two peer reviews and comments from Dr. Hentschel will be returned to authors Dec 12. Each author should use this feedback to improve his/her paper prior to Dec 19.

Final Version of Term Paper (200 pts max. Due Dec 19 at 13:00)

As stated above, any student who wants to improve his/her grade on the paper turned in Nov 23 can revise his/her paper and turn it in by Dec 19 for a complete re-grade. Students should note that there is only one week between the time when graded (and peer-reviewed) papers are returned to students (on Dec 12) and the due date for the final version of the term paper (Dec 19). Rigorous, consistent, and fair grading of a 12-15 page paper requires 3-4 h (i.e., 80-90 h total for 24 papers). To be fair to all students, Dr. Hentschel will not return any graded/reviewed papers to their authors prior to Dec 12. Students who expect that they need to make major revisions to the Nov-23 version of their term paper have no reason to wait any longer than Nov 24 to get started! Students are also advised to *plan ahead* and leave room in their Dec 12-18 schedules to revise their term paper. Dr. Hentschel sets the due dates at the beginning of the semester so students are able to plan ahead (not because he likes being a hardass!).

Final versions of papers should follow the formats described for the initial version of the paper (see p. 6), except that students need to turn in *two printed copies* and an electronic version to the *Digital Drop Box* at the Blackboard website. Electronic files must be named with the student's last name followed by an underscore, v2, and the file extension ".doc" or ".txt" (e.g., *smith_v2.doc*).

Authors of outstanding term papers can have their work posted on the Biol 515 website.

All authors who earn at least 180 pts on the final version of their term paper will be invited to have their paper posted on the Biol 515 website. This is entirely optional. Online papers provide helpful examples for future Biol 515 students and, more importantly, showcase the outstanding work of students who deserve special recognition of their achievement.

Literature Cited

- Alford, R. A., and R. N. Harris. 1988. Effects of larval growth history on anuran metamorphosis. *American Naturalist* **131**:91-106.
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- Wilbur, H. M., and J. P. Collins. 1973. Ecological Aspects of amphibian metamorphosis. *Science* **182**:1305-1314.