

Writing in EEB: General Guidelines

Writing is all about communicating ideas or data to others. To be effective, writing must be clear, with logical flows of sentences, paragraphs and the whole paper.

In this guide, we summarize EEB's expectations for writing that is clear, direct, simple and concise. We expect students to use these styles in all of our classes; faculty and TAs who grade your work will be evaluating your written communication skills as well as your logic and results [Note: other departments may have different preferences that you should follow in their courses.].

References for further reading and published sources used for this guide are listed on page 11.

THE BIG PICTURE: Always write with the reader in mind.

- **Become a ruthless, critical editor → create multiple drafts based on thoughtful editing.**
- **Start with an outline/list – which you should think about critically after you think you have it all down. Then revise that list to improve the logical flow, and add or remove some points.**
- **Use your first draft to write all/any ideas you have.**
- **The second draft should be a small part of the first draft.**
- **Leave several days to make revisions – that helps you to view your work with 'fresh eyes' and to see problems.**

TACTICS: How to write assignments or research papers. (see Appendix)

1. Plan ahead

- **Don't just write:** start with an idea of what you want to say, such as a list that includes only essentials such as key words or bullet points. Make sure you cover all the points in the guidelines for your assignment.

Important: think of this list as a first (rough) draft for your initial ideas; this is also a useful way to begin to organize a well-constructed answer for exam questions.

This is the place to edit for content – where you can add or remove points on the list – or revise the order (and it is much more efficient to do this here than after you start to write)

- Leave enough time to edit several drafts of your paper

2. Write:

- write a first draft by amplifying your outline
- follow the writing guidelines below
- proofread all of your writing carefully so that you can →
- edit your draft several times, checking for grammar, voice, conciseness and flow

3. Edit: be completely ruthless.

- Editing means thoughtfully consider each sentence, paragraph and flow of the entire report/paper. You should plan to spend more time on editing than on actually writing your first

draft (even of your list/outline).

- First, edit for structure and logic (easier if you first edited your outline for these). This means thinking carefully about the relationships among paragraphs and sentences. Are they in a logical order? Does each word, sentence and paragraph have a clear purpose? Are transitions between major points clear and strong?
- Second, edit for style, grammar, and the power of your sentences. Be especially careful that you do not fall in love with your own prose! You should always ask yourself whether your writing is clear enough to convey your ideas to your readers, not just that it is clear to you. NOTE: Checking your spelling is important – spell-checking routines on computers can be useful. But remember that they don't distinguish between different spellings of words that sound alike but have very different meanings (e.g., to vs too; it's vs its) or know how to spell specialized biological terms.
- Third (etc.) edit again, and again..... . (paginate and date everything, so there is no confusion among versions).
- Most scientists go through many (*many*) drafts before they let colleagues see their papers, but it is a good idea to find a peer who writes well and ask him/her to go over a more polished draft. Impress on them that they should be ruthless about this: otherwise it is a waste of your time and theirs. You could also take advantage of writing help offered on campus
- Make editorial changes using 'Track Changes' so that you can see where you've made the alterations. Keep older versions until you've completed the assignment or submitted the paper: you may decide that parts of an earlier version should be put back into the paper. One useful tool is to use footnotes to give date and possibly even time, as well as page numbers. You could also put the draft or draft number in the file name.

SCIENTIFIC PAPERS - SECTIONS:

Several topics specific to writing scientific papers in biology are given in the Special Topics section at the end of this guide.

Summary/Abstract (for proposals or reports):

An Abstract is always the last section of a paper to write, but is very important because it is the first, and often the only, portion of a paper that readers look at and will greatly influence whether they continue to read the rest of the paper.

Format: Write one paragraph: 6-8 sentences with the following flow (5 mini-sections) that essentially summarizes the Introduction, Methods, Results and Conclusions of your study.

1. Set out the general problem or question; this is critical because it gives the **context** and purpose for the research.
2. State what you are testing: your hypothesis (or your question).
3. What is your organism(s) or research system and why/how does it address #1?
4. In very general terms, what method(s) will you use (experimental, observational, mathematical)?

5. Summarize the key results of the study [not in a proposal]
6. Provide a general summary statement, including your conclusions (how the details of your project address the general problem you gave in the first sentence).

Introduction:

An introduction to a proposal or to a paper is essentially an expansion of the first part of the Abstract (or summary) without the conclusions. Your introduction should have these components, preferably *in the following order*:

- the context for your work (i.e. big important questions)
- how your work links to this context
- your specific question
- your specific question often links to a description of the system (species, environment) you used to conduct the study
- your approach – could be general (eg, field/lab, observations/experiments, mathematical models) or more specifics if you are at that stage.

More specifically, your Introduction should have 3-4 paragraphs:

1. The opening paragraph is most important: it explains the context for your work and sets the stage for later details.

The first sentence should state the context for the proposed research. This should be an informative and compelling general statement, and might be the most difficult sentence to write; it sets the stage for everything that follows. Do NOT use meaningless, general sentiments (conservation is good/needed; this theme is important because I am interested in it, little is known, etc.) because they use up precious space and are not informative. This can be the same first sentence that is in your abstract.

The rest of the first paragraph should give the rationale → why this is interesting and important -- not to you, but to the scientific community. Saying that you will work on a project because 'little is known about it' is not a compelling reason to do the research! So, be very explicit in your rationale. Include a sentence about the main, specific question/hypothesis of your work. Because this first paragraph provides context, including our current understanding of the problem and what previous studies have addressed this question, it should include several references to relevant published literature.

2. The second paragraph should explain the approach you will take...in very general terms. What type of system (e.g., habitat, species), monitoring program, experiments (field? lab?), modeling, how do you link your different approaches.....?

3. The final paragraph (depending on how you structure paragraph 1) could relate your work back to the broader theme you introduced at the start of the summary or to specific applications.

- NOTE: only include material very relevant to your paper in this Introduction. All points or questions that you raise in this Intro should also be addressed in the Discussion section. Don't have any unneeded material in the Introduction.
- See Example of an Introduction in Box 1.

Methods:

This section is where you explain what you did in enough detail that someone else could replicate your work. Think of all the details (first as a list) and then write this section. You can use graphs or pictures here as appropriate (e.g., what the site or species look like).

- Because you are describing what you *did*, the Methods are written in past tense.
- It is often easier to break this section into headers by category, e.g.: *The study system* (a description of when and where the study was conducted, including the environment and species) and then by the *specific questions or hypotheses* that are addressed with descriptions of the design (e.g., field/lab experiments) and specific methods (e.g., how samples were collected) and the statistical analyses used to test each specific hypothesis.
- Use these subheadings to link methods to questions and tests of hypotheses. Always state *why* you used a method before stating *what* or *how* you did it.
- Justify your methods. You need to convince readers that you used the most appropriate methods to test your hypotheses. Sometimes this requires providing some background on analytical techniques (especially lab instruments and genetic analyses) and explaining how the measurements bear on the tests of hypotheses.

Results:

- This section is where you present your results to readers.
- Depending on sentence structure and context, Results can be presented in past or present tense (e.g., prey density tripled in the absence of predators; mean prey densities triple in the absence of predators). Present tense is particularly common in describing results of models.
- Use distinct sections (with headings) to separate different aspects of the work. When possible, use the same subheadings you used in the Methods section so the reader can easily refer back to the Methods and the analyses used to generate the results you are describing.
- Use figures and tables to display your data. They should all have legends that are complete sentences. Explain each symbol (in legend or on figure) if you use more than one; explain the meaning of error bars or \pm (standard error, standard deviation, range).
- Describe results in the text and point the reader to the supporting data by referring to tables and figures parenthetically at the end of the sentence. Do NOT just say “Results are shown in Figure 3”. Be specific: “Biodiversity declined with the addition of nitrogen (Fig. 3).” Say “positively correlated” instead of just “correlated”. Refer to magnitudes of effects (e.g., give effect sizes and confidence intervals) rather than just *P*-values. [from guidelines for the journal, Science]
- Only give the same data (any statistical results) in one place (text, graph *or* table).
- Present and summarize, but do not interpret the results. Interpretations are presented in the Discussion section.

Discussion:

- This is where you interpret and explain your results.
- Don't repeat your results here, but point out important general patterns.
- Discuss how your results relate to other work (other papers, your text). Do they show the same or different patterns. Why?

- Identify caveats and how the study could have been enhanced (e.g., possibility of increasing the statistical power of tests when you failed to detect differences among treatment levels of an experiment; or use a different method).
- Describe the implications of the results for advancing our understanding of the problem and the field.
- Suggest next steps or new directions for future studies.
- Make sure that you pick up on all points that you made in the Introduction.and don't leave loose ends in the Discussion.

DETAILS OF WRITING: STYLE, GRAMMAR, STRUCTURE

Construct Powerful Sentences

Preferred writing styles in science have changed greatly in the last 30 years. The old view of writing, based on the idea that science must be “objective”, was to use the passive voice (e.g., this was done and that was done). More recently, the active voice (and also using first person) has become the preferred writing style (e.g., I did this and we did that); it is much more direct, concise and easier to understand than passive sentence constructions. Today, most journals in biology – and even general science –prefer papers that have active writing styles.

EEB wants you to: use active voice and first person as much as possible. Sometimes, use of passive voice is needed for clarity – and to break up a string of sentences that start “I did ...”. Be aware of the voice you use in each sentence and why you might want to use active or passive in particular circumstances. See Box 2 for preferred styles in a sample of journals.

What Is the Active Voice¹?

The **active voice** emphasizes the **performer** (or agent) of the action:

Wind disperses plant seeds.

Smith et al. investigated the relationship.

We have analyzed the results.

The active voice is **direct** (performer–verb–receiver), vigorous, clear, and concise. The reader **knows** who is responsible for the action.

What Is the Passive Voice¹?

The **passive voice**, in contrast, emphasizes the **receiver** (or product) of the action:

Plant seeds are dispersed [by wind].

The relationship was investigated [by Smith et al].

The results have been analyzed [by us].

The passive voice is **indirect** (receiver–verb–performer) and can be weak, awkward, and wordy. Passive voice uses a form of the verb *to be* followed by a past participle (e.g., *dispersed*, *investigated*) and a *by* phrase. If the *by* phrase is omitted (the truncated passive), the reader will not directly know who or what performed the action.

NOTE: A particularly awkward and ambiguous form of the passive voice occurs when an author uses *it* as the receiver rather than the

first-person pronouns **I or we**:
It is concluded that the treatment is effective.
 These types of passive-voice sentences are a form of **hedging**.

Example¹: An example of active vs. passive:

In 1953, one elegantly written paper began:

“We wish to suggest a structure for the salt of deoxyribose nucleic acid (D.N.A.)”

The opening sentence of Watson and Crick's classic article is **simple, direct, and clear**. But suppose the authors had taken the passive point of view:

In this paper, a structure is suggested for the salt of deoxyribose nucleic acid (D.N.A.).

The emphasis is now on the receiver of the action (the structure), but at a price—the sentence has lost its clarity (*who suggested?*), energy (*passive verb*), and overall impact.

- **Be Concise²⁻⁴**: Don't use unnecessary words.

Using the active voice will make your writing more concise. But there are several phrases and words that are commonly used but make writing too verbose. Examples:

Avoid:	Use:
There is no doubt but that	no doubt (doubtless)
The question as to whether	whether
Used for fuel purposes	used for fuel
He is a man who	he
In a hasty manner	hastily
This is a subject that	this subject
Their result is a strange one	their result is strange (or, their strange result)
The reason why is that	because
Owing to the fact that	because
In spite of the fact that	though (although)
The fact that	because, though
Call your attention to the fact that	remind you
I was unaware of the fact that	I was unaware that

→ But remember, the most overused word in most writing is “the”. It can often be removed without losing meaning.

Excellent suggestions and more examples of these approaches to writing more concisely (and less ambiguously) are presented in all of the references.

Examples of editing for conciseness³:

X	Dr. Smith’s research investigated the effect of pesticide on the reproductive biology of birds.
maybe	Dr. Smith investigated the effect of pesticides on the reproductive biology of birds.
√	Dr. Smith investigated the effect of pesticides on avian reproduction.

X	It was found that the shell lengths of live snails tended to be larger for individuals collected closer to the low tide mark (Fig. 1).
better	Live snails collected near the low tide mark had greater average shell lengths (Fig. 1).
better	Snails found closer to the low tide mark typically had larger shells (Fig. 1).
√	Snails found closer to the low tide mark typically had larger shells than those further away (Fig. 1).

→ **Avoid weak verbs³:**

X	Plant vascular tissues function in the transport of food through xylem and phloem.
better	Plant vascular tissues transport food through xylem and phloem.
√	Plants transport nutrients through their vascular tissues, xylem and phloem.

→ **Make the organism the agent of the action³:**

- Authors should guide and influence readers.
- Establish importance: word location (power) within a sentence.

X	Studies on the rat show that the activity levels vary predictably during the day (ZZ 2011).
√	Rats vary their activity levels predictably during the day (ZZ 2011).

The problem with the first sentence (“Studies ...show....”) is that it leads with the word ‘studies’, while what you want the reader to know is that ‘rats vary’.

<i>Example²:</i>	
a	Although vitamin B6 seems to reduce the risk of macular degeneration, it may have some side effects.
b	Vitamin B6 reduces the risk of macular degeneration, but it may have some side effects.
c	Taking vitamin B6 may have some side effects, but vitamin B6 also reduces macular degeneration.
d	Although taking vitamin B6 has some side effects, vitamin B6 reduces macular degeneration.

Which is most powerful?? Why??

In general, the end position in a sentence is more emphasized (powerful) than the beginning position.

COMMON GRAMMAR PROBLEMS ²⁻⁴:

1. Among/between:

- between – refers to only 2 things.
- among – refers to >2 things.

2. Which/that:

- which – introduces a nondefining clause (it is basically an aside) and is used after a comma.
- that – introduces a *defining* clause that gives specific information about a particular item.

This is a big difference and affects the meaning of the sentence:

→ Flowering plants, which have green leaves, have high photosynthesis.
(This implies that all flowering plants have green leaves and is not correct.)

→ Flowering plants that have green leaves, have high photosynthesis.
(This refers specifically to those flowering plants that have green leaves and is correct.)

3. Its/it's:

It's abbreviates 'it is'.

Its designates ownership.

4. Effect/affect:

Effect – as a noun, means a result.

it can also be a verb that means “to bring about” (but it is passive and weak – so avoid it if possible).

Affect – is a verb that means “to influence” or “to produce an effect on”.

→The effect of birds is to reduce seed survival.

→Birds affect seed survival.

5. i.e./e.g.

i.e. stands for 'id est', which means 'that is'. It is used to clarify a statement or example.

e.g. stands for 'exempli gratia', which means 'for example'. It is used to give an example of a statement you just made.

6. Fewer/Less

Fewer – refers to numbers: use with quantities or counts.

Less – refers to quantity: use with mass nouns (which you can't count individually).

→ She had fewer apples than I did.

→ He had less energy.

7. Data are or data is?

This is a tough one because the accepted use of “data” as a plural noun (the data are...) has recently changed because it was misused so often. Some instructors will accept it as a singular noun (the data is...[because that implies that the data represent a collection of information]).

But: there is a good case to be made to stick with the original usage – and to remember that the singular of data is datum or anecdote (= only one data point).

8. Tenses:

Past tense: for observations, completed actions, and specific conclusions.

Present tense: for generalizations and statements of general validity.

A sentence can also have mixed tenses:

Sultan **observed** that certain species of bacteria **respond** to light stimuli.

9. While/Whereas

“While” refers to time (e.g., this happened while that happened). If making contrasts that do not involve time, use “whereas” (e.g., Whereas horses are larger than people, their brains are smaller.)

Other important style issues:

- Avoid jargon; explain obscure terms and define acronyms (many readers will not know specialized terms). Additionally, in assignments the instructor also wants to know that *you* understand the terms.
- Avoid using "-fold" because expressions such as "20-fold smaller" are imprecise; use percentages, proportions, orders of magnitude, or "factor of" instead.
- Avoid using "times more" or "times less" (see above).
- Use "significant" only when discussing statistical significance. "Substantial" or "marked" are good substitutions when not referring to a statistical significance.

Paragraphs:

- First and last sentences are power positions.
- Usually, the first sentence introduces the topic of the paragraph and gives the reader a direction of where the paragraph is going.... or it can also be a transition from the previous paragraph.
- The last sentence can summarize, draw a conclusion, or emphasize something of importance.
- A well written paragraph generally gives an overview first and then goes into detail.
- → The "psychological geography" of the sentence structure is particularly important.

Think clearly about the flow of sentences and paragraphs:

Use flow to create linkages.

Example²: Go from:

General → Specific → even MORE specific

Macular degeneration is affected by *diet*. *One of the diet components* that influences the progression of macular degeneration is *vitamin B6*. Although *vitamin B6* seems to reduce the risk of macular degeneration, it may have some *side effects*.

→ Information at the end position of a sentence is placed at the beginning, or topic position of the next sentence.

Or, for an even punchier, shorter and more concise paragraph: combine sentences 2 & 3: While vitamin B6 influences the progression of macular degeneration, it may have some side effects.

AN IMPORTANT POINT: PLAGIARISM

Plagiarism is unethical and a very serious issue. *Never do it:* your grade could be seriously reduced, you could be placed on academic probation, or you even can get expelled.

Plagiarism means using someone else's words and/or ideas without proper attribution. If you need to quote portions of someone's work from any published material (print or online) (or even something unpublished but not your work) then you **MUST** give your source. We've done this in this guide, using the number format as superscripts to indicate use of specific information and examples. NOTE: simply changing a few words here and there is still considered plagiarism³.

One way to guard against unintended plagiarism is to take notes as key words only and then to use your own words as you write. Then, just remember to cite information that you got from someone else.

Plagiarism is now very easy to detect, both through specific software and even by googling a portion of text. Experienced faculty and TAs can spot potential plagiarism because the writing style changes or the paper contains information that it is unlikely for an undergraduate to know.

One common excuse students give for plagiarism is that they simply didn't have time (3 finals the day before, work 25 hours a week, someone died....). If you really have a problem submitting the assignment on time, then explain it to your teacher and ask for an extension. In many cases, you'll get it; in some cases your grade might be reduced a bit or if it is a major assignment, you could get an Incomplete that you can change later. But, these are all much better than the consequences of getting caught.

References:

1 Biomedical editor: <http://www.biomedicaleditor.com/active-voice.html>

2 Hofmann, AH. Scientific Writing and Communication: Papers, Proposals, and Presentations. Oxford, UK.

3 Pechenik, JA. 2009. A Short Guide to Writing about Biology (7th ed). Harper/Collins, NY.

4 Strunk W Jr. and EB White. 2000. The Elements of Style (4th ed). Longman, NY

SPECIAL TOPICS IN WRITING FOR EEB AND BEYOND

1. *Where do you edit?*

There is a difference between editing (thoughtfully considering how to improve your text) and changing text. Computers have made it easier to make changes, but (in many cases) they may also reduce the likelihood of thoughtful editing.

Writers differ in how they edit, and some change tactics as they gain experience and improve editing skills. Here are some general guidelines for you.

- Initially, only use a computer for minor changes (e.g., spelling, tenses within sentences and paragraphs).
- Then, make editorial changes on a paper version.
- Finally, use your computer to implement these editorial changes.

Why?

- 1) We tend to focus more intently on printed words than words on a screen.
- 2) It is easier to retrace your changes and to alter some/all before you commit to modifying the text. Editing on a printed copy always leaves the option to decide that your original version was better.
- 3) It is very hard to see big organizational changes that are usually needed, such as taking parts of two paragraphs that are on different pages and moving them to the start of a different paragraph 3 pages later.

For outlines, sentences and paragraphs, it is often easier to indicate additions, cross-out words or ideas or draw arrows to change the order.

This is especially true if you can't see the whole paper on the screen at once; whereas with paper, you can compare several pages side-by-side to see if paragraphs (or parts of them) should be moved up or down.

- It is often difficult to see large sections of the document at once for formatting (scrolling up and down is difficult) and especially for comparing assertions in the text with results in tables or figures. Recommendation: use a split screen for these purposes.
- Use track changes to see previous changes; share edits with co-authors or instructors (each use a different color). This also allows electronic changes.
- Once you start altering your paper on a computer, remember to save the file fairly often – so that you only lose change since the last save and not the whole session if there is a glitch. Some word processing files allow you to specify timing of automatic saves (e.g., every 10 min.).
- Use headers or footers to identify different drafts.
- Use different file names for each draft (or add date).

2. Using common and scientific names

Biologists have very specific conventions for referring to common and scientific names.

- Introduce the common and scientific name the first time you refer to a species (e.g., “To better understand how aspects of the kelp forest environment influence the distribution and abundance of species, we tested for a relationship between density of the blue rockfish, *Sebastes mystinus*, and density of the giant kelp, *Macrocystis pyrifera*.”)
- Common names are never capitalized unless (1) it is a proper name (e.g., California banana bug) or (2) it is a bird. For some reason bird people capitalize common names, but this is unique relative to all other animals or plants.
- Scientific names are ALWAYS italicized or underlined (italicized is preferred).
- Capitalize the name of the genus, but not the species (except for special cases where the species is named for a person).
- From that point on, you can abbreviate the scientific name as *S. mystinus*.

3. Tables and Figures

- Figures and Tables are numbered and presented in the order that they are referred to in the text.
- Both table and figure legends should fully describe what is presented in the table or figure and the result you are trying to convey. Start with a sentence indicating what the table or figure is meant to convey, then describe in greater detail what is presented, including the definition of variables (e.g., n= the number of samples) and symbols (could be in legend or on the figure).
- If tables and figures are presented at the end of a manuscript, tables are presented immediately after the Literature Cited section, followed by a list of Figure legends, then the Figures. There are two ways to include **tables** in a Word document. You can create simple tables directly in Word or you can insert more complicated tables made in other programs (e.g., Excel) by copying a table and pasting it as a “picture” in the format of an “enhanced metafile”. After copying the table in Excel, use :Paste Special” in Word to select “picture” (enhanced metafile) to paste it into Word and move to where you want in the document.
- Similarly, copy a graph from Excel, Powerpoint or some other graphics program and “Paste Special” in Word to select “picture” (enhanced metafile) to paste it into Word and move to where you want in the document.

4. Citing References in the text and in a Bibliography

- The style used to cite references within the text and how it is presented in the Literature Cited is varies among journals. Look at the journal or proposal guidelines to see the proper style. OR:
- In the absence of a predefined style for citing literature in the text (e.g, the numerical

citation style used in this guide), use the following common rules:

- list the author by last name only followed by the year of the publication (Kay 2011) or (Kay and Pitterman 2010)
- for articles with more than two authors use the first author and “*et al.*” (e.g., Pitterman *et al.* 2010)
- for multiple publications within the same sentence, list publication in chronological order from oldest to most recent (Sinervo 1990, Pogson and Fox 1998, Thompson 2002)

Note: In this guide, we use a different format that is found in a few journals → citing the references in the text by using superscript numbers.

- In the absence of a predefined style for the Literature Cited section, use this common style: authors, year of publication, title of article, journal, issue: page numbers. For example:

Lyon, B.T. and M.L. Kilpatrick. 2010. Why birds have had it with mosquitoes. *Botswanian Naturalist* 10:7-8.

- If referring to a chapter in a book, list the authors of the article, the year, the title of the article, “in”, the names of the book editors, title of the book.
 - Mehta, R.J., G.F. Bernardi and P.T. Raimondi. 1776. The feeding morphology of eels and why we can’t sleep at night. Pages 4-5 *In*: Croll, D.P., M.H. Carr and D.C. Costa (editors) *Nature Gives Us the Willies*. Totally Free Press, Santa Cruz, California USA, 8 pages.
- NOTE that only the first word of a journal article is capitalized (except for proper nouns such as California, Raimondi, or the genus [but not species or subspecies names] of a particular species), whereas all words in the title of a book are capitalized.

Box 1:

Example: from a funded NSF grant proposal that generally follows these guidelines:

Variable sex ratios in both insect parasitoids and their herbivorous hosts may modify population regulation and dynamics in 3-trophic level systems. Our research links two traditions in ecology: studies of 3-trophic level interactions and investigations of reproductive strategies of parasitoids. We propose that interactions between sex-ratio variation and plant preferences of the hosts and parasitoids may provide a mechanism for density-dependent regulation of herbivore populations in both time and space. In this proposal, we focus on implications of these interactions for reproductive strategies. We will extend our previous work by providing detailed estimates of the effects of plants on herbivore and parasitoid fitness and sex ratios, and by assembling these parameters into comprehensive dynamic models.

We concentrate on direct and indirect effects of plants on interactions between herbivores and parasitoids, by combining experiments on key fitness traits with population dynamic models that incorporate genetic mechanisms of parasitoid responses. Our experimental system consists of several cruciferous plants, one of their most important herbivores, the diamondback moth (*Plutella xylostella*) and its major parasitoid (*Diadegma insulare*). Our previous work indicated unexpected links between plant properties, sex ratios and dynamic interactions of herbivore and parasitoid populations.

Paragraph 2: general approach --- lab and field experiments.... Yadda, yadda

Our work has both basic and applied importance. The diamondback moth is a major, world-wide pest of crucifer crops. Thus, our work is immediately relevant to questions of stability in parasitoid-host dynamics and to biological control in an important system.

Box 2. Examples of guidelines from journals¹:

Science, (a very general, influential science journal): Use active voice when suitable, particularly when necessary for correct syntax (e.g., "To address this possibility, we constructed a λ Zap library . . .," not "To address this possibility, a λ Zap library was constructed . . .").

Nature, (a very general, influential science journal): "Nature journals like authors to write in the active voice ('we performed the experiment...') as experience has shown that readers find concepts and results to be conveyed more clearly if written directly."

Behavioral Ecology: "The first-person active voice is preferable to the impersonal passive voice."

British Medical Journal: "Please write in a clear, direct, and active style....Write in the active [voice] and use the first person where necessary."

The Journal of Neuroscience: "Overuse of the passive voice is a common problem in writing....in many instances it makes the manuscript dull by failing to identify the author's role in the research....Use direct, active-voice sentences."

APPENDIX: Here are some great tips on writing, from an excellent write, Anne LeMotte. She gives advice about writing fiction, but these sections apply to any style of writing.

HELPFUL HINTS FOR WRITING

FROM

Bird by Bird
Anne LeMotte

'Two of the most helpful things
about writing!':

①

Short Assignments

The first useful concept is the idea of short assignments. Often when you sit down to write, what you have in mind is an autobiographical novel about your childhood, or a play about the immigrant experience, or a history of—oh, say—say women. But this is like trying to scale a glacier. It's hard to get your footing, and your fingertips get all red and frozen and torn up. Then your mental illnesses arrive at the desk like your sickest, most secretive relatives. And they pull up chairs in a semicircle around the computer, and they try to be quiet but you know they are there with their weird coppery breath, leering at you behind your back.

What I do at this point, as the panic mounts and the jungle drums begin beating and I realize that the well has run dry and that my future is behind me and I'm going to have to get a job only I'm completely unemployable, is to stop. First I try to breathe, because I'm either sitting there panting like a lapdog

Short Assignments

or I'm unintentionally making slow asthmatic death rattles. So I just sit there for a minute, breathing slowly, quietly. I let my mind wander. After a moment I may notice that I'm trying to decide whether or not I am too old for orthodontia and whether right now would be a good time to make a few calls, and then I start to think about learning to use makeup and how maybe I could find some boyfriend who is not a total and complete fixer-upper and then my life would be totally great and I'd be happy all the time, and then I think about all the people I should have called back before I sat down to work, and how I should probably at least check in with my agent and tell him this great idea I have and see if he thinks it's a good idea, and see if *he* thinks I need orthodontia—if that is what he is actually thinking whenever we have lunch together. Then I think about someone I'm really annoyed with, or some financial problem that is driving me crazy, and decide that I must resolve this before I get down to today's work. So I become a dog with a chew toy, worrying it for a while, wrestling it to the ground, flinging it over my shoulder, chasing it, licking it, chewing it, flinging it back over my shoulder. I stop just short of actually barking. But all of this only takes somewhere between one and two minutes, so I haven't actually wasted that much time. Still, it leaves me winded. I go back to trying to breathe, slowly and calmly, and I finally notice the one-inch picture frame that I put on my desk to remind me of short assignments.

It reminds me that all I have to do is to write down as much as I can see through a one-inch picture frame. This is

all I have to bite off for the time being. All I am going to do right now, for example, is write that one paragraph that sets the story in my hometown, in the late fifties, when the trains were still running. I am going to paint a picture of it, in words, on my word processor. Or all I am going to do is to describe the main character the very first time we meet her, when she first walks out the front door and onto the porch. I am not even going to describe the expression on her face when she first notices the blind dog sitting behind the wheel of her car—just what I can see through the one-inch picture frame, just one paragraph describing this woman, in the town where I grew up, the first time we encounter her.

E. L. Doctorow once said that “writing a novel is like driving a car at night. You can see only as far as your headlights, but you can make the whole trip that way.” You don’t have to see where you’re going, you don’t have to see your destination or everything you will pass along the way. You just have to see two or three feet ahead of you. This is right up there with the best advice about writing, or life, I have ever heard.

So after I’ve completely exhausted myself thinking about the people I most resent in the world, and my more arresting financial problems, and, of course, the orthodontia, I remember to pick up the one-inch picture frame and to figure out a one-inch piece of my story to tell, one small scene, one memory, one exchange. I also remember a story that I know I’ve told elsewhere but that over and over helps me to get a grip: thirty years ago my older brother, who was ten years old at the time,

was trying to get a report on birds written that he’d had three months to write, which was due the next day. We were out at our family cabin in Bolinas, and he was at the kitchen table close to tears, surrounded by binder paper and pencils and unopened books on birds, immobilized by the hugeness of the task ahead. Then my father sat down beside him, put his arm around my brother’s shoulder, and said, “Bird by bird, buddy. Just take it bird by bird.”

I tell this story again because it usually makes a dent in the tremendous sense of being overwhelmed that my students experience. Sometimes it actually gives them hope, and hope, as Chesterton said, is the power of being cheerful in circumstances that we know to be desperate. Writing can be a pretty desperate endeavor, because it is about some of our deepest needs: our need to be visible, to be heard, our need to make sense of our lives, to wake up and grow and belong. It is no wonder if we sometimes tend to take ourselves perhaps a bit too seriously. So here is another story I tell often.

In the Bill Murray movie *Stripes*, in which he joins the army, there is a scene that takes place the first night of boot camp, where Murray’s platoon is assembled in the barracks. They are supposed to be getting to know their sergeant, played by Warren Oates, and one another. So each man takes a few moments to say a few things about who he is and where he is from. Finally it is the turn of this incredibly intense, angry guy named Francis. “My name is Francis,” he says. “No one calls me Francis—anyone here calls me Francis and I’ll kill them. And another thing. I don’t like to be touched. Anyone

here ever tries to touch me, I'll kill them," at which point Warren Oates jumps in and says, "Hey—lighten up, Francis."

This is not a bad line to have taped to the wall of your office.

Say to yourself in the kindest possible way, Look, honey, all we're going to do for now is to write a description of the river at sunrise, or the young child swimming in the pool at the club, or the first time the man sees the woman he will marry. That is all we are going to do for now. We are just going to take this bird by bird. But we are going to finish this *one* short assignment.

(2) **S h i t t y F i r s t D r a f t s**

Now, practically even better news than that of short assignments is the idea of shitty first drafts. All good writers write them. This is how they end up with good second drafts and terrific third drafts. People tend to look at successful writers, writers who are getting their books published and maybe even doing well financially, and think that they sit down at their desks every morning feeling like a million dollars, feeling great about who they are and how much talent they have and what a great story they have to tell; that they take in a few deep breaths, push back their sleeves, roll their necks a few times to get all the cricks out, and dive in, typing fully formed passages as fast as a court reporter. But this is just the fantasy of the uninitiated. I know some very great writers, writers you love who write beautifully and have made a great deal of money, and not *one* of them sits down routinely feeling wildly enthusiastic and confident. Not one of them writes elegant

first drafts. All right, one of them does, but we do not like her very much. We do not think that she has a rich inner life or that God likes her or can even stand her. (Although when I mentioned this to my priest friend Tom, he said you can safely assume you've created God in your own image when it turns out that God hates all the same people you do.)

Very few writers really know what they are doing until they've done it. Nor do they go about their business feeling dewy and thrilled. They do not type a few stiff warm-up sentences and then find themselves bounding along like huskies across the snow. One writer I know tells me that he sits down every morning and says to himself nicely, "It's not like you don't have a choice, because you do—you can either type or kill yourself." We all often feel like we are pulling teeth, even those writers whose prose ends up being the most natural and fluid. The right words and sentences just do not come pouring out like ticker tape most of the time. Now, Muriel Spark is said to have felt that she was taking dictation from God every morning—sitting there, one supposes, plugged into a Dictaphone, typing away, humming. But this is a very hostile and aggressive position. One might hope for bad things to rain down on a person like this.

For me and most of the other writers I know, writing is not rapturous. In fact, the only way I can get anything written at all is to write really, really shitty first drafts.

The first draft is the child's draft, where you let it all pour out and then let it romp all over the place, knowing that no one is going to see it and that you can shape it later. You just

let this childlike part of you channel whatever voices and visions come through and onto the page. If one of the characters wants to say, "Well, so what, Mr. Poopy Pants?," you let her. No one is going to see it. If the kid wants to get into really sentimental, weepy, emotional territory, you let him. Just get it all down on paper, because there may be something great in those six crazy pages that you would never have gotten to by more rational, grown-up means. There may be something in the very last line of the very last paragraph on page six that you just love, that is so beautiful or wild that you now know what you're supposed to be writing about, more or less, or in what direction you might go—but there was no way to get to this without first getting through the first five and a half pages.

I used to write food reviews for *California* magazine before it folded. (My writing food reviews had nothing to do with the magazine folding, although every single review did cause a couple of canceled subscriptions. Some readers took umbrage at my comparing mounds of vegetable puree with various ex-presidents' brains.) These reviews always took two days to write. First I'd go to a restaurant several times with a few opinionated, articulate friends in tow. I'd sit there writing down everything anyone said that was at all interesting or funny. Then on the following Monday I'd sit down at my desk with my notes, and try to write the review. Even after I'd been doing this for years, panic would set in. I'd try to write a lead, but instead I'd write a couple of dreadful sentences,

xx them out, try again, xx everything out, and then feel despair and worry settle on my chest like an x-ray apron. It's over, I'd think, calmly. I'm not going to be able to get the magic to work this time. I'm ruined. I'm through. I'm toast. Maybe, I'd think, I can get my old job back as a clerk-typist. But probably not. I'd get up and study my teeth in the mirror for a while. Then I'd stop, remember to breathe, make a few phone calls, hit the kitchen and chow down. Eventually I'd go back and sit down at my desk, and sigh for the next ten minutes. Finally I would pick up my one-inch picture frame, stare into it as if for the answer, and every time the answer would come: all I had to do was to write a really shitty first draft of, say, the opening paragraph. And no one was going to see it.

So I'd start writing without reining myself in. It was almost just typing, just making my fingers move. And the writing would be *terrible*. I'd write a lead paragraph that was a whole page, even though the entire review could only be three pages long, and then I'd start writing up descriptions of the food, one dish at a time, bird by bird, and the critics would be sitting on my shoulders, commenting like cartoon characters. They'd be pretending to snore, or rolling their eyes at my overwrought descriptions, no matter how hard I tried to tone those descriptions down, no matter how conscious I was of what a friend said to me gently in my early days of restaurant reviewing. "Annie," she said, "it is just a piece of *chicken*. It is just a bit of *cake*."

But because by then I had been writing for so long, I would

eventually let myself trust the process—sort of, more or less. I'd write a first draft that was maybe twice as long as it should be, with a self-indulgent and boring beginning, stupefying descriptions of the meal, lots of quotes from my black-humored friends that made them sound more like the Manson girls than food lovers, and no ending to speak of. The whole thing would be so long and incoherent and hideous that for the rest of the day I'd obsess about getting creamed by a car before I could write a decent second draft. I'd worry that people would read what I'd written and believe that the accident had really been a suicide, that I had panicked because my talent was waning and my mind was shot.

The next day, though, I'd sit down, go through it all with a colored pen, take out everything I possibly could, find a new lead somewhere on the second page, figure out a kicky place to end it, and then write a second draft. It always turned out fine, sometimes even funny and weird and helpful. I'd go over it one more time and mail it in.

Then, a month later, when it was time for another review, the whole process would start again, complete with the fears that people would find my first draft before I could rewrite it.

Almost all good writing begins with terrible first efforts. You need to start somewhere. Start by getting something—anything—down on paper. A friend of mine says that the first draft is the down draft—you just get it down. The second draft is the up draft—you fix it up. You try to say what you have to say more accurately. And the third draft is the dental

draft, where you check every tooth, to see if it's loose or cramped or decayed, or even, God help us, healthy.

What I've learned to do when I sit down to work on a shitty first draft is to quiet the voices in my head. First there's the vinegar-lipped Reader Lady, who says primly, "Well, *that's* not very interesting, is it?" And there's the emaciated German male who writes these Orwellian memos detailing your thought crimes. And there are your parents, agonizing over your lack of loyalty and discretion; and there's William Burroughs, dozing off or shooting up because he finds you as bold and articulate as a houseplant; and so on. And there are also the dogs: let's not forget the dogs, the dogs in their pen who will surely hurtle and snarl their way out if you ever *stop* writing, because writing is, for some of us, the latch that keeps the door of the pen closed, keeps those crazy ravenous dogs contained.

Quieting these voices is at least half the battle I fight daily. But this is better than it used to be. It used to be 87 percent. Left to its own devices, my mind spends much of its time having conversations with people who aren't there. I walk along defending myself to people, or exchanging repartee with them, or rationalizing my behavior, or seducing them with gossip, or pretending I'm on their TV talk show or whatever. I speed or run an aging yellow light or don't come to a full stop, and one nanosecond later am explaining to imaginary cops exactly why I had to do what I did, or insisting that I did not in fact do it.

I happened to mention this to a hypnotist I saw many years

ago, and he looked at me very nicely. At first I thought he was feeling around on the floor for the silent alarm button, but then he gave me the following exercise, which I still use to this day.

Close your eyes and get quiet for a minute, until the chatter starts up. Then isolate one of the voices and imagine the person speaking as a mouse. Pick it up by the tail and drop it into a mason jar. Then isolate another voice, pick it up by the tail, drop it in the jar. And so on. Drop in any high-maintenance parental units, drop in any contractors, lawyers, colleagues, children, anyone who is whining in your head. Then put the lid on, and watch all these mouse people clawing at the glass, jabbering away, trying to make you feel like shit because you won't do what they want—won't give them more money, won't be more successful, won't see them more often. Then imagine that there is a volume-control button on the bottle. Turn it all the way up for a minute, and listen to the stream of angry, neglected, guilt-mongering voices. Then turn it all the way down and watch the frantic mice lunge at the glass, trying to get to you. Leave it down, and get back to your shitty first draft.

A writer friend of mine suggests opening the jar and shooting them all in the head. But I think he's a little angry, and I'm sure nothing like this would ever occur to you.

... And a problem.

Perfectionism

Perfectionism is the voice of the oppressor, the enemy of the people. It will keep you cramped and insane your whole life, and it is the main obstacle between you and a shitty first draft. I think perfectionism is based on the obsessive belief that if you run carefully enough, hitting each stepping-stone just right, you won't have to die. The truth is that you will die anyway and that a lot of people who aren't even looking at their feet are going to do a whole lot better than you, and have a lot more fun while they're doing it.

Besides, perfectionism will ruin your writing, blocking inventiveness and playfulness and life force (these are words we are allowed to use in California). Perfectionism means that you try desperately not to leave so much mess to clean up. But clutter and mess show us that life is being lived. Clutter is wonderfully fertile ground—you can still discover new treasures under all those piles, clean things up, edit things out, fix

things, get a grip. Tidiness suggests that something is as good as it's going to get. Tidiness makes me think of held breath, of suspended animation, while writing needs to breathe and move.

When I was twenty-one, I had my tonsils removed. I was one of those people who got strep throat every few minutes, and my doctor finally decided that I needed to have my tonsils taken out. For the entire week afterward, swallowing hurt so much that I could barely open my mouth for a straw. I had a prescription for painkillers, though, and when they ran out but the pain hadn't, I called the nurse and said that she would really need to send another prescription over, and maybe a little mixed grill of drugs because I was also feeling somewhat anxious. But she wouldn't. I asked to speak to her supervisor. She told me her supervisor was at lunch and that I needed to buy some *gum*, of all things, and to chew it vigorously—the thought of which made me clutch at my throat. She explained that when we have a wound in our body, the nearby muscles cramp around it to protect it from any more violation and from infection, and that I would need to use these muscles if I wanted them to relax again. So finally my best friend Pammy went out and bought me some gum, and I began to chew it, with great hostility and skepticism. The first bites caused a ripping sensation in the back of my throat, but within minutes all the pain was gone, permanently.

I think that something similar happens with our psychic muscles. They cramp around our wounds—the pain from our childhood, the losses and disappointments of adulthood, the

humiliations suffered in both—to keep us from getting hurt in the same place again, to keep foreign substances out. So those wounds never have a chance to heal. Perfectionism is one way our muscles cramp. In some cases we don't even know that the wounds and the cramping are there, but both limit us. They keep us moving and writing in tight, worried ways. They keep us standing back or backing away from life, keep us from experiencing life in a naked and immediate way. So how do we break through them and get on?

It's easier if you believe in God, but not impossible if you don't. If you believe, then this God of yours might be capable of relieving you of some of this perfectionism. Still, one of the most annoying things about God is that he never just touches you with his magic wand, like Glinda the Good, and gives you what you want. Like it would be so much skin off his nose. But he might give you the courage or the stamina to write lots and lots of terrible first drafts, and then you'd learn that good second drafts can spring from these, and you'd see that big sloppy imperfect messes have value.

Now, it might be that your God is an uptight, judgmental perfectionist, sort of like Bob Dole or, for that matter, me. But a priest friend of mine has cautioned me away from the standard God of our childhoods, who loves and guides you and then, if you are bad, roasts you: God as high school principal in a gray suit who never remembered your name but is always leafing unhappily through your files. If this is your God, maybe you need to blend in the influence of someone who is ever so slightly more amused by you, someone less

anal. David Byrne is good, for instance. Gracie Allen is good. Mr. Rogers will work.

If you don't believe in God, it may help to remember this great line of Geneen Roth's: that awareness is learning to keep yourself company. And then learn to be more *compassionate* company, as if you were somebody you are fond of and wish to encourage. I doubt that you would read a close friend's early efforts and, in his or her presence, roll your eyes and snicker. I doubt that you would pantomime sticking your finger down your throat. I think you might say something along the lines of, "Good for you. We can work out some of the problems later, but for now, full steam ahead!"

In any case, the bottom line is that if you want to write, you get to, but you probably won't be able to get very far if you don't start trying to get over your perfectionism. You set out to tell a story of some sort, to tell the truth as you feel it, because something is calling you to do so. It calls you like the beckoning finger of smoke in cartoons that rises off the pie cooling on the windowsill, slides under doors and into mouse holes or into the nostrils of the sleeping man or woman in the easy chair. Then the aromatic smoke crooks its finger, and the mouse or the man or woman rises and follows, nose in the air. But some days the smoke is faint and you just have to follow it as best you can, sniffing away. Still, even on those days, you might notice how great perseverance feels. And the next day the scent may seem stronger—or it may just be that you are developing a quiet doggedness. This is priceless. Perfectionism, on the other hand, will only drive you mad.

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Your day's work might turn out to have been a mess. So what? Vonnegut said, "When I write, I feel like an armless legless man with a crayon in his mouth." So go ahead and make big scrawls and mistakes. Use up lots of paper. Perfectionism is a mean, frozen form of idealism, while messes are the artist's true friend. What people somehow (inadvertently, I'm sure) forgot to mention when we were children was that we need to make messes in order to find out who we are and why we are here—and, by extension, what we're supposed to be writing.