BIOSCIENCES MENTORS' MANUAL

Contents

INTRODUCTION

The Cain Project in Engineering and Professional Communication designed this manual for students who plan to become communication mentors in biosciences. The materials prepare mentors for the experience of both consulting and grading sessions: reading, evaluating, and offering helpful feedback in conference with individual students. Training sessions for mentors will include discussion, in-class exercises, and annotated cases.

The goal of the mentoring process, both for mentors and their student clients, is to develop a voice in the field. Because the biosciences are highly collaborative, fast-changing, and competitive, individual scientists must be able to communicate with one another in teams, give feedback, and analyze, summarize, and respond to scientific studies. These studies are usually reported through lab notebooks, laboratory reports, published articles, and research proposals.

This booklet integrates the results of conversations with biosciences faculty, a study of student essays, and scholarly work in scientific and technical communication. Analysis of graded student essays in BIOS 202 in 1999 showed two principal problems: (1) inconsistent grading criteria and contradictory comments among graders, and (2) a lack of engagement with specific issues of the students' essays. Faculty felt that students needed to meet and know advanced students who were involved in analyzing scientific studies, learning to design them, and carrying out research projects. Such mentors could respond to student writing, could hone their own writing skills, and act as guides and examples for younger students. This manual will help students become mentors to their peers and younger students. Besides lessons on common writing errors and grammar, this manual contains exercises and sample essays designed to address the problems identified in graded essays and advice on interacting with students as a mentor.

Grader comments in the past lacked a sense of dialogue. Generally, student writers did not seem to receive the amount of specific feedback they needed to improve their writing, and the advice that was given sometimes contradicted the advice given by other graders from the same course. This contradictory feedback can create a sense of anonymity for students- "writing for nobody." In a large course whose rigorous scientific content can sometimes intimidate, students may end up feeling like faceless wheel-cogs in the information-churning academic machine. Mentoring brings human interaction back to the forefront of intellectual activity in biosciences.

Student writers need to feel they are involved in a conversation with other engaged members of their field. Even a summary can manifest a dialog between the writer and those whose writings he or she is presenting. By summarizing the ideas and findings of others, student writers simultaneously construct a position for themselves alongside these others in the field. As readers, we relate to the published authors through the voice of the writer who summarizes. We judge the value of a summary in terms of accuracy and a well-constructed explanation of the source, as expressed in the summarizer's own words. A student writer who does not engage with the arguments s/he summarizes, and merely regurgitates bits without a larger sense of coherence also falls short of genuine dialogue. Likewise, a mentor who takes a condescending or dismissive voice towards the writer's work sends out red flags.

Although the writing aspect of a science course may seem like a diversion from the challenge of mastering the course's content of environments and rules of the natural world, it is a mistake to underestimate the importance of writing well. Writing helps students find a voice in the field, and mentors become especially articulate members themselves, not only writing as scientists but as empowered leaders capable of helping others become members of the biosciences conversation.

What Is a Mentor ?

A mentor cares about the person who learns, and that means the mentor commends before criticizing, tries to understand the student's purposes, and aims comments toward helping the student succeed. Realizing that praise changes habits much more than nagging or condemning, a mentor may point out a place where a student made a decision correctly and then suggest that the student look for a couple of places where the decision went wrong and try to figure out why. The mentor might mark one of these places with a note: "Here's one of the places I asked you to look for."

A mentor models the attitudes he or she wants others to imitate. It's all right to tell a student that you were disappointed in the work and that you hope he or she will do a better job next time. It's not all right to demean the student. However, you don't want to give a student the idea that a weak draft will earn a high grade; you can't take responsibility for the student's work, which must remain his or her own. So you want to be honest. Furthermore, when you grade the student's work, you must be free to award points without favoritism. Students should expect the scientific community to be comprised of warm human beings who have high standards.

Dialogic mentoring through grading

A mentor develops relationships through dialogs with student writers. Sometimes the dialog takes place through comments on papers or grading sheets, but these comments have to be fashioned with the main goal in mind: a helpful human connection. Here are points to remember:

- **Make your first comment a "person to person comment."**
  Put it at the top of the grading sheet. If you don't connect, the student will probably not look at the circled errors or other comments. You're making a bid for a conversation. If you start comments out with a bland, "Nice job!" readers don't have any reason to think you read the paper carefully or that you have anything worth listening to. When you're grading, you're in charge. When students get their papers back (if they pick them up), they're in charge. You need to acknowledge their power by addressing their initiative: "You used this essay to investigate a new explanation for the Cambrian explosion. Being able to recognize the critical features of a new theory like this one will help you keep up with this rapidly changing field."

- **Be selective in what you comment on: Students turn off overwhelming criticism or feedback.**

- **Make a difference with your help.**
  Link your written advice to those aspects that would change the paper's quality. Don't correct a comma when the value of the whole sentence is in doubt. Work on the organization, the clarity of the thesis, and the forecasting sentence in each paragraph before making notes about other aspects.

- **Use your time for comments that describe rather than label.**
  Many English teachers maintain their power through negative labels: "awkward," "trite," or "vague." You wouldn't say that to the student directly in a conversation, and it won't help the student write better, so rephrase to describe what you're seeing: "The sentence has three major claims in it, but I can't tell how you want me to see their relationship." "If only I had a specific example from the article, I would be able to understand your reasoning better." "This phrase is so general that it doesn't make your point precisely."

- **Write comments that another mentor could explain to students.**
  Having written comments and marginal marks will help mentors give students sound advice for future papers.

MENTORING

Helping students read scientific articles well

Before they read the article, tell them to

Make a short list of questions, issues, or concerns that caused them to seek the article in the first place. Those questions will function like "mental hooks" to snag connections as they read.

While they're reading the article, suggest that they

- Make notes
- Highlight key passages
- Draw lines between the highlighted parts and write a phrase that shows in their own words how these passages are connected.
- Look for evidence that a concept explained in class was applied to a new population or situation.
- Look for evidence that contradicts something that was said in class.
- Figure out relationships among key concepts.

As they plan their papers, tell them to

- Organize the paper to show the answers to their own questions
- Explain whether the key terms in the article seemed to be defined in the way they heard them in class. (They should be applying knowledge as they write.)
- Have fun while they write. Enjoy being part of the community that evaluates biological or ecological issues.

When you consult, develop students' reading skills as follows:

- Start by discussing low-level information vs. high-level hierarchies and subordination of ideas. What's the main point of the article? How is it organized? What questions must be answered to accomplish the authors' purposes? What questions are answered first, second, and so on?

- Help students identify the author's voice. Say, "Who's talking here? The Sopranos? Ted Koppel? " Help the students see writing as speaking to an audience and reading as detecting the speaker's voice, assumptions, prejudices, and tactics.

- Ask students whether the article has the qualities they want in their own papers:

  An excellent article **will**:
  - set up a context that shows why the issue to be studied matters in the field
  - state its focus clearly early on
  - explain the work of previous investigators
  - describe its methods and theoretical assumptions clearly

- present results convincingly, discussing their relevance and linking them to the theories and assumptions presented earlier
- draw reasonable, sometimes limited conclusions
- look forward to next steps, future research remaining

Helping students understand "readability"

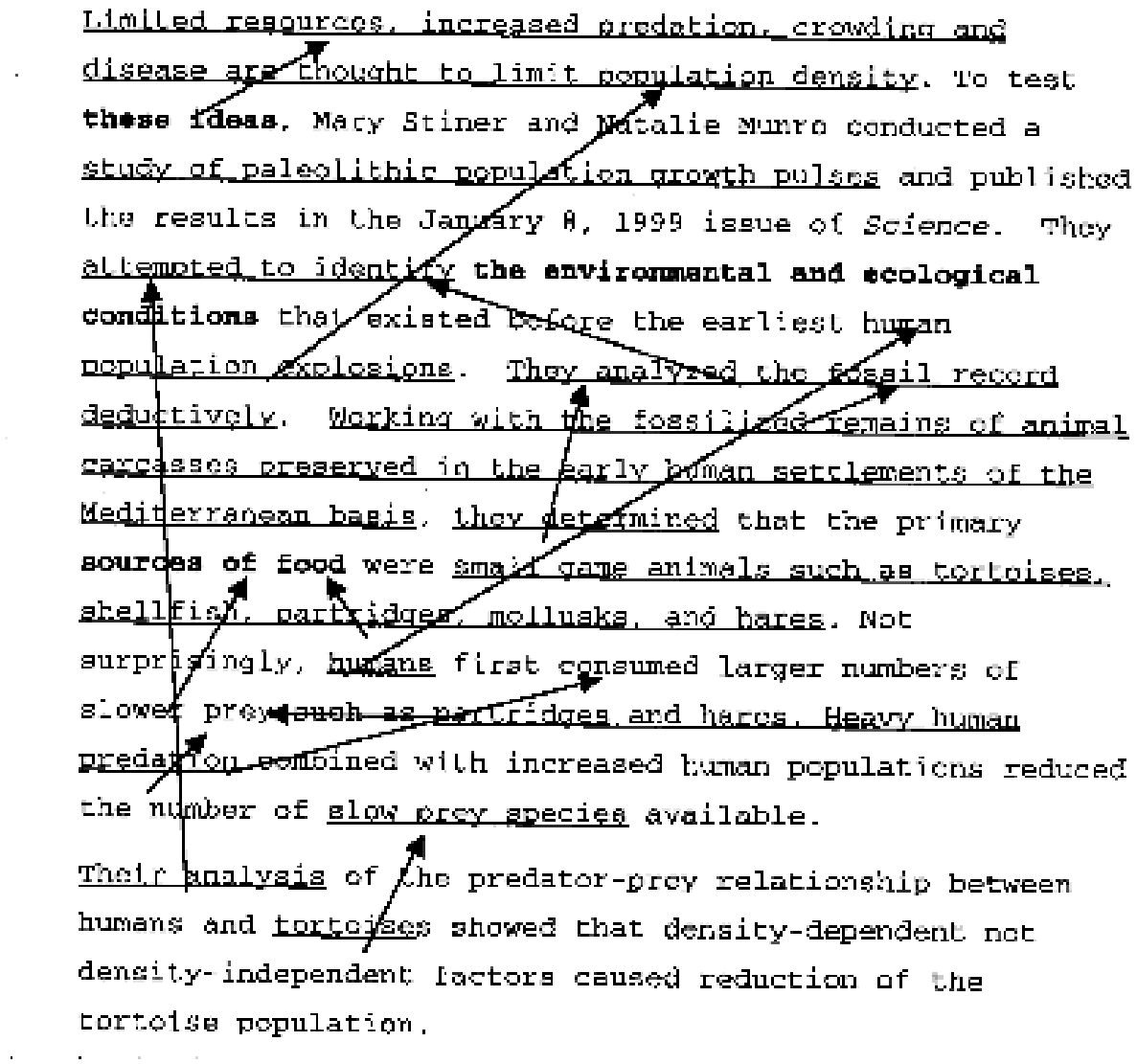
Several researchers have tried to define "readability" as features of a text that enable readers to grasp the message or information quickly. However, the experience a reader has with the subject being discussed and his or her familiarity with the vocabulary and concepts affects how quickly and effectively the reader interprets a text. Indexes developed in the mid-twentieth century (such as the "fog index") focused on the number of words as well as the number of polysyllabic words per sentence. Today experts advise paying attention to the audience's level of expertise in choosing words and controlling sentence length. They also emphasize using sentences that put the agent (human, concrete, or abstract) into the subject and the action into the verb (with the object following) to make sentences easy to comprehend.

Consider the following example:

> **Original:** In approaching the resin coated male dummies with larger claws and with raised claws (vs. claws in the resting position), a strong preference for the larger and raised claws was shown by female fiddler crabs in the study.
>
> **Structure**: prepositional phrase, action, object, agent.
>
> **Revised**: Female fiddler crabs that approached resin-coated male dummies in the study strongly preferred males with larger claws or raised claws over those with smaller or resting claws.
>
> **Structure**: agent, modifying clause, action, object.

Helping students understand coherence: "The Given/New Contract"

Linguists contend that readers expect writers to begin with concepts both readers and writers understand (The GIVEN) and then to add elaborating details or new information (The NEW). When writers break this contract by introducing new information that is not linked to shared understanding, the reader must hesitate, extrapolate or infer meanings, and risk misunderstanding. The following writer expects the graders to be familiar with course concepts such as predation, crowding, and population density. The arrows suggest some of the pattern of "given" and "new" information that elaborates on already "given" phrases.



Help students look for the pattern of "given" and "new" concepts in the articles they read. These patterns will help them understand how the argument is organized. If the pattern is broken, it will help them figure out why they are having difficulty following the authors.

Strategies to help students reading scientific articles

Reading a scientific article is a complex task. The *worst* way to approach this task is to treat it like the reading of a textbook—reading from title to literature cited, digesting every word along the way without any gross assessment of the document, without reflection, without a critical eye. Rather, the reader should begin by skimming the article to identify its structure and features. Advise your students to look for the author's main points as they read. They should generate questions before, during, and after reading. Readers should inferences based on their own experiences and knowledge. And to really improve understanding and recall, readers should take

notes as they read. These strategies, discussed in more detail below, will help students read, comprehend, and summarize their chosen articles.

Strategy 1: Skim the article and identify its structure.

Most journals use a conventional IMRD structure: An abstract followed by Introduction, Methods, Results, and Discussion. Each of these sections normally contains easily recognized conventional features, and if you read with an anticipation of these features, you will read an article more quickly and comprehend more.

Features of Abstracts

Abstracts usually contain four kinds of information:

- purpose or rationale of study (why they did it)
- methodology (how they did it)
- results (what they found)
- conclusion (what it means)

Most scientists read the abstract first. Others—especially experts in the field—skip right from the title to the visuals because the visuals, in many cases, tell the reader what kinds of experiments were done and what results were obtained. You should probably begin reading a paper by reading the abstract carefully and noting the four kinds of information outlined above. Then move first to the visuals and then to the rest of the paper.

Features of Introductions

Introductions serve two purposes: creating readers' interest in the subject and providing them with enough information to understand the article. Generally, introductions accomplish this by leading readers from broad information (what is *known* about the topic) to more specific information (what is *not known*) to a focal point (what *question* the authors asked and answered). Thus, authors describe previous work that led to current understanding of the topic (the broad) and then situate their work (the specific) within the field.

Features of Methods

The Methods section tells the reader what experiments were done to answer the question stated in the Introduction. Methods are often difficult to read, especially for graduate students, because of technical language and a level of detail sufficient for another trained scientist to repeat the experiments. However, you can more fully understand the design of the experiments and evaluate their validity by reading the Methods section carefully.

Features of Results and Discussion

The Results section contains results—statements of what was found, and reference to the data shown in visuals (figures and tables). Normally, authors do not include information that would need to be referenced, such as comparison to others' results. Instead, that material is placed in

the Discussion—placing the work in context of the broader field. The Discussion also functions to provide a clear answer to the question posed in the Introduction and to explain how the results support that conclusion.

Atypical Structure

Some articles you read will deviate from the conventional content of IMRD sections. For instance, Letters to *Nature* appear to begin with an abstract, followed by the body of the article. Upon reading, however, you will see that the "abstract" is a summary of the work filled with extensive introduction (for the purpose of catching the attention of a wide audience), and the next paragraph begins a description of the experiments.

Therefore, when you begin to read an article for the first time, skim the article to analyze the document as a whole. Are the sections labeled with headings that identify the structure? If not, note what the structure is. Decide which sections contain the material most essential to your understanding of the article. Then decide the order in which you will read the sections.

Strategy 2: Distinguish the article's main points.

Because articles contain so much information, it may be difficult to distinguish the *main points* of an article from the *subordinate points*. Fortunately, there are many indicators of the author's main points:

Document level

- Title
- Abstract
- Keywords
- visuals (especially figure and table titles)
- first sentence or the last 1-2 sentences of the Introduction

Paragraph level: words or phrases to look for

- *surprising*
- *unexpected*
- *in contrast with previous work*
- *has seldom been addressed*
- *we hypothesize that*
- *we propose*
- *we introduce*
- *we develop*
- *the data suggest*

Strategy 3: Generate questions and be aware of your understanding

Reading is an active task. Before and during your reading, ask yourself these questions:

- Have I taken the time to understand all the terminology?
- Have I gone back to read an article or review that would help me understand this work better?
- Am I spending too much time reading the less important parts of this article?
- Is there someone I can talk to about confusing parts of this article?

After reading, ask yourself these questions:

- What specific problem does this research address? Why is it important?
- What method was used? Is it a good one?
- What are the specific findings? Am I able to summarize them in one or two sentences?
- What evidence supports the findings?
- How are the findings unique/new/unusual or supportive of other work in the field?
- What are some of the specific applications of the ideas presented here? What are some further experiments that would answer remaining questions?

Strategy 4: Draw inferences.

Not everything that you learn from an article is stated explicitly. As you read, rely on your prior knowledge and world experience, as well as the background provided in the article, to draw inferences from the material. Research has shown that readers who actively draw inferences are better able to understand and recall information.

As an example, in the box below is an excerpt from the Introduction of an article in the journal *Biochemistry**. The comments in italics are questions and inferences that might be drawn by a student reader.

Rett Syndrome is a childhood neurodevelopmental disorder and one of the most common causes of mental retardation in females *Comment: Hmmm…must be related to a gene on the X-chromosome*, with an incidence of 1 in 10000-15000. *Comment: How common is that? Not too likely to happen to me, but there must be several such children born in Houston every year.* Rett syndrome patients are characterized by a period of normal growth and development (6-18 months) followed by regression with loss of speech and purposeful hand use. *Comment: What happens? Something must be triggered or activated at late infancy.* Patients also develop seizures, autism, and ataxia. After initial regression, the condition stabilizes and patients survive into adulthood. Studies of familial cases provided evidence that Rett is caused by X-linked dominant mutations in a gene subject to X-chromosome inactivation. Recently, a number of mutations in the gene encoding the methyl-CpG binding transcriptional repressor MeCP2 have been associated with Rett Syndrome. *Comment: MeCP2 mutations probably cause Rett Syndrome. This must be an important master-regulator to affect so many processes in the brain. I wonder what they know about it…*

*excerpt from Ballestar, E., Yusufzai, T.M., and Wolffe, A.P. (2000) Effects of Rett Syndrome Mutations of the Methyl-CpG Binding Domain of the Transcriptional Repressor MeCP2 on Selectivity for Association with Methylated DNA. *Biochemistry* 31, 7100-7106. Comments added.

Strategy 5: Take notes as you read.

Effective readers take notes—it improves recall and comprehension. Put quotation marks around any exact wording you write down so that you can avoid accidental plagiarism when you write your summary.

Essential notes to take about your article:

- Complete citation. Author(s), Date of publication, Title, Journal, Volume #, Issue #, pages:

- Key Words:

- General subject:

- Specific subject:

- Hypothesis:

- Methodology:

- Result(s):

- Summary of key points:

- Significance:

ONE-ON-ONE CONSULTATIONS

Interpersonal skills (COACH approach)

Although some professional sports coaches are notorious for their callous and rude behavior, we see a coach as someone who takes the following actions:

Commends
Observes
Asks questions
Constructively criticizes
Helps

Remembering this acronym can make you a better mentor. It also will make you a better team member or leader in a research project.

Mentoring requires good interpersonal skills. As a mentor, you need to be sensitive to more than how much your client knows about biosciences. As a mentor, you should try be aware of when you are competent to be helpful professionally and when you should help the student get help elsewhere.

Students often confide in consultants and mentors about stress, fears, and problems that are beyond the mentor's power of action. If someone has a serious problem, suggest talking to a college master or an advisor, or going to the Counseling Center. The people at the Counseling Center are experts: what they do every day is evaluate people's situations and find help for them. Sometimes it's medical help. Sometimes it's therapy. Your work at Rice hasn't made you an expert, and if you misjudge the situation, the student client may suffer or do something harmful because he or she didn't have help.

Here is the reference you need:

Rice Counseling Center Office
303 A Lovett Hall
8:00 am - 12:00 pm and 1:00 pm - 5:00 pm
Monday through Friday
Phone (713) 348-4867 (24 hours)
Fax (713) 348-5953
http://www.ruf.rice.edu/-rucc/

Try to avoid “yes/but” games with a student client

Students sometimes try to avoid acting in their best interests by playing a game psychologist Eric Berne refers to as "Why don't you? Yes BUT. .." They tell you their problem. They remain in charge of the game by saying "Yes, But. . . "whenever you make a suggestion. So long as they come up with reasons why your suggestion won't work, they remain in charge of the game. To

end the game and shift your position, you reply to the student: "That's really bad. What do you plan to do about it?" This reply puts YOU in charge, and then you can evaluate how well the student's suggestion is going to work OR suggest that the student discuss his or her plan with the counselor at the Counseling Center.

How to conduct a consultation

Establishing rapport

Be friendly and professional. Chat a moment. Gauge the client's feelings and attitudes. Why is he or she here? Is he or she in a hurry? Ready to take a break and talk things out? Set an appropriate tone.

Hearing the student's understanding of the assignment

People only solve the problems they identify; they only do assignments as they understand them. Even though you KNOW what the assignment was, you'll not be able to help unless you also know what the student thinks he or she is supposed to do. Those are not always the same. You can clarify misconceptions and get better results just by ensuring that the assignment is understood. However, you're not supposed to let a student bring work for you to do. Don't be suckered by a student who says, "What am I supposed to do?" To that you reply, "Well, where's your copy of the assignment? What do YOU think you're supposed to do?"

Asking the student client what his or her goals are

One glance at a page with no paragraph breaks may cause you to think that organization is the primary goal for the session, but you need to find out what the student hopes to gain from the session. Don't be too quick to jump into an analysis of the paper. ASK WHAT THE STUDENT IS CONCERNED ABOUT.

Establishing a plan for the session

If you're working on a 30-minute session, allocate time to the issues the student has identified. Perhaps 3 minutes to skim the paper, then 10 minutes on the student's first concern, 5 minutes on the second one, and then, you can inquire whether it would be all right to deal with some format or organization issues or whatever else you think should get attention. However, the student's own issues come first.

Working through the plan

Always try to get a picture of the student's view of the issue. Suppose the issue is how well the method has been explained. Ask what the student considers the main tests for a well explained method. Then ask where the draft accomplishes those objectives (states the main steps, descriptive or measurement techniques, and interpretive techniques, for example, and shows how these are related to the purpose or aims of the study). Then you can comment on either the tests/criteria or the way the draft fulfills these.

Keep on schedule. Monitor your time according to your plan for the session.

Eliciting the student's summary of what he or she will do next

The student may not work on the paper again soon. Ask the student to sum up what he or she will do next toward completing the paper. Suggest that he or she jot these ideas down and then tell you what they are. Augment or reinforce these plans before the student leaves.

Concluding the session

Describe the best thing you think has happened or that the student has done in the session. Close with an encouraging word.

The Honor Code and consulting as mentor

> **from 2002 Rice Student Handbook**:
> Re: Pre-grading assistance. Tutors or consultants may discuss homework, papers, projects or assignments on which the student is working, but they may not provide the answers to problems or suggest the exact wording to be used on a paper. They may coach a student who is mastering scientific concepts, developing a line of scientific reasoning, evaluating paper topics, brainstorming or formulating a thesis, but the tutor or consultant may not perform the specific intellectual task on which the student is to be graded. Tutors and consultants may use similar problems or examples to show students the process they are to go through. A labbie may weigh a different sample to demonstrate how to use a balance; labbies should not weigh students' samples for them.

Instructors assign work for different reasons. When the assignment is made to help the student learn by doing, or to pursue a class topic that is of personal interest, or to make a contribution to the ongoing class discussion by means of writing a paper on a topic, most instructors will allow students to consult teaching assistants, writing consultants, or labbies. When the assignment is made as a test of the student's mastery of the concepts or techniques, consultants' help may be prohibited. It is the responsibility of the mentor to find out whether consulting is allowed in the course. The mentor must rely on the student's truthfulness in this matter.

Being a mentor is a little different from being a tutor. A tutor is someone who knows course material that a student does not know; it is assumed that a student who approaches a tutor "needs help"—that the student is unable in some way or finds difficult the task of learning the material in a course. A tutor teaches content that the professor has assigned for the session or that the tutor thinks would be helpful to students in that stage of the course.

A mentor who is consulting, on the other hand, is an advisor and learning resource that a student can work with in the process of pursuing projects and assignments. The Cain Project facilitates and honors student scholarship. We assume that students are important people, pursuing intellectual goals and carrying out important assignments. These students may benefit from working with mentors who share their student clients' enthusiasm and commitment to excellence in learning.

A consulting session is driven by the student's agenda or by the agenda that the student and his or her instructor have chosen for the session. The first part of every consulting session is a review of the student's goals and a mutual definition of the session's purpose. In other words, the mentor provides the assistance requested based on his or her training and experience; the student carries out his or her work. The mentor does not take over a student's project, write papers, choose the actual words used, proofread papers, or earn the grade: those are the student's responsibility.

These differences have important consequences in the session. It is the mentor's job to help the student perform for himself or herself the primary intellectual tasks of the assignment and to improve the process of scholarship—to suggest ways to think about the tasks, to point out tools and techniques, and to teach the student techniques the student needs to know. The mentor may go over similar papers or projects, talk about the process used, and prompt the student to identify elements of the example that may be a guide for the student's own choices. But in every case the mentor makes these choices in order to achieve the objectives of the consulting session and separates his or her work as someone consulted by the student from the work the student is supposed to perform.

Abiding by the Honor Code is essential. The Honor Pledge forbids "aid," which is the heart of the matter. In the Cain Project, we take "aid" to mean supplying the content of a paper, specific words, or corrections—roughly the parallel to handing the student the answer on a test. We strive to ensure that coming for consulting is NOT the same as coming to get a paper to hand in. Rather, the mentor helps the student learn what he or she must do to write well—how to discover ideas, organize them, formulate a thesis about them, support ideas with evidence, revise a paper, and edit it. A consultant must determine whether the assignment is one in which the student is allowed to consult a writing mentor before beginning the session.

WRITING

Summarizing a scientific article

Some writing texts advise you to include "the author's main points" in a summary. That may work well for other kinds of materials, but not so well for a scientific article. If you are writing a summary to help a physician or grandparent learn about a research article or to show a professor that you read and understood it, you will need to answer a fairly typical set of questions, "the baker's dozen":

BAKER'S DOZEN QUESTIONS

1. What was the topic of the article?
2. How was the problem/question/issue defined?
3. What was the purpose of the research? What question, problem, or issue did the article address in relation to the topic?
4. Were any assumptions unusual or questionable? (for example, that all members of a population were substantially uniform or equal)
5. Why is the question, problem, or issue important?
6. What work has been done or what situation exists that motivated the research?
7. What experimental design was used (if the research involved an experiment)?
8. What methods were used?
9. What was the character of the results?
10. How were the results interpreted?
11. What did the researcher conclude?
12. Why were YOU reading this paper?

In most cases, some of these questions will be much more important than others. As you look for the answers to these questions as you read, keep in mind that the article you have chosen contributes in some unique way to the scientific field, and in summarizing you want to make that aspect of the article especially obvious to your readers.

Some of the possible reasons that an article is special:

- Introduces a new method or technique
- Contradicts an old set of conclusions
- Answers a previously unanswered question
- Connects earlier research works in a new way
- Tests a method or conclusion on a new type of data or specimen
- Tests an earlier conclusion by a new method or with a larger sample
- Proves an old assumption faulty.

Which of these possibilities (or others we left out) is the main reason the article you read is worthwhile? Your summary should make clear what aspect of a work makes it valuable. If the method, for example, is less complicated or more efficient than earlier methods, you should give enough detail about the method and its simplicity or efficiency to help the reader understand that aspect of the article. In that respect, the summary of a scientific article may not be a mere miniature of the larger article, but the answers to the principal questions above.

How much you say in answer to any one question will probably be determined by your purpose and the reason that article is valuable to your reader.

How to write the summary:

1. Writing the summary begins with annotating the original article. After you've skimmed the article quickly to get the main "map" of the article in your head, read to find the answers to the dirty dozen questions. Using your highlighter (or boldface command if you're reading an electronic article), highlight the answers or make a note in the margin.

2. Without directly quoting the article, write a sentence that tells why the article is valuable or noteworthy. Then write answers to the key questions without worrying at all about the kind of sentences you write. Just get the answer down.

3. Go back and wordsmith the answers and divide the summary into chunks that have one topic and point per paragraph. Whenever you change topics or say something substantially new or different about a current topic, create a new paragraph.

4. Polish the sentences to eliminate unnecessary words. At the same time, put in extra transitional words. Summaries, because of their brevity, have to have more "pointers" such as "first," "second," "in contrast," or "however" to glue the content together firmly.

Standards for Writing Science

Citing References

References to works by three or more authors in the text should be abbreviated (Able *et al* 1986). When different groups of authors with the same first author and date occur, they should be cited thus (Able, Baker & Charles 1986; Able, David & Edwards 1986).

The references in the list should be in alphabetical order with the journal name unabbreviated. The format for papers, entire books and chapters in books is as follows:

Boutin, C. & Harper, J. L (1991) A comparative study of the population dynamics of five species of Veronica in natural habitats. *Journal of Ecology*, 79, 199-221.

Clarke, N.A. (1983) *The ecology of dunlin* (Calidris alpina 1.) *wintering on the Severn estuary*. PhD thesis. University of Edinburgh.

Pimm, S.L. (1982) *Food Webs*. Chapman and Hall, London.

Sibly, R.M. (1981) Strategies of digestion and defecation. *Physiological Ecology* (eds C. R. Townsend & P. Calow), pp 109-139. Blackwell Scientific Publications, Oxford.

References should only be cited as 'in press' if the paper has been accepted for publication. Other references should be cited as 'unpublished' and not included in the list.

Units, symbols and abbreviations

Authors are requested to use the International System of Units (SI. Système International d'Unités) where possible for all measurements (see Quantities, Units and Symbols, 2nd edn (1975) The Royal Society, London). Note that mathematical expressions should contain symbols not abbreviations. If the paper contains many symbols, it is recommended that they should be defined as early in the text as possible, or within a subsection of the Materials and methods section.

Scientific names

Give the Latin names of each species in full, together with the authority for its name, at first mention in the main text. If there are many species, cite a Flora or checklist which may be consulted for authorities instead of listing them in the text. Do not give authorities for species cited from published references. Give priority to scientific names in the text (with colloquial names in parentheses, if desired).

Makers' names

When a special piece of equipment has been used it should be described so that the reader can trace its specifications by writing to the manufacturer, thus:

Data were collected using a solid-state data logger (CR21X, Campbell Scientific, Utah, USA)

Sample of Using Baker's Dozens Questions to Generate a Summary

Jagdt, Bjorn, Warncke, K. Auer, H., and Rudiger, H. Sleep deprivation does not induce sister chromatid exchange in humans. Mutation Research 361 (1996): 11-15.

Topic	Validity of sister chromatid exchange for measuring genotoxic exposures.
Purpose of the Research	The research was conducted to determine whether results of a preliminary study by Bamezai and Kumar, reporting dramatic increases of SCE after sleep deprivation, could be verified.
How defined?	Whether there were significant deviations between the SCE rates of workers who were sleep deprived and normal sleep.
Assumptions	Previous genotoxic exposures would not have elevated the mean baseline of persons in the studies.
Why study important?	Widely used procedures might give faulty results and misjudge genotoxic exposures in the workplace.
What motivated research?	Unusual results after sleep deprivation suggested that SCE levels might be confounded when occupational medicine studies involved night shift workers.
What experimental design?	Comparison of 20 persons' SCE levels during control and experimental periods under different sleep behaviors.
What methods were used?	Individual baseline of SCE was estimated by the mean of the SCE per metaphase of two subsequent days (control period) and compared to that of a test period two weeks later, plus questionnaires about sleep and dietary habits.
Results	The rates were slightly different, but the differences were not statistically significant.
Interpretation	The study did not verify the results of the earlier study. Differences in conditions of cell cultures might explain the outcomes.
Conclusions	The effect of sleep deprivation on SCE, if there is one, would be in the range of normal day-to-day variance, and does not have to be taken into account when SCE is used for genotoxic monitoring at workplaces.
Reason article is valuable/noteworthy	The article by Bjorn and others confirms that using sister chromatid exchange to measure genotoxic exposures in the workplace produces reliable results for men and women who work night shift as well as for ordinary daytime workers.

Sample 250-Word Summary

"Sleep deprivation does not induce sister chromatid exchange in humans," a 1996 article in Mutation Research by Bjorn and others, confirms that using sister chromatid exchange (SCE) to measure genotoxic exposures in the workplace produces results within the range of normal daily

variation for men and women who work night shifts as well as for ordinary daytime workers. A preliminary study by Bamezai and Kumar in 1992 reported dramatic increases of SCE after sleep deprivation. If confirmed, these results would have raised questions about whether SCE levels might be confounded when occupational medicine studies involved night shift workers.

Bjorn and his colleagues compared the SCE levels of 20 persons (10 men, 10 women). Individual baselines of SCE were estimated by the mean of the SCE per metaphase of two subsequent days (control period) and compared to that of a test period two weeks later after 24 hours without sleep. Daily questionnaires about sleep and dietary habits were used to eliminate possible influence of other factors. The rates differed slightly, but the differences were not statistically significant. Differences in conditions of cell cultures might explain differences in the two studies. Previous genotoxic exposures were assumed not to have elevated the mean baseline of individuals. Bjorn and colleagues concluded that the effect of sleep deprivation on SCE, if there is one, would be in the range of normal day-to-day variance, and does not have to be taken into account when SCE is used for genotoxic monitoring at workplaces.

GRADING

- Use the “strengths” and “suggestions” written response categories to say something that specifically addresses *that student paper*. Oftentimes, grader advice ranges from trite stock phrases ("interesting topic!," "nice writing," etc.) to conflictingly vague advice, to automatic responses that offer little insight regarding improving their writing ("look at second source").

- Use margin notes to address problematic writing specifically. Margin notes are effective for engaging specifics of a paper, and show the student that her paper is actually being read by a human.

- Stick to a standard plagiarism policy. Bring papers of concern to Mary Purugganan.

- Award points as accurately as possible. Thus, a student can get 4/5 maximum points, even if the grade sheet shows “_/3” for “good” and “_/5” for “excellent.” HALF-POINT AWARDS ARE ALLOWED.

- Reread the assignment carefully before grading. Make sure the student chose a paper from the allowed list of journals, met the format requirements, etc.

- Be sure to create a helpful, personal dialog with your student writer. Your comments establish the nature of the mentoring relationship. For more, see “Dialogic mentoring thorugh grading” on page 3 of this handbook.

APPENDIX

For further reading

Chase, Geoffrey. "Accommodation, Resistance and the Politics of Student Writing." *College Composition and Communication* 1 (39) Feb 1988: 13-23.

This more theoretical article discusses the implications of writing standards in terms of ideology and power, and examines possibilities for resistance within the structures of academic grading. Not exactly the topic at hand, but a fascinating essay nonetheless.

Giltrow, Janet. *Academic Writing: Writing and reading across the disciplines.* 2nd edition. Orchard Park: Broadview Press, 1995.

This longer work also examines academic writing and grading in terms of discourse, although without the focus on resistance. This book foregrounds audience as the key concept of effective academic writing regardless of specific discipline. Easy to read despite its sophisticated content. Lots of drawings.

Shaw, Harry Edmund. "Responding to Student Essays." ch. 5 from *Teaching Prose: A Guide for Writing Instructors.* Edit. by Bogel, Gottschalk, et a!. New York: Norton, 1984: 115-154.

Just a short chapter, but this essay covers grammar basics and offers excellent advice for writing effective feedback for students.

Acknowledgements

This manual rests on the contributions of many students and instructors. Drs. Paul Harcombe, William Rogers, and Lisa Meffert of the Department of Ecology and Evolutionary Biology and Drs. Mike Gustin, Richard Gomer, and Dave Caprette of the Department of Biochemistry and Cell Biology have collaborated in assignment design and mentor training. Andrew Yerkes, a graduate student in the Department of English, analyzed graded essays from the 1999 BIOS 202 course and drafted portions of this manual. Students from several BIOS classes permitted us to revise their drafts and create exercises for mentors in training and other students. Linda Driskill, Jan Hewitt, and Mary Purugganan contributed to and edited the manual.

SCHEDULE FALL 2004

Paper Due Dates

The schedule for student papers is shown in the table below. You are responsible for the full set of papers assigned to you, but if you cannot grade all of your papers or make your deadline due to illness or emergency, please contact Julia Amborski at jambor@rice.edu or x6141 *as soon as possible.*

BIOS 201 **Assignment Due in class**	**Papers Available for Pick-up after 12 noon in Biology 211**	**Graded Papers Due by 5 pm in Biology 211**
Wed., September 29	Thursday, September 30	Tues., October 5
Wed., November 17	Thursday, November 18	Tues., November 23

Emergency Help Sessions

In addition to your regular mentoring with your assigned "mentees," you have the opportunity to work with students who need emergency "last-minute" help. These help sessions are scheduled as follows:

Tuesday, September 28, 8-10 p.m.
Tuesday, November 16, 8-10 p.m.

You may be busy during the session or you may not—either way you will be paid. If you are interested in working one or both of these sessions, please contact Julia Amborski. On the night of your session, ask for key #8 at the library entrance. You'll need to sign for the key and leave your ID. When you leave, remember to turn in the key and get back your ID.

Bios 201 Fall 2004 ♦ Instructions for written papers

Required extra credit paper
Due date: Wed Sept 29, 10 AM in class
Length: 400-500 words (not including references); double-spaced, printed
Source: Pick a human disease (e.g., diabetes, Alzheimer's) and find a research article where the researchers found out something new about a specific cell or a part of the cell, e.g., an enzyme, an organelle, the cytoskeleton, something in the nucleus or on the plasma membrane, that relates to the understanding or cure of the disease. The article must be recent, published sometime between 1998 and 2003, and have a section of the paper in which the methods are explained, i.e., an original research article and not a review.
Assignment: Write a paper in which you summarize and explain the research paper to a medical doctor treating a patient with that disease (thus, you can assume your audience has working knowledge of the disease and general biology, but not of the particular article you have chosen). Your paper must include the following:
1. A description of the purpose and specific aims of the article. What did the authors intend to do? Why did they do it? How did they do it? (You don't need to elaborate on methods, but you need to understand the purpose of the experiments).
2. A well organized explanation of how the study's results leads to its conclusion, i.e., the main line of argument in the paper.

Extra credit paper
Due date: Wed Nov 17, 10 AM in class
Length: 800-1000 words (not including references): double-spaced, printed
Assignment: Choose another research article on the same disease as the first paper. You must summarize and explain this article to your grandmother or grandfather (assuming that your grandparents do not have degrees in biology). The longer length of this assignment will allow you to include more background material for your grandparent.

Requirements for both papers:

1. Hand in a stapled printed copy in class (see late policy below)
2. Include at the top of the page:
   - your name
   - Bios 201
   - the date
   - the word count (use your word processing program)
3. Provide the full reference including all authors, title of journal, volume, inclusive pages (e.g., 17-24), year, and title of article.
4. List two related references (include full reference information). See instructions below for how to obtain these references.
5. Provide a copy of the article stapled to the back of your paper.

Locating articles
The research article you will summarize must be from one of the following journals:
Proceedings of the National Academy of Sciences USA
Cell

Neuron
Journal of Cell Biology
Molecular Cell
Developmental Cell
Current Biology
Nature Biotechnology
Nature Cell Biology
Nature Neuroscience

These journals are electronically accessible through the Fondren library at this web address: http://antioch.rice.edu/fondren/collections/electr/ejournals.php
All of these journals have search functions at their respective website. Download the article as a .pdf file using your browser and Adobe Acrobat (free version available at http://www.adobe.com/products/acrobat/readstep2.html). Print out the research article and staple it to the back of your paper.

Related research articles
For both papers, I ask that you also find two related research articles and list them at the end of your paper. You must find these papers by the following method. First, find your research article, the one on which you're writing the paper, at PubMed (a database maintained by the National Library of Medicine):
http://www.ncbi.nlm.nih.gov/entrez/query.fcgi
Try searching with the authors last names, i.e., Smith AND Williams; also try other words in the title: Smith AND Williams AND insulin. Once you find your article on PubMed, click on related research articles to the right of your reference. List the first two references that come up at the end of your paper.

Late paper policy
Each paper will be worth up to 12 points on the final exam. For each day the paper is late, the maximum points will be reduced by a third. After 11 AM Wed, the paper is worth 8 pt maximum, after 11 AM Thursday 4 pt maximum, after 11 AM Friday, it is worth no points.

Grading criteria
I include a grading sheet so that you can see what criteria will be used by the graders.

Writing mentors
If you need help while writing your papers, student writing mentors will be available in Fondren Library for individual meetings. The dates and times will be announced in class.

Date _____

BIOS 201 Comments for _____

Strengths:

	EXCELLENT	**GOOD**	**POOR**	
Purpose and aims of article	___/3	___/2	___/1	
Discusses how results lead to conclusions	___/3	___/2	___/1	
Organization and style	___/3	___/2	___/1	
Appropriate for audience	___/2	___/1	___/0	
Format requirements	___/1	___/0	___/0	
TOTAL				___/12

Suggestions for improvement:

Grading Criteria			
	excellent (max pts)	**good (mid pts)**	**low (low pts)**
• Purpose and aims	Accurately and completely communicates purpose and aims of article.	Inaccurately or incompletely identifies either purpose or aims.	Fails to identify purpose or aims.
• Discusses how results lead to conclusions	Identifies main argument of paper and how authors used results obtained to argue for conclusions.	Incomplete description of argument or how authors used results to arrive at their conclusions.	Little or no accurate description of argument or authors' conclusions.
• Organization and style	Organizes discussion of aims and results logically to assist reader's understanding of article's conclusions. Paragraphs have topic sentences; easy for reader to access. Correct use of grammar.	Poor organization or poor style.	Poor organization and style.
• Appropriate for audience	Depth of discussion, use of terminology and definitions, and context of discussion are appropriate for audience.	Depth of discussion, use of terminology and definitions, and context of discussion are occasionally too sophisticated or too simple for audience.	Depth of discussion, use of terminology and definitions, and context of discussion are either too sophisticated or too simple for audience.
• Format	Stapled copy submitted with: • Your name • BIOS 201 • Date • Word count • Full reference • Two related references • Copy of article.		