WRITING A SCIENTIFIC PAPER (for Geology/EST 116G)

FORMAT - The paper will be at least 2500 words (about 10 typed pages, not including the title page, references, and figures, etc.) Don't fool yourself, or try to fool us, by using great big print and widely spaced lines. Use 12 point font, 1 inch margins, and double-space the text. Number the pages. The components of the paper are discussed below in the order in which they would appear:

Title Page - On the title page, include the following: the paper title, your name, the class and section number, and the date. Choose a title that describes accurately what the paper is about. For example, Plate Tectonics is much too broad a title for a paper that is actually about deep ocean rifts, and Scum of the Sea (a paper about algal mats in subtidal waters) is ambiguous and a bit corny. You don't need to use fancy plastic covers.

Abstract - An abstract is not a rewording of the conclusions, nor is it part of the introduction. Rather, it is a brief review (usually a paragraph) of the most important findings or points discussed in your paper. Condense the paper into the main points you hope the reader should get out of it. Abstracts are placed first, but written last. Use the heading “Abstract.”

Introduction - The introduction gives some background information about your subject, and lets the reader know why the subject is worth the research you put into it. Near the end of the introduction, you must state very specifically the purpose/goals of the paper (i.e., what you are trying to investigate or prove/disprove) and how you will go about it. For example:

   This paper describes how the shell hydrodynamics of the gastropod Strombus pugilis affect the geometry of current- and wave-associated shell deposits. I discuss processes that affect the geometry of modern shell deposits and the results of current and wave experiments with S. pugilis. I then infer the hydrodynamic processes that were involved in forming S. pugilis-bearing deposits in Florida.

By the end of the paper, the reader should feel that these stated goals of the paper were adequately addressed. Use the heading “Introduction.”

Body (Main Text) - The body of the paper is where you discuss your topic. In papers detailing experimental results (such as a lab report you may have written for a biology class), the body is typically composed of sections headed Materials and Methods, Results, and Discussion. For a research-type paper such as this, however, the sections can be given whatever heading you want as long as they indicate clearly the subject matter in them. Do not head the section “Body.” Instead, use sub headings to identify main subject discussions. For example: “Previous Hydrodynamic Studies,” “Studies of Modern Shell Deposits,” and “Shell Deposits of Florida.”
Conclusions - In the conclusions, you summarize your findings. This demonstrates to the reader that you addressed the goals you stated in the introduction. The summary follows the advice of a saying you probably heard in English classes: “Tell them what you are going to say (the introduction in this paper), then tell them (the body), and then tell them what you just said (the conclusions).” At the end of a conclusions section, one typically offers a statement about the future of the subject you discussed—future work you or someone else might do. Use the heading “Conclusions.”

References - This section is an alphabetical listing of sources you referenced in the text of the paper. (Referencing sources in the text is discussed later.) Use the heading “References Cited.” Here are examples of the reference formats that you must use for the paper. Notice the indent after the first line.

Article in a journal:

Book:

Specific paper in a book:

Proceedings of a symposium:

Government (or specific agency) document:

Personal communication (letter or conversation):
Sorre, P.F., 1990, Assistant Professor of Geology, University of Louisiana-Charlemagne, Pers. Comm.

Web page:
Last name, First name. Date created or last revised [YYYY, Month DD]. "Title of web page."
    Title of complete work, if this page is part of a group of documents (italicized). <URL>
    (Date you saw it [YYYY, Month DD]).

Figures and Tables - You can often pass along more information to your reader more effectively, and in less space, in a figure (graph, map, picture) or a table than in words. That means more communication for less work by you and by your reader. Everybody wins. Figures and tables must be:
    (1) numbered separately (i.e., Figure 1, 2, 3... and Table 1, 2, 3...);
    (2) labeled with a caption (including a reference if it is not yours); and
Here are examples of captions:

**Figure 1.** Diagram of atmospheric CO\(_2\) levels in the last 75 years, recorded at Mauna Loa Observatory (Barron, 1990). Levels of CO\(_2\) have risen primarily due to increased industrial activity.

**Table 4.** Summary of mean monthly variations in temperature, salinity, and dissolved gases in waters off Rodriguez Bank in Florida Bay, Florida (Ginsburg, 1974). Concentrations of dissolved gases are highest in winter when temperatures and salinities are lowest.

**Word Processing and Keeping Ahead of Schedule.** - It should be obvious that writing this paper involves taking the same material through several drafts, each time editing and adding material. It is so much easier to go through this process on a word-processor that you should seriously consider learning how to use one if you do not know already. If you keep ahead of schedule, you should be able to get access to the computer labs on campus: usually they are jammed only in the final ten days or so of the quarter. As a word of caution (and from painful experience), when using computers, always back up your term paper on a second computer diskette, and save your text often while typing at the computer.

**PLAGIARISM, PARAPHRASING, AND REFERENCING.** - There is a persistent problem with plagiarized papers in this University and in most others—papers from old fraternity files, papers copied more or less word for word from magazines, papers that have been purchased. Please protect yourself from any hint of plagiarism, because it is serious academic misconduct exactly equivalent to cheating in an exam. It means that a student is trying to get credit he or she didn’t earn. There is no excuse for deliberate plagiarism: it has ruined the professional careers of a few scientists and authors.

To avoid plagiarism without having to use and reference entire blocks of quoted text (something to avoid like the plague in scientific papers), you paraphrase, which simply means that you write something in your own words, and then you reference the author. This does not mean that you simply change a word or two (which, by the way, is very obvious). Paraphrasing involves using the ideas of an author, not his or her words! To avoid unconscious plagiarism, it may help to read a passage from a reference, wait a minute or two, and then write the ideas in your words. This way, your short-term memory has most likely forgotten the exact wording of the author. Two other ways to avoid plagiarism used by working scientists in their everyday research are to: 1) Always keep your working notes, and rough drafts. This way, you can show how your paper evolved from the first crude efforts to the final polished production. 2) Don’t sit down and copy material direct from your sources. Put it into your own words as you read it. This makes sure you understand it, and also prevents you from accidentally including long sections of someone else’s words in your paper.

Common Question: “If I have to reference every idea that is not my own, won’t I have a reference after about every sentence?” Yes! You must give others credit for their findings and ideas, and the references could get that thick, especially when you introduce a new subject. However, once you have stated the source of a specific idea, you are...
free to build upon that idea without repeating the reference. Do not list references at the end of a paragraph; list them at the end of the sentence.

Referencing in the Text (Formats) - References in the text are abbreviated versions of the full references found in the References Cited section in the back of the paper (discussed earlier). Text references include the author and year of publication, all enclosed within parentheses. If a reference has three or more authors, use “et al.” (Latin for “and others”) for the names of authors after the first. References occur before punctuation at the end of a sentence. Below are examples of the formats you will use in referencing within the text (using the reference examples discussed earlier):

... is influenced by phytoplankton productivity (Arthur et al., 1983).
... the water column is well-mixed during the winter (Colton and Stoddard, 1973).
... lower maximum values occur in shells from deeper waters (Fairbanks et al., 1992).
... winds displace the upper 40-78 m of Gulf waters (Fleming, 1939).
... the direction and degree of carbon isotopic fractionation vary (Galimov, 1985).
... salt diapirs are common along the Gulf Coast (Sorre, pers. comm., 1990).

If there is more than one reference for an idea, the references are strung together from oldest to most recent, separated by semicolons:

... blah blah blah (Fleming, 1939; Arthur et al., 1983; Galimov, 1985).

WRITING STYLE

There are several writing styles for papers on scientific topics. Use a technical writing style which gives you the authority as the author. Avoid the popular science writing style (as found in Newsweek or Time), which uses quotations from scientists to give authenticity for informative and explanatory narration, and the journalistic writing style (newspapers), which gives important facts and numbers, then personalizes their meaning for the reader, often in an over-simplified or over-dramatized way (sensationalization!?).

Papers in technical journals such as Nature or Science provide good models for a technical style. Because you will be citing references in the text, your paper is more technical than Scientific American or the textbook, so these are not as good models. Several points to keep in mind include: 1) Give information as an outside observer rather than in the first person. For example, "Many of the world's richest fisheries are found in regions of oceanographic upwelling (ref)." is a strong sentence, but "I heard in lecture that many of the world's richest fisheries..." gives a vague and unauthoritative impression. 2) Be literal and quantitative (give the number values of features you wish to describe, where applicable, and provide references). For example, "Fish harvests increased from 8 to 10 million tons from 1985 to 1987 (ref), whereas the cod population decreased 47% during the same interval (ref)." provides specific, quantitative information that is more useful than "Fish harvests increased and fish populations decreased over the years (ref)." 3) Do not stray from your subject when writing. For example, if you are supposed to be writing about the conservation of manatees and you launch into an extended discussion about their digestive system, that would be "straying." 4) Address your paper to a well-read adult reader who is interested in science and
who wants to learn more detail about your topic than that provided in your textbook. 5) Do not use contractions when you write a scientific paper, because it sounds too informal.

**Active Versus Passive Voice** - Good scientific writers use the active voice as often as possible. In the active voice, the subject of a sentence does something, rather than having something done to it (the passive voice). For example:

Active (good): “Currents and waves affect the geometry of shell deposits.”

Passive (bad): “The geometry of shell deposits is affected by currents and waves.”

**Proof Read** - Make sure you proofread your paper well, and try to persuade a friend to act as a constructive critic who will read your paper and tell you what is good and bad about it! This catches errors that could run all the way from small ones (spelling mistakes) to medium ones (problems with sentence structure) to really big ones (you haven’t really written about your subject, or you have it in the wrong order). The primary goal of a scientific paper is to convey information clearly, effectively, and logically. If your sentences don’t make sense to you (or your roommate, or whomever), then they won’t make sense to the scientific community – or your TA!

UCD has excellent resources that can help you with your writing in a group or one-on-one atmosphere. Everyone can always improve their writing, so it would be worth your time to check out the Learning Skills Center in South Hall. Give the LSC a call at 752-2013 for more information.