

HINTS ON WRITING TERM PAPERS AND PREPARING SEMINARS

C. William Birky, Jr.

I. READING, THINKING AND WRITING

1. **Topic Selections.** The most important consideration for selecting a topic is that it should be interesting to you, the author; if it is the project will be easy and pleasant; if not, it will be dull hard work.
2. **Getting started.** The first step is to obtain a few recent references, preferably including a review article, to provide a toe-hold in the literature. Read these carefully, and think about them.
3. You should try to accumulate as complete a reference list as possible. Each paper will lead you to others; don't stop until you have every reference likely to be pertinent. For the most recent papers, you can:
 - Use the research services of the library, e.g. the CD ROM databases, Current Contents.
 - Get references from faculty and students likely to be familiar with the topic.
 - Go through the tables of contents of the journals likely to have papers on the subject, covering unbound volumes and the last year or two of bound volumes.
4. At every step, think about the paper you are reading and about the topic as a whole. Don't wait for inspiration to strike; it won't unless you are actively and intensively thinking. A good plan is to totally immerse yourself in the topic for a period of a couple of days, thinking about it whenever time permits (e.g. in the shower, while eating, walking to class). Then concentrate on other things for a while when it appears that no new understanding or ideas are coming through. Repeat this cycle several times. Periodically organize your thoughts and knowledge by writing simple outlines of questions and answers, concepts, etc. in a logical sequence.
5. You are expected to become a real authority on the subject, so be thorough. Be sure you understand all concepts, theories, experiments, and techniques. To avoid being unable to see the forest for the trees, try to mentally "step aside" from time to time and view your topic, or the particular paper you are reading at the moment, from a broad perspective. Ask yourself what is really important to the topic.
6. Be critical. Look for flaws in experimental design; for gaps in the evidence upon which crucial concepts are based; and for flaws in logic. When the author of a paper says his evidence favors hypothesis A over hypothesis B, always ask yourself what other possible hypotheses have been overlooked.
7. Look for connections with other related problems or phenomena with which you are familiar.
8. When you think you are ready to write, the following procedure is suggested. Note that it requires at least a week, and preferably two.

(1) Write a broad topic outline. Make sure all important points are covered, and in a logical order. Revise this, then discuss it with your advisor.

(2) Write a very detailed outline, perhaps including some actual sentences, and covering all points, major and minor. Think about it and revise it.

(3) Write a rough draft. The outline may have to be revised again. Think about it and revise it. Then put it aside and forget it for several days. Return to it fresh, think about it and revise it again. Show it to your adviser if possible.

(4) Write the final draft. Proof-read it carefully.

9. Some hints for the writing.

(1) Adopt a consistent format; the *AIBS Style Manual for Biological Authors* can be used as authority on format, and also contains many useful suggestions about how to write clearly. Also read *Elements of Style* by Strunk and White, a superb little pocket book that can help your writing immensely. Have *Roget's Thesaurus* handy. Read papers or books written by good scientists who are also good writers, such as Edward O. Wilson.

(2) Identify your audience. Ask what they know, and never, never overestimate their background knowledge! One of the most common mistakes is to assume that the readers or listeners know more than they actually do; it is better to explain too much than not enough. If you have done your work properly, you know more than almost anyone about this subject.

(3) Your paper should begin with an introduction which states the problem, shows why it is important and interesting to biologists or geneticists in general, and briefly states the important points and conclusions which will be made. This will help the reader follow the argument in the rest of the paper, for he/she will know "where you are coming from" and "where you are going". The paper should conclude with another brief summary of important points. It should also include important questions which remain unanswered and ideas for future experiments to answer those questions.

(4) Consider every sentence and paragraph carefully from the viewpoint of the ignorant reader. Does the sentence say exactly what you intend it to say? Writing that is not crystal-clear usually indicates unclear thinking on your part, and will be judged accordingly.

(5) Experiments should be described in just sufficient detail to support the conclusions you are drawing from them. Don't reproduce original figures or tables except when necessary; don't reproduce more data than essential (in most cases use a few typical data, not all). Never quote sentences unless they are exceptionally clever or profound (which almost never happens in scientific literature), or unless it is a key sentence which is ambiguous. Distinguish carefully between the authors' observations and their speculations. Distinguish between your own ideas or interpretations and those in the literature.

II. THE MECHANICS OF GIVING A SEMINAR

Outline

1. The usual kind of outline is shown below. An old adage for speakers on any subject is that you should "Tell 'em what you're gonna tell 'em; tell 'em; and tell 'em what you told 'em."

I. Introduction

A. Context

B. Essential background information

C. Brief summary of important methods and results ("Tell 'em what you're gonna tell 'em"). This is a kind of preview that helps the audience watch for important things in the talk and evaluate the project as you go along.)

II. Methods and results ("Tell 'em").

III. Discussion

IV. Summary ("Tell 'em what you told 'em"). Include only the main point(s) that you want to be sure that they remember.

2. It is okay to have a slide giving the outline of your talk, but it shouldn't name the parts as in the above outline; instead it should say what is in each part.

3. If you are reporting on more than one project, or more than one basic kind of experiment, give the methods, results, and perhaps a brief discussion, for the first project or kind of experiment, then do the same for the second, etc.. Don't give all the methods, then all the results, because one listener won't remember them or will get them confused when you finally to the discussion.

4. The hardest part is figuring out how much detail to give. There are two general rules: First, most of your listeners know much, much less about the subject than you think they do. Second, most of your listeners don't want to know any more about the subject than they have to in order to understand what your are doing and evaluate it.

How can you follow these apparently contradictory rules, walking the fine line between talking way over the audience's heads and insulting their intelligence? Here are two suggestions:

(1) If there is something that you think that some members of your audience might not know, but that they all have to know in order to follow your presentation, you can bring the listeners up to speed without insulting them by saying things like "Let me remind you that ..." or "Now recall that ...".

(2) Work backward: decide what conclusions you want everyone to understand and remember, then consider what is minimum information they need to understand the experiments, and finally what background information they need to understand why it was done.

5. You may be firmly convinced that identifying all the sequences needed for transcription control of a heat shock protein gene in the Honduran sidenecked turtle is the most important research project in the world, but the only people in your audience who think so are your major professor and one or two grad students from the same lab. Everyone else thinks that their project is so much more interesting and important that you would be working on it, if you had any sense at all. You have to convince them that your project is at least worth listening to, and you have to do this in the first five minutes of your talk; after that it's too late. Remember, part of the problem is that none of them know what a sidenecked turtle is, and some don't know what a heat shock protein is or what it does, and some don't know what Honduras is.

Preparing Slides

1. The most common problem with slides is to include too much information. A cynical view is that no slide should have more than a half-dozen numbers in a table or a half-dozen parts in one figure. It's OK to show slides giving all your data (e.g. an entire sequence) to impress your audience, but after that you should show only representative data and summary information (e.g. summary statistics) to make your point. It is even better to just say how many kilobases of DNA you sequenced or how many times you did an experiment, then show the representative data and summarize the results.

2. Make sure everything on the slide is legible. If it isn't, make it bigger. If you don't think that something needs to be clearly legible, then it shouldn't be there at all; remove it. Don't get carried away with colors; no dark red lines on a light red background. Some people find white or colored letters on a black background to be extremely annoying. Avoid using red and green to distinguish lettering or parts in a figure, because red-green colorblindness is fairly common.

3. All slides that have data or text or diagrams should be clearly legible with most or all of the lights on. About the only kind of slide that has to be shown with lights off are some photomicrographs requiring very high resolution or involving fluorescent dyes. If you have to turn the lights off for more than one or two slides at a time, some of your audience will go to sleep (joining those who are already dozing). If you have the lights off all the time, all of your audience will go to sleep. Remember that you want your audience to take notes, and they can't do so when the lights are off.

Practice Makes Perfect (or at least, it helps)

1. Check the timing of your seminar by saying it out loud to yourself, with slides.

2. Practice giving your seminar to a friendly but knowledgeable audience consisting of your faculty advisor and several students. If possible, practice at least part of the seminar in the room where it will be presented, with a friend sitting in the back to see if your slides are legible and your voice is intelligible.

Presenting the Seminar

1. Don't read your seminar. It is OK to write it out word-for-word, but by the time you deliver it you should know it so well that you can deliver it with only an occasional glance at your notes to make sure you don't leave anything out. Also if you do write it out in detail, make sure that you write as if you were speaking, not as if you were writing.
2. You are talking too fast ... s l o w d o w n .
3. You are talking too softly . . . **project your voice to the back of the room.** Actors and orators do this without sounding as if they are shouting by lowering the pitch of their voice slightly (when we shout, the pitch usually rises and we sound strident).
4. Audience contact is essential. You should look directly at each person in your audience several times during your talk. Make yourself look all around the room. Talk to the audience, not to the screen (which can't hear you).
5. Move around. If you always stand on one side of the screen, the audience will get a one-sided impression of you, and you will only look at half of them.
6. Take a pointer with you; a good laser pointer is a good investment. There may not be one and you will end up using your finger.
7. Take a cup of water or something else to drink during your seminar (non-alcoholic if you don't want to make a spectacle of yourself!).
8. Arrive early for the seminar to give yourself a chance to relax and get used to the surroundings. Familiarize yourself with the equipment (light switches, etc.).

Answering Questions (and Criticisms)

1. Be confident. If you have done your preparation well, you know more about the subject than anyone else. Most "mistakes" you make will be minor and noticed only by you, because you are the only one who knows exactly what you intended to say.
2. No b---s---! If you don't know the answer to a question, just say so and move on. The worst thing you can do is try to fake it. If you don't know the answer but can make an educated guess, do so but say that it is an educated guess.
3. When a question is asked, repeat it to the audience. This ensures that the audience will hear it (remember the people asking the question are facing you and people behind can't hear them). Equally important, it ensures that you understand the question and gives you a chance to think before you answer.

Finally, try to enjoy yourself. If telling other people about your wonderful research isn't almost as much fun as sex, you are in the wrong profession!