Bio 181 Lab Notebooks

A significant part of your grade will be based on your Laboratory Notebook. Each student is expected to diligently maintain an up-to-date lab notebook.

In "real" laboratory science, the lab notebook serves several purposes.

1. An accurate record of experimental details allows experiments to be replicated, or altered in a controlled way.
2. Results are collected, stored, organized, labeled, etc. in one location, alongside procedural details.
3. The scientist's thinking process (purpose, conclusion) is clearly summarized.
4. Fraud (either accidental or intentional) is minimized by using a bound notebook, permanent ink, and clearly dated entries.

Your notebook should do these things as well. Here's how:

- Use a bound or spiral notebook and blue or black ink (no pencils). Do not erase or white-out errors. For this course, if you wish to use a word processor for purpose or discussion sections, you may tape the printout into the notebook.
- Number ALL pages
- Leave about 3 pages blank at the beginning for your Table of Contents
- **DATE** all entries.
- Do not tear out or add pages. Blank pages should be blocked out with a big "X".
- Use TITLE—PURPOSE—PROCEDURE—RESULTS—DISCUSSION format.

Title: Give the experiment a title.

Purpose should be a concise statement, *in your own words*, of what the goal of the experiment is. This should NOT be a "learning objective", but rather a summary of what type of data or molecular construct the experiment is expected to produce.

Procedure section should be in *outline form*. Here you describe step by step what you did so that a year from now you could return to this page and repeat the experiment exactly the same way. **Include key experimental details *as the experiment was performed,* not just how you are told to do it in the textbook (i.e., actual incubation times, running voltages).** The lab manual is a record of actual work, not the instructions you were given. This means you need to *keep up to date* with your notebook. It is inappropriate and usually inaccurate to just go back and write down whatever the textbook says, or what you *think* you remember. Always include DNA concentrations (if known), not just volumes.

Results section should include all data gathered in the experiment. In this class, much of the data will be visual (such as photographs of gels). Such images should be taped into the lab notebook and thoroughly labeled: what sample is in each lane, DNA fragment sizes, etc. If results are delayed until a following experiment, make a note of it.

Discussion section is perhaps the most important, and requires the most mental effort. Here, the results should be *interpreted* or explained. For example, what does it mean that you see 3 bands in lane 2? You should present your conclusions as related to the purpose of the experiment, and the

results obtained. Offer possible explanations for any deviation from predicted results, and for any experimental error (such as failure of ethidium bromide to stain gel, or incorrect sample loading). Identify the various kinds of controls that were performed, explain the meaning of their results, and how they help you evaluate your "experimental" results. IN THIS SECTION, interpret the "big picture". **Lab notebook grades will be based largely on your results and discussion sections, and how successfully you demonstrate a clear understanding of the work performed.** This is also the stuff that exam questions are made of.

If it makes sense for a particular experiment, you may combine results & discussion sections.

Do not take lecture notes in your lab notebook. Use a different notebook.

DO NOT LET YOURSELF FALL BEHIND with the lab notebook. You will soon lose track of which experiment is which as many experiments overlap over several days.

The lab notebook: Advanced guidelines

{Read this after the first week or two of class}

A lab manual's procedure section should reflect a judicious compromise between detail adequate to allow replication of the work, and detail so excessive that the essence of the matter is lost. For example, after the first lab or two at the most, you can drop elaborate descriptions of casting a gel, loading and operating an electrophoresis apparatus. The only details of importance are agarose % and voltage used. (Naturally if you deviate from your convention in some significant way, that should be noted.) The choice of what to say, and what not to say, will necessarily reflect your familiarity with the procedures involved. For a graduate student who has performed hundreds of plasmid minipreps, a procedural description may require nothing more than "Overnight cultures were miniprepped." **To maximize the clarity of your procedure section you should therefore describe the essential steps, eliminate the obvious or repetitive, and ALWAYS note variables that may change each time (such as incubation times).** To do this successfully requires as much intelligence as writing the discussion.

Photocopies of procedural details from the text are appropriate if done SELECTIVELY (see above). A better choice probably is to write your procedure on a word processor and print that out to paste in your notebook.

When possible, indicate DNA <u>concentrations</u> in addition to volumes. This is essential for calculating transformation efficiency, or any other analysis for which you need to know weight of DNA.

For first EtBr gel stain, state EtBr concentration and staining time. If conditions unchanged, need not repeat this in lab notebook.

For restriction digests of any kind, whenever possible **draw** a simple restriction map of the DNA and list <u>predicted</u> fragment sizes. If <u>observed</u> sizes are different, note this in results, and explain in discussion. THIS WILL BE ESPECIALLY IMPORTANT as the experiments become more complicated. Likewise, any ligation experiment must include a sketch or other clear description of the exact DNA fragments involved, and *all possible products of ligation.*

<u>Always</u> label all lanes of a gel. Be sure to indicate what DNA size marker/ladder was used, and somewhere in your notebook (or beside each gel), <u>list its band sizes</u>.

For results, show gel and translate that visual data into concrete statements, i.e., "Lane 3 shows uncut supercoiled, linear, nicked circular, and multimeric forms of plasmid; EcoRI digestion of same DNA in lane 4 shows appearance of predicted 800 bp & 2.2 kb bands. Disappearance of all other forms indicates endonuclease digestion was complete." IN THIS SECTION, be specific and detailed.