How to Keep a Laboratory Notebook

Record books are theproperty of the laboratory, where they form a "library of experiments" (just as an accountant's records belong to the corporation and should be intelligible to any other accountant). The system recommended here is a proven one, borrowed in part from that used in O. H. Lowry's laboratory. The general features of the system are described below.

1. Each record book has a unique number, which is issued chronologically.

2. When a notebook is filled, it is placed in the record library, which is located in the laboratory and accessible to all researchers.

3. The first pages of each book are reserved for a table of contents.

4. The right-hand pages are used to record protocol, solution preparation, and results--that is, a log of laboratory activity.

5. The left-hand pages are for planning and interpretation. There it is appropriate to summarize a previous experiment (e.g., with a graph and a short statement), to outline the next experiment, to make a note of literature citations, to record calculations, etc.

6. Solution preparation should be recorded in a standardized manner, thus:

$$\underline{\text{1 M Tris(base)}} \qquad \frac{\sout{121.1}}{118.6}\ \text{g Tris(base)} \qquad \Sigma\ \text{91F-5002 qs}\ \frac{\sout{1000}}{979}\ \text{ml}\ H_2O$$

The above notation indicates the nominal concentration in the left margin. The supplier (Sigma) and lot number (91F-5002) are also recorded. (There are often significant differences in purity and impact of contaminants among suppliers and lots.) It is calculated that a 1 M solution would contain 121.1 g of tris(base) per liter of solution. However, the researcher only weighs out *approximately* 121.1g; to weight out exactly 121.1 g is inefficient. The lower numbers record the *precise* quantity weighed out and the final volume, adjusted accordingly. The bottle is labelled with the solution and concentration and the book and page numbers of the records documenting the preparation. A solution or reagent derived from this stock would be recorded as shown on the following page.

100 mM Tris-Cl	10 ml l M Tris(base) 57/173
(pH 8.1)	+ 0.2 ml 12 N HCl Mall KJAL
	qs 100 ml H_2O
	electrode pH = 7.9

"57/173" indicates the book and page number documenting preparation of the 1 M tris(base). Ingredients are added in order. The checks (√) are made as the ingredients are added.

Generally, solution concentrations are nominal. First, some reagents age (e.g., many enzymes lose activity during storage). Second, chemicals often are not supplied at absolute purity, and some inaccuracy accrues from imprecision in mass and volume measurements. Third, many solutions are required in small amounts and are expensive. For example, 100 ml of 10 mM (+)abscisic acid could be prepared accurately, but would cost more than US$100,000! On the other hand, the required amount, say 0.25 ml, is difficult to prepare. A compromise is to make the solution, not by diluting to a final volume, but the *adding* a certain volume of diluent, accounting in an approximate way for volume displacement by the solute, thus:

100 mM (+)ABA	6.6 mg (+)ABA Supplier, Lot number
	+0.246 ml diluent

The total volume of this solution is approximately 0.25 ml, as 1 g ABA displaces about 0.6 ml of diluent.

In some cases, it is desirable to know precisely the concentration of reagent, even when the solution has necessarily been prepared imprecisely. Usually, the concentration is easy to measure. Thus, the original solution may be labelled 100 mM (+)ABA 57/175; after an accurate determination of the exact concentration (“standardized”), it is relabelled 97.4 mM (STD) (+)ABA 57/179.

7. Protocols should be written out in advance of their execution and some system must be used to ensure they are followed, especially when time is of the essence. There are two
simple ways to establish fidelity. The method **required** in this course is to place a check by each task as it is accomplished. A statement such as “expt like pg 10” wholly **inadequate**. A second method is to accumulate "waste" (e.g., after a pipette is used, it can be set aside, in sequence, at the edge of the work area). A typical protocol can be recorded as shown on the following page.

13 June 1996

Expt.: A_{340}/ time, + PGA, + extract (= PGal DH)

t_0	To Tubes 1-4, + 3 ml Assay Cocktail 57/128			
t_4 (at 0.3 minute intervals)	To Tubes 1,2, + 30 µl extract-1 57/128			
	To Tubes 3,4, + 30 µl extract-2 57/128			
A_{340} of Tubes	1	2	3	4
t_6 (at 0.3 minute intervals)	0.77	0.78	0.77	0.79
t_8	0.77	0.77	0.77	0.78
t_{10}	0.76	0.77	0.76	0.78
t_{12} (at 0.3 minute intervals)	To Tubes 1,3, + 30 µl 200 mM PGA 57/114			
A_{340} of Tubes	1	2	3	4
t_{14} (at 0.3 minute intervals)	0.74	0.77	0.75	0.78
t_{16}	0.72	0.77	0.73	0.78

..... (etc.)

Even now, your experiment is **NOT** over! Analyze your data. Plot it. Discuss your interpretation with the TA. Plan your next experiment. Discuss your plan with the TA. Write out your protocol for the next experiment. Discuss it with the TA. Remember that no observation is reliable until it has been repeated.