Laboratory Notebooks

Biochemistry Boot Camp 2023
Session #10
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Overview

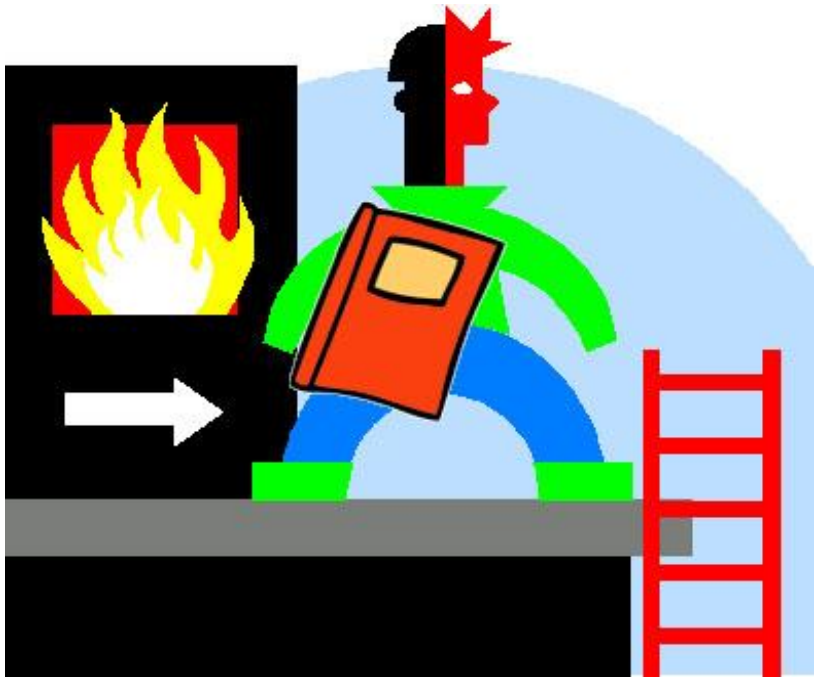
- What is a Lab Notebook?
- What to include in Notebook?
- How to maintain a good Notebook?
- Entry Examples

What is a Lab Notebook?

- Primary record of research
- Contains - procedures, reagents, data, and thoughts to pass on to other researchers
  - Why experiments were initiated, how performed, and results, comments
  - Place to compile data/charts/photos/ideas
  - Place of clues, to troubleshoot problems
  - Place to observe whole picture and think
  - Legal document, to prove patents
  - Defense against accusations of fraud or lawsuits

How important?

Very- Often has all original data in it…



Wh

- Table c
- Title of
- Experi
  - Proc
    wha
- Print out of
  - Gels, Grap
- Protocols ar
- Conclusion

Calculations: Example 1

- Making 100 mL of 200 mM NaCl (1.17 g), 20 mM HEPES pH 7.3 (2 mL), 10% (w/v) Glycerol (10g)

- Making 100 mL of: 200 mM NaCl

$$\frac{100\ \cancel{mL}}{} \left| \frac{1\ \cancel{L}}{1000\ \cancel{mL}} \right| \frac{0.2\ \cancel{mol}}{1\ \cancel{L}} \left| \frac{58.44\ g}{1\ \cancel{mol}} \right| = 1.17\ g$$

Calculations: Example 2

- 100 mL of 20 mM HEPES pH 7.3 (from 1 M Stock):

$C_1 V_1 = C_2 V_2$

(100 mL) * (20 mM) = (x mL) * (1000 mM)

x = 2 mL

Maintenance and Ethics

- All data goes into the lab notebook
  - “Good” and “Bad” results
  - Failed or contradictory experiments
- No pages come out of the lab notebook
  - Even if there are mistakes or spills on the page
  - Don’t skip pages
  - Cross out any unused parts of the page
- Correct mistakes
- Honesty is essential

*Information taken from NIH:
https://www.training.nih.gov/assets/Lab_Notebook_508_(new).pdf

Correcting Mistakes in Notebook

- Bad

[redacted] a [redacted]

Misread the 260 value. A_{280} is 0.531, or 123 uM.

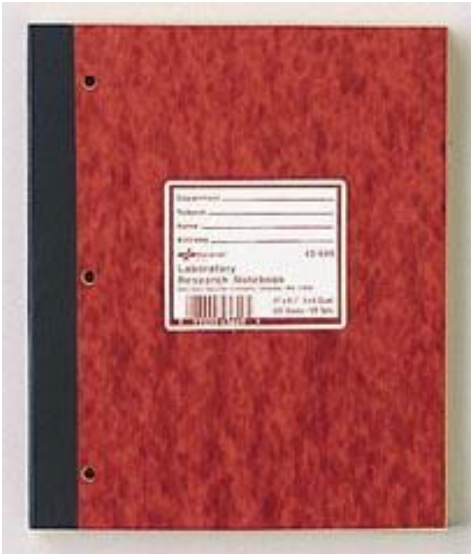
- Good

~~I measured the UV absorbance at 280 nm to be 0.325,~~ a ~~concentration of 75.0 uM.~~ RH 06/01/18

Misread the 260 value. A_{280} is 0.531, or 123 uM.

Characteristics of a Good "Paper" Notebook

- Paper:
  - Large- >= 8.5x11 at least
  - Bound (stitched) pages to ensure integrity
  - Numbered pages
  - White gridded
  - Acid free paper
  - Duplicate pages



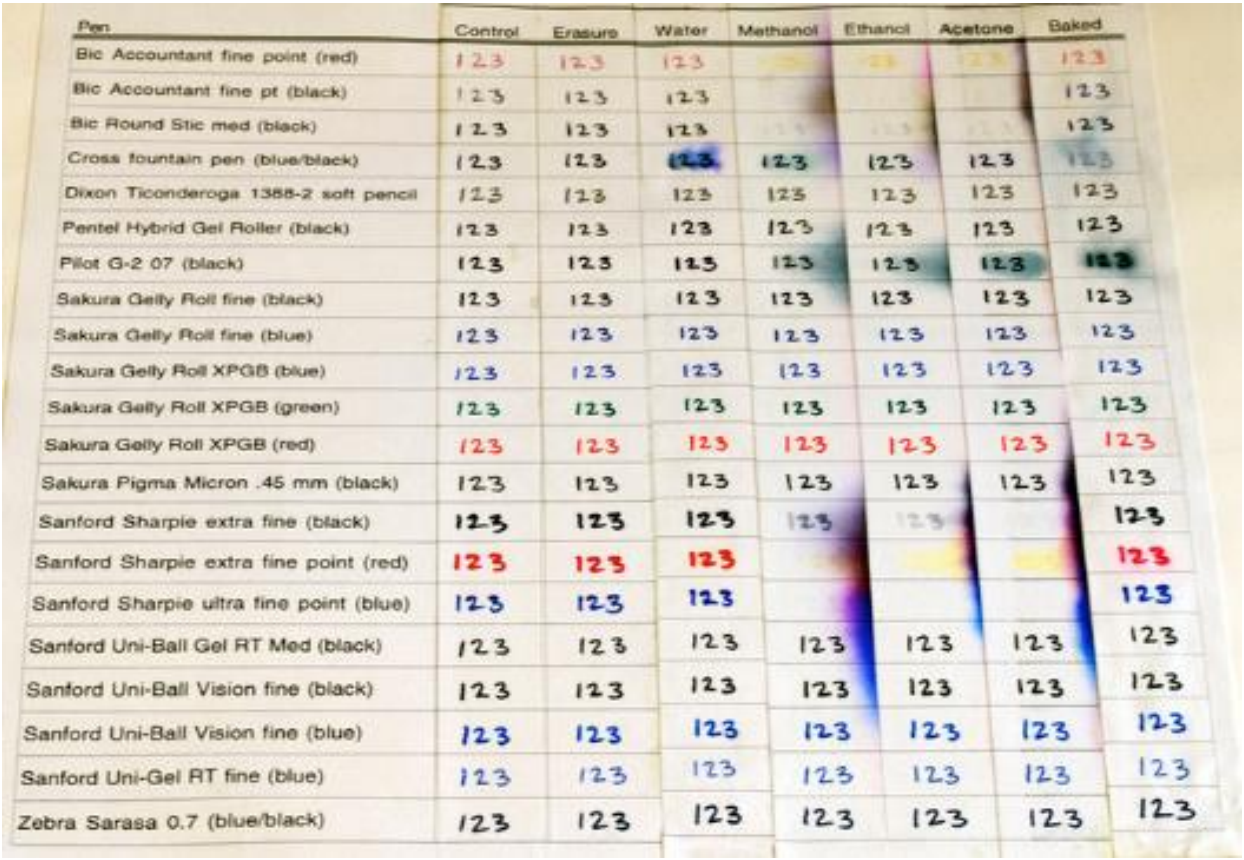
Recording the Data

- Directly into notebook in black or blue ink
  - Make sure you choose an appropriate pen to document results – many bleed when exposed to water or common solvents
- Make entries only in ruled areas of the numbered pages
- Unnumbered pages not to be used
- Attach supporting data

Pen Test

Pens Tested:

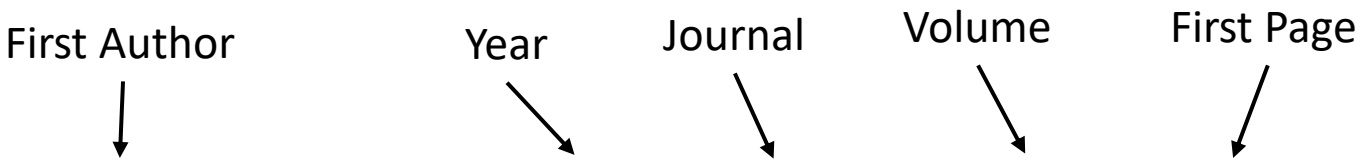
1. Control
2. Erasing
3. Water
4. Methanol
5. Ethanol
6. Acetone
7. Baking



Pen	Control	Erasure	Water	Methanol	Ethanol	Acetone	Baked
Bic Accountant fine point (red)	123	123	123				123
Bic Accountant fine pt (black)	123	123	123				123
Bic Round Stic med (black)	123	123	123				123
Cross fountain pen (blue/black)	123	123	123	123	123	123	123
Dixon Ticonderoga 1388-2 soft pencil	123	123	123	123	123	123	123
Pentel Hybrid Gel Roller (black)	123	123	123	123	123	123	123
Pilot G-2 07 (black)	123	123	123	123	123	123	123
Sakura Gelly Roll fine (black)	123	123	123	123	123	123	123
Sakura Gelly Roll fine (blue)	123	123	123	123	123	123	123
Sakura Gelly Roll XPGB (blue)	123	123	123	123	123	123	123
Sakura Gelly Roll XPGB (green)	123	123	123	123	123	123	123
Sakura Gelly Roll XPGB (red)	123	123	123	123	123	123	123
Sakura Pigma Micron .45 mm (black)	123	123	123	123	123	123	123
Sanford Sharpie extra fine (black)	123	123	123	123			123
Sanford Sharpie extra fine point (red)	123	123	123				123
Sanford Sharpie ultra fine point (blue)	123	123	123				123
Sanford Uni-Ball Gel RT Med (black)	123	123	123	123	123	123	123
Sanford Uni-Ball Vision fine (black)	123	123	123	123	123	123	123
Sanford Uni-Ball Vision fine (blue)	123	123	123	123	123	123	123
Sanford Uni-Gel RT fine (blue)	123	123	123	123	123	123	123
Zebra Sarasa 0.7 (blue/black)	123	123	123	123	123	123	123

Pen Test Done by Colin Purrington:
http://photography.colinpurrington.com/lab-notebook/h636c797b#h636c797b

Journal References



- Some information from the paper that pertains to your research
- Concentration of solutions, equilibrium constants, mechanisms, etc.

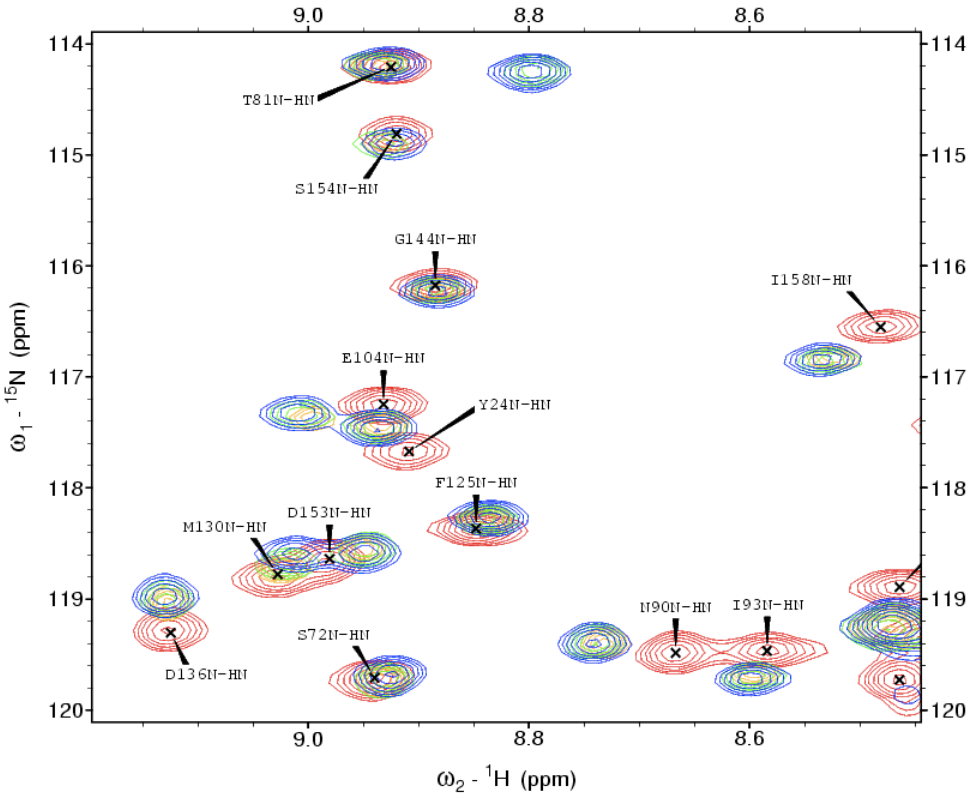
Who Owns the Notebook

- It Depends:
  - Your research adviser
  - The university
  - The company you work for
  - Generally, not you!

- This means your notebook must stay in the lab
- In most academic settings, making photocopies of the pages are okay and encouraged (but not in industry!)

Handling Complex Digital Data

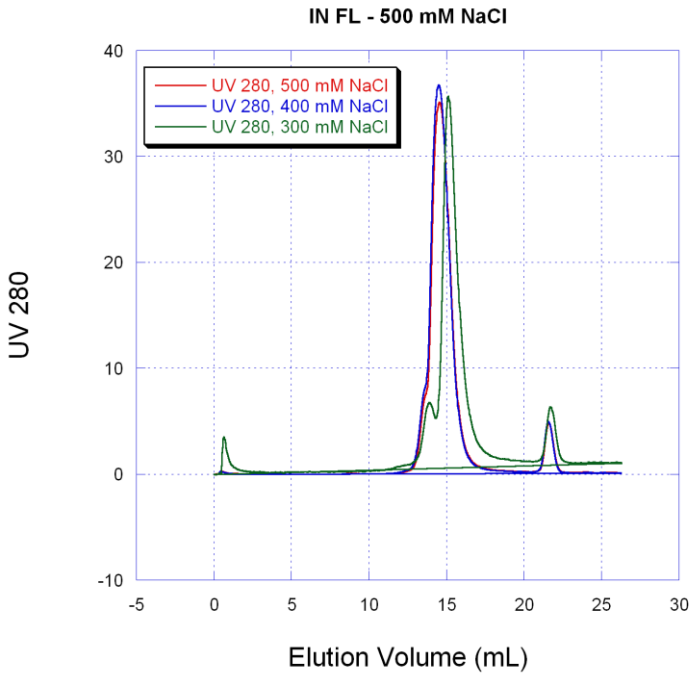
- A printout of typical data should be saved
- Emphasize important points
- Always note where original data can be found



Cross Referencing: Example

- Use text like this:

Chromatogram data is stored on FPLC PC with filename “20100315 Size Exclusion.dat” in the “Smith data” directory. Details given on pg. 65. I collected fractions C1-C5 for further study. A_{280} trace is pasted at right.



Think and Discuss

- In what ways do you benefit by keeping a good lab notebook?

- In what ways do others benefit?

Our Lab's Current Policy

- When a paper is submitted a shared directory is created (on Dropbox) containing these subdirectories:
  1. Manuscript files (Word document)
  2. Figures (one directory per figure)
  3. EndNote library and styles, etc. (see last session!)
  4. Original data directory

- Original data does not contain NMR spectra (yet), but it does contain:
  1. Graphpad/Origin/Excel files for calculations
  2. Original chromatography data
  3. Raw data files for instruments (e.g. fluorimeter data, CD, DLS)
  4. PDF scans of any important calculations/lab notebook sections

- More journals are *requiring* raw data to be available for publication

Your Lab Needs a Backup

- More data is digital than ever before; what happens if your computer is stolen or breaks?

- **Recommendation:** Pay for a Dropbox account and sync *all* your data (and all your personal files) there
  - Dropbox is secure, and it will keep backups for you
  - Data sync'ing happens automatically and requires no effort from you
  - If data is sync'ed a broken computer is no worry (and you can share across multiple computers)

- *In addition*, store your data on a common lab server (that should also be backed up)
  - You will not always be in the lab, your data should not disappear when you do!

Example Notebook

- Download and examine the example notebook from the boot camp website
- These entries cover a very typical protein expression and purification, including characterization
- Let’s take a look…

Summary

- Reasons for keeping a good lab notebook:

- Convenience
  - Know what you did
  - Keep data in one place
  - Continuity between members
- Catastrophe
  - Fraud
  - Professional work ethic
  - Evidence for patent lawyers