Keeping a Lab Notebook

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Take Home Message

A lab notebook is a tool for effective research, not an end.
Overview

- Why Keep a Notebook?
- Types of Notebooks
- Organization
- Notebook Management
Reasons for Keeping a Notebook

• Record original intent
• Preserve data and observations
• Assist others with understanding and reproducing your observations
• Support intellectual property claims
• Defend against false allegations of research misconduct
• Prime source for writing a dissertation or paper
Types of Notebooks

- Bound notebook
- Loose-leaf notebook
- Electronic notebook
  - Lab Track
  - Live Scribe
# Pens

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<th>Water</th>
<th>Methanol</th>
<th>Ethanol</th>
<th>Acetone</th>
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[http://www.swarthmore.edu/NatSci/cpurrin1/notebookadvice.htm](http://www.swarthmore.edu/NatSci/cpurrin1/notebookadvice.htm)
Bound Notebook

• Pages are sewn or glued together
• Advantages
  – Portable
  – Simple set-up
  – Common
Bound Notebook

• Disadvantages
  – Not easily searchable
  – Requires reference to other data
  – Difficult to duplicate
  – Requires legible handwriting
Loose-leaf Notebook

• “Three Ring Binder”
• Advantages
  – Pre-formatted data sheets.
  – Allows primary data to be kept adjacent to experimental entries
Loose-leaf Notebook

• Disadvantages
  – Not easily searchable
  – Easier, but still difficult to duplicate
  – Requires legible handwriting
  – Pages may “fall out”
Electronic Notebook

http://medblog.stanford.edu/lane-faq/archives/2008/06/class-electroni-1.html
Electronic Notebook

- Computer program or computer record – Live Track
- Pen capture – Live Scribe
- Advantages
  - Searchable
  - Legible
  - If appropriately backed up, cannot be misplaced, lost, or accidentally destroyed
  - Easier to incorporate computer files
  - Enormous amounts of data can be stored in a small space
  - Security
  - Uniform system
  - Can be shared by a group
  - Can be accessed remotely
Electronic Notebook

• Disadvantages
  – Requires encrypted laptop for easy portability
  – Theft or damage
  – Transcription error
  – Data can be lost if not backed up
  – Data may become inaccessible due to “upgrades”
  – “Cut and Paste” protocols
Organization

- Front section
- Body
Organization
Front Section

• Front section
  – Notebook name (GLC001)
  – Preface
    • Name, affiliation, co-workers
    • Goal of the work and any progress to date
    • Location of the work, equipment, samples
    • Funding
  – Table of abbreviations
    • List of abbreviations used
    • Abbreviations for equipment
    • Describe sample labeling
Organization
Front Section

- Front section
  - Table of contents
    - Dates
    - Page numbers
    - Subject

TABLE OF CONTENTS - Analyst Chem 233-2

<table>
<thead>
<tr>
<th>Date</th>
<th>Subject</th>
<th>Page No.</th>
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<td>9 Sept. 1984</td>
<td>Preface</td>
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<td>(Begun 10 Sept.)</td>
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<td>Controlled-potential coulometry</td>
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<td>Summary of Experimental Techniques</td>
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</table>

I Learned this Semester
Exercise

• Take a few minutes
• Describe what you see
Behind every great love is a great story.

The Notebook

Ryan Gosling, James Garner, Sam Shepard
Rachel McAdams, Gena Rowlands, Joan Allen

FROM THE BEST-SELLING NOVEL
Organization

Body

• Write enough detail that another researcher could repeat your work based on your written descriptions and make the same observations.
Observations

- Reagents: source, product number, lot number, expiration date, how stored
- Number and volume in washes
- Cells used: source, passage number
- Centrifuge speeds
- Heating rates and levels of agitation
- Time between and during steps
- Instruments: type, calibration
- Type of water used
- Gel percentages
A Notebook Page

- Written immediately after work was performed
- In English
- Dated (24 June 2010)
- Signed
- Clear, descriptive headings
- Legible and grammatical
- Active voice in the first person
- Indicates who did the work
- Read by a witness, signed and dated
<table>
<thead>
<tr>
<th>SUBJECT</th>
<th>Synthesis of 2-Aminopropyl benzoate</th>
<th>Project anthranilic acid deriv.s.</th>
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<tbody>
<tr>
<td>Purpose</td>
<td>The methyl ester of an ortho-substituted amino acid can be prepared by the method of Brenner &amp; Huber (Helv. Chim. Acta, 35, 1112 (1952)). The purpose of this experiment is to determine if their method is applicable to the synthesis of a propyl ester. The plan is to cool n-propanol to -10°C, add SOCl₂ dropwise, then add anthranilic acid with stirring while maintaining the low temperature. Warming is allowed to proceed slowly, followed by evaporation of the solvent and recrystallization of the product from ethanol/ether. This will produce the HCl salt.</td>
<td></td>
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<tr>
<td>Procedure</td>
<td>(The amounts of reagents used are taken from M.S. Jones; calculations in her notebook #MSJ-3.) I took 16.90 mL (0.223 mol) n-propanol (previously distilled from Mg ribbon), poured into a 200 mL round-bottom 3-neck flask, and chilled to approx. -7°C with an ice/rock salt bath. I added dropwise 2.44 mL of chilled SOCl₂ (0.034 mol), followed by 4.00 g anthranilic acid (0.029 moles, Baker Reag, lot #423177). The milky-colored suspension slowly cleared as I removed the ice bath and the temp warmed up to 30°C.</td>
<td></td>
</tr>
</tbody>
</table>

Recorded by

K. Kanare

12 March 1974

Read and Understood by

F. Salvador

12 March 1974

Related work on pages: apparatus sketch on pg 16.
Body Headings

- Introduction
- Experimental plan
- Observations and data
- Discussion
- Conclusions
Body - Introduction

• Short term goal of the work
• Why is it undertaken?
• What previous work was done?
• Cite the literature
• Why was the approach taken?
• What project the research was part of?
Body – Experimental Design

- Description of the planned experiment
- Who will do the work?
- Work flow
- References to previous work
- Established protocols
- Materials to be used
- Safety
Body – Observations and Data

- Record of observations
- Objective and honest
- Raw data
- Avoid interpretations
- Who did the work?
Body - Discussion

- Reflect on what you did
- Interpreted data
- “Thinking in the notebook”
- Not a restatement of data
Body - Conclusions

• Summary
• Your overall interpretation
• Was the goal achieved?
• Quality of experimental design
• What to do differently?
• The next step
Notebook Management
Electronic Files

• Media used
  – Permanent storage
  – Images
  – Sequences
  – Readouts

• Indexing / Referencing
  – Allocation of space
  – Access / shared folders
  – Clearly labeled storage location
Making Corrections

• Single mark through

2783  2785

• Attaching notes
  – Do not paste over something else
  – Sign and date

Writing the Laboratory Notebook, Kanare, ACS, 1985
Making Corrections – Electronic

- Use software to track changes
- Maintain all electronic copies
- Do not keep only a single file
- Errors that change data interpretation
Other Thoughts

• Do not rip out pages or leave pages blank
• Update established protocols
• Failed experiments
• Multiple notebooks
• Avoid “obvious” or “abandoned”
• Do not take it from the lab
• Block off time to review
Conclusion

• If you didn’t write it down, it didn’t happen
• Keeping notebooks is a developed skill
• Continue to improve
• A tool for better research, not an end in itself