



UNIVERSITY OF  
**LOUISIANA**  
SYSTEM  
FOR YOUR FUTURE. FOR OUR FUTURE.

# BRIDGING THE DIVIDE

## Summer Series

### ***RESEARCH LAB SAFETY***

# **HOW TO KEEP A LAB NOTEBOOK**

---

**Dr. Jean Fotie**

Department of Chemistry and Physics  
Southeastern Louisiana University



## *OVERVIEW*

- Generality of laboratory notebook**
- Selection of laboratory notebook**
- Notebook labelling**
- What should be recorded in the laboratory notebook**
- Who owns the laboratory notebook**
- Laboratory notebook ethics**
- Summary**



## WHAT IS A LAB NOTEBOOK

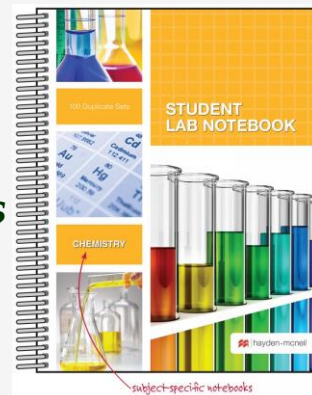
- ❑ *Written record of procedures, reagents, data, calculations, thoughts, explanations, and results of experiments*
- ❑ *Legal document used to defend intellectual property and accusations of fraud*
- ❑ *Knowledge for future researchers*
- ❑ *Support document for thesis and publications*

[Guidelines for keeping a laboratory notebook \(rice.edu\)](http://rice.edu)

[How to keep a lab notebook | Science | AAAS](#)

[tutorial LabNotebook V9.pdf \(columbia.edu\)](#)

[guide to keeping laboratory notebooks 2002 508.pdf \(nih.gov\)](#)





## *THE DISCOVERY OF HIV-1*

- ❑ *1983: Luc Montagnier published a paper in Science, describing a retrovirus called LAV (lymphadenopathy associated virus), isolated from a patient at risk for AIDS.*
  
- ❑ *1984: Robert Gallo published a series of four scientific papers demonstrating that a retrovirus they had isolated (HTLV-III) was the cause of AIDS.*
  
- ❑ *1989: John Crewdson suggested that Gallo's lab might have misappropriated a sample of HIV isolated at the Pasteur Institute by Montagnier's group.*

*[Robert Gallo and the Co-Discovery of HIV \(verywellhealth.com\)](http://verywellhealth.com)*

*[Crewdson, John \(1989-11-19\). "The Great AIDS Quest; Science under the microscope". \(Special section, 16 pp.\) Chicago Tribune.](#)*



## U.S. AND FRANCE END RIFT ON AIDS

Lawrence K. Altman (April 1, 1987)

*President Reagan and Prime Minister Jacques Chirac of France ended a festering international scientific dispute today.*

*2008: The Nobel Prize for Medicine was awarded to French co-discoverers Françoise Barré-Sinoussi and Luc Montagnier, But Robert Gallo not included?*

*"And the Bank Played On" by Randy Shilts*

[U.S. AND FRANCE END RIFT ON AIDS - The New York Times \(nytimes.com\)](http://www.nytimes.com)  
[And the Band Played On \(1993\) \(imdb.com\)](http://www.imdb.com)





## *PHYSICAL LABORATORY NOTEBOOK*

- ❑ *Paper laboratory notebooks*
- **Hard-cover, stitched binding**
- **Numbered pages**
- **Pages not easily removable**
- **Durable**



Leonardo Da Vinci



Dmitri Mendeleev



Marie Curie



Thomas Edison



MBIA | R



## LAB NOTEBOOK IDENTIFICATION

- ❑ *Easy identification to the owner of the notebook*
- ❑ *Ability to easily reference collected data to a given entry in the corresponding notebook*
- ❖ *Use of name/initials of researcher, name of the project or a unique code*

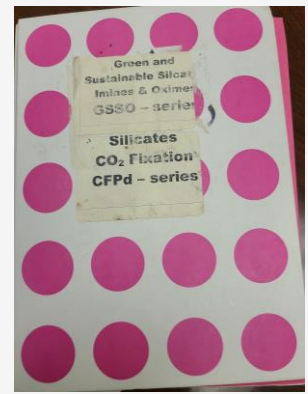
### LAB NOTEBOOK

Your Name

INTRO TO BIOTECH LAB

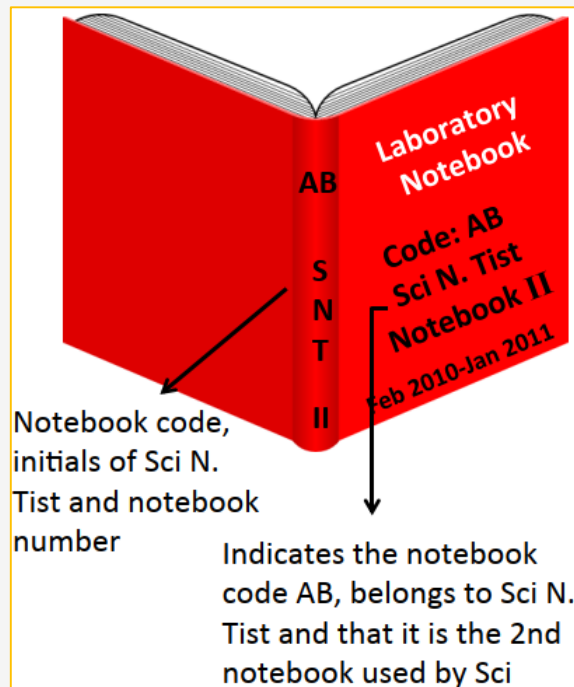
Professor's Name

Semester/Year



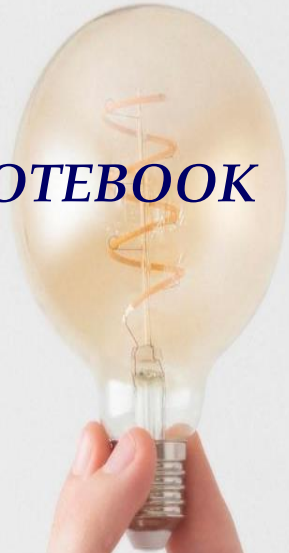


- ❑ *Label your notebook clearly with your full name on the front*
- ❑ *If multiple lab note books are need they may be numbered*
- ❑ *Indicate the dates notebook is used*
- ❑ *If the notebook is specific to a particular project, include on the front cover*



## ***CONTENTS OF LABORATORY NOTEBOOK***

- ❑ **Inside cover or cover page**
- ❖ *Period the lab notebook was used*
- ❖ *Project name(s)*
- ❖ *The address of the laboratory or office of researcher*
- ❖ *Table of contents*
- ❖ *Each page numbered and dated*



## Table of content

Laboratory of Organic Chemistry	Page #	Dates	Title of the experiment
Southeastern Louisiana University	1	06/01/2018	Synthesis of oximes
Pursley Hall – SLU 10878	2	06/05/2018	Purification of ZnO <sub>2</sub>
Preparation of zinc nanoparticles	3	06/06/2018	Preparation of Zn nanoPs
From June 01, 2018 to July 27, 2019			
John Doe's lab notebook # 2			



UNIVERSITY OF  
LOUISIANA  
SYSTEM  
FOR YOUR FUTURE. FOR OUR FUTURE.

# BRIDGING THE DIVIDE

## Summer Series



CLASS SCHEDULE			
Time:			
Monday			
Tuesday			
Wednesday			
Thursday			
Friday			
DATE	EXPERIMENT	READ	DO
Jan 22 - Jan 28	Introduction, Safety Lecture and Test Fischer Esterification: Preparation of Benzocaine	Chapter - 1 P 759 - 763 (Sec. 20.1 - 20.2)	
Jan 29 - Feb 04		Chapter - 2 P 79 - 81 (Sec. 2.22) P 715 - 727 (Sec. 19.1 - 19.3)	P 764 - 765 (Miscscale) P 719 - 727, A (Miscscale) P 728 - 729, A (Miscscale)
Feb 05 - Feb 11	Grignard: Synthesis of Triphenylmethanol	P 499 - 500 (Sec. 15.1) P 528 - 533 (Sec. 15.5) P 421 - 425 (Sec. 12.1 - 12.3)	P 533 - 534, A (Miscscale) P 428 - 429, B (Miscscale) P 678 - 679, A (no isomerization) (Miscscale)
Feb 12 - Feb 18	Relative Rates of Electrophilic Aromatic Substitutions (Completion of Grignard)	P 689 - 691 (Sec. 18.3)	
Mar 03 - Mar 05	Diels-Alder Reaction	P 36 - 41 (Sec. 2.7 - 2.8) P 111 - 114 (3.3) On-Line	P 691 - 692 On-Line + Handout
Mar 10 - Mar 12	Wittig Reaction: Preparation of (Z) / (E) Stilbenes		
Mar 17 - Mar 19	Aldol Condensation: Synthesis of <i>trans-p</i> -Anisalacetophenone ----- Start Unknowns: Complete Physical Properties and Solubility Tests		
Mar 24 - Mar 26	MID TERM EXAM		NOTEBOOKS DUE
Mar 27	LAST DAY TO	WITHDRAW	W/O PENALTY
Mar 31 - Apr 02	Unknowns Continued - Complete Classification Test	On-Line	On-Line
Apr 07 - Apr 09	Unknowns Continued - Complete Classification Test	On-Line	On-Line
Apr 21 - May 23	Unknowns Continued - Begin Synthesis of Derivatives	On-Line	On-Line
Apr 31 - May 02	Unknowns Continued - Complete Synthesis of Derivatives	On-Line	On-Line
May 05 - May 07	FINAL EXAM		NOTEBOOKS DUE

Table of Contents

Score	Experiment #	Experiment Name	Page
	1	Fischer Esterification: Preparation of Benzocaine	
	2	Grignard: Synthesis of Triphenylmethanol	
	3	Electrophilic Aromatic Substitutions (Completion of Grignard)	
	4	Diels-Alder Reaction	
	5	Wittig Reaction Preparation of (Z)/(E) Stilbenes	
	6	Aldol Condensation: Synthesis of <i>trans-p</i> -Anisalacetophenone	
		Start unknowns Complete Physical Properties & Solubility tests	

Gallup Organization: [www.gallup.com](http://www.gallup.com)  
Search thousands of poll results, special reports,  
societal trends and social audits.

Hoovers Business Research: [www.hoovers.com](http://www.hoovers.com)  
Comprehensive index of over 45,000 leading U.S.  
private and public companies.

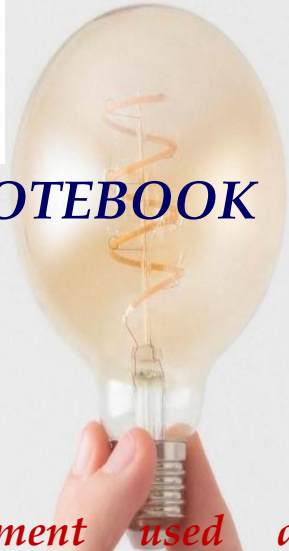
U.S. Department of Labor: <http://stats.bls.gov>  
Bureau of Labor statistics site containing current  
labor statistics and links to hundreds of state and  
Federal agencies.

U.S. Federal Government: [www.fedstats.gov](http://www.fedstats.gov)  
Statistical information from over 100 federal agencies.

## CONTENTS OF LABORATORY NOTEBOOK

- ❑ *Date and titles each experiments*
- ❑ *Provide all the experimental details*
  - *Protocols, calculations, reagents, equipment used during experiments*
  - *Observations: anything planned or unplanned, raw data, permanently affixed with reference to data*
  - *Conclusions*

*If multiple researchers using same notebook, name the author of each entry*





## BRIDGING THE DIVIDE

Summer Series

19 August 2013

Using the procedure outline on page 15 on this notebook.

However, using 30 mL- 50.0 mL of acetone (ACS grade, lot #123)

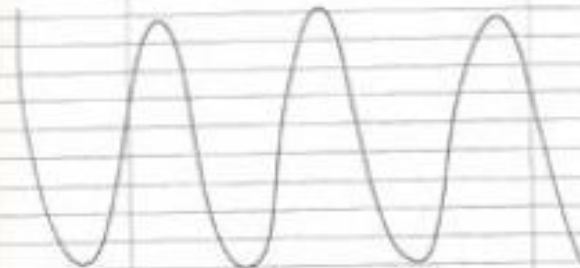
Observed the solution turned cloudy after 30 minutes stirring (40 rpm) at room temperature ( $\sim 25^\circ\text{C}$ )  
After 1 hour of stirring, used roto-vap  
At 100 rpm rotation with hot water bath set at  $35^\circ\text{C}$  to remove extra solvent

Used spatula to transfer solid from flask to weigh paper and massed solid  
Amount of product collected: 0.0156 g

27

Becher 08/19/13

Date	Subject	Page No.
9 Sept 1989	Preface	1
(Begin notes)	Table of abbreviations	2
10 Sept 1989	Determination of chloride by gravimetry	3
17 Sept 1989	Equivalent wt. of a solid acid	7
1 Oct 1989	Determin of oxalate by $\text{KMnO}_4$ titrimetry	10
2 Oct 1989	$\text{Fe}$ in ore by dichromate titration	14
15 Oct 1989	The titration curve and ionization constants of phosphoric acid	20
5 Nov 1989	Potentiometry with quinhydrone electrode	26
12 Nov 1989	Formation constant of $\text{Ag}_2\text{NH}_3$ complex	32
19 Nov 1989	Solubility of $\text{Ag}_2\text{CrO}_4$ by conductivity	39
4 Dec 1989	Controlled-potential coulometry	44
10 Dec 1989	Summary of Experimental Techniques I Learned this Semester	52



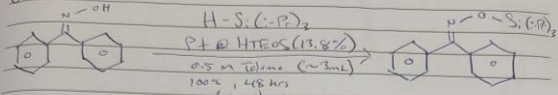


# BRIDGING THE DIVIDE

Summer Series

9/24/19

GSSO-3



GSSO-1A	H Si(-P) <sub>2</sub>	(13.8%) (13.8% P)	HTEOS	GSSO-3
mw: 197.23 g/mol	mw: 158.36 g/mol	mw: 195.1 g/mol	mw: 353.5 g/mol	
n: 1.5201 mol	n: 1.825 mol	n: 1.521 × 10 <sup>-5</sup> mol	n: 1.5201 mol	
m: 0.3g	m: 0.287g	mp: 2.97ms	mp: 0.537g	
	d: 0.773 g/ml	mp: 21.5mg	mp: 0.211g	
	n: 394 ml		mp: 39.3%	

Procedure:

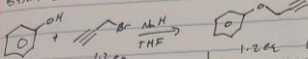
GSSO-1A & HTEOS were added to a round-bottom flask in stated amounts. ~3ml toluene was added as a solvent to reach 0.5M toluene. Trisopropylsilane was added to the flask in the stated volume. The flask was degassed with nitrogen for 30 mins (~3pm-3:30pm). The reaction was set in 100°C oil bath and allowed to proceed for 48hrs (3:30pm 9/24/19-3:30pm 9/26/19).

GC-MS showed potential reaction. Product was purified into 4 fractions. GC-MS of fraction 1 showed formation of product. GC-MS of fraction 4 showed retention of starting material (GSSO-1A). <sup>1</sup>H NMR of fraction showed

3:30pm

2-24-19

BSR7-6A



Phenol	Propargyl Bromide	Sodium Hydride	BSR7-6A
mw: 94.11 g/mol	mw: 178.96 g/mol	mw: 24.00 g/mol	mw: 132.16 g/mol
mp: 7.21 g	M: 10.81 g	n: 0.908 mol	mp: 10 g
mp: 10757	d: 1.575 g/ml	M: 3.632 g	nexp: 0.757 mol
	V: 7.4 ml @ 0.88 ml		% yield: 41.5%
	n: 0.908 mol		mp: 4.150 g

Procedure

Phenol and Propargyl Bromide were combined in a 500 ml RBF in THF. The flask was put on ice and the sodium hydride was added slowly. Reaction was stirred strongly until the reaction slowed down. The flask was removed from ice and allowed to run at room temperature

Hx: 670AC  
9.5.0.9



100  
200  
300  
400

Print Date: 08 Nov 2019 15:07:25

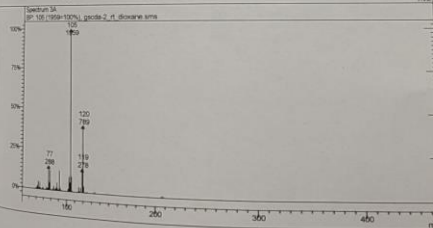
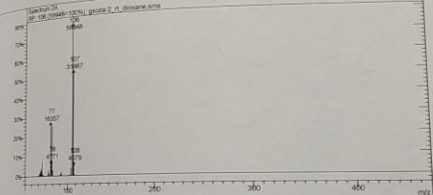
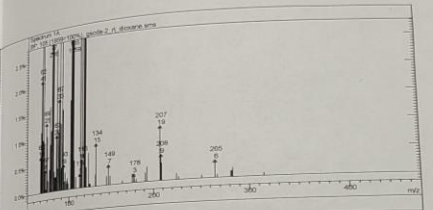
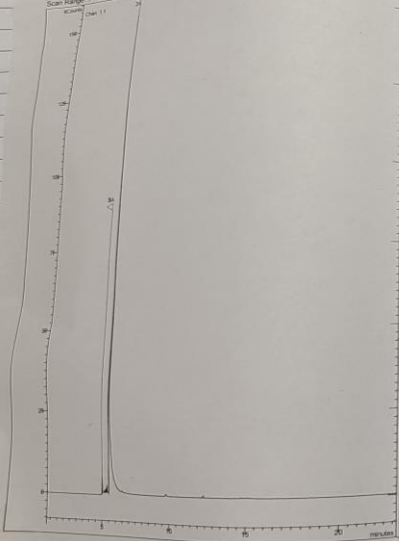
MS Data Review All Plots - 11/8/2019 3:07 PM

File: C:\chem\ms\data\081019\08101902\08101902\_2\_1.dioxane.ms

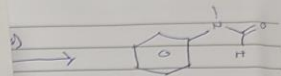
Operator:  
Date: 11/8/2019 2:40 PM

Scan Range: 1 - 2295 Time Range: 0.00 - 76.00 min

CGCDA-2\_RT\_DIOXANE.SMR Chan: 1



11/7/19



~6ml

ml %

(15.8%P)	GSCDA-2
5.1 ml	ms: 135.16 ml
946 x 10 <sup>6</sup> ml	n: 2.7496 mol
462 mg	mass: 0.374g
37 mg	mass:
	olig:

1 to B.B.F. ~6ml dioxane  
 SiEt<sub>3</sub> added. CO<sub>2</sub>  
 24 hrs @ RT.  
 material w/ trace





## ***TIPS FOR NOTEBOOK HOUSEKEEPING***

- Use an ink pen (not Pencil) to write in notebook*
- Write as you go: do not write important results on scratch paper*
- In a case of error or mistake, draw a single line through errors, and re write the correct information*
- Never use white-out or blackout to fix errors*
- Complete notebook entries in consecutive page order, avoid blank pages.*



## ***TIPS FOR NOTEBOOK HOUSEKEEPING***

- Begin new experimental entries on a new page*
- Avoid empty spaces in the lab notebook – When not avoidable, cross out any unused blank space and pages*
- Do not remove pages from the notebook*
- Sign/date at the end of each page. Some institutions require a witness or a direct supervisor to cosign entries, at the end of each day or each week.*



## ***A LAB NOTEBOOK IS NOT...***

- A journal*
- A record of communications*
- A place to compile*
- *lab protocols/manuals*
- *Hypothesis/goals/specific aims*
- *Background information*
- *Yours to take home*



## SELECTING A LABORATORY NOTEBOOK

### *Electronic lab notebook (ELN)*

- *Strong and easy to use note-taking capabilities*
- *“Secured” and Easily navigable*
- *Allows for imbedded data and images*
- *Easy link between pages*
- *Lock notebook pages*
- *Secure login*
- *Audit trail – timestamp for changes and by whom*
- *Allows for witness signatures*
- *Ability to easily export information in different file types*



UNIVERSITY OF  
LOUISIANA  
SYSTEM  
FOR YOUR FUTURE. FOR OUR FUTURE.

# BRIDGING THE DIVIDE

Summer Series

Evernote

Search notes

Table of Contents

Tags

Sample tags

Linked files

Link to other pages

Linked file "Quick Look"

EB-35 EB-34 Sheet1

10-Fluorescence Measurements to measure DNA binding - MM-streptavidin

- Compare binding to streptavidin-coated particles
- Procedure:
  - Coupling: **Linked files**
  - Particle concentrations and standards: **Linked file "Quick Look"**
  - Particles: EB-35
- Experiment: [Page 35 - 1-Subject Notebook 2](#) **Link to other pages**
- Results:
  - Fluorometer: **Linked file "Quick Look"**
- Analysis:
  - EB-35.pzfx 14.1 KB
  - There may be a problem
  - Concentration bound

	3	4	5	6	7	8	9	0	0.05	0.1
0 A	306	303	284	367	10	9	4			
1 B	23	19	19	26	107	122	85	4		
2 C	7085	7103	6354	5445	185	227	164	11		
3 D	9	7	5	7	224	271	211	21		
4 E	6	8	6	5	283	273	235	21		
6 F	10	10	10	6	574	617	413	45		
8 G	11	10	12	9	647	647	474	51		
10 H	11	9	9	8	429	490	531	61		



UNIVERSITY OF  
LOUISIANA  
SYSTEM  
FOR YOUR FUTURE. FOR OUR FUTURE.

# BRIDGING THE DIVIDE

## Summer Series

Experiment Document Chris Strassel - EN1300 E-Notebook Instance - 'Notebook 1-001'

Home View Signing Data Tools Document

Navigation: Forward, Home, Go Up, Back, Paste, Copy, Duplicate, Delete, Edit

Insert: MS Excel Spreadsheet, MS Word Document, Text, Image Table, MS PowerPoint Slideshow, Attachment

Quick Links: Purpose, Microscopy, Dosing

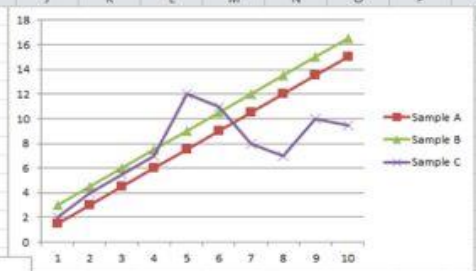
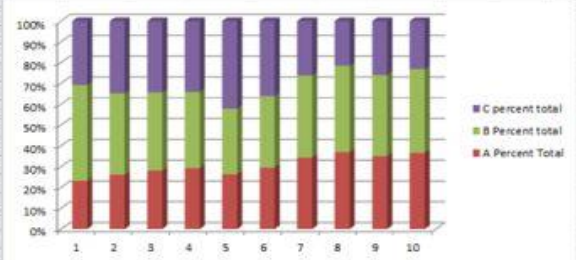
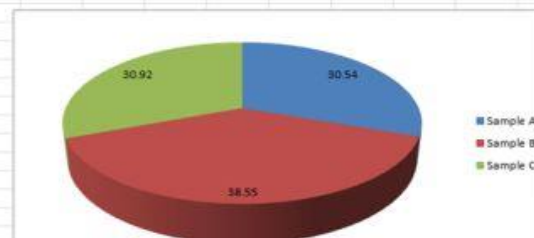
Search: Vaccine Studies Search

Chris Strassel

- Chris Strassel
  - User Configuration
  - Offline
  - Dengue Fever
    - Cambridge.DI.CMV.C
    - Marcy.PD.FLU.Dg
  - Notebook 1
    - Notebook 1-001
    - Influenza
      - Cambridge.PD.FLU.M
      - Ethical Form
      - Protocol
      - Results and Anal
      - Cambridge.PD.FLU.H

Home Insert Page Layout Formulas Data Review View Add-Ins

Day	Sample A	Sample B	Sample C	A Percent	B Percent	C percent total
1	1.5	3	2	23.08	46.15	30.77
2	3	4.5	4	26.09	39.13	34.78
3	4.5	6	5.5	28.13	37.50	34.38
4	6	7.5	7	29.27	36.59	34.15
5	7.5	9	12	26.32	31.58	42.11
6	9	10.5	11	29.51	34.43	36.07
7	10.5	12	8	34.43	39.34	26.23
8	12	13.5	7	36.92	41.54	21.54
9	13.5	15	10	35.06	38.96	25.97
10	15	16.5	9.5	36.59	40.24	23.17
Averages:				30.54	38.55	30.92

Audit Trail

Operation	Date
Save	26-Sep-2011 11:00:37
Save	26-Sep-2011 10:48:22
Create	26-Sep-2011 9:41:20 A



# ***NOTEBOOKS – ADVANTAGES & DISADVANTAGES***

<b>Type of Notebook</b>	<b>Advantages</b>	<b>Disadvantages</b>
Bound/Stitched	No lost pages, legally stronger	Difficult to copy, not logically organized, requires references to data stored elsewhere
Loose Leaf / Binder	Organized by experiment, data stored together	Sheets fall out, difficult to authenticate as pages can be added as needed.
Computer / Electronic	Easy to search, easy to read, Easy to store, available from different locations	Requires electronic security, files could be easily corrupted, Software compatibility issue, potential cyberattack



## WHO OWNS THE LABORATORY NOTEBOOK

- The institution where the experiments are conducted are the owners of the lab notebooks*
- As a researcher, your responsibility is to maintain an intelligible notebook, for yourself, your PI, and for future lab members*
- Laboratory notebooks should never leave the laboratory*

*Some institutions allow for a researcher to have a secondary lab notebook or a journal for daily summaries and keys information a researcher might need when away from the lab*





## *INTELLECTUAL PROPERTY*

- Laboratory notebook is a proof of intellectual property*
- The entry pages should also be signed, dated, and have a person witness the invention*
- List all co-inventors*
- Unless specifically waived, the University or company where the experiments were performed, and/or where the idea was originated holds the intellectual property rights to patentable inventions and discoveries, and any associated technology resulting primarily from the use of its facilities.*



## LABORATORY NOTEBOOK ETHICS

- All data needs to go into notebook, even the result from unsuccessful experiments*
- Pages should not be removed from the lab notebook. Simply draw a line through error and provide the corrected version.*
- Record facts, not opinions (ex: no reaction occurred under these experimental conditions vs. this reaction will never work!)*
- Be honest!*



## REFERENCES

- ❑ *[Guidelines for keeping a laboratory notebook \(rice.edu\)](#)*
- ❑ *[How to keep a lab notebook | Science | AAAS](#)*
- ❑ *[tutorial LabNotebook V9.pdf \(columbia.edu\)](#)*
- ❑ *[guide to keeping laboratory notebooks 2002 508.pdf \(nih.gov\)](#)*