

SCIENTIFIC RECORD KEEPING

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What does "Data Management" involve?

1) Physical record keeping

- lab notebook
- instrument printouts
- images
- computer analysis
- e-mail
- lab meeting discussion
- probes and cells

2) Analysis of primary data

- data selection
- statistical analysis
- calculations
- normalization

3) Presentation of results

- graphs
- tables
- pictures
- Figures

4) Publication

- posters
- seminars
- manuscripts
- funding requests



Featured Collections

		
All Dental Products	Nitrile Gloves	Sterilization Pouches
See all collection >	See all collection >	See all collection >



BEST
PRACTICE



Why is data management important?

- Mandated by funding agency
- Maintain focus on experimental objective
- Document observations
- Troubleshooting
- Organization of thoughts
- May analyze data differently in the future
- Communication with mentor





TYPES OF LAB NOTEBOOKS

General notebook: Experiment description, data, interpretation, conclusions

Procedure or reagent notebook

Computerized records

Summary of findings, figures for papers



LABORATORY NOTEBOOKS

- Bound with serially numbered pages
- Date all records
- Use permanent ink
- Prepare table of contents
- Include the exact data, e.g., photographs, readings, negatives, autoradiograms, printouts, etc.



E-NOTEBOOK

GradHacker

Evernote

Search notes

Table of Contents

Tags

Sample tags

Linked files

Link to other pages

Linked file "Quick Look"

EB-35 EB-34 Sheet1

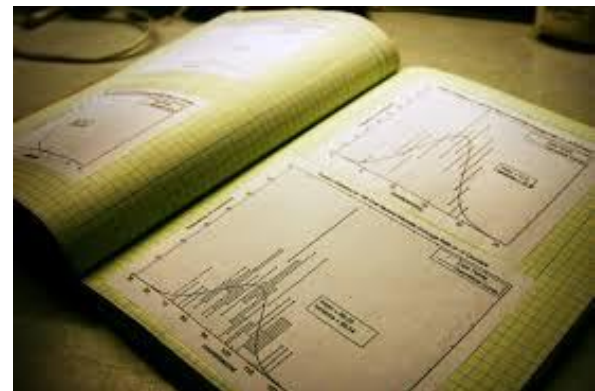
10-Fluorescence Measurements to measure DNA binding - MM-streptavidin

- Compare binding to streptavidin-coated particles
- Procedure:
 - Coupling: 13-07-09 Coupli...in particles.docx 92.0 KB Quick Look
 - Particle concentrations and standards: 13-07-09 Com...vidin particles.xlsx 67.1 KB Quick Look
 - Particles: EB-35
- Experiment: [Page 35 - 1-Subject Notebook 2](#)
- Results:
 - Fluorometer: EB-34 and EB-35.xlsx 18.0 KB Quick Look
- Analysis:
 - EB-35.pzfx 14.1 KB
 - There may be a problem with the data
 - Concentration bound up

	3	4	5	6	7	8	9	0.05	0.0
0 A	306	303	284	367	10	9	4		
1 B	23	19	19	26	107	122	85		
2 C	7085	7103	6354	5445	185	227	164	15	
3 D	9	7	5	7	224	271	211	25	
4 E	6	8	6	5	283	273	235	27	
6 F	10	10	10	6	574	617	413	45	
8 G	11	10	12	9	647	647	474	58	
10 H	11	9	9	8	429	490	531	68	

DATA IN LABORATORY NOTEBOOKS

- Include all original data
- Paste all data materials (photographs, negatives and similar)
- Insert all other materials (CD, DVD, readings) in plastic sleeves
- Store the oversized materials and magnetic media properly with coding scheme included in the lab book
- Bindings must be sewn or glued
 - Plastic comb, wire spiral, or ring binders are unacceptable
- Data books may be inventoried
 - Master data book log
 - This policy applies in industry



POLICIES IN INDUSTRY

- Only bound laboratory notebooks are acceptable
- Entries must be countersigned weekly or more often
- The rules are firmer as the notebooks may be used as evidence for patent protection





ELECTRONIC RECORD KEEPING

- **ELN – Electronic Laboratory Notebook**
 - Database software
 - Generic electronic notebooks
 - Scientific electronic notebooks
- **CENSA – Collaborative Electronic Notebook Systems Association**
- **Access**
- **Excel**

NOTEBOOK

Ohm's Law Sluff

$R (\Omega)$	$I (mA)$
237.9 Ω	64 mA
237.9 Ω	64 mA
414 $k\Omega$	29 mA
548 $k\Omega$	17.5
14.56 $M\Omega$	2 mA
694 $k\Omega$	10 mA
923 $k\Omega$	3 mA
1.03 $k\Omega$	0 mA

← didn't have series circuit

BAD.

for error bars: $V = 20.19 \text{ V}$

take V/R , then error is $\pm I_{\text{measured}} = V/R$

* Dad says if I plot my graph on a computer, I have to show my data table typed up neatly. Crap.

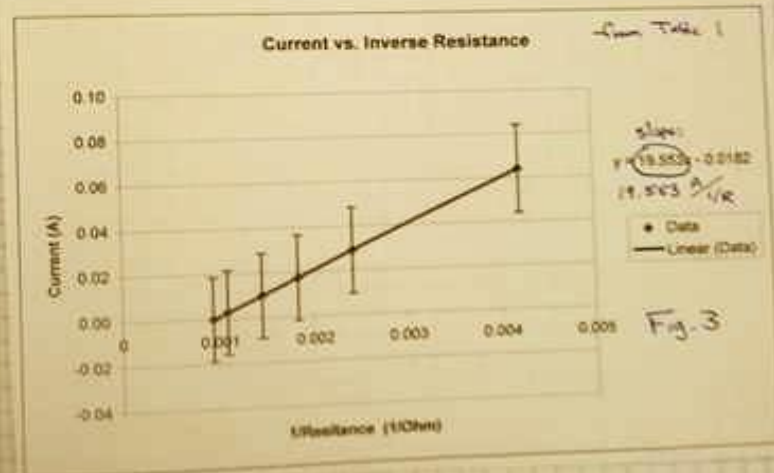
We measure the current in each resistor in Fig 2 (see page 3), and the resistance of each resistor. We multiply the current times resistance for each resistor, and compare it with the known voltage supplied to the circuit.

III Data

$V = 20.19 \text{ V}$

R (Ohms)	I (A)	VR	I (measured) - VR (for error bars)	1/R (1/Ohm)
237.9	0.06	0.084069	0.0201	0.004203447
414	0.03	0.048309	0.0193	0.002415459
548	0.02	0.036496	0.0190	0.001824818
694	0.01	0.028819	0.0188	0.001440922
923	0.00	0.021668	0.0187	0.001083424
1073	0.00	0.018639	0.0186	0.000931956

Table 1:
 I and R
data.



Exp 2.4 The Mass of Ice and Water

10/20/06

Taylor L.

I. Purpose: To determine if the mass changes when ice melts in a closed system.

II. Blue Dot Questions

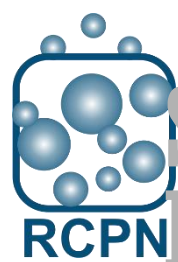
1. The total mass of the ice and water was 13.98 grams.
2. There is condensation on the outside of the container where the ice is melting.
3. Wipe off the condensation with a cleaning implement that doesn't leave residue as the condensation adds mass. However, the amount isn't enough to alter the mass.
4. From a histogram, a conclusion can say that the mass of ice when melted in a controlled system remains unchanged or only slightly changes.

III. Data and Observations:

Quantitative Data:

Trials	Mass Initial (g)	Mass Final (g)	Change in Mass (g)
1	12.12	12.12	0.00
2	12.70	12.71	0.01
3	11.87	11.82	-0.05
4	13.85	13.84	-0.01
5	11.86	11.86	0.00
6	12.15	12.15	0.00
7	12.98	12.98	0.00
8	13.98	13.97	-0.01
9	13.41	13.42	0.01

Valid #5.



SAMPLE FORMAT FOR EXPERIMENT DESCRIPTION

Title of experiment

Objective, purpose

Rationale for doing experiment

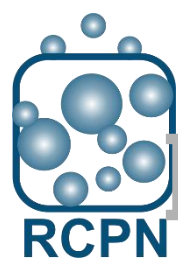
Procedures and reagents

Experimental design and performance

Details of samples, set-up, what you did

Results: primary data, calculations, graphs

Interpretation, conclusions, next step



MAKING CORRECTIONS TO LAB NOTES

Do not erase or use whiteout

Draw a line through what is being changed

Write above or in the margin; date & initial it

Use a different color ink

Computer record; add a blank line, put in the correction with a date beside it




ACCESS

Access

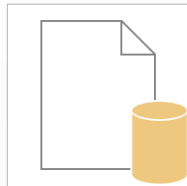
Recent

You haven't opened any files recently. To browse for a file, start by clicking on Open Other Files.

 Open Other Files

Search for online templates 

Suggested searches: Database Business Logs Industry Lists Personal Inventories



Blank desktop database



Custom web app



Updated: Asset tracking



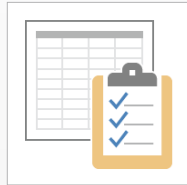
Updated: Contacts



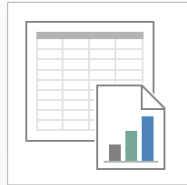
Updated: Students



Updated: Event management



Updated: Task management



Product inventory



Services



Price comparison



Nutrition tracking



Charitable contributions



Call tracker



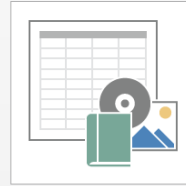
Customer service



Home inventory



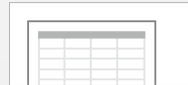
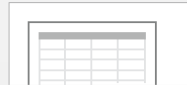
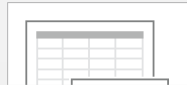
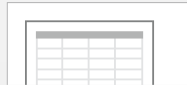
Inventory



Lending library




Personal account ledger








Navigate Up Access Server



- ★ Tasks
- ★ Employees
- ★ Projects
- ★ Customers

List Datasheet By Status

Filter the list... 

(New)

Project Name
Priority 2 - Medium
Start Date
Changed Date 3/20/2012 4:40:09 PM
Active
Owner 
Customer 

Tasks

Task Title	Priority	St
There are no matching items.		

Project management (SharePoint web app)

Provided by: [Microsoft Corporation](#)

Manage projects by breaking work items into tasks, associating them with customers, and assigning them to employees. Like all Access 2013 apps, the Asset tracking template requires Sharepoint so you can share content with others. Customize by adding more tables, new views of table data, or adding logic for your particular needs.

Download size: 17 KB

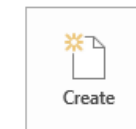
[Should I create an Access 2013 app or an Access desktop database?](#)

Create your app, then use it and share it on the web.

App Name

Web Location

[Get help finding your web location](#)





ACCESS

Database1 : Database- C:\Users\yomidr\Documents\Database1.accdb (Access 2007 - 2013 file format) - Access

Yadollah Omidr

FILE HOME CREATE EXTERNAL DATA DATABASE TOOLS

View Paste Copy Format Painter Filter Ascending Descending Selection - Advanced - Remove Sort Toggle Filter Refresh All New Save Spelling More - Delete Find Replace Go To Select Text Formatting

SECURITY WARNING Some active content has been disabled. Click for more details. Enable Content

All Access Objects Task List

Search

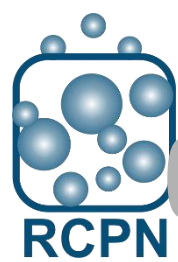
Task List

New Task E-mail List Contact List Show/Hide Fields Reports ?

Open	Task Title	Priority	Status	% Complete	Assigned To	Start Date	Due Date	Completed Date
*	(New)	(2) Normal	Not Started	0%		12/8/2016		

Task | Unfiltered | Search

Form View NUM LOCK 8:41 AM 12/8/2016



CONCERNS ABOUT COMPUTER RECORDS

Difficulty inputting some primary data

Scanners are improving; some data difficult

Ease of manipulation; temptation to alter data

Loss of data - need to backup

Constantly changing computer systems

Computers; operating systems

Hacking or duplication (for sensitive information)





HOW LONG TO KEEP NOTEBOOKS?

Provenance

- NIH policy mandates 3 years after the end of the project (grant funding period)
- FDA policy mandates 10 years after use
- Patent policy mandates 23 years after issue of the patent
- All data collected as part of funded project are owned by the grantee institution
- Data books of all investigators (PI, postdocs, grad students, technicians) are the property of the institution
- <https://www.princeton.edu/main/news/archive/S18/65/99O25/index.xml>
- http://mitadmissions.org/blogs/entry/life_as_a_physics_major_research
- http://rrcns.readthedocs.io/en/latest/provenance_tracking.html

IMPACT OF FRAUD OR SUSPICION OF FRAUD

- What happens when questions are raised about the validity of work?
- Concerns about relying on data
- Lost time to defend against charges
- Lost time to investigate charges
- Damage to careers, friendships
- Public loses confidence in science





KEYS TO RELIABLE RECORD KEEPING

- Provide a table of contents in each book
- Keep all records up to date
- Number experiments in a series in order
- Put primary data in the lab notebook if possible; if not, put in easy to find place
- Make corrections in different color and date



... and researchers agree!

Rigor or Mortis: Best Practices for Preclinical Research in Neuroscience

Oswald Steward^{1,*} and Rita Balice-Gordon^{2,*}

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²Neuroscience Research Unit, Pfizer, Inc., 610 Main Street, 5th floor, Cambridge, MA 02139, USA

*Correspondence: osteward@uci.edu (O.S.), rita.balice-gordon@pfizer.com (R.B.-G.)

<http://dx.doi.org/10.1016/j.neuron.2014.10.042>

Numerous recent reports document a lack of reproducibility of preclinical studies, raising concerns about potential lack of rigor. Examples of lack of rigor have been extensively documented and proposals for practices to improve rigor are appearing. Here, we discuss some of the details and implications of previously proposed best practices and consider some new ones, focusing on preclinical studies relevant to human neurological and psychiatric disorders.

GLP: GOOD LABORATORY PRACTICE

- **GLP** is an FDA regulation.
- **Definition:** GLP embodies a set of principles that provides a framework within which laboratory studies are planned performed, monitored, reported and archived.
- GLP is sometimes confused with the standards of laboratory safety like wearing safety goggles.



WHY WAS GLP CREATED?



- In the early 70's FDA became aware of cases of poor laboratory practice all over the United States.
- FDA decided to do an in-depth investigation on 40 toxicology labs.
- They discovered a lot fraudulent activities and a lot of poor lab practices.
- Examples of some of these poor lab practices found were
 1. Equipment not been calibrated to standard form , therefore giving wrong measurements.
 2. Incorrect/inaccurate accounts of the actual lab study
 3. Inadequate test systems



FAMOUS EXAMPLE



- One of the labs that went under such an investigation made headline news.
- The name of the Lab was Industrial Bio Test. This was a big lab that ran tests for big companies such as Procter and Gamble.
- It was discovered that mice that they had used to test cosmetics such as lotion and deodorants had developed cancer and died.
- Industrial Bio Test lab threw the dead mice and covered results deeming the products good for human consumption.
- Those involved in production, distribution and sales for the lab eventually served jail time.

MISSION OF GLP

- Test systems
- Archiving of records and materials.
- Apparatus, material and reagent facilities.
- Quality assurance programs.
- Performance of the study.
- Reporting of study results.
- Standard operating procedures (SOP)
- Personnel and test facility organization





STANDARD OPERATING PROCEDURES (SOP)

- Written procedures for a laboratories program.
- They define how to carry out protocol-specified activities.
- Most often written in a chronological listing of action steps.
- They are written to explain how the procedures are suppose to work
- Routine inspection, cleaning, maintenance, testing and calibration.
- Actions to be taken in response to equipment failure.
- Analytical methods
- Definition of raw data
- Keeping records, reporting, storage, mixing, and retrieval of data





INSTRUMENTATION VALIDATION

- This is a process necessary for any analytical laboratory.
- Data produced by “faulty” instruments may give the appearance of valid data.
- The frequency for calibration, re-validation and testing depends on the instrument and extent of its use in the laboratory.
- Whenever an instrument’s performance is outside the “control limits” reports must be discontinued
- Equipment records should include:
 - Name of the equipment and manufacturer
 - Model or type for identification
 - Serial number
 - Date equipment was received in the laboratory
 - Copy of manufacturers operating instruction (s)



INSTRUMENT VALIDATION (CONT)

- **Equipment records should include:**
- **Name of the equipment and manufacturer**
- **Model or type for identification**
- **Serial number**
- **Date equipment was received in the laboratory**
- **Copy of manufacturers operating instruction (s)**



ANALYST CERTIFICATION

- Some acceptable proof of satisfactory training and/or competence with specific laboratory procedures must be established for each analyst.
- Qualification can come from education, experience or additional trainings, but it should be documented
- Sufficient people
- Requirements of certification vary



LABORATORY CERTIFICATION

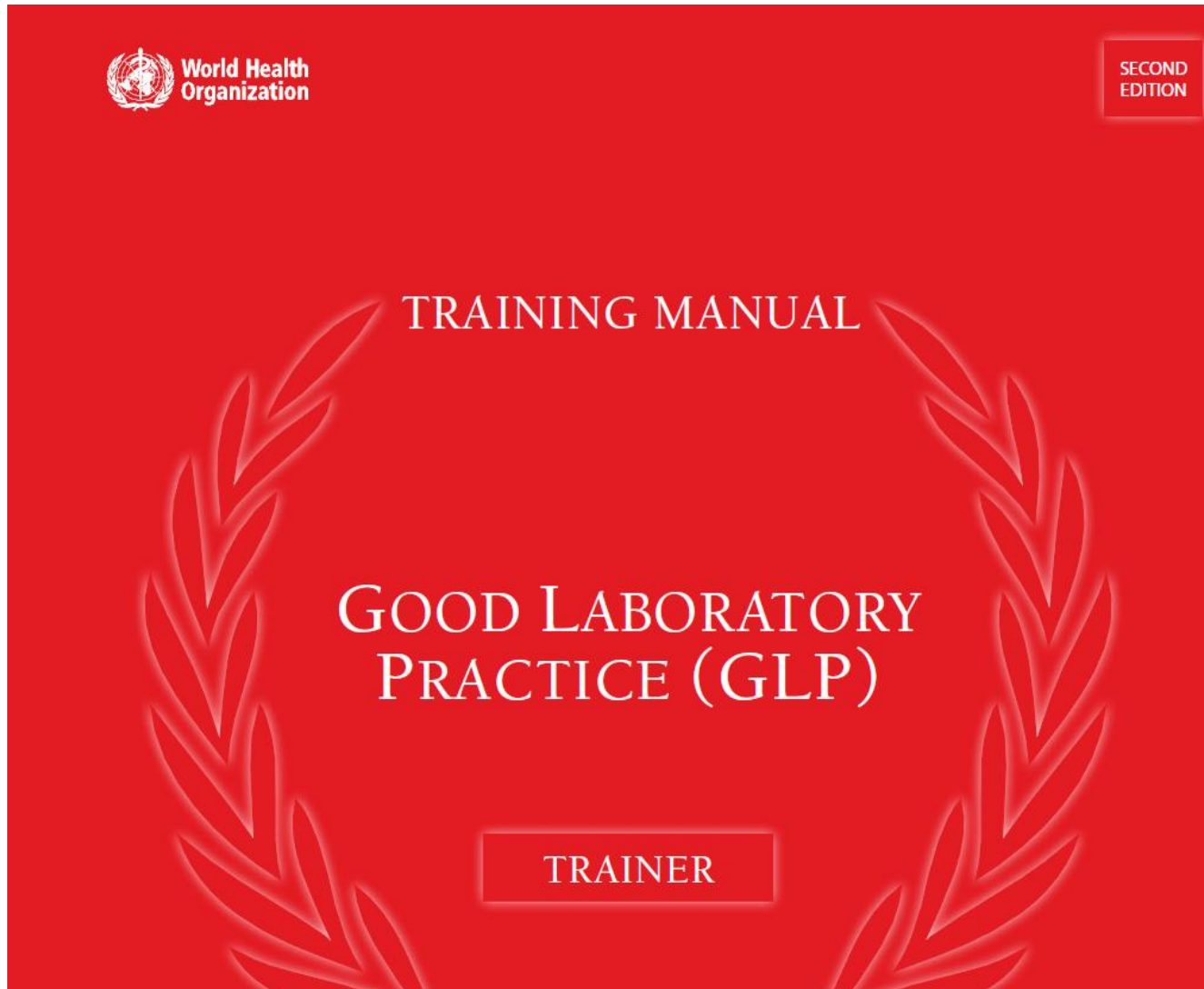
- Normally done by an external agency
- Evaluation is concerned with issues such as
 - Adequate space
 - Ventilation
 - Storage
 - Hygiene



ISO/IEC 17025:2005

- ISO/IEC 17025:2005 specifies the general requirements for the competence to carry out tests and/or calibrations, including sampling.
- It covers testing and calibration performed using standard methods, non-standard methods, and laboratory-developed methods.
- ISO/IEC 17025:2005 is for use by laboratories in developing their management system for quality, administrative and technical operations.
- Laboratory customers, regulatory authorities and accreditation bodies may also use it in confirming or recognizing the competence of laboratories. ISO/IEC 17025:2005 is not intended to be used as the basis for certification of laboratories.

GLP BY WHO





GLP BY NIH

Guidelines for
SCIENTIFIC
RECORD KEEPING
in the Intramural
Research Program
at the NIH

National Institutes of Health
Office of the Director