

Science and Ethics:
A Focus on
Scientific Record Keeping

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Proper Record Keeping Yields

Authenticity: research records that are original, accurate and trustworthy

Accountability: fulfills an explicit or implicit obligation to keep appropriate records for sponsored research

Practical Applications: records allow you and others to reproduce and build on results

Proper Record Keeping

A properly kept data book is a teaching tool that may be used to demonstrate the process of analysis of results, hypothesis construction, and trouble shooting experiments to solve problems or corrects errors

Scientific records are critical to assigning credit, establishing priority, and, acquiring and defending intellectual property protection (e.g., patent protection)

Record Keeping and Scientific Misconduct

Some have argued that proper record keeping reduces the risk of scientific misconduct.

Investigation and prosecution of scientific misconduct allegations puts a burden on the resources of the scientific infrastructure. This burden is increased by incomplete or shoddy records.

Defending against research misconduct allegations is more difficult without good research records.

Keeping Useful Scientific Records

Useful databooks explain:

Why you did it

How you did it

Where materials are

What happened (and what didn't happen)

Your interpretation

What's next

Good databooks:

Are legible

Are well organized

Allow repetition of your experiments

Are the ultimate record of your scientific contributions

What do scientists recognize as data?

Quantitative data: graphs, recorded numbers, instrument output of any type, including photographic materials from which measurements can be made

Qualitative data: notes of any type (in any form), some types of instrument output, including photographic media

Original samples in unanalyzed form; e.g., biological specimens

Research tools: protocols in any form; computer software

Tools and Techniques

Preferred choice: bound notebook with consecutively numbered pages; sewn binding, with high quality, acid-free paper.

Write with a black ink; standard grade ball point pen is acceptable; do not use pencil or any pen with water soluble ink

Data may be recorded using a computer, but printouts of such material should be affixed to databook pages.



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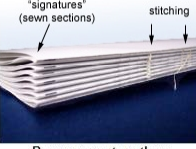
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Advice on keeping a laboratory notebook
If you have not kept up a proper laboratory notebook, other researchers and their patent lawyers will beat you to the Patent Office and to the bank ...
www.swartmore.edu/ratoc/crc/pum1/notebookadvice.htm - 27x - [Cached](#) - [Similar pages](#)


Standard Laboratory Notebook
Eureka manufactures custom laboratory notebooks, used by research and development companies to record scientific findings -- legal documentation is critical ...
www.eureka-labbook.com/Standard.html - 47x - [Cached](#) - [Similar pages](#)

Experimental Biosciences (Bios 211) -- notebook guidelines
The following is a general description of how to keep a proper laboratory notebook. Requirements for different teaching, research, clinical, or industrial ...
www.ruf.rice.edu/~bioslabs/tools/notebook/notebook.html - 27x - [Cached](#) - [Similar pages](#)

laboratory notebook maintenance
Texas A&M Department of Chemistry recommendations on how to maintain a laboratory notebook.
www.chem.tamu.edu/class/majors/ty/labmaterials/laboratorynotebook.htm - 7x - [Cached](#) - [Similar pages](#)



Pages sewn together before assembly



unsewn books can fall apart and lose pages

Corroboration:

Know when to have your data entries witnessed and dated by an impartial party who understands the work.

For applied research, records must demonstrate that the work was diligently pursued from conception to practice; there must be no evidence of abandonment in the research record

Handling of data books:

Keep books in safe place to prevent damage and destruction

Keep books secure to prevent their theft

Writing the Laboratory Notebook

Write legibly and in the first person with an eye towards sharing your notebook with your mentor and your colleagues.

Be organized: reserve opening pages for a Table of Contents; cross reference experiments wherever needed

Writing the Laboratory Notebook

Plan the use of your data book in the experiment

- its placement and access is critical to your successful data recording
- plan the time you will need for recording data and writing interpretations
- write everything directly in the databook
- never record data on the "first available piece of paper" and then transcript to the data book

Writing the Laboratory Notebook

Every experiment should have a

- title, and all entry records should be dated
- list of other investigators who are involved besides yourself
- statement of purpose, a hypothesis, or a goal(s)
- careful compilation of materials and equipment used including specific information about these resources (lot numbers, suppliers, equipment model/serial numbers)

Record everything in detail: conception, process, data, interpretation, plans

Writing the Laboratory Notebook

Explain abbreviations and special terms

Record relevant discussions with mentor and lab colleagues (e.g., lab meetings)

Entries in the data book should be "stand alone" in terms of style: use headers, legends and annotations wherever needed

Never obliterate any entry in the data book. Cross out so that the information is still readable, annotate your reason, then date and initial the transaction.

Never remove a page from the data book

Writing the Laboratory Notebook

Mark through unused portions of pages with an X

Attached primary data in the data book (printouts, negatives, photos, etc.)

Data that cannot be practically affixed in the data book should be keyed, stored in a permanent, safe, and secure location in the lab suite; it should be referenced accordingly in the data book

If appropriate maintain a methodology notebook; typically done at the lab group level than on an individual basis.

Laboratories should have a notebook tracking system

Ownership of Data and Data Books

Universities own data and data books based on interpretation of federal agency policy (e.g., NIH) and prevailing practice in higher education

Copies of data books may be made for practical reasons like back-up, using data to prepare reports and papers off-site, but only with the permission of the principal investigator or lab chief.

When you leave the lab for your next position, the lab books stay

Federal agencies typically require research records be kept for three years from the date of the filing of the final expenditure report. State law usually prevails over federal law, so if the state requirement for retention is more than 3 years that time would have to be honored (e.g., 5 years in Virginia).

In the end, it's up to you!

With few or any exceptions, funding agencies do not promote or enforce record keeping practices in a formal way

Two exceptions:

- Some contractual research with for-profit sponsors

- Research that may produce results with regulatory implications; in this case recordkeeping is in keeping with Good Laboratory Practices (GLP) as published by the US Food and Drug Administration.

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1-14-99 PCR analysis of transformants

Want to see if I can perform PCR on colonies or colonies without performing O.A.A. prep. In 54T 66(1):562-39 PCR was performed on cell pellets of S. pneumoniae after heating them 5 min at 94°C in 100 µl H₂O. However, 5. pneumoniae have more readily than 5. minutes. Will try boiling cells for 5 min for 5 min. Will use transformants 142 spread on 54T out-12 and still at 57°C overnight. If that doesn't work, can try growing the cells on BHI/T rather than T51 and/or growing them in liquid BHI/T.

Also want to try out a new primer and new conditions for PCR.

DNA samples:

- VH03 O.A.A. 7-50-87, 5 µg/ml (medium, tissue for PCR)
- VH04 O.A.A. from yellow "petals" 5-1-97, 5 µg/ml
- VH05 O.A.A. 6-10-98 prep diluted 1:10 to 5 µg/ml
- VH07 transformant 1 - colony read in 100 µl H₂O, boiled 5 min, sent 2 min
- " " " " " " " " " " " "
- " " " " " " " " " " " "

Primers:

- 374 new upstream primer, acc p. 120
- 833 new primer, back to old mt, acc p. 120
- 1260R used normal time for PCR with old primer, acc p. 70-71, 114-115
- Deleted -374 to 250 mt/ml. Also had 250 mt/ml stock of the other 2 primers. Want to see if 374 in place of -833 (or deleted) because it will reduce the size of the products about 500 bp, which should make the reaction more robust.

Expected	full size from A (VH03)	deleted for A (VH03)
-374 + 1260R	1549 bp	876 bp
-833 + 1260R	2098 bp	1369 bp

Set up as follows:

	5	113
833 upstream (VH) 225 µl	113 µl	250 µl
primer 1 15 µl	250 µl	250 µl
primer 2 15 µl	250 µl	250 µl
(D.H.A.) 2 µl	250 µl	250 µl

Had some program error p. 115. Set volume to 250 µl

Table 1-5 Primers: -374R/1260R Template VH03+VH04+VH05+VH07+VH10
 " 6-10 " " 833R/1260R " " " " " "
 (Table 54-10 received 2 µl supernatant primers rather than the full 23 µl)

1-14-99 80ul of 10x analysis of transformant colonies

1.0%, 7.6%, 8.8%, 7.0% 2:35-4:35



- Conclusions
- I included V2404 because my first sequence comes from there, so it's possible that some of my primers would work with V403 but will with V2404.
 - It looks like -833 probably works better with V3404 than V403 (though it appears more specific in V403).
 - Even though -344 produces a smaller product, -833 appears to be a better primer when used with 1260R.
 - All of the primary products (the largest in each case) are the expected sizes.
 - There appears to be a faint band there of the 615 band in the -833+ disc amplification. However, I need better results.

Modifications to hopefully produce better results with PCR using cells

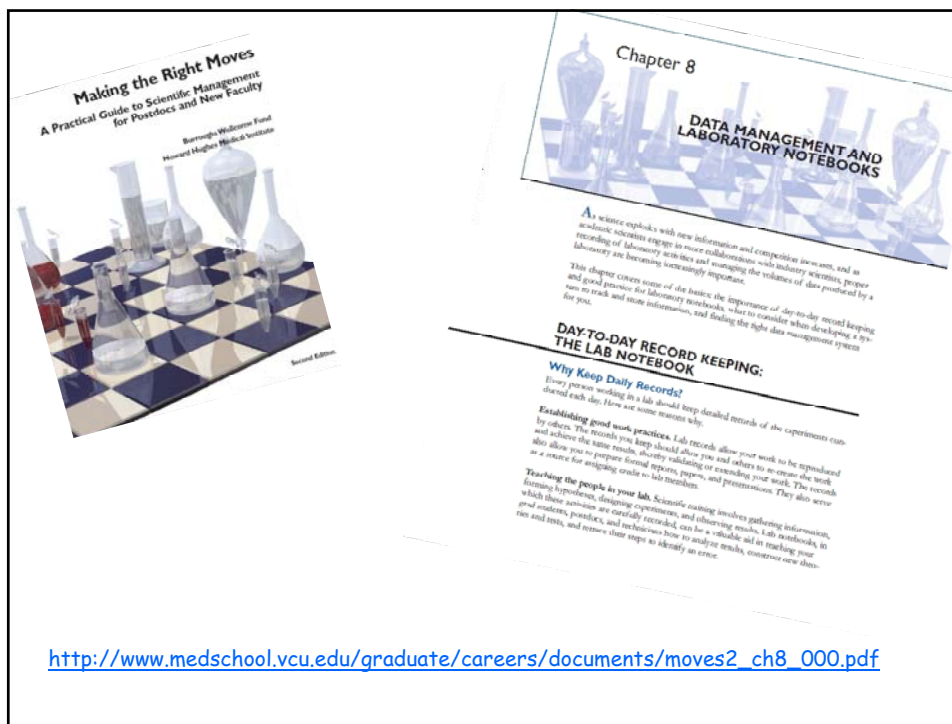
- Strained out V2413 & all 5 mutants onto B.H.I.T. Used single colonies & toothpicks. (I'm not including one because I don't need pV2938 to be maintained.)
- Also started 'in' cultures in (freshly prepared) B.H.I.T. broth - 5 ml ea. Inoculated w/ V2413 & transformants 1-3 (from the plates that were streaked out 2 days ago).

Oct. 6, 1983

		α P19	IgG	← Guc →		← E7 →	F4491
		%		1:1	1:2	1:4	%
09/01	A	97%	-	-	-	X	+98%
0344/ma	A	98%	-	-	-	X	+98%
EP	A	8%	-	20% ±	25%	X	20% ± 26% ± 23%
ET low	A	-	-	-	-	X	25% ± 17%
9/6/102	A	95%	-	-	-	X	+34% ± 29% ± 99%
9/6/178	A	-	-	-	-	X	-
0846/ma	A	99%	-	-	-	X	+100%
05/MS	A	73%	-	(18%)	(7-8%)	X	85%
010/MS	A	90%	-	-	-	X	89% ± 76% ±
011 condp	A	65%	-	-	-	X	36% ± 21% ± 92%
011 dep	A	88%	-	15% ±	20%	X	41% ± 27% ± 87%
019/ma	A	-	-	37%	47%	X	43% ± 39% ±
Ch C low	A	-	-	51% ±	22%	X	-
TS low	A	-	-	-	-	X	-
LSH low	A	-	-	-	-	X	-
WH low	A	-	-	-	-	X	-
YK low	A	93%	-	73%	68%	X	67% ± 27% ± 65%
0321	A	-	-	-	-	X	-

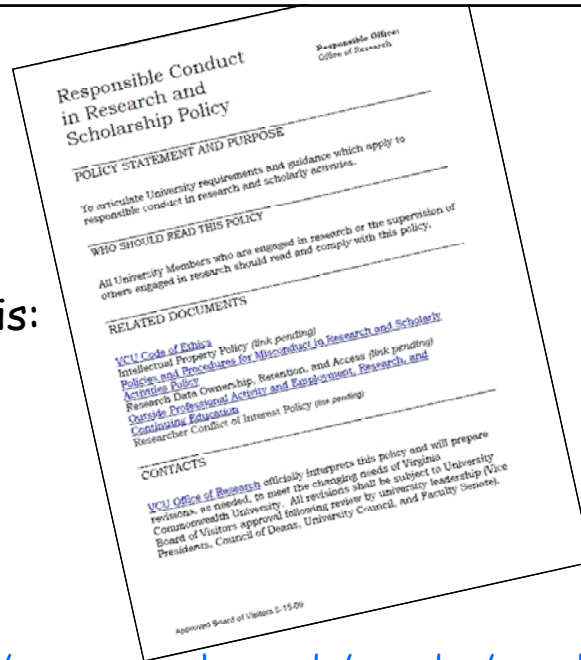
Sea Used:

- ET AIDS sea from Duke
- F4491 H.I.V.T. sea



Will Tanana, a predoctoral trainee in biology spends about a third of his research time in the field collecting data. While doing his field work, he uses a digital camera to make images, a digital voice recorder to rapidly record observations, as well as a spiral-bound field notebook to make general notes on his data collection. Upon return from the field he organizes the data from all three of these sources into a bound notebook, which he considers his definitive research data book. He prints relevant images and attaches them to the data book pages. He also makes verbatim transcriptions and detailed notes into the bound note book using this digital voice files and the notes made in his field notebook. Will tells you that he knows his bound data book is the property of his institution, and it must stay with his dissertation mentor when he leaves. He plans to ask his mentor's permission to make a photocopy of it for his use after he graduates. However, he plans to maintain custody of all of his digital images, recordings, and field notebooks when he leaves. He says this will provide an additional backup of the data, and because of their personalized nature, they are meaningful only to him anyway. He asks you to comment on his plans. What do you tell him?

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http://www.research.vcu.edu/p_and_g/rcrpolicy.htm