Boston University Guidelines for Maintaining Laboratory Records

Office of the Associate Provost for Research and Graduate Education

May, 2003



Pictured: Professor Tom Tullius, Chairman of the Department of Chemistry, checks experimental results with doctoral student Beatriz Blanco.

Why do we need a protocol for the maintenance of Laboratory and Field Records?

Boston University is committed to the highest possible standards of integrity in scholarship and research. The University advocates responsible conduct of research for all scholars and scientists, especially, but not exclusively, those who conduct research involving human subjects and animals. As noted by the U.S. Office of Science and Technology Policy "Advances in science and engineering depend on the reliability of the research record..." but in recent years, highly publicized cases of scientific misconduct have not helped to bolster the public trust in scientists and the scientific method. Scientists can no longer assume an automatic cloak of innocence and they are held accountable to their sponsors for their research activities. As part of a move to strengthen the public trust in scientific and professional societies are reexamining their research ethics guidelines and are urging a stronger emphasis on responsible conduct of research within universities.

Boston University's policies and procedures concerning allegations of misconduct in scholarship and research are clearly laid out in the Faculty Handbook, available on-line at <u>http://www.bu.edu/faculty/handbook/policies</u> and it is not the intent here to restate them. It is assumed for the purposes of this document that the individual scholar or researcher maintains intellectual honesty at all stages of the work. Rather, this document is meant to serve as a guideline for the maintenance and preservation of laboratory and field records so that appropriate and authorized researchers or other individuals may readily access the data. For example, the validity of results that are reported to peers through publications, or to federal or industrial sponsors of the research, may need to be demonstrated if, for some reason, the methods or data are called into question.

In addition, it is worth noting that laboratory records are legal documents that may be used to establish professional and patent precedence. Proof of the date of an invention and the inventor may be crucial in a patent dispute, as patents are granted to the inventor who was first to conceive the invention. The proof of concept process and 'reduction to practice' of an invention are extremely important and must be fully documented. A section on recommended practice for any research on inventions is provided at the end of this document.

Who needs to maintain laboratory and/or field records?

All researchers who generate original data and ideas are responsible for maintaining adequate records. This automatically includes research faculty and technical staff, graduate students and post doctoral research assistants, and may include undergraduate students if they are involved in Research Experience for Undergraduates (REU) projects, Undergraduate Research Opportunities Programs (UROP), or original research as part of a Work for Distinction or Senior Thesis.

Every research laboratory should have a secure location designated for laboratory notebooks and other forms of laboratory records. This is usually within the laboratory itself or in immediately adjacent space, and it is recommended that records be kept in a fireproof safe where possible. Electronic data that reside on a hard drive should be backed up regularly (at least daily) and periodically burned onto read-only, write-once storage media. Boston University's Office of Information Technology provides a back up service (see: <u>http://www.bu.edu/it/OPER/supportinfo.html</u>) and many laboratories also have their own secure servers housed outside the main facility.

Originals of laboratory records should never leave the laboratory area. There are countless tales of students (and professionals!) who took their original records home and left them in a car that was stolen or at home where they somehow got into the garbage on collection day! It is preferable to make photocopies of the records for work outside the laboratory, *unless* the work is classified or connected with a patent or invention, in which case copies of the data should not leave the laboratory without specific permission of the principal investigator.

Not all research is conducted within the confines of a laboratory. In some disciplines, such as ¹ archaeology, anthropology, earth and environmental sciences, ecology, marine biology or the social sciences, much of the data collection may involve fieldwork. As it is often difficult or impossible to return to the exact situation after a season of data collection has finished, the field notebook supplemented by other field records (such as photographs, sketches, maps, videotapes, audio tapes) becomes the only reliable data source for that project.

¹ This list is meant to be illustrative, not inclusive.

Aim for Permanence and Completeness

Laboratory records are permanent records that must be able to prove the conception of an idea, the testing of a model, or the results of an experiment. Records may be kept as entries in a laboratory notebook or as electronic files on a secure medium and should demonstrate beyond doubt:

- what was done,
- why it was done,
- who suggested it,
- who did the work,
- when it was done,
- what results were obtained, and
- what conclusions were drawn.

Laboratory records should be kept in a secure location for a reasonable period of time - at least several years. In rare instances, records of inventions may need to be kept for as long as 30 years. Students who graduate or transfer from the University should be aware that all data obtained as part of a University-approved project is the property of the University and must remain within the laboratory when the student leaves. If the student's advisor gives permission, a duplicate of the data may be provided to the student.

Paper records can be copied onto microfiche for more compact long-term storage. In most cases, the University library will be willing to provide secure storage of microfiche films for you. Paper records may also be electronically scanned to convert them to a more convenient digital format. Original photographs, films, tapes and sample/specimen collections that are no longer in use should be archived and placed in a secure, storage facility, in a controlled environment where necessary.

Use of Laboratory Notebooks **Especially important for patentable ideas or inventions.**

Despite the move toward more electronic forms of data storage, many laboratories still rely upon traditional laboratory notebooks as their principal form of record-keeping. Nearly all research laboratories and institutions in the USA adhere to the following specific guidelines for laboratory notebooks:

The notebook should be bound, with no loose pages.

There must be no replacement, deletion or insertion of pages. Each book and each page in each book should be numbered sequentially.

Each new notebook should list the principal investigator, other investigators, the title of the project or experiment and the date of commencement of the study. A Table of Contents, Index and Glossary of terms should be included in each notebook.

Each entry should be signed, dated and witnessed.

Entries and witness signatures should be timely. Corroboration should be weekly at a minimum. **Never backdate an entry or witness signature.** The witness should be someone who can read and understand the records but who is not an inventor or connected with the invention. Thus a witness should *not* be a technician working on the project. Entries must be sufficiently complete that an educated observer can interpret them without recourse to the author.

Entries must be made legibly, consecutively, in non-erasable ink. Corrections should be made by drawing a single line through the original. The correction should be dated and signed.

Entries must be consecutive. Two or more investigators using the same book should each initial their own entries. No blank pages or spaces should be left in the consecutive record. A completed notebook should be recorded as complete and submitted for filing.

'Reduction to practice' is an important step.

'Reduction to practice' is the successful testing of a piece of equipment, experimental procedure, or new compound. A witness should actually observe the reduction to practice prior to corroboration. The date of this step may be crucial.

What entries should be included?

- all ideas generated during brainstorming sessions,
- all protocols and design of experiments,
- photographs and sketches of equipment and/or circuits that were conceived as well as ones that were tested,
- experimental data,
- formulae derived and/or used,
- calculations,
- reactants where appropriate, and
- plans for future experiments and protocols.

Any diagrams, photographs, charts or sketches should have an accompanying explanation. Permanently attach such materials to the book - do not use staples or paperclips. Additional materials should NOT be on loose sheets unless the chart, diagram or computer printout is too large to include in the book. Sign and date the attachment with the signature crossing both attachment and notebook page. (see also section on electronic data)

If the material is too large to permanently attach to the notebook, the material should be indexed and filed in an accessible location and its location cross-referenced in the notebook. The essential information from such referenced material should be transferred into the notebook.

Include the manufacturer and model number of any commercial equipment used (e.g. Jobin-Yvon JY170C Inductively Coupled Plasma Emission Spectrometer (ICP-ES)

Reactants should be clearly identified by generic name, trade name(s), chemical formula, or structure. Trademarks should only be used where chemical formula or generic name is unknown (e.g., Wheaties Energy CrunchTM)

Any ideas, proposals or suggestions should be clearly noted as such and should identify who made the idea, proposal or suggestion. Conception of an invention is an idea. A proposal to carry an idea into practice should specify details. Avoid unnecessary negative comments on the worthiness or utility of the work.

Either avoid abbreviations altogether, or provide a key to abbreviations used.

What about electronic data and software development?

The legality of electronic data records remains unclear.

Electronic data can be easily altered and such alterations are not always detectable.

Do not rely on computer storage of data.

Hard drives have been known to crash. Where feasible, print out your records, notes and data/results regularly (e.g., once per week) and bind them into a permanent notebook (not a loose-leaf binder). Have each hard copy signed, dated and witnessed.

If you must rely on electronic storage, use a secure system, such as write-once, read-only Compact Discs. **And back up regularly**!

Use a standard file format, such as a PDF, but remember that storage technology moves apace. It is now almost impossible to find a machine to read paper tapes (popular in the 1980's), magnetic tapes (1990's) and floppy disks that were so commonly used only a decade ago. Upgraded system software may not read older zip disks. Be prepared to transfer important data into more current formats and media as the storage technology improves.

Document algorithms in a notebook.

Include commentary on development code, especially regarding who contributed what to the code, any problems encountered, and the solutions.

Use consistency in numbering different versions of software code.

Detail how each version differs from the previous version(s).

Print out the program code periodically; sign, date and witness the printout.

Store and archive your electronic files or development code in a secure location, accessible only by a designated independent custodian under predetermined conditions. If the material is not classified, you may want to make duplicate copies and store them in separate locations. **Acknowledgements:** These Guidelines benefited greatly from discussion with the Boston University Research Activities and Libraries Committee of the University Council. Special thanks to Dennis Hart, Joan Kirkendall, Barbara Millen, John Straub, Selim Unlu and graduate students in the Chemistry department for their insightful comments. Numerous other Boston University professors also contributed to the development of these Guidelines.

Please send comments and suggestions for improvement of the Guidelines to:

Dr. Carol Simpson Associate Provost for Research and Graduate Education Office of the Provost Boston University 1 Sherborn Street Boston, MA 02215

Or by email to: <research@bu.edu>