MAINTAINING THE SCHOLARLY RESEARCH RECORD IN THE CLOUD

INTRODUCING LABARCHIVES ELECTRONIC LABORATORY NOTEBOOK
Presenters

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Overview

• Challenges of recording digital research
• History of ELNs
  – The ELN product market
  – Higher education adoption
• The LabArchives platform
• Implementations in higher education
• Feedback from institutions
• LabArchives roadmap
Changes in the nature of data collection

- **Volume**
- **Automated and computation-intensive**
  - Instrumentation software
  - Imaging
  - Analysis pipelines and workflows
- **Collaborative**
- **Paper notebooks are less useful for many**
Changes in requirements

- Funder requirements
  - Data management plans
  - Data retention
  - Public sharing
- Protected information
  (PHI, human subjects, select agent, export control)
- Desire for institutional long-term preservation
Other concerns

• Reproducibility
• Academic misconduct
• Ability to track provenance of data
• Internal laboratory records management
Reproducibility

- Sense and Reproducibility panel, American Society of Cell Biology meeting, 2012
  Q: How to build a “culture of validation” inside labs?
  A: ELNs will allow PI’s to “delve into complete data sets and double check the provenance of reagents.”

- Must Try Harder, Nature editorial, March 2012
  “It is unacceptable for lab heads — who are happy to take the credit for good work — to look at raw data for the first time only when problems in published studies are reported.”

  “Examination of the original Western blot data revealed that primary Western blot documents were not archived with due diligence.”
Provenance of data

- Audit trail, time and date stamps
- Data management practices
  - Versioning data files (raw, modified versions)
  - Annotating changes made to data files
  - Recording information about data linked from ELN
  - Use of tags
Why do we use a lab notebook?

Today, over 95% of laboratory notebooks in academia are paper... in spite of the fact that most data ARE digital!

Isn’t there a better way than using ground up carbon on wood pulp?

• To provide a complete record of who, what, when, where and why
• To protect your intellectual property
• A place to collect the reams of data
• A forum to talk to yourself, to ask questions, to jot down important thoughts and comments about the experimental design and how your results might eventually be interpreted.
• To provide information to a person who is interested in continuing your research project... or in repeating your experiments
March 10, 1876

M. Watson was stationed in one room with the receiving instrument. He pressed one ear closely against S and closed his other ear with his hand. The transmitting instrument was placed in another room and the doors of both rooms were closed.

Then shouted into M the following sentence: "M. Watson - come here - I want to see you." To my delight he came and dictated that he had heard and understood what I said. I asked him to repeat the words - the second name "you said "M. Watson come here - I want to see you." He then changed places and I shouted at S, while M. Watson read a few pages from a book into the mouth piece M. It was certainly the case that articulate sounds proceeded from S. The effect was loud and distinct and intelligible - if I had read beforehand the passage given to M. Watson, I should have recognized every word. So it was, I could not make out the sense - but can occasional words here and there was quite distinct. I made note "to and out" and "father" and finally the sentence "M. Bell do you understand what I say? Do you hear?" M. Watson - what? - I keep "come quite clearly and intelligibly. Then sound was audible when the armature S was run round.
Lab Notebook of Alexander Fleming
Discovery of Penicillin - October 30, 1928
Example of a Gel Photograph Pasted into a Laboratory Notebook
Data Input

Example of a Spreadsheet Pasted into a Laboratory Notebook
First ELNs

Howard M. Kanare’s 1985 book

Writing

the Laboratory

Notebook

Published by American Chemical Society,

- Final Chapter: “The Electronic Notebook”
- Speculates on ELNs
- Discusses advantages/disadvantages of paper records
Problems...

with Paper Laboratory Notebooks

• Management of laboratory staff
• Ability to protect / retain IP Data
• Analog technology in a digital age
• Lost / misplaced / overwritten Data
• Incomprehensible Data
• Difficulty in sharing / collaboration
• No search capabilities

And sometimes lab notebooks look like this.....
The Perfect Paper Notebook?
First ELNs

- 1997 Labbook
- 1997 Visual Genomics
- 2003 Rescentris CERF (licensed Labbook)

....None are still in operation today
In the mid-2000’s, a series of ELN solutions were launched:

• Most targeted the big pharma market
• Solutions were very expensive
• Required installation and maintenance of a local server
• Almost no penetration in the academic community
• Most data are now digital (images, spreadsheets, proprietary files, etc.)
• Most academic labs use a combination of paper notebooks, various files, and other software tools
• Many of these tools are NOT secure
The **COMPLETE** Solution –

Whether managing a research lab as a Principal Investigator, reviewing students lab work as an instructor or securing the integrity of your institutions research data as an RIO, LabArchives as the complete data management solution.
What is LabArchives?

• A **secure cloud-based** collaborative platform for the storage, organization, **sharing and publication** of scientific data
• A “living repository” for scientific data – Cross between a data repository and Lab Notebook
• Combining the features of collaboration software, wikis, search engines, and software tools
Company History

Headquartered in: Carlsbad, CA

- **2009** LabArchives founded
- **2010** Professional Edition commercially released
- **2011** Classroom Edition commercially released
- **2013** Mobile Apps released (both iOS and Android)
- **2014** Approved Internet2 NET+ Provider
- **2015** Site Licenses at Tufts University

- **2010** Site License at CalTech
- **2012** Site License at CalTech
- **2013** Site Licenses at Yale and Cornell
- **2014** Site Licenses at UT Southwestern, University of Wisconsin, University of Sydney
- **2014** Mobile Apps released (both iOS and Android)
Internet2 NET+

• LabArchives is the ONLY Internet2 NET+ approved Electronic Laboratory Notebook (ELN) Service Provider
• Institutions such as Caltech, Cornell University, Yale University, UT Southwestern, University of Wisconsin - Madison along with many others have become early adopters of LabArchives with campus-wide licenses
• Cornell University sponsored LabArchives to meet Internet2’s NET+ program requirements, which required an extensive vetting process including a review of security, features, usability and documentation

“We chose LabArchives to meet the growing number of requests that we had received for a lab notebook software. It met all of our requirements, including security and usability requirements, at a reasonable price. That is why we were proud to sponsor their service inclusion within the Internet2 NET+ program."
- Barbara Friedman, interim director, Academic Technologies, Cornell University
Unique Benefits

Data in the Cloud

Worldwide support and access, with servers in the US and Australia
• Support research staff productivity and efficiency
• Data stored with multiple redundancy
• ALL data preserved and versioned on U.S. based servers
• 3rd party (NIST) date and time stamp
• Support funding agencies' Data Stewardship and Data Management Plans requirements (i.e. NIH, NSF)
• Standard HTML format
• Single Sign on via Shibboleth
Security

- Servers are protected by redundant, industry standard firewalls and security devices
- All network and application traffic is logged and monitored for any suspicious or unusual activity
- SSL certificates provide full-time HTTPS security for all user interactions
- Supports both a proprietary login option and allows for integration with Shibboleth
- LabArchives has successfully passed numerous network and application security tests from multiple vendors
Compliance

• Federal Funding Agency Data Management Policy Compliant
  “Investigators are expected to share with other researchers, at no more than incremental cost and within a reasonable time, the primary data, samples, physical collections and other supporting materials created or gathered in the course of work under NSF grants. Grantees are expected to encourage and facilitate such sharing.” - NSF Data Sharing Policy

• Amazon Web Services (AWS) Compliant
• FDA - 21 CFR Part 11 Compliant
• HIPAA (Health Insurance Portability and Accountability Act) Compliant
• FERPA (Family Educational Rights and Privacy Act) Compliant
• Shibboleth single sign-on Integration
LabArchives will improve **compliance** with your data management plans, **secure** your research data and **ensure control** over your intellectual property.

- **Replace the Paper Notebook and Lab Manuals** to better protect, monitor, engage and evaluate your PI teams’ lab work.
- **Complete audit control** - tracks and stores ALL revisions, by users, for every entry - NO entry can be deleted - Protect IP -
- **Notebook user access** can be managed to allow access rights to certain notebooks, pages and/or entries.
- **Create and adhere to funding agency Data Management Plans** which require data sharing (via public URL or DOI).
LabArchives will improve **compliance** with your data management plans, **secure** your research data and **ensure control** over your intellectual property.
Classroom Edition

• Enable 24/7 real-time feedback and collaboration
• Discipline-agnostic tool
• Detect students' misconceptions and underperformance
• Improve student success rates
• Students prefer the electronic notebook to paper
• Easy to set up. Simple to use.
• Reduce carbon footprint (24 students x 50 + 1,200)
Adoption in Higher Ed

• ELN Pilots
  – Goals
  – What was learned

• Beyond Pilots
  – Hosted vs cloud?
  – Other decision factors in selecting an ELN
  – Procurements (RFPs)
  – Funding
  – NET+ service validation

(http://www.internet2.edu/products-services/cloud-services-applications/lab-archives/)
Implementation at Cornell

- Initial 6 month pilot; site license as of June 2013
- Key features for IT:
  - Shibboleth login
  - Content encryption
  - Cloud based option
- Key features for researchers:
  - Collaboration features – access controls
  - Versioning of content
- Key features for classroom use:
  - Ability to monitor and manage student notebook
  - Creation of sections for class organization and access control
- Supported by Academic Technologies (financial, administrative and Classroom Edition) and the Cornell University Library (Professional Edition users)
Implementation at Wisconsin

- Integration with IdM through Grouper
- Service team with representatives from:
  - College of Agriculture and Life Sciences
  - Medical School
  - Chemistry
  - Engineering
  - Office of Vice Chancellor for Research
  - Patent Office
  - Office of the CIO
- HelpDesk support for Level 1
- Knowledgebase documents
Campus Data Policy

• PI is steward
  – Notebook “owner”
  – Sets roles, access, edit/view rights
  – Approves exporting and sharing

• 7 year retention (minimum)

• Transfer
  – Exporting copies
  – Migrating original
Lab Onboarding

- Lab meetings
- Data and security policies
- Roles, rights
- How to organize notebooks
- Sharing, printing, exporting
- Data management
  - File naming, version tracking
  - Linking to large files
- Backup and migration strategy
Partial Customer List

DEPAUW UNIVERSITY
THE UNIVERSITY OF SYDNEY
UC
THE UNIVERSITY OF WISCONSIN
Tufts University
UBC
THE UNIVERSITY OF BRITISH COLUMBIA
SPARIS SUD
UNIVERSITÉ PARIS SUD
GEORGE MASON UNIVERSITY
Duke University
OXFORD
NORTHWESTERN UNIVERSITY
SOUTHWESTERN MEDICAL CENTER
UNIVERSITY OF ICHELAND
NATIONAL INSTITUTES OF HEALTH
UNIVERSITY OF FLORIDA
WOLVERHAMPTON UNIVERSITY
STANFORD UNIVERSITY
UNIVERSITY OF MEXICO
VANDERBILT
SOUTH WESTERN MEDICAL CENTER
UNIVERSITY OF STANDORD
LABARCHIVES

Chance Favors the Organized Lab
“I found that LabArchives was one of the more intuitive programs around and provided the type of record keeping that enabled easy sharing of data and lab notebooks, but at the same time was also secure and kept track of all revisions made…”
- Richard van Rijn PhD, Dep. Medicinal Chemistry and Molecular Pharmacology, Purdue University

“LabArchives has been transformative for researchers at the University of Sydney, delivering multiple benefits. Fundamentally, researchers have found that LabArchives integrates seamlessly into their research practices, rather than changing the way they do research. Uniformly it is saving people time and making their research more efficient. For some that means increasing the amount of experimentation they do each day, and with others it has enabled more thorough analysis of research findings and writing. LabArchives has supported researchers in organizing their information in ways that are impossible with normal files, giving them the ability to search all their experiments and manage data and IP much more coherently, for example. One researcher even commented that LabArchives is like having their own Personal Assistant in the lab!.

-Dr. Black., Director, Research Development and Collaboration, University of Sydney

"UT Southwestern Medical Center selected LabArchives as a platform for our research community to maintain their valuable research data as well as to facilitate collaborations and assist in compliance with government regulations. It has been a very smooth and easy transition with little impact on Information Resources, and I have received very positive feedback from our investigators in using LabArchives"

-Dr. Dipti Ranganathan, Associate Vice President, Academic Information Systems, UT Southwestern Medical Center
Roadmap

- Section 508 Compliance
- User Interface Enhancements
- Workflow tools
- Integration to addition 3rd party products
- Upgraded “Folder Monitor” Application
- Integration to campus and other cloud-based storage systems