LabArchives Electronic Lab Notebook:

- Cloud platform to manage research workflow & data
- Support Data Management Plans
- Annotate and prove discovery
- Secure compliance

Improve **compliance** with your data management plans, **secure** your research data and **ensure control** over your intellectual property with LabArchives!

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Agenda

• Quick Introduction of Electronic Laboratory Notebooks (ELN)
• Functionality to look for in an ELN
• Implementation Examples
• What is LabArchives?
• Laboratory Data and Publishing
• LabArchives Advantages
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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!

- Provide a complete record of discovery
- Protect Intellectual Property (IP)
- Manage & Collect data
- A forum: Collaborate, Query, Thoughts, Annotate, Comment, re-think, interpret.
- Information others who are interested in continuing the research project
- Provide basis for replication.
History of Lab Notebooks

- Lab Notebook of Alexander Graham Bell - March 10, 1876
Lab Notebook of Alexander Fleming Discovery of Penicillin - October 30, 1928
Data Input technology of choice

Gel Photograph Pasted into a Laboratory Notebook

Spreadsheet Pasted into a Laboratory Notebook

..... What happens when a researcher has big data?
The Perfect Paper Notebook?
Howard M. Kanare’s 1985 book

Writing the Laboratory Notebook

Published by American Chemical Society, ISBN 0-8412-0933-2

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

- **No 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
- No citable **audit trail**.
- No **integration** with other technology
Work is done digitally; paper notebooks require printing, cutting and pasting of data
Science is a collaborative pursuit; paper notebooks are individual technology
Electronic notebooks can be archived and shared without losing or taking away from the original
First ELNs appeared in the mid-1990’s.

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
• No inter-institution **collaboration**.
• Not designed around scientific work-flow.
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.

Most of these tools are NOT secure

Classroom use and Lab use are not the same platform.

Requirements for grant funding includes Data Management Plan
Considerations for ELN Selection

- **Researcher perspective:**
  - Basic content addition
  - Access controls, sharing and collaboration
  - Exporting content
  - Audit trail
  - Classroom & Research use

- **Administrator / IT perspective:**
  - Security
  - Infrastructure
  - Reporting and user metrics
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ELN Content Input

• Virtually any file type.
• Basic text editor / word processing features
• Templates – custom / shared
• Adding content as attachments
  – Auto-Import / Mobile App / Instruments
• Integration with other tools / standards
  – Smartpens (Livescribe), mobile devices, specialized equipment
• Linking to content outside the ELN
LabArchives enables users to work with content to help them be more effective in their research endeavors. When evaluating ELNs content enablement, look for flexibility.

- Basic folder structure – custom or template
- Searching, tagging, linking, commenting
- Editing – internal or external to ELN?
- Annotations
- Secure date stamp.
- Non-discipline specific.
- Tools for specific tasks
- Integration with authentication systems
  - Single Sign on LMS, LIMS, remote access, off line data entry.
- Automatic import
- Integration with other software for data import
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Considerations for ELN Selection

Access, Collaboration and Sharing

General Access and collaboration controls
• Levels of control? (Read / Write / Delete)
• By individual or group?
• At what levels (notebook / folder / entry / item)?
• Content change notification / Internal messaging
• 24/7 access to work product

Sharing
• How widely can content be shared?
• How can content be shared? (via URL / Embedded Content / Persistent Identifiers (DOI)).
• Use for Data Management Plan access to support research grants

Classroom Specific
• Publish course content
• Instructor, TA, Student differentiated rights
• Grading module
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Considerations for ELN Selection

Exporting Content
• What are the backup / local copy options?
• What happens when you STOP using an ELN?
• What are the export options?
  – PDF
  – XML
  – HTML
• File Size Limitations
• Institutional Limitations – throttling
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Considerations for ELN Selection

Security and Infrastructure

Intellectual Property Issues
• Versioning and deletion of content
• Digital signatures
HIPAA, FERPA and other secure content requirements
Local Install vs. Cloud-based offerings
• Location of servers / back-ups
• Content encryption
Software – OS limitations and update schedules
Administrative access / controls
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Considerations for ELN Selection

Reporting and Metrics

• Administrative usage records
• Accounts & Users
• Frequency of use / login records
• Space allocation
• Ability to configure / script routine actions
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Implementation Examples – Cornell

• ELN requests initiated by researchers
• 6 month pilot: 1 vendor, 12 participants from a variety of disciplines
• Key Features:
  – IT: Shibboleth login / Content encryption / Cloud-based option
  – Researchers: Collaboration features – access controls / Versioning content
  – Classroom: Ability to monitor and manage student notebook / Creation of sections for class organization and access controls
• Current Status: Enterprise License with LabArchives
  – > 1100 registered users – lab and classroom
  – > 50 “regular” research users
  – Plant sciences, engineering, human ecology, microbiology, VET
  – Collaborative support model – Academic Technologies and Cornell Library
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Implementation Examples – Yale

• Initial investigations done by Central IT
• Chose LabArchives based on:
  – Researcher requirements from interviews
  – Desire to meet all needs with one cloud-based supplier
• Initial ELN promotion in August 2013
• Collaborative support model – Central IT and Yale Library Support
  – On-Demand demonstrations
  – Support Documentation
Institutional context
  – Growing emphasis on research productivity
  – Increase interdisciplinary research

ELNs important tool to increase productivity and connect researchers, research groups and labs across institution

Conducted focus groups / environmental scan

Collaborative support model – Central IT and Tufts Library Support
  – On-Demand demonstrations
  – Support Documentation
Institutional concerns
- Funding Requirements
- Collaborative
- Reproducibility
- Academic misconduct
- Ability to track provenance of data
- Internal laboratory records management

Adoption
- Conducted pilots / review
- What are the decision factors? Are they met?

Integration with idM through Grouper

Service team representatives from all departments

Collaborative support model – HelpDesk Level 1
- On-Demand demonstrations
- Support Documentation Knowledgebase
What is LabArchives?

- A **secure** collaborative platform for the storage, organization, **sharing and publication** of scientific data
- A “living repository” for **research data** – Cross between a data repository and Lab Notebook
- Combining the features of **collaboration software, wikis, search engines, and software tools**
- Specifically built to **support scientific research workflow**.
- **PC, Mac, IOS, ANDROID**
- **Integrated** with other popular software.
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Company History

2009 LabArchives founded

2011 Classroom Edition commercially released

2013 Mobile Apps released (both iOS and Android)

2014 Approved Internet2 NET+ Provider


Caltech  Yale  University of Sydney  University of Wisconsin Madison  Southwestern Medical Center
LabArchives, used by researchers worldwide: Two Nobel Laureates, 60,000+ notebooks, 100,000 users, 1.6 Million entries, 300 courses, 24 TB storage, & 1.4 million logons.
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Unique Benefits (continued)

• Customization Platform for template creation and application development
  – ChemDoodle
  – Freezer Box Tracking
  – Inventory Management
  – And many more...

• Direct Integration with:

• Editors and viewers for common file types:

• Automated data upload from devices/software to your ELN Notebooks
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Unique Benefits

• Only ELN platform to offer Institutional solutions for both Research and Education.
• Only Internet2 Net+ approved/vetted ELN.
• Full audit trail for all entries.
• Nothing can ever be permanently deleted.
• Multiple 3rd party security audits performed.
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

HIPPA (Health Insurance Portability and Accountability Act) Compliant

FERPA (Family Educational Rights and Privacy Act) Compliant

ADA Compliant

Shibboleth single sign-on Integration
Key Components of your Data Management Plan

• Managing project data
  – Comprehensive description of the data and contextual information
  – Meta-data strategies
  – Version control

• Sharing data
  – Access for collaborators
  – Public access

• Preserving data
  – Security

• Intellectual property considerations
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- All entries data and time stamped
- Nothing is deleted from the notebook
- All versions remain accessible
- Create local back up
- Bank-like security

Archiving and Preservation

Types of Data Produced
- Detailed descriptions of processes, methods, observations
- Files of any format
- Images, movies
- Protocols, freezer box, inventory
- Link to large data sets

Data and Metadata Standards
- Establish naming standards
- Use Rich Text, Descriptions and Tags

Accessing and Sharing
- Access control at multiple levels
- Read/write options
- Share with collaborators (including non-subscribers)
- Linking between files/entries connecting data with protocols

Re-Use and Distribution
- Make data publicly available
- Utilize DOI for sharing data
- All data stored in one location, easy to compile for distribution

Data Management Plan

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Chance Favors the Organized Lab
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Security

- LabArchives is a secure application written in Ruby and runs on Linux servers
- 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
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Tools and Features to Improve Workflow

- **Full audit trail** for all entries, nothing can ever be permanently deleted
- **Control over access and permission rights** to any portion of a notebook
- **Editors and Viewers** for common file types (Office, PDF, Images)
- **Templates** – Entry, page and notebook
- **Widgets - Customization Platform** application development (i.e. Freezer Box Tracking, Inventory Management, etc.)
- **Direct Integration** with external software - MS Office Suite, GraphPad Prism, FlowJo, & ChemDoodle (Vernier LoggerPro , PASCO and Sapling are in development)
- **Folder Monitor - Automated data upload** from devices & software.
- **Comments** – communication between users, with direct reference
- **Activity Feed** – for all notebook data and staff members
- **Mobile Applications** – image upload, entry editing, and comments
Questions?

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