

E₁lectronic L₃aboratory N₁otebooks

ELN Means Many Things to Many People

What is an ELN? What function does it serve? Where does it fit within my laboratory informatics strategy? Do we need an ELN, and if so what would be best for the needs that exist within my company? When to use an ELN, LIMS or both? These are all important questions, and unfortunately, they are questions that are being asked with increasing frequency due to a lack of clarity in the market.



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Introduction

In its simplest form, an Electronic Laboratory Notebook can be thought of as for an electronic embodiment of what is currently being done in a paper laboratory notebook. It is a tool that facilitates the workflows that play out in your particular laboratory. Having said that, Laboratory Information Management System (LIMS), Electronic Laboratory Notebook (ELN) and Lab Execution System (LES) applications all support this basic definition, to a greater or lesser extent, as they exist within various laboratory environments. So what's the difference between these applications?

To start, the majority of publications comparing ELN, LES or LIMS are product centric. Would it not be more appropriate to start with the end user in mind and look at the application from a user-centric perspective?

What the Researcher Needs

Let's begin with looking at the world from the perspective of a researcher. The researcher should be able to record scientific data, make observations, describe procedures, include images, drawings and diagrams and collaborate with others to find new chemical compounds, biological structures, etc., without any limitation. In a research environment, workflows are often methodical but unscripted, and qualitative characteristics are often most important. Complex chemical and biological searches and cloning experiments produce a significant in-

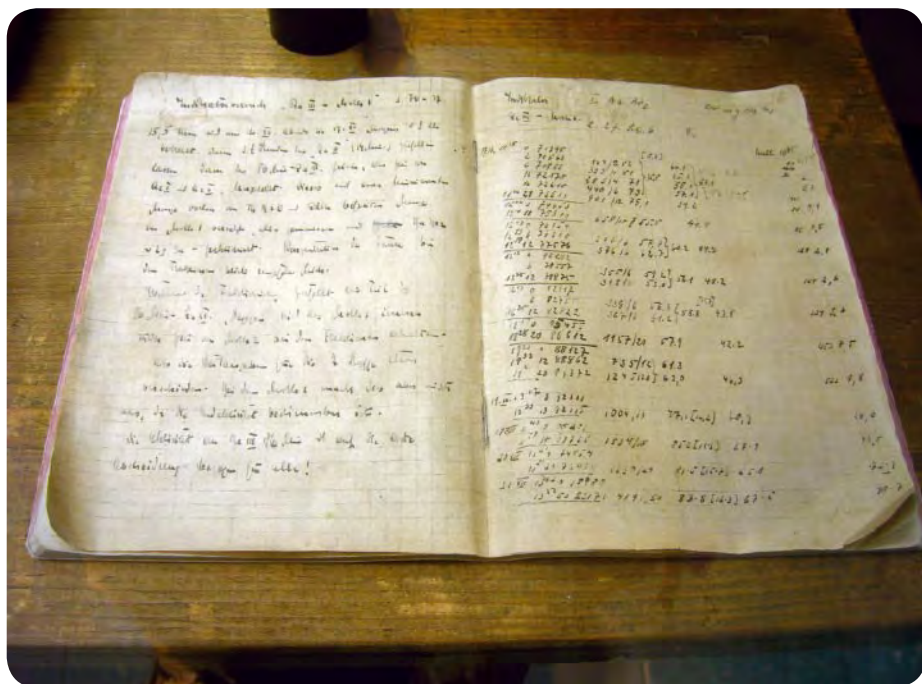


Fig. 1a: Otto Hahn's laboratory notebook 1938 © J.Brew

crease in the research efficiency for the scientist. Intellectual property protection needs to be well implemented to support legal departments, and to assure protection of the new inventions as corporate assets. Audit trail features such as time/date stamps and user authentication are a must in this regard. Researchers like to be in the laboratory where the experiments are performed. It is no surprise

that mobile computing platforms such as iPad's and other tablet devices are popular form factors. Because researchers tend to want to evolve and adapt relatively easily, the software and hardware platforms that support them should quickly adapt as well. Thus, for the researcher an ideal research ELN is one that provides the most flexibility and freedom— a blank page that allows the researcher to do anything

	Research ELN	LES	LIMS
Where in use	Chemistry & Biology Research & Development	Analytical Testing laboratories	Analytical Testing laboratories
Main purpose	<ul style="list-style-type: none"> ■ Intellectual Property Protection ■ Knowledge re-use ■ Research efficiency 	<ul style="list-style-type: none"> ■ Electronic SOP's ■ Compliance ■ Error reduction 	<ul style="list-style-type: none"> ■ Secured laboratory information hub ■ Compliance
Database focus	Document centric RDBMS	Transactional RDBMS	Transactional RDBMS
Typical IT infrastructure	<ul style="list-style-type: none"> ■ Windows workstation ■ Web client ■ Cloud ■ SaaS ■ SOA 	<ul style="list-style-type: none"> ■ Windows workstation ■ web client ■ portable devices 	<ul style="list-style-type: none"> ■ Windows workstation ■ Web client
Application behavior	Experiment centric	Sample/Process centric	Sample/Process centric
User Interface behavior	<ul style="list-style-type: none"> ■ User centric ■ Free form & Adaptable 	<ul style="list-style-type: none"> ■ User centric ■ Procedural ■ Natural language 	<ul style="list-style-type: none"> ■ Organizationally centric ■ Procedural ■ System defined
Related Applications	Scientific databases	LIMS, ERP, Instruments	LES, ERP, MES, CAPA
End user adoption	High	High	Mixed
Licensing models	<ul style="list-style-type: none"> ■ Named user ■ SaaS 	<ul style="list-style-type: none"> ■ Named user ■ Concurrent user ■ Instrument 	<ul style="list-style-type: none"> ■ Named user ■ Concurrent user ■ Virtual user ■ Enterprise
Compliance support	+/-	++	++
Sponsors	<ul style="list-style-type: none"> ■ Legal departments ■ Academia networks ■ Scientific communities 	<ul style="list-style-type: none"> ■ QA directors ■ Lab managers 	<ul style="list-style-type: none"> ■ Production managers ■ Customer care

that they would in a paper notebook, while adding the benefits inherent to an electronic medium including the ability to collaborate without boundaries.

What the Analyst Needs

For the laboratory analyst, the requirements for an electronic laboratory notebook are quite different. In labs where a routine sample-processing paradigm dominates, workflows are more repeatable and data are often much more structured & quantitative. Analysts, therefore, need a structured and robust platform to ensure that proper procedures are followed, that the progression of samples through the lab is tracked, and that discrete measurement data are captured and reported reliably. Analytical services and quality control laboratories frequently de-

ing them through reproducible workflows, managing the associated data, and helping to ensure compliance.

Look Before You Leap

Clearly, ELN means many different things to many people throughout an organization. So how to decide what kind of tools are right for my organization? The key lies in developing an objective and un-biased view of your needs and the options available to you, and a disciplined approach to decision-making.

Understand the Needs

...of the users & business processes to be served. As discussed above, there are very legitimate and fundamental differences in the way

communities and business functions to be served, and the justifiable gaps in your application portfolio, you will then need to consider what type of ELN product best matches your requirements. The table below compares and contrasts the various types of ELN products versus a more traditional LIMS platform.

Consider Your Existing Application Landscape

Very seldom does a company have the luxury of starting from scratch when it comes to making an ELN decision. Due to the prevalence of Merger & Acquisition activity today, the need to rationalize your portfolio of applications in a holistic manner will almost inevitably be an essential part of your decision-making process. The cost/benefit analysis frequently needs to be done in a way that considers the functionality already being provided by legacy applications, and business justifications need to be based upon providing transformational benefits to the organization. The benefits of creating a consolidated & more integrated informatics portfolio must be weighed carefully and objectively against the merits of adding another best-in-breed application.

It is important that companies refuse to be limited by conventional thinking and to consider all their options openly. Today's global markets offer companies many choices. Whether you do the work yourself, or you retain an independent 3rd party consultancy to assist you, approaching your ELN decisions with a solid understanding of the available products and how well they match your needs is critical to your success. After all, "ELN means many things to many people", the one you choose should be the right one for your organization.

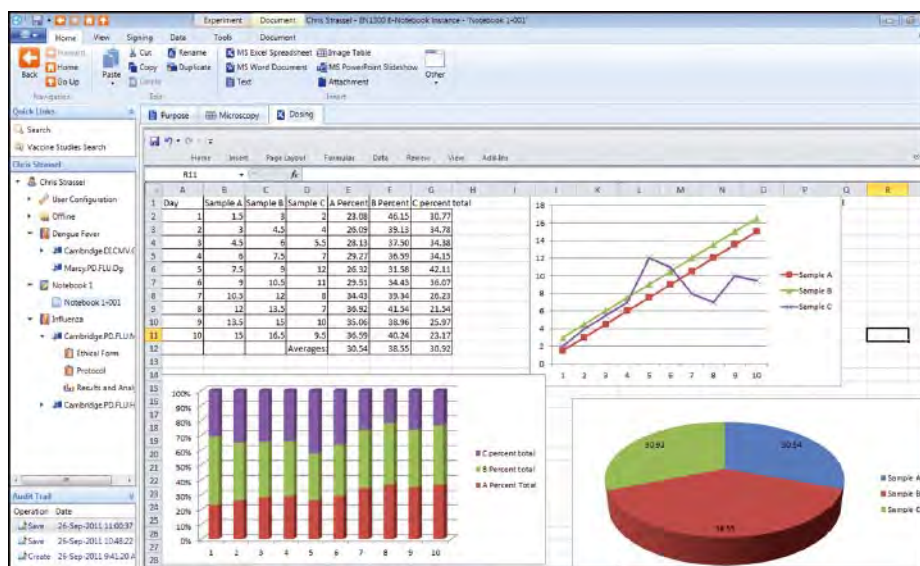


Fig. 1b: modern laboratory notebook solution

ploy systems to automate high-volume workflows and to ensure compliance. In addition, many of the same needs and characteristics hold true for analysts working in core sequencing & genotyping laboratories that support R&D. clinical diagnostics labs, and the like. Traditionally, in these laboratories LIMS has been very successful. In recent years, however, another category of ELN has emerged and is gaining significant popularity. This category of ELN products is often referred to as Laboratory Execution Systems (LES), and they range in functionality from simple to quite complex. These LES products are designed to support the analyst's daily workflows in a natural language form, and typically provide the analyst with a User Interface (UI) that closely resembles existing laboratory worksheets and/or Standard Operating Procedures (SOP's). Ultimately, whether they appear as electronic laboratory worksheets augmenting LIMS functionality, or as stand-alone applications, the LES category of ELN products serve the laboratory analyst by guid-

ing them through reproducible workflows, managing the associated data, and helping to ensure compliance. various user communities operate. As with so many things in life, there are no free lunches, and making a wise decision about which ELN or LIMS platform might be right for your organization requires that you invest the necessary time and effort. Opting for the shortcut of developing a preliminary set of requirements and floating them out to a host of vendors via an RFP process will inevitably produce a confusing set of responses and a questionable result. Furthermore, pushing out the development of detailed requirements until you have made a vendor selection exposes you to a significant risk of making your needs conform to the tool. Performing this work with a technology-agnostic and vendor-agnostic perspective, and prior to vendor selection is foundational to your future success.

Match Your Needs

...with the existing products under consideration. Given the user

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