

THREE SWEDISH UNIVERSITIES ADOPT CENTRALIZED ELN TO ADVANCE ACADEMIC RESEARCH



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Cecilia Björkdahl

Project Manager For Research Documentation, Karolinska Institutet

Karolinska Institutet (KI) adopted a central ELN that's available free to all KI researchers.

- **In six months, 550 researchers had adopted the KI-ELN; 2,000—over one third of the university's scientific staff—are expected to be using it by the end of 2012.**
- **Scientists need just one hour to learn how to use the system; templates to facilitate specific work can be designed and deployed in just half an hour.**
- **KI-ELN is supported by one trainer/educator; about one full-time equivalent in IT assists with implementing and maintaining the system.**
- **Scientists can capture, search, and share research activity and decision making using the KI-ELN.**

In the 200 years since its founding in 1810, the Karolinska Institutet in Stockholm (KI) has become Sweden's premier medical university and is recognized as one of the world's leading medical universities. Scientists and clinicians at KI are working in some of medicine's most challenging areas, including stem cell research and clinical applications of cell and regenerative therapies, epidemiological studies, and global health and patient care initiatives. Yet as much as medicine has changed in 200 years, one thing has stayed the same: The way scientists and clinicians at KI document their research. Until recently, all research conducted at KI was documented exclusively in handwritten, paper lab notebooks.

"In our 201st year of documenting research, we've made an extra effort not just to get better at what and how we document, but to provide our students, faculty, and research staff with basic information on research documentation and best practices for doing it—which includes providing them with modern software tools that can make their lives easier," said Cecilia Björkdahl, project manager for research documentation at KI.

When an extensive audit of research documentation procedures revealed the limitations of paper notebooks in making past scientific work and intellectual property

easy to locate, decipher, and share, KI partnered with Uppsala University and Umeå University to license an electronic lab notebook (ELN) that could be made available to all scientists and clinicians at each university. In six months, 550 scientists in 16 of KI's 22 departments are using the system to document and track research group activity, collaborate more effectively with colleagues, and manage previously disparate and difficult to access research documentation. KI aims to move 2,000 of the university's 6,000 scientists to the ELN by the end of 2012.

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MODERNIZING RESEARCH DOCUMENTATION

KI's mission is to contribute to the improvement of human health through research and education. About 6,000 students attend the university each year, working with KI's 3,500 faculty and scientific staff. KI accounts for over 40 percent of the medical academic research conducted in Sweden. It also offers Sweden's broadest range of education in medicine and health sciences. Additionally, the Nobel Assembly at KI has selected the Nobel laureates in physiology or medicine since 1901.

KI's decision to modernize the way it documented research came gradually. In 2003, KI established the KI Biobank, which provides sample collection services for the university, its departments, and hospitals within the Stockholm City Council. In order to meet legal requirements for traceability of human biobank samples, KI purchased a commercial laboratory information management system (LIMS). While implementing the LIMS in 2007, KI began to examine other aspects of research documentation. An extensive internal audit in 2008 revealed several issues with paper-based systems for documenting research:

- **Data security:** In a paper-based system, only one version of the documentation exists. Even paper notebooks that aren't lost or damaged ultimately deteriorate with age. Copies can be made, but these are also subject to paper's inherent limitations—and multiple copies can lead to confusion about authenticity.
- **Data integrity:** With so much data now being generated electronically by modern laboratory instrumentation, it's

anachronistic to expect scientists to print out and paste results into a paper notebook. Preserving electronic material electronically not only saves scientists' time in recording the work they are currently doing, it reduces errors that can occur during manual cutting and pasting.

- **Legibility:** Individual handwriting can be difficult to decipher, and idiosyncrasies in how scientists choose to record their work can make it hard for other scientists to locate an individual experiment or result months or years later. Records stored electronically are not just easier to read, but can be searched to enable scientists to rapidly locate and build upon past work.
- **Accessibility:** University research is highly dynamic and fluid. New students join research groups, old students graduate, grants dictate which projects groups pursue, and partnerships vary according to the work in which groups are engaged. Backtracking through a paper notebook to discover what past group members did can take hours or even days, time that could be much better spent on research.
- **Collaboration:** Paper notebooks are closed systems, offering no transparency into the work they are documenting. Modern research requires deep collaboration; the ability to share information in real-time can spur insights that can take research in a new direction.

In 2009, KI formulated a new approach to research documentation. A dedicated research documentation project group was organized to establish best practices for research documentation, including instruction and experience using electronic systems such as the LIMS. The project group further recommended that to facilitate research documentation processes and data traceability at KI, the university procure and centrally locate an ELN that all KI researchers could use.

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AN ELN FOR ACADEMICS

While ELNs are now quite commonplace in industry, academia has been slower to adopt the systems. One reason is cost and overhead. The enterprise ELN configurations popular in industry require dedicated infrastructure, support, and maintenance that individual academic labs simply can't afford. And because of the diversity of research conducted in academic settings, universities themselves have not been able to see the benefit of implementing a single system to service all of their departments.

“We saw from working with the LIMS how much customization and configuration was necessary to make the system usable by all the different groups involved,” said Björkdahl. “We didn't want to go through that again with an ELN. What academia demands is something scaled down and simple so that it can be tailored by individual labs to do exactly and only what they need it to do.”

Several departments at KI already had experience using an ELN that offered a low-profile infrastructure and a clean, easy-to-use interface: the Accelrys Notebook. In 2005, 20 scientists in KI's Structural Genomics Consortium piloted this system and found it gave research groups a better, more lasting “memory” of long-term research activities in Stockholm, Oxford (UK), and Toronto (Canada). Over the next three years, several other experimental research groups at KI and Uppsala University also implemented iLabber. KI faculty also had experience using ELNs in commercial settings, including an iLabber installation at Swedish Orphan Biovitrum, a specialty pharmaceutical company based in Stockholm that actively partners with KI researchers on many projects.

“These early adopters all shared a vision for how they could move their labs away from paper,” said Björkdahl. “They had seen ELNs at work and knew that there were systems that

could work in an academic setting. That vision supplied the initiative—they bought the servers and allocated the people in their labs to maintain the ELN. Our goal with KI-ELN was to centralize the university-wide experience with ELNs and provide a single, central system that everyone at KI could tap into.”

Uppsala, Umeå, and KI ultimately agreed to a single tender which it issued to vendors in 2009. The universities would together purchase an ELN that would be used within the different research and education projects run at each separate university. While each university would implement a central ELN for university-wide use, individual, independent research groups would ultimately control how they interfaced with the system and who would have access to any data stored in the ELN. Information would be stored locally at each university on a central server that could be accessed from any computer—platform independence was crucial, as the universities had no control over what types of hardware and operating systems their researchers use in their labs.

The universities selected the Accelrys Notebook and began implementing the system in 2010. Björkdahl commented that a key selling point of iLabber was how easy it was to implement. “The KI-ELN has been straightforward and easy to handle with just one point person—me—for training and demos. I also have help from IT, but it works out to a little less than one full-time equivalent responsible for practical, day-to-day system maintenance,” she said.

More importantly, Björkdahl noted that it's easy to get scientists up and running on the KI-ELN. Scientists who want to use the ELN merely request an account, which is usually provided in less than a week. Training is also minimalist—one hour of training is all it takes to get started. And because KI's Board of Research funds the necessary licenses, the system is free to all users.

Research groups decide for themselves how the system will look and function. “Everyone starts with a blank page, and research groups decide how to design the ELN to support their work,” Björkdahl explained. “Groups can include anything they want: text, images, spreadsheets, or relevant files. Templates, which take at most half an hour to build, give groups ways to standardize best practices and work streams—and they are easy to modify as work in the lab changes.” Labs also dictate data access rights, determining exactly who within the research group or elsewhere in the university has access to what.

The KI-ELN is flexible enough to accommodate the needs of experimentalists and clinical and epidemiological researchers, the two main types of users at KI. Experimentalists use the ELN to record work in classic scientific method form: aim, methods and materials, results, and discussion (see Figure 1). One benefit of the ELN is the ability to create standard templates for routine experimental work. “If scientists want to conduct a specific method or protocol, they can just look it up in the ELN, clone the procedure, and add their unique parameters to the template, rather than having to develop the protocol from scratch or write the same procedure down every time,” said Björkdahl.

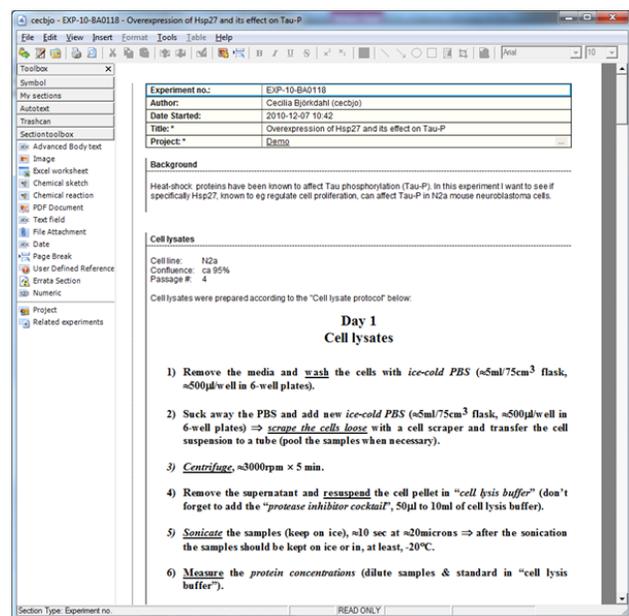


Figure 1: Experimentalists can easily prepare standard protocols, such as procedures for cell lysates or Western blots using templates, which saves time when the same protocol must be repeated time and again.

Tips for successfully implementing an academic ELN

How did KI get so many of its researchers to try out an ELN? Björkdahl credits four strategies adopted by KI's Board of Research and the research documentation project group.

- 1. Centrally finance the system.** A major barrier to ELN adoption in academia is that labs lack the funding and resources to maintain an ELN. The KI Board of Research removed this barrier by purchasing the system licenses and housing the system centrally. Because scientists perceive the system as free to use, they are more likely to give it a go. And while use isn't mandated, the Board of Research's support for the ELN serves as an incentive and a prod.
- 2. Demonstrate the benefits.** “Some people would rather die than get rid of paper,” said Björkdahl. Yet once researchers begin working in the ELN, they never want to go back to paper. The key is getting scientists to try the system in the first place, which means showing researchers how the system can help them. “I ask scientists how they are doing their work today—and then show them how they can do that same work in the ELN, often better and faster,” Björkdahl said. “When they can see how the system will simplify work they do daily, they'll be more likely to use it.”
- 3. Know the science.** Major software implementations are often managed by IT. But with a system like an ELN that directly impacts research work, it's helpful to have a scientist liaison between IT and the scientific users. “It gives the system credibility when researchers are the ones promoting it,” said Björkdahl.

- 4. Choose a flexible system.** A typical enterprise ELN requires extensive overhead and maintenance, and to be used across a university, enterprise systems often require additional (often expensive) customization. Large-scale academic installations demand flexibility to accommodate different research workflows, documentation styles, and computer platforms rapidly with as little administrative support as possible.

Clinical and epidemiological researchers, on the other hand, use the ELN more as a journal and document management system (see Figures 2 and 3). “Most of our clinicians are aware that the information they need to make decisions about their work may be scattered in many different places,” Björkdahl said. “The ELN gives them one place to gather together all relevant information: ethical approvals, patient questionnaires, project plans, and sample information and results. Clinicians can quickly check the appropriate approvals for a study by searching the ELN, or can jot down instructions for a nurse conducting a blood draw, knowing that those notes will be saved with the sample data for future reference.”

While KI has not yet documented specific quantitative impacts of the ELN on research productivity, it has seen changes in the way groups work. For instance, the ELN now plays a direct role in group meetings. Rather than working from individual lab notebooks or presentations, groups now pull up the ELN when they want to discuss an experiment. “The beauty of this is that decisions made during the meeting can now be recorded in the ELN,” said Björkdahl. “So we’re not just documenting that the experiment occurred, we’re documenting the entire research process—including the decision making that takes research in new directions. That’s something that was nearly impossible to do with paper notebooks, and we think it will have tremendous value to labs in the future.”

Björkdahl fully expects the system to eventually serve 2,000 of KI’s 6,000 scientists. “The world is becoming more computerized and electronic,” she said. “In fact, before the ELN was in place, our newer graduate students were baffled that they needed to document experiments on paper. They expect everything to be electronic—and now, thanks to the KI-ELN, we can meet those expectations.”

To learn more about Accelrys Notebook, go to accelrys.com/accelrys-notebook

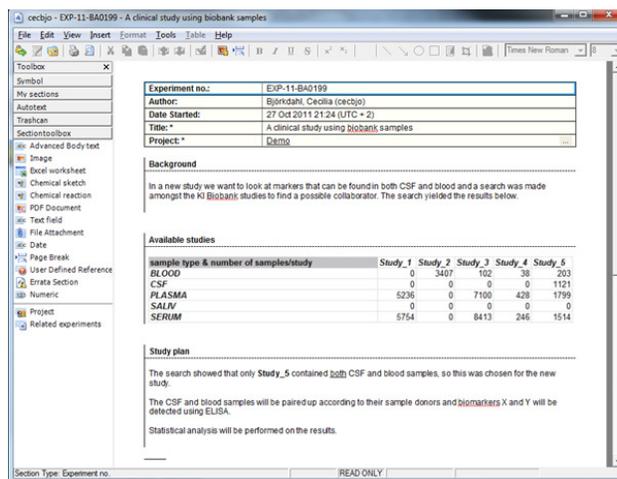


Figure 2: Clinicians use the KI-ELN as a journal to record different steps and major decisions within a research project.

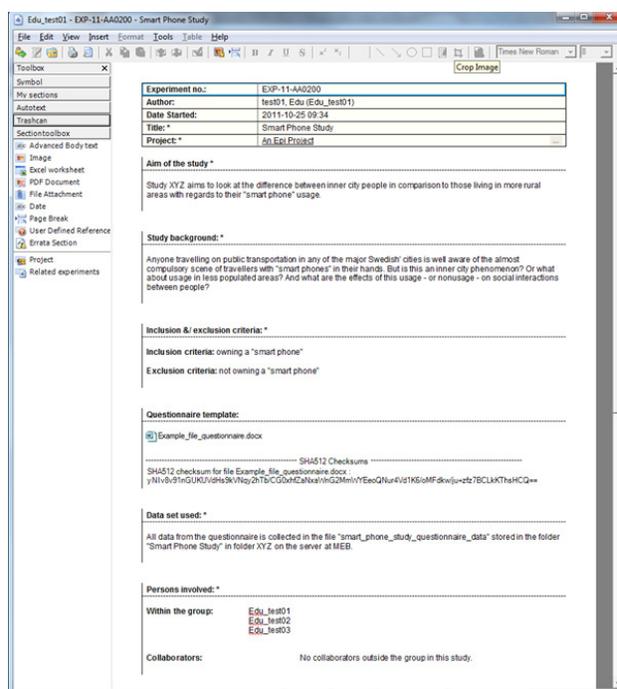


Figure 3: KI-ELN is used to collect various information about epidemiological studies, making information easy to find and accessible to everyone within a research group.