1. Introduction

Computers and information technology have penetrated almost every aspect of laboratory work over the past few decades, but even today, scientists still turn to the bound paper notebook, a pen, scissors and adhesive tape to fully document their experiments in a way that is compliant with legal and regulatory requirements, and that meets their corporate directives for intellectual property protection. However, the continued use of a reliable, convenient and trusted medium such as paper has its drawbacks too. In an age where the rapid dissemination of information is considered fundamental to collaboration and team-working, and where easy access to existing information is essential, the right information technology infrastructure, the right tools and the right processes are critical enablers to support the creation, sharing and re-use of an organisation's explicit knowledge.

Electronic Laboratory Notebooks (ELNs) have become a hot topic in laboratory environments over the past few years. On the one hand, it may seem surprising that at the start of the 21st century, the bound paper laboratory notebook is still the medium in which most experiments are documented, but on the other hand, there are some good reasons why the move away from paper has been treated with a good deal of caution. However, there is a growing trend towards implementing an electronic solution for documenting experiments based on (a) expected productivity gains and (b) an enhanced approach to managing scientific knowledge.

The argument for an electronic solution is becoming increasingly powerful as one by one the objections to the transition from paper to electronic weaken. So what are the major objections? Basically they can be considered to fit into three different categories. Firstly, from a business perspective, there have been concerns about the admissibility of electronic records in support of patent interferences and patent infringements, there are concerns about the costs associated with an electronic solution, and in some instances there may be concerns regarding compliance issues. Secondly, from a technology perspective, there has been, and still exists a certain amount of doubt about the available technologies that are able to preserve electronic records over the long term. And thirdly, from a user perspective, there is the worry about change management and the impact upon scientists of replacing an established and proven documentation process.

TRADITIONAL FUNCTIONS OF LAB NOTEBOOKS

- **record ideas**
- **inventions**
- **experimentation records**
- **observations**
- **work details**

THE LABORATORY NOTEBOOK CAN HELP YOU PROVE:

- **Exact details and dates of conception**
- **Details and dates of reduction to practice**
- **Diligence in reducing your invention to practice**
- **Details regarding the structure and operation of your invention**
- **Experimentation observations and results**
- **A chronological record of your work**
- **Other work details**

2. What is an ELN?

In its simplest form, an electronic laboratory notebook can be considered to be a direct replacement for the paper lab notebook. In this instance, it can provide the generic functionality to support 'broad' documentation processes that apply to all scientists, for example patent evidence creation, cross discipline collaboration and general record keeping. However, the integration capabilities that we readily associate with information technology raise the possibility of a tighter coupling of other laboratory systems into the 'electronic laboratory notebook'. In other words, can the information that is currently printed from other laboratory systems, cut out and pasted into the paper lab notebook be electronically entered or linked into the electronic laboratory notebook? For example, systems that provide chemical structure drawing, structure and sub-structure searching, compound registration, etc. are an integral part of the chemistry laboratory's process, and therefore would be expected to become part of an electronic solution. Similarly, other scientific disciplines will have specific requirements consistent with their particular laboratory processes. Figure 1 illustrates the relationship between 'broad' (generic) and 'deep' (specific) systems. Another way of looking at this is to define an information structure (see Figure 2) that identifies how different systems fit into the laboratory architecture. The triangle represents the different layers of abstraction that exist in R&D information flows. These are almost always handled by different systems. Above the experimental layer is often a management context that is handled by traditional IT tools that are used elsewhere in the enterprise. Cross discipline collaboration tends to happen around the experiment layer. Below the experiment level there is an increasing specialisation of data types and tools, and only a few systems are comfortably deployed across workgroups.

From a patent perspective, the experimental layer is crucial as it captures what the scientist is thinking and doing, and therefore will provide the evidence of conception and reduction to practice. In broader Intellectual Property (IP) terms, it is the experiment layer that constitutes a record of the laboratory's work and as such represents a scientific knowledge repository. Whilst this repository resides on paper, the ability to access, collaborate and share the knowledge is constrained. The implementation of an ELN is therefore critical in order to bring about greater efficiencies in these processes.

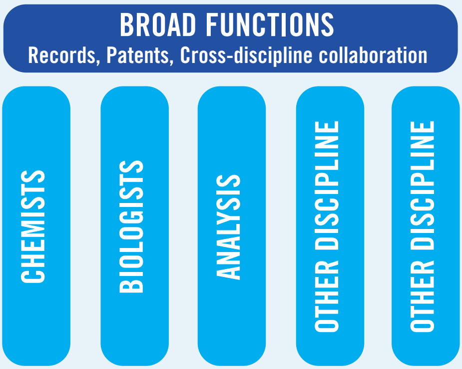

FIGURE 1
Broad vs. Deep