THE NEW DIGITAL AGE OF THE LABORATORY

Considerations for Better Data Provenance and the Case for a Holistic Approach

Lab7™
ACCELERATING SCIENCE

ALIGNING LAB OPERATIONS WITH TODAY'S DATA INTENSIVE METHODS

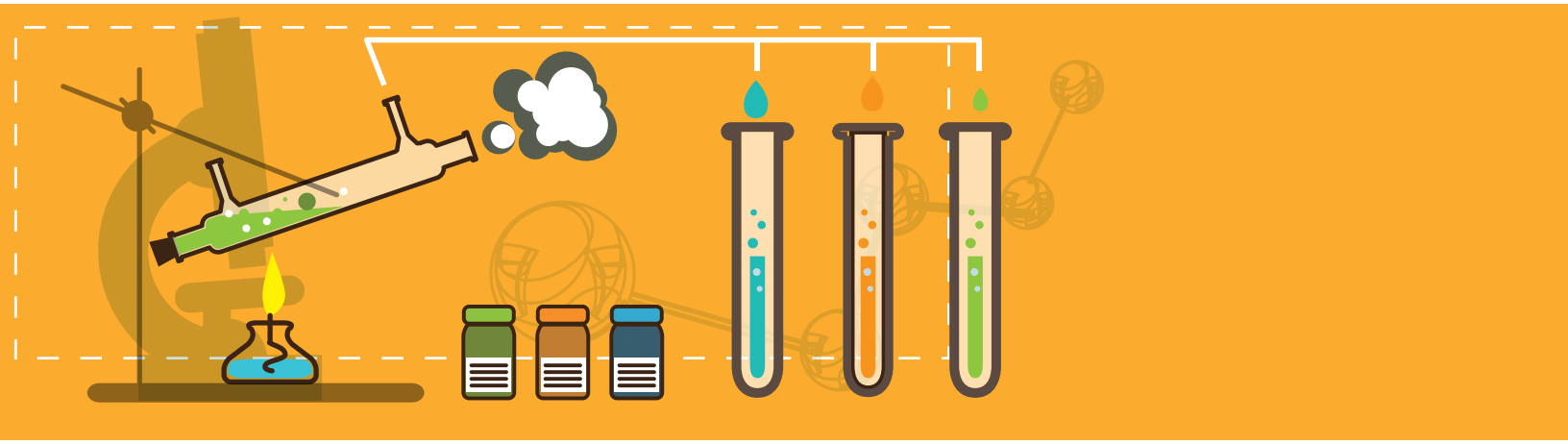
"Every man knows that in his work, he does best and accomplishes most when he has attained a proficiency that enables him to work intuitively." –A. Einstein

Your lab processes have been built based on a meticulous methodology. You and your team go through your day with an exacting proficiency that allows you to work in an almost intuitive way. You know the steps of every protocol like the back of your hand. But what if someone else had to come in and understand exactly what you were doing and how you were doing it?

Take a second and imagine a situation where your integrity as a scientist is called into question. That your work, the work that you've spent months—maybe years—testing, analyzing, documenting, and re-analyzing was on the verge of being subject to intense scrutiny.

The scientific community is subject to both internal and external evaluations and has to live up to high standards. When research scientists publish their results, they must hold up to peer review. Labs dealing with human samples must be able to properly represent data. Pharmaceutical companies have to be able to show that therapies and drugs are developed under specific sets of conditions and adhere to legal and ethical guidelines. Clinical contract research organizations must be able to withstand the scrutiny of third parties.

Would your current methodologies stand up to a rigorous evaluation? Great science is a science that ties together your laboratory operations with today's data-intensive methods. Great science is a science that can withstand evaluations and audits. Now more than ever, scientific journals are requiring raw data to be submitted along with your results. The lesson for scientists is simple: Make all of your methods deeply accountable.

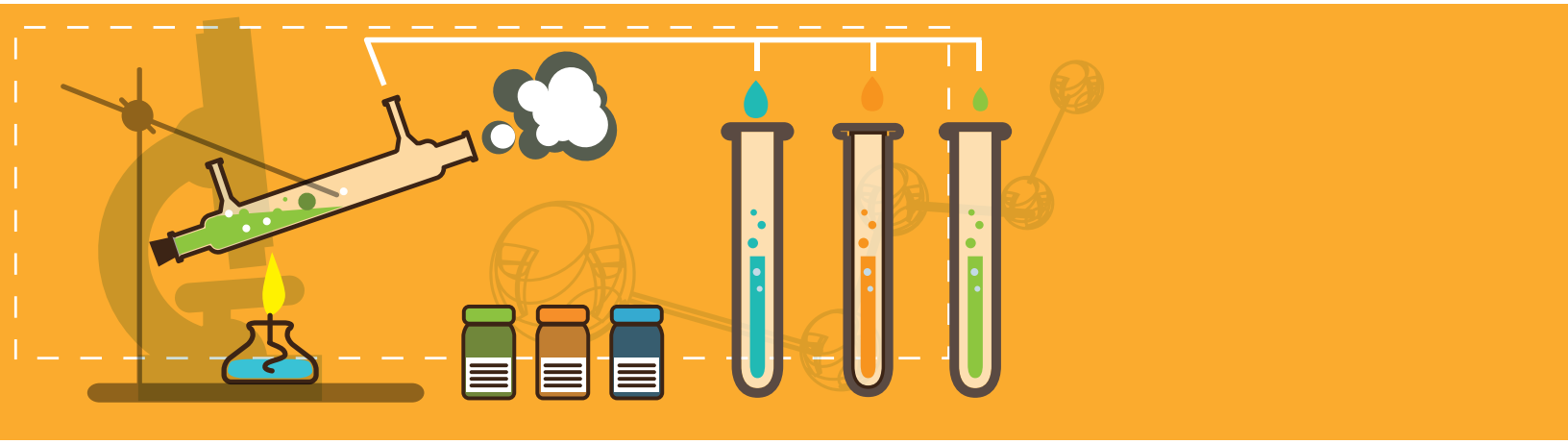


TRUST, BUT VERIFY

According to a study from the Public Library of Science, an analysis of past studies indicates that the cumulative prevalence of irreproducible preclinical research exceeds 50%, resulting in approximately $28 billion per year spent on preclinical research that is not reproducible in the United States alone.[1]

In the many cases reviewed, scientists were unable to retrieve enough of their original data to even allow someone to attempt to reproduce their results. A recent article published in Nature noted a handful of studies that the scientific community must use as a benchmark for improvement:[2]

- A team at Bayer HealthCare in Germany last year reported that only about 25% of published preclinical studies could be validated to the point at which projects could continue.
- The haematology and oncology department at the biotechnology firm Amgen Scientific found that scientific findings could be reproduced in only 6 of 53 papers that were deemed 'landmark' studies.[3]
- In the case of the 'landmark' studies, hundreds of additional citations were found that were based off of the non-reproducible work.
- The flawed research in the 'landmark' studies even triggered a number of clinical trials, meaning that patients were put through a trial of a regimen or agent that probably wouldn't work.



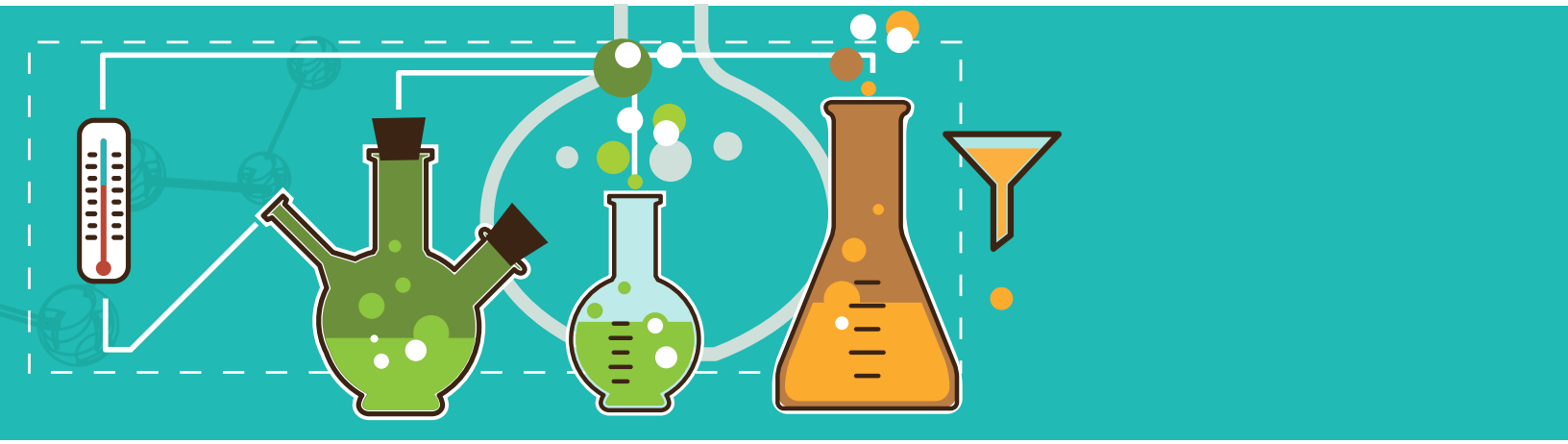
TRUST, BUT VERIFY (CONTINUED)

Journals, associations, and legal and governmental bodies spend great amounts of time, money, and effort looking into scientific findings. Ready to find flaws. Ready to call into question months or years of your painstaking work. Great scientists want their work to stand up to this level of scrutiny. In some extreme cases, errors in the lab can jeopardize reputations and put human lives at risk. Many more cases, though, involve small flaws that are both preventable and professionally embarrassing.

Compliance and audits demand that great science be repeatable, reproducible, and trackable. When put under the microscope, your research must be able to be checked backwards and forwards. Transparent science makes for a greater science.

So how do you bring a line of provenance to your work that can withstand tough evaluation? How do you ensure that you and your team don't have your time pulled away from important work to manually audit every step of every process?

1 Public Library of Science | http://journals.plos.org/plosbiology/article?id=10.1371/journal.pbio.1002165
2 Nature | http://www.nature.com/nature/journal/v483/n7391/full/483531a.html
3 Reuters | http://www.reuters.com/article/us-science-cancer-idUSBRE82R12P20120328#6yEq8EFywKWOMPjY.97



IS YOUR MODERN LAB REALLY THAT MODERN?

The lab environment of today is moving towards a more data-intensive science. At the same time, however, many labs are still operating with documentation methods of the last century. The progress enabled by new compute power, lab software, and analytics processing often lives in a flawed documentation system where lab techs peer at device readings and take handwritten notes. Those notes are transcribed into Excel, and sample tracking, preparation, data analysis, and reporting are done in silos.

There's a kind of anachronism in seeing science professionals with sophisticated lab tools and some of the most powerful computers in the world working out of notebooks and manually copying data from one system to another, often using paper as the intermediary. The process may feel like second-nature, but the potential for transcription and transposition errors increases every time data is manually moved from one source to another. Double data entry may help catch many of these errors, but the time associated with these kinds of redundant activities can be costly.

Truly modernized labs are moving away from processes that exist in silos. Labs are beginning to unify sample, experiment, and protocol management with the goal of making sure that all steps of their process are accessible. Labs can better track and manage all data under a single umbrella. When these processes are unified, workflows are streamlined, compliance standards are more easily met, and provenance is strengthened.

A technology solution alone doesn't equate to a modern system with strong provenance. More than the system, a strong provenance is established by evaluating all process from the ground up so that there is a cohesive understanding of what everyone in the lab is doing. Lab modernization means establishing a holistic approach to your laboratory science.

THE CASE FOR A HOLISTIC APPROACH

Poorly documented science is bad science. To get to a greater science – a modern science – life science researchers, bioinformaticians, and IT professionals involved in data-intensive laboratory process need to take provenance more seriously. Provenance should begin the moment a sample enters the lab and continue to be tracked until the final results are published. The holistic approach to the lab data experience is a step towards both lab modernization and better science.

World-class labs are adopting a holistic approach. By ending functional lab silos, they are creating efficiencies in reporting that allow them to better track, manage, and document all steps of the lab process. World-class labs are not only breaking down the process silos, but they are also streamlining the data flows within and between these silos. In so doing, they are creating a foundation for strong provenance.

We are living in an age of amazing innovation. Technologies like next-generation genomic sequencing, mass spectrometry, and functional MRI are allowing revolutionary scientific advances. With these technologies comes a problem, though. Considerations have to be made on how to handle the greater data loads that arise from these new technologies.

Taking a holistic approach to these big data loads means that the tools and software handling this data must be tied together. Although working with thousands of lines of data in Excel might be achievable without a management system, this is not possible with a larger data set. Bigger data means that there's more room for failure.

The big data age not only demands a holistic approach for unified lab processes and reporting, it also requires a management system that can meet the specific needs of the modern lab. By adopting a holistic approach, one where processes are unified and lab provenance is strong, labs can start to achieve a greater science. So how do labs choose a management system that brings them closer to this ideal?

MODERN LABS MUST EMPLOY MODERN MANAGEMENT SYSTEMS

Out-of-the-box data management only goes so far in a lab situation. Many tools have limitations that don't meet the integration needs that are required of the disparate and often disjointed scientific software and hardware toolkit. Many tools only support one aspect of the workflow, blindly passing data over the fence into the next silo.

Your modern management system should be modeled based on how a modern lab works. Wet lab tasks, analytical tasks, and reporting tasks are all part of the process now. Creating this system takes more than understanding the technology from an IT perspective. It means using one's understanding of the science and the technology to create an integrated approach.

An improved scientific process can be achieved through a management system that recognizes and employs a holistic approach. This means solving the challenges of lab managers who need greater insight, IT staff who needs to manage multiple systems, and end users who need specific reports.

A fully modernized lab employs an end-to-end platform that prioritizes a streamlined workflow, has the ability to comply with any standards, and has strong data provenance. A more complete and sound science can be achieved when data collection, processing, analysis, and reporting is managed by a single system. This not only streamlines and better organizes your current process, but it also allows your data to be queried years after laboratory studies are complete.

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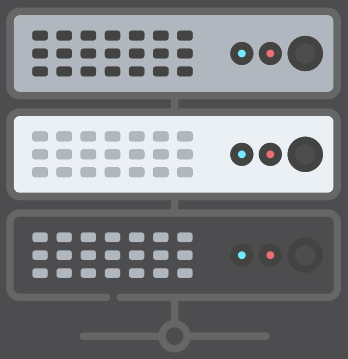

THE LAB7 TEAM – SCIENTISTS BUILDING SOLUTIONS FOR BETTER

At Lab7 Systems, our team understands that your laboratory management software needs to be flexible. You shouldn't have to reorganize your lab around the way a third party solution works. You need a solution that integrates easily with your existing systems and is designed to support the way you already work. This means the ability to configure it to support your current processes, practices, and regulations.

Our team knows the problems faced by biologists, bioinformaticians, and IT professionals, and we have extensive domain knowledge of your core issues. We make platforms that are easy to operate and customizable to your specific requirements.

Lab7 Systems has teamed up with the Power Systems team from IBM to deliver a fully-integrated and comprehensive hardware and software solution. Lab7 ESP is optimized for IBM Linux on Power.
Watch our video to learn more.

ARE YOU READY TO START FOCUSING ON YOUR SCIENCE AND NOT YOUR SOFTWARE?

Power Systems

Available

To continue this discussion and talk about how better provenance in the lab leads to better science, visit us at www.lab7.io/company/contact-us

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MEET OUR TEAM!

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President & Chief Technology Officer

Chris founded Lab7 having led Informatics at Life Technologies. He's developed commercial and Open Source software in Industry and Academia. He has a BS from Notre Dame and PhD in CS from Indiana University.

VARSHAL DAVÉ

VP Sales and Marketing & Chief Product, Positioning, Promotion Officer

Varshal has over 15 years of life science marketing and sales experience, having led Genomics at Molecular Devices. Trained at UT Southwestern in Dallas, Varshal has a MS in Biology from UT Arlington and an AB in Chemistry from Duke.

CHENG LEE

Principal Software Engineer

Cheng designed the back-end architecture of the Lab7 ESP. Prior to Lab7, he was a database analyst and bioinformatician at the University of Texas Southwestern Medical Center. He holds an MSEE and BSEE from the University of Texas at Dallas.

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