smartlab Exchange smartlab Exchange

5 QUESTIONS FOR LAB LEADERS

Ahead of our Smartlab Exchanges in Berlin & Florida we sat down with 8 leading Lab experts to hear their unique insights and advice on the challenges and trends of Lab Transformation.

Yan Song
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Vanessa Cook
Associate Director, Laboratory Services Tyson Foods

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How can you effectively balance lab innovation while maintaining quality control standards and regulatory compliance?

YAN SONG

I tend to focus more on synergies than balances, that is, finding win-win strategies and solutions that improve both productivity and compliance at the same time. Good information management practices and automation tend to accomplish exactly that, it makes both business processes more efficient and closes loop holes that cause compliance issue due to human error.

VANESSA COOK

Standardization, compliance, and quality control does not have to be at odds with innovation. Having a clear understanding of the requirements and getting the right people in the room can help an organization to successfully take their out-of-the-box idea and anchor it to requirements. Sometimes implementing innovation just takes an additional layer of creativity to look at all the possible ways requirements can be met.

ALAN LOUIE

It is important to understand how innovation is contributing to advances in the laboratory to ensure that contributions are technically sound and don't introduce errors or access concerns that could impact data quality or regulatory compliance. This includes things like cloud storage that the innovation introduces and new uncontrolled access to data that may become available.

PRABHAKAR KASTURI

Using IoT technology to monitor instruments in reliable and effective way to maintain quality and compliance and eliminate downtime

NICK RAVENSCROFT

This depends on the lab. Some labs have more freedom to innovate, it will often be the case therefore that these places are where new ideas can be tried and tested. It is by definition difficult for a fully validated system to develop new ideas. This can be seen by looking at places such as the NHS for example, new ideas where they can be developed must run in parallel with current operations which is a drain on resources and can be difficult to justify.

Research labs have a bit more freedom as there will be change involved in order to follow the findings of the organization.

Vendors have rather more scope to make changes as they can treat each project slightly differently and have the ability to try different approaches and technologies. Therefore one could reasonably expect to see a trend of most innovation from vendors then by research and then finally by validated organisations with mature systems.

DARRYL DAVIS

Lab innovation is actually a driver of quality control and compliance. Think of ELNs and robotics as 2 examples.

ROGER LEACH

For much of DuPont's plastics & materials R&D, our laboratory operations and systems supporting R&D operations are relatively un-regulated, so for us, we think more in terms of "stability" of these systems. For R&D enterprise-wide IT systems and applications, we are clear around when we are in the "run & maintain" mode vs. engaged in testing & development activities. For all enterprise-wide applications, we manage changes (configuration changes; version upgrades) very deliberately, including system validation.

ARKADIUSZ SZCZECINSKI

Quality standards and regulatory compliance should not block the innovation. At NIBR we always listen to our scientists and trying to adopt regulatory compliance to their needs, but keeping the high quality standards.

> "Sometimes implementing innovation just takes an additional layer of creativity to look at all the possible ways requirements can be met."
>
> **VANESSA COOK**
> *Associate Director, Laboratory Services, Tyson Foods*

What methods can be employed to ensure effective data management and facilitate advanced analytics?

YAN SONG

Make sure that you operationalize data management before deploying advanced analytics. Many R&D areas are still being run using pencil and paper. Until we find a way to capture operational data electronically in an efficient and accurate manner, all the potential of AI and ML remains a pipe dream!

VANESSA COOK

Standardization and advanced analytics go hand in hand and is most easily accomplished when an organization designs their Master Data with the end user in mind. Data needs to be managed at a level that is granular enough to differentiate between individual data points, but also categorized so that related data points can be grouped in a fashion to show the big picture across the organization. Knowing what level of data analysis each group of end users needs can be a big help in establishing and effective hierarchy of meta-data to be assigned to each data point.

ALAN LOUIE

Using a team approach, it is important to understand data and its analysis from both a top-down and bottom up perspective. Top-down assesses the bigger picture view of data's potential and bottom-up ensures that data analytics and use align with how and why the data was collected and its potential limitations.

PRABHAKAR KASTURI

Avoid data (junk) hoarding. The data that meets good quality standard, policies, procedures, should be relevant and meet what we need.

NICK RAVENSCROFT

Common sense and the ability to learn by mistakes / successes are the best plans here. There is unlikely to be a one size fits all approach but other organisations may have solved some problems successfully and looking at how that was done can save a great deal of effort and expense. Clearly if one is expecting to be handling data in an automated way it needs to be consistent so things that remove the user from directly typing in data is important. Implementing a general concept that data is only entered by a user once can prove very useful here, i.e. once data has been entered by a human it is transmitted to other systems electronically and selected from lists etc rather than typing more data in which invariably never matches.

Large organisations may have also developed protocols of their own which can be copied even if they are as simple as return results from an Instrument always in the same order of Sample ID, Component ID, Result

DARRYL DAVIS

Effective metadata, essentially making the data smart enough to know where to go, is the key. This enables both effective parsing and tracking of data.

ROGER LEACH

We continue to find that our advanced analytics opportunities are hindered by poor data management practices and systems employed during the execution of R&D projects, spanning the R&D cycle from discovery to application development. Recently, we have been focusing extra effort to develop data management strategies up-front as part of every new R&D project initiation, as well as retroactively going into the highest priority operating R&D teams to organize unstructured historical data. Automated "data engineering" tools now make this quite practical.

> "Until we find a way to capture operational data electronically in an efficient and accurate manner, all the potential of AI and ML remains a pipe dream!"
>
> **YAN SONG**
> *Director, Scientific Architecture,*
> *Abbvie*

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What can be done to optimize collaboration in the lab?

YAN SONG

Develop a collaborative mindset and culture among scientists , design collaborative processes for scientists to share knowledge and results with each other, provide collaboration tools (e.g., ELN, LIMS, etc.) to make collaboration easier and stickier.

VANESSA COOK

Different kinds of labs have very different needs for collaboration but regardless, effective collaboration needs to be supported by highly available facts. Without having the necessary information to validate or invalidate ideas, innovation and collaboration can be very time consuming and have a negative impact on operations due to delayed or ineffective implementations.

ALAN LOUIE

Open data sharing, accessible ELNs, collaborative platforms that streamline leveraging and contribution of the individual skills within the team and regular recognition by senior management of team collaboration achievements

PRABHAKAR KASTURI

Interface mobile devices to systems to effect on the fly collaborations for ease, convenience and speed.

NICK RAVENSCROFT

This normally comes down to communication, the better the workplace communication the easier collaboration is, this applies to both people and to systems. There is the potential that as laboratories deal with more and more specialised work, the workers find it harder and harder to communicate, similarly analysers which deliver more and more data of a specialised type will be harder to interface to.

DARRYL DAVIS

Collaboration is built upon trust and common goals. Any tools that allow researchers to benefit from each other's work while protecting proprietary aspects is helpful.

ROGER LEACH

For DuPont, our number one objective to increase collaboration within R&D teams is to pull data out of the hands of individual researchers and get it into better structured, shared data management systems. This approach gives everyone working in an R&D team a bigger picture view that stimulates questions/discussions that lead to better solutions.

ARKADIUSZ SZCZECINSKI

The typical labs are designed to provide the necessary space for lab equipment and computers. However we are missing the space where scientists can gather together and discuss the certain problems directly in the lab. Usually these meetings take place in the common meeting rooms of the office. We are trying to change it by providing the collaboration tools, like digital whiteboards or tablet devices in the lab.

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ROGER LEACH
Leader, Core Analytical Sciences / Information & Data Sciences, DuPont

How do you see AI and machine learning impacting lab operations?

YAN SONG

The general concepts of AI and ML are the same as RPA (robotic process automation) as far as labs are concerned. We have been doing this for decades, AI and ML are just new labels.

VANESSA COOK

I believe that AI and machine learning could be very helpful tools in a laboratory environment where there are many repetitive tasks and decisions to be performed. The ability to expand in this area is limited only by our ability to standardize work processes and data.

ALAN LOUIE

AI is a spectrum of analytical capabilities. NLP and RPA should be transparent and embedded in existing processes to relieve the researcher of repetitive, low value efforts. ML and deep learning will be important contributors to increasingly complex analyses that would be hard to interpret otherwise.

PRABHAKAR KASTURI

Predict and design products, methods and tests. Increase innovation speeds and reduce tests.

NICK RAVENSCROFT

This is tricky as it depends what is understood by these terms. Generally they just refer to statistical analysis done on a larger data set than a human can cope with and therefore seems 'intelligent'. There are a number of issues surrounding this approach, if one does not know how a 'black box' is making a decision then it can be rather difficult to test that the decision and so validation becomes rather less dependable. I would also expect it to be rather an expensive item to commit to especially if one is looking for a bespoke solution as there is not yet a large pool of solutions to choose from. It may however, become more widespread for areas that use large datasets and want to use a statistical analysis but for other areas it might find that has rather a meagre uptake.

DARRYL DAVIS

I think you will see a rapid adoption of machine learning to manage large datasets and provide an access point that lowers the burden on researchers to spend a ton of time on prepping data. As for AI, It would seem that researchers are working hard on predictive capabilities. When AI can design itself and comes along with the analysis so to speak, it will then become a backbone of the analytical strategy of many organizations.

ROGER LEACH

These are essentially tools for automating routine processes, which tends to free up our subject-matter expert scientists to do more high-value adding work on the projects they are working on, or enables lower-level scientists to do higher-value work that they might be able to on their own. Our intent is to not eliminate subject matter experts... rather, to liberate them to focus on less-tedious, more interesting/fulfilling aspects of the R&D work.

ARKADIUSZ SZCZECINSKI

Logistics in the lab is critical for the lab operations. I can see AI and machine learning playing huge roles to optimize the lab processes in the future, e.g. lab conveyors using AI to predict the shortage of the lab equipment and deliver necessary supplier on time. The other example would be to use AI to help scientists to optimize the instruments usage and guide scientist to the right location where they can perform their experiments.

"I think you will see a rapid adoption of machine learning to manage large datasets and provide an access point that lowers the burden on researchers."

DARRYL DAVIS

Associate Director, Head of Biophysical Research & Analytical Development, Janssen Pharmaceuticals

In your view, what will the "Lab of the Future" look like?

YAN SONG

Let robots do what robots do best – perform repeatable tasks; and let humans do what humans do best – come up with innovative ideas, experiment with them and fine-tune the procedure until a robot can take over.

VANESSA COOK

Ultimately, laboratories can be subdivided into two key groups; research and innovation labs, and labs that support industries with finite purposes. Each of these kinds of labs have very different needs, expectations and business models so I think that the "Lab of the Future" will continue to be quite diverse. As technology moves forward and becomes more affordable, I expect that organizations will continue to migrate toward automation, reduced hazards to human and environmental health, and centralized data. Technology and data should allow future laboratories to be more focused on their purpose, more effective with their resources, and bring greater value to their organizations.

ALAN LOUIE

Optimized for the scientist, leveraging consumer best practices (e.g. "voice driven scales that are connected to the ELN and ask the researcher if they're ready to weigh out xyz for the experiment and takes notes as required, who knows who is coming up the scale by the RFID-enabled ID badge), the lab should assist, where possible, getting experiments done, ensuring that process failures (e.g. lack of specific reagents, pushing out alerts where needed) are addressed beforehand, and freeing up researchers to focus on higher level thinking.

PRABHAKAR KASTURI

Miniature smart surface sensors and instruments that scan or float in samples to produce data. No Sample prep and solvents required.

NICK RAVENSCROFT

I think it will look very much as it does today, labs have not fundamentally changed that much in the last 50 or so years. The basic principles remain, however there have been many changes around the periphery, for example the quality of equipment has changed even if the equipment itself looks very familiar. The immediate future will probably see ongoing changes in the quality of the software as that is one of the latest additions on that periphery. Computer hardware will probably also see advances especially in areas such as cameras and modelling simply because of advances made mobile phone companies and computer graphics companies respectively.

The changes and advances like this becomes easier and easier when other larger industries have made those advances first, this then bleeds into other areas because the legwork has already been done, the problems are resolved and the price is reduced.

DARRYL DAVIS

Step in most labs and you will see most of the components. Robotic systems, connected compute nodes which are aware of other compute nodes, smaller and smaller footprints of analytical instruments and larger integrated "systems" that bring it all together. In short, the future lab is here.

ROGER LEACH

I'm hoping to see more WiFi connected mobile devices such as tablets for the UI and IoT connected laboratory tools. For us, the jury is still out on "robotics" due to the high fraction of "non-routine" or ever-changing tasks performed in our labs.

ARKADIUSZ SZCZECINSKI

In the future I can see the labs working similar as a smart cities, with lots of sensors and cameras that will monitor the lab conditions and provide necessary information that scientists might need in the form of holograms or voice controlled assistants. The labs will be interconnected and dependable, which means we will reduce the time when the samples are sent for certain analysis or the reports are created. However this could take many years, until then we will continue doing science in the good old fashion way.

"The immediate future will probably see ongoing changes in the quality of the software as that is one of the latest additions on that periphery."

NICK RAVENSCROFT

Senior Business Systems Analyst, Adaptimmune

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