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**A Call for Connected Diagnostics**  
For pathologists to fully benefit from the connectivity of modern diagnostics, they need to embrace multidisciplinary collaboration and computer-based technologies.

## A Call for Connected Diagnostics

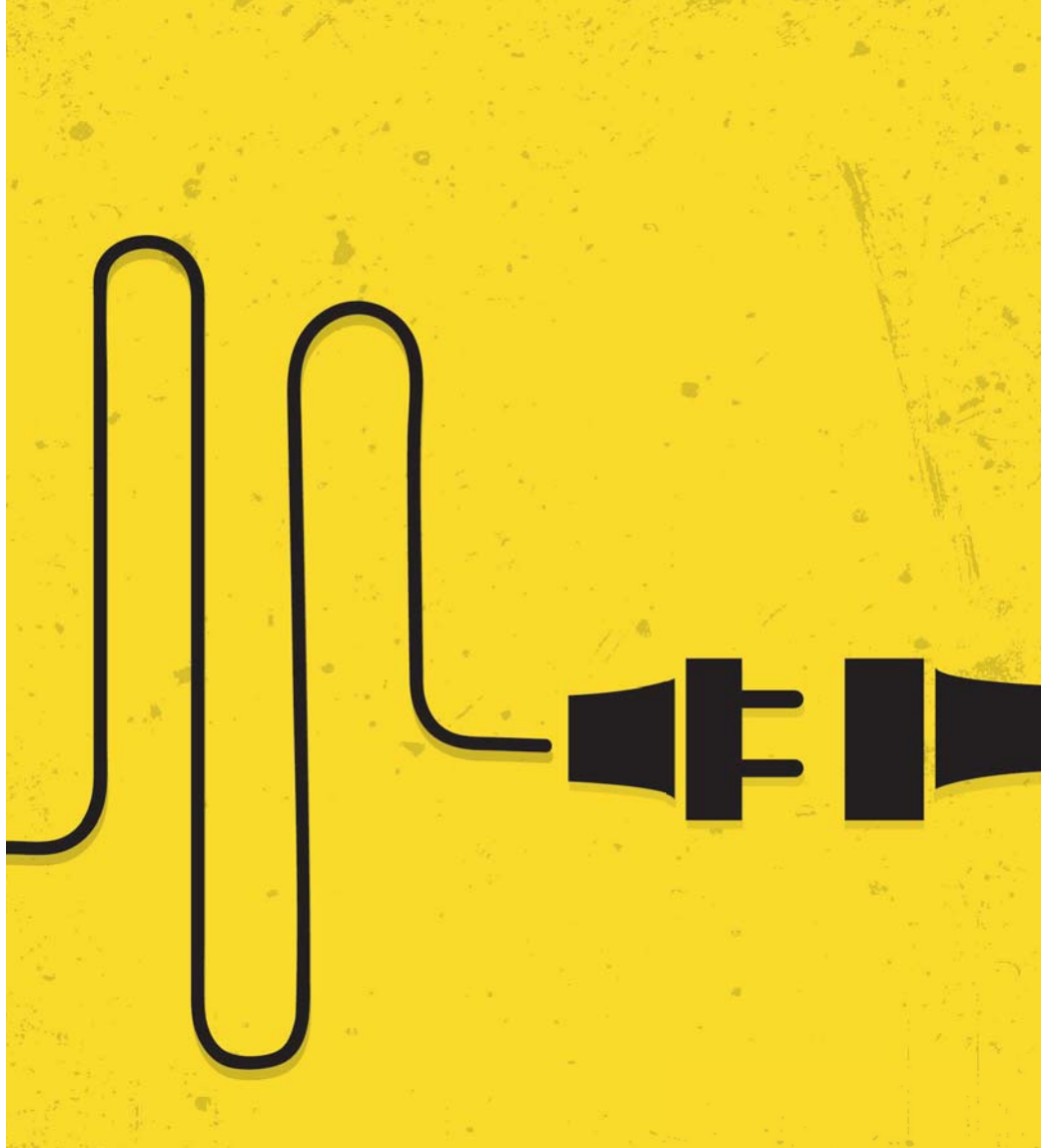
**Laboratories and vendors should take a more practical approach to digital integration to truly help pathologists**

By Jane Rendall

Digitization – it’s a hot topic across pathology, especially as conversations about artificial intelligence and computer-assisted diagnosis add to the fire. But what does it actually mean to pathologists “on the ground?” What does the process of transitioning to digital involve, and what can it actually do for pathologists right now? Most importantly, how can digital technologies fit into the existing workflow so that they help, rather than hinder, the vital day-to-day work of the laboratory?

### At a Glance

- *Connected diagnostics are becoming increasingly important as collaboration becomes essential*
- *Integration has something to offer laboratories at every level of digital maturity, but change must take place logically and sensibly*
- *Interoperability is key; new technologies should be as compatible as possible with a laboratory’s existing software and equipment*
- *Computer-based technologies should help pathologists cope with the growing volume of information they must handle every day*



### A call to connect

We’ve been working on our digital pathology product as part of our enterprise solution for a number of years. Now, we’re rolling it out in several countries – notably Sweden, the Netherlands and the United Kingdom. Integrated diagnostics is beginning to really capture the imagination of healthcare providers. Particularly since the emergence of the Carter Review on hospital productivity in 2016 (1); the UK’s National Health Service (NHS), for instance, is pursuing a variety of strategic initiatives – many of which involve the adoption of digital pathology. There’s a trend toward breaking down the silos between departments and bringing together medical professionals from all specialties, and connected tools allow that to happen.

Obviously, there are a number of stakeholders involved in this kind of integration. Often, patients (key stakeholders!) – already expect all of their data to be integrated across departments, and sometimes even across institutions. To them, it seems like a “no-brainer” that everyone who looks after them should have all of their medical information – and in some cases, that’s true; in many others, it is unfortunately not.

Information technology (IT) and healthcare professionals are focused on the same questions: how can we collaborate more efficiently? How can we work better? How can technology help us to help our patients? What benefits can a new system offer us that our current systems cannot? At the moment, different departments and specialties may all have different IT

workflows and multi-disciplinary meetings. And for laboratory medicine professionals, the consensus seems to be that digital pathology is the way forward. It's a massive change, but it's also a great opportunity!

#### The integration equation

How a laboratory tackles integration will depend on the degree to which its workflow is already digitized; every institution has a different level of digital maturity. Assuming a very analog workflow (thus, essentially, starting from scratch), requests will arrive at the lab on a piece of paper. Samples will be handled manually – fixation to staining – and results will be returned and reported on another piece of paper that then must be delivered back to the requesting physician. Today there are degrees of automation and digitization in a lab (such as automatic processing, embedding, or staining) – but, equally, there are plenty of opportunities to streamline those processes. The good news is that I think most pathology departments truly understand the need for efficiency, and the benefits that agile process changes can bring – so the real hurdle is in the nature of the change, not the need itself.

A good starting point for this theoretical laboratory would be sample barcoding, ensuring that each sample is always denoted by a single identifier. Purchasing a tissue-tracking system might be a good second step, so that the sample is tracked throughout the entire testing process by having its barcode scanned at each station to maintain the chain of custody. The impetus is then to automate as many steps in the process as possible. Then you can say, “We’ve got brilliant processes; we’ve got high-tech equipment; we’ve got a good laboratory infrastructure; now it’s time to work toward new digital opportunities – collaborating with other hospitals, for instance, or sharing images with a multidisciplinary team.” That’s the real benefit of digitization and integration – it builds exponentially. The more you

take on, the more ability you have to expand further!

When looking into digitization and integration, it’s important to remember that what we see at the clinical level is just the tip of the iceberg. Patient care considerations are obviously first and foremost, but we also need to begin taking into account aspects like accessibility, scalability and security. How safe is the patient’s data? What level of support does a given product have? What effort is required in implementing and maintaining a particular solution? Ultimately, we need solutions that can deliver benefits while fitting into existing patient pathways and workflows. The more a technology can mesh with what’s already in the lab, the more likely it is to present a useful solution to an existing problem. We’re now seeing the rise of technological solutions based on artificial intelligence and machine learning – so these kinds of things will need to integrate smoothly into the existing laboratory infrastructure. The goal is for pathologists to understand their tools and for IT departments to be able to set them up for immediate use.

systems, which can make collaboration and information sharing difficult. From an IT perspective, we need to establish which systems are the best – most user-friendly, most affordable, easiest to combine, and so on; however, those may not be the foremost points in the minds of other stakeholders.

System users – doctors, nurses, laboratory technicians, and other healthcare professionals – must also consider how their computational tools benefit them. Radiologists, for instance, may benefit from seeing pathology images and results, and vice versa. In my opinion, it’s hugely important for integration and consolidation to go hand-in-hand so that the patient record is as rich as it can be. Such integration and consolidation will bring all the images, reports, and advanced tools to clinicians and support concordance

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Standardization (of file formats, for example) is another problem we need to tackle – ideally as soon as possible. In my opinion, digital pathology platforms should all have the ability to work with one another’s file formats – or, better yet, we should define a standard format for all platforms to use going forward. These “bleeding-edge” technologies suffer from enough barriers to entry; we should aim to remove as many as possible.

Flexible – but robust – solutions  
Many pathologists may think, “I’m in a very strong standalone department. I don’t see the need (or there’s no pressure on me) to collaborate or take

in work from anywhere else.” But even those who don’t think they have an immediate need for collaboration can still benefit from digital technology – so the best way to approach purchasing is to make sure your chosen IT solutions are flexible. They need to be scalable, of course – but they also need to allow users to “cherry-pick” the technologies they want. You should be able to say, “I don’t want to buy a solution that only works with a certain scanner. I want to buy one that lets me have this scanner here, that scanner there, and yet another scanner for other types of work.” The more compatible a solution is with the equipment you already use – or may want to use in the future – the better

it will serve you.

I find that the questions users ask at the start of their digital journeys aren’t the same ones they ask after they’ve gained a level of familiarity. When you first invest in technology, you ask things like, “What core features does it have? What can it do?” When you’re in your second or third generation, as radiologists are now, you ask, “How stable is it? What’s your customer satisfaction like? What’s your downtime? How often do you upgrade? What support services do you offer?” The biggest negative effect on efficiency and productivity is unexpected downtime – something you only find out through experience. And when clinicians and patients are depending on your results, you quickly learn to avoid anything that might create delays.

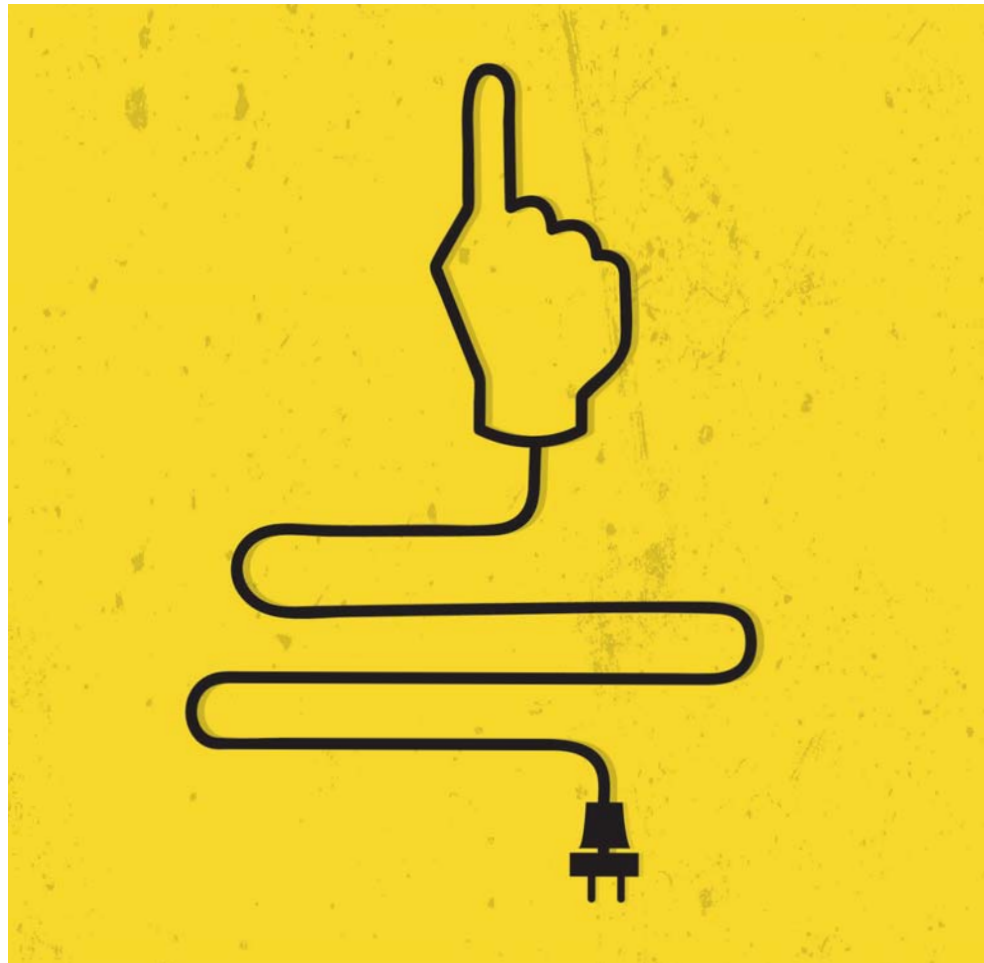
*“The more compatible a solution is with the equipment you already use, the better it will serve you.”*

Consider what would happen if all of a hospital’s radiology services were unavailable for a day – or even just a few hours. Some patients wouldn’t be able to undergo surgery; emergency departments would be compromised in their ability to diagnose or treat; injured patients could be left without medical care until services were restored.

Pathology is an equally critical service – without the laboratory, critically ill patients go undiagnosed, cancer treatments are postponed, and infections may be left to spread unchecked because clinicians can't select the appropriate antibiotic. To avoid these kinds of issues, our technological solutions must be robust – and that may mean looking for technologies with good interoperability, so that each lab can create its own custom setup without building in known restrictions ahead of time. The monolithic approach is not always the right approach. A solution shouldn't just offer its own, homegrown solution that may lag behind the curve of technology development; it should be open to plugging in bleeding-edge technologies and exciting new AI tools developed by small, agile companies. Integration and interoperability are the way to future-proof your service.

#### Developing a digital future

The next step forward is to incorporate artificial intelligence and machine learning into the available platforms for digital pathology. Fortunately, I think the researchers who are developing these technologies now understand that, to take them from a research lab and put it into a clinical setting, they have to understand the practical considerations involved. So now, many of those researchers are partnering with health service providers, such as the NHS to ask: "How can we make our algorithms work in such a crazy, chaotic environment? (Or – in other words – how can we take something that works in a research lab and make it work for all kinds of users in a much less controlled setting?) How does it fit into the existing workflow?" We want to see these technologies help medical professionals by taking away tedious chores (that machines do well and humans often dislike), freeing up time



for clinicians to tackle more difficult tasks and deliver better patient care.

When I started my career as a radiographer, we used to print out magnetic resonance images on film and look at every single image individually; nowadays, that would be impossible with the thousands of images involved! Thankfully, in the meantime, we've developed solutions and algorithms that work with viewing technologies to manage the volume of data, highlight aberrances, and direct the human's attention where the need is greatest, which helps modern radiologists cope with the sheer volume of data they see every day. It's my hope that the same will be true for pathology; I want

digital and computational methods to support people coping with a tsunami of information. Anything that can merge (almost) seamlessly into the existing workflow and go hand-in-hand with existing processes and technologies is welcome – that's how new technologies become not just shiny new toys, but powerful enhancers of patient care.

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#### Reference

1. Department of Health and Social Care, "Productivity in NHS hospitals" (2016). Available at: <http://bit.ly/1FU1TzC>. Accessed January 31, 2018.