# PathLAKE

## Computational Pathology Excellence
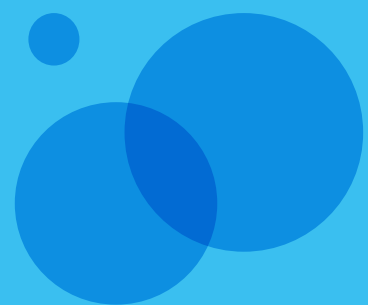
**David Snead**

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Pathologists analyse tissue samples using a microscope. This is often a fundamental step in making a diagnosis for a patient and deciding on the best treatment option. Digital pathology uses a camera mounted on a microscope which scans the slides at high resolution for a pathologist to view on a computer screen. One of the advantages of doing this is that images can be examined by a pathologist at any site, or even working from home.

Having slides in digital format also means we can start to see how computers might help pathologists do their job. Artificial intelligence is being applied to pathology slides, just as it is in every other walk of life. PathLAKE is at the forefront of developing some of these AI algorithms and aims to provide a data lake of images to help other researchers to do the same. These tools will help provide faster more accurate reports to clinicians which will help improve outcomes for patients in the future.
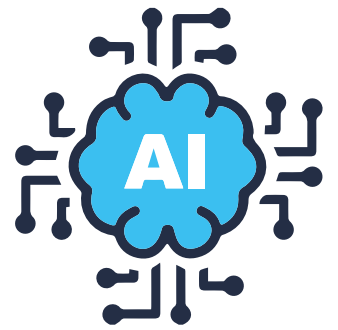
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# Labs go digital and pave the way for AI

**AI**

**Pathologists analyse tissue samples using a microscope. Very thin sections of tissue are stained and mounted on glass microscope slides. Pathologists can then see what is happening inside the tissue sample. This is often a fundamental step in making a diagnosis for a patient and deciding on the best treatment option.**

Using a digital camera mounted on a microscope, the slides can be scanned at high resolution and the images viewed on a computer screen. There are many advantages to this. For example, scanned slides can be examined by a pathologist working at any site, even from home. Cases can be shared between pathologists easily so that diagnoses can be checked and we can prevent errors from happening. Also, complicated and rare cases can easily be shared with experts in the field which will help improve the quality of the reports issued, meaning patients will receive better care.

PathLAKE's work package to digitise five NHS Histopathology labs is almost complete with scanners being provided and installed by our commercial partner, Philips. University Hospitals Coventry and Warwickshire, Oxford University Hospitals and Nottingham University Hospitals, along with Northern Ireland BioBank, have Philips ultra-fast scanners installed and operational. Frimley Park Hospital in Surrey has had its scanner installed which is going through thorough testing before going live.

The benefits of digitisation are already having impacts in routine clinical use. UHCW is making progress towards 100% digitisation: all histology slides are scanned on the Philips scanners, and 90% of our pathologists are reporting cases from digital slides. Dr Richard Colling (Consultant Pathologist) tells us about progress at Oxford University Hospitals:

"In Oxford we are now 100% digital, meaning that we are scanning all in-house FFPE surgical histology. We started with a few subspecialties and added more in a stepwise fashion over the last few years. About 40% of our pathologists are fully digital having completed validation.



(Kieron White with Philips scanner)

Digital pathology has transformed our way of working; we now can report remotely, train registrars digitally, run remote digital MDTs, and even run regional referral networks digitally. And of course, the opportunities for R&D have been outstanding. While it has certainly not been plain sailing, I do believe the advantages and the flexibility that digital brings is worth it for us, and for our patients."

**Richard Colling**

# Going digital paves way for AI tools

Digitisation presents an enormous opportunity. Having slides in digital format means we can start to see how computers might help pathologists do their job - to help diagnose and grade disease, establish prognosis and treatment prediction, and further our understanding of complex diseases.

AI tools are a disruptive technology, performing tasks normally done by human observation. AI tools will help provide faster, more accurate reports to clinicians which will help improve outcomes for patients in the future. This has the potential to greatly improve safety and accuracy of pathology reports, better outcomes for patients and more efficient use of expensive treatment costs.

PathLAKE is at the forefront of developing some of these AI algorithms and we'll be looking at these in the next newsletter issue. Having our labs working digitally has also enabled PathLAKE partners to work on multicentre studies, such as Articulate Pro and IP6-Chairos which are testing and validating new prostate cancer detection systems.

Prostate cancer is the most common cancer among men. In the UK, nearly 100,000 men undergo a prostate biopsy every year - a number expected to double in the next 10 years. More than 40,000 men are diagnosed with prostate cancer in England every year.

## Articulate Pro

A prostate cancer detection software system to help pathologists quickly identify suspicious areas of tissue, developed by the digital diagnostic company Paige, will be investigated in a multicentre clinical study led by the University of Oxford as part of a successful NHSX Artificial Intelligence Health and Care Award.

Oxford University and its NHS partners Oxford University Hospitals (OUH) NHS Foundation Trust, North Bristol NHS Trust and University Hospitals Coventry and Warwickshire, will use Paige Prostate prospectively in a real-world cancer laboratory setting, taking the technology one step closer to widespread use in the NHS to benefit patients.

Professor Clare Verrill from Oxford University's Nuffield Department of Surgical Sciences and OUH is Principal Investigator on the study. She said: *"I see this both as a natural evolution and key transformational point for histopathology. With this award we can advance the adoption of powerful technology to help pathologists by demonstrating the system-wide potential of using AI-based diagnostic systems in routine reporting."*

This histopathologist-led study builds on investments made in digital pathology technology and infrastructure as part of the PathLAKE Centre of Excellence.

*https://oxfordbrc.nihr.ac.uk/ oxford-wins-government-funding-to-evaluate-prostate-cancer-detection-system/*

## IP6-Chairos – a cohort study evaluating a histology AI tool to diagnose prostate cancer

Five NHS Trusts have been chosen to test revolutionary computer screening to analyse prostate biopsies from 600 patients over 14 months.

The technology, which has been developed by Ibex Medical Analytics is designed to help reduce diagnostic errors and speed up diagnosis.

Clinicians will compare the results of the AI analysis to current diagnosis methods, where biopsies are meticulously reviewed by a pathologist.

Prof David Snead, pathologist at University Hospitals Coventry & Warwickshire and director of PathLAKE said: *"We are excited to participate in this important validation of Ibex's platform.*

*"I believe that AI will forever change the pathology practice. Pathologists will adapt and learn to utilise such tools in ways that provide better care to our patients."*

*https://www.nationalhealthexecutive. com/articles/hospitals-prostate-cancer-study-NHS-ai*

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## What is Computer Assisted Diagnosis? PathLAKE launches new animated video for patients and the public

PathLAKE is excited to launch a new video for patients and the public giving a brief introduction to computer assisted diagnosis.

With the help of animations, Dr John Guelke explains what whole slide images of tissue are, and how the patterns found on whole slide images may indicate diseases, such as cancer.

Professor Tom Sorell, head of the Interdisciplinary Ethics Research Group at the University of Warwick and ethics lead for PathLAKE, said:

*"This video is intended to give patients and the general public a brief introduction to computer assisted diagnostics. Patients were heavily consulted before the video was made, so it reflects their views.*

*The video shows that the patterns (on which diagnoses are based) use annotations of the images made by expert human pathologists. Patients who think machine diagnosis is independent of expert human judgement should be reassured."*

Subtitles are available in English, Polish, Punjabi and Urdu using the closed caption (CC) settings on the video toolbar.

**Link** to video on PathLAKE's YouTube channel.
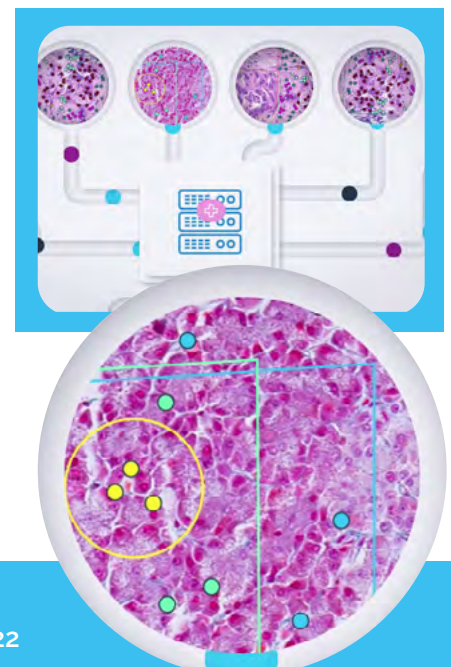
# PathLAKE Plus

## PathLAKE Plus aims to deliver digital pathology and AI benefits to over 17 million NHS patients

**UHCW NHS Trust is proud to be leading a consortium of NHS hospital trusts to implement digital pathology and artificial intelligence (AI) across the NHS through the PathLAKE Plus project. PathLAKE Plus has been funded by a £13.5m grant from the Office of Life Sciences to scale up the work of the PathLAKE Centre of Excellence.**

Despite the challenges of the COVID-19 pandemic and ongoing microchip shortages, the PathLAKE Plus consortium has successfully engaged with suppliers to procure digital pathology solutions throughout 2021. Many sites are looking to install their scanning equipment before Christmas 2021. As the procurement stage of the project comes to an end, the implementation stage will begin - along with a new set of challenges.

Dr Andrew White, PathLAKE Plus Project Manager, had these words to say:

"Two years ago UHCW and the other PathLAKE Plus partners came together, united by a single vision of delivering much needed innovative technologies into NHS pathology labs. Seeing that vision starting to become a reality represents a major achievement for the project. We are proud of everything accomplished so far - but procurement is only the first step.
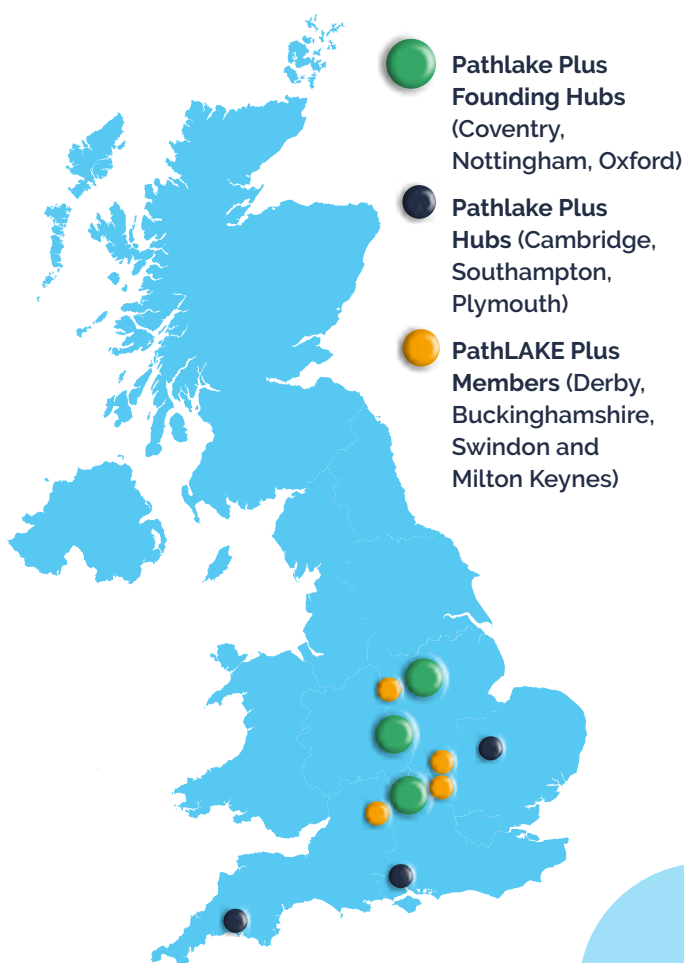
Whilst we will face new challenges as these technologies are integrated into NHS labs, the adoption of AI into clinical practice is particularly exciting.

Digital pathology will provide a gateway for the use of AI in clinical practice, giving pathologists access to invaluable diagnostic tools and information that would not otherwise be available. However, exactly how AI will be deployed and integrated into pathology lab work flows has yet to be determined.

These are exciting times and PathLAKE Plus will be leading the way in realising the benefits of digital pathology and AI within the NHS."

### PathLAKE Plus - NHS sites map

**Pathlake Plus Founding Hubs** (Coventry, Nottingham, Oxford)

**Pathlake Plus Hubs** (Cambridge, Southampton, Plymouth)

**PathLAKE Plus Members** (Derby, Buckinghamshire, Swindon and Milton Keynes)

The PathLAKE Education platform is open to all. To request free access to the PathLAKE Pathology Education Tutor Platform, **simply enter your details here.**

# Publications

In each edition, we shine a spotlight on one of the most recent PathLAKE publications and interview some of the authors involved in creating these papers.

"Current and future applications of artificial intelligence in pathology: a clinical perspective."

Prof Emad Rakha is a Professor of Breast Pathology and Honorary Consultant Pathologist at the University of Nottingham and Nottingham University Hospitals NHS Trust.



**What are the three key future applications of artificial intelligence (AI) in pathology?**

This is a fast-moving area. In my opinion, the three key future applications will be:

- Streamlining the workflow and automatic quality control (QC) of cases

- Diagnostic applications to provide primary or secondary reporting of cases. This includes reporting of a component of cases such as lymph nodes, primary reporting of whole cases, second opinion and double reporting of cases and retrospective audits of diagnosis.

- Providing information relating to tumour behaviour and response to therapy, to replace and improve the existing prognostic and predictive tools and classifications systems.

**Why do you think there are delays in the implementation of these applications?**

The main reason for delays in the implementation of these applications is the pace of adoption of digital pathology.

In addition, the development of AI-based tools is time consuming: once developed, a tool then needs to be validated and approved which is also a lengthy process.

I don't think the implementation is slow, but it is gradual and progressing. It is currently at an early stage, but I am confident it will reach an exponential phase in the near future.

**How do you think we can raise awareness of these applications and improve the implementation efficiency?**

This is really a challenging question. Although public and patient awareness and endorsement is very important and essential in order to be able to use the technology, the real customers of the technology are pathologists, pathology department managers and NHS/Trust managers.

Increasing awareness of the target groups of the technology and its benefits, highlighting the various applications, and the actual cost efficiency and impact of performance on patient care is likely to allow and support its implementation in routine practice.

Positive results from pilot sites which have implemented the technology can be used as real-life evidence of the tools and potential applications and increase the trust in the technology.

It is also important to differentiate between public and patient awareness of the AI technology in general, the use of data to develop and validate AI algorithms, and the routine applications of AI based tools as a platform to improve patient care. Clarity and explainability of AI algorithms including development, validation, approved clinical use and potential impacts are also important.

To read the full paper in the Journal of Clinical Pathology, click this **link**.

Please follow the link here to find a list of our most recent PathLAKE publications

# Events and News

The PathLAKE consortium runs regular events, workshops and masterclasses aimed at supporting those in the pathology and computer science communities in the adoption of digital pathology and AI technologies

**TIA Centre Seminars:** The TIA Centre Seminar Series welcomes external speakers to give presentations on Computational Pathology and aims to stimulate thought-provoking discussions among participants. So far, we have had four exciting speakers from across the globe, who have discussed various interesting concepts and their applicability to histology image analysis.

**Recorded sessions are now available on YouTube:** TIA Centre Seminar Series - YouTube

**Please find further information of upcoming dates on the TIA Seminar webpage:** TIA Centre: Seminar Series (warwick.ac.uk)

**International Pathology Day:** Prof Rajpoot delivered a talk on the Role of AI in Pathology at the RCPath International Pathology Day, held on 10 November 2021. The focus of his talk was the tremendous opportunities for early diagnosis and personalised treatment offered by the digitisation of tissue slides, offering the chance to leverage the power of billions of raw pixels for deep learning of known and deep mining of unknown histological patterns in digitised whole-slide images.

The talk video is available on **YouTube**

**The AI Centres of Excellence ethics webinar series continues with our colleagues at iCAIRD and LMIAIC hosting webinars in November.**

On 9 November, iCAIRD hosted a webinar on the theme **AI in Ethics**. Three presentations covered safety assurance processes in healthcare AI, data governance and ethics committees and involved the public in AI research. This was followed by a panel discussion and Q&A.

The recording and speakers' slides are now available to view here: **https://icaird.com/presentations/**

The theme of the London Medical Imaging & AI Centre's webinar on 18 November was **Trustworthiness in Healthcare AI**. The three speakers looked at ethical AI from an academic, philosophical and legal perspective. The event focused on the theme of trust: how you improve or damage it? The presentations covered the black box, bias, profiling in medical AI, and data governance and were followed by a panel discussion.

**Conference report:**

"The PathLAKE team attended the 8th Digital Pathology and AI Congress: Europe which took place in London on 1 and 2 December. It was a welcome opportunity to meet and speak to attendees and exhibitors in person in a well-managed COVID-safe environment. There were some very interesting talks led by a wide range of speakers, including from PathLAKE, director Professor David Snead, Professor Nasir Rajpoot and Professor Clare Verrill. It was a fantastic event concluded by the PathLAKE team's very own, Mahmoud Ali, as a winner of the poster competition with his poster titled 'Digital Pathology archiving based on SNOMED codes'. Well done Mahmoud!" – **Rachel Flowers**
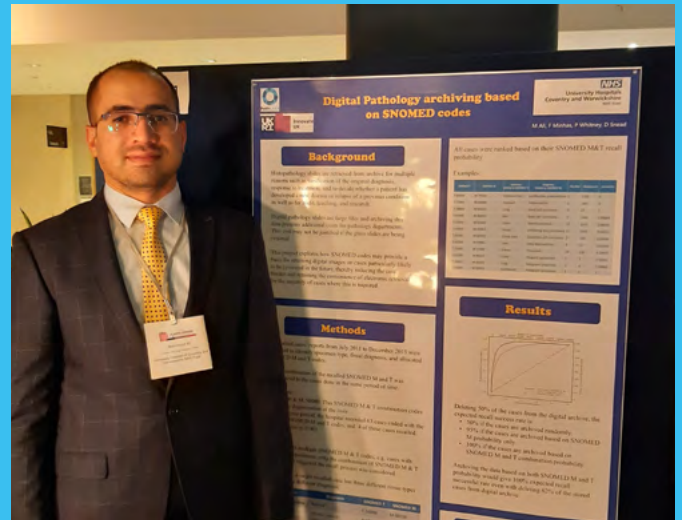


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