COLLEGE of AMERICAN PATHOLOGISTS

Lessons Learned: Successful Adoption of Digital Pathology

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March 4, 2025

Conflict of Interest

- The speakers of this webinar will discuss their conflict of interest within their presentations.
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Marilyn Bui, MD, PhD, FCAP

Dr. Bui is the chair of the Digital and Computational Pathology Committee, member of the Council on Informatics and Pathology Innovation, Vice Speaker of the House of Delegates, and the ex-officio member of the Board of the Governors. She is a Senior Member in the Department of Pathology at Moffitt Cancer Center in Tampa, FL. She serves as the Scientific Director of Analytic Microscopy Core, with adjunct faculty appointment at the Machine Learning Department of Moffitt. She is also a Professor at the University of South Florida (USF) Morsani College of Medicine.

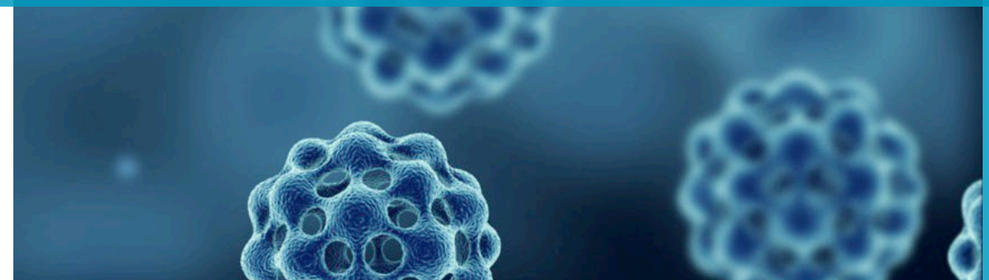
The CAP Digital and Computational Pathology Committee

- The charge of the Digital and Computational Pathology Committee (DCPC) is to advance the adoption of digital pathology within the CAP and to serve as a respected resource for information and education for pathologists, patients and the public on the practice and science of digital pathology.

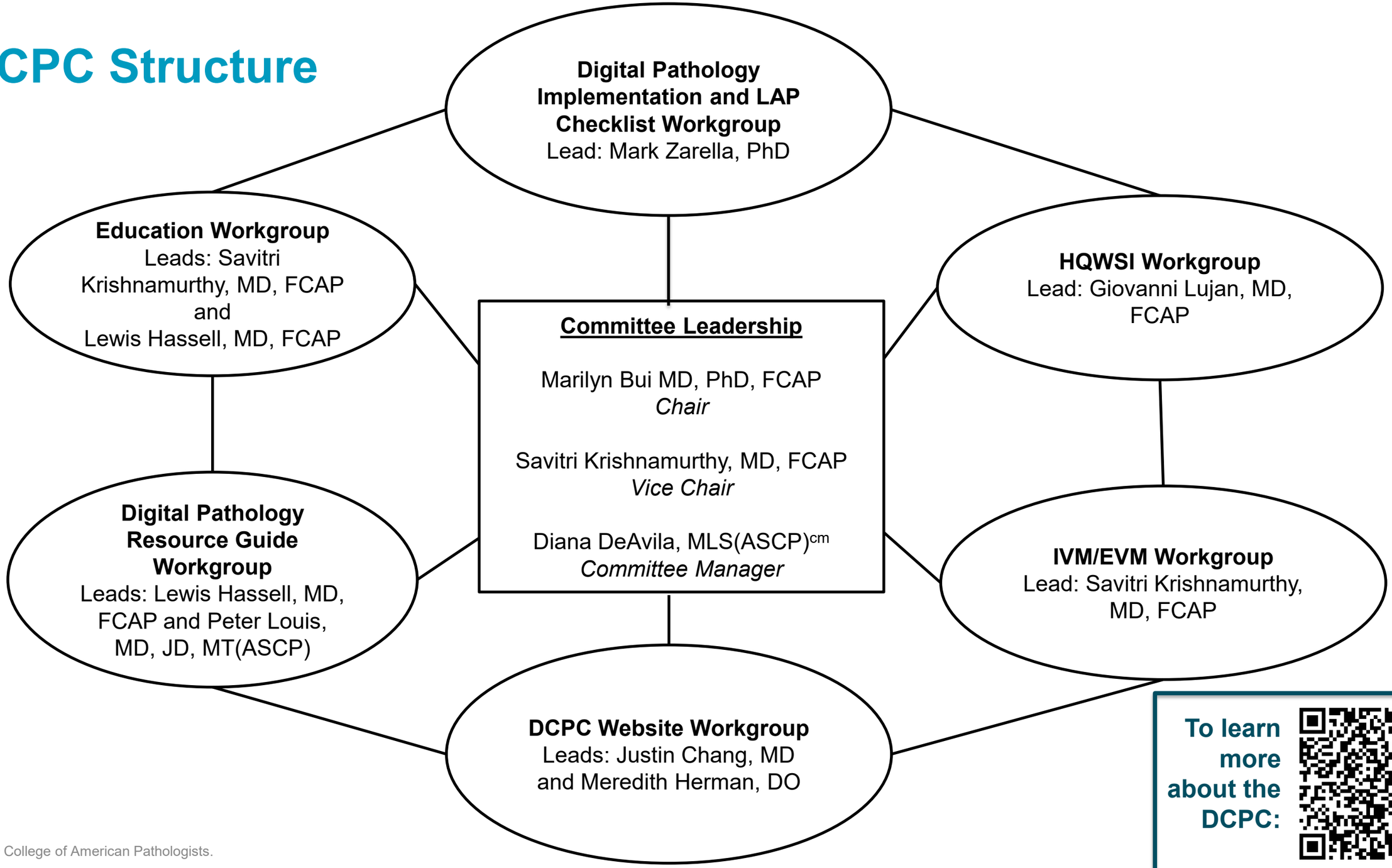
- Committee Leadership:
  - Marilyn Bui, MD, PhD, FCAP Chair
  - Savitri Krishnamurthy, MD, FCAP Vice Chair

Composition of the DCPC

- **Diverse Pathology Expertise:** 24 pathologists with a wide range of specialty interests and expertise in informatics, digital pathology (use, development, standards, validation), AI, IVM/EVM, and more.
- **Rising Stars:** 2 talented junior members bringing fresh perspectives.
- **Wide Representation:** Members from academic institutions, private practices and industry.



DCPC Structure



To learn more about the DCPC:

Savitri Krishnamurthy, MD, FCAP

Dr. Krishnamurthy is Vice Chair of the Digital and Computational Pathology Committee of the CAP. She is a Professor of Pathology at the University of Texas MD Anderson Cancer Center in the Breast Pathology and Cytopathology sections. She completed her residency training from New England Medical Center in Boston followed by Oncologic Surgical pathology fellowship training in Memorial Sloan Kettering Cancer Center, New York and Cytopathology fellowship training in MD Anderson Cancer Center, Houston. She contributes towards patient care, education and clinical translational breast cancer research. She is an avid researcher of digital and computational pathology applications pertaining to Anatomic Pathology and ex vivo digital microscopy techniques.

Agenda

TOPICS	PRESENTERS
HNL Lab Medicine's Adoption of Digital Pathology	Dr. Olson
Univ. of Louisville Digital Pathology/Artificial Intelligence Journey	Dr. Gondim
Q&A Session	Drs. Bui, Krishnamurthy, Olson, Gondim, and Borkowski

Learning Objectives

- Understand the primary challenges and barriers to adopting digital pathology and explore practical solutions for addressing them.
- Learn how effective collaboration among pathologists, IT professionals, and clinical informatics experts can facilitate a smooth transition to digital pathology.
- Gain an understanding of the critical steps and infrastructure required for the successful implementation of digital pathology in clinical workflows.

HNL Lab Medicine®

Lessons Learned:
HNL Lab Medicine's Adoption of Digital Pathology

Jordan Olson, MD, FCAP

Jordan Olson, MD, FCAP

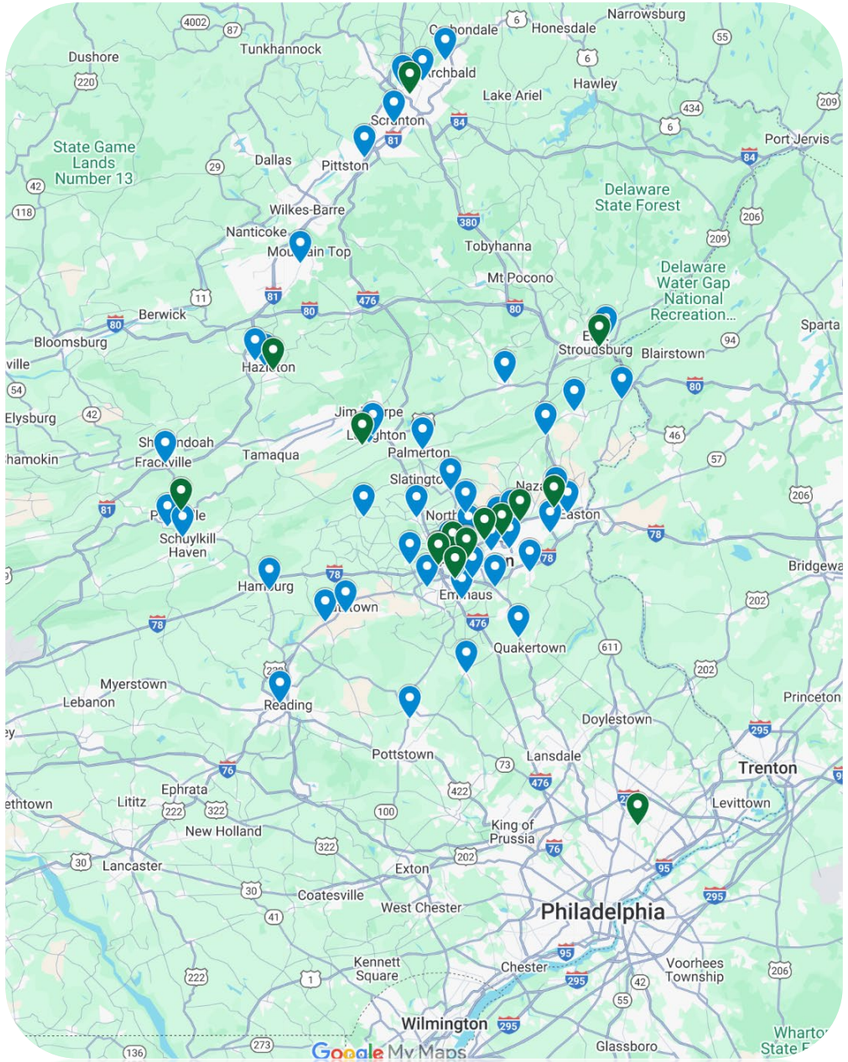
Dr. Jordan Olson, is the Chair and Medical Director of the Department of Pathology at HNL Lab Medicine and Lehigh Valley Health Network, now part of Jefferson Health.

He earned his undergraduate and medical degrees from the University of Wisconsin-Madison and his pathology training at Penn State Milton S. Hershey Medical Center, where he also completed a fellowship in Blood Banking and Transfusion Medicine. He is board-certified in clinical informatics.

A member of the DCPC for two years, Dr. Olson is passionate about leveraging technology to enhance patient care.

Who We Are

- **HNL Lab Medicine is Based in Allentown, PA**
- **An independent laboratory that is owned by and provides all laboratory services for LVHN Health Network part of Jefferson Health.**



HNL LAB MEDICINE

A leading, full-service medical laboratory

At a Glance

Health System Clients

Lehigh Valley Health Network

Holy Redeemer Hospital System

Good Shepherd Rehabilitation Hospital

Outpatient Clients

2,300+
Lehigh Valley Physician Groups

3,400+
Independent Physicians

140+
Post-Acute Care Facilities

300+
Genomics Clients

...and more

Agnostic IT Platforms

2,700 Clients
Interfaced orders/results

7,500 providers
Interfaced orders/results

AI-Enabled Services
Cytogenetics, Billing, Customer Care

Testing & Resulting

1,300
Tests Offered

99%
In-House Tests Resulted within 24 Hours

60 Million+
Annual Clinical and Anatomical Pathology Results

About HNL Lab Medicine

1,150
Team Members

44
Pathologists & Scientific Directors

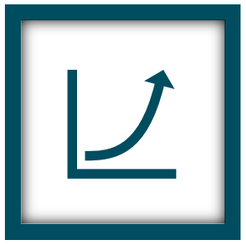
20
Clinical Departments

102,000 Sq. Ft.
Core Laboratory

DIGITAL PATHOLOGY
Where We are Today

- 6 scanners in use, 1 on order
- All H&E slides scanned (2500/day)
- All IHC slides scanned
- All pathologists using digital pathology for clinical sign-out
- Hybrid work model with remote workdays for pathologists

DIGITAL PATHOLOGY
Why Now?



Greater workload due to aging population

Shortage of pathologists with many aging into retirement

Increased need for efficiency due to high demand

Technology has matured to a clinically usable point

Strong desire for remote work

New legislation that enables remote work

THE OBJECTIVES

What do We Hope to Accomplish?

01

Optimize Patient Care

02

Maximize Efficiency

03

Decrease Tasks

04

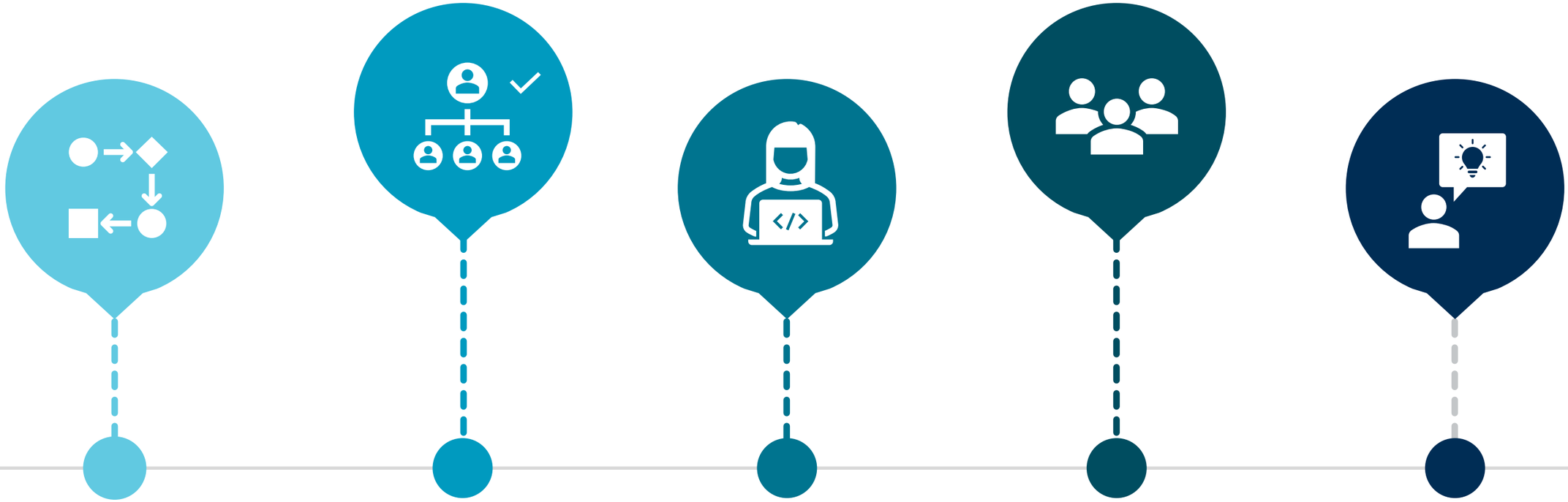
Maximizing Flexibility for Current Pathologists

05

Future Hiring – Remote Pathology

GETTING STARTED

Our Approach to Implementation



Create a Business Plan

Obtain Support

Early-Stage IT Involvement

Engage AP Management and Histology

Identify at least one champion among each team

THE TRANSITION

What does it take to go Digital?

- Vision & Clear Goals
- Business Case
- Organizational Support

LAUNCHING DIGITAL PATHOLOGY

Reach out to the Digital pathology Community

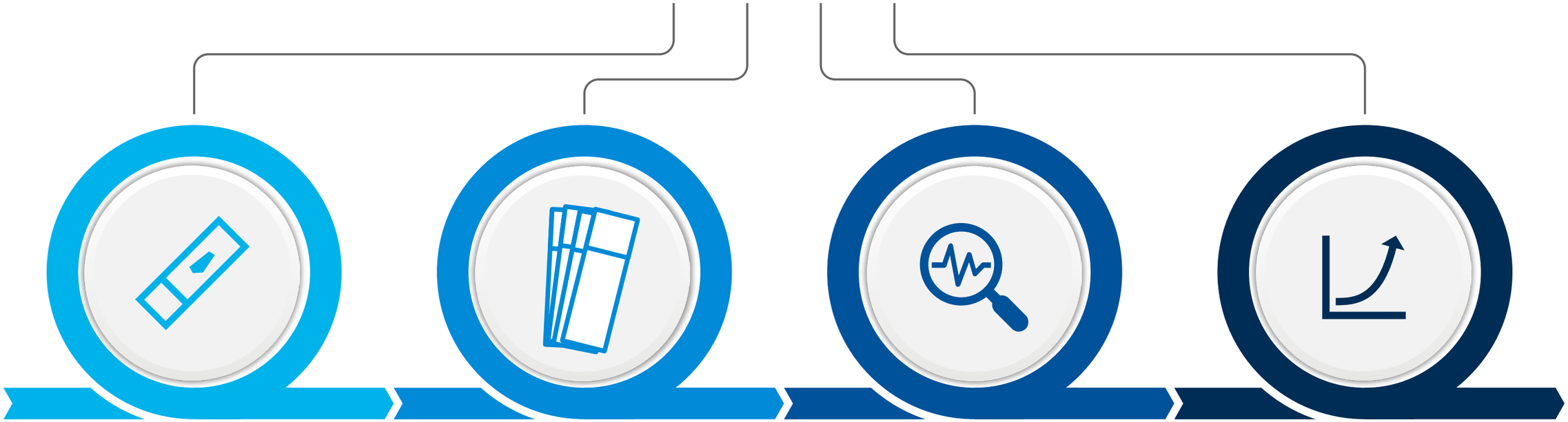
Look at the workflow from multiple viewpoints

Multiple Demos

Weekly meetings with pathologists, IT, LIS, Viewing system, and OPEX

THE DATA FRONTIER

Managing the Data Deluge



One Glass Slide = 1 to 2 GB of Data!

Busy Labs = 2-3,000 Slides a Day

Multiple Terabytes Generated Each Week

Petabytes of Data if Everything is Kept (1 Petabyte = 1,000,000 GB)

DIGITIZATION DILEMMAS

Tackling the Challenges

- Building the IT infrastructure
- Integrating our Viewing system with our LIS
- Planning for storage
- Working in a hybrid system until completely digital without disrupting our regular workflow

Training and Implementation

Training Our Staff was a Big Focus

Hybrid Work to Transition Pathologists into Digital

Multiple Methods Used:

- Asynchronous
- In person
- At elbow
- Group Settings

Setting Workflow Milestones Helps Drive Adoption

UNEXPECTED
Lessons Learned

- Champions in Multiple Areas Drive Success
- Workflow Must Be a Priority
- Clear Expectations Shape Engagement - Including Pathologists
- Question Assumptions
- Connect—You're Not Alone

Questions?

HNL Lab Medicine

Jordan Olson MD FCAP

Jordan.Olson@hnl.com

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The Journey to Implement Digital Pathology & AI at the University of Louisville Laboratory

Dibson Dibe Gondim, MD, FCAP

Dibson Dibe Gondim, MD, FACP

- Member of the Artificial Intelligence Committee, CAP
- Director of Pathology Informatics and Associate Professor of Pathology at the University of Louisville
- Certified by the American Board of Pathology in:
  - Anatomic Pathology
  - Neuropathology
  - Clinical Informatics
- Lead on the large-scale digital pathology and AI Initiative at the University of Louisville

Large-scale Digital Pathology with AI

Laser-focused on creating an efficient, scalable rollout

- Avoidance of vendor lock-in
- Low risk of obsolescence (future-proofing)

Scope & scale

- Digitization of 100% of FFPE slides (~200,000 slides per year)

Key collaborators & focus

- Director of Pathology Informatics
- Chair of Pathology (Dr. Eyas M. Hattab)
- UofL Health C-suite
- UofL Health Central IT

Core Requirements

Coverage

- 100% scanning of all FFPE cases

Case availability

- Minimal or no additional turnaround time due to scanning

Scalability

- Increase capacity from minimal volumes up to 200,000 slides/year

Storage: 300 TB capacity/year

Viewer: Web-based, accessible remotely

AI Platform: Clinical-grade algorithms

University of Louisville DP/AI Journey

Deep dive approach to efficiently deploy large scale DP/AI

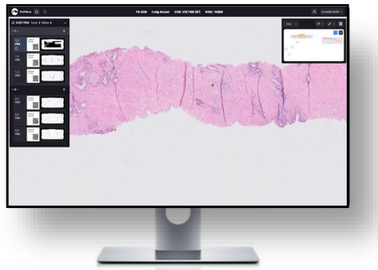
Rapid scale-up

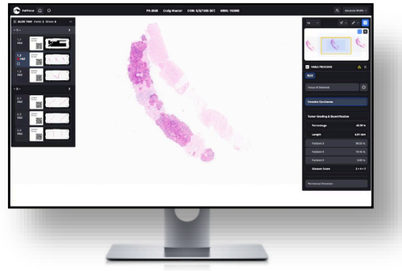
- Grew from minimal scanning to 100% slide coverage in just 9 months

AI from the start

- Artificial Intelligence integration was a core requirement from day one

Digital Pathology and AI Infrastructure





Scanning
GT450 x3

Optimized physical integration

WSI Storage, cloud-based, Paige
1.5 GB Direct Link between UofL Health Datacenter/AWS

8K monitors

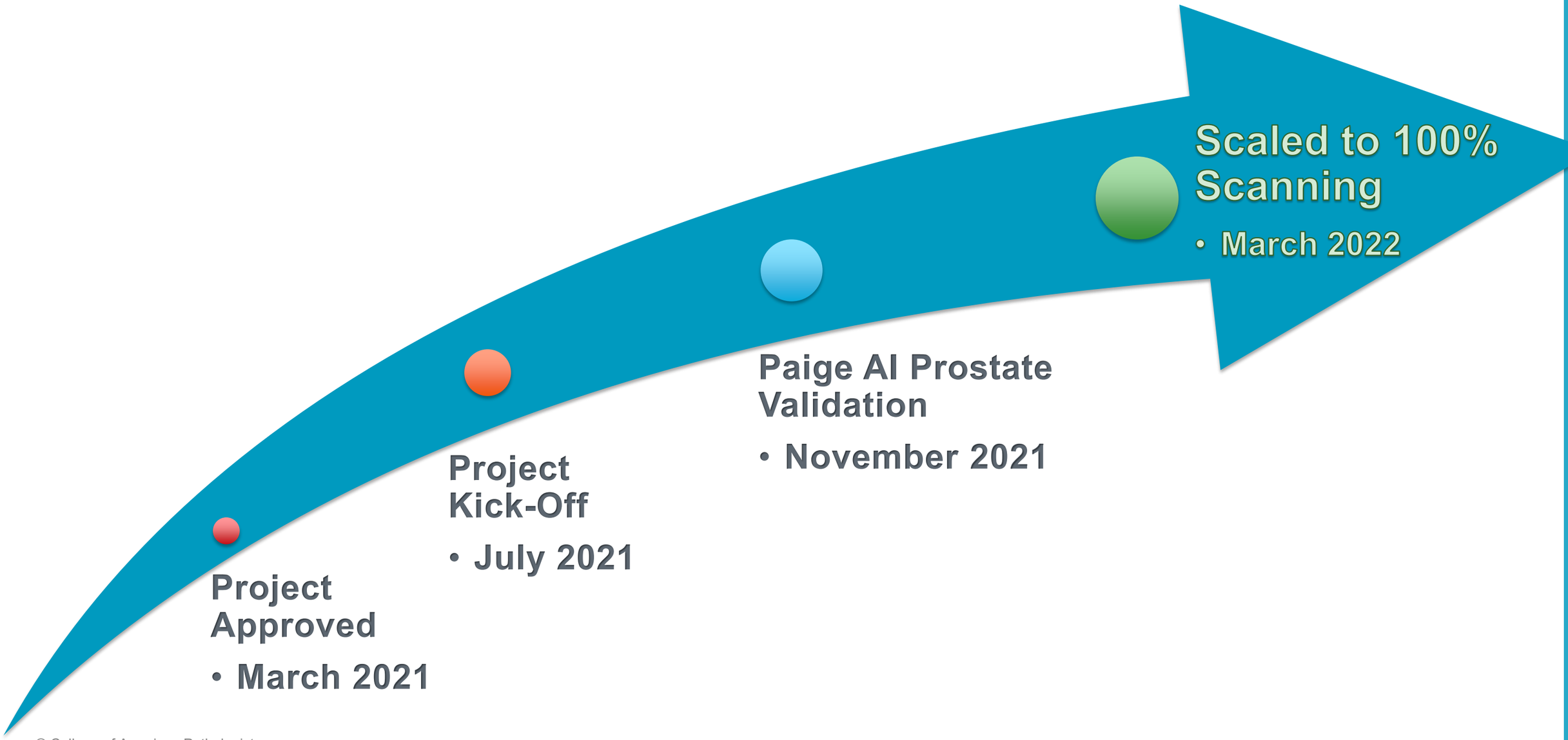
Web-based viewer and image management System, **Paige**

Clinical grade AI, **Paige**
First system deployed and validated: Paige Prostate AI

LIS integration *(build by in-house team in collaboration with Paige team)*

UofL Health

Timeline & Milestones



Paige

100% Digital Pathology — But Not All at Once

Project divided into 3 phases

Foundation and validation

Digitization integration and scaling

Advanced Interface

Gradual, manageable rollout to ensure

- **Thorough validation**
- **Scalability**

Phase 1 – Foundation and Validation

- GT450 scanner x1
- Unidirectional interface
- DP validation
- AI validation (Paige prostate AI)

Phase 1 – Foundation and Validation

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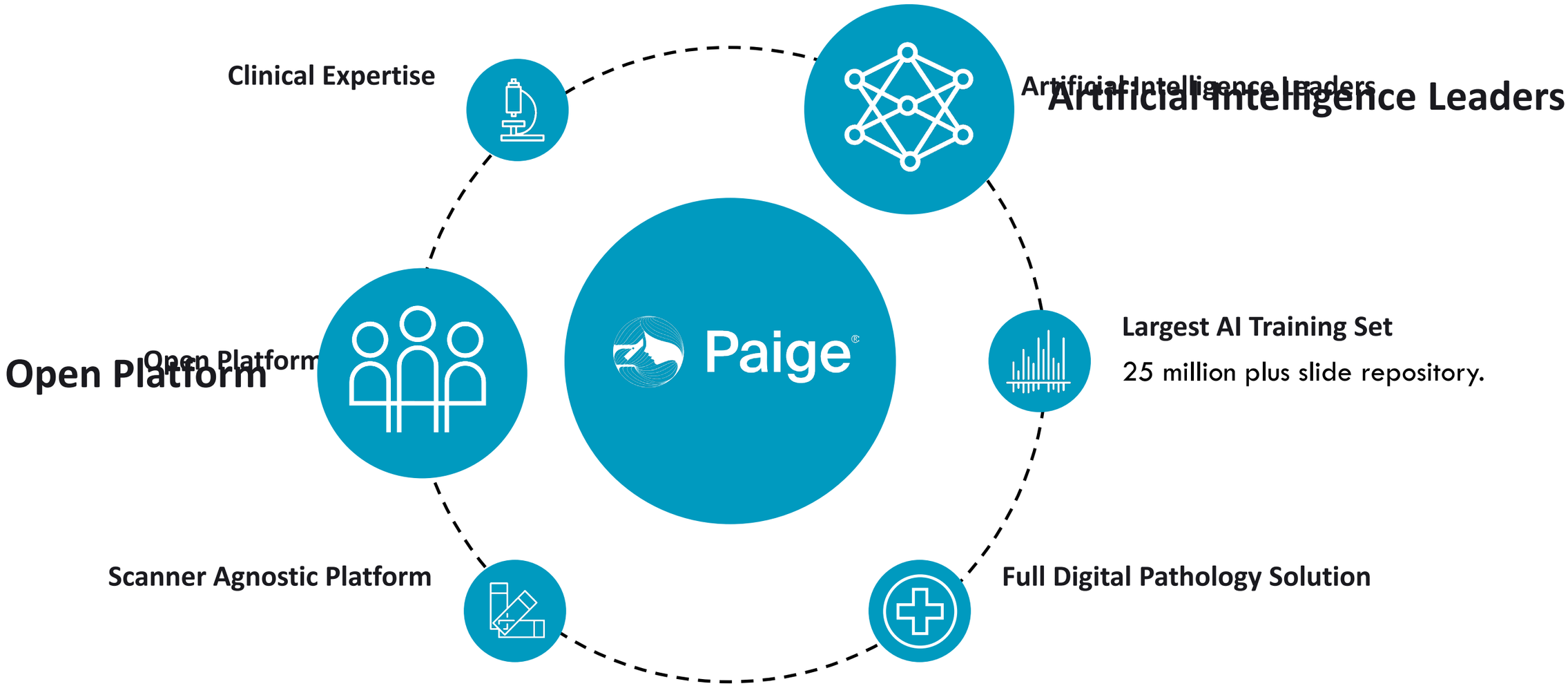
Validating Whole Slide Imaging for Diagnostic Purposes in Pathology

https://www.cap.org/protocols-and-guidelines/cap-guidelines/current-cap-guidelines/validating-whole-slide-imaging-for-diagnostic-purposes-in-pathology

Image Management System and AI



Paige Prostate AI Validation

Validation study: 1141 images

Only images containing cancer or benign tissues

Results

- **Sensitivity**: 0.97 (97%)
- **Specificity**: 0.98 (98%)
- **Positive predictive value (PPV)**: 0.93 (93%)
- **Negative predictive value (NPV)**: 0.9943 (99%)
- **Accuracy**: 0.9807 (98.07%)

Tarymé López-Díaz, Dibson Dibe Gondim

Paige Prostate AI Validation (*continued*)

AI contributions

- **6/1141 slides = diagnostic correction 0.5%**
  - **2 slides**: Corrections from **BENIGN** to **CANCER**
  - **4 slides**: Corrections from **CANCER** to **BENIGN**

AI distractions

- **17 slides**: AI incorrectly called **CANCER**
- **4 slides**: AI incorrectly called **BENIGN**

Importance of pathologist oversight

Tarymé López-Díaz, Dibson Dibe Gondim

Phase 2 – Digitization Integration and Scaling

- Histology lab renovation to accommodate scanners
- Added GT450 x 2
- Accomplished 100% FFPE digitization with minimal delays

Scale of Digitization Operation

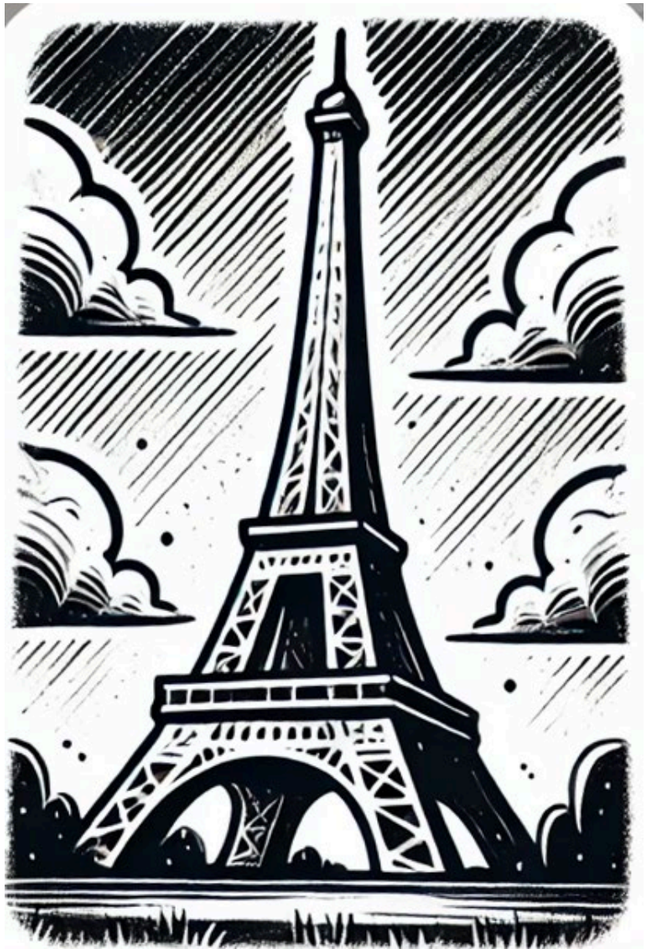
Digitization

- 600-800/day
- 200k /year
- Avg file: 1.6 GB
- 1.2 TB/day
- 300TB/year

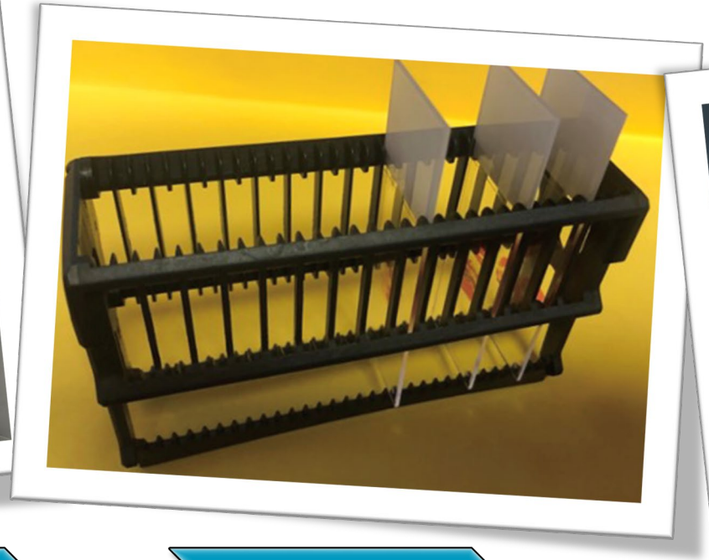
Large Scale = Efficiency is a Must

Digitization

- 200,000 slides scanned yearly
- Stacked slides = 270m
- Eiffel tower = 330m

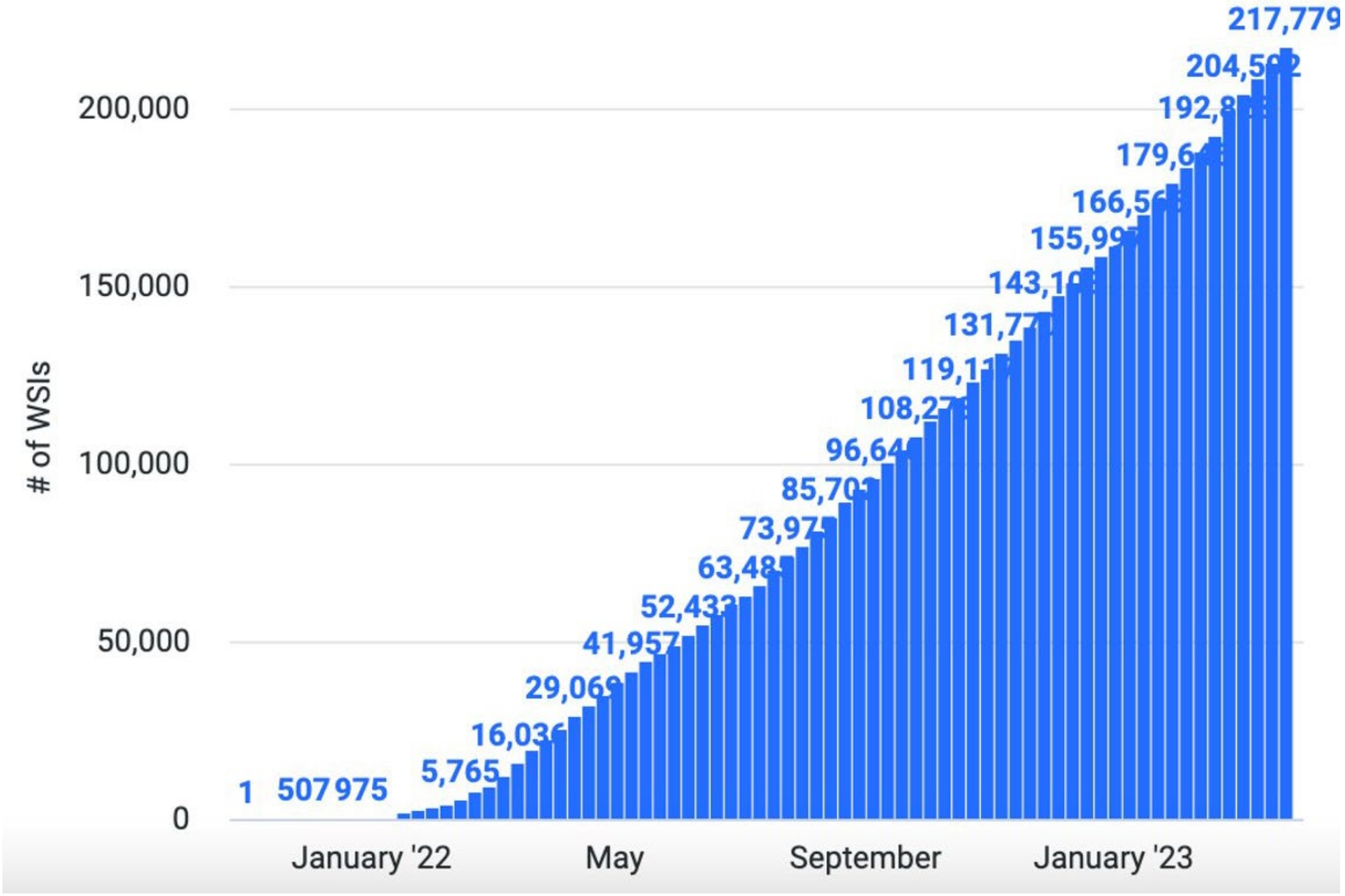


Digitization Optimally Integrated in Histology Laboratory



Staining → Cover-slipping → Drying → Same rack → Digitization

Cumulative Number of WSIs Ingested Over Time



Scanning Functionality and Histology Operation Impact on Digitization

OPTIMAL HISTOLOGY OPERATION → NO DELAY

HISTOLOGY DISRUPTION → DELAY

→ PROSPECTIVE SCANNING WITH DELAYS

→ NO PROSPECTIVE SCANNING

→ NO PROSPECTIVE SCANNING

→ NO PROSPECTIVE SCANNING

Phase 3 – Advanced Interface

Functionalities

- **Updates**
- **Slide counts (pathology workflow visibility)**
- **Button to launch WSI from LIS**

Project milestones

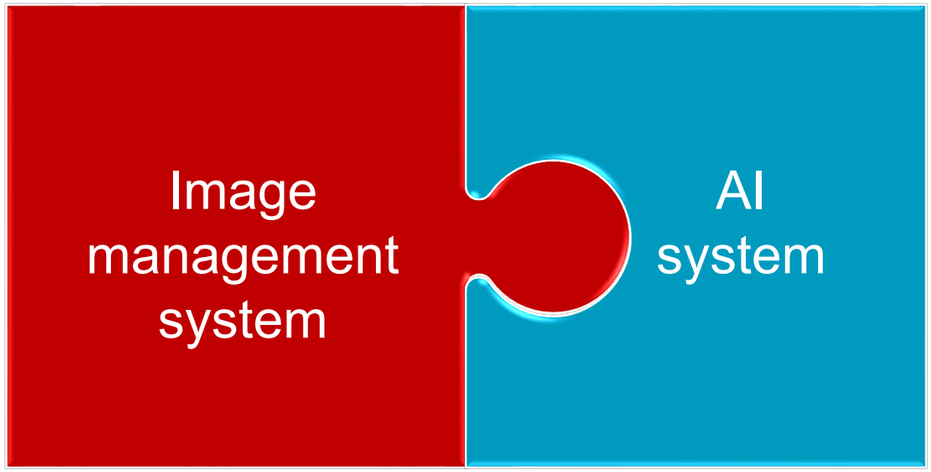
- Engaged with LIS vendor since 2021
- Original completion goal: Q4 2022
- **Revised timeline:** April 25

Key considerations

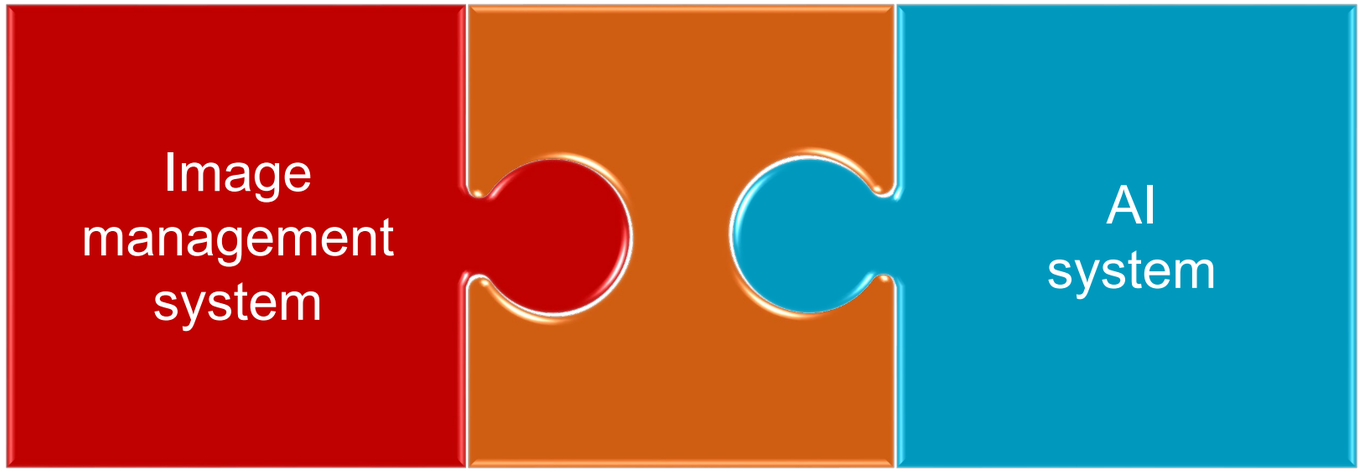
- First client to request a digital pathology interface
- Low vendor priority initially, causing delays
- Transitioned from an alpha driver to a fully mature solution

IMS + AI Interoperability

Integrated (same vendor)



Standard-based interface



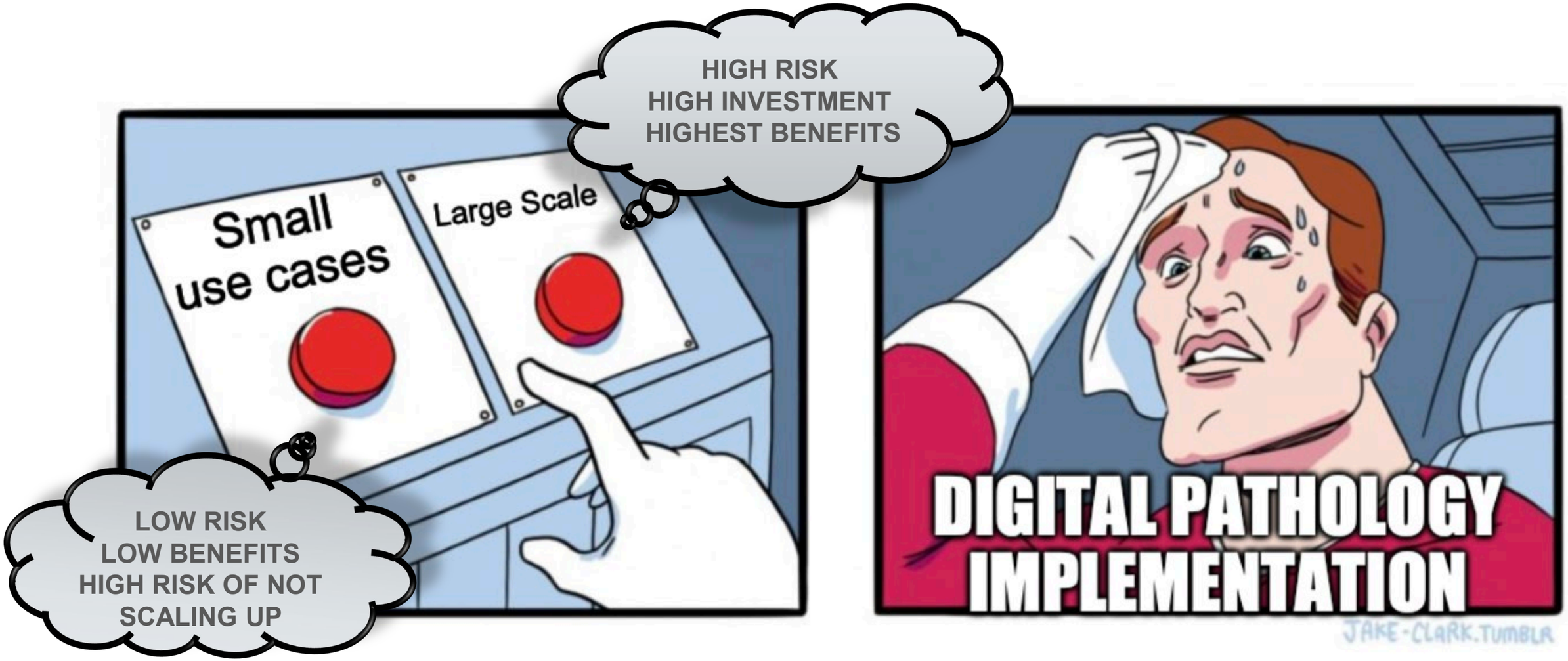
Custom interface

Discussion

Contrasting

- Small use case
- Small use case without interoperability
- Large scale digital pathology

Implementation Dilemma



Small Use Case

Narrow focus

- Buy a scanner to support a limited objective (e.g., tumor boards)

Continuous expansion challenges

- Keeping adding use cases may become too complex
- No guarantee of successful scalability to 100% digitization if not planned from the outset

Administrative burden

- Requires repeated capital expenditures
- Significant time commitments for multiple stakeholder

Small Use Case

Limited interface requirements

- Advanced interface development may be unnecessary
- High costs are difficult to justify for smaller-scale operations

Scanning approach

- **Prospective:** Integration into the histology lab is optional
- **Retrospective:** Requires more labor (locating, cleaning, scanning, and refiling slides)

Key takeaway

- Prioritize minimal investment and manual processes over full automation and interoperability

Small Use Case WITHOUT INTEROPERABILITY

- Not scalable
- A lot of manual work
- Lack of consistency, only some cases are available
- Difficult to retrieve scanned cases (limited metadata)
- High-risk of failure due to low adoption, proceed with caution

Aiming for 100% – Key Enablers

Covers most of use cases including primary diagnosis and remote work

Histology workflow integration

- Scanning at the histology lab
- Scanner located next to stainers
- Compatibility between stainer and scanner rack

Interoperability between multiple systems

- Laboratory information system
- Image management system
- AI systems

Advantages of 100% Prospective Scanning Approach

Consistency	No need to confirm whether a case has been scanned or track down missing slides	
Cleanest slides	Scanning immediately after staining captures the highest quality images	
No triage protocol	Eliminates the complexity of selecting which cases to scan	Enables a single, streamlined workflow
Easier scaling	Avoid repeated budget requests to expand digital pathology	Secure upfront resources for a comprehensive, long-term solution

Takeaways

- The current DP technologies available in the market make large scale digital pathology a viable option
- Appropriate physical and IT integrations make the operation more efficient and affordable
- Large scale planning can be successfully implemented gradually

THE DARK REPORT
Since 1995, Reliable Business Intelligence for Clinical Laboratories, Pathology Groups and Laboratory Diag

DIGITAL PATHOLOGY ROLLOUT WAS 'BIG BANG' AT UNIVERSITY OF LOUISVILLE

Academic pathology department's goal was full implementation, including primary diagnosis

By Scott Wallask > From the Volume XXX, No. 11 - July 31, 2023 Issue

← OIG: Billing Code 81408 Is at 'Risk of Improper Payment' 2022 Ranking of the World's Top 12 IVD Corporations →

CEO SUMMARY: It took less than one year to achieve full implementation of whole slide imaging and digital pathology at the University of Louisville's Department of Pathology. One decision was to scan slides in a central location to promote efficient workflows. Integrating digital pathology with the pathology LIS and artificial intelligence software proved to be [...]

SCAN ME

Thank you!

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Piotr Artur Borkowski, MD, FCAP

Dr. Piotr Borkowski attended and graduated from the Medical University in Gdansk, Poland in 1990. He completed his anatomic and clinical pathology training at Mount Sinai Medical Center in Florida. Dr. Borkowski currently serves as a Managing Director for Quest/Ameripath Tampa and Central Florida Business Unit. Dr. Borkowski also serves as the Director of the Center of Excellence for Digital and AI-Empowered Pathology of Quest Diagnostics. He also serves on the board of Florida Society of Pathologists, the CAP Digital and Computational Pathology Committee and the editorial board of AI in Precision Oncology publication. Dr. Borkowski is board certified in Anatomic Pathology, Clinical Pathology and Clinical Informatics by the American Board of Pathology.

Q&A Session

Thank You!

The DCPC will be producing more digital pathology educational content in 2025. Scan the QR code for a list of all upcoming CAP webinars:

Interested in joining the Digital and Computational Pathology Committee?

The application window to serve on a CAP committee for 2026 will close on May 2, 2025. Visit the DCPC website and select “Apply Now”

New Resource for Digital Pathology Implementation

December 6, 2024

COLLEGE of AMERICAN PATHOLOGISTS
Laboratory Quality Solutions

NATIONAL SOCIETY FOR HISTOTECHNOLOGY

Practical Tips to Assist Implementation of Whole Slide Imaging

Contributors/Acknowledgements

Michael LaFriniere, HT(ASCP), Humberto E. Trejo Bittar, MD, FCAP, Marilyn M. Bui, MD, PhD, FCAP, Andrew J. Evans, MD, PhD, FCAP, Anil V. Parwani, MD, PhD, FCAP, Mansoor Nasim, MD, PhD, FCAP, Robert Lott, BS, HTL(ASCP), Liron Pantanowitz, MD, FCAP, Caitlin Routhier HT, QIHC (ASCP), Jamie Pert HTL, QIHC(ASCP)CM, Antonia Valdez, BS, HTL (ASCP)

Declaration of Conflicting Interests

The authors declared no potential conflicts of interest with respect to the research, authorship, and publication of this article.

Keywords: digital, imaging, microscopy, pathology, histology, whole slide images (WSI), digital pathology, quality control

Introduction

Whole slide images (WSI) are one of the newest technological developments in pathology review and are currently being implemented in histology laboratories worldwide. Over the next decade it is believed WSI will be the primary means of providing images to pathologists for diagnostic interpretation. It is believed

Integrating Generative Artificial Intelligence into Pathology and Laboratory Medicine

- *Introduction to Generative Artificial Intelligence: Contextualizing the Future*
- *Generative Artificial Intelligence in Anatomic Pathology*
- *Ethical and Regulatory Perspectives on Generative Artificial Intelligence in Pathology*
- *Harnessing the Power of Generative Artificial Intelligence in Pathology Education: Opportunities, Challenges, and Future Directions*
- *Evaluating Use of Generative Artificial Intelligence in Clinical Pathology Practice: Opportunities and the Way Forward*

Acknowledgments

Council for Informatics and Pathology Innovation
Diana DeAvila

Laboratory Improvement Program
Brittany Lombardo

Marketing
Dorothy Koziol
Shelly Staat

Quality Center for Evidence-based Guidelines
Sophia Dimoulis

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