ABSTRACT: 2016 ELAM Institutional Action Project Symposium

Project Title: Digitization of Pathology- Next Generation Pathology

Name and Institution: Wendy L. Frankel, the Ohio State University Wexner Medical Center

Collaborators: Christopher Ellison (Dean), Anil Parwani (Vice-Chair, AP and Director Informatics), Mike Caligiuri (Director, Comprehensive Cancer Center and CEO James Cancer Hospital/Solove Research Institute, CCC/James), Jeff Walker (Executive Director Administration, CCC/James)

Background, Challenge or Opportunity: Medical Centers are continually focusing on increasing efficiency and improving patient care quality. In addition, there is increased emphasis on targeted therapies, and healthcare providers must work collaboratively to target the right patient, for the right therapy, at the right time. Currently, pathologic diagnosis is made by reviewing glass slides using a microscope and diagnostic reports requiring many manual steps which are prone to error. Furthermore, text in reports is not discrete data, making it hard to find in electronic medical records. In that the OSUWMC mission statement is "As one of America's top-ranked academic medical centers, our mission is to improve people's lives through innovation in research, education and patient care", this project will be in perfect alignment with our institutional goals.

Purpose/Objectives: Our goal is to digitize anatomical pathology workflow by focusing on information management, digital image creation and sharing and designing innovative image analysis algorithms to enhance clinical care and translational research. We aim to (1) improve workflow efficiency, (2) enhance quality in diagnosis, (3) increase opportunities for innovation in research, and (4) to increase revenue generation, and thereby (5) foster OSUWMC brand recognition.

Methods/Approach: A world leader in Digital Pathology and Informatics, Dr. Anil Parwani was recruited, and an evaluation of workflow, hardware and software needs and financial requirements was performed. Funds were secured from CCC/James and the philanthropic annual Pelotonia event. A financial assessment and risk mitigation analysis was presented to OSUWMC leadership to gain support and help determine to partner with a commercial vendor rather than build the entire system ourselves. Currently, we are developing a work flow plan, purchasing equipment, hiring personal, implementing bar coding and interfaces and building support within the department. Implementation will be phased in concert with system refinements, education and FDA approval for primary diagnosis. Phase 1 (1-2 years) will include learning the system by initiating retrospective scanning of slides for research and teaching. Phase 2 (3-5 years) will involve opening a consultation portal for staff and faculty to gain experience. Phase 3 (4-6 years) will start after FDA approval, and prospective scanning for primary diagnosis will begin, and Phase 4 (6-10 years), will be full digital pathology workflow for clinical and research use.

Outcomes and Evaluation Strategy: Evaluation of this important institutional project will include efficiency, clinical, research and fiscal metrics. Efficiency will be measured by improved turnaround times for diagnosis. Improved clinical quality will be assessed by tracking specimen and diagnostic errors. Research productivity will be measured by increased grants, patents, papers, invited lectures, and intellectual property commercialized. Financial metrics will include increased consultations (local, national, global) and pull through revenue (new patient care) together with cost savings.

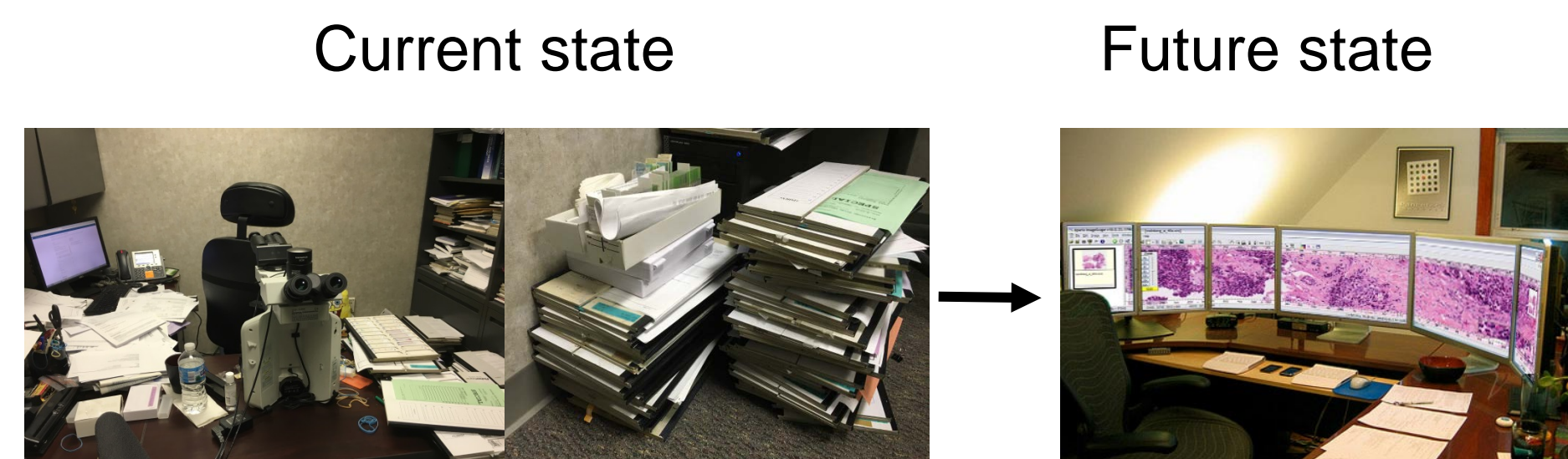# Digitization of Pathology: Next Generation Pathology

Wendy L. Frankel, MD; E. Christopher Ellison, MD (Sponsor); Anil Parwani, MD, PhD, MBA; Michael Caligiuri, MD; Jeff Walker MBA
Department of Pathology, College of Medicine, Comprehensive Cancer Center (CCC), James Cancer Hospital/Solove Research Institute, OSUWMC

Background

Medical Centers are continually focusing on increasing efficiency and improving patient care quality. In addition, there is increased emphasis on targeted therapies, and healthcare providers must work collaboratively to target the right patient, for the right therapy, at the right time. Currently, pathologic diagnosis is made by reviewing glass slides using a microscope and diagnostic reports requiring many manual steps which are prone to error. Furthermore, text in reports is not discrete data, making it hard to find in electronic medical records. In that the OSUWMC mission statement is:

 "As one of America's top-ranked academic medical centers, our mission is to improve people's lives through innovation in research, education and patient care";
this project will be in perfect alignment with our institutional goals.

Current state   Future state

Purpose

Our goal is to digitize anatomical pathology workflow by focusing on information management, digital image creation and sharing and designing innovative image analysis algorithms to enhance clinical care and translational research. We aim to (1) improve workflow efficiency, (2) enhance quality in diagnosis, (3) increase opportunities for innovation in research, and (4) increase revenue generation, and thereby (5) foster OSUWMC brand recognition.

Methods

- World leader in Digital Pathology Anil Parwani recruited to OSUWMC
- Evaluation of workflow, hardware, software and financial requirements
- Funds committed from CCC / James and philanthropic annual Pelotonia event
- RFP to partner with a commercial vendor completed
- Building support within department and identifying early adopters
- Developing workflow plan, purchasing equipment, hiring personnel, implementing bar coding and interfaces
- Engaging other stakeholders
  - Faculty and staff
  - Senior leaders, COM, CCC / James, Health system
  - Medical center informatics and legal services

- Implementation to be phased in concert with system refinements, education and FDA approval of scanners for primary diagnosis
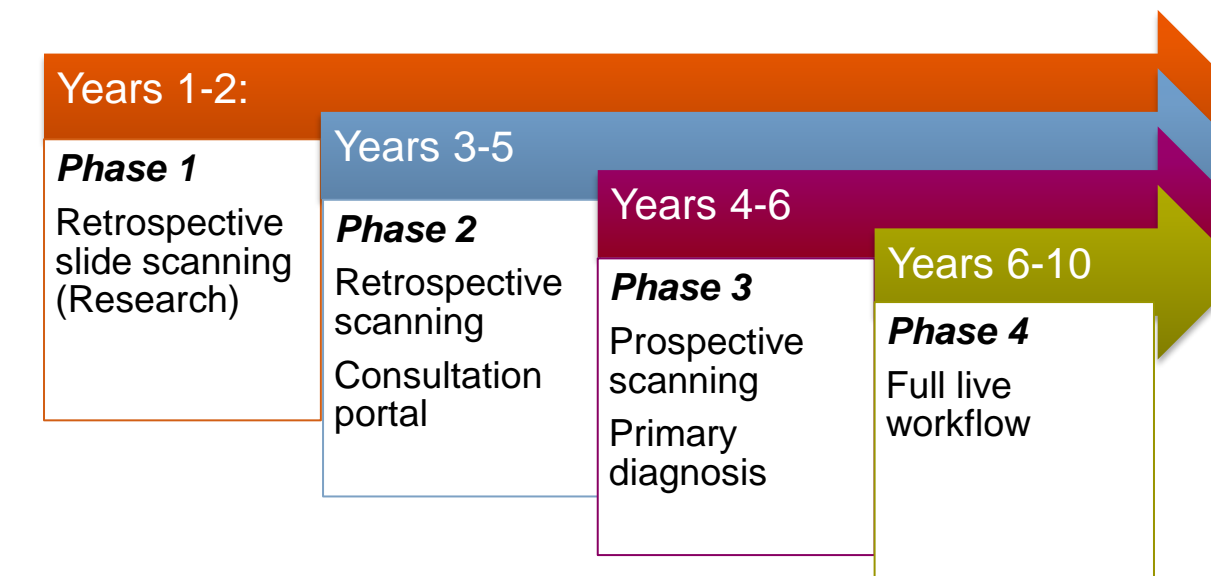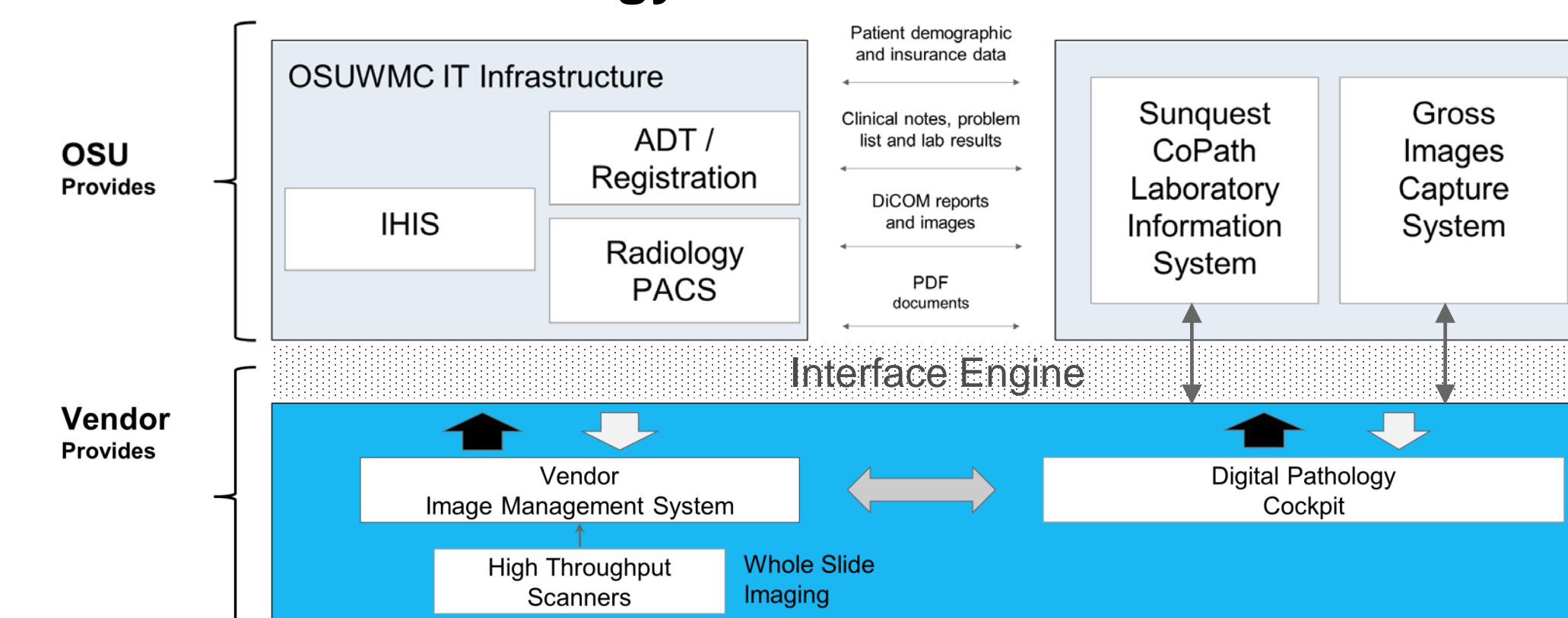

Discussion / Impact Digital Pathology

Information Integration of:

- Microscopic images
- Clinical data
- Molecular testing
- Image analysis

Image sharing

Image analysis & computer aided diagnosis

Information management
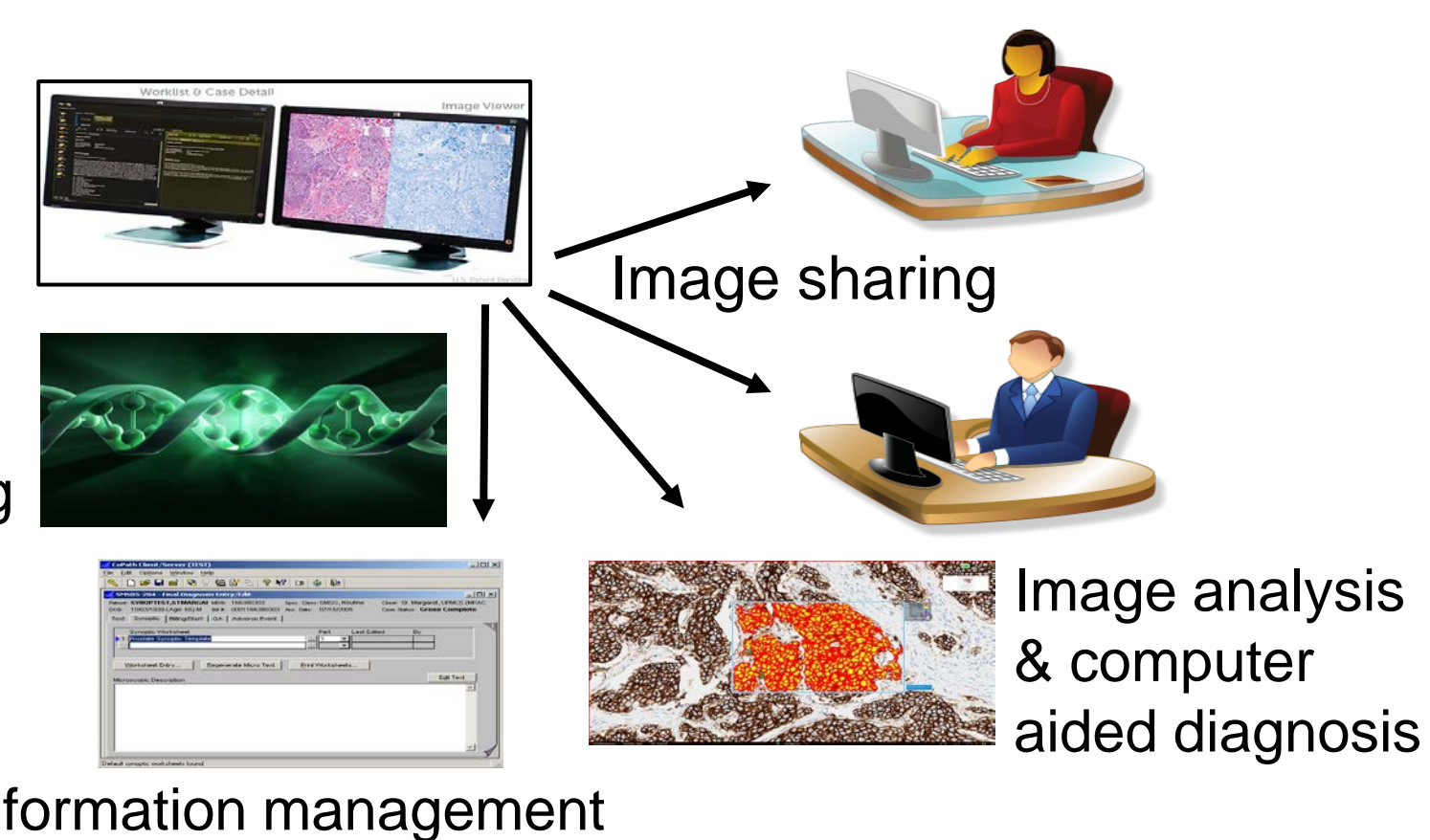
Information Technology Interfaces

Cost Analysis

Digital Pathology Initiative: Buy vs. Build ($ in thousands)

	Costs: 3rd Party Vendor BUY MODEL				Costs: James / OSU Pathology BUILD MODEL			
	YR1	YRS 2-5	YRS 6-10	TOTAL	YR1	YRS 2-5	YRS 6-10	TOTAL
CAPITAL EXPENSES								
SUBTOTAL CAPITAL (Includes whole slide scanners, servers, software & licensing)	$ 442	$ 770	$ 250	$ 1,462	$ 2,202	$ 2,620	$ 2,340	$ 7,162
OPERATIONAL EXPENSES								
PERSONNEL (Includes Project Director, IT Manager, Scanning Techs, Data Abstractors, Image Analysis Staff, Pathologist compensation)	$ 365	$ 1,946	$ 1,505	$ 3,816	$ 1,451	$ 7,805	$ 8,336	$ 17,593
NON-PERSONNEL (Includes hardware & software, service maintenance, supplies, medical grade monitors, PCs, and 3rd party vendor contract)	$ -	$ 4,000	$ 5,000	$ 9,000	$ 472	$ 1,204	$ 1,676	$ 3,352
SUBTOTAL OPERATIONAL	$ 365	$ 5,946	$ 6,505	$ 12,816	$ 1,923	$ 9,009	$ 10,012	$ 20,945
OSUWMC Development Contributions	$ -	$ (2,000)	$ -	$ (2,000)	$ -	$ (2,000)	$ -	$ (2,000)
TOTAL CASH OUTLAY	**$ 806**	**$4,716**	**$6,755**	**$12,277**	**$4,125**	**$ 9,629**	**$12,352**	**$ 26,106**

Key Result Areas and Impact of Digital Pathology

OSUWMC Key Result Areas	Impact Digital Pathology
Productivity & efficiency	Workload balance Automation, improved workflow
Quality	QA program, image sharing
Innovation & strategic growth	New consultation cases, local & global partners
Service & reputation	Research; image analysis, predictive algorithms Branding as a leading medical center
Financial performance	Revenue from consultations, new patients
Workplace of choice	Improved / easier conferences & education

Metrics / Evaluation Strategy

Evaluation will include efficiency, clinical, research and fiscal metrics. Efficiency will be measured by assessing turnaround times for diagnosis. Improved clinical quality will be assessed by tracking specimen and diagnostic errors. Research productivity will be measured by increased grants, patents, papers, invited lectures, and intellectual property commercialized. Financial metrics will include increased consultations (local, national, global) and pull through revenue (new patient care) together with cost savings.

OSUWMC Key Result Areas	Metrics	1 year post	5 years post
Productivity & efficiency	Turnaround time (days)	5% ↓	10% ↓
Quality	# Technical errors # Diagnostic errors	8% ↓ 3% ↓	10% ↓ 5% ↓
Innovation & strategic growth	# Consultation cases # New hospital partners	3% ↑ 3% ↑	6% ↑ 6% ↑
Service & reputation	# Papers & patents # Invited talks	0% 2% ↑	10% ↑ 10% ↑
Financial performance	Grants funded ($) Cost savings ($) Pull through revenue ($)	0% 0% 0%	10% ↑ 10% ↑ 5% ↑
Workplace of choice (surveys)	Staff satisfaction workflow Faculty satisfaction workflow Satisfaction conferences Satisfaction education (residents and students)	5% ↑ 10% ↓ 10% ↑ 10% ↑	10% ↑ 10% ↑ 20% ↑ 20% ↑

Conclusions

Digital pathology and new imaging platforms allow for a paradigm shift in the way pathology is practiced; and has potential to improve efficiency, quality, and opportunities for innovation, research, branding and revenue.

Next steps:
- Operational and workflow details
- Educate and incentivize faculty
- Negotiate final contract with commercial partner
- Form local, national and global partnerships
- Work through legal and informatics challenges
- Advice from radiology and other experienced pathology departments
- Develop Digital Pathology Core for COM and OSU