PATHOLOGY INFORMATICS IN 2022: THE FUTURE IS NOW!

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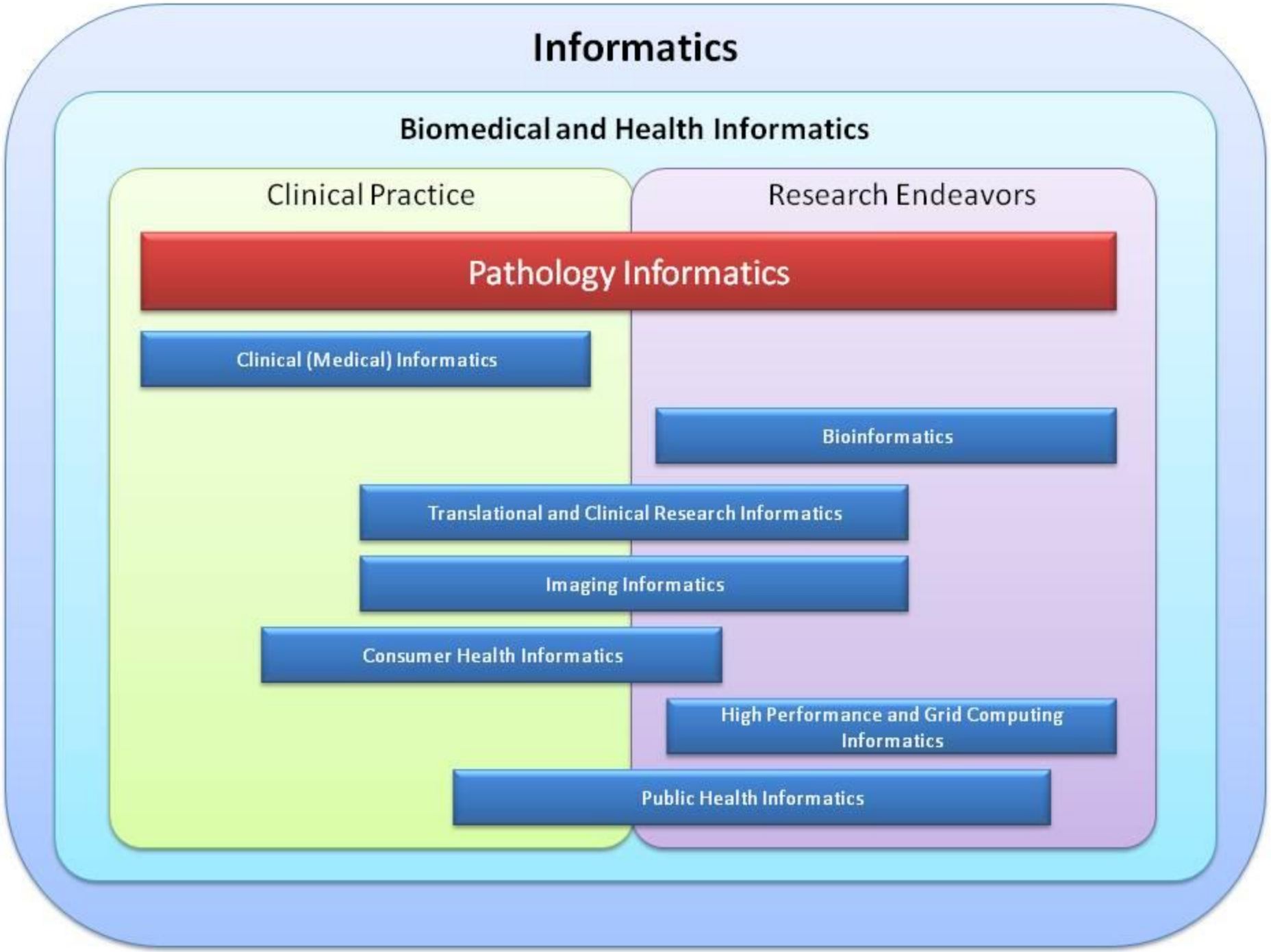
Grand Rounds
University of Utah

PATHOLOGY INFORMATICS: THE FUTURE IS NOW!

OBJECTIVES

1. Understand pathology informatics as a subspecialty of pathology
2. Describe the relationship of pathology informatics to clinical informatics
3. Describe project work in Pathology Informatics that powers the modern laboratory
4. Define requirements for success in pathology informatics

UNDERSTAND INFORMATICS AS A SUBSPECIALTY

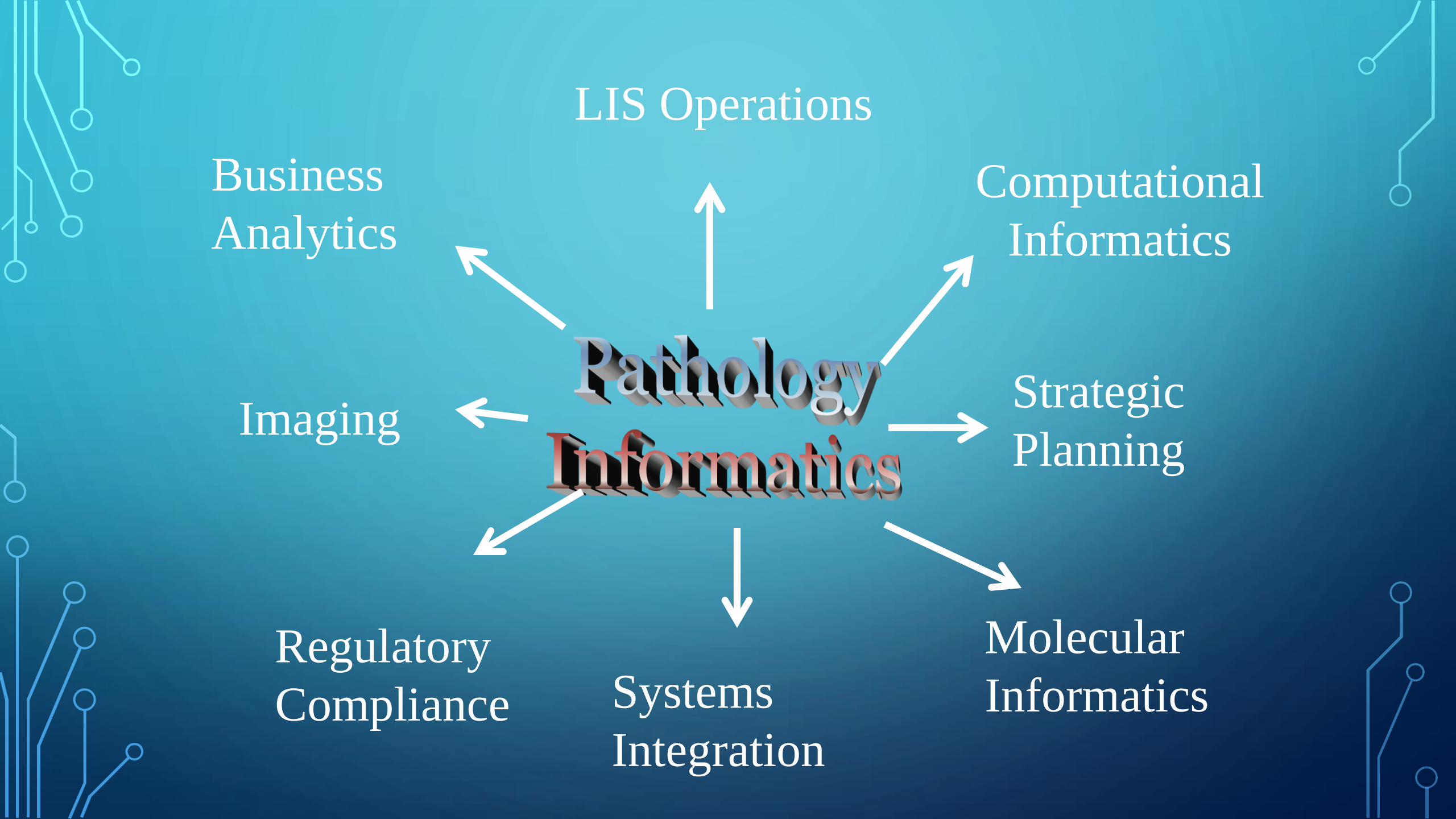

Informatics
Biomedical and Health Informatics
Clinical Practice
Research Endeavors
Pathology Informatics
Clinical (Medical) Informatics
Bioinformatics
Translational and Clinical Research Informatics
Imaging Informatics
Consumer Health Informatics
High Performance and Grid Computing Informatics
Public Health Informatics

BOARD EXAM FOR CLINICAL INFORMATICS?

- American Board of Preventive Health created a credentialing exam
  - This is jointly sponsored by American Board of Pathology and includes pathology informatics
- First exam was offered in 2013
- Qualification requirements: fellowship vs. by experience route
- Clinical Informatics Fellowships by the ACGME has been established
  - CDC recently created a fellowship in public health informatics

PATHOLOGY INFORMATICS
WHAT IS IT?

- The study of information technology and its application to the problems of pathology and laboratory medicine
  - What are information needs of pathology and laboratory medicine?
  - What are the information needs of pathology and laboratory medicine **customers**?
  - How can these needs be met?
  - Implementation of solutions (systems)
  - What new opportunities exist?
  - Keeping the lights on!

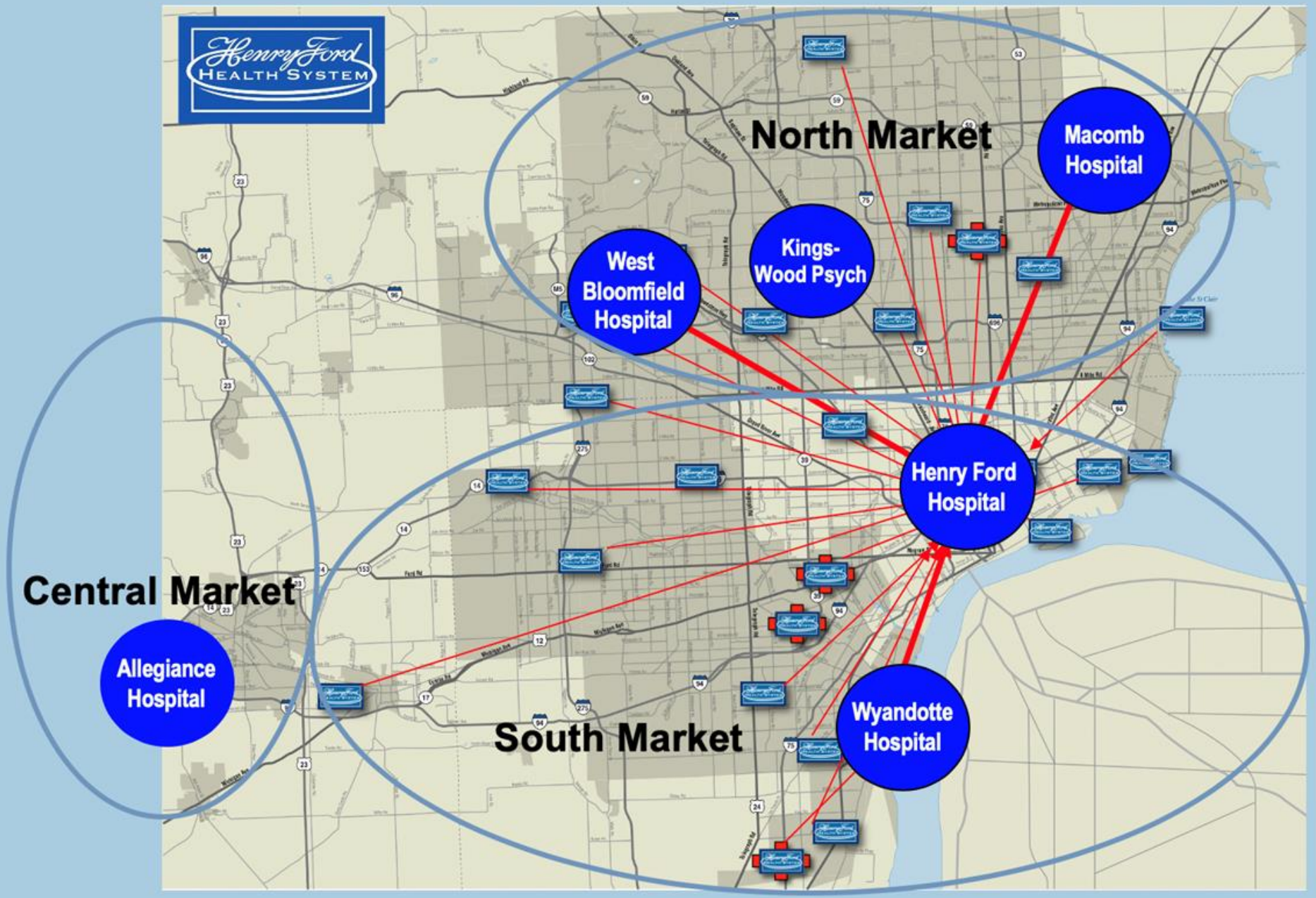

LIS Operations
Business Analytics
Computational Informatics
Pathology Informatics
Imaging
Strategic Planning
Regulatory Compliance
Systems Integration
Molecular Informatics

OPERATIONAL INFORMATICS

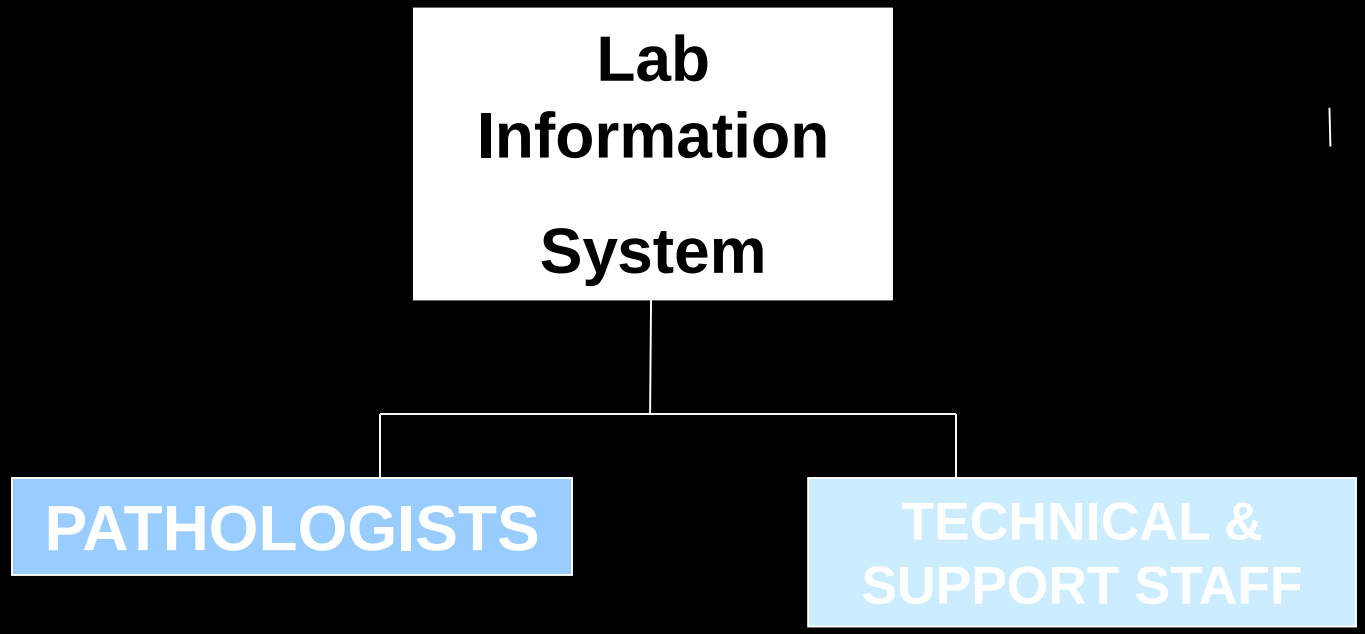
ABOUT PATHOLOGY AND LABORATORY MEDICINE

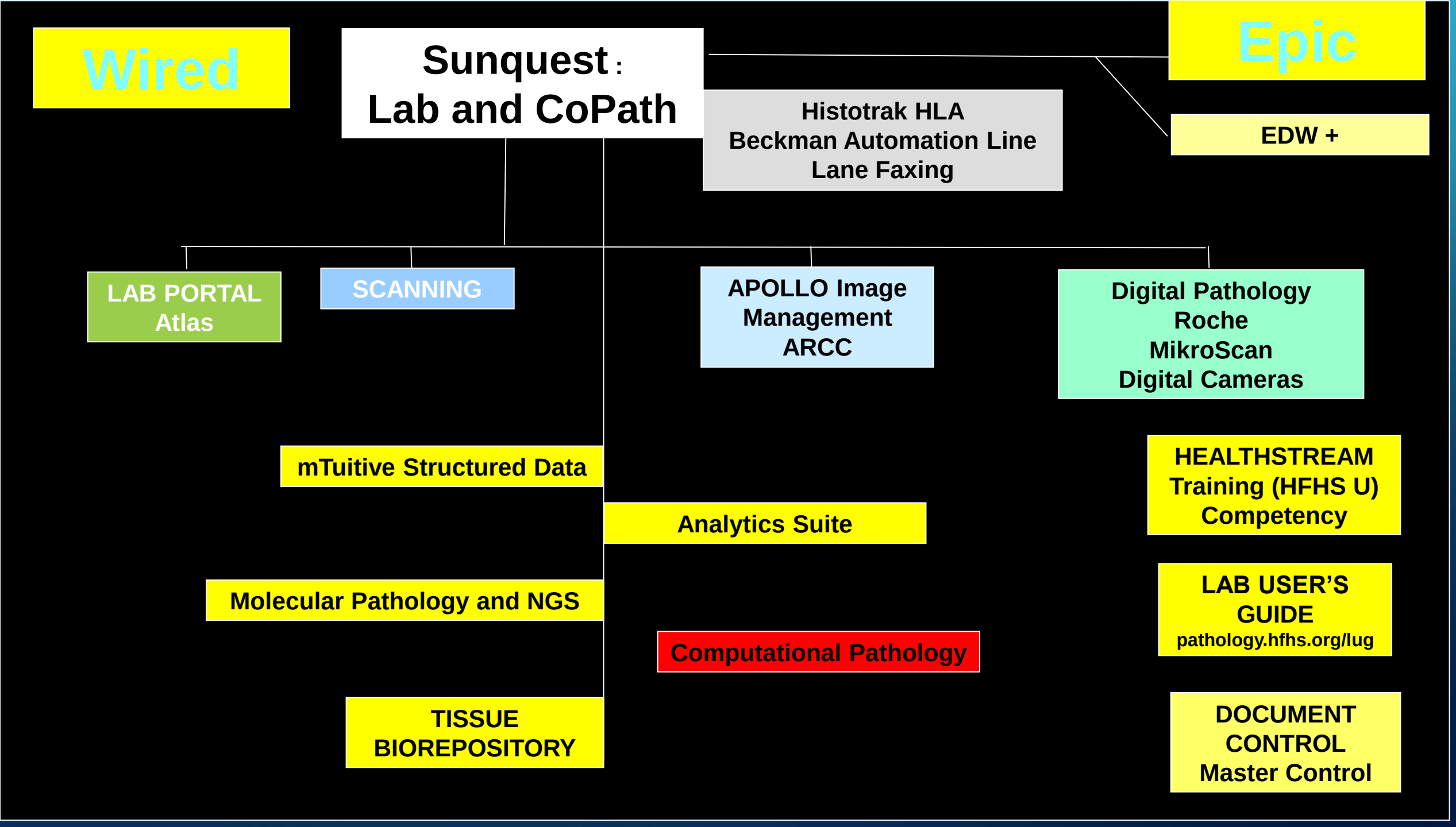
HENRY FORD HEALTH SYSTEM

- 14 million billable clinical laboratory tests
- 200, 000 Anatomic Pathology Reports
- 12th largest hospital based laboratory in the U.S.
- Operates as a single product line across:
  - 6 hospitals
  - 34 medical centers
- Laboratory grouped into divisions
  - Anatomic Pathology divisions
    - Cytology, Surgical Pathology, Autopsy
  - Clinical Pathology divisions
    - Blood bank, chemistry, microbiology, hematology
  - Molecular pathology
  - Informatics

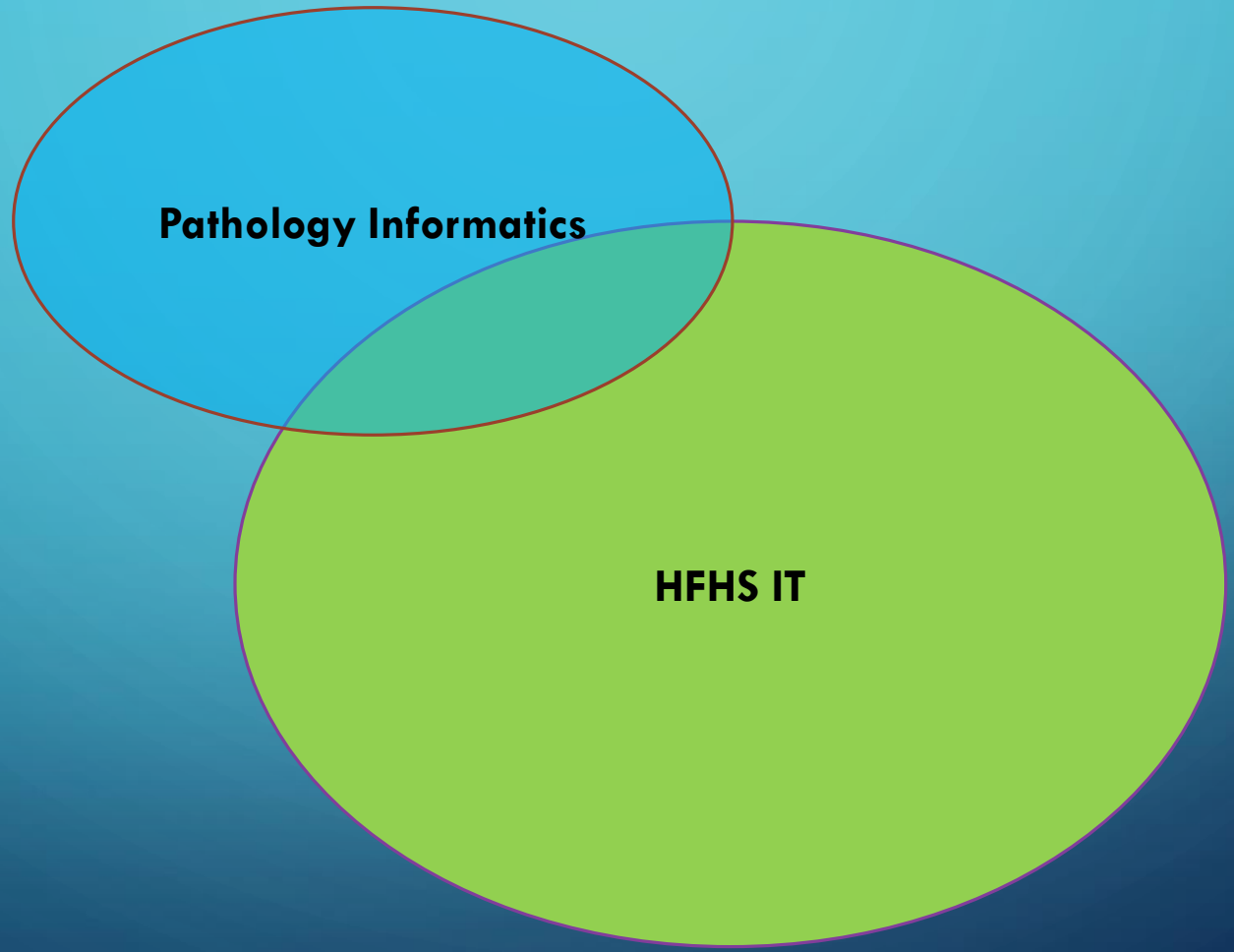

Henry Ford Health System
North Market
Macomb Hospital
West Bloomfield Hospital
Kings-Wood Psych
Henry Ford Hospital
Central Market
Allegiance Hospital
South Market
Wyandotte Hospital

Information Technology




Wired
Sunquest :
Lab and CoPath
Epic
Histotrak HLA
Beckman Automation Line
Lane Faxing
EDW +
LAB PORTAL
Atlas
SCANNING
APOLLO Image
Management
ARCC
Digital Pathology
Roche
MikroScan
Digital Cameras
mTuitive Structured Data
HEALTHSTREAM
Training (HFHS U)
Competency
Analytics Suite
Molecular Pathology and NGS
LAB USER'S
GUIDE
pathology.hfhs.org/lug
Computational Pathology
TISSUE
BIOREPOSITORY
DOCUMENT
CONTROL
Master Control

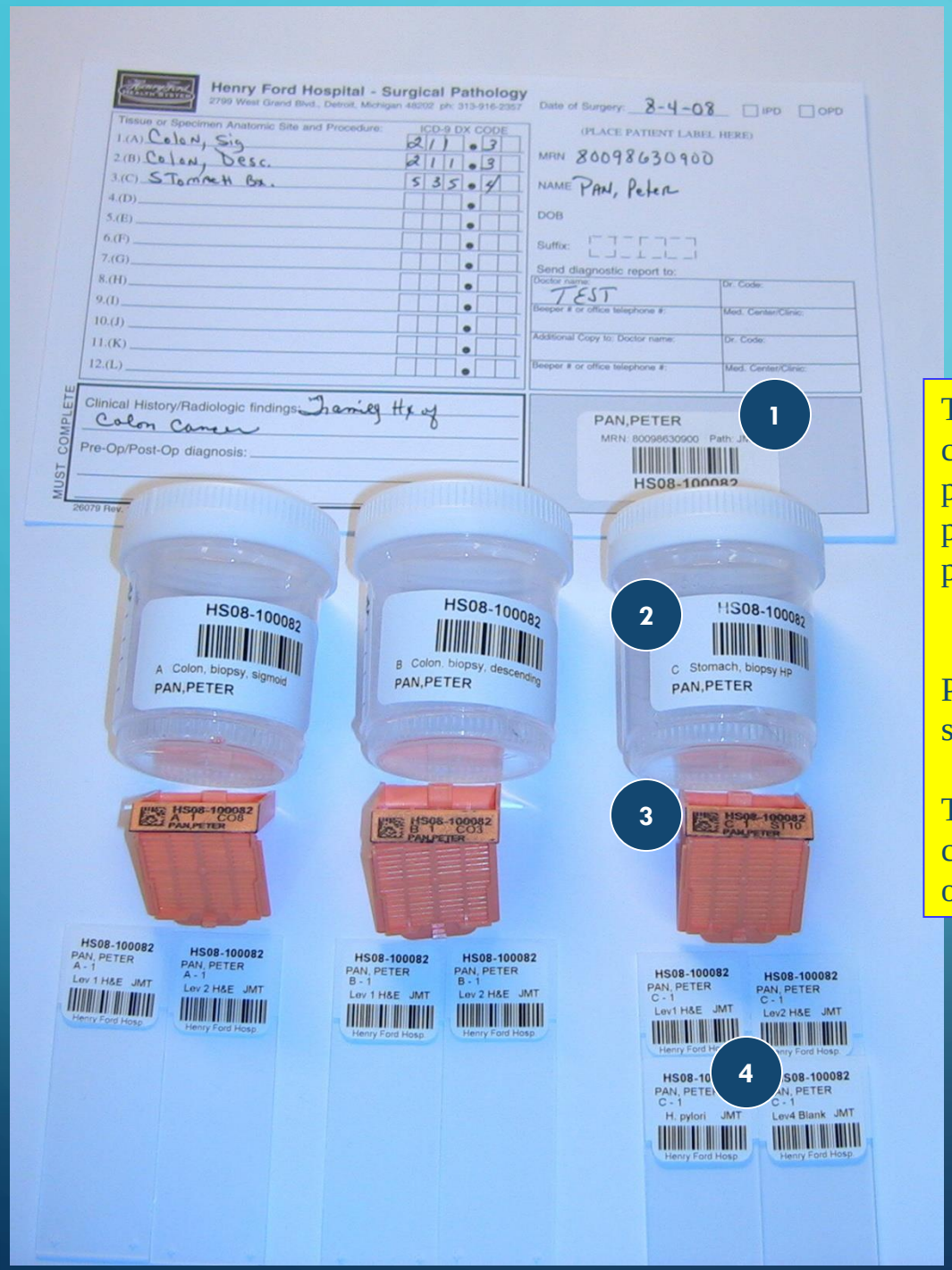
PATHOLOGY INFORMATICS RELATIONSHIP TO IT



PREREQUISITES FOR ANATOMIC PATHOLOGY AUTOMATION

- Bar code labeled assets within the laboratory
  - This is **most essential** early prerequisite to achieve automation within the laboratory
  - Bar coding of assets allows for:
    - Bar code driven workflow
    - Identification error reduction due to mislabeling
    - Improved efficiency by reducing manual labeling
    - Automation of subsequent activities
      - Integration whole slide imaging, interface devices
  - This is the key for all automation requirements, and thus the AP-LIS

Barcode Specified Work Processes



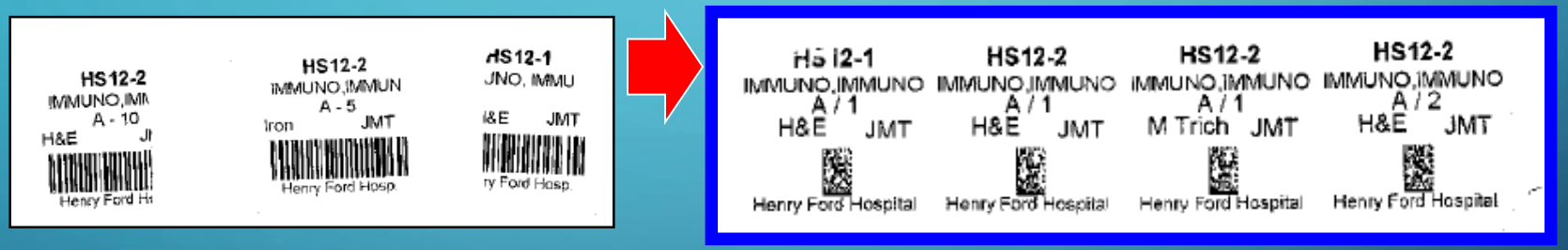
This case is submitted in 3 specimen containers consisting of:
part A - sigmoid colon biopsy,
part B - transverse colon biopsy and
part C - stomach biopsy with standing preorder for Helicobacter pylori immunostain.

Protocol driven information is reflected in the slide labels dictating 2 levels cut for each part.

The stomach biopsy protocol, part C, calls for an additional 2 blanks slides to be cut, one for the immunostain & a 4th left unstained.

IMPROVEMENT

- We replaced linear barcodes with 2D bar codes as part of an upgrade of our LIS
  - This included replacement of the old labeling subsystem with 'real-time labeling‘
  - Native Sunquest CoPath solution (They got it!)



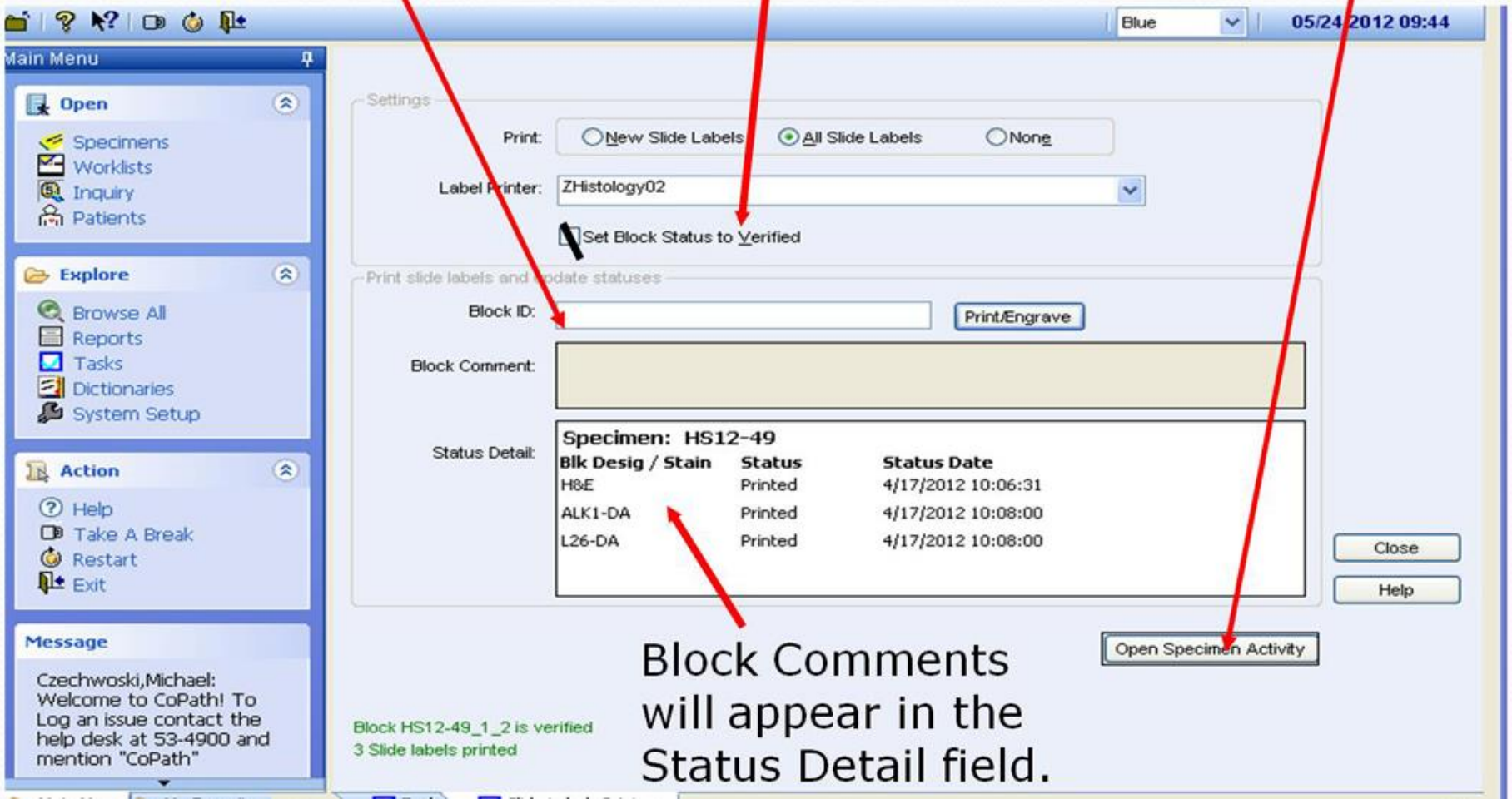
- The new functionality in the LIS allowed seamless, automated slide label printing in real-time as each histology tissue block was scanned before sectioning

Slide Label Print

Scan Next Block, Cursor will automatically return to Block ID. Previous Block ID is Cleared.

Set Block Status to Verified.

Open Specimen Activity, Option to Choose New Activity.

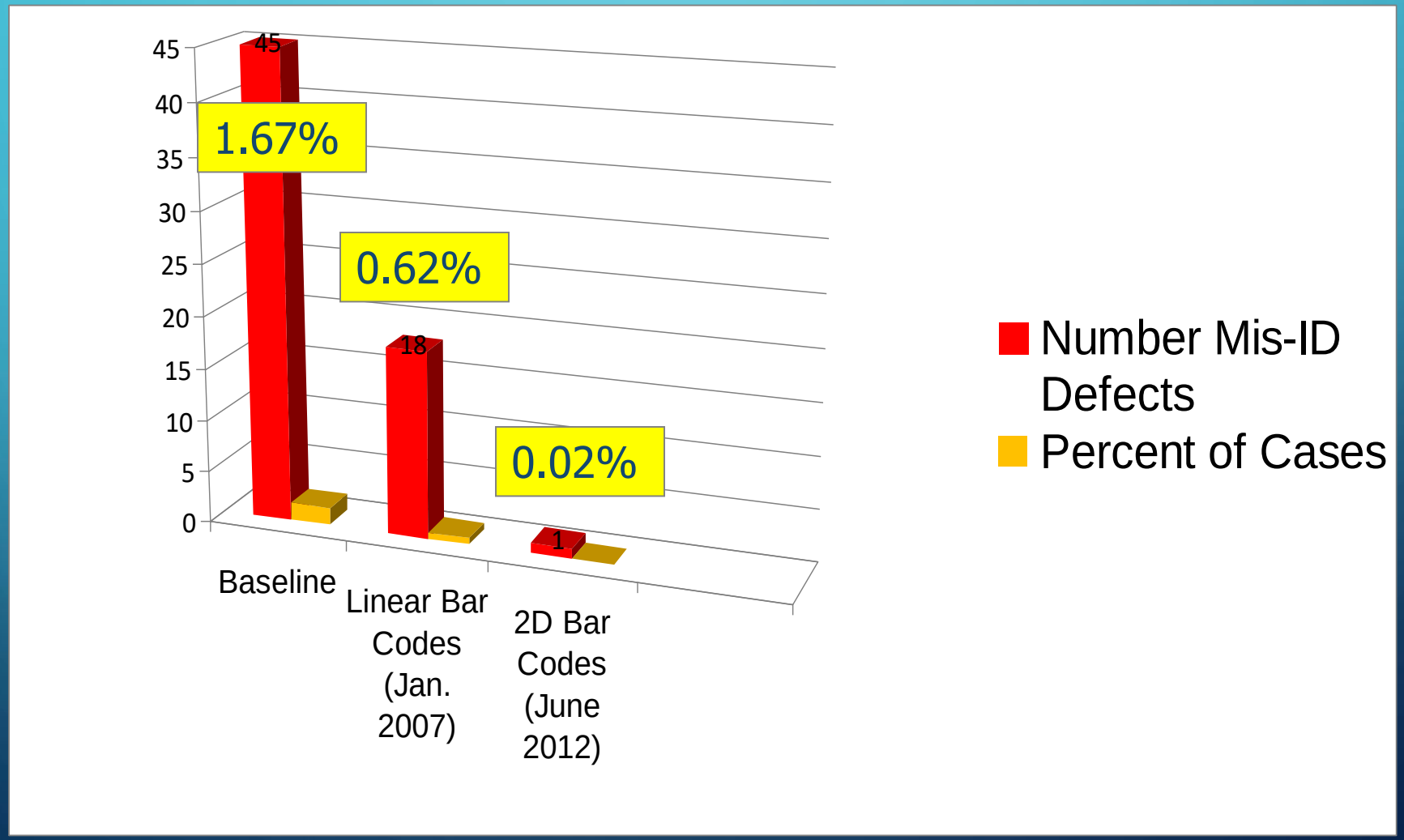


Block Comments will appear in the Status Detail field.

OUTCOME

- With 'real-time labeling' the batch printing process has now been eliminated
- Specimen misidentification rates have been further reduced
- Workflow efficacy in the histology lab has increased as cassette reading defects have been eliminated
  - Barcode reading defects required the histotechnologist to manually type in cases numbers, leading to increased risk of patient misidentification

RESULTS: MISIDENTIFICATION RATES



SPECIMEN TRACKING TECHNOLOGY

AP-LIS: CoPath Plus v7.1

(Sunquest Information Systems, Tucson, AZ)

CoPath Specimen Management Routing and Tracking (SMART) module

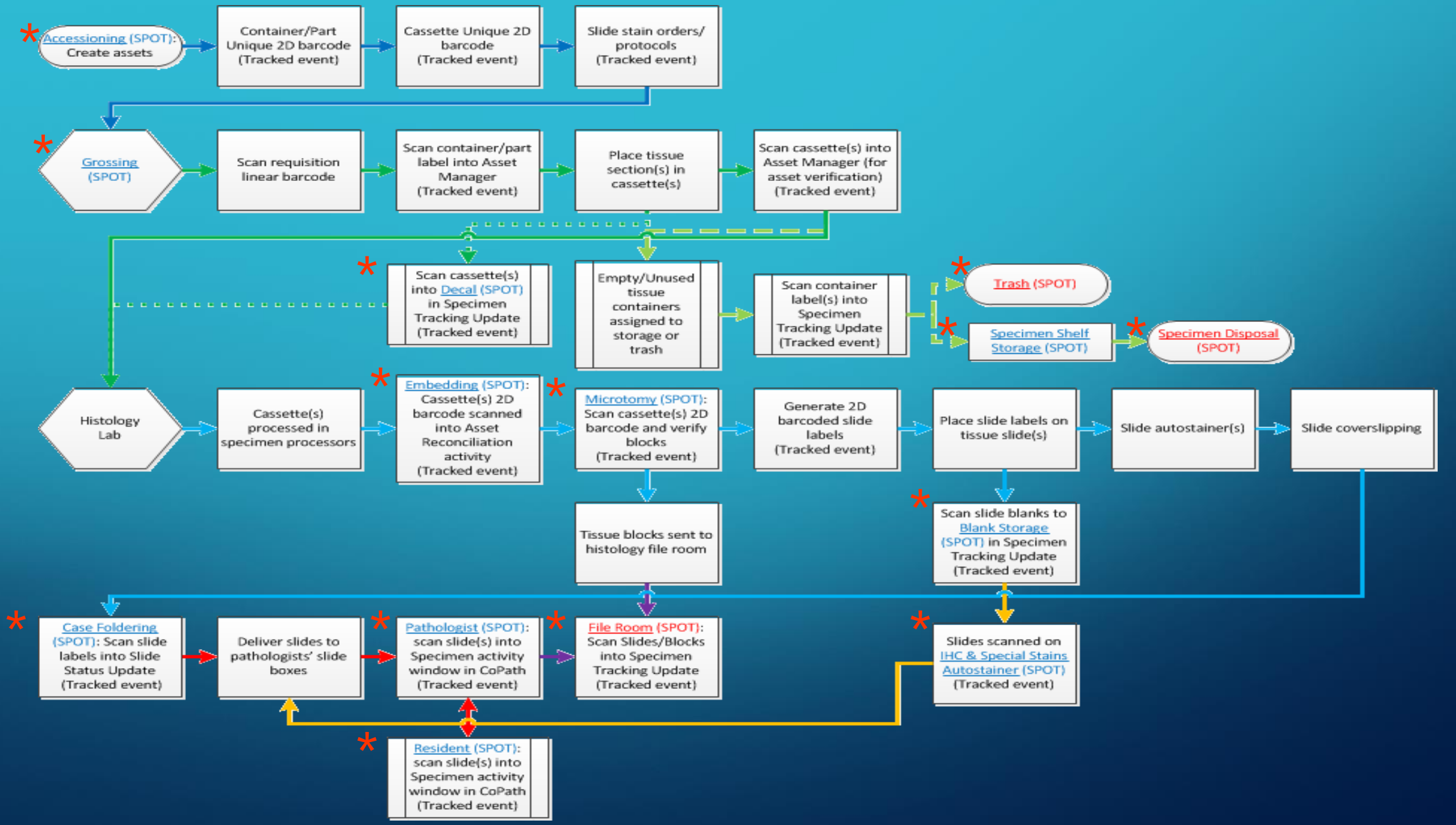
InfoMaker reports were created using PowerBuilder software (Sybase, Dublin, CA).

Specimen Tracking

DESIGN

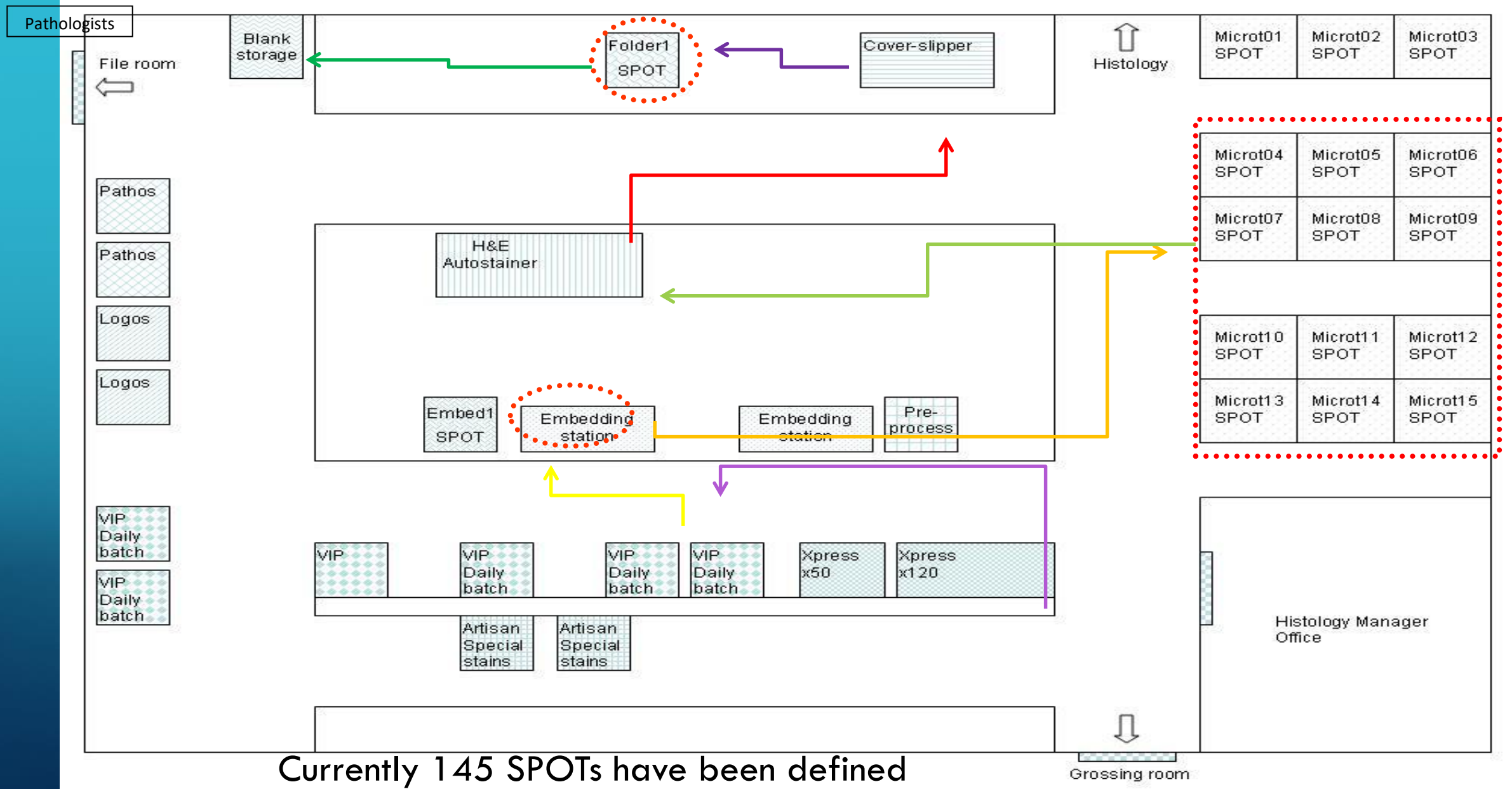
- We defined specimen points of tracking (SPOTs) in the AP-LIS dictionary
  - Each SPOT is linked to a specific workstation as defined on the health system's internal network
- As each asset is scanned and processed
  - location, scan time, status, and associated user data are automatically recorded
- Standard tracking tools allowed us to monitor assets in real-time

AP WORKFLOW DESIGN



DESIGN: SPOT IMPLEMENTATION

Histology Lab

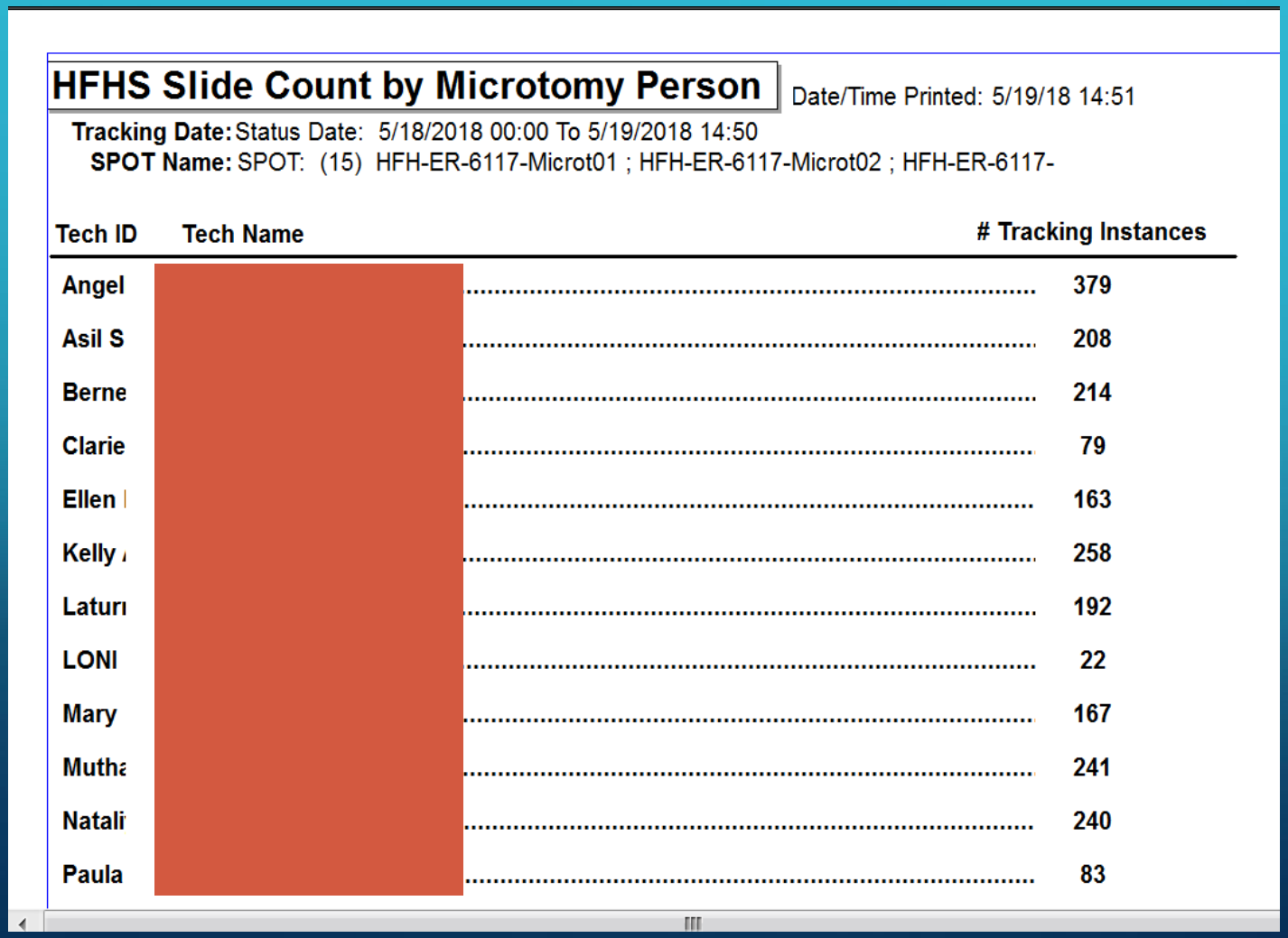


Currently 145 SPOTs have been defined

Tracking Activities	Tracking Reports
Asset Manager	Asset Location Report
Specimen Discard	Parts/Blocks/Slides at a SPOT
Specimen Tracking Update	**Parts/Blocks/Slides Aging Report**
Slide Status Update	Scan History Log
View/Update Specimen Tracking	Specimen Tracking Scan Errors
Asset Reconciliation	SPOT Turnaround Time Report
	Unique ID Report

- Some functions are workflow specific while others can be utilized at multiple points in the process

WORKLOAD REPORTS



HFHS Slide Count by Microtomy Person Date/Time Printed: 5/19/18 14:51

Tracking Date: Status Date: 5/18/2018 00:00 To 5/19/2018 14:50

SPOT Name: SPOT: (15) HFH-ER-6117-Microt01 ; HFH-ER-6117-Microt02 ; HFH-ER-6117-

Tech ID	Tech Name	# Tracking Instances
Angel	[redacted]	379
Asil S		208
Berne		214
Clarie		79
Ellen		163
Kelly		258
Laturi		192
LONI		22
Mary		167
Mutha		241
Natali		240
Paula		83

- Scan events can be tracked at individual SPOTS and users
- Allows us to provide workload and productivity data for lab managers
  - Example: Slide counts by microtomy person

ASSET RECONCILIATION

- Allows the user to reconcile the assets in hand with the assets assigned to a case
- Can be use iteratively
  - Gross
  - Accession
  - Embedding
  - Foldering

Matching / Reconcile

Unique ID:

Set Slide Status to Verified when Reconciling

Unique ID: HS18-100031_1_1 is already reconciled

Filter by:

Parts Blocks Slides Others

Filtered Reconciled Count: 2/2

Reconciled Count: 4/18

Type	Status	SPOT
Block: 1 UID: HS18-100031_1_1	Ordered	HFH-ER-6117-Embed1
Block: 1 UID: HS18-100031_2_2	Ordered	HFH-ER-6117-Embed1

No Action

Set Case Status to Case Assembled/Send to Assembled Worklist

Save/Next Specimen

Matching / Reconcile

Unique ID:

Set Slide Status to Verified when Reconciling

Unique ID: HS18-100031_2_8_1 is reconciled and verified

Filter by:

Parts Blocks Slides Others Filtered Reconciled Count: 14/14

Reconciled Count: 18/18

Type	Status	SPOT
Slide: 1 xxxH&E, Initial UID: HS18-100031_1_1_1	Verified	HFH-ER-6117-Collate1
Slide: 2 Blanks-for protocol UID: HS18-100031_1_2_1	Verified	HFH-ER-6117-Collate1
Slide: 3 Blanks-for protocol UID: HS18-100031_1_3_1	Verified	HFH-ER-6117-Collate1
Slide: 4 Blanks-for protocol UID: HS18-100031_1_4_1	Verified	HFH-ER-6117-Collate1
Slide: 5 Blanks-for protocol UID: HS18-100031_1_5_1	Verified	HFH-ER-6117-Collate1
Slide: 6 Blanks-for protocol UID: HS18-100031_1_6_1	Verified	HFH-ER-6117-Collate1
Slide: 7 Blanks-for protocol UID: HS18-100031_1_7_1	Verified	HFH-ER-6117-Collate1
Slide: 1 xxxH&E, Initial UID: HS18-100031_2_8_1	Verified	HFH-ER-6117-Collate1
Slide: 2 Blanks-for protocol UID: HS18-100031_2_9_1	Verified	HFH-ER-6117-Collate1
Slide: 3 Blanks-for protocol UID: HS18-100031_2_10_1	Verified	HFH-ER-6117-Collate1
Slide: 4 Blanks-for protocol UID: HS18-100031_2_11_1	Verified	HFH-ER-6117-Collate1
Slide: 5 Blanks-for protocol UID: HS18-100031_2_12_1	Verified	HFH-ER-6117-Collate1
Slide: 6 Blanks-for protocol UID: HS18-100031_2_13_1	Verified	HFH-ER-6117-Collate1
Slide: 7 Blanks-for protocol UID: HS18-100031_2_14_1	Verified	HFH-ER-6117-Collate1

No Action Set Case Status to Case Assembled/Send to Assembled Worklist

Save/Next Specimen

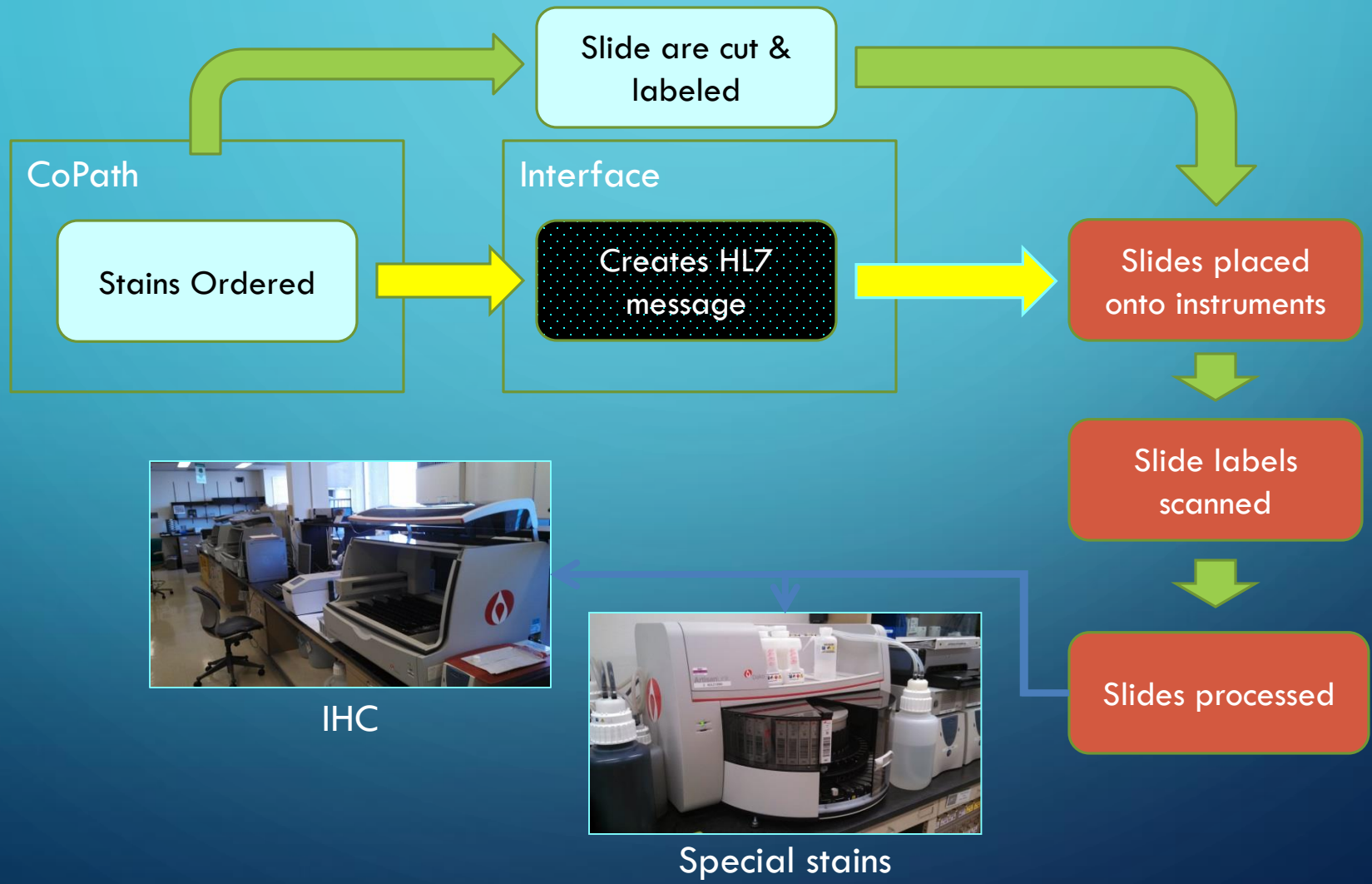
AUTOMATED STAINING PLATFORMS

- Perhaps the most automated process in the current AP lab
  - Included automated cover slipping
  - This saves hundreds of man hours per year
  - Has more consistent results versus manual staining and cover slipping
- Interfaces with AP LIS will further enhance productivity and decrease errors
  - Immunostaining and special staining platforms
    - Dako (Agilent) and Roche

COPATH – DAKO NEW WORKFLOW

1. Stains are ordered in CoPathPlus.
2. Stain orders are released to the interface on demand or scheduled.
3. Interface creates an HL7 message and delivers to Dako
4. Message is routed to instrument. Slide labels print from CoPath.
5. Slides are cut in the laboratory and Slide labels print from CoPath and labels are applied to slides.
6. Slides are placed into the instrument. Label is scanned by instrument which indicates the reagent stain workup.
7. Slides are processed.

NEW WORKFLOW AFTER DEPLOYMENT OF THE AUTOMATED STAINER INTERFACE



FROM COPATH PRINTER TO SLIDES TO DAKO BYPASSING DAKO RELABELING

RESULTS

- With elimination of relabeling the slides and dual order entry through automation markedly decreases assay run time
  - This saves upward of ~1000 hours of manual effort per year while eliminating errors, and improving laboratory throughput
- Increases order accuracy by reducing keystroke errors.
- Enhances operational efficiency by automating processes.
- Enforces safe, consistent, efficient handling of specimen.

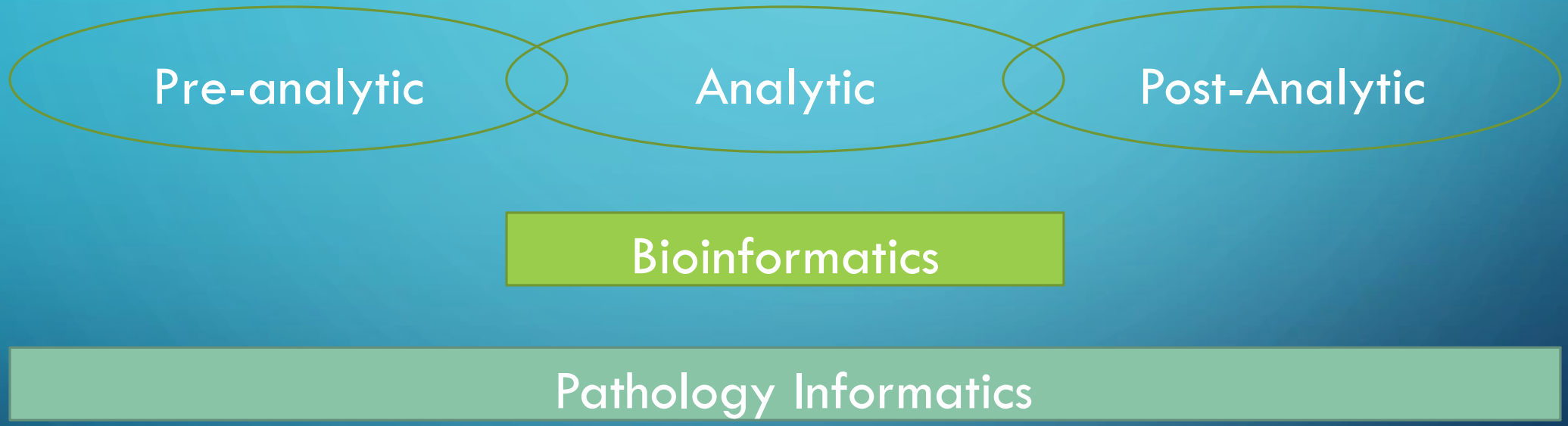
MOLECULAR INFORMATICS

- Applying the principles and practices of pathology informatics to the molecular diagnostic laboratory
  - Secure data management
  - Network solutions
  - Interfaces for ADT and Results
  - Lab operations management
    - QA, QC, Label generation, worklists/logs
- Why is this a challenge?
  - Molecular testing platforms have come out of a research “milieu”
    - Lack of interfaces
    - Little HL7 integration
  - LIS and EMR partners have been slow to develop and implement solutions
  - Molecular solutions are sophisticated in their use of the cloud

PRECISION MEDICINE BIOINFORMATICS PIPELINE

- The process whereby genetic sequence information is translated into actionable information with clinical importance
- The comparison of DNA sequence information in a given sample to a variety of referential databases for the assay of interest
  - Analyzers provide sequences using sophisticated computer technology
  - Sequences are sent to a computers that provide of referential analysis
    - Both of these activities are referred to as “bioinformatics”
- Bioinformatics can be managed both as an in house as well as an outside model
  - HFHS model: we currently leverage sophisticate bioinformatics pipeline through our vendor partners, while providing significant in-house interpretive services

ANOTHER WAY TO LOOK AT IT…



MOLECULAR LABORATORY INFORMATICS INITIAL NGS DATA FLOW

EHR

Physician Portal

Orders

Results

Results

LIS

Manual Processes

NGS Analysis

VCF file Written to Network drive

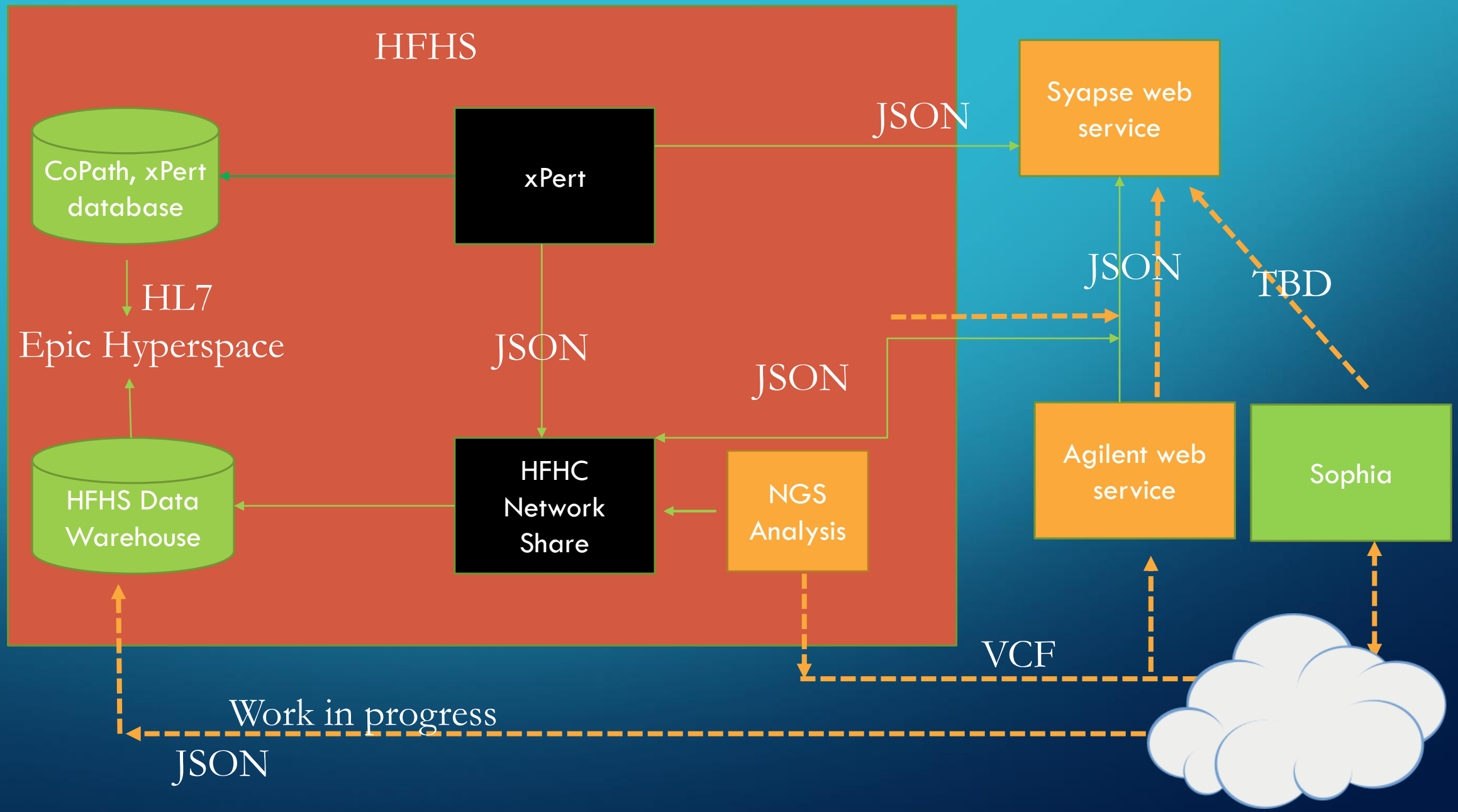
Files Stored on attached network drives

VCF file transmitted Via Secure Internet

Sequence Analysis and Pathologist Annotation

3RD PARTY DATA FEEDS

- Working with Agilent (formerly Cartegenia) we designed a process whereby the finalization of a variant report would
  - Generate a JSON file that posts to 3rd party systems
    - Data includes machine readable structured molecular pathology data
- Structured pathology staging data is also created at time that cases are signed out in the LIS
  - —Shipped to 3rd party systems for consumption
    - JSON was the file format produced
- Structured pathology staging data combined with structure molecular data is a powerful


HFHS
CoPath, xPert database
xPert
JSON
Syapse web service
HL7
Epic Hyperspace
JSON
JSON
JSON
TBD
HFHS Data Warehouse
HFHC Network Share
NGS Analysis
Agilent web service
Sophia
VCF
Work in progress
JSON

DIGITAL PATHOLOGY AND IMAGE ANALYSIS

WHAT IS DIGITAL PATHOLOGY?

- Not just whole slide imaging! (WSI)
- Distributed microscopic images
- Distributed EM
- Gross images
- Scanned documents
- Image analysis
- Clinical lab images: gels, plates, hematology analyzers
- Cytogenetics and cytopathology analysis
- Digital Pathology is:
  - digitally capturing, storing, moving, analyzing, interpreting tissues (and other assets) submitted to the laboratory for the purpose of diagnosis, clinical communication, documentation and quality assurance

APOLLO ARCC

- Apollo ARCC Image management provides:
  - Expandable EMC SAN based storage
  - Thin-client, web services based deployment
  - Management for all existing image-generating devices
  - Disk and network monitoring
  - Security management for users
    - Permission-based logon, very nuanced
    - Thick-client and Thin-client access
  - **LIS integration**
    - Interfaces for ADT and images
    - Images to be send to the EMR via AP-LIS (CoPath)
  - Sophisticated device integration including interfaces and file mover services

FINAL WORKFLOW

- Cases accessioned into CoPath
  - ADT sent to Apollo
- Images acquired for case automatically stored in Apollo
- Images “links” are sent back to LIS (or not) as “results”
  - Those returned are configurable:
    - Associated with the case
    - Attaached into the report
- Images viewable in Apollo or LIS
- Report send to EMR with or without images as desired

WSI DRIVERS FOR HFHS PATHOLOGY 2013-2021

- Maturity of the WSI technology platforms
  - Improved performance
  - Decreasing costs
- FDA approval/acceptance for primary diagnosis
- The need for a distributed digital pathology workflow to support diagnostic studies
  - Move images not glass!
- Loss of support for our robotic telepathology platforms
- The desire to adopt cISH and **image analysis for diagnostic panels**

DECISIONS AND GOALS

- Stand up technology to replace robotic telepathology
  - Selected Mikroscan as a vendor
- Selected Ventana Roche as WSI partner for cISH analysis and distributed diagnostic imaging
  - Implement iScan Coreo and Coreo HT platforms, and recently DP200
  - Interface these platforms with Sunquest CoPath
  - Validate the Ventana Ultra cISH platform
  - Harmonize bar code labeling symbologies so that CoPath generate bar codes labels would be used
  - Integrate this technology into CoPath and Apollo workflow

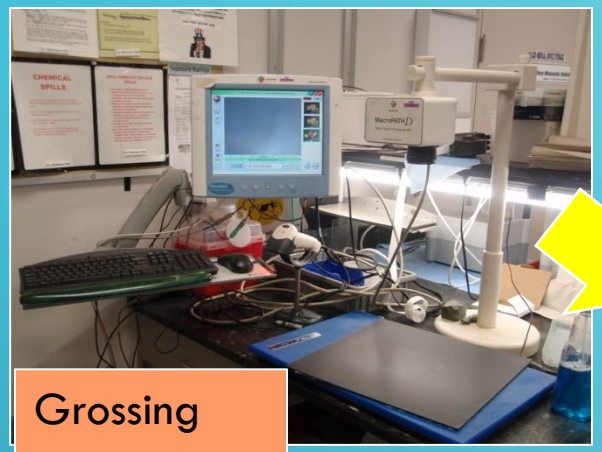
PREREQUISITES FOR INTERFACING WSI

- Requisite hardware and software for WSI capable of using HL7 messaging
  - Network attached storage solution
  - Network bandwidth
    - We had WSI in place since January 2016
- An LIS capable of communicating with WSI systems via HL7
- **Electronic histology orders used for all histology processes**
- **Bar code labeled assets with unique ID's**

Ventana iScan Coreo with AI

Ventana HT

TECHNOLOGY



Grossing stations

File mover services leveraged

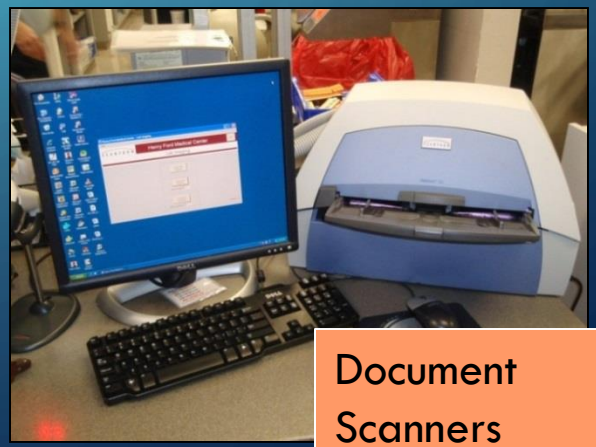
Apollo ARCC

LIS Integration

Autopsy suite

Specimen X-rays

Whole Slide Imaging



Document Scanners

LIS INTEGRATION

- All gross images and images captured from cameras mounted on microscopes go into Apollo EPMM and can be sent directly via HL7 interfaces to pathology reports, then onto the EMR embedded in PDF's
  - The include Scanned documents, EM, and X-ray (Faxitron) images
- WSI is a completely different imaging stream
  - WSI for a pathology cases can be launched from
    - CoPath LIS
    - WSI image viewer (Roche Virtuoso)
    - Apollo Enterprise Viewer (soon to come)
- The LIS is the integrator
  - All images can be opened from CoPath on a case by case basis
    - This is the basis of the true next generation pathology workflow

CoPath Client/Server (cotest) - [HS19-109 - Attachments Entry/Edit]

File Edit Options View Favorites Window Help

Blue 9/20/2019 14:28

Main Menu

Open
- Specimens
- Worklists
- Inquiry
- Patients

Explore
- Browse All
- Reports
- Tasks
- Dictionaries
- System Setup

Action
- Help
- Take A Break
- Restart
- Exit

Message

J.M. Tuthill, M.D., System Manager: Welcome to CoPath! To Log an issue contact the help desk at 53-4900 and mention "CoPath"

Case #:	HS19-109	Med. Rec. #:	40304240	Client:	10 - Henry Ford Laboratories
Patient:	LIGAND,LIGAND	Billing #:	12345678\40304240\10\2\1	Case Status:	Accessioned
DOB:	1/2/2017 (Age: 2) M	Spec. Class:	HS, Routine	Acc. Date:	8/14/2019 Univ. #:

Attachments

- Add New
- Part: A: Anal canal, anterior midline, biopsy
  - Block: 1
    - Slide: 1: Level 1 H&E
      - HS19-109_1_1_1_thumbnail_180 http://RHWAPP605B:85/?imageId=180&LABEL&rotate=270
    - Slide: 2: Level 2 H&E
      - HS19-109_1_2_1_thumbnail_179 http://RHWAPP605B:85/?imageId=179&LABEL&rotate=270
  - Block: 2

Details for HS19-109_1_2_1_thumbnail_179

Entered on 8/15/2019 11:31 by intf Size = . KB

Type: Microscopic
Asset(s): S:2 Level 2 H&E Slide:1 (P: A)
Title: HS19-109_1_2_1_thumbnail_179
Status: Attached
File Name: http://RHWAPP605B:85/?imageId=179&LABEL&rotate=270&SCALE=15
Comment:
Vendor: VIRTUOSO
Unique Slide Id: HS19-109_1_2_1
Stain: Level 2 H&E

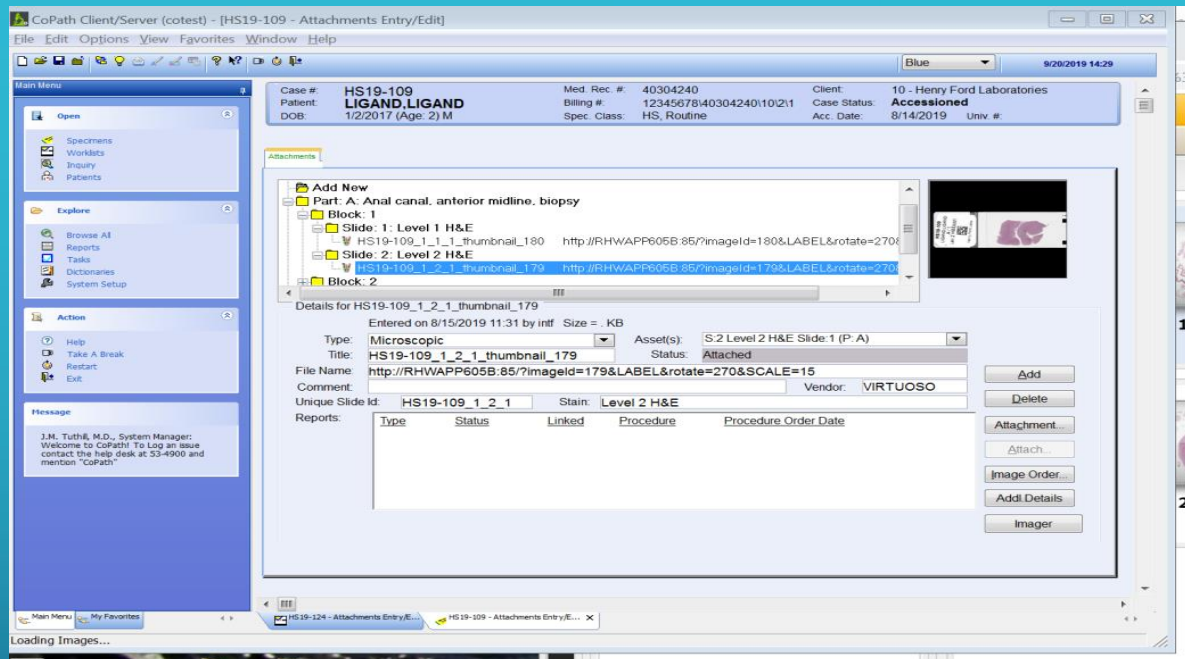
Reports:

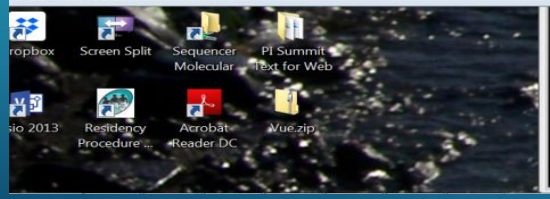
Type	Status	Linked	Procedure	Procedure Order Date

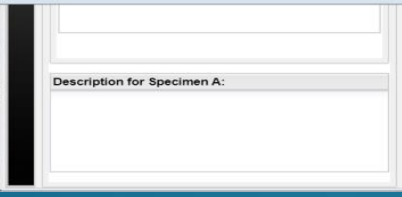
Add
Delete
Attachment...
Attach...
Image Order...
Addl.Details
Imager

Main Menu | My Favorites | HS19-124 - Attachments Entry/E... | HS19-109 - Attachments Entry/E...

Loading Images...


CoPath Client/Server (cotest) - [HS19-109 - Attachments Entry/Edit]
File Edit Options View Favorites Window Help
Case #: HS19-109
Patient: LIGAND,LIGAND
DOB: 1/2/2017 (Age: 2) M
Med. Rec. #: 40304240
Billing #: 12345678\40304240\10\2\1
Spec. Class: HS, Routine
Client: 10 - Henry Ford Laboratories
Case Status: Accessioned
Acc. Date: 8/14/2019
Add New
Part: A: Anal canal, anterior midline, biopsy
Block: 1
Slide: 1: Level 1 H&E
HS19-109_1_1_1_thumbnail_180 http://RHWAPP605B:85/?imageId=180&LABEL&rotate=270
Slide: 2: Level 2 H&E
HS19-109_1_2_1_thumbnail_179 http://RHWAPP605B:85/?imageId=179&LABEL&rotate=270
Block: 2
Details for HS19-109_1_2_1_thumbnail_179
Entered on 8/15/2019 11:31 by intf Size = . KB
Type: Microscopic
Asset(s): S:2 Level 2 H&E Slide:1 (P: A)
Title: HS19-109_1_2_1_thumbnail_179
Status: Attached
File Name: http://RHWAPP605B:85/?imageId=179&LABEL&rotate=270&SCALE=15
Comment:
Vendor: VIRTUOSO
Unique Slide Id: HS19-109_1_2_1
Stain: Level 2 H&E
Reports:
Type Status Linked Procedure Procedure Order Date
Add
Delete
Attachment...
Attach...
Image Order...
Addl Details
Imager
Loading Images...


Screen Split
Sequencer Molecular
PI Summit Text for Web
Residency Procedure ...
Acrobat Reader DC
Vue.zip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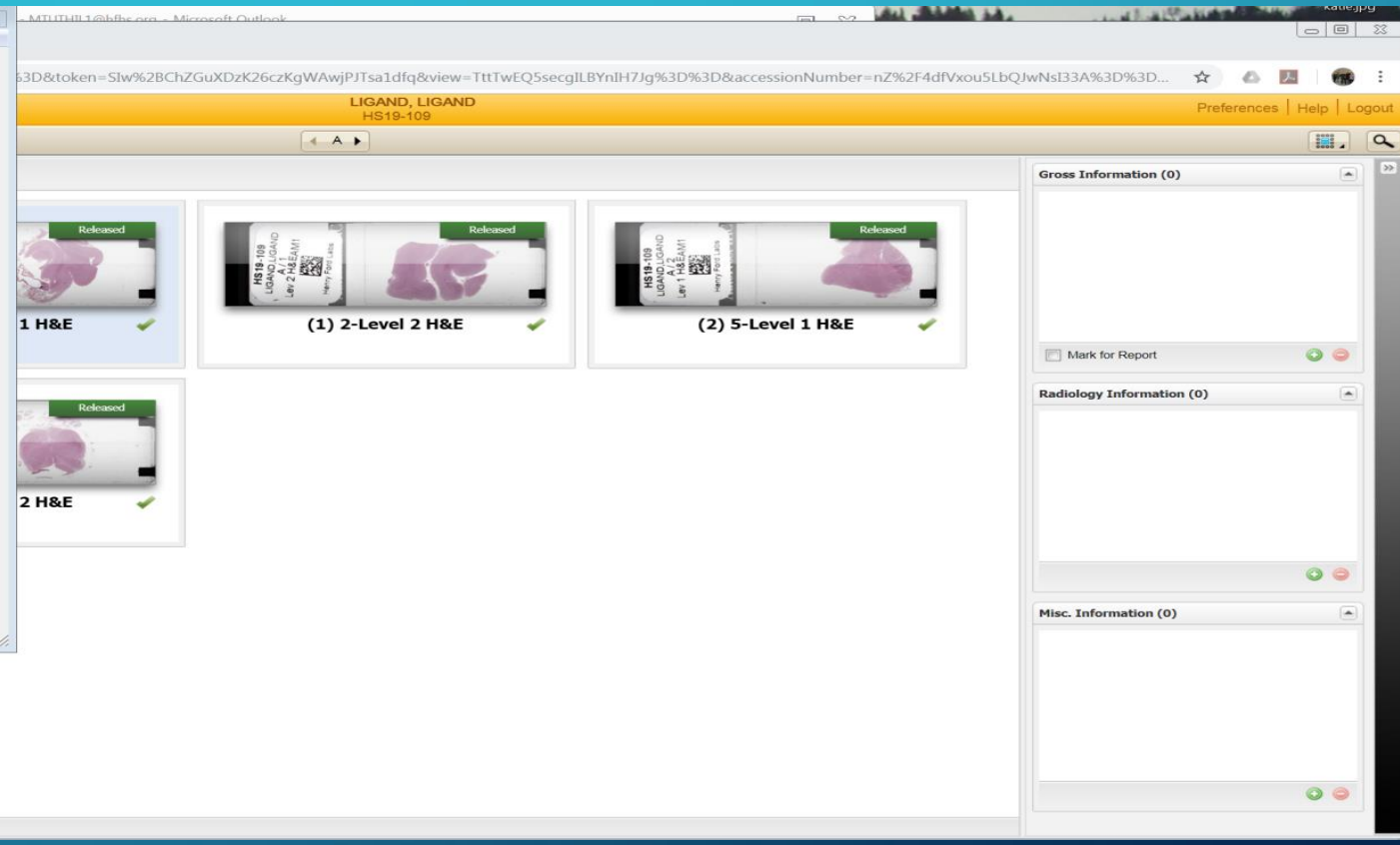
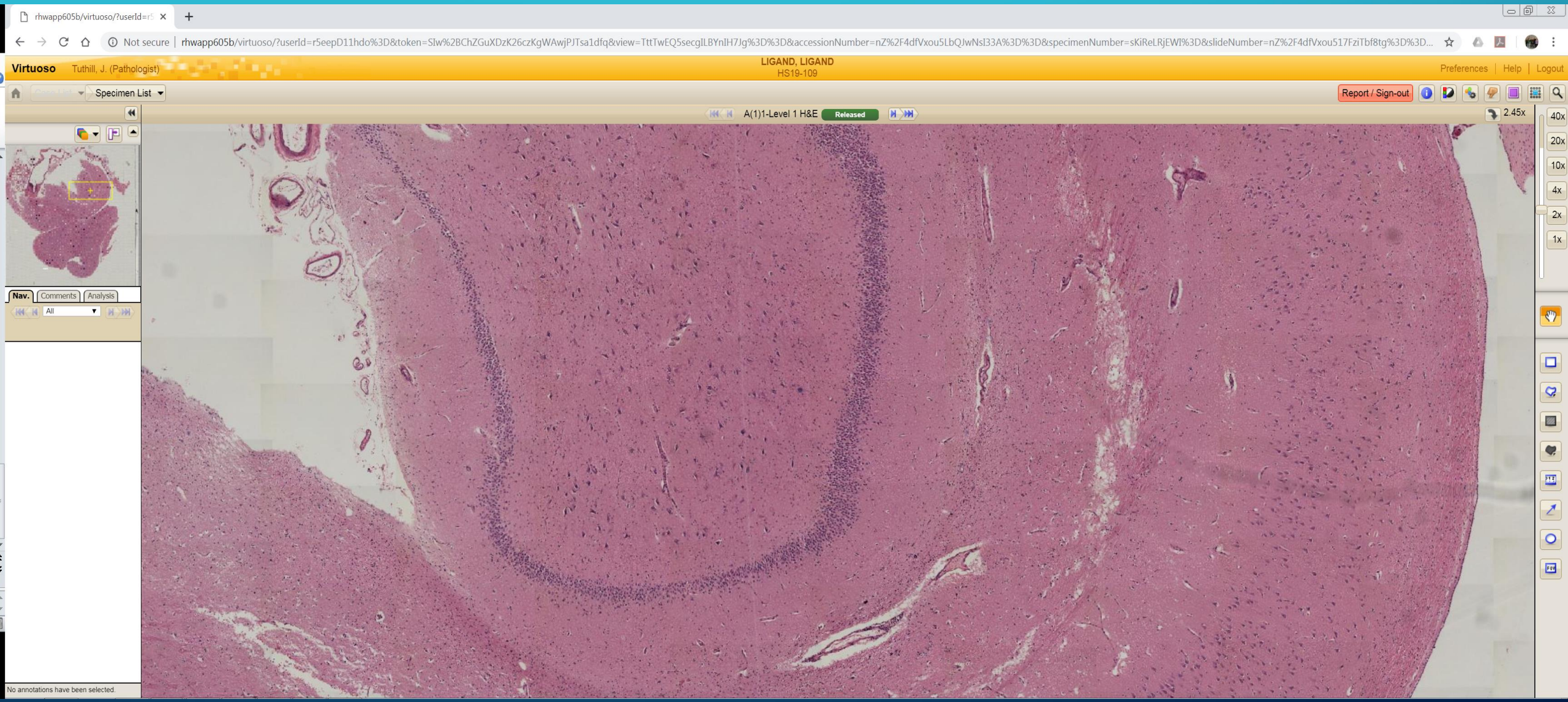
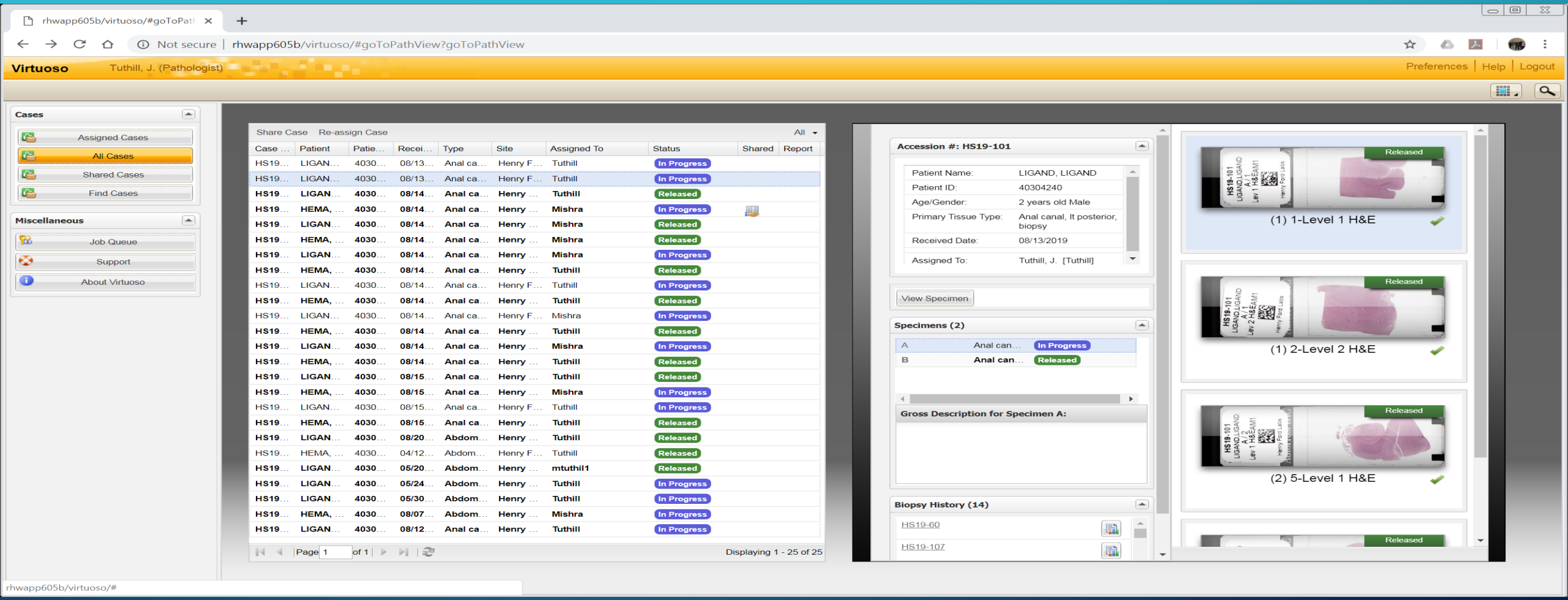
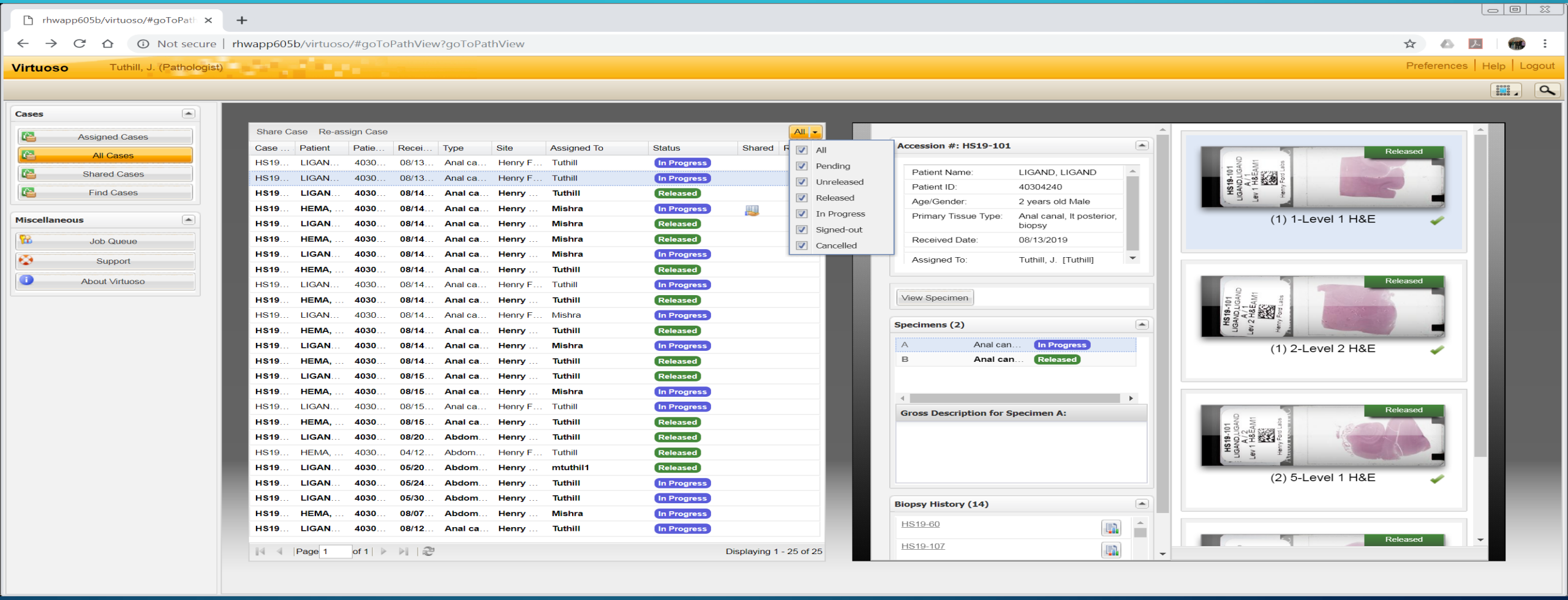

LIGAND, LIGAND
HS19-109
Preferences | Help | Logout
Released
(1) 2-Level 2 H&E
(2) 5-Level 1 H&E
Gross Information (0)
Mark for Report
Radiology Information (0)
Misc. Information (0)


rhwapp605b/virtuoso/?userId=r5
Not secure | rhwapp605b/virtuoso/?userId=r5eepD11hdo%3D&token=SIw%2BChZGuXDzK26czKgWAwjPJTsa1dfq&view=TttTwEQ5secgILBYnIH7Jg%3D%3D&accessionNumber=nZ%2F4dfVxou5LbQJwNsI33A%3D%3D&specimenNumber=sKiReLRjEWI%3D&slideNumber=nZ%2F4dfVxou517FziTbf8tg%3D%3D...
Virtuoso
Tuthill, J. (Pathologist)
LIGAND, LIGAND
HS19-109
Preferences | Help | Logout
Specimen List
Report / Sign-out
A(1)1-Level 1 H&E
Released
2.45x
40x
20x
10x
4x
2x
1x
Nav.
Comments
Analysis
All
No annotations have been selected.


rhwapp605b/virtuoso/#goToPath
Not secure | rhwapp605b/virtuoso/#goToPathView?goToPathView
Virtuoso
Tuthill, J. (Pathologist)
Preferences | Help | Logout
Cases
Assigned Cases
All Cases
Shared Cases
Find Cases
Miscellaneous
Job Queue
Support
About Virtuoso
Share Case
Re-assign Case
All
Case ... Patient Patie... Recei... Type Site Assigned To Status Shared Report
HS19... LIGAN... 4030... 08/13... Anal ca... Henry F... Tuthill In Progress
HS19... LIGAN... 4030... 08/13... Anal ca... Henry F... Tuthill In Progress
HS19... LIGAN... 4030... 08/14... Anal ca... Henry ... Tuthill Released
HS19... HEMA, ... 4030... 08/14... Anal ca... Henry ... Mishra In Progress
HS19... LIGAN... 4030... 08/14... Anal ca... Henry ... Mishra Released
HS19... HEMA, ... 4030... 08/14... Anal ca... Henry ... Mishra Released
HS19... LIGAN... 4030... 08/14... Anal ca... Henry ... Mishra In Progress
HS19... HEMA, ... 4030... 08/14... Anal ca... Henry ... Tuthill Released
HS19... LIGAN... 4030... 08/14... Anal ca... Henry F... Tuthill In Progress
HS19... HEMA, ... 4030... 08/14... Anal ca... Henry ... Tuthill Released
HS19... LIGAN... 4030... 08/14... Anal ca... Henry F... Mishra In Progress
HS19... HEMA, ... 4030... 08/14... Anal ca... Henry ... Tuthill Released
HS19... LIGAN... 4030... 08/14... Anal ca... Henry ... Mishra In Progress
HS19... HEMA, ... 4030... 08/14... Anal ca... Henry ... Tuthill Released
HS19... LIGAN... 4030... 08/15... Anal ca... Henry ... Tuthill Released
HS19... HEMA, ... 4030... 08/15... Anal ca... Henry ... Mishra In Progress
HS19... LIGAN... 4030... 08/15... Anal ca... Henry F... Tuthill In Progress
HS19... HEMA, ... 4030... 08/15... Anal ca... Henry ... Tuthill Released
HS19... LIGAN... 4030... 08/20... Abdom... Henry ... Tuthill Released
HS19... HEMA, ... 4030... 04/12... Abdom... Henry F... Tuthill Released
HS19... LIGAN... 4030... 05/20... Abdom... Henry ... mtuthil1 Released
HS19... LIGAN... 4030... 05/24... Abdom... Henry ... Tuthill In Progress
HS19... LIGAN... 4030... 05/30... Abdom... Henry ... Tuthill In Progress
HS19... HEMA, ... 4030... 08/07... Abdom... Henry ... Mishra In Progress
HS19... LIGAN... 4030... 08/12... Anal ca... Henry ... Tuthill In Progress
Page 1 of 1
Displaying 1 - 25 of 25
Accession #: HS19-101
Patient Name: LIGAND, LIGAND
Patient ID: 40304240
Age/Gender: 2 years old Male
Primary Tissue Type: Anal canal, lt posterior, biopsy
Received Date: 08/13/2019
Assigned To: Tuthill, J. [Tuthill]
View Specimen
Specimens (2)
A Anal can... In Progress
B Anal can... Released
Gross Description for Specimen A:
Biopsy History (14)
HS19-60
HS19-107
Released
(1) 1-Level 1 H&E
Released
(1) 2-Level 2 H&E
Released
(2) 5-Level 1 H&E
Released
rhwapp605b/virtuoso/#


rhwapp605b/virtuoso/#goToPath
Not secure | rhwapp605b/virtuoso/#goToPathView?goToPathView
Virtuoso
Tuthill, J. (Pathologist)
Preferences | Help | Logout
Cases
Assigned Cases
All Cases
Shared Cases
Find Cases
Miscellaneous
Job Queue
Support
About Virtuoso
Share Case
Re-assign Case
All
All
Pending
Unreleased
Released
In Progress
Signed-out
Cancelled
Case ... Patient Patie... Recei... Type Site Assigned To Status Shared
HS19... LIGAN... 4030... 08/13... Anal ca... Henry F... Tuthill In Progress
HS19... LIGAN... 4030... 08/13... Anal ca... Henry F... Tuthill In Progress
HS19... LIGAN... 4030... 08/14... Anal ca... Henry ... Tuthill Released
HS19... HEMA, ... 4030... 08/14... Anal ca... Henry ... Mishra In Progress
HS19... LIGAN... 4030... 08/14... Anal ca... Henry ... Mishra Released
HS19... HEMA, ... 4030... 08/14... Anal ca... Henry ... Mishra Released
HS19... LIGAN... 4030... 08/14... Anal ca... Henry ... Mishra In Progress
HS19... HEMA, ... 4030... 08/14... Anal ca... Henry ... Tuthill Released
HS19... LIGAN... 4030... 08/14... Anal ca... Henry F... Tuthill In Progress
HS19... HEMA, ... 4030... 08/14... Anal ca... Henry ... Tuthill Released
HS19... LIGAN... 4030... 08/14... Anal ca... Henry F... Mishra In Progress
HS19... HEMA, ... 4030... 08/14... Anal ca... Henry ... Tuthill Released
HS19... LIGAN... 4030... 08/14... Anal ca... Henry ... Mishra In Progress
HS19... HEMA, ... 4030... 08/14... Anal ca... Henry ... Tuthill Released
HS19... LIGAN... 4030... 08/15... Anal ca... Henry ... Tuthill Released
HS19... HEMA, ... 4030... 08/15... Anal ca... Henry ... Mishra In Progress
HS19... LIGAN... 4030... 08/15... Anal ca... Henry F... Tuthill In Progress
HS19... HEMA, ... 4030... 08/15... Anal ca... Henry ... Tuthill Released
HS19... LIGAN... 4030... 08/20... Abdom... Henry ... Tuthill Released
HS19... HEMA, ... 4030... 04/12... Abdom... Henry F... Tuthill Released
HS19... LIGAN... 4030... 05/20... Abdom... Henry ... mtuthil1 Released
HS19... LIGAN... 4030... 05/24... Abdom... Henry ... Tuthill In Progress
HS19... LIGAN... 4030... 05/30... Abdom... Henry ... Tuthill In Progress
HS19... HEMA, ... 4030... 08/07... Abdom... Henry ... Mishra In Progress
HS19... LIGAN... 4030... 08/12... Anal ca... Henry ... Tuthill In Progress
Page 1 of 1
Displaying 1 - 25 of 25
Accession #: HS19-101
Patient Name: LIGAND, LIGAND
Patient ID: 40304240
Age/Gender: 2 years old Male
Primary Tissue Type: Anal canal, lt posterior, biopsy
Received Date: 08/13/2019
Assigned To: Tuthill, J. [Tuthill]
View Specimen
Specimens (2)
A Anal can... In Progress
B Anal can... Released
Gross Description for Specimen A:
Biopsy History (14)
HS19-60
HS19-107
Released
(1) 1-Level 1 H&E
Released
(1) 2-Level 2 H&E
Released
(2) 5-Level 1 H&E
Released

http://rhwapp605a/virtuoso/#goToSpecimenView?goToSpecir

rhwapp605a

File Edit View Favorites Tools Help

Virtuoso Tuthill, J. (Pathologist)

91, VAL
HS 15-12016

Preferences | Help | Logout

Case List ▸ Specimen List ▸ 00-1

Accession #: HS 15-12016

Reopen Work Orders Others

Patient Name:	91, VAL
Patient ID:	2505747
Age/Gender:	Female
Primary Tissue Type:	Breast
Received Date:	06/21/2017
Assigned To:	Tuthill, J. [Tuthill]

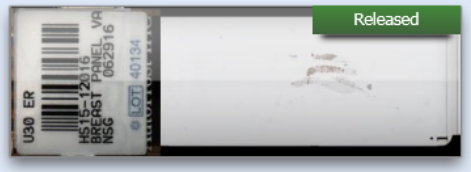
Report / Sign-out Share

Specimens (1)

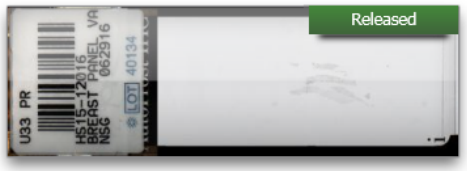
00-1	Breast	In Progress

Gross Description for Specimen 00-1:

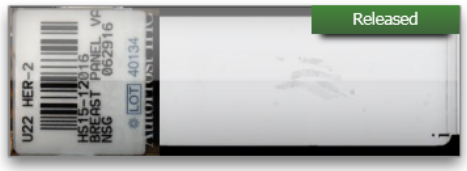
Description for Specimen 00-1:



00-1-ER *
99.47%



00-2-PR *
0.35%



00-3-HER2 *
1+

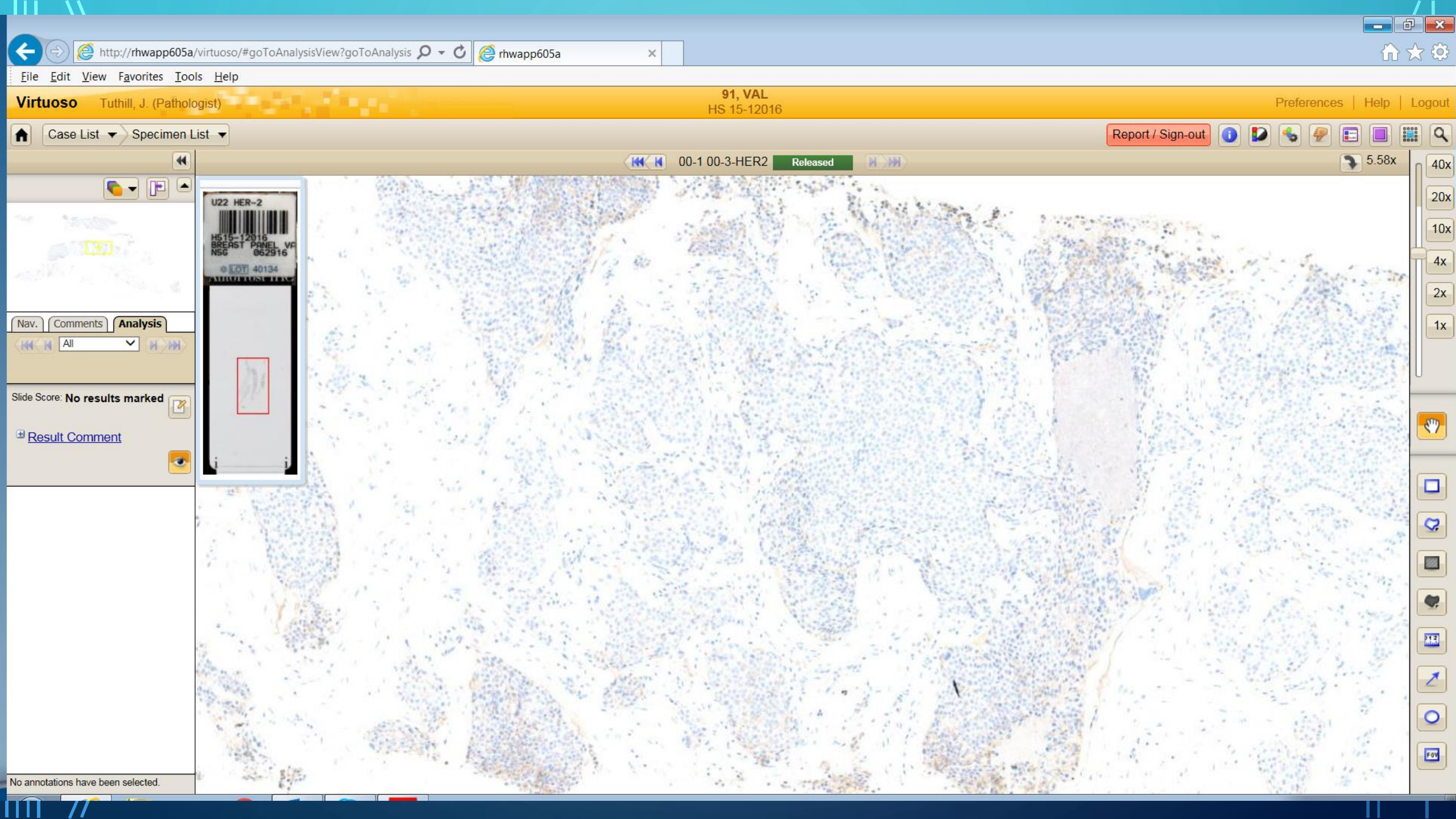
*COMPANION ALGORITHM Image Analysis Software

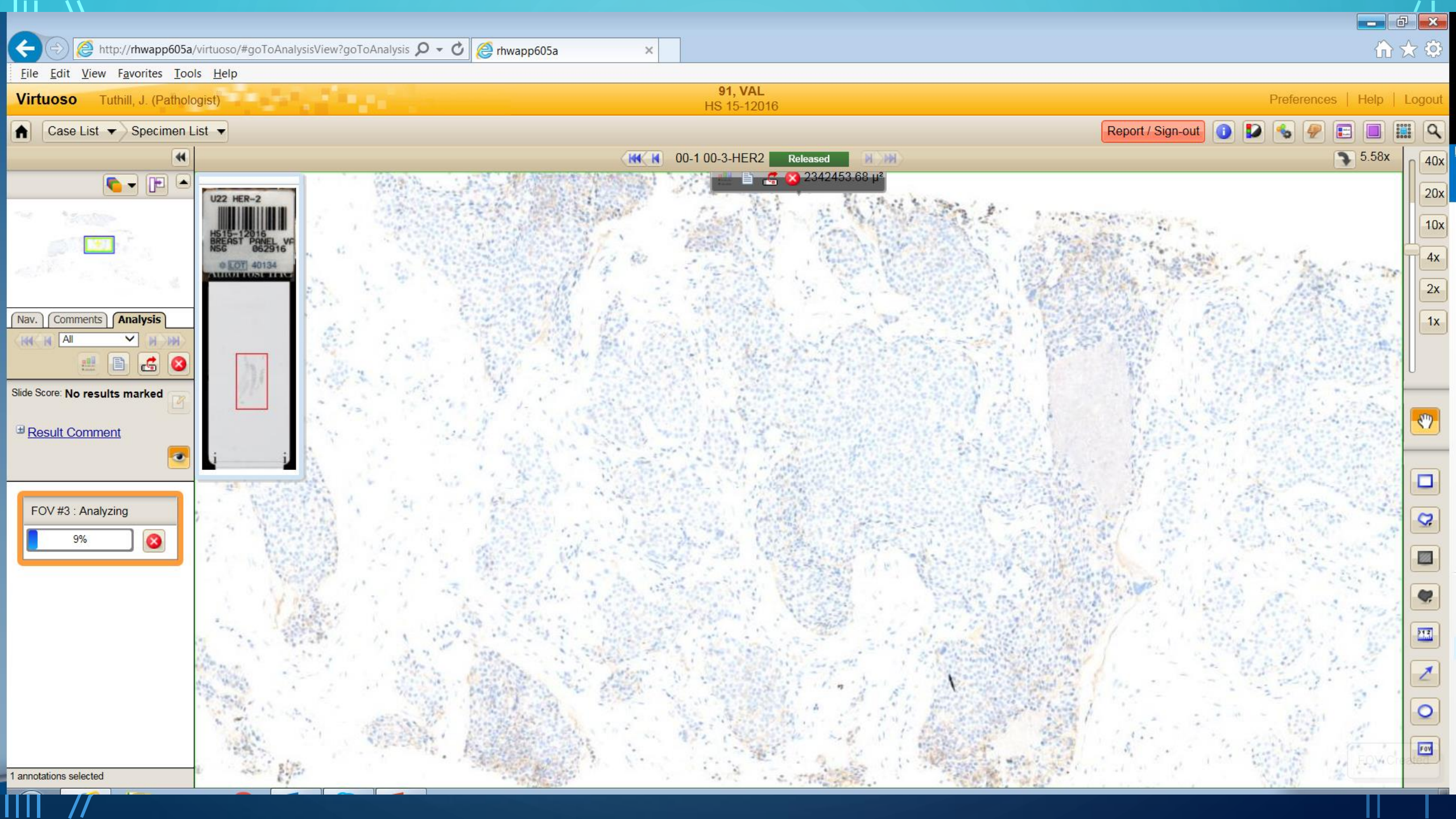
Gross Information (0)

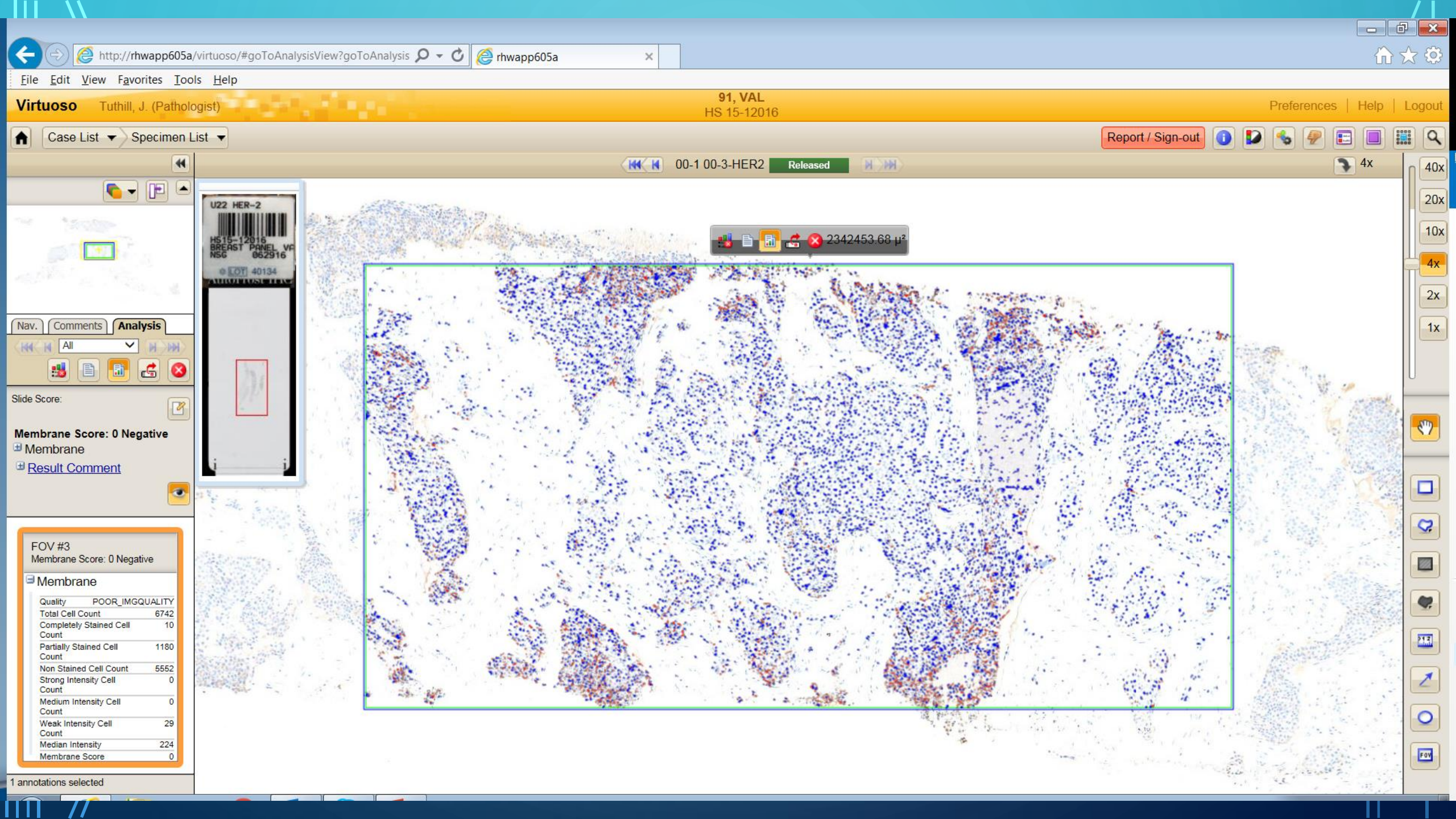
Mark for Report

Radiology Information (0)

Misc. Information (0)


http://rhwapp605a/virtuoso/#goToAnalysisView?goToAnalysis
rhwapp605a
File Edit View Favorites Tools Help
Virtuoso
Tuthill, J. (Pathologist)
91, VAL
HS 15-12016
Preferences | Help | Logout
Case List
Specimen List
Report / Sign-out
00-1 00-3-HER2
Released
5.58x
40x
20x
10x
4x
2x
1x
U22 HER-2
HS15-12016
BREAST PANEL VP
NSG 062916
LOT 40134
Nav.
Comments
Analysis
All
Slide Score: No results marked
Result Comment
No annotations have been selected.


http://rhwapp605a/virtuoso/#goToAnalysisView?goToAnalysis
rhwapp605a
File Edit View Favorites Tools Help
Virtuoso
Tuthill, J. (Pathologist)
91, VAL
HS 15-12016
Preferences | Help | Logout
Case List
Specimen List
Report / Sign-out
00-1 00-3-HER2
Released
5.58x
2342453.68 µ²
40x
20x
10x
4x
2x
1x
U22 HER-2
HS15-12016
BREAST PANEL VP
NSG 062916
LOT 40134
Nav.
Comments
Analysis
All
Slide Score: No results marked
Result Comment
FOV #3 : Analyzing
9%
1 annotations selected


http://rhwapp605a/virtuoso/#goToAnalysisView?goToAnalysis
rhwapp605a
File Edit View Favorites Tools Help
Virtuoso
Tuthill, J. (Pathologist)
91, VAL
HS 15-12016
Preferences | Help | Logout
Case List
Specimen List
Report / Sign-out
00-1 00-3-HER2
Released
4x
40x
20x
10x
4x
2x
1x
U22 HER-2
HS15-12016
BREAST PANEL VP
NSG 062916
LOT 40134
2342453.68 µ²
Nav.
Comments
Analysis
All
Slide Score:
Membrane Score: 0 Negative
Membrane
Result Comment
FOV #3
Membrane Score: 0 Negative
Membrane
Quality POOR_IMGQUALITY
Total Cell Count 6742
Completely Stained Cell Count 10
Partially Stained Cell Count 1180
Non Stained Cell Count 5552
Strong Intensity Cell Count 0
Medium Intensity Cell Count 0
Weak Intensity Cell Count 29
Median Intensity 224
Membrane Score 0
1 annotations selected

Accession #:	HS 15-12016	Sex:	Female
Patient Name:	91, VAL	Referring physician:	
Patient ID:	2505747	Date collected:	06/21/2017
Birth Date:		Time collected:	8:30 AM
Age:		Date received:	06/21/2017
External case ID:		Time received:	8:30 AM
Hospital/medical facility:	Henry Ford Health Systems	Report Date:	10/02/2019
Treating physician:			

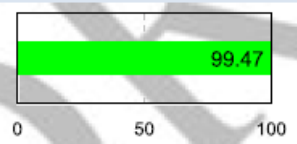
BREAST SPECIMEN REPORT

Summary of findings	Test name	Type	Path. score
	ER	% positive	99.47
	PR	% positive	0.35
	HER2	Score	1 +

00-1 Individual assay findings

Computer-assisted pathologist score

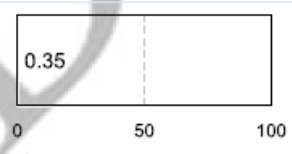
Estrogen Receptor (ER) (SP1)



>= 1 Favorable
< 1 Unfavorable

% positive **99.47**

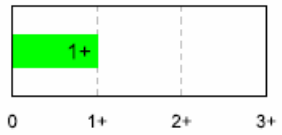
Progesterone Receptor (PR) (1E2)



< 1 Unfavorable
>= 1 Favorable

% positive **0.35**

HER2 (4B5)



= 2 Equivocal
< 2 Negative
= 3 Positive

Score **1 +**

BUSINESS ANALYTICS

DEFINE BUSINESS ANALYTICS

- Using data to drive and manage business
- Skills, technologies, practices for continuous iterative exploration and investigation of past business performance to gain insight and drive business planning
  - Wikipedia

DEFINE BUSINESS ANALYTICS

- Types of Analytics
  - Descriptive
    - Static
      - Presentation of data in a non interactive format
      - Typically “yesterdays' data”
    - Dynamic
      - Real time up to the minute
  - Predictive
    - Leverage machine learning and artificial intelligence

DEFINITIONS

- Formative Data
  - Real time
  - Informs moment to moment decisions
  - Front line staff
  - Predictive
  - Should be electronic
  - E.g. volume dashboard
- Summative Data
  - Cumulative, static data
  - Informs long term decisions
  - Leadership
  - Predictive
  - Can be paper based
  - TAT's

PREDICTIVE ANALYTICS

- "The practice of extracting information from existing data sets in order to determine patterns and predict future outcomes and trends. **Predictive analytics** does not tell you what will happen in the future."
  - How do we use this in the laboratory?
  - It depends on who you are….
  - Can leverage Static or Dynamic data sets

ANALYTIC ENVIRONMENT AT HFHS PATHOLOGY AND LABORATORY MEDICINE

- Descriptive Analytics
  - Static analytics
  - Dynamic “ePending log” monitors: electronic “Andon Boards”
  - Development of real time analytics
- Vision of predicative analytics and AI
- LEAN culture going back to the founding of Henry Ford Hospital
  - Henry Ford Production System
- Evolving analytics team

ENVIRONMENT AT HFHS

- Beckman Automation Line Implemented November 8, 2016
  - Remisol, Cennexus
  - Elimination of defects
  - Goal for “one touch” workflow
- LIS
  - Sunquest Laboratory™ with SMART
  - Instrument-ready bar codes labels printed at point of service out of Epic
- Analytics Partners
  - Vision
  - Sunquest Information Systems

VALUE OF ANALYTICS

- Operations
  - Efficiency of operations
  - Cost accounting
  - Deviation management
  - Customer Satisfaction
  - Leadership Engagement
  - Workflow design
  - Eliminate waste
  - Planning services, staffing

VALUE OF ANALYTICS

- Regulatory Requirements
  - Performance
    - Volumes, Turn around times
  - Conformance
    - Critical Value reporting
  - Justification of services
    - Point of care testing versus central testing
  - Quality management program

FUTURE STATE

- Create a real-time metrics driven core laboratory leveraging real time, predictive analytics
  - Focus on our core lab
    - Avoid scope creep, but also share gains that are of value
  - Process
    - Kaizen teams, Sprints, deployment of solutions
    - Prioritization of development by people doing the work
    - Collaborative partnership with Sunquest Information systems
      - Real time development using rapid application development
- Recognized that this is a multi-year iterative effort!

PRIORITIZE BUSINESS ANALYTICS EFFORTS

- Where is your laboratory in deployment of such tools?
  - Culture
    - Top down
    - LEAN
    - Commitment
  - Support
    - IT engagement
    - Financial
    - Enterprise analytics team

PRIORITIZE BUSINESS ANALYTICS EFFORTS

- Where is your laboratory in deployment of such tools?
  - Applications
    - Lab specific analytics
    - Hospital Analytics
    - EDW integration
  - Governance of analytic efforts
    - IT Leadership
    - Medical Leadership
    - Laboratory leadership

Turnaround Outlier Monitor Display

Time Since Received	Processing Time	Acc	Name	Ordered	Received	Collected	PID	Priority	Spot Code	Order Code	Test Code	Or... Locat Coc...	Or... Locat	HID	Threshold	Percent of Error	Dept
94:19:13	5659	M43564	RUIZ,LISA	4/23/2018 10:52:00 AM	4/23/2018 10:50:00...	4/23/2018 10:4...	3269205	-	PROB	LYTE	CL	R	ROUTINE LAB	HID1	2	282950.00	CHEMISTRY T1 TEST
42:20:13	2540	W7292	EARLY,DANIEL	4/25/2018 2:51:00 PM	4/25/2018 2:49:00 PM	4/25/2018 2:47:...	3269212	T	PROB	FLGL	FLGL	R	ROUTINE LAB	HID1	3	84666.67	CHEMISTRY T1 TEST
42:20:13	2540	W7292	EARLY,DANIEL	4/25/2018 2:51:00 PM	4/25/2018 2:49:00 PM	4/25/2018 2:47:...	3269212	S	PROB	FGLU	FGLU	R	ROUTINE LAB	HID1	3	84666.67	CHEMISTRY T1 TEST
42:20:13	2540	W7292	EARLY,DANIEL	4/25/2018 2:51:00 PM	4/25/2018 2:49:00 PM	4/25/2018 2:47:...	3269212	S	PROB	FGLU	FGLU	R	ROUTINE LAB	HID1	4	63500.00	CHEMISTRY T1 TEST
42:20:13	2540	W7292	EARLY,DANIEL	4/25/2018 2:51:00 PM	4/25/2018 2:49:00 PM	4/25/2018 2:47:...	3269212	-	PROB	K	K	R	ROUTINE LAB	HID1	7	36285.71	CHEMISTRY T1 TEST
35:48:13	2148	W7293	TEST,UDP4	4/25/2018 9:21:00 PM	4/25/2018 9:21:00 PM	4/25/2018 9:20:...	10504	-	PROB	K	K	R	ROUTINE LAB	HID1	7	30685.71	CHEMISTRY T1 TEST
42:20:13	2540	W7292	EARLY,DANIEL	4/25/2018 2:51:00 PM	4/25/2018 2:49:00 PM	4/25/2018 2:47:...	3269212	-	PROB	CHOL	CHOL	R	ROUTINE LAB	HID1	10	25400.00	CHEMISTRY T1 TEST
29:9:13	1749	H8753	NEWEST,MAX	4/26/2018 4:00:00 AM	4/26/2018 4:00:00 AM	4/26/2018 3:58:...	3269216	-	PROB	K	K	R	ROUTINE LAB	HID1	7	24985.71	CHEMISTRY T1 TEST
28:34:13	1714	H8758	RAHUL,J	4/26/2018 4:35:00 AM	4/26/2018 4:35:00 AM	4/26/2018 4:33:...	12	-	PROB	K	K	R	ROUTINE LAB	HID1	7	24485.71	CHEMISTRY T1 TEST
27:57:13	1677	H8760	P9,T9	4/26/2018 5:12:00 AM	4/26/2018 5:12:00 AM	4/26/2018 5:11:...	9	-	PROB	K	K	R	ROUTINE LAB	HID1	7	23957.14	CHEMISTRY T1 TEST
42:20:13	2540	W7292	EARLY,DANIEL	4/25/2018 2:51:00 PM	4/25/2018 2:49:00 PM	4/25/2018 2:47:...	3269212	-	PROB	K	K	R	ROUTINE LAB	HID1	105	2419.86	CHEMISTRY T1 TEST
35:48:13	2148	W7293	TEST,UDP4	4/25/2018 9:21:00 PM	4/25/2018 9:21:00 PM	4/25/2018 9:20:...	10504	-	PROB	K	K	R	ROUTINE LAB	HID1	105	2045.71	CHEMISTRY T1 TEST
29:9:13	1749	H8753	NEWEST,MAX	4/26/2018 4:00:00 AM	4/26/2018 4:00:00 AM	4/26/2018 3:58:...	3269216	-	PROB	K	K	R	ROUTINE LAB	HID1	105	1665.71	CHEMISTRY T1 TEST

Current Time

4/27/2018 9:09:13 AM

Lab Volumes*

Filters

...

Receive Date

Select date range

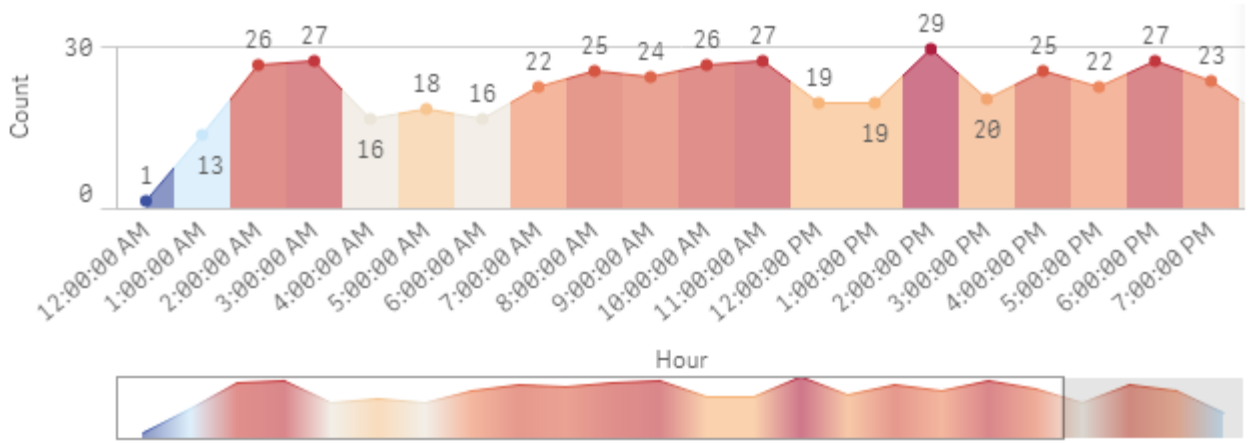
Avg Orders Per Week

55

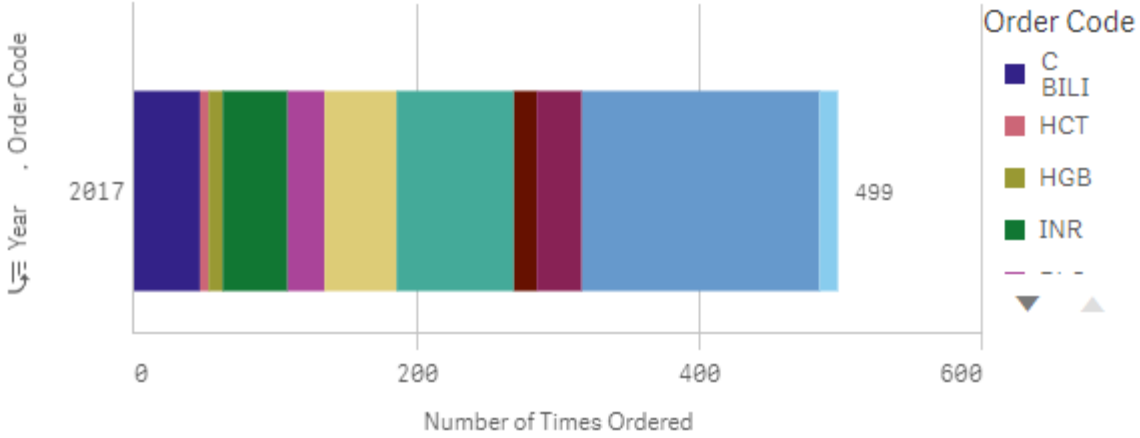
Avg Orders Per Day

16

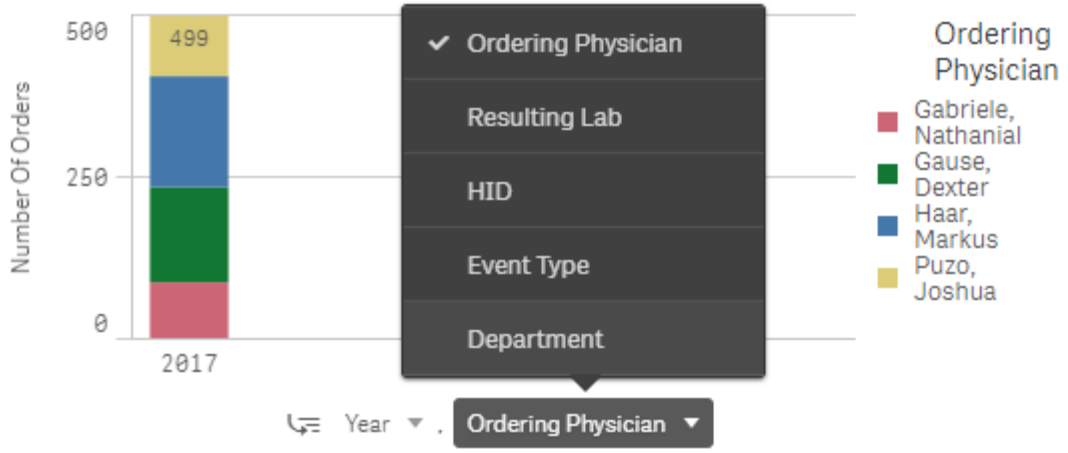
Volume by Hour



Total over a Time Period



Volume by Groups



A... N...	HID	Col... Date	Col... Time	Re... Date	Re... Time	Or... Co...	Test code	Me...	Re...	Re... Lab	Pat... Type	Ord... Phy...	Or... Date	Or... Time
S2035	HID2	7/5/2017	2:56:00 PM	7/5/2017	4:26:00 PM	INR	INR	DAMM	0.1	AUX	OP	Gabriele, Nathanial	7/5/2017	2:30:00 PM

CHEM HFH TAT Histogram

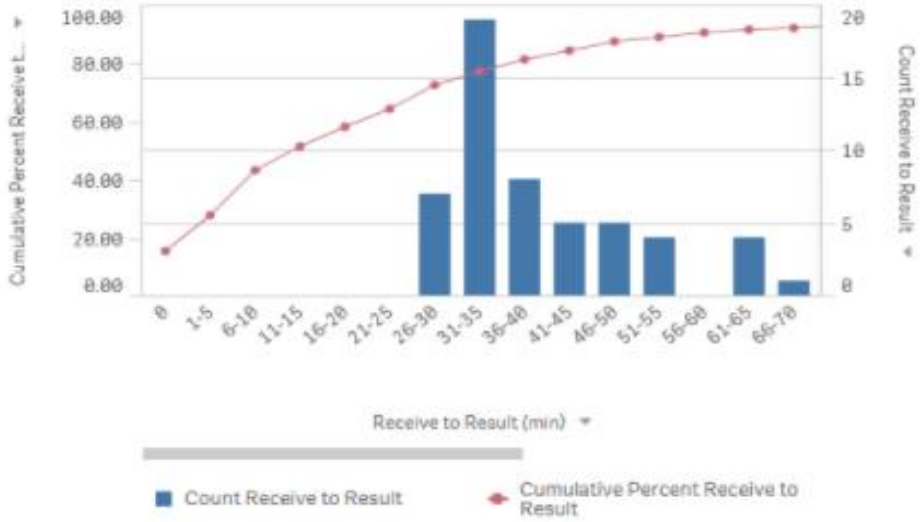
Result Date

12/19/2017

CTNI COUNT:55

Min = 29 Max = 84 Mean = 42 Median = 36

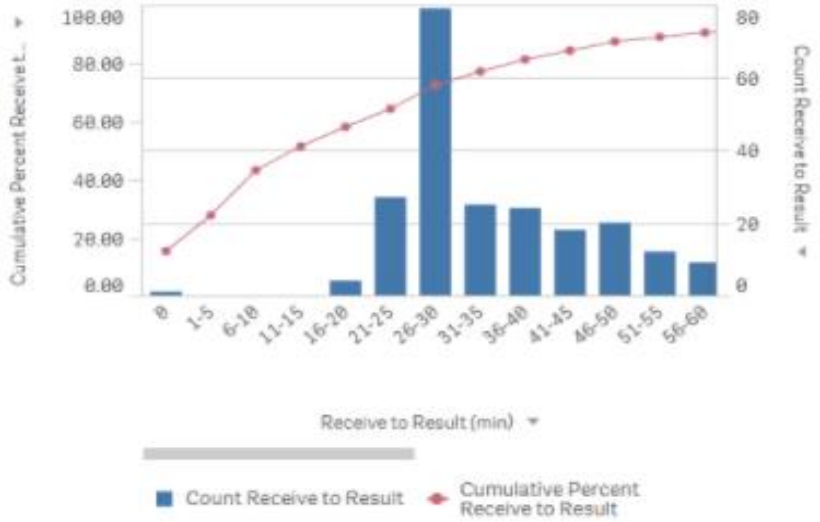
CNTI TAT Histogram



LYT7 COUNT:251

Min = 0 Max = 155 Mean = 42 Median = 33

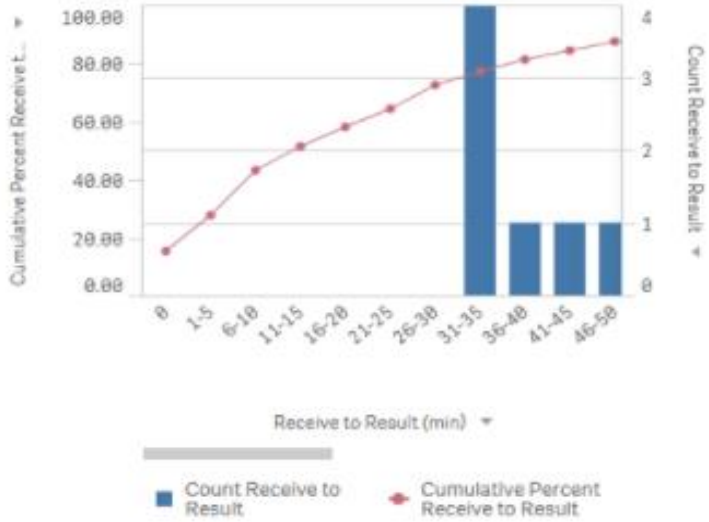
LYT7 TAT Histogram



BNP COUNT:9

Min = 31 Max = 507 Mean = 93 Median = 37

BNP TAT Histogram



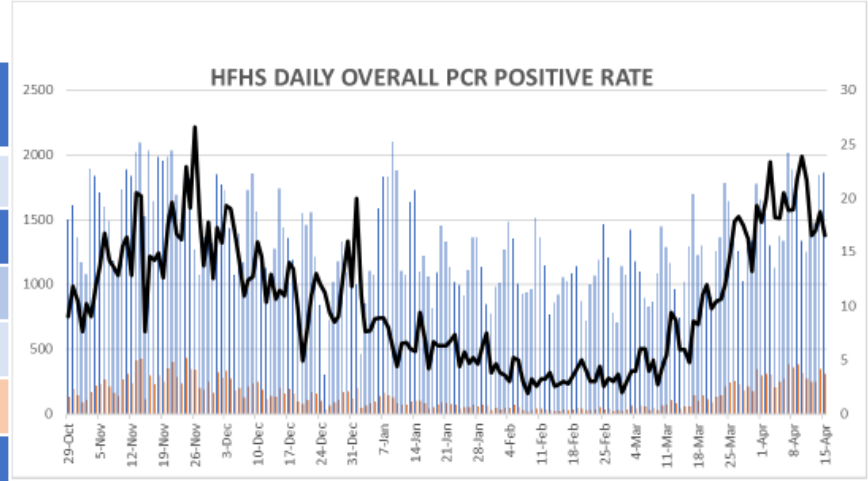
Cancel

Henry Ford Health System
COVID-19
PCR Diagnostic Testing

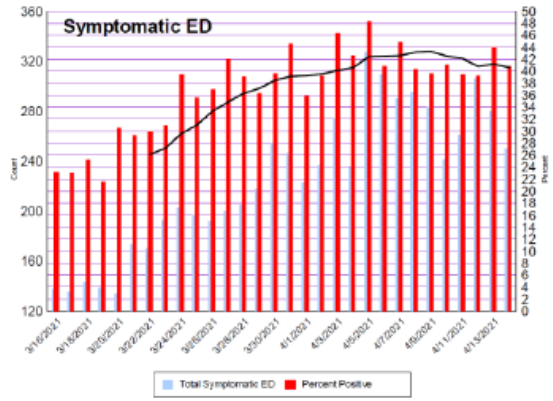
Post date: April 15th, 2021	LAB DAILY PCR	Cumulative PCR Testing
COVID-19 PCR Test Results for April 14th, 2021	RESULTS By Midnight HFHS + Outreach	In-house + Sendout PCR Cumulative from March 9, 2020
POSITIVE COVID-19	308	35,922
NEGATIVE COVID-19	1557	381,266
TOTAL REPORTED	1865	417,188
OVERALL % POS	16.5%	8.6%

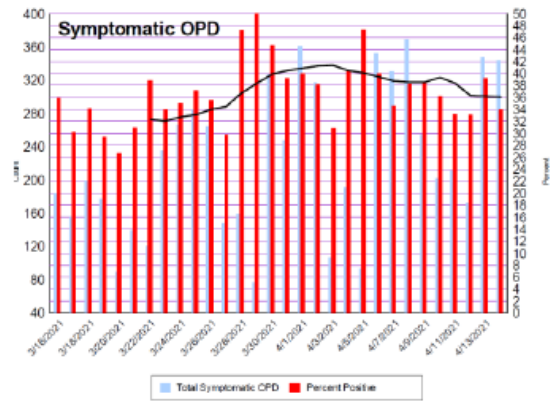
Daily TAT	<48h	<36h	<24h	<12h	<6h
IPD, ED	100%	100%	100%	100%	99%
L&D	100%	100%	100%	100%	100%
PRE-Surg	100%	100%	100%	93%	7%
Employee	100%	100%	100%	92%	5%
Outpatient	100%	100%	92%	66%	8%

Daily %	POSITIVITY RATES by Curated Groups Tested Overall and by Symptomatology Reported
4%	All In-Patient sites (2 of 45 tested)
	EMERGENCY DEPARTMENTS
23%	All ED site testing (119 of 515 tested)
41%	SYMPTOMATIC ED Patients (102 of 250 tested) See Moving Avg
6%	ASYMPTOMATIC ED Patients (13 of 228 tested)
	OUTPATIENTS
24%	All OUTPATIENT testing (140 of 572 tested)
34%	SYMPTOMATIC Outpatients (117 of 344 tested) See Moving Avg
8%	ASYMPTOMATIC Outpatients (16 of 201 tested)
0%	First Responders (0 of 0 tested)
0%	DTE/Critical Infrastructure Workers (0 of 0 tested)
	EMPLOYEES (See SYM/ASYM Moving Averages page-5)
21%	All EMPLOYEES (23 of 111 tested)
31%	SYMPTOMATIC EMPLOYEES (21 of 68 tested)
3%	ASYMPTOMATIC EMPLOYEES (1 of 39 tested)
	LABOR & DELIVERY (See Cumulative page-6)
75%	SYMPTOMATIC L&D (9 of 12 tested)
4%	ASYMPTOMATIC L&D (1 of 26 tested)
	PRE-SURGICAL / PRE-PROCEDURE SCREENING (See Cum. page-7)
0%	SYMPTOMATIC PRE-Surgical / PRE-Procedure (0 of 6 tested)
2%	ASYMPTOMATIC PRE-Surgical/PRE-Procedure (11 of 508 tested)



% POSITIVE PCR - 7-Day Moving Average
Percent Positive | Total Tested | 30 day line plot



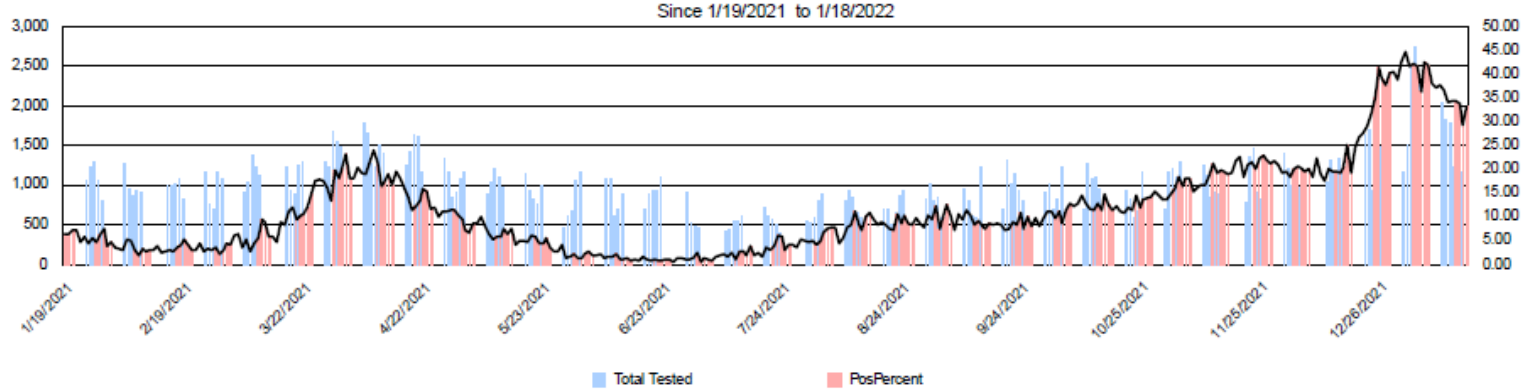


Henry Ford Health System

TOTAL HFHS POPULATION FOR 1/18/2022

HFHS Daily Overall PCR Positive Rate

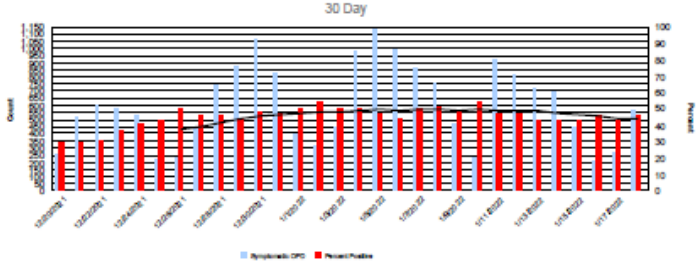
Since 1/19/2021 to 1/18/2022



Covid-19 PCR Test Results for 1/18/2022	LAB DAILY PCR RESULTS By Midnight HFHS + Outreach Last 24 Hours	Cumulative PCR Testing YTD	Cumulative PCR Testing from March 9, 2020
POSITIVE COVID-19	505	11746	78778
NEGATIVE COVID-19	1021	18973	638953
TOTAL REPORTED	1526	30719	717731
OVERALL % POS	33.09%	38.24%	10.98%

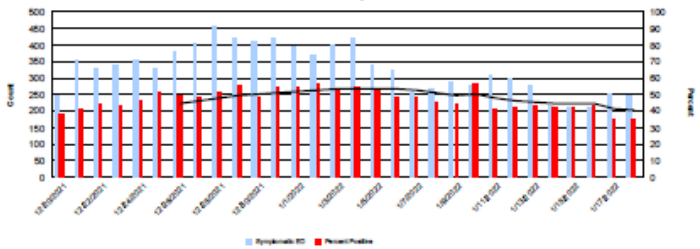
Symptomatic OPD

30 Day



Symptomatic ED

30 Day



Daily Positivity Rates by Curated Groups Tested

1/17/2022 Total tested: 1175 POS 345 NEG 830

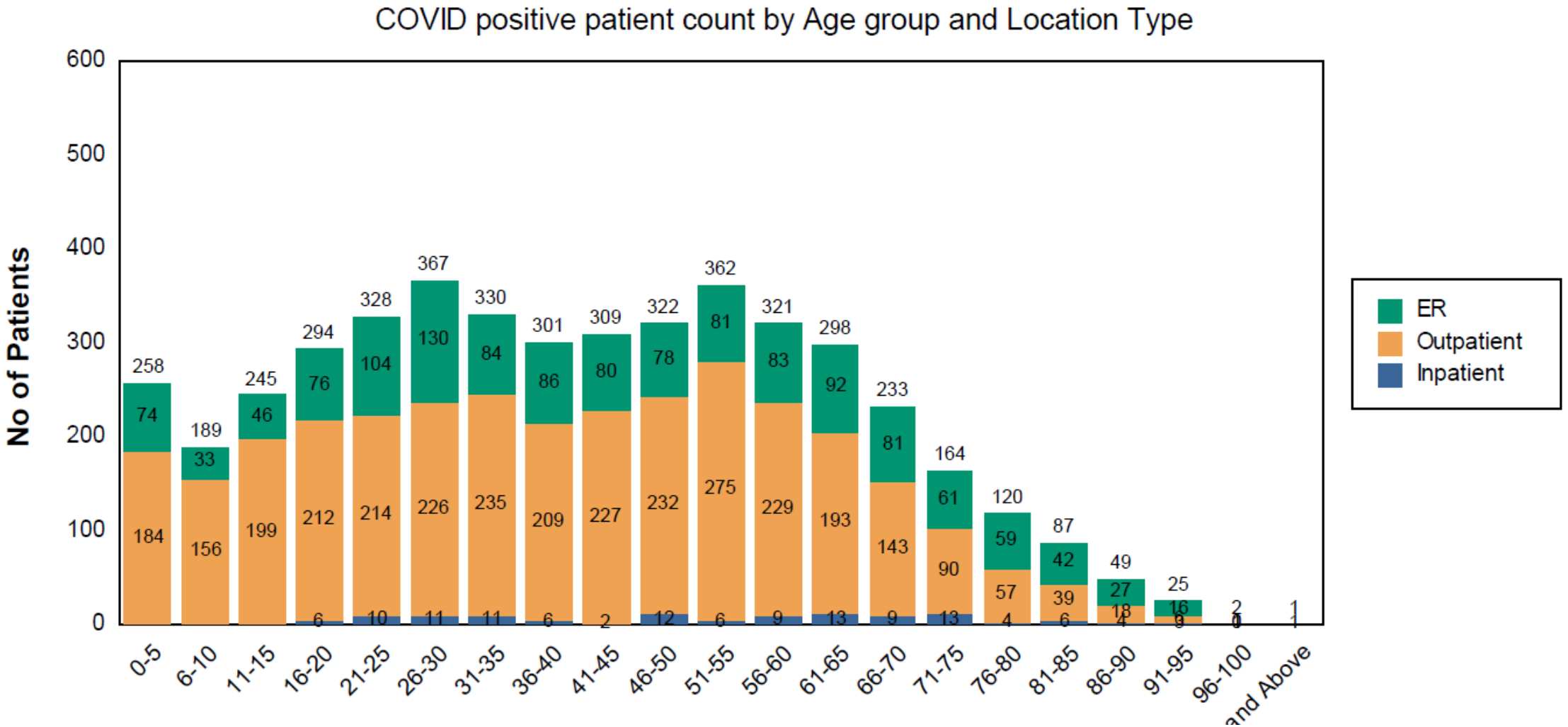
ED	**467**	
Asymptomatic	**176**	
POS	27	15.34%
NEG	149	
Symptomatic	**250**	
POS	88	35.20%
NEG	162	
Employee*	**116**	
Asymptomatic	**24**	
POS	4	16.67%
NEG	20	
Symptomatic	**90**	
POS	35	38.89%
NEG	55	
Inpatient	**106**	
Asymptomatic	**95**	
POS	16	16.84%
NEG	79	
Symptomatic	**9**	
POS	3	33.33%
NEG	6	
Labor & Delivery*	**14**	
Asymptomatic	**12**	
POS	1	8.33%
NEG	11	
Symptomatic	**2**	
POS	1	50.00%
NEG	1	
Outpatient	**390**	
Asymptomatic	**69**	
POS	19	27.54%
NEG	50	
Symptomatic	**265**	
POS	114	43.02%
NEG	151	

* Symptomatic and Asymptomatic totals are displayed. Discrete unknown condition counts are not displayed but are included in the total for every location type

HENRY FORD HEALTH SYSTEM
COVID positive report

Resulted for *1/9/2022 to 1/16/2022*

Report Date:*1/17/2022*



VALUE OF COURIER AND SAMPLE TRACKING

- Decrease missing samples
- Decrease time to detect missing samples
- Enforce standard work: accountability through visibility
- Understand the volume of samples arriving and en route
- Maximize courier efficiency

DESCRIBE THE DESIGN BEHIND THE LABTRACKS PROGRAM

- Leverages the Sunquest SMART system; similar features exist in other LIS
  - CIDs into batches
  - Batches into master batches
  - Master batches include a variety of assets:
    - Coolers, bags, satchels
      - Each of this is labeled with a SMART Batch ID
- Couriers ping **all** master batch bar codes into **their** tracking system as they pick up and drop off assets
  - This includes both AP and CP specimens as well as supplies and other assets that couriers deliver to sites such as AP slides and container, blood products etc.
- The SMART master batch ID is visible in the courier system, which used in combination with Sunquest SMART queries, and Inquiry tools sample transport issues can be identified, and resolutions implemented

ANALYTICS TOOLS USED TO VISUALIZE SAMPLE FLOW IN THE LABTRACKS PROGRAM

- Two information systems are used:
  - Courier sample management system that provides GPS tracking, sample pickup and drops offs, time stamps, management reports
  - Sunquest SMART
    - Produces bar codes
    - Management reports
    - Inquiry Functionality
  - Based off SMART "Master Batch ePending log
    - Andon board with a visualization for samples too long in transit (In progress)
    - Similar to the ePending Dashboards used to monitor TAT
  - We will briefly look at these tools for a show and tell
- https://reliabledelivery.com/

ANALYTICS TOOLS USED TO VISUALIZE SAMPLE FLOW IN THE LABTRACKS PROGRAM

- LIS integration provides for:
  - Crystal Reports data extraction with MS Access Visualizations
    - Base Sunquest functionality
  - Allows for real time, filterable views of data
    - Refresh is hourly
  - The ability to visualize, and anticipate work volume
  - Connections to instrument level data for workflow processing
- In lab visualizations

Last Update
3/30/2021 4:07:52 PM

Batch Transport ePending Monitor

When Red
When Yellow
First Appears

CollectDateODBC	OrderLab	ParentBatch	BatchID	AccNumber	ContainerIndex	BatTstCode	BatchedDateTime	RecTech	SPOTCode	LabDept	HRElapsed
3/30/2021	APF	46086	45488	T327241	L339708880	BCPRO	3/30/2021 11:39:32 AM	922	APFCP	C	5
3/30/2021	APF	46086	45488	T327241	L339708880	LIPOP	3/30/2021 11:39:32 AM	922	APFCP	C	5
3/30/2021	APF	46086	45488	T327241	L339708880	MG	3/30/2021 11:39:32 AM	922	APFCP	C	5
3/30/2021	APF	46086	45488	T327892	L339709757	BCPRO	3/30/2021 11:39:32 AM	922	APFCP	C	5
3/30/2021	APF	46086	45488	T327892	L339709757	ICA	3/30/2021 11:39:32 AM	922	APFCP	C	5
3/30/2021	APF	46086	45488	T327892	L339709758	BSAP	3/30/2021 11:50:31 AM	922	APFCP	CS	5
3/30/2021	APF	46086	45488	T327892	L339709759	FT4	3/30/2021 11:50:31 AM	922	APFCP	CS	5
3/30/2021	APF	46086	45488	T327892	L339709759	TSH	3/30/2021 11:50:31 AM	922	APFCP	CS	5
3/30/2021	APF	46086	45488	T327892	L339709760	SCTX	3/30/2021 11:50:31 AM	922	APFCP	CS	5
3/30/2021	APF	46086	45488	T327893	L339709761	PTHA	3/30/2021 11:50:31 AM	922	APFCP	CS	5
3/30/2021	APF	46086	45488	T327955	L339709843	BCPRO	3/30/2021 11:50:31 AM	922	APFCP	C	5
3/30/2021	APF	46086	45488	T327955	L339709843	LIPOP	3/30/2021 11:50:31 AM	922	APFCP	C	5
3/30/2021	APF	46086	45488	T327955	L339709845	TSH	3/30/2021 11:50:31 AM	922	APFCP	CS	5
3/30/2021	APF	46086	45733	T327954	L339709841	RNACT	3/30/2021 11:40:16 AM	922	APFCP	IS	5
3/29/2021	HC		45869	Z67307	L339713153	MSAFP	3/30/2021 12:56:42 PM	11041	HFHS	CS	4
3/29/2021	HC		45869	Z67308	L339713186	MSAFP	3/30/2021 12:56:42 PM	11041	HFHS	CS	4
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3/30/2021	FRL		45691	T329495	L339712222	COV19	3/30/2021 12:20:52 PM	15105	FRLCP	IS	4
3/30/2021	MIL		45792	T329459	L339711816	A1C	3/30/2021 12:06:03 PM	4213	MILCP	C	4
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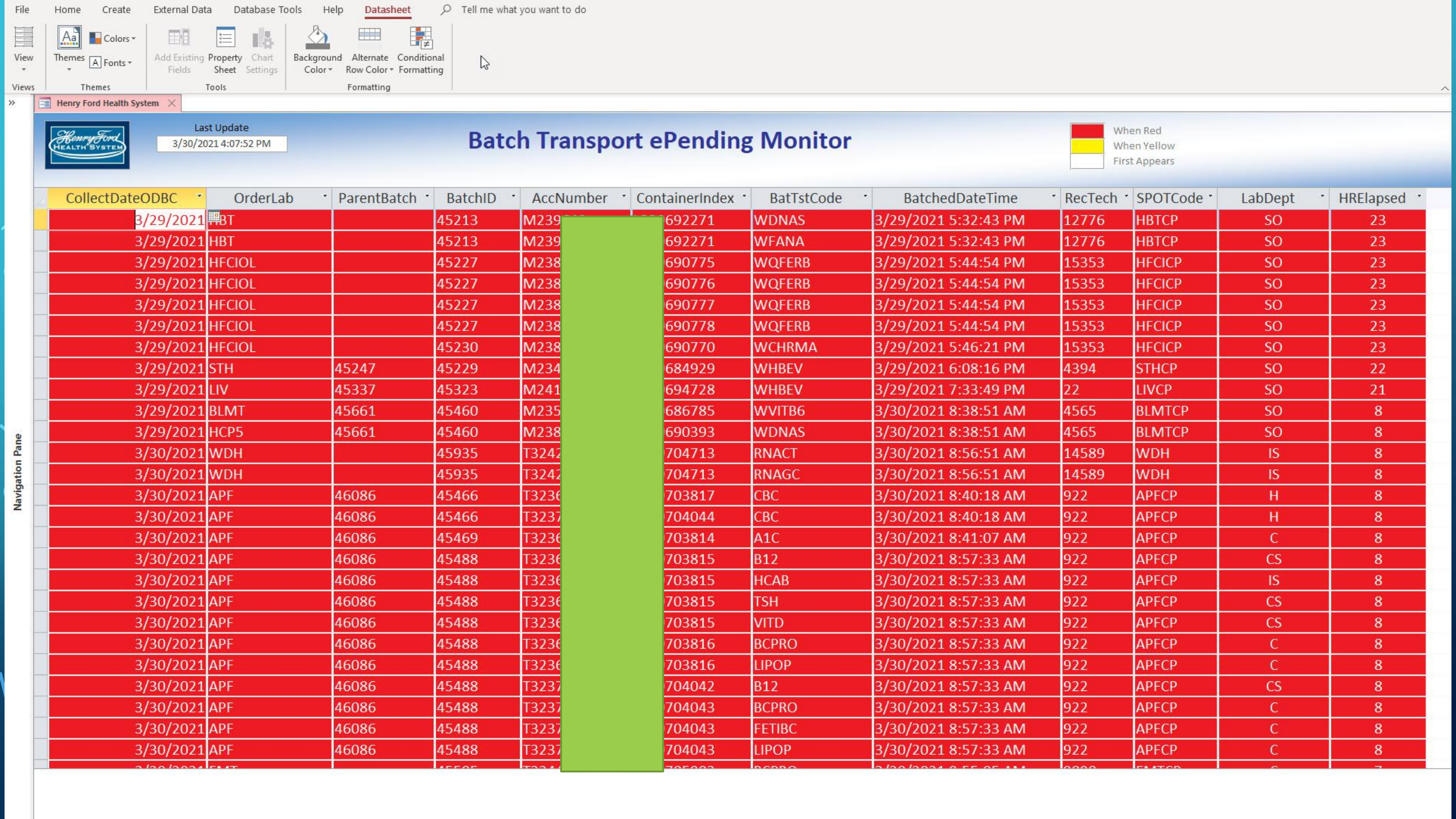

CollectDateODBC	OrderLab	ParentBatch	BatchID	AccNumber	ContainerIndex	BatTstCode	BatchedDateTime	RecTech	SPOTCode	LabDept	HRElapsed
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3/29/2021	HBT		45213	M239	692271	WFANA	3/29/2021 5:32:43 PM	12776	HBTCP	SO	23
3/29/2021	HFCIOL		45227	M238	690775	WQFERB	3/29/2021 5:44:54 PM	15353	HFCICP	SO	23
3/29/2021	HFCIOL		45227	M238	690776	WQFERB	3/29/2021 5:44:54 PM	15353	HFCICP	SO	23
3/29/2021	HFCIOL		45227	M238	690777	WQFERB	3/29/2021 5:44:54 PM	15353	HFCICP	SO	23
3/29/2021	HFCIOL		45227	M238	690778	WQFERB	3/29/2021 5:44:54 PM	15353	HFCICP	SO	23
3/29/2021	HFCIOL		45230	M238	690770	WCHRMA	3/29/2021 5:46:21 PM	15353	HFCICP	SO	23
3/29/2021	STH	45247	45229	M234	684929	WHBEV	3/29/2021 6:08:16 PM	4394	STHCP	SO	22
3/29/2021	LIV	45337	45323	M241	694728	WHBEV	3/29/2021 7:33:49 PM	22	LIVCP	SO	21
3/29/2021	BLMT	45661	45460	M235	686785	WVITB6	3/30/2021 8:38:51 AM	4565	BLMTCP	SO	8
3/29/2021	HCP5	45661	45460	M238	690393	WDNAS	3/30/2021 8:38:51 AM	4565	BLMTCP	SO	8
3/30/2021	WDH		45935	T3242	704713	RNACT	3/30/2021 8:56:51 AM	14589	WDH	IS	8
3/30/2021	WDH		45935	T3242	704713	RNAGC	3/30/2021 8:56:51 AM	14589	WDH	IS	8
3/30/2021	APF	46086	45466	T3236	703817	CBC	3/30/2021 8:40:18 AM	922	APFCP	H	8
3/30/2021	APF	46086	45466	T3237	704044	CBC	3/30/2021 8:40:18 AM	922	APFCP	H	8
3/30/2021	APF	46086	45469	T3236	703814	A1C	3/30/2021 8:41:07 AM	922	APFCP	C	8
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3/30/2021	APF	46086	45488	T3236	703815	TSH	3/30/2021 8:57:33 AM	922	APFCP	CS	8
3/30/2021	APF	46086	45488	T3236	703815	VITD	3/30/2021 8:57:33 AM	922	APFCP	CS	8
3/30/2021	APF	46086	45488	T3236	703816	BCPRO	3/30/2021 8:57:33 AM	922	APFCP	C	8
3/30/2021	APF	46086	45488	T3236	703816	LIPOP	3/30/2021 8:57:33 AM	922	APFCP	C	8
3/30/2021	APF	46086	45488	T3237	704042	B12	3/30/2021 8:57:33 AM	922	APFCP	CS	8
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3/30/2021	APF	46086	45488	T3237	704043	FETIBC	3/30/2021 8:57:33 AM	922	APFCP	C	8
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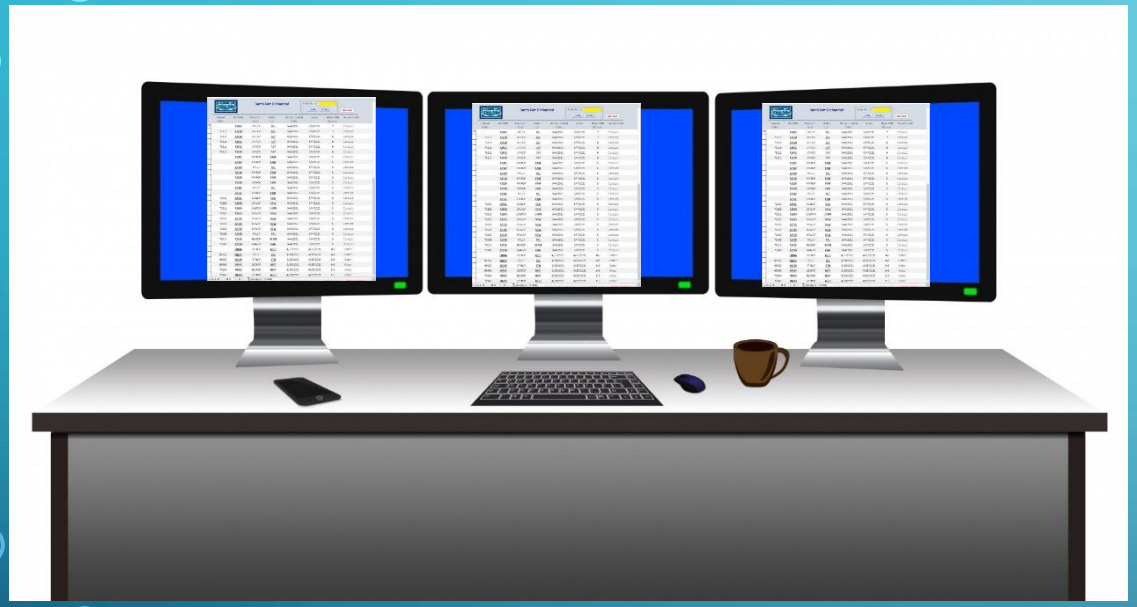
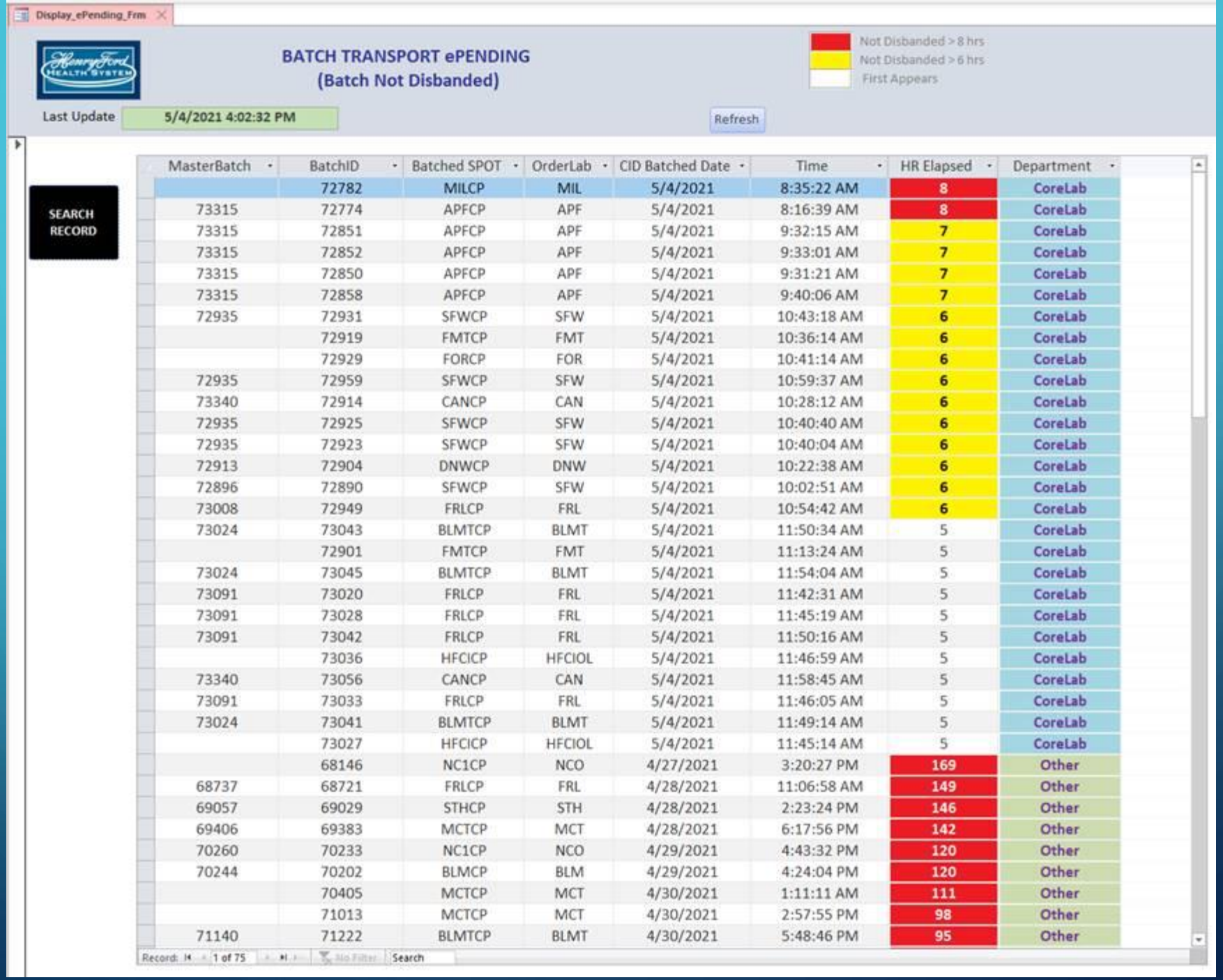


Investigation and Control

Alert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BATCH TRANSPORT ePENDING
(Batch Not Disbanded)
Not Disbanded > 8 hrs
Not Disbanded > 6 hrs
First Appears
Last Update
5/4/2021 4:02:32 PM
Refresh
SEARCH RECORD
MasterBatch
BatchID
Batched SPOT
OrderLab
CID Batched Date
Time
HR Elapsed
Department
72782 MILCP MIL 5/4/2021 8:35:22 AM 8 CoreLab
73315 72774 APFCP APF 5/4/2021 8:16:39 AM 8 CoreLab
73315 72851 APFCP APF 5/4/2021 9:32:15 AM 7 CoreLab
73315 72852 APFCP APF 5/4/2021 9:33:01 AM 7 CoreLab
73315 72850 APFCP APF 5/4/2021 9:31:21 AM 7 CoreLab
73315 72858 APFCP APF 5/4/2021 9:40:06 AM 7 CoreLab
72935 72931 SFWCP SFW 5/4/2021 10:43:18 AM 6 CoreLab
72919 FMTCP FMT 5/4/2021 10:36:14 AM 6 CoreLab
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72935 72925 SFWCP SFW 5/4/2021 10:40:40 AM 6 CoreLab
72935 72923 SFWCP SFW 5/4/2021 10:40:04 AM 6 CoreLab
72913 72904 DNWCP DNW 5/4/2021 10:22:38 AM 6 CoreLab
72896 72890 SFWCP SFW 5/4/2021 10:02:51 AM 6 CoreLab
73008 72949 FRLCP FRL 5/4/2021 10:54:42 AM 6 CoreLab
73024 73043 BLMTCP BLMT 5/4/2021 11:50:34 AM 5 CoreLab
72901 FMTCP FMT 5/4/2021 11:13:24 AM 5 CoreLab
73024 73045 BLMTCP BLMT 5/4/2021 11:54:04 AM 5 CoreLab
73091 73020 FRLCP FRL 5/4/2021 11:42:31 AM 5 CoreLab
73091 73028 FRLCP FRL 5/4/2021 11:45:19 AM 5 CoreLab
73091 73042 FRLCP FRL 5/4/2021 11:50:16 AM 5 CoreLab
73036 HFCICP HFCIOL 5/4/2021 11:46:59 AM 5 CoreLab
73340 73056 CANCP CAN 5/4/2021 11:58:45 AM 5 CoreLab
73091 73033 FRLCP FRL 5/4/2021 11:46:05 AM 5 CoreLab
73024 73041 BLMTCP BLMT 5/4/2021 11:49:14 AM 5 CoreLab
73027 HFCICP HFCIOL 5/4/2021 11:45:14 AM 5 CoreLab
68146 NC1CP NCO 4/27/2021 3:20:27 PM 169 Other
68737 68721 FRLCP FRL 4/28/2021 11:06:58 AM 149 Other
69057 69029 STHCP STH 4/28/2021 2:23:24 PM 146 Other
69406 69383 MCTCP MCT 4/28/2021 6:17:56 PM 142 Other
70260 70233 NC1CP NCO 4/29/2021 4:43:32 PM 120 Other
70244 70202 BLMCP BLM 4/29/2021 4:24:04 PM 120 Other
70405 MCTCP MCT 4/30/2021 1:11:11 AM 111 Other
71013 MCTCP MCT 4/30/2021 2:57:55 PM 98 Other
71140 71222 BLMTCP BLMT 4/30/2021 5:48:46 PM 95 Other
Record: 1 of 75
No Filter
Search

Henry Ford Health System

Batch Not Disbanded

Enter Batch

Find | Reset | Go Back

Parent Batch	BatchID	Created Spot	Order Lab	Batch Created Date	Time	MaxOfHR Elapsed	Department
	72782	MILCP	MIL	5/4/2021	5/4/2021	7	CoreLab
73315	72774	APFCP	APF	5/4/2021	5/4/2021	7	CoreLab
73315	72850	APFCP	APF	5/4/2021	5/4/2021	6	CoreLab
73315	72851	APFCP	APF	5/4/2021	5/4/2021	6	CoreLab
73315	72852	APFCP	APF	5/4/2021	5/4/2021	6	CoreLab
73315	72858	APFCP	APF	5/4/2021	5/4/2021	6	CoreLab
	72901	FMTCP	FMT	5/4/2021	5/4/2021	5	CoreLab
	72902	FMTCP	FMT	5/4/2021	5/4/2021	5	CoreLab
	72909	MILCP	MIL	5/4/2021	5/4/2021	5	CoreLab
	72919	FMTCP	FMT	5/4/2021	5/4/2021	5	CoreLab
	72928	FMTCP	FMT	5/4/2021	5/4/2021	5	CoreLab
	72929	FORCP	FOR	5/4/2021	5/4/2021	5	CoreLab
	72947	MILCP	MIL	5/4/2021	5/4/2021	5	CoreLab
	72951	FMTCP	FMT	5/4/2021	5/4/2021	5	CoreLab
72837	72831	CCNCP	CCN	5/4/2021	5/4/2021	5	CoreLab
72896	72890	SFWCP	SFW	5/4/2021	5/4/2021	5	CoreLab
72913	72904	DNWCP	DNW	5/4/2021	5/4/2021	5	CoreLab
72935	72923	SFWCP	SFW	5/4/2021	5/4/2021	5	CoreLab
72935	72925	SFWCP	SFW	5/4/2021	5/4/2021	5	CoreLab
72935	72931	SFWCP	SFW	5/4/2021	5/4/2021	5	CoreLab
72935	72959	SFWCP	SFW	5/4/2021	5/4/2021	5	CoreLab
73008	72949	FRLCP	FRL	5/4/2021	5/4/2021	5	CoreLab
73014	72915	BLMCP	BLM1	5/4/2021	5/4/2021	5	CoreLab
73340	72914	CANCP	CAN	5/4/2021	5/4/2021	5	CoreLab
	68146	NC1CP	NCO	4/27/2021	4/27/2021	168	Other
68737	68721	FRLCP	FRL	4/28/2021	4/28/2021	148	Other
69057	69029	STHCP	STH	4/28/2021	4/28/2021	145	Other
69406	69383	MCTCP	MCT	4/28/2021	4/28/2021	141	Other
70244	70202	BLMCP	BLM	4/29/2021	4/29/2021	119	Other
70260	70233	NC1CP	NCO	4/29/2021	4/29/2021	119	Other

Record: 1 of 65 | Unfiltered | Search

CID NOT YET DISBANDED

Enter CID | Find | Reset | Go Back

Parent Batch	Batch ID	Acc Number	Collect Date	CID	BatTst Code	Lab Dept	Container Status	Batched DateTime	SPOT Code	Order Lab	HR Elapsed
	72782	T437428	5/4/2021	L34	A1C	C	ASSIGNED	5/4/2021 8:35:22 AM	MILCP	MIL	7
	72782	T437906	5/4/2021	L34	A1C	C	ASSIGNED	5/4/2021 8:35:22 AM	MILCP	MIL	7
	72782	T439212	5/4/2021	L34	A1C	C	ASSIGNED	5/4/2021 9:26:08 AM	MILCP	MIL	6
	72782	T439869	5/4/2021	L34	A1C	C	ASSIGNED	5/4/2021 9:53:53 AM	MILCP	MIL	6
	72782	T440737	5/4/2021	L34	A1C	C	ASSIGNED	5/4/2021 10:26:50 AM	MILCP	MIL	5
	72782	T441549	5/4/2021	L34	A1C	C	ASSIGNED	5/4/2021 10:57:10 AM	MILCP	MIL	5
	72782	T441549	5/4/2021	L34	DRTSH	CS	ASSIGNED	5/4/2021 10:57:10 AM	MILCP	MIL	5
	72782	T441549	5/4/2021	L34	FT4	CS	ASSIGNED	5/4/2021 10:57:10 AM	MILCP	MIL	5
	72782	T437428	5/4/2021	L34	LDLC	C	ASSIGNED	5/4/2021 8:35:22 AM	MILCP	MIL	7
	72782	T437428	5/4/2021	L34	LIPOP	C	ASSIGNED	5/4/2021 8:35:22 AM	MILCP	MIL	7
	72782	T437906	5/4/2021	L34	LIPOP	C	ASSIGNED	5/4/2021 8:35:22 AM	MILCP	MIL	7
	72782	T439212	5/4/2021	L34	LIPOP	C	ASSIGNED	5/4/2021 9:26:08 AM	MILCP	MIL	6
	72782	T439869	5/4/2021	L34	LIPOP	C	ASSIGNED	5/4/2021 9:53:53 AM	MILCP	MIL	6
	72782	T440737	5/4/2021	L34	LIPOP	C	ASSIGNED	5/4/2021 10:26:50 AM	MILCP	MIL	5
	72782	T441549	5/4/2021	L34	LIPOP	C	ASSIGNED	5/4/2021 10:57:10 AM	MILCP	MIL	5
	72782	T437906	5/4/2021	L34	LYT7	C	ASSIGNED	5/4/2021 8:35:22 AM	MILCP	MIL	7
	72782	T440737	5/4/2021	L34	LYT7	C	ASSIGNED	5/4/2021 10:26:50 AM	MILCP	MIL	5
	72782	T437906	5/4/2021	L34	PSAS	CS	ASSIGNED	5/4/2021 8:35:22 AM	MILCP	MIL	7
	72782	T439869	5/4/2021	L34	PSAS	CS	ASSIGNED	5/4/2021 9:53:53 AM	MILCP	MIL	6
	72782	T439869	5/4/2021	L34	SGOT	C	ASSIGNED	5/4/2021 9:53:53 AM	MILCP	MIL	6
	72782	T440737	5/4/2021	L34	SGOT	C	ASSIGNED	5/4/2021 10:26:50 AM	MILCP	MIL	5
	72782	T439869	5/4/2021	L34	SGPT	C	ASSIGNED	5/4/2021 9:53:53 AM	MILCP	MIL	6
	72782	T440737	5/4/2021	L34	SGPT	C	ASSIGNED	5/4/2021 10:26:50 AM	MILCP	MIL	5
	72782	T441549	5/4/2021	L34	HCAB	IS	ASSIGNED	5/4/2021 10:57:10 AM	MILCP	MIL	5

CID Details

Go Back

Parent Batch	Batch ID	Acc Number	Collect Date	CID	BatTst Code	Lab Dept	Container Status	Batched DateTime	SPOT Code	Order Lab	HR Elapsed
	72782	T44	4/2021	L3	DRTSH	CS	ASSIGNED	5/4/2021 10:57:10 AM	MILCP	MIL	6
	72782	T44	4/2021	L3	FT4	CS	ASSIGNED	5/4/2021 10:57:10 AM	MILCP	MIL	6
	72782	T44	4/2021	L3	HCAB	IS	ASSIGNED	5/4/2021 10:57:10 AM	MILCP	MIL	6

DESCRIBE THE IMPACT OF THE LABTRACKS PROGRAM

- Forced us to develop standard practices across all sending sites
  - This alone has a positive impact on the reliability of sample movement
- Re-design receiving lab process
  - Core lab and central receipt vs. Back end labs with longer life cycles or slower receipt processes
- Accountability
  - Lab staff
  - Couriers
- Rework with our courier
- Early detection of missing or delayed samples
- Anticipation of important samples and tracking their imminent arrival

COMPUTATIONAL PATHOLOGY

COMPUTATIONAL BIOLOGY-WIKIPEDIA

- Computational biology, which includes many aspects of bioinformatics, is the science of using biological data to develop algorithms or models in order to understand biological systems and relationships
- Computational biology, bioinformatics and mathematical biology are all interdisciplinary approaches to the life sciences that draw from quantitative disciplines such as mathematics and information science
- The NIH describes computational/mathematical biology as the use of computational/mathematical approaches to address theoretical and experimental questions in biology
- By contrast, bioinformatics as the application of information science to understand complex life-sciences data

Editorial

Computational Pathology

An Emerging Definition

David N. Louis, MD; Georg K. Gerber, MD, PhD; Jason M. Baron, MD; Lyn Bry, MD, PhD; Anand S. Dighe, MD, PhD; Gad Getz, PhD; John M. Higgins, MD; Frank C. Kuo, MD, PhD; William J. Lane, MD, PhD; James S. Michaelson, PhD; Long P. Le, MD, PhD; Craig H. Mermel, MD, PhD; John R. Gilbertson, MD; Jeffrey A. Golden, MD

Arch Pathol Lab Med—Vol 138, September 2014

Computational Pathology:

A Path Ahead

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Laboratory Investigation (2021) 101:412–422
https://doi.org/10.1038/s41374-020-00514-0

REVIEW ARTICLE

Artificial intelligence and computational pathology

Miao Cui[1] · David Y. Zhang[2]

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Abstract

Data processing and learning has become a spearhead for the advancement of medicine, with pathology and laboratory medicine has no exception. The incorporation of scientific research through clinical informatics, including genomics, proteomics, bioinformatics, and biostatistics, into clinical practice unlocks innovative approaches for patient care. Computational pathology is burgeoning subspecialty in pathology that promises a better-integrated solution to whole-slide images, multi-omics data, and clinical informatics. However, computational pathology faces several challenges, including the ability to integrate raw data from different sources, limitation of hardware processing capacity, and a lack of specific training programs, as well as issues on ethics and larger societal acceptable practices that are still solidifying. The establishment of the entire industry of computational pathology requires far-reaching changes of the three essential elements connecting patients and doctors: the local laboratory, the scan center, and the central cloud hub/portal for data processing and retrieval. Computational pathology, unlocked through information integration and advanced digital communication networks, has the potential to improve clinical workflow efficiency, diagnostic quality, and ultimately create personalized diagnosis and treatment plans for patients. This review describes clinical perspectives and discusses the statistical methods, clinical applications, potential obstacles, and future directions of computational pathology.

DEFINITION: COMPUTATIONAL PATHOLOGY

An approach to diagnosis that incorporates multiple sources of raw data (eg, clinical electronic medical records, laboratory data including "-omics," and imaging [both radiology and pathology imaging]); extracts biologically and clinically relevant information from these data; uses mathematic models at the molecular, individual, and population levels to generate diagnostic inferences and predictions; and presents this clinically actionable knowledge to customers through dynamic and integrated reports and interfaces, enabling physicians, patients, laboratory personnel, and other health care system stakeholders to make the best possible medical decisions.

Computational Pathology: A Path Ahead. Louis DN, et al. Arch Pathol Lab Med. 2016 Jan;140(1):41-50.

WHAT IS COMPUTATIONAL PATHOLOGY?

- Using artificial intelligence and mathematical models to arrive at pathologic diagnosis and interpretations
  - Can be applied to AP, CP, Molecular Pathology etc
- Computational pathology is enabled by pathology informatics
  - How do computation algorithms get applied to patient cases?
- Don't we do this already?
  - Molecular pathology
  - Microbiology
  - Hematology
  - Cytogenetics?

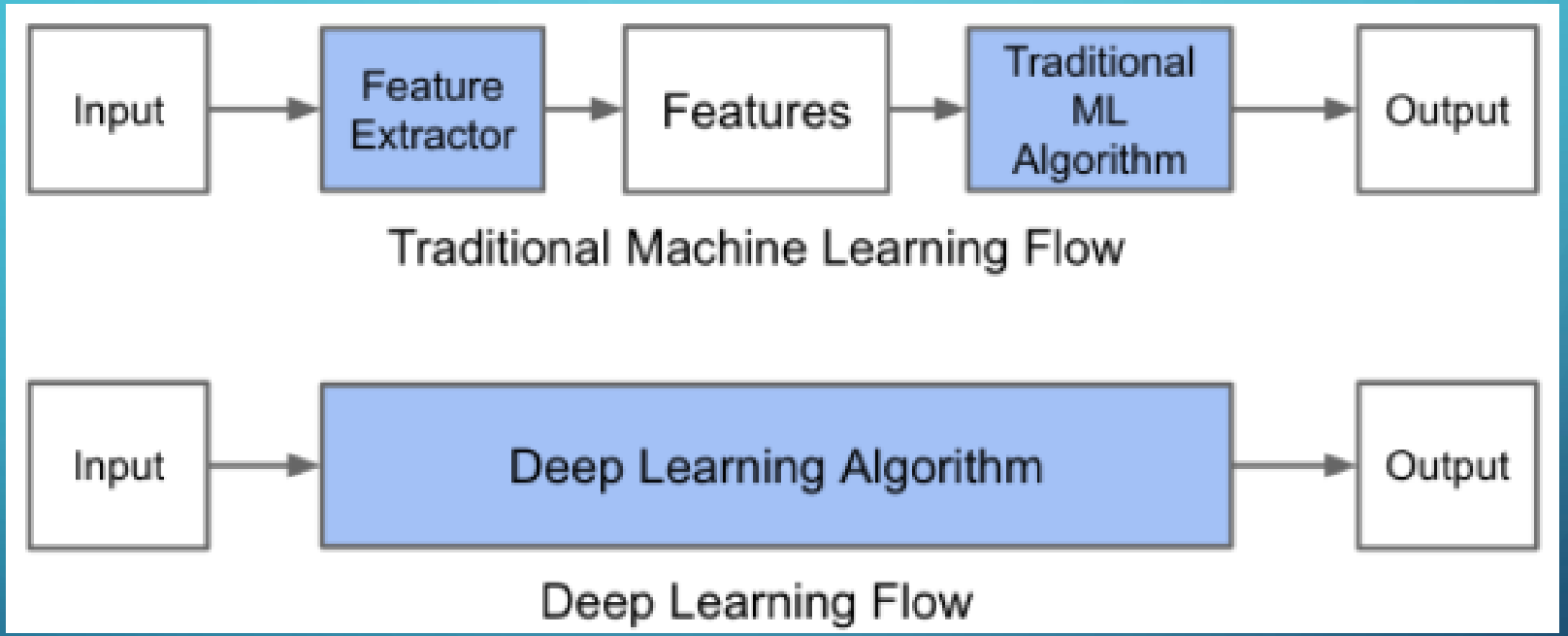
WHAT IS COMPUTATIONAL PATHOLOGY?

- Much of the focus on what is referred to as computational pathology is focused on image analysis
  - Quantitative analysis
    - Counts and measures
  - Qualitative
    - Feature abstraction
- Don't forget CP
  - MAAAs assays

BRIEF OVERVIEW OF ARTIFICIAL INTELLIGENCE

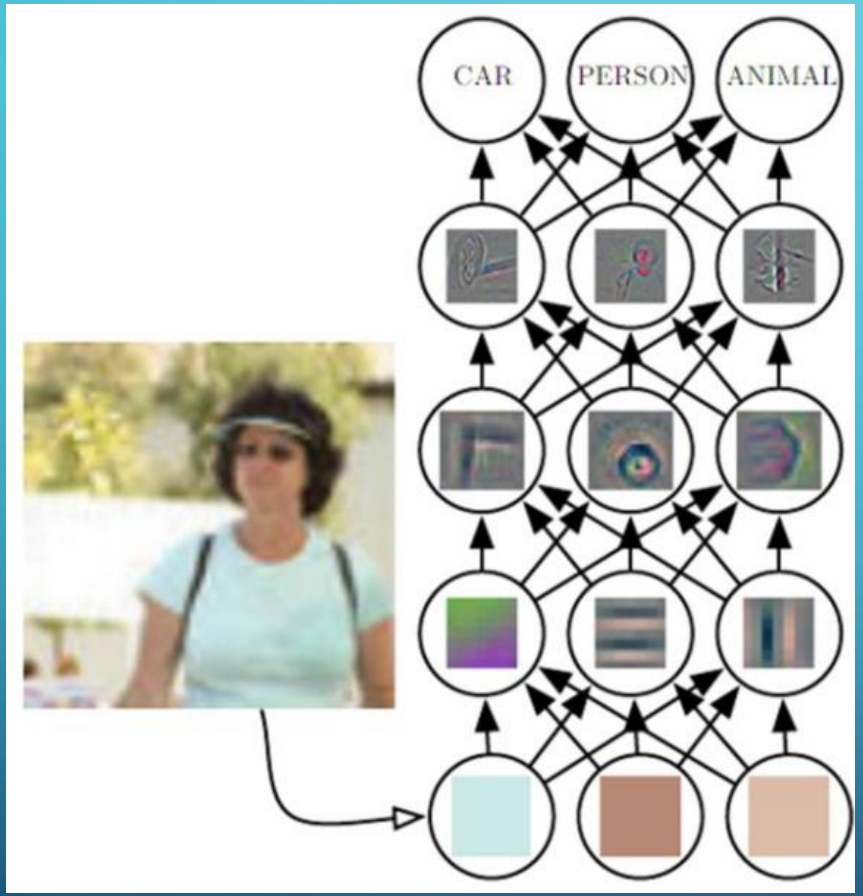
- Artificial Intelligence is an over arching subject that includes
  - Machine Learning: allows computers to make predictions from data without being explicitly programmed
    - Depends on training
  - Deep Learning
    - Depends less on training, and can learn independently
    - Computationally intense; only recently possible
    - Application of concepts like neural networks

MACHINE LEARNING *V.* DEEP LEARNING



http://adilmoujahid.com/posts/2016/06/introduction-deep-learning-python-caffe/

A DEEP LEARNING MODEL EXAMPLE



Output
(object identity)

3rd hidden layer
(object parts)

2nd hidden layer
(corners and contours)

1st hidden layer
(edges)

Visible layer
(input pixels)

Goodfellow et al., Deep Learning. 2016

APPLYING COMPUTATION TO ANATOMIC PATHOLOGY

- Artificial intelligence and Deep Learning for Computational Pathology
- Detection, classification and segmentation of tissue structures (cells, glands etc.)
- Detection and discovery of predictive and prognostic tissue biomarkers
- Whole-slide image analysis
- Registration of whole-slide images
- Stain normalization/standardization
- Immunohistochemistry scoring
- Multiplexed staining
- Unlabeled multiplexing
- Crowdsourcing for ground truth collection and machine learning applications
- Applications of computational pathology in the clinic

https://www.embs.org/jbhi/computational-pathology/

IN SUMMARY

MAKING INFORMATICS OPERATIONAL THE SECRET SAUCE

- Develop a clear vision and mission
- Commit resources
- Develop people
- Develop strategic relationships
- Have a plan and stick to it!

SUMMARY

- Operational Informatics provide the substance and substrate for advanced activities?
- Digital Pathology and Image Analysis are game changing for the practice of pathology
- Business Analytics drives and justifies laboratory activities and support the healthcare enterprise
- Computational Pathology will drive innovation and new knowledge at a pace never seen before

WHERE DOES THIS LEAVE US?

- Perplexed?
- Unprepared?
- Energized!
- Engaged
- The Future

- On the threshold of a new world
- Determine the path forward
- There's so much to do
- Lab has never been more impactful!
- Can we imagine?

PATHOLOGY INFORMATICS IN 2022: THE FUTURE IS NOW!

Questions and Discussion?

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