A Roadmap of the Evolution of the Digital Pathology Department

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Massachusetts General Hospital

- Founded in 1811 – by Dr John Warren
- Largest teaching hospital of Harvard Medical School
  - (900 acute care beds)
  - (1.6 million visits)
  - (38,000 operations)
- Largest hospital-based research program in the country ($500,000,000)
- Home of the New England Journal of Medicine
- In 1994 the Massachusetts General Hospital partnered with the second largest Harvard Medical School Hospital to form the Partners Health Care System
The Massachusetts General Hospital
The Massachusetts General Hospital
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The Massachusetts General Hospital
Background

- Massachusetts General Hospital
- Partners Healthcare
- Harvard
- Case Western Reserve University
- University of Pittsburgh and UPMC
Today’s Talk

• Imaging (and automated histology)
• Data Systems (LIS…)
• Structured Data
• Enterprise Systems
• Outcomes and Quality
• Informatics Training
• Comments

Some of the components of a digital department
Today’s Talk

- The most important part of the Roadmap, is the development of pathologists willing to accept, use and challenge the new technologies.
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Slide Imaging

• If we can Image all slides

• The potential to apply computational power and network connectivity to biologic morphology and the full practice of pathology

• See morphology with different eyes

• Putting pathologist on the right side of Moore’s law

• Multiple applications
Slide Imaging

- We have a full time PhD focused of slide imaging – COI
- Have a research lab – multiple devices and post docs
- Have clinical facilities in the main histology lab and “in” the slide room
Imaging Begins in Histology

Removal and fixation of tissue → Paraffin embedding → Slicing and Adhesion → Heating and dry → Staining → Diagnostic imaging

- Imaging Begins in Histology

- Removal and fixation of tissue
- Paraffin embedding
- Slicing and Adhesion
- Heating and dry
- Staining
- Diagnostic imaging

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Imaging & Histology

- Image Quality is a function of slide quality (thickness…) and staining
- Imaging decisions need to be embedded in histology orders
- Imaging parameters are like stains (sampling, spectrum, etc)
- Bar coding and specimen tracking is key – the right slide imaged for the right reason at the right time.
- Images “semi-linked” to the LIS (John Sinard, Yale)
- Need for imaging technicians and pathologist – technician communication
Imaging & Histology

- Speed Matters
  - In image capture
    - Great activity here
  - In Histology (continuous flow)
    - Great activity here
  - On the pathologists desk
    - Network
    - Hardware (RAM)
    - Application
      - Great activity here
Virtual Slide Box and LIS Integration

- Very important if one is dealing with many images
- Imaging and LIS need to communicate at capture time (through Bar Codes and/or interface)
- Slides need to be presented rationally – by case, part and block
- Specimen descriptions and processing details are needed to interpret a WSI
Patient Name: Madison, Dolley
Accession #: S01-00104

Accession Date: 10/19/2000
Procedure Date: 10/18/2000
DOB: 6/19/1948
MRN: 999820372
Signout Date: Not Signed Out
Sex: Female
Attending MD: Walter Brown, DR

PATIENT HISTORY:
Polyps

GROSS DESCRIPTION:
1. Esophagogastric Junction, Biopsy: A formalin container is received labeled with the name "D. Madison" and "bx E-G Junction". It contains three 0.1 cm. diameter items of tan soft tissue that are submitted in toto as #1.

2. Stomach, Not otherwise specified, Biopsy: A formalin container is received labeled with the name "D. Madison" and "gastric bx". It contains a 0.1 cm. diameter item of tan soft tissue that is submitted in toto as #2.

3. Colon, Sigmoid, Polypectomy: A formalin container is received labeled with the name "D. Madison" and "sigmoid colon polypl". It contains multiple fragments of tan soft tissue that in aggregate are 0.4 cm. in diameter. They are submitted in toto as #3.

*Patient Demographic* *Patient History* *Gross Description*
Patient Name: Dolley Madison
Accession #: S01-00104
Viewing Slide #: 1.1.1.1
Flag Case
Patient Name: Dolley Madison

Accession #: S01-00104

Viewing Slide #: 1.1.1.1
Can your LIS support WSI?

- Does it identify slides uniquely
- Are pathologist’s descriptions (gross descriptions, block labels) available at the specimen or slide level?
- Is your part type dictionary clear and useful?
- Is the staining and processing dictionaries clear and unambiguous?
The Pathologist Desktop

• There is an entire industry around radiology reading rooms

• An ideal pathology system would look a lot like a radiology workstation: A large, high resolution monitor of for the entire slide, a smaller high resolution monitor for the slide box, another for the detailed examination of the WSI, and a separate monitor for LIS data
Slide organization, specimen description and processing data needed to interpret the image
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Departmental Data Systems

- Laboratory Information Systems
- AP CP Integration
  - Needed for Molecular Pathology – the hemepath model
  - Needed for Integrity
  - This has been a holy grail for … ever
Departmental Data Systems

- Laboratory Information Systems
- AP CP Integration
- Modularity (Middleware)
  - Imaging
  - Structured Data
  - Tissue Tracking...
  - No one product does everything well
Departmental Data Systems

- Laboratory Information Systems
- AP CP Integration
- Modularity (Middleware)
- Warehouse
  - To many reports
  - What if
  - Integration
    - AP / CP / Research
    - MGH / BWH
Departmental Data Systems

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Structured Data

• In a digital world, non-standard narrative text kills us. Increasingly, more and more of our data is reconfigured by our users

• Multiple Specimen / Finding in one data field issue

• Narrative Text - pathologists as poets ;-) 

• Autocoding (Copath, SPIN, TIES, etc) and Human Coders (Billing, Compliance, Quality)

• Practices have had varied levels of success with structured data

• MGH is hiring a P)hD “curator” to manage a structured data program
Structured Data

• Increasingly, we are ‘reconfiguring” our own data for our own uses …
  – Outcomes base residency management
Today’s Talk

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- Structured Data
- **Enterprise Systems**
- Outcomes and Quality
- Informatics Training
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Enterprise Systems

The Enterprise Advances - Health Systems and the rise of the CIO

• The Federated Model is a very good one, but…

• In my world, the Enterprise is Big, the Department is Small – The Enterprise controls IT vision and funding.

• Specimens appear in the lab → Pathology generate a report → Report sent through HL7 v2.x interfaces to the E.H.R Infrastructure – Including clinical systems (CAS) and research / De-ID systems (RPDR)

• New Infrastructure BETR: Enterprise Inventory of Specimens – Specimen Data sent to RBDR through Z-Segments – EMSI.

• Genetic Sequencing is done at the Enterprise Level
Enterprise Systems

The Enterprise Advances - Health Systems and the rise of the CIO

There are options:

• Hide in the Department
• Actively Get Involved.

We have actively merged Pathology Informatics Operations with Enterprise Operations
• My People
• My Time

We believe that this puts us in the best position to image pathology’s digital future
Enterprise Systems

Pathology “Supports the Enterprise..”

There two fronts:
• The last 100 feet and generation of data
• There is more than one enterprise
• Pathology is complicated and Important

The last 100 feet: Tissue Initiative Examples
• Crimson (Dr. Bry)
• Z-Segment
• EMSI
• SPIN
• (Structured Data), (Outcomes), (Imaging)
Enterprise Systems

Pathology “supports the enterprise”…

There two fronts:
• The last 100 feet and generation of data
• There is more than one enterprise
• Pathology is complicated and Important

More than one enterprise:
• Harvard (CTSA)
• Unifying Pathology Information Model (within and without the Enterprise)
Enterprise Systems

Pathology “Counter Attacks”…

Using the Enterprise Infrastructure…

• A well designed enterprise infrastructure (EMPI, E.H.R, POE, etc) allows pathology to the entire “Total Testing Cycle” (not just the analytic component)
  – Pre-analytic (POE, Lab Catalog) Dr Dighe
  – Post analytic (CP consultation)

• “Pathology View” of the E.H.R – Getting data back from the E.H.R in a way we can use
  – Radiology and Pre-op notes in the grossing room tied to the accession

• Rationalization of send out testing - Mayo
Enterprise Systems

• The opportunities in “digital pathology” exist in the enterprise (as well as in the department)

• I spend most of my time in the enterprise (and with our vendors) → not in the department
Pathology Informatics Training

- Imaging (and automated histology)
- Data Systems (LIS…)
- Structured Data
- Enterprise Systems
- **Outcomes and Quality**
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Outcomes and Quality

- **Quality**: Increasingly important issue – legally, financially, operationally
- It is very much an informatics issue
  - Collecting, standardizing, Managing Data
  - Standardizing and Tracking Specimens
  - Automated Labs, Standard Bar Code Tracking and Structured Data
  - Department wide vision….
Outcomes and Quality

- **Outcomes**: Increasingly important issue – legally, financially, operationally
- It is very much an informatics issue
  - Collecting, standardizing, Managing Data
- Structured Data
- **Outcomes (Vital Status)** – Pathology / Cancer Outcome Group (SSN, CDC, Death Certificates, etc…)
- Autopsy
- Patients Like Me Dot Com
Pathology Informatics Training

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Pathology Informatics Training

- Residency training is fairly weak – are we teaching what pathologists need to know
  - process engineering vrs PC repair?
  - Budgets

- Are there enough pathology informatics fellowships to support a digital future?

- Are we training (or recruiting) the technical infrastructure?
Pathology Informatics Training

• At Harvard, the **pathology imaging and informatics fellowship** is:
  – 2 fellows funded
  – Included PhD fellows (Post docs)
  – Includes Engineers
  – Resident rotations (optional)
  – Partners wide

• **Pathology imaging and informatics fellowship**
  – Based at MGH, BWH and NSMC
  – ~10 Active Faculty
  – All areas of informatics
Pathology Informatics Training

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• Not Enough
  – The safe house
  – Other models
Comments

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Comments

• A Roadmap for a Digital Pathology Department

  – Our technology, the requirements of modern medicine and society itself require that pathology change

  – There will be digital pathology departments, the question is what will they look like, when will they happen and how much of it will pathology control. In other words, how well will pathology be able to leverage digital technology to improve pathology practice

  – Our plan, fundamentally, is to get appropriate tools and resources available, a corps of pathologists to help develop and manage them, and pathologists willing to champion and use them