Overview of Changes in Histology
Techniques, Tools, & Workflow

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Disruptive Technologies in Histology & Digital Pathology

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• Theresa Ford
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• Marco Bellini
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Conflicts

- I have no personal financial relationship with any company*
- However, I am Associated Chief of Pathology and Director of Pathology Informatics in a Department that does significant research and co-development with industry
- The Laboratory for Pathology Imaging Research and The Laboratory for Pathology Operations Research
- All are disclosed and compliant with Partners and Harvard ethics rules
- Names that we work with and I might mention today include Kurabo, Sony, Olympus, NEC, 3D Histech, Corista, Barco, Bioimagene, Philips, Hamamatsu and Sunquest*

*M see next slide

MGH & Sunquest

- On August 24, 2009 the Massachusetts General Hospital, Partners Healthcare System and Sunquest Information Systems Corporation signed a ten year collaboration agreement to co-create modules of a next generation AP LIS as part of an modular AP CP LIS to be marketed and commercialized by Sunquest
- As part of this agreement, both MGH and Sunquest are committing resources to the co-development. MGH will receive a royalty stream back from Sunquest. The size of which will depending on the commercial success of each module and the amount of MGH resources used in its creation
- I am Sunquest advisory boards (unpaid)
• I am a pathologist

• The stained slide is the best, most powerful way medicine has to interrogate the nature of disease in tissue
Histopathology

How histology labs will save the world
This is not an implemented system!

Histology and imaging are one…

- Imaging begins in Histology
- WSI digitizes it
- WSI is one of many AH robots
Whole Slide Imaging

- If we could digitize all of our slides, rapidly, easily and at high resolution, then we could apply computational power and network connectivity – the drivers of efficiency, communication and discovery in the modern world - to the study of morphologic biology and practice of anatomic pathology.

We took the Slide (histology) for granted: Skill and Variance
Things that were never a problem for the human hand and pathologist’s eye were problems for the robotic actuator and the digital camera.
We found that some of the most important problems/failures of WSI devices (tissue finding, focusing, etc), had root causes in histology.
WSI developers spend a lot of effort compensating for upstream variations (technical problems in slides). Upstream variation caused trouble in Slide Handling, Tissue Finding and Focus which limited Capture Speed, Image Quality and Device Throughput.

- A robot for every step – could we minimize the variance at the source?
- Better slides → better images with less effort…

Better, faster, cheaper imagers?
High slide quality, low variance
• Better images → Better Slides
• Quantitative QA

Bautista PA, Yagi Y
Detection of tissue folds in whole slide images.
Workflow and Dataflow Infrastructure (LIS)

- Lower Variance, Quantitative QA
- Better slides → Images
- Faster image capture speed

- Lower variances – faster focus
- Lower variance – fewer failures
  (unacceptable focus, tissue finding or mechanical failure)

Throughput

Continuous Flow

John Gilbertson: Thursday, April 29, 2010
Executive War College, New Orleans LA
2400 Slides / Day

Batch Mode
(then image)

3 Devices
1 Minute / Slide / Device

Cases are collected
the day before

John Gilbertson: Thursday, April 29, 2010
Executive War College, New Orleans LA

2400 slides / day

Histology
3 Lines
1 Slide / Minute / Line

WSI
3 Devices
1 Slide / Minute / Device

~ 13 hours
~ 1 Additional Minute

Cases are collected
and entered in the process

John Gilbertson: Thursday, April 29, 2010
Executive War College, New Orleans LA
Pathology on the right side of Moore’s Law…
Conclusions

• For most people histology is about getting slides to pathologists and automated histology is about containing or decreasing cost

• But there is more, it as also an area through which we can change the dynamic of the field (pathology)
Conclusions

- Without digitization, what pathology can do will be limited by our ability to physically manipulate and distribute slides and the time (and eyes) of our pathologist
- Molecular Medicine
- Personalized Medicine
- Baby Boomers
- Global Opportunities

What if the rest of the medicine is taking advantage of growing computational power and network connectivity and pathology isn’t?

… It will not end well
Conclusions

- Imaging is part of histology
- Better Slides → Better digitization
- Ubiquitous digital slides
- A new dynamic in pathology

More

- Surgery ← Collection ← Transport ← Accessioning
- Archive → Research
• The goal this morning was to connect automated histology to digital pathology

• To give a prediction of how histopathology might look in 5 – 10 years

• We are thinking about this…

• We are stable, strong…
• We are not “agile”
• We are worried about disruptive technologies…

Will we be displaced?

Will we have the cycles to take advantage?
- We are stable, strong...
- We are not “agile”
- We are worried about disruptive technologies...

Will we be displaced?

Will we have the cycles to take advantage?

Workflow and Dataflow Infrastructure (LIS)

Surgery ← Collection ← Transport ← Accessioning

Archive → Research
Specially Clinics

Clinic

Order Entry & Collection

Express Accession

Robotic Grossing

Automated Histology

Color
Number
Shape
Size

Camera Documentation

50%

MGH Laboratory for Pathology Operations

Workflow and Dataflow Infrastructure (LIS)

This is not “real”

We have an R&D facility that examines the technology, but this is not in our clinical lab

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