We receive any tissue or fluid sample (from an FNA to a whole patient) and use any method (from gross visualization to DNA sequencing) to either make a diagnosis or provide a clinician with diagnostically or prognostically relevant information.
Tests per year (at CUMC):

| Total: | 4,900,000 |

“Anatomic pathology”:
- Autopsy: 270
- Surgical pathology: 59,000
- Cytopathology: 60,000

Tests per year (at CUMC):

| Total: | 4,900,000 |

“Laboratory medicine”:
- Microbiology
- Molec. Diagnosis
- Coagulation
- Cytogenetics
- Hematology
- Immunogenetics
- Clinical chemistry
- Transfusion medicine
- Toxicology
- Immunology
- Flow cytometry
- Informatics
Anatomic Pathology vs. Lab Medicine

Morphology:
gross, light microscopy, special stains, immunofluorescence, EM

Quantitative and qualitative Analytical methods

Anatomic Pathology vs. Lab Medicine

Hematopathology:
Diagnosis of APL
Clinical history
CBC and smear
Bone marrow aspirate
Cytochemistry and IHC
Bone marrow core biopsy
Molecular Dx: PCR for t15-17
Cytogenetics: FISH for t15-17
Flow cytometry
Border skirmishes:
Dermatopathology
Bone marrow aspirates
Oral pathology
Genetic testing
Microbiology
Muscle and nerve biopsies
Tissue typing

What pathologists do:
(research)

Develop molecular, mechanistic understanding of how the pathogenesis of a disease leads to morphological changes and clinical consequences.

The goal is for this increased understanding to suggest new diagnostic approaches and new treatment regimens.
The cycle of laboratory testing

Idea
Order/Request
Collect
Transport
Receive
Accession
Analyze: prepare, perform, verify
Report
Assimilate
Control
Idea

What test?

Why?

Necessity?

Turn-around-time (TAT):
  Seconds (Glucose POCT)
  Minutes (STAT BMET)
  Hours (Routine ELISA)
  Days (Blood culture)
  Weeks (TB susceptibilities)

How good is it? Sensitivity/Specificity

Order/Request

Paper: formal requisition, prescription, FAX

Computerized physician order entry (CPOE)

Verbal: Phone call, yelling, etc.

Documentation:
  ordering physician
  ordering location, phone #, etc.
  signatures

Errors:
  wrong requisition
  wrong box checked
  requisition discarded
Collect

Phlebotomy:
  Venous
  Finger stick
  Arterial
  Central line
  Pediatric

Urine

CSF

Sputum, wound, oral, eye, etc.

Tissue: bone marrow, lung biopsy, etc.

Temperature: RT, 4°C, 37°C, frozen

Potential errors: mislabeling

The Washington Post

“Patient Dies From Blood Mismatch”
Friday, August 29, 2003

A woman who switched beds to be closer to the window died after she was given the wrong type of blood during surgery at Inova Fairfax Hospital. A technician had taken a blood sample from her roommate, hospital officials confirmed this week. The death came at the end of a chain of events that began when a technician went to the unidentified patient’s room to draw blood so the laboratory could determine her blood type for an operation the next day.
But the technician collected the sample from the patient on the wrong side of the curtain in the semiprivate room. The technician may have failed to perform two identification screens that were required: checking the name on the patient's plastic hospital bracelet and asking the patient to state her name aloud, said Russell Seneca, chairman of surgery at the hospital.

"The technician doesn't recall whether she asked the patient her name or not or whether she checked the armband," Seneca said. "I'm not certain what transpired between the technician and the patient whose blood was drawn."

The next day, surgeons performed a bowel resection on the woman, removing an abscess in her colon that perforated an intestinal wall.

The woman received two pints of the wrong blood during the operation, and toward the end, it became apparent that her blood was not clotting properly. In the recovery room, she plunged into an acute hemolytic transfusion reaction.

The medical team tried numerous treatments to reverse the reaction, but the woman died about 5:30 a.m. on July 24.
Potential errors: mislabeling

Saunders said an internal probe has prompted changes; a second person now accompanies a technician to draw blood for cross-matching and typing to guard against misidentification.

"This was a human error," Saunders said. "This individual who made the error failed to follow our procedures for identification."

The worker, who also was unidentified, was so distraught that she resigned, Saunders said. "Because of the grief ... we want to protect her privacy. We would prefer to just let you know this was an exemplary employee who never had a problem like this before."

Transport

Sneakers
Pneumatic tubes
Point-of-care (POC)
Taxi, van, courier, etc.
FedEx, DHL, etc.
Receive

Acknowledge receipt:
  Verbal
  Computer
  Pen
  Wand bar code

Read

Talk

Empty bench

Accession

Automated: bar code

Computerized

Pen and paper
Analyze: prepare, perform, verify

Visually inspect: hemolysis, lipemia, etc.
Chemical analysis: spectrophotometry, etc.
Immunoassays: ELISA, agglutination, flow cytometry, etc.
Microscopy: blood smear, gram stain, FISH, etc.
Culture: bacteria, fungi, viruses, fibroblasts
Molecular: Southern blots, PCR, sequencing, etc.

Controls: positive/negative, high/low
Quality assurance: within-run and between-run variation
Proficiency testing: NYS, CAP

Report

To whom?
Ordering MD
Primary care MD?
Consultants?
Floor?

Paper: mail, FAX, FedEx, etc.
Hospital/Laboratory Information System (HIS/LIS)
Email
Phone: critical values
Blackberry, etc.
Assimilate

When?
How use the information?
Is it correct? Does it fit?
Repeat for confirmation?
Alternative tests for confirmation?
Accession
Analyze: prepare, perform, verify
Report

Control:
*efficiency, timeliness, productivity, cost containment*

Idea: education
Order/Request: algorithms, repeat testing
Collect: who, time of collection, training
Transport: who, how, timing
Receive: timing
Accession: timing
Analyze (prepare, perform, verify): timing of each step
Report: timing
Assimilate: ??
Control:
efficiency, timeliness, productivity, cost containment

Collect: Phlebotomy Manager: Ms. Earlene Cook
Collect: Print labels

Collect: Print collection list
Collect: Draw patient

Collect: Wand in collect time
Transport: Walk to tube station

Transport: Send samples through pneumatic tube
Director of the Core Laboratory: Dr. Daniel Fink

Receive: Core Laboratory
Analyze: Core Laboratory; chemistry

Analyze: Core Laboratory; chemistry
Analyze: Core Laboratory; chemistry

Analyze: Core Laboratory; hematology
Analyze: Core Laboratory; hematology
Analyze: Core Laboratory; hematology

Analyze: Core Laboratory; hematology
Analyze: Core Laboratory; hematology

Report: Core Laboratory
Receive: STAT Laboratory

Accession: STAT Laboratory
Accession and analyze: STAT Laboratory

Analyze: STAT Laboratory
Analyze: STAT Laboratory

Director of Transfusion Medicine: Dr. Hal Kaplan
Dispense: Blood Bank

Dispense: Blood Bank
Dispense: Blood Bank

Therapy: Apheresis Unit
Director of Microbiology: Dr. Phyllis Della-Latta

Director of Molecular Microbiology: Dr. Fann Wu
Receive: Microbiology

Receive: Microbiology
Prepare: Microbiology

Analyze: Microbiology
Analyze: Microbiology
Analyze: Microbiology

Turn-around-time (TAT)

Idea
Order/Request
Collect
Transport
Receive
Accession
Analyze: prepare, perform, verify
Report
Assimilate
Control
Turn-around-time (TAT)

Laboratory

Idea

Order/Request

Collect

Transport

Receive (acknowledged)

Accession

Analyze: prepare, perform, verify

Report (on LIS)

Assimilate

Control

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Final Thoughts

1. Turn-around-time
2. Specimen labeling
3. Pathology = Truth
4. Lab Error
5. Call us