A Day in the Life of a Beaumont Laboratory Medical Laboratory Scientist

Updated: August, 2020

Module Purpose

To provide
School of Medical Laboratory Science
applicants and students an
in-depth view of the daily roles of
medical laboratory scientists
(aka medical technologists)
employed by the Beaumont Laboratory
Department of Clinical Pathology on the
Beaumont Hospital, Royal Oak campus.

Objectives

Upon reviewing this presentation, the MLS applicant and/or student will be able to:

1) Describe the daily responsibilities of a medical laboratory scientist in each major discipline.

2) Appreciate reflections about the career as shared by clinical instructors in the Beaumont School of Medical Laboratory Science.

3) Respond to questions related to this information at the admissions interview and program orientation.

INTRODUCTION

Beaumont - Royal Oak

Research Institute

Main Hospital

- Among the highest test volume hospital-based laboratories in the country, more than 10 million specialized and routine tests are performed annually.
- The various laboratories are located in the Research Institute building and the Main Hospital.
- Staff include: 12 M.D. pathologists, 5 bio-scientific Ph.D.'s, 200+ certified medical laboratory scientists, and approximately 100 phlebotomists, clerical and specimen processing assistants.

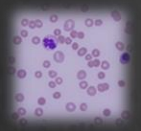
Clinical Pathology

- The clinical laboratory at Beaumont Hospital, Royal Oak is called Clinical Pathology.
- Laboratory professionals use sophisticated, biomedical instrumentation, technology, and computers - as well as various manual methods - to perform the thousands of currently available laboratory tests.
- Fact: 70-80 % of patient care decisions are based on the results of laboratory testing.

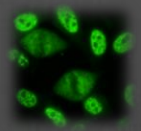
Clinical Pathology Laboratories include:

Blood Bank

Chemistry

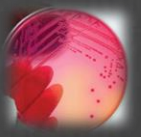


Hematology

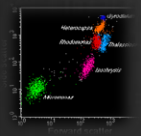


Special Testing & Immunology

Coagulation



Microbiology



Flow Cytometry

Molecular Pathology

Phlebotomy

Ancillary Testing

DAILY ROLES & RESPONSBILITIES OF A BEAUMONT MEDICAL LABORATORY SCIENTIST

Blood Bank / Transfusion Medicine

Erin, Class of December 2009, issuing a unit of red cells

- One of the country's busiest Transfusion Medicine Laboratories
- Automated and fully computerized
- Major role of the MLS: Test and issue wide variety of blood and tissue products

Blood Bank techs rotate among four major analytical benches:

- Triage
- Type & screen
- Antibody problems
- Crossmatch / Moms & Babies

Triage Responsibilities

Heather, Class of 2010, preparing a massive transfusion cooler containing red cells, plasma, platelets, and cryoprecipitate at triage

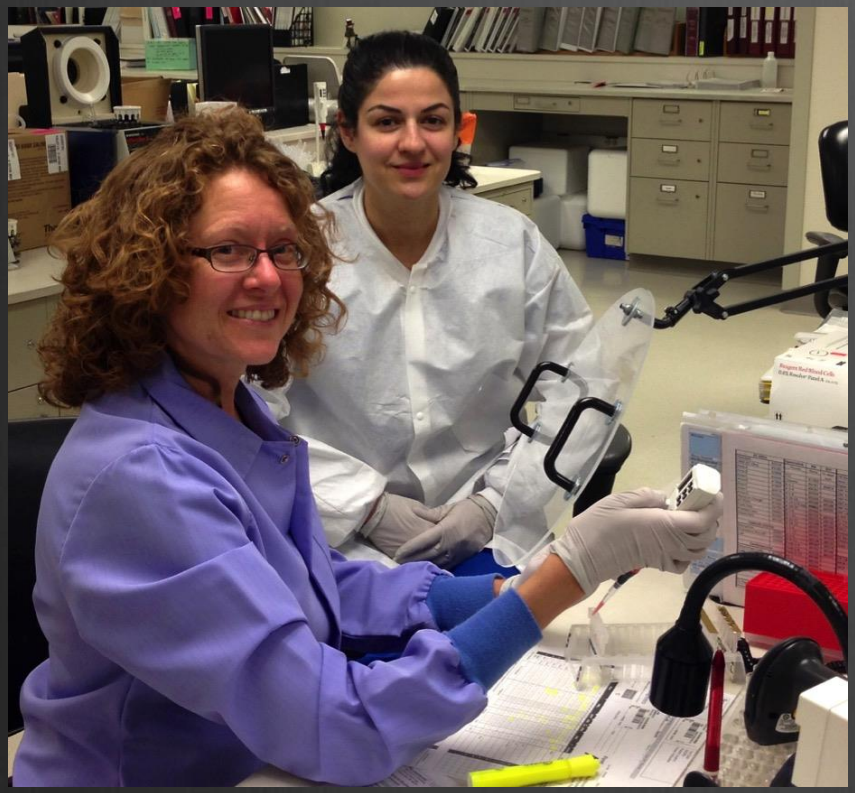
- ✓ Issue blood products in coolers on ice when Nursing and operating room staff come to the Blood Bank to request products in person.
- ✓ Accept samples arriving via the tube system and spin them down for testing
- ✓ Thaw fresh frozen plasma and cryoprecipitate needed for patient use.
- ✓ Receive and issue cadaver bone products for surgery as well as organs such as kidneys, livers, and corneas for transplantation purposes.

Type & Screen

- The MLS assigned to the type and screen bench is in charge of the physical testing of all patient samples.
- They perform ABO and Rh typing as well as and antibody screening procedures on each sample.
- Depending on the urgency of the test results, samples can be run manually or on the instrumentation using gel technology.

Marc, Class of 2010, loading a specimen onto the Ortho *Provue*™ automated instrument that performs patient ABO and Rh typing

Antibody Problems



Danelle, Class of 2000, training Zeinab,
Class of June 2015, at the antibody problems bench

- The most complex bench in the blood bank.
- Patient samples with a positive antibody screen will receive a thorough workup before blood products can be released.
- Some problems are simple single antibody specificities only needing a single panel and antigen typing performed, however many of our patients have been multiply transfused and require an extensive multi-panel work up.

Crossmatch / Moms & Babies

- The MLS will crossmatch blood products for patients with orders for transfusion.
- Electronic, immediate spin, all-phase, and 60 minute no liss crossmatching are just some of the testing performed on this bench.
- The MLS on this bench are also in charge of reviewing the daily labor and delivery log to ensure all moms and babies have received the appropriate testing and that Rh negative mothers who have had Rh positive babies receive their Rhogam shots prior to being discharged from the hospital.

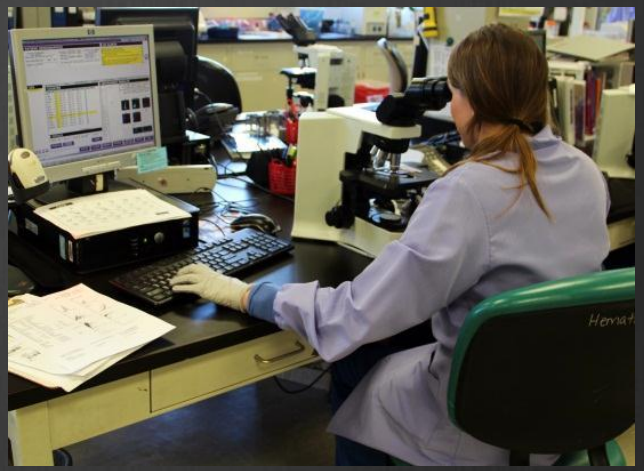
Sarah, Class of 2003, preparing a unit of crossmatch packed RBC's for transfusion.

Additional Responsibilities

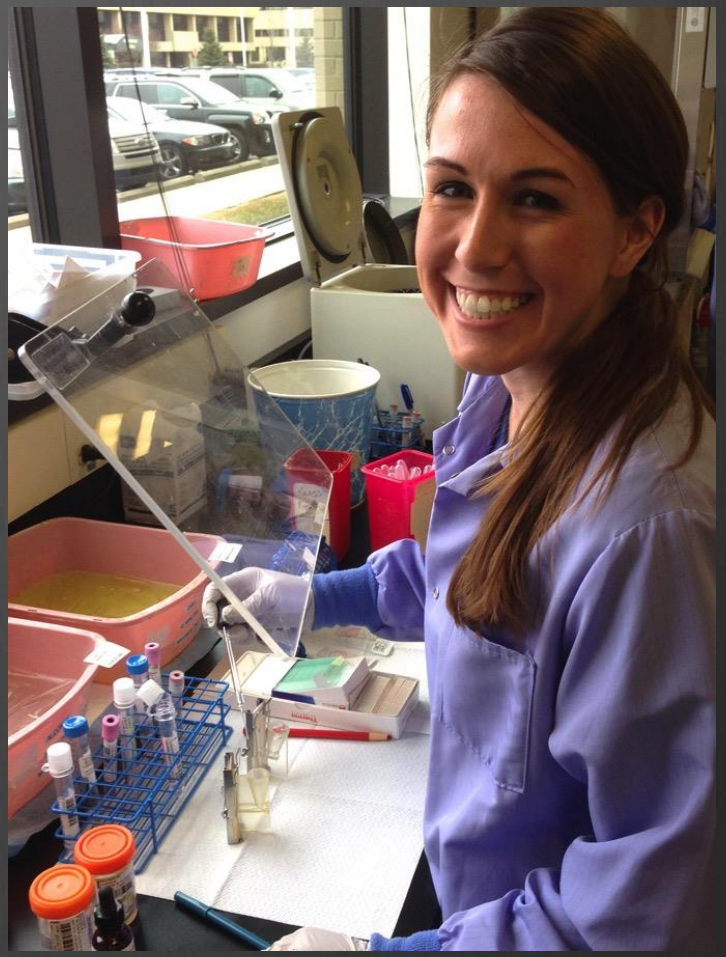
- ✓ All shifts begin with quality control (QC). Each shift has designated tasks to complete before patient work begins.
  - ➢ Day shift is responsible for making sure there are enough reagents in inventory, performing QC on select reagent racks, and taking temperatures of all equipment and refrigerators/freezers in the blood bank.
  - ➢ Afternoon shift is responsible for the ordering of blood products for the following day, in addition to taking temperatures of equipment, and running QC on reagent screening cells.
  - ➢ Midnight shift is responsible for all instrument maintenance, some of which is run daily, weekly, or monthly, and preparing reagent racks.
- ✓ In addition to the daily work at the benches, the Blood Bank MLS also takes part in daily rounds with the blood bank pathologist; is assigned annual competency assessments; takes part quality assurance reporting; attend weekly department staff meetings and attends educational seminars.
- ✓ The MLS is also in charge of running patient direct antiglobulin testing, hemoglobin S testing of units, antigen typing units, and working with our area reference laboratory and blood centers to find rare blood products.

Hematology

- Medical Laboratory Scientists perform blood & body fluid cell enumeration on computerized automation.
- They also evaluate blood and body fluid cell morphology under the microscope to detect the presence of:
  - Red cell, white cell and platelet disorders
  - Infection
  - Malignancy



- Hematology analytical benches include:
  - Automated blood cell analysis
  - Morphology bench for peripheral blood and body fluid differential counting
  - Bone marrow
  - Body fluid analysis
  - Special RBC tests



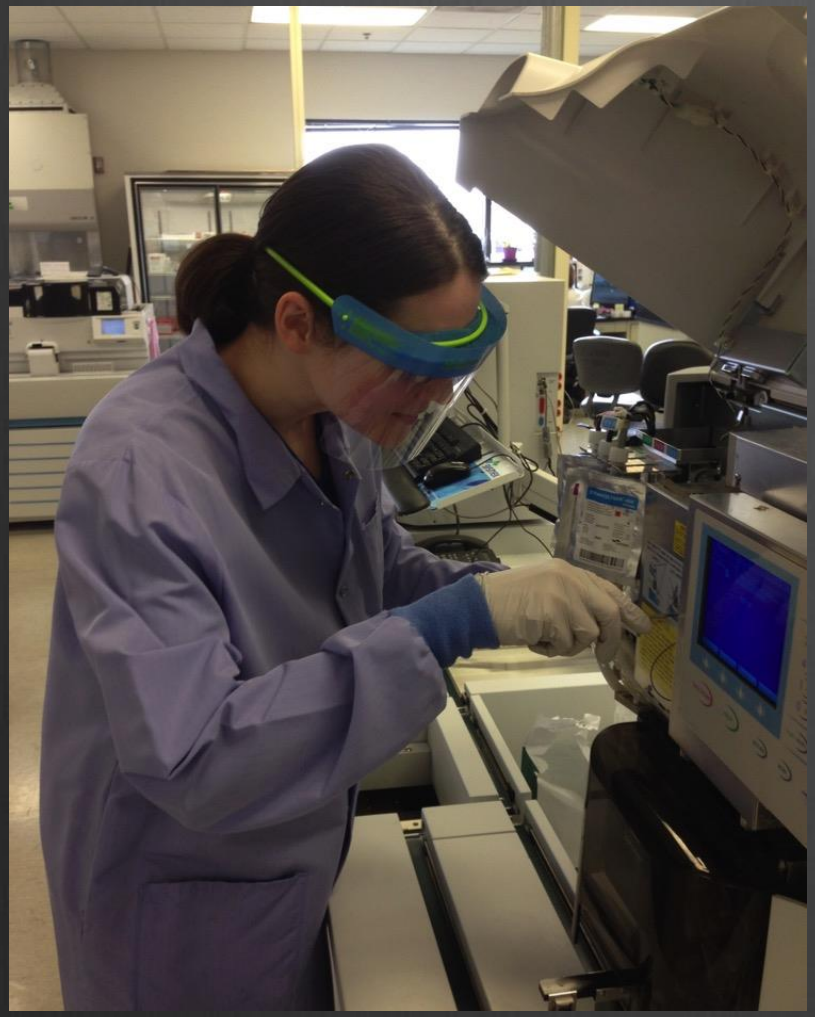
Jackie, Class of 2012, preparing body fluid specimens for analysis

Automated Blood Cell Analyzers

State-of-the-art *Sysmex*™ cell analyzers and automated slide makers

- The MLS runs QC on the analyzer and verifies all results are in control before starting the daily run.
- Their major responsibility on this bench is to evaluate patient results and determine if further action needs to be taken.
  - ✓ For example, perhaps a clot is suspected, the smear needs to be reviewed, or a manual method needs to be performed to obtain valid results.

Automated Blood Cell Analyzers (cont.)

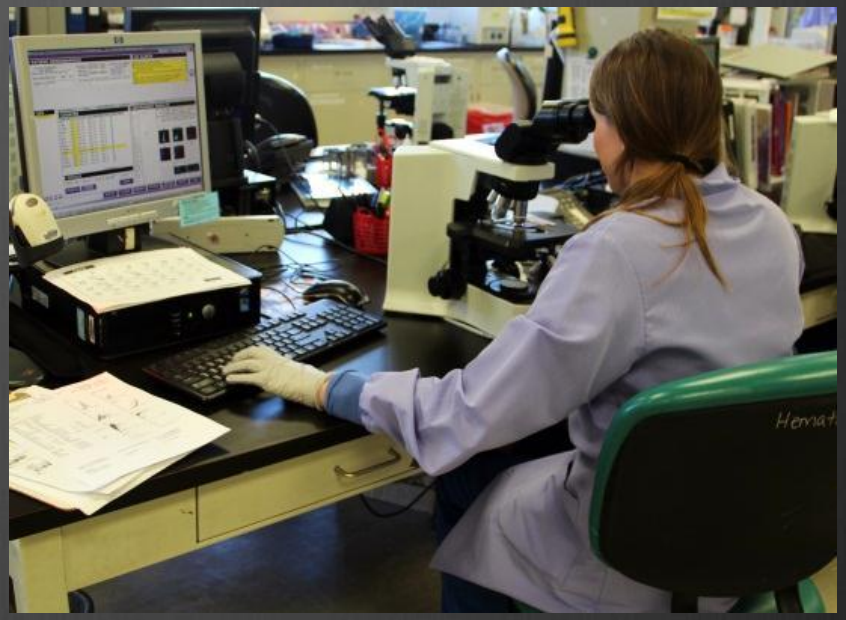


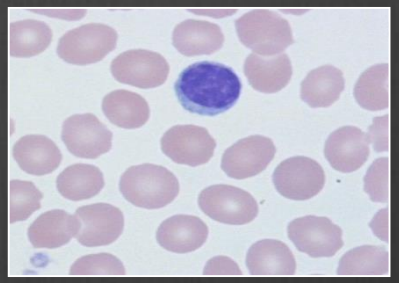
Michelle, Class of 2002, performing maintenance on *Sysmex* XE-5000 cell analyzer

The MLS also performs instrument maintenance such as cleaning, replacing parts, and recording status values on a maintenance sheet.

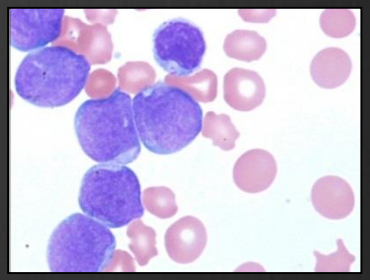
Morphology Bench

- The MLS evaluates blood and body fluid cell morphology under the microscope to detect the presence of anemia, leukemia, or lymphoma.
- They need to have a keen eye for differentiating details between normal and abnormal cells.





Normal Lymphocyte



Leukemic Blasts & Lymphocyte

Bone Marrow Bench

- The MLS assists the nurse practitioner or pathologist by making smears at the patient bedside.
- The MLS then process the biopsy specimen and stains the smears for review by the pathologists.

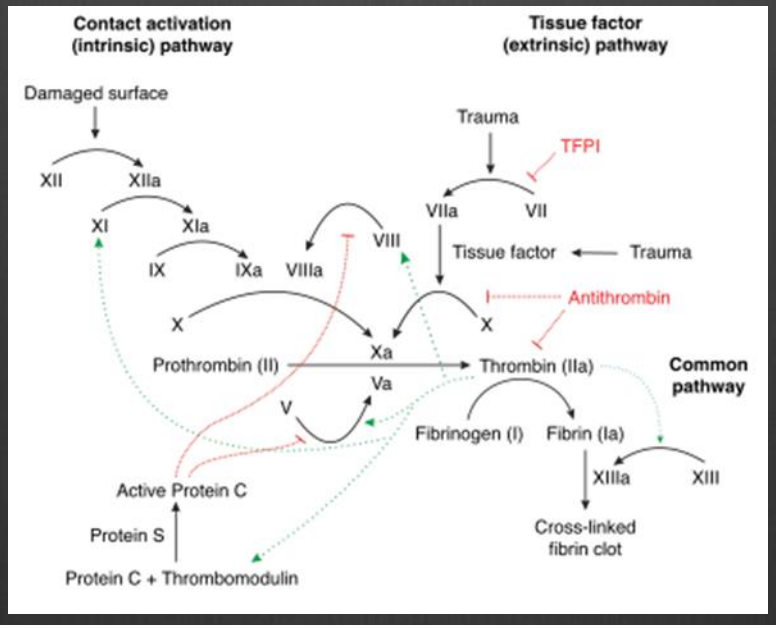
Natalie, Class of 2009, staining bone marrow aspirate smears for examination by the pathologist

Additional Responsibilities

- ✓ Interaction between technologists and pathologists is essential to the Hematology lab running smoothly. You may need to consult the pathologists when certain abnormalities are observed on smear reviews.
- ✓ Your skills as a technologist will be tested by yearly competency assessments that measure the ability of the technologist to perform daily tasks such as running controls and reporting patients.
- ✓ A CAP survey may be assigned to your bench on that day and you will be responsible to complete this survey. Surveys come in the form of prepared samples that are to be tested in the same manner as a real patient specimen.
- ✓ Technologist are in charge of inventory. They make sure there are enough supplies to get us through until the next order can be placed.

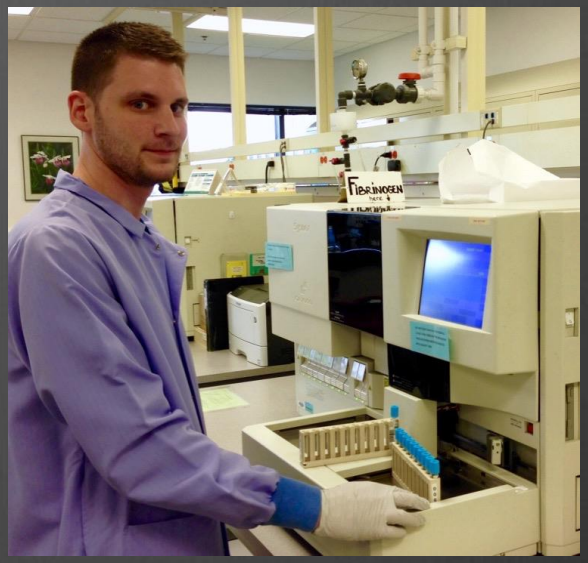
Hemostasis (Coagulation)

In this department, Medical Laboratory Scientists perform a complete range of routine and specialized tests for comprehensive evaluation of patients with inherited and acquired bleeding disorders, thromboembolic complications, hypercoagulable states, and disorders of platelet function.



Routine Coagulation Testing

- Routine testing is performed on the *Sysmex*™ CA-7000
- Tests include:
  - aPTT (Activated Partial Thromboplastin Time)
  - Protime INR
  - Thrombin Time (TT)
  - Fibrinogen
  - Inhibitor/Anticoagulant Screen
  - D-Dimer



Matt, Class of Dec, 2012, loading routine coagulation specimens onto the *Sysmex*™ CA-7000 analyzer

Specialized Coagulation Testing

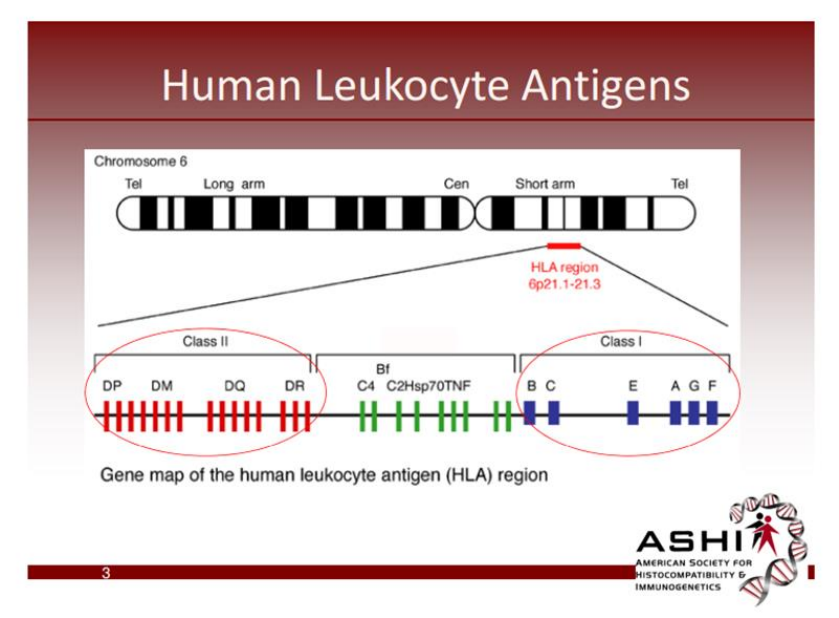
The MLS is trained to perform over 20 specialized tests, each via it's own analytical test methodology. They include:

- Platelet function & aggregation
- Special factor studies
- Fibrin Stabilizing Factor
- Factor Assays
- Von Willebrand Factor Antigen
- Antithrombin III
- Protein C Activity and Antigen
- Protein S Activity and Antigen
- Activated Protein C Resistance
- Risocetin Cofactor
- Reptilase Time
- Anti-Xa LMWH
- Heparin anti-Xa
- Dilute Russell Viper Venom Time (dRVVT)

HISTOCOMPATIBILITY

Medical Laboratory Scientists perform typing of white blood cells for HLA antigens to determine:

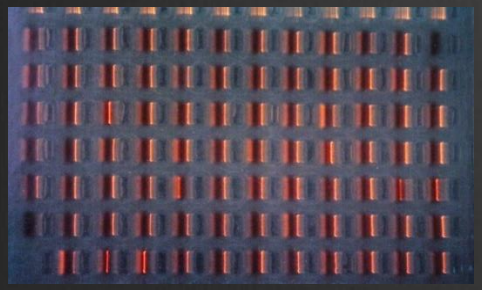
- if a donor organ or bone marrow is a good match for transplantation into a recipient
- certain disease associations

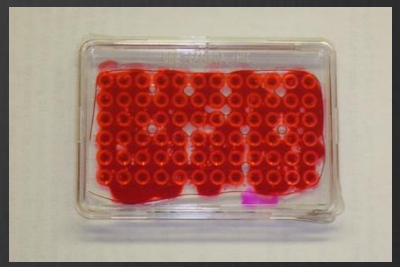


HLA Typing

- Historically, HLA typing has been done at the protein level using the microlymphocytoxicity test method.
- Today, HLA typing at the DNA level using PCR has become the method of choice for clinical laboratories.

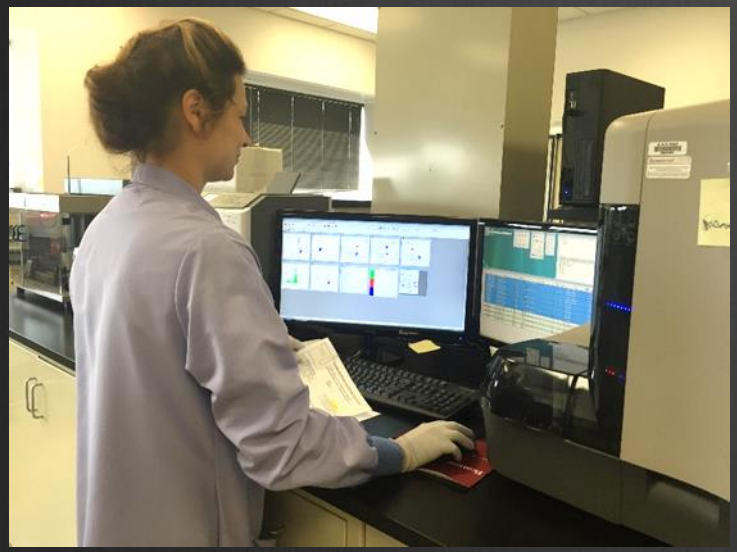
Kathryn, Class of 1995, analyzing lymphocyte toxicity reactions

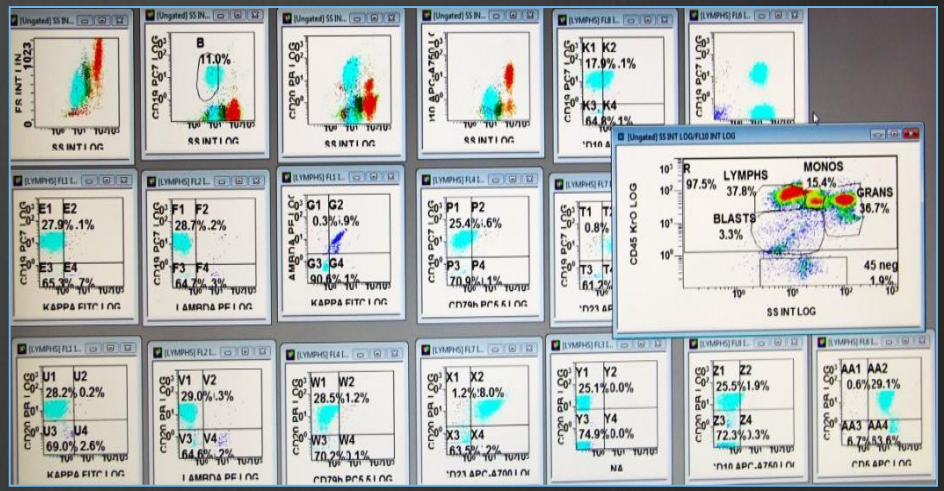




Flow Cytometry

The Flow Cytometry Laboratory uses sensitive multi-parametric flow cytometry methods to provide semi-quantitative analysis of blood, bone marrow, fresh tissue (e.g., lymph node) suspensions, and body fluids including CSF. Sensitivity of detection for most specimens has been validated to 0.1-0.5 percent.

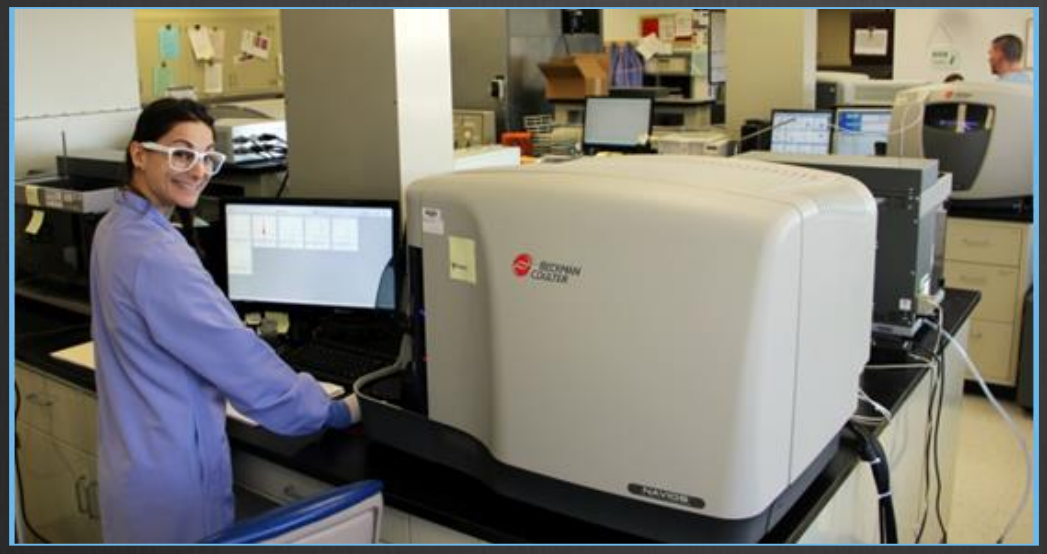




Flow Cytometry (cont.)

Medical Laboratory Scientists use the flow cytometer to detect:

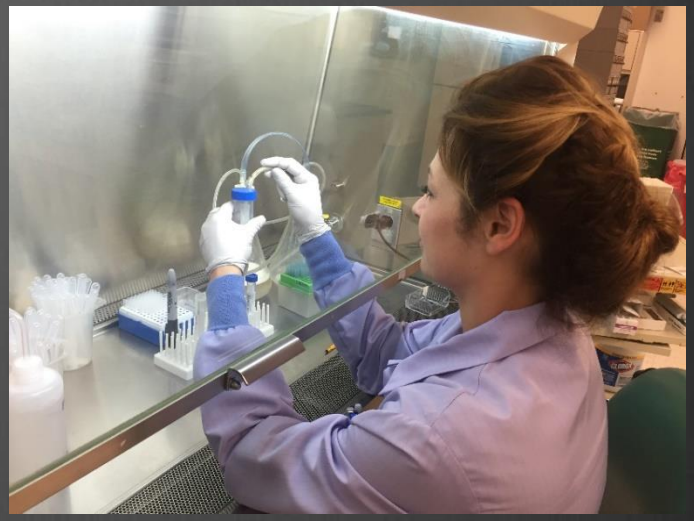
- abnormal cell surface markers found in leukemia and lymphoma
- lymphocyte subsets in HIV infection



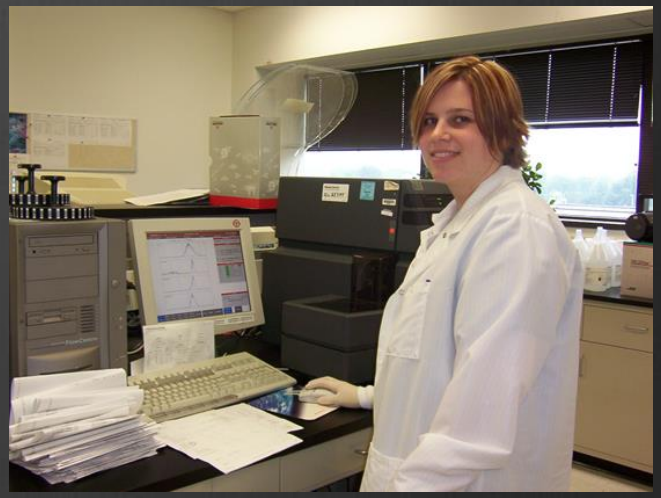
Jessica,
Class of June, 2010,
operating a
Beckman-Coulter
Flow Cytometer

Typical day-to day analysis includes:

- Document receipt of specimen
- Process specimen to isolate the cells
- Add monoclonal fluorescent antibodies to the cells and incubate
- Load the cell/antibody samples on the flow cytometer for optical measurement
- Analyze the resulting scatterplots
- Evaluate final test results
- Report results in the LIS



Jennifer processing a lymph node tissue under the biohazard hood



Brandy, Class of 2004, analyzing resulting scatterplots

Additional Responsibilities

Flow Cytometry techs are also responsible to:

- ✓ Evaluate Quality Control measures to determine reagent and instrumentation acceptability and troubleshoot any issues that arise in the process
- ✓ Set up tests according to procedure that they run, evaluate and report out while using information from patient history and current presentation.
- ✓ Work closely with each other, supervisors, pathologists, residents and fellows to help determine proper patient care, troubleshooting issues and excellent customer service.

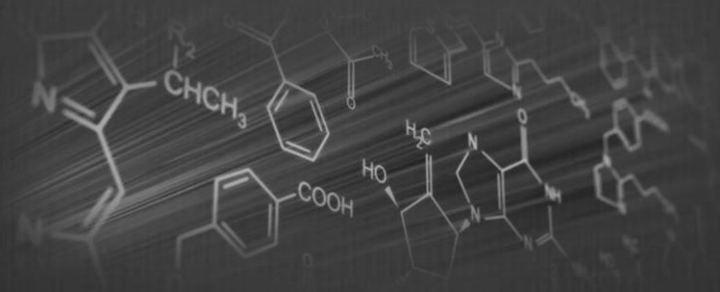
Automated Chemistry

- State-of-the-art automation
- One of the largest laboratory departments, it receives:
  - 5 thousand specimen tubes a day
  - 1.8 million specimens a year

- Chemistry Medical Laboratory Scientists and Technicians analyze blood serum for hundreds of biochemical elements that reflect cardiac, liver, renal, endocrine and acid/base function.
- A typical day includes the responsibility to:
  - Monitor instrument function and quality control data.
  - Review and verify patient results, being sure all results correlate with previous results as well as the disease state of the patient.

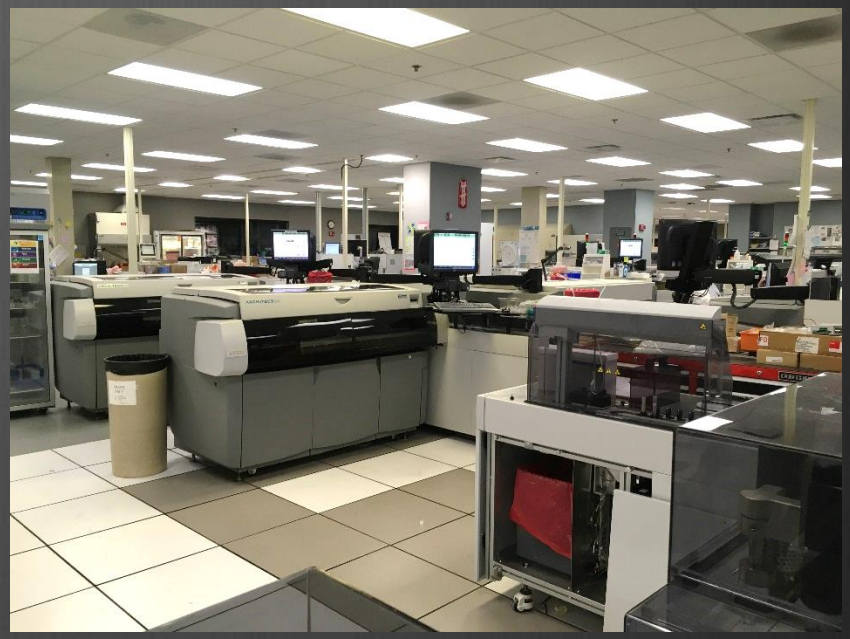
Automated Chemistry benches include:

- **Core Lab Automation Line**
  - Serum chemistry panels
  - Hemoglobin A1c
  - Cardiac and liver markers
  - Immunoassays for HIV, Hepatitis, and COVID antibodies
  - Tumor markers
- **STAT Lab**
- **Urinalysis**



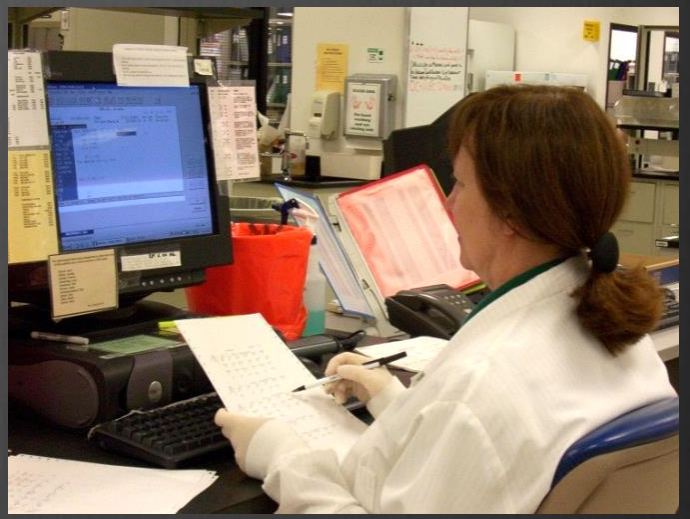
Chemistry Line

- The robotic line is comprised of Abbott Architect analyzers.
  - Separate analyzers perform traditional chemistry and immunoassay testing
- Line operators set up the instruments each day before patient sample analysis begins.
  - The set-up includes any daily/weekly/monthly maintenance that is required, loading the proper amount of reagents for the daily workload, and running calibrations and quality controls (QC) on each instrument.



Chemistry Line (cont.)

- Line operators then run patient samples during their shift including tests for electrolytes, liver enzymes, renal function testing, HIV, hormones and hepatitis, just to name a few.
- They are also responsible for troubleshooting any issues that arise on either the instruments or for patient samples.
  - Some examples of issues that can arise throughout the day are failed calibrations, failed QC, probe jams, instrument malfunctions, and patient specimen integrity issues that need to be addressed (hemolyzed, lipemic, clotted, quantity not sufficient, etc.).



STAT Lab

- A separate testing laboratory located in the main hospital next to the Blood Bank.
- This lab provides testing services for EC, pre-OP, OR, and ICU patient care areas.
- Variety of instrumentation to perform “STAT” chemistry, blood gas, hematology, coagulation tests as well as manual qualitative urine pregnancy tests and serum osmolality.

STAT Lab (cont.)

Katie, Class of December 2017, reporting patient test results on the STAT Lab manuals bench.

- Medical Laboratory Scientists must recognize a critical value and call it to the appropriate patient unit nurse in charge.
- The critical result must be repeated back by the nurse and is documented in the laboratory information system.
- Some instruments are “interfaced” to the laboratory software permitting results within a normal range to be automatically reported out.

Additional Responsibilities

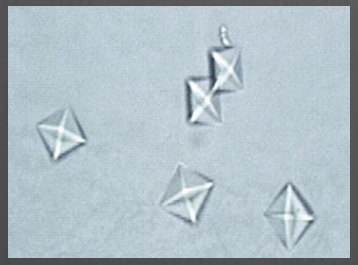
Chemistry technologists are also busy with:

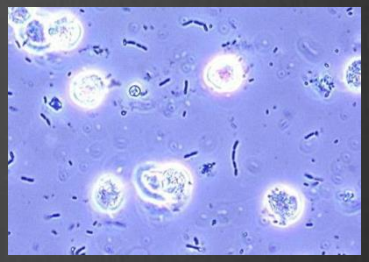
- ✓ Daily instrument maintenance and quality control.
- ✓ Chemistry technologists are also responsible for running CAP Proficiency testing samples on all instruments and testing platforms to ensure our instruments are properly performing the testing and the technologists are following procedures. These are not performed daily on each instrument/test platform but they are run when required according to CAP.
- ✓ Special projects and statistical analysis for stability testing and other studies when needed.

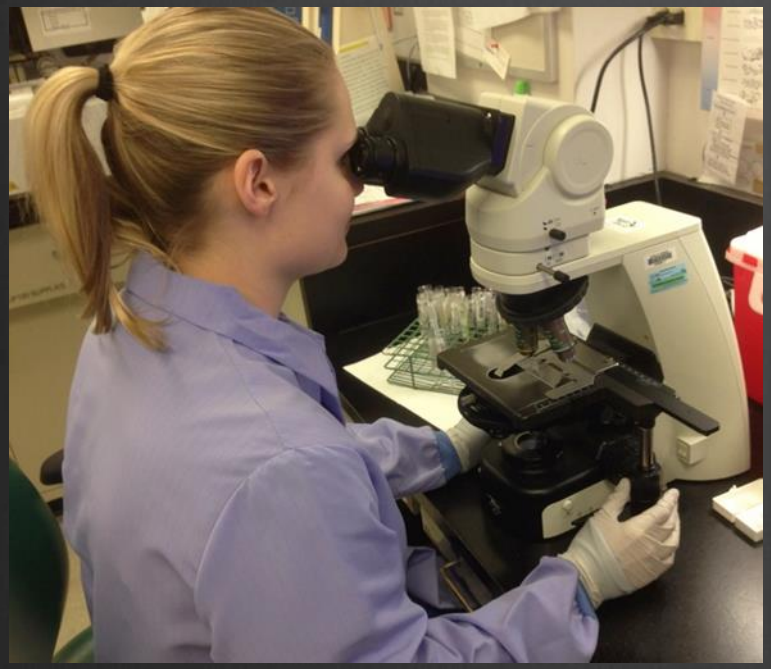
Urinalysis – Chemical Analysis

- Medical Laboratory Scientists use automated analyzers and chemical dipstick methodology to test urine for pH, glucose, protein, ketones, bilirubin, and other constituents.
- When abnormal results are detected by the analyzer, the technologist will manually confirm those results by looking at a drop of centrifuged urine sediment under the microscope.
- The microscopic examination is done to identify elements such as white blood cells, red blood cells, epithelial cells, casts, crystals, yeast, and bacteria.

Urinalysis – Microscopic Analysis



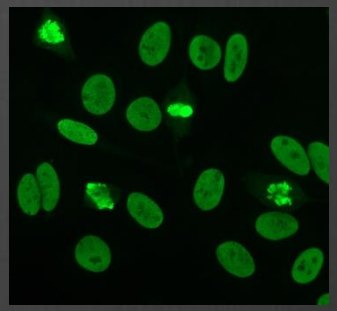



Sara, Class of 2012, performing manual microscopic urine examination

Special Chemistry

- Performs testing for autoimmune diseases, in-vitro allergy testing, infectious disease serology's, protein quantitation, tumor markers, protein immuno-fixation, and therapeutic drug monitoring.
- Provides a battery of assays to determine antibody and antigen responses to viral and bacterial infections for diagnosis of disease.

Hemoglobin Electrophoresis



Homogenous ANA immunoflorescence pattern

Sandwich ELISA microtiter plate

The Special Chemistry MLS works in two separate laboratories that offer a wide variety of testing methodologies and instrumentation.

Special Chemistry (cont.)

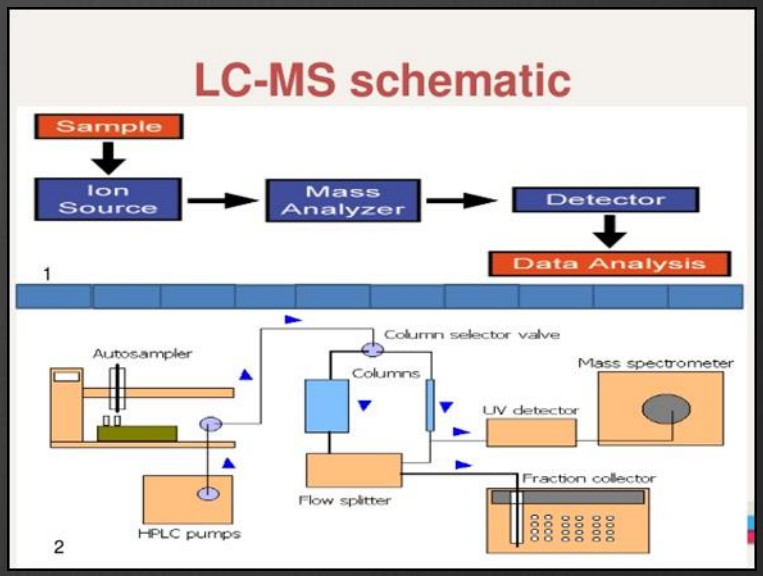
Routine benches include:

- Immuno-electrophoresis
- Immuno-fixation
- ELISA
- Radioimmunoassay
- Antigen/antibody assays

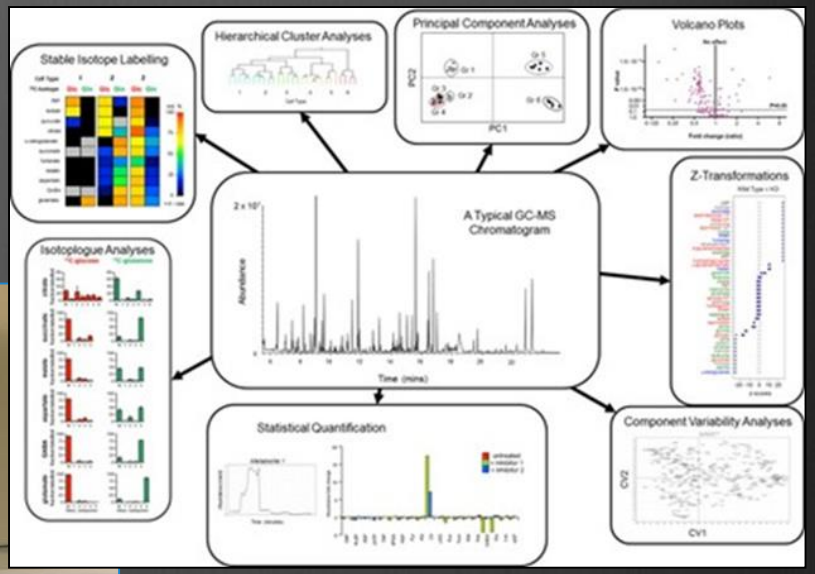
Kelsey, Class of 2015, learning the use of an automated allergy testing instrument from medical technologist
Janell, Class of 2004

Toxicology

- Medical Laboratory Scientists utilize an Architect immunoassay analyzer to measure concentrations of therapeutic drugs in urine and serum samples to assist the physician in monitoring immunosuppressive, anti-epileptic, cardio-active and antibiotic drug therapy.
- In addition, they use sophisticated liquid or gas chromatography and mass spectrometry equipment to screen and identify drugs of abuse and perform toxic alcohol screening.



Toxicology (cont.)



Kim, class of 1977, working on the Liquid Chromatography (LC) column

Microbiology

The Clinical Microbiology Laboratory provides a full spectrum of tests (ranging from traditional culture to state-of-the-art molecular methods) for the detection of medically important bacteria, fungi, parasites, and viruses in clinical specimens and provides information about the susceptibility of bacterial agents to select antibiotics.

- Medical Laboratory Scientists use various culture techniques to determine which bacteria, virus or fungus might be causing illness.
- They also perform antimicrobial susceptibility testing on bacterial isolates to determine what antibiotics will be effective in treating the infection.

Latoya, Class of 2004, performing colony isolation for antibiotic susceptibility testing.

The Microbiology benches include:

Routine cultures

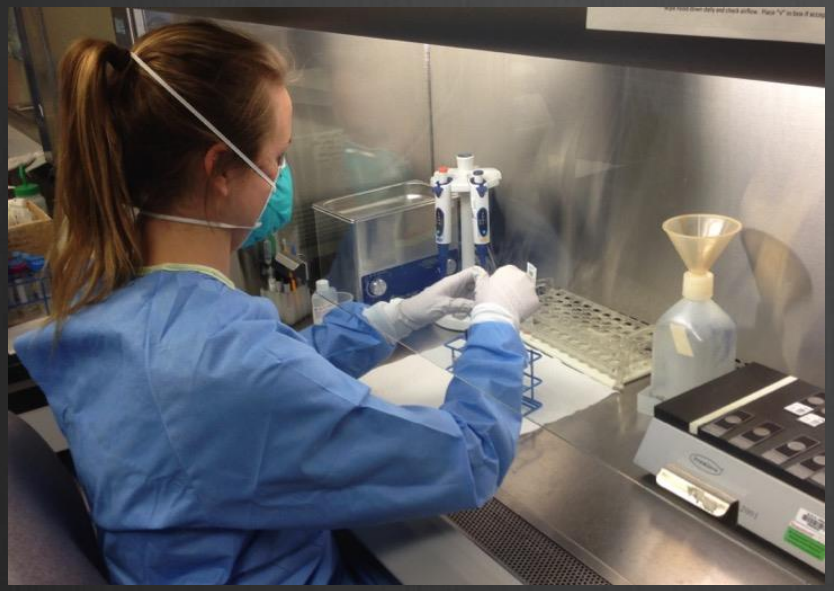
- Blood
- Respiratory
- Stool
- Wounds
- Urine
- Genitals

Specialty benches

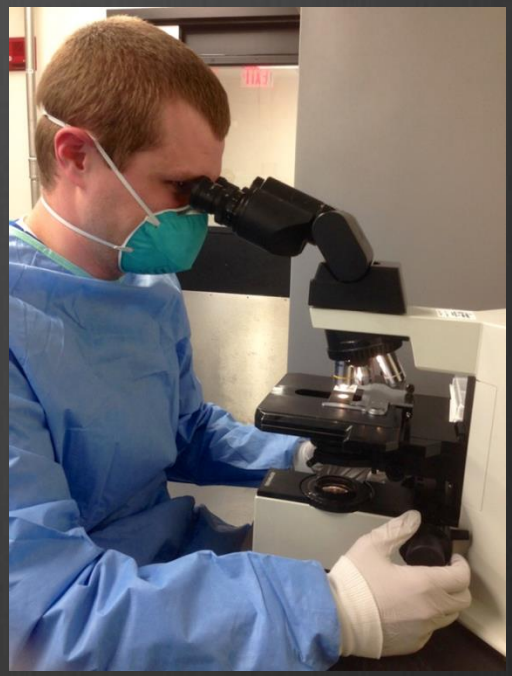
- Anaerobes
- Parasitology
- Virology
- PCR
- MALDI-TOF
- Antibiotic susceptibility testing

Biosafety Level 3 (BSL-3) Laboratory

- This is a specially contained laboratory for:
  - Acid-fast bacilli testing and cultures
  - Fungal cultures



Kelsey, Class of 2015, preparing specimens for mycobacterial culture



Chris, Class of 2015, examining a direct smear for the presence of acid-fast bacilli

Molecular Pathology

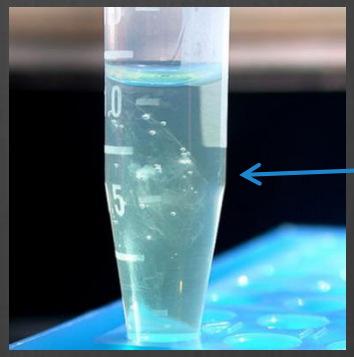
Opened in 1991, it was among the first national molecular pathology laboratories and is now recognized as a Molecular Center of Excellence.

This laboratory utilizes a variety of DNA-based technologies for specimen analysis.

In addition, Southern blot-based and polymerase chain reaction based assays are used in the diagnosis/prognosis of disease and monitoring of disease therapy.

Molecular Pathology

- Typical day-to day analysis includes:
  - Document receipt of specimen
  - Extract DNA
  - Run amplified DNA via required analytical technique
  - Evaluate testing data
  - Report result in LIS



Extracted DNA

Amplifier

Molecular Pathology (cont.)

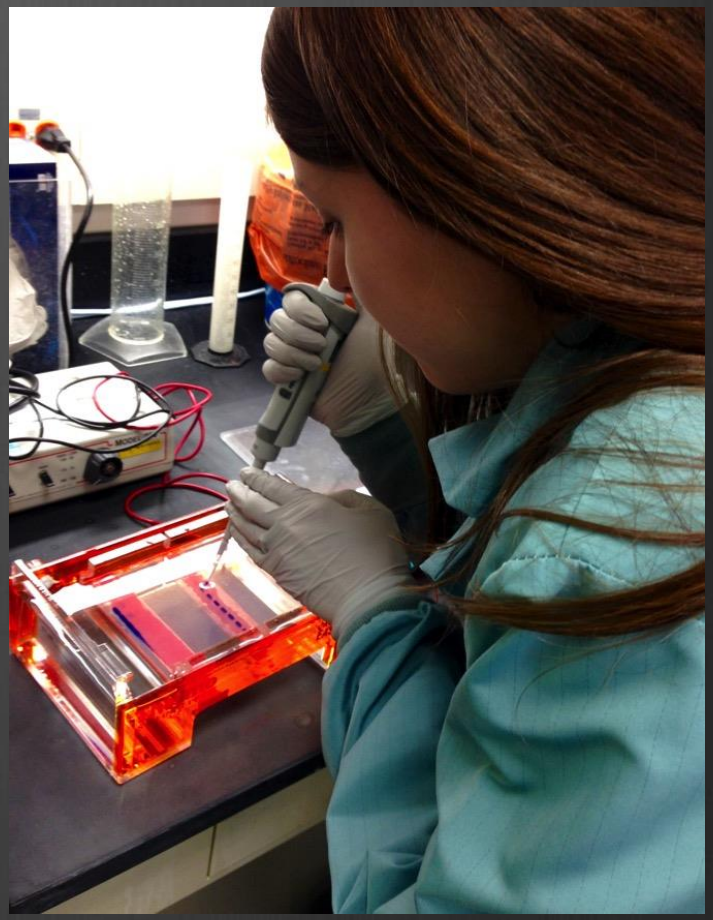
The DNA nucleic acid sequences are then studied for:

- unique sequences of various bacterial, fungal or viral organisms
- defective genes found in inherited disease such as cystic fibrosis
- mutations in certain cancer cells

More specifically, molecular testing is utilized to investigate hematological and solid tumor malignancies; infection by Chlamydia trachomatis, Neisseria gonorrhea, and hepatitis C virus; HIV; HSV; factor V deficiency; thrombotic risk assessment and most recently COVID-19 antigen.

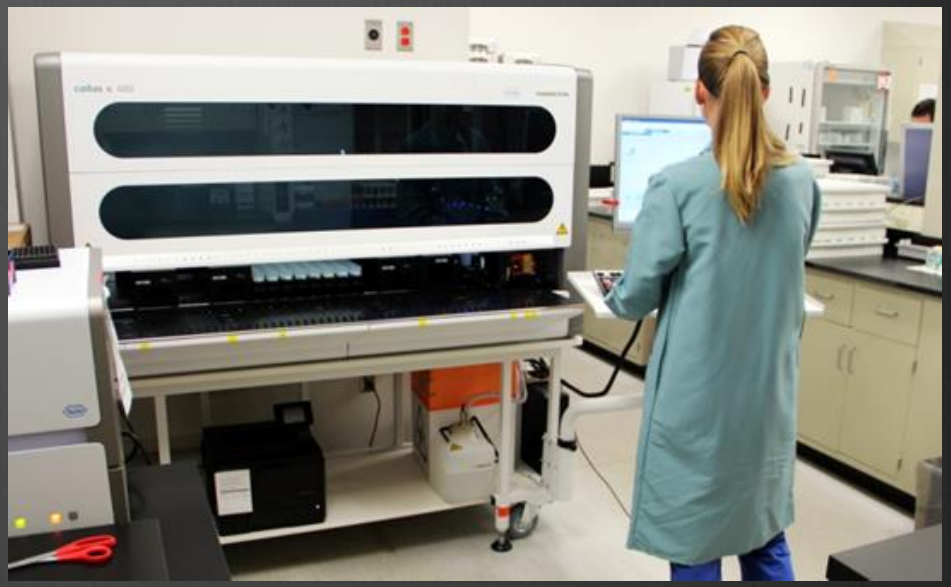
Molecular Pathology (cont.)

- Laboratory techniques include:
  - Nucleic acid extraction
  - Purification and processing
  - Electrophoresis
  - *In-vitro* nucleic amplification techniques
  - End-point & real-time PCR
  - Next-Gen sequencing
- Multiple genotyping assays via:
  - PCR, xTAG and Invader technologies



Kirstin, Class of 2015, manually loading an agarose gel for a genotyping assay

Molecular Pathology Automation



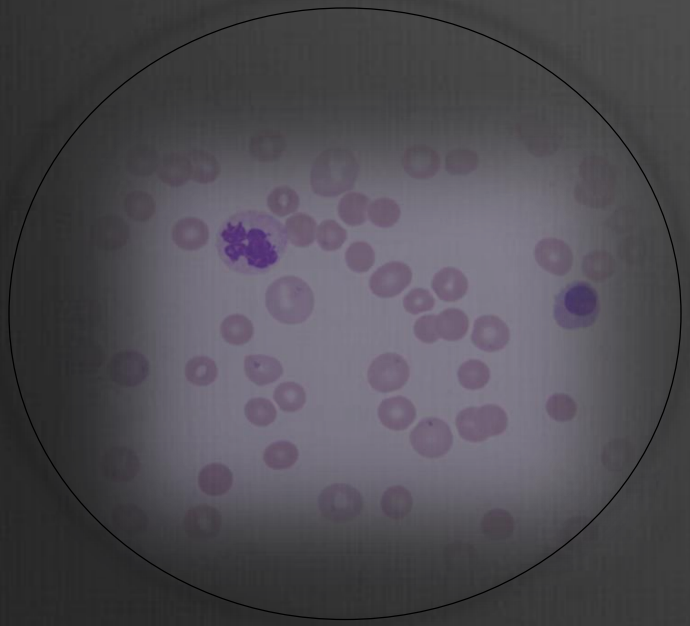
Left: Samantha, Class of 2010, operating an automated platform that runs sexually transmitted disease assays (HSV, Chlamydia, Gonorrhea and Trichomonas).
Right: Samantha operating the real-time polymerase chain reaction (PCR) oncology technology system for the detection of mutations in the KRAS, BRAF and EGFR genes in tumor samples.

Ancillary Testing

- Ancillary Testing technologists oversee instrumentation, training and supervision of "point-of-care" (POC) testing personnel in approximately 70 nursing units and 30 off-site testing areas.
- Examples of POC testing include fingerstick glucose testing, activated clotting times, hemoglobin and blood gas testing along with many others.
  - The largest POC testing program is for glucose meter testing with over 250 meters throughout the hospital and off-site testing areas.

Education & Training

- As reflected in previous slides, another important job role of the Medical Laboratory Scientist is to assist in the training of students as well as new employees and pathology residents and fellows.



Students (Steve, Chris, and Kirstin, Class of 2015), and new hire (Matt, Class of 2012), receiving Hematology morphology training from clinical instructor (Dana Snyder, Class of 2009).

CAREER REFLECTIONS

Why We Chose the Medical Laboratory Science Profession

Comments from the
Beaumont MLS Program Clinical Instructors

Blood Bank/Transfusion Medicine
Brent Vasicek, Lead Technologist

What got me interested in medical technology is all the science.

What kept me in medical technology is that the rules and procedures are typically well defined.

This is great for two reasons:

- I am very logical and try to make situations as black and white as possible. Rules and procedures help accomplish that.
- Also, I like to have a personal life. The rules and procedures are written to ensure that others may do my job in my absence. In short, Med Lab Science is a great way to feel valued and maintain a balance in your life.

In addition, I wanted to be an actor on a hit show. Per the Nielsen ratings, I noticed that ER, Scrubs, House, CSI, Grey's Anatomy, General Hospital, etc. were the shows consistently at the top of the ratings. What do they all have in common? Lab professionals! Without a lab professional Meredith Grey would lose more patients than she already does. Without a lab professional Turk and JD would have never been friends. Lab professionals drive Hollywood and advertisements and, most importantly, your personal health. So, I did all this to become the best actor. I will let you decide if I am real or just play one on TV.

Chemistry/Immunology
Felicia Oleksik, Lead Technologist

"I originally chose this career path as a stepping stone to becoming a physician. Over time, I realized that being a physician was not for me, but I still loved human physiology. Medical Laboratory Science gives us a glimpse into the function of the human body and what's going on in patients whether they're healthy or in a state of disease. We play a crucial role in identifying possible errors and safeguarding the integrity of patient results – and therefore patient diagnosis and treatment. There is always more to learn in this field either by new discoveries, new technologies, or simply taking your experience and knowledge to new depths."

Hematology / Hemostasis
Sara Wagner, Lead Technologist
(2012 Graduate)

"I chose this career because I really enjoyed my science curriculum in school but found patient contact was not for me. With the right guidance, I learned of Medical Laboratory Science and its very important role in the medical community. Although there are things about the career I dislike, I stay because of the new challenges that each day brings. I'm constantly learning and there is always opportunity to change to a different lab section which keep this career interesting. I also enjoy knowing that indirectly my coworkers and I save lives every day that may not be save if it weren't for our commitment to excellence. This is truly a noble profession and a service that will always be needed."

Microbiology
Caroline Loomis, Lead Technologist

"I chose the career of medical laboratory science because……

- I always liked math and science
- In high school I wanted to be an accountant but my science teacher talked to me about different health professions which changed my interest
- I did not want to be a doctor or nurse because of the patient contact, so I chose Medical Technology
- I like the idea of helping not only the physician but also the patient without having contact with them
- After working in all the areas of the lab, I decided I enjoyed Microbiology the best
- I am organized and detail oriented which is very useful in Microbiology.
- I like putting the "puzzle" together when the cultures are difficult to figure out.
- I like making decisions(based on procedures and experience)for cultures that require more than the "normal" workup.
- I find it interesting to learn something new every day especially with methods that detect resistant organisms.
- I also like the variety of work in Micro from bacterial cultures, parasites, mycobacteriology, mycology and virology."

Flow Cytometry
Jennifer Barszczowski, Lead Technologist

- "I chose the career of Medical Laboratory Science because I enjoyed the science field and gravitated towards medical science. After taking different MLS labs, I discovered that I really enjoyed lab work and manual testing. All in all, I like being behind the scenes to provide excellent patient quality and care."

MLS Program Applicants:

Please be prepared to discuss the following questions at your upcoming interview:

- What new information about the role of a medical laboratory scientist did you learn from this presentation?
- What clinical laboratory techniques are you currently learning in your university lab courses?

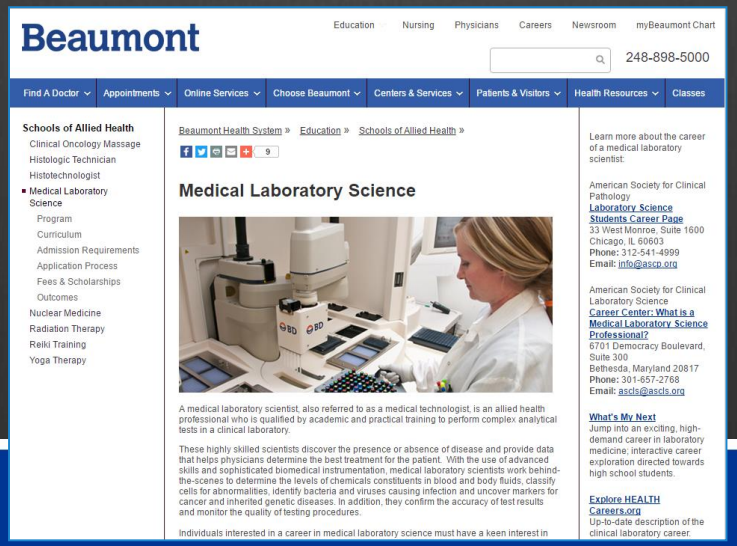
Summary

- Beaumont Laboratory is among the highest test volume hospital-based laboratories in the country. This presentation highlighted the operations of the Beaumont-Royal Oak campus.
- Our Medical Laboratory Scientists are highly skilled, dedicated professionals who are vital members of the health care team. They typically specialize in one clinical laboratory discipline.
- We hope this presentation has provided a better understanding and appreciation of the day-to-day responsibilities of a Medical Laboratory Scientist.

Individuals Interested in Medical Laboratory Science:

For others who have happened upon this presentation, please visit the Beaumont School of Medical Laboratory Science webpage for additional information about our clinical laboratory training program.

https://www.beaumont.edu/other-education/allied-health/medical-laboratory-science



Thank you for viewing this presentation.

Stay safe and well!