Laboratory Studies by Category

- Chemistries & Immunology
- Hematology
- Microbiology
- Urinalysis
- Anticoagulation
- Blood gas
- Cytology
- Pathology

Specimen Collection

- Obtaining a specimen by venipuncture:
**Tracking and Handling…**

- The robotic LAB InterLink® automated specimen processor control station:

**Chemistries & Immunology**

**Recall Antibodies…**

- Variable regions:
  - Determine antigen specificity.
  - Subdivided into the hypervariable (HV1-3) & framework regions (FR).
  - Proteases may cleave this region, leaving the FAB (Fragment antigen binding).

- Constant region:
  - Determines the mechanism to destroy the antigen.

**e.g. IgG Antibody…**

- Heavy chains in blue and blue-green.
- Light chains in green and yellow.
- Carbohydrate in red.
Recall Fluorophores…

- A fluorophore is a fluorescent chemical compound that may re-emit light upon light excitation.
- Fluorophores typically contain several combined aromatic groups, or plane or cyclic molecules with several π bonds.
- Generally covalently bonded to a macromolecule, serving as a marker (or dye, or tag, or reporter) for affine or bioactive reagents (antibodies, peptides, nucleic acids).
- Fluorophores are notably used to stain tissues, cells, or materials in a variety of analytical methods.

Uses for Fluorophore-Conjugated Antibodies…

- Clinical Techniques:
  - ELISA
  - Western Blot
  - Immunofluorescence
  - Immunohistochemistry
**ELISA**

- The Enzyme-linked Immunosorbent Assay (ELISA)
- A biomolecular technique that utilizes the specificity of an antibody, as well as the sensitivity of enzyme assays, to detect and quantify molecules such as hormones, peptides, antibodies, and proteins.

**Uses:**
- Identification of cancer biomarkers for early detection of cancer.
- Drug screening (urine) and concentrations in patients undergoing treatment.
- Pregnancy screening.
- Detection of platelet antibodies – e.g. idiopathic thrombocytopenic purpura (ITP) and systemic lupus erythematosus.
- Virus detection e.g. HIV (human serum cystatin C), and West Nile virus.

**Methodologies...**

**Chemiluminescence Immunoassays (CLIA)**

- Rapid and accurate diagnosis of autoimmune diseases.
  - SLE, Rheumatoid Arthritis, Sjögren syndrome, systemic sclerosis, antiphospholipid syndrome, celiac disease, primary biliary cirrhosis, and autoimmune diseases.
- The label is a luminescent molecule: (luminescence is the emission of visible or near-visible 300–800 nm).
  - Chemiluminescent methods
    - Direct—using enzyme markers (alkaline phosphatase with adamantyl 1, 2-dioxetane aryl phosphate (AMPPD) substrate and horseradish peroxidase with luminol or its derivatives as substrate).
    - Indirect—using antibody markers (alkaline phosphatase with adamantyl 1, 2-dioxetane aryl phosphate (AMPPD) substrate and horseradish peroxidase with luminol or its derivatives as substrate).
  - Either method may be competitive or non-competitive.
• Nephelometry/turbidimetry is based on the scattering or absorption of light by solid or colloidal particles suspended in solution.
• Used in immunology to determine the levels of several blood plasma proteins.
Antinuclear Antibodies (ANAs)

- Normally antibodies, produced by white blood cells (white blood cells) recognize and combat infectious organisms in the body.
- ANAs are produced by a person's immune system, and mistakenly directed towards normal, naturally-occurring proteins in our bodies.
- By itself, a positive ANA test does not indicate the presence of an autoimmune disease or the need for therapy.
- Diseases include lupus, scleroderma, Sjogren's syndrome, polymyositis/dermatomyositis, mixed connective tissue disease, drug-induced lupus, autoimmune hepatitis, and juvenile arthritis.

Immunofixation

- Used for identifying immunoglobulins in the blood.
**Direct & Indirect Immunofluorescence**

- Direct immunofluorescence uses a fluorophore-conjugated antibody to stain the target protein.
- Indirect immunofluorescence involves first binding the primary antibody to the target, then detecting the primary antibody using a conjugated secondary antibody.

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**Hematology**

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**Hemopoiesis**

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Viruses, Fungi and Parasites

Influenza virus
Herpes simplex
Aspergillus flavus
Candida albicans
Giardia lamblia
Malaria

Gram Stain

Plating a Microbial Specimen
Antimicrobial Susceptibility Tests

- Dilution Method
- Disc Diffusion Method


Steven S. Saliterman

Urinalysis


Anticoagulation

- Anticoagulant drugs are used in patients with:
  - Heart disease (including coronary artery disease and mural thrombi),
  - Atrial fibrillation (an arrhythmia),
  - Pulmonary embolism (clot in the lung vasculature),
  - Deep venous thrombophlebitis (DVT),
  - Artificial heart valves and other prosthetic cardiovascular devices, and
  - Other disorders.
- Coagulopathies include genetic and acquired deficiencies in coagulation factors, abnormal synthesis performance of the liver in hepatic (liver) diseases.
The International Normalized Ratio (INR)
- Created by the World Health Organization (WHO) because PT results can vary depending on the thromboplastin reagent used.
- The INR is a conversion unit that takes into account the different sensitivities of thromboplastins.
- The INR is widely accepted as the standard unit for reporting PT results.

**PT & INR Measurement**

Image courtesy of HemoSense Inc

**Arterial Blood Gases**

Summary

- Antibodies & Fluorophores
- Studies by categories include:
  - Chemistries & Immunology
  - Hematology
  - Microbiology
  - Urinalysis
  - Anticoagulation
  - Blood gases