Preparing for the American Board of Pathology (ABPath) Primary Examination of Fundamental Knowledge and Skills

Clinical Pathology

Content Specifications

Overview:

Clinical Pathology Content Specifications

This guide outlines the content that may appear on an American Board of Pathology Primary Certification examination.

Guidance: Residents are expected to have a mastery of material designated as Core/Foundational and at least achieved competence for material designated as Advanced Resident. This document also includes content that would be covered in Fellow-level training (shaded in blue) for which Residents should be superficially familiar.

Key to Designations:

C = Core/Foundational Knowledge

AR = Advanced Resident

F = Fellow/Advanced Practitioner

The exam assesses the knowledge, judgment, skills, and abilities needed to identify particular entities, appropriately process specimens (i.e., work-up), and diagnose and/or characterize disease by methods used in clinical pathology, including molecular methods. Residents are also referred to the Molecular Genetic Pathology Content Specifications document for an in-depth outline of content related to Molecular Pathology, in addition to that presented here.

The specific diseases listed in this document are important for trainees to know, but it is not possible to create a fully comprehensive list of all the material needed for certification and effective practice. This document should be used as a guide.

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Blood Banking/Transfusion Medicine

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2. Autoantibodies	AR
3. Clinical Features	AR
4. Laboratory Features	AR
5. Treatment/Transfusion	AR
6. Treatment/Pharmacologic	F
iii. Cold Hemagglutinin Disease	AR
1. Pathophysiology	AR
2. Autoantibodies	AR
3. Clinical Features	AR
4. Laboratory Features	AR
5. Treatment/Transfusion	AR

6. Treatment/Pharmacologic	F
iv. Paroxysmal Cold Hemoglobinuria	AR
1. Pathophysiology	AR
2. Autoantibodies	AR
3. Clinical Features	AR
4. Laboratory Features	AR
5. Treatment/Transfusion	AR
6. Treatment/Pharmacologic	F
v. Drug-Induced Immune Hemolytic Anemia	
1. General considerations	AR
2. Drug-Adsorption Mechanism	F
3. Drug-Dependent Antibody Mechanism	F
4. Autoimmune Induction Mechanism	F
b. Paroxysmal Nocturnal Hemoglobinuria	
i. General Considerations	AR
ii. Clinical Presentation and Course	F
iii. Causes and Pathogenesis	F
iv. Laboratory Features	F
v. Treatment-Transfusion	F
c. Anemia in Oncology Patients	C
i. Causes	C
ii. Clinical Features	C
iii. Management	
1. Growth Factors	AR
2. Transfusion Therapy	F
d. Immune Thrombocytopenia	
i. Classification, Epidemiology, and Causes	C
ii. General Tests to Investigate Thrombocytopenia	C
iii. Platelet Antibody Assays HLA/HPA	C
iv. Tests for Heparin-Induced Thrombocytopenia	C
v. Immune Thrombocytopenia	
1. Pathogenesis	C
2. Clinical Features	C
3. Laboratory Features	C
4. Treatment	C
5. Immune Thrombocytopenic Purpura in Pregnancy	AR
6. Acute Immune Thrombocytopenic Purpura of Childhood	AR
7. Chronic Immune Thrombocytopenic Purpura of Childhood	AR
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2. Neonatal Alloimmune Thrombocytopenia
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b. Neonatal Treatment AR
c. Prenatal Management AR
3. Platelet Transfusion Refractoriness
a. Causes, Mechanisms, and Management C
4. Post transfusion Purpura F
a. Pathophysiology and Clinical Features F
b. Treatment F
5. Passive Alloimmune Thrombocytopenia F
6. Transplantation-Associated Alloimmune Thrombocytopenia F
a. Hematopoietic Transplantation F
b. Solid Organ Transplantation F

e. Bleeding from Congenital and Acquired Coagulation Defects, and Antithrombotic Therapy
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3. Management of Bleeding C
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2. Hemorrhagic Disease of the Newborn C
3. Other Causes of Vitamin K Deficiency C
4. Treatment C
iii. Disseminated Intravascular Coagulation C
1. Pathophysiology C
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3. Laboratory Features C
4. Treatment C
iv. Coagulation Factor Inhibitors
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2. Factor VIII Inhibitors AR
3. Acquired von Willebrand Syndrome F
4. Factor V Inhibitors F
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v. Acquired Platelet Function Disorders
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    ii. Donor Selection and Criteria F
    iii. Donor Stimulation – Corticosteroids and G-CSF F
    iv. Product Collection F
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    vii. Infusion and Monitoring F
    viii. Adverse Events (Donor and Recipient) F
    ix. Clinical Outcomes F

2. Cell and Tissue Therapy

a. HLA Antigens and Alleles
    i. Major Histocompatibility Complex AR
    ii. Class I and II Antigens and Their Function AR
    iii. Polymorphism of HLA System and Nomenclature AR
    iv. Identification of HLA Antigens, Antibodies, and Alleles
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        2. Cellular Methods F
        3. Nucleic Acid-Based Methods F
        4. Crossmatching F
    v. Genotypes, Phenotypes, and Haplotypes F
    vi. Medical and Biological Significance of HLA
        1. Transplantation F
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b. Tissue Banking
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viii.	General Principles of Tissue Preservation and Clinical Use	F
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2.	Antigen-Specific T-cell Therapies	F
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iv.	Approaches to Improving Cellular Immunotherapy	F
v.	Adoptive Immunotherapy Regulatory Issues	F
d.	Gene Therapy in Transfusion Medicine	
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vi.	Urology	F
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1.	Regulation of Production	C
2.	Interaction with- and Effects on Erythroid Progenitor Cells	C
ii.	Nutritional Requirements for Erythropoiesis	C
iii.	Influence of Pathologic States on Erythropoiesis	C
b.	Oxygen Delivery and Use of Red Cells	
i.	Regulation of Systematic Oxygen Delivery	C
ii.	Regulation of Regional Oxygen Delivery	C
iii.	Regulation of Oxygen Delivery in the Microcirculation	C
1.	Red Cell Transfusion and the Microcirculation	C
2.	Effect of Red Cell Storage on Microcirculation (N Oxide)	C
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2.	Alternative Substrates	C
3.	Regulation of Energy Metabolism	C
4.	Synthetic Processes	C
5.	Membrane Metabolism	C
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7.	Rejuvenation	F
8.	Frozen Storage	F
9.	Validation of RBC Storage Systems	F
d.	Red Cell Immunology and Compatibility Testing	
i.	Red Cell Immunology	
1.	Immune Response – Components and Characteristics	C

2. Blood Group Antibodies
    a. Physical Properties & Characteristics C
3. Red Cell Antigen-Antibody Interactions C
    a. Direct Agglutination C
    b. Hemolysis C
    c. Antiglobulin test (DAT) C

ii. Compatibility Testing
1. Donor Testing C
2. Patient Testing C
    a. Specimen Collection C
    b. ABO Typing C
    c. Rh Typing C
    d. Tests for Unexpected Antibodies C
    e. Reagent Red Cells for Antibody Detection AR
    f. Automated Pre-Transfusion Testing AR
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4. Pre-Transfusion Testing C
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e. Carbohydrate Blood Groups and Blood Group Systems
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2. Antigenic Variants C
3. Secretion AR
4. Se and H genes AR
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6. Medical Implications of ABH and Secretor Systems F
    a. ABO-Incompatible Solid Organ Transplantation F
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ii. Lewis System AR
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iv. P System AR

f. Rh and LW Blood Group Systems
i. Rh Blood Group System – General Information & Nomenclature C

ii.	Rh Genes and Their Expressed Proteins	AR
iii.	Molecular Basis for Rh Antigen Expression	AR
1.	D Antigen	AR
2.	C/c and E/e Antigens	AR
3.	RH Genotyping	AR
iv.	Rh-membrane Complex	AR
v.	Immune Response to Rh	AR
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2.	Serologic Aspects	AR
3.	Molecular Aspects	AR
vi.	Rh Function	F
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1.	General Information	F
2.	Genes and Their Expressed Proteins	F
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i.	Kell and Kx Blood	
1.	Structure and Function of the Kell and XK Proteins	AR
2.	Kell-Transfusion Medicine Aspects	AR
a.	Transfusions	AR
b.	Hemolytic Disease of the Fetus and Newborn	AR
3.	Kell Variants	F
ii.	Duffy	
1.	Structure and Function of the Duffy Protein	AR
2.	Duffy-Transfusion Medicine Aspects	AR
a.	Transfusions	AR
b.	Hemolytic Disease of the Fetus and Newborn	AR
iii.	Kidd	
1.	Structure and Function of the Kidd Protein	AR
2.	Kidd-Transfusion Medicine Aspects	AR
a.	Transfusions	AR
b.	Hemolytic Disease of the Fetus and Newborn	AR
iv.	MNS	F
1.	Structure and Function of Glycoproteins A & B	F
2.	MNS – Transfusion Medicine Aspects	F
v.	Diego	F
vi.	Gerbich	F
vii.	Colton and GIL	F
viii.	Lutheran	F
ix.	Indian, Xg, and Scianna	F
x.	Chido/Rodgers	F
xi.	Knops	F
xii.	Cartwright, Dombrock, Cromer, and JMH	F

xiii.	OK and RAPH	F

4. Anemia and Red Blood Cell Transfusion

a.	Physiologic Adaptations to Blood Loss and Anemia	C
i.	Oxygen Transport to Blood Loss and Anemia	C
ii.	Adaptive Mechanisms in Anemia	C
iii.	Microcirculatory Effects of Anemia and Red Cell Transfusion	C
iv.	Pathophysiologic Processes and Anemia – Interactions	C
b.	Clinical Outcomes of Anemia and Red Cell Transfusion	C
i.	Risks of Anemia	C
ii.	Efficacy of Transfusion	C
3.	Adults	C
4.	Children	C
c.	Transfusion Guidelines	C
d.	Red Cell Transfusions – Decision Making	C
i.	The Bleeding Patient	C
ii.	The Surgical Patient	C
iii.	The Patient with Chronic Anemia	C
iv.	Transfusion Threshold	C
v.	Dose and Administration	C

5. Apheresis

a.	Apheresis: Principles and Technology of Hemapheresis	
i.	General Information and Principles	C
ii.	Current Devices and Technology	AR
iii.	Donor Apheresis	AR
1.	Donor Care	AR
2.	Specific Products and Procedures	AR
3.	Adverse Effects on Donors and Recipients	AR
iv.	Therapeutic Apheresis	AR
1.	Procedural and Technical Aspects	AR
a.	Substances Removed	AR
b.	Volume Removed	AR
c.	Replacement Fluids (Technical & Composition)	AR
d.	Schedule of Procedures (Timing, Number, & Location)	AR
e.	Vascular Access	AR
f.	Anticoagulant	AR
g.	Oversight	AR
h.	Adverse Effects	AR
b.	Therapeutic Plasma Exchange	
i.	General Principles	AR
1.	Mathematic Principles	AR

2.	Regulation of IgG Metabolism	AR
3.	Replacement Fluids (Clinical Aspects)	AR
4.	Selective Extraction of Plasma Components	AR
5.	Indication and Treatment Intensity Categories	AR
ii.	Neurologic Disorders	
1.	Guillain-Barré Syndrome	AR
2.	Chronic Inflammatory Demyelinating Polyneuropathy	AR
3.	Peripheral Neuropathy and Monoclonal Gammopathy	AR
4.	Myasthenia Gravis	AR
5.	Lambert-Eaton Myasthenic Syndrome	F
6.	Neuromyotonia and Limbic Encephalitis	F
7.	Stiff-Person Syndrome	F
8.	Paraneoplastic Neurologic Syndromes	F
9.	Nonneoplastic Disorders with CNS Antibodies	F
10.	Multiple Sclerosis	F
iii.	Hematologic and Oncologic Disorders	
1.	Thrombotic Thrombocytopenic Purpura	C
2.	Monoclonal Proteins	AR
3.	Blood Cell Alloantibodies	F
4.	Hemolytic Uremic Syndrome	F
5.	Posttransfusion Purpura	F
6.	Idiopathic (Immune) Thrombocytopenic Purpura	F
7.	Autoimmune Hemolytic Anemia	F
8.	Pure Red Cell Aplasia and Aplastic Anemia	F
9.	Coagulation Factor Inhibitors	F
iv.	Rheumatic and Other Immunologic Disorders	
1.	Goodpasture Syndrome	AR
2.	Cryoglobulinemia	F
3.	Rheumatoid Arthritis	F
4.	Systemic Lupus Erythematosus	F
5.	Rapidly Progressive Glomerulonephritis	F
6.	Solid Organ Transplantation	F
a.	Rejection	F
b.	Disease Recurrence	F
v.	Toxic and Metabolic Disorders	
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2.	Refsum Disease	F
3.	Drug Overdose and Poisoning	F
4.	Acute Liver Failure	F
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vi.	Therapeutic Phlebotomy	C
1.	Polycythemia Vera	C
2.	Secondary Erythrocytosis	C
3.	Hereditary Hemochromatosis	C

vii.	Red Cell Exchange	
1.	Principles and Techniques	AR
2.	Sickle Cell Disease	AR
3.	Acute and Emergent Complications	AR
a.	Indications and Management	AR
4.	Chronic Conditions or Preventive Strategies	AR
a.	Indications and Management	AR
5.	Malaria	F
6.	Babesiosis	F
viii.	Extracorporeal Photochemotherapy	
1.	Cutaneous T-cell Lymphoma	AR
2.	Graft-Versus-Host Disease	AR
3.	Techniques and Mechanisms	F
4.	Cardiac Allograft Rejection	F
ix.	Therapeutic Platelet Apheresis	F
1.	Primary Thrombocytosis	F
2.	Secondary Thrombocytosis	F
x.	Therapeutic White Cell Apheresis	F
1.	Hyperleukocytosis	F
2.	Inflammatory Bowel Disease	F
xi.	Selective Extraction of Low-Density Lipoproteins	F
1.	Principles, Indications, and Techniques	F

6. Hazards of Transfusion: Specific Adverse Events

a.	Hemolytic Transfusion Reactions	C
i.	Incidence	C
ii.	Signs and Symptoms	C
iii.	Complications	C
iv.	Causes	C
v.	Differential Diagnosis	C
vi.	Laboratory Investigation	C
vii.	Pathophysiology	C
viii.	Treatment	C
ix.	Prevention	C
b.	Febrile, Allergic, and Non-Immune Transfusion Reactions	
i.	Febrile Non-Hemolytic	C
1.	Description and Characteristics	C
2.	Causes	C
3.	Diagnosis	C
4.	Treatment	C
5.	Prevention	C
ii.	Allergic	
1.	Description and Characteristics	C

	2. Causes	C
	3. Diagnosis	C
	4. Treatment	C
	5. Prevention	C
iii.	Transfusion-Associated Circulatory Overload	C
	1. Description and Characteristics	C
	2. Causes	C
	3. Diagnosis	C
	4. Treatment	C
	5. Prevention	C
iv.	Anaphylactic and Anaphylactoid	AR
	1. Description and Characteristics	AR
	2. Causes	AR
	3. Diagnosis	AR
	4. Treatment	AR
	5. Prevention	AR
v.	Massive and Rapid Transfusion – Complications	AR
	1. Definitions and Description	AR
	2. Citrate Toxicity	AR
	3. Electrolyte and Acid/Base Disorders	AR
	4. Hypothermia	AR
	5. Microaggregate Reactions	AR
vi.	Special Transfusion Settings	AR
	1. Granulocyte Transfusion	AR
	2. Autologous Transfusion	AR
vii.	Toxic Reactions from Blood Manufacture or Processing	F
	1. Hypotension	F
	2. Ocular	F
	3. Plasticizer Toxicity	F
	4. Dimethyl Sulfoxide Toxicity &Cryopreserved Progenitor Cells	F
c.	Transfusion-Associated Graft-Versus-Host Disease	AR
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ii.	Incidence	AR
iii.	Risk Factors-General	AR
iv.	Fetuses and Neonates	AR
v.	Patient Populations at Risk	AR
	1. Congenital Immunodeficiency Syndromes	AR
	2. Malignancies	AR
	3. Hematopoietic Progenitor Cell Transplants	AR
	4. Solid Organ Transplants	AR
vi.	Immunocompetent Patients-Risk Factors	AR
vii.	Clinical Presentation and Diagnosis	AR
viii.	Treatment	AR
ix.	Prevention	AR

d.	Transfusion-Induced Iron Overload	AR
i.	Pathophysiology	AR
ii.	Iron Burden of Transfusions	AR
iii.	Clinical Features	AR
iv.	Measurement of Iron Burden	AR
v.	Management	AR
1.	Goals	AR
2.	Chelation Therapy	AR
e.	Transfusion-Related Acute Lung Injury	C
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ii.	Clinical Features	C
iii.	Pathophysiology	C
1.	Acute Lung Injury-Features	C
2.	Causes	C
3.	Mechanisms of Lung Damage	C
4.	Multiple Hit/Threshold Theory	C
iv.	Diagnosis and Differential Diagnosis	C
1.	Clinical, Physiologic, Radiologic, & Laboratory Features	C
2.	Consensus Definition	C
v.	Treatment and Management	C
vi.	Donor Investigation	C
vii.	Prevention	C
f.	Posttransfusion Purpura	AR
i.	Pathophysiology and Clinical Features	AR
ii.	Treatment	AR
g.	Transfusion-Associated Dyspnea	C

7. Plasma Components and Derivatives

a.	Plasma Composition	
i.	General Features and Factors Influencing Plasma Composition	C
ii.	Albumin	C
iii.	Immunoglobulins	C
iv.	von Willebrand Factor Cleaving Protease	AR
v.	Coagulation Factors, Coagulation Factor Inhibitors, and von Willebrand Factor (e.g., description, half-life)	AR
vi.	Alpha-1-Antitrypsin	F
vii.	C1 Inhibitor	F
b.	Preparation of Plasma Derivatives	
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1.	Prothrombin Complex Concentrate (PCC)	C
ii.	Adverse Effects	C
iii.	Plasma Procurement	AR
iv.	Pathogen Inactivation/Removal	AR
v.	Plasma Manufacture	F

vi.	Industry Safety Programs	F
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1.	Recombinant Factor VIIa	F

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i.	Fresh Frozen, Frozen, Cryo-Poor, Thawed & Stored Plasma	C
1.	Manufacture and Features	C
2.	Clinical Use, Indications, and Guidelines for Use	C
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b.	Massive Transfusion, Trauma, and Disseminated Intravascular Coagulation	C
c.	Intensive Care	C
d.	Liver Disease	C
e.	Warfarin Reversal	C
f.	Therapeutic Apheresis	C
3.	Dosing	C
4.	Risks and Adverse Effects	C
5.	Pathogen-Inactivated Plasma	C
ii.	Cryoprecipitate	C
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2.	Clinical Use, Indications, and Guidelines for Use	C
3.	Risks and Adverse Effects	C
iii.	Albumin	AR
1.	Manufacture and Features	AR
2.	Clinical Use, Indications, and Guidelines for Use	AR
3.	Risks and Adverse Effects	AR
iv.	Rh Immune Globulin	AR
1.	Manufacture and Features	AR
2.	Clinical Use, Indications, and Guidelines for Use	AR
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v.	IVIG	AR
1.	Manufacture and Features	AR
2.	Clinical Use, Indications, and Guidelines for Use	AR
3.	Risks and Adverse Effects	AR
vi.	Other Plasma Derivatives	
1.	Fibrinogen Concentrates	AR
2.	Alpha-1-Antitrypsin	F
3.	C1 Inhibitor	F

8. Infectious Hazards of Transfusion

a. Transfusion-Transmitted Hepatitis

i.	Incidence	C
ii.	Hepatitis B Virus	C
1.	Epidemiology	C

2.	Transmission	C
3.	Clinical Features	C
a.	Acute Infection	C
b.	Chronic Infection	C
4.	Serologic and Molecular Markers of Infection	C
5.	Donor Testing and Counseling	C
6.	Prevention	C
7.	Treatment	C
iii.	Hepatitis C Virus	C
1.	Epidemiology	C
2.	Transmission	C
3.	Clinical Features	C
a.	Acute Infection	C
b.	Chronic Infection	C
4.	Prevention	C
5.	Treatment	C
iv.	Hepatitis A Virus	F
1.	Epidemiology	F
2.	Transmission	F
3.	Clinical Features	F
4.	Donor Testing and Counseling	F
5.	Prevention	F
6.	Treatment	F
v.	Hepatitis D	F
1.	Epidemiology	F
2.	Diagnosis	F
3.	Transmission	F
4.	Clinical Features	F
5.	Prevention	F
vi.	Hepatitus E Virus	F
1.	Epidemiology	F
2.	Diagnosis	F
3.	Transmission	F
4.	Clinical Features	F
5.	Prevention	F

b. Retroviruses

i.	Overview	C
ii.	Human Immunodeficiency Virus	C
1.	General Information and Epidemiology	C
2.	Incidence and Prevalence Among Blood Donors	C
3.	Window Period and Risk of Transmission	C
4.	Donor Testing and Counseling	C

5. Clinical Features	C
6. Prevention	C
7. Treatment	C
iii. Human T-cell Lymphotropic Viruses (HTLV I/II)	F
1. General Information and Epidemiology	F
2. Incidence and Prevalence Among Blood Donors	F
3. Window Period and Risk of Transmission	F
4. Donor Testing and Counseling	F
5. Clinical Features	F
6. Prevention	F
7. Treatment	F
c. Cytomegalovirus (CMV)	
1. General Information and Epidemiology	C
2. Incidence and Prevalence Among Blood Donors	C
3. Clinical Features	C
4. Prevention	C
5. Treatment	C
6. Window Period and Risk of Transmission	AR
7. Donor Testing and Counseling	AR
d. Other Viruses	
i. Other Herpesviruses	C
ii. West Nile Virus	AR
1. General Information and Epidemiology	AR
2. Transmission	AR
3. Donor Testing and Counseling	AR
4. Clinical Features	AR
5. Prevention	AR
iii. Parvovirus B19	F
1. General Information and Epidemiology	F
2. Transmission	F
3. Clinical Features	F
iv. Zika, Dengue, and Chikungunya	F
e. Transfusion Transmission of Parasites	
i. Chagas Disease	
1. General Information and Epidemiology	AR
2. Transmission	AR
3. Donor Testing and Counseling	AR
4. Clinical Features	F
5. Prevention	F
ii. Malaria	
1. General Information and Epidemiology	AR
2. Transmission	AR
3. Donor Testing and Counseling	AR
4. Clinical Features	F

5.	Prevention	F
iii.	Babesiosis	
1.	General Information and Epidemiology	AR
2.	Transmission	AR
3.	Donor Testing and Counseling	AR
4.	Clinical Features	F
5.	Prevention	F
iv.	Leishmaniasis	
1.	General Information and Epidemiology	F
2.	Transmission	F
3.	Donor Testing and Counseling	F
4.	Clinical Features	F
5.	Prevention	F
f.	Bacterial Contamination of Blood Products	AR
i.	Red Blood Cells – Overview and Epidemiology	AR
ii.	Allogeneic RBCs – Agents and Incidence	AR
iii.	Autologous RBCs – Agents and Incidence	AR
iv.	Plasma, Cryoprecipitate, and Derivatives – Agents and Incidence	AR
v.	Platelets	AR
1.	Sources of Contamination	AR
2.	Agents and Incidence	AR
3.	Clinical Features	AR
4.	Treatment	AR
5.	Prevention	AR
vi.	Strategies to Reduce the Risk of Posttransfusion Sepsis	AR
1.	Donor Screening	AR
2.	Skin Preparation	AR
3.	Diversion	AR
4.	Apheresis versus Whole Blood-Derived Platelets	AR
5.	Storage Time and Temperature	AR
6.	Bacterial Detection	AR
7.	Bacterial Elimination	AR
8.	Syphilis	AR
g.	Prion Diseases	F
i.	General Information and Epidemiology	F
ii.	Transmission	F
iii.	Clinical Features	F
iv.	Risk Management – Donor Selection	F
v.	Blood Component Processing	F
vi.	Plasma Derivative Manufacture	F
vii.	Cellular, Tissue, and Organ Transplantation	F
h.	Pathogen Inactivation	
i.	Overview and Description	AR
ii.	Plasma	

1.	Psoralen Ultraviolet Light Treatment	C
2.	Solvent/Detergent Treatment	AR
3.	Methylene Blue Light Treatment	AR
4.	Riboflavin Light Treatment	AR
iii.	Platelets	
1.	Psoralen Ultraviolet Light Treatment	C
2.	Riboflavin Light Treatment	AR
3.	Thionine Light Treatment	AR
iv.	Red Cells	F
1.	Alkylating Agents	F
2.	Photosensitizers	F
3.	Riboflavin Light Treatment	F
v.	Emerging Technologies	F

9. Blood Donors and Blood Collection

a.	Recruitment and Screening of Donors and the Collection, Processing and Testing of Blood	
i.	Organization of Blood Services	
1.	United States	C
2.	Outside the United States	F
ii.	Blood Donor Recruitment	AR
iii.	Collection Process	
1.	Donor Evaluation	AR
a.	Consent	AR
b.	History & Physical Examination	AR
c.	Laboratory Testing	AR
d.	Deferral Criteria	AR
2.	Blood Collection	AR
a.	Whole Blood	AR
b.	Component Separation	AR
c.	Leukocyte Reduction	AR
d.	Automated Collection	AR
3.	Blood Component Testing	AR
a.	ABO/Rh	AR
b.	Antibody Screening	AR
c.	Infectious Disease	AR
4.	Distribution	AR
5.	Source Plasma	AR
iv.	Blood Donor Adverse Events	
1.	Donor Reactions	AR
a.	Categories	AR
b.	Incidence	AR
c.	Clinical Features	AR

d. Risk Factors	AR
e. Treatment	AR
f. Prevention	AR
2. Phlebotomy-Related	AR
a. Categories	AR
b. Incidence	AR
c. Clinical Features	AR
d. Risk Factors	AR
e. Treatment	AR
f. Prevention	AR
3. Long-Term Effects of Donation	F
a. Iron	F
b. Platelets	F
c. Plasma Proteins	F

10. Surgery Patients

a. Alternatives to Transfusion: Perioperative Blood Management	AR
i. Preoperative	AR
1. Autologous Blood Donation	AR
2. Anemia Optimization	AR
a. Iron	AR
b. Erythropoietin	AR
ii. Intraoperative/Postoperative	AR
1. Acute Normovolemic Hemodilution	AR
2. Intraoperative Autologous Blood Recovery and Reinfusion (Cell Salvage)	AR
3. Postoperative Autologous Blood Recovery and Reinfusion	AR
b. Hemostasis for Surgery/Invasive Procedures	
iii. Preprocedure Blood Components	
1. Common Laboratory Tests of Hemostasis and Their Relationship with Procedure-Related Bleeding	C
2. Procedure-Related Bleeding	
a. Central Venous Catheter	AR
b. Liver Biopsy	AR
c. Thoracentesis and Paracentesis	AR
d. Gastrointestinal Endoscopy and Biopsy	AR
e. Procedures on Upper Airway, Bronchoscopy, and Transbronchial Lung Biopsy	AR
f. Renal Biopsy	AR
g. Epidural Anesthesia, Lumbar Puncture, and Neurosurgical Procedures	AR
h. Angiography	AR
iv. Treatment of Bleeding	F

3. Local F
   a. Physical – Sutures, Electrocautery, Compression, Direct Packing, etc. F
   b. Topical Agents F
   c. Topical Sealants F
   d. Topical Thrombin F
   e. Topical Antifibrinolytics F
4. Generalized F
   a. Skin and Membrane F
   b. Purpura and Soft Tissue F
   c. Small Vessel Bleeding During Surgery F
   d. DDAVP F

c. Transfusion Therapy for Trauma and Burn Patients

i. Shock

1. General Information and Definition C
2. Hemorrhagic Shock and Classification C
   a. Acidosis C
   b. Hypothermia C
   c. Coagulopathy C
3. Trauma Patient
   a. Initial Resuscitation
      a. Damage Control C
      b. Blood Component Therapy C
      c. Hemostatic Agents AR
      d. Pharmacologic Agents AR
   b. Intraoperative
      a. Blood Component Therapy C
      b. Damage Control AR
      c. Temperature AR
      d. Autotransfusion AR
      e. Solid Organ Injury AR
      f. Hemostatic Agents AR
      g. Pharmacologic Agents AR
   c. Recovery Phase C
      a. Blood Component Therapy C
   d. Massive Transfusion C
      a. Definition C
      b. Blood Component Therapy C
      c. Complications C
4. Patients with Thermal Injuries (Burns) F
   a. Initial Resuscitations F
      a. Fluid Therapy F
         1. Colloid F
         2. Crystalloid F

b. Transfusion Therapy		F
c. Hemostatic Agents		F
d. Pharmacologic Agents		F
d. Transfusion Therapy in Solid Organ Transplantation		
i. Organ Procurement and Transplants		F
ii. Immunologic Barriers – ABO and HLA		AR
a. Across Immunologic Barriers		AR
b. Organ Selection		AR
c. Plasma Exchange		F
d. Pharmacologic Agents		F
iii. Immunohematology		AR
a. Patient Alloantibodies		AR
b. Passenger Lymphocyte Antibodies		AR
iv. Transfusion Therapy		AR
a. Liver		AR
b. Heart		AR
c. Lung		AR
d. Kidney		AR
e. Pancreas		AR
f. Other		AR
v. Special Needs		AR
a. CMV Low Risk		AR
b. Leukocyte Reduction		AR
c. Irradiation		AR

11. Biovigilance and Transfusion-Related Immunomodulation

a. Biovigilance/Hemovigilance	F
i. Requirements for Effective Program	F
ii. Scope	F
1. Reporting Criteria	F
a. Adverse Reactions	F
b. Adverse Incidents	F
c. Near Misses	F
2. Biovigilance	F
a. Passive Reporting versus Active Surveillance	F
b. Traceability	F
3. Blood Donors	F
4. Transfusion Recipients	F

12. Platelets

a. Platelet Production (Thrombopoiesis)	C
i. Megakaryocyte Development, Maturation, and Differentiation	C
ii. Thrombopoietic/Megakaryocyte/Hematopoietic Growth Factors	C

iii. Genetic and Cellular Regulation of Thrombopoiesis	C
iv. Platelet Production, Shedding, and Release	C
b. Platelets and Hemostasis	C
i. Normal Platelet Plug and Clot Formation	C
ii. Genetic/Congenital Platelet Disorders	C
iii. Acquired Platelet Disorders	C
c. Platelet Transfusions	
i. Collection and Storage of Platelet Preparations/Concentrates	C
ii. Clinical Platelet Transfusions (Indications, Dose, and Schedule)	C
iii. Alternatives to Platelet Transfusions (Thrombopoietic & Pharmacologic Agents)	AR
d. Platelet Immunity	AR
i. Platelet Antigens (ABO, HLA, Platelet Specific)	AR
ii. Disorders of Platelet Alloimmunization	AR
iii. Platelet Autoimmunity	AR
e. Platelets in the Bloodstream	AR
i. Platelet Circulation, Distribution, and Destruction	AR
ii. Platelet Survival Kinetics in Health and Disease	AR

13. Neutrophils

a. Neutrophil/Granulocyte Transfusions – Primary Clinical Issues	AR
i. Neutrophil Collection, Storage, and Transfusion	AR
ii. Alternatives to Neutrophil Transfusions (Myelopoietic Factors)	AR

14. Intravascular Cell Kinetics **F**

a. Concepts of Post-Transfusion Recovery and Tracking Labeled/Tracer Cells	F

15. Obstetric and Pediatric Patients

a. Hemolytic Disease of the Fetus and Newborn	
i. ABO Incompatibility	C
ii. Rh(D) and Other Fetal-Maternal RBC Incompatibilities	C
iii. Management	AR
1. Diagnostic and Surveillance Tests	AR
2. Fetal and Neonatal Transfusions, Phototherapy, IVIG, etc	AR
b. Obstetric Transfusion Practices	AR
i. Maternal Hematologic Disorders During Pregnancy	AR
ii. Maternal Hemorrhagic and Transfusions During Pregnancy	AR
iii. Fetal (Intrauterine) Transfusions	AR
c. Congenital Disorders of Clotting and Anticoagulant Protein	
i. Developmental Physiology of Plasma Proteins	C
ii. Hemophilia A, B, and von Willebrand Disease	
1. Pathophysiology and Treatment	C

2. DDAVP C
3. Congenital Disorders of Non-Hemophilia Clotting Proteins F
4. Congenital Disorders of Anticoagulant/Prothrombotic Proteins F

d. Congenital Hemoglobinopathies and Hemolytic Anemias
   i. Sickle Cell Disease (Pathophysiology and Treatment) C
   ii. Non-Sickle Cell Hemoglobinopathies C
   iii. Thalassemias (Pathophysiology and Treatment) C
   iv. Congenital Red Cell Membrane and Enzyme Defects AR

e. Neonatal Transfusions
   i. Anemia of Prematurity (Pathophysiology and Treatment) C
   ii. Thrombocytopenia of Prematurity (Pathophysiology and Treatment) C
   iii. Neonatal Blood Banking Practices (Dedicated Units, WBC-Reduction, Irradiation, etc.) AR
   iv. Neonatal/Infant Plasma, Cryoprecipitate, and Neutrophil Transfusions AR

16. Hematopoietic Progenitor Cell (HPC) Transplantation

a. Biology of Marrow Transplantation
   i. Autologous AR
   ii. Allogeneic/Syngeneic AR
   iii. Indications, Methods, Results, and Adverse Effects F

b. Biology of HPC and HPC Transplantation
   i. HLA Typing for HPC Transplantation AR
   ii. HPC Biology F
   iii. Identification and Measurement of HPC F
   iv. Allogeneic/Syngeneic Donor Selection, Quantification, Eligibility F
   v. Processing Requirements for HPC F
      1. General F
      2. Patient-Specific F
   vi. Regulatory, Compliance, and Accreditation F

c. HPC Sources and Collection AR
   i. HPC Apheresis – Characteristics and Adverse Effects AR
      1. Biology of Stem Cell Mobilization AR
      2. Apheresis Consideration
         a. Techniques, Vascular Access, Donor Management, and Adverse Events (Allogeneic vs. Autologous) AR
      3. Mobilization Regimens
         a. Indications, Dose, Schedule, Efficacy, and Adverse Effects F
            Chemotherapy F
            Growth Factors – G-CSF, GM-CSF F
            Adhesion Blockers-Plerixafor F
         b. Scheduling Mobilization and Apheresis Collection F

c. Monitoring Mobilization and HPC Collection	F
d. Collection of Lymphocytes for Infusion (Donor Lymphocyte Infusion [DLI])	F
4. Scheduling Mobilization and Apheresis Collection	F
ii. HPC-Marrow	F
1. Methods of Harvesting	F
2. Characteristics	F
3. Adverse Effects	F
iii. HPC Cord Blood	
1. Characteristics and Methods	F
a. Cord Blood Banking Donor Eligibility, Collection Methods, Processing, Testing, and Cryopreservation	F
b. Cord Blood Characteristics	F
c. Donor Selection for Transplant (Related and Unrelated)	F
iv. Selection of Appropriate HPC Source for a Given Patient	F
d. HPC Processing – Goals, Guidelines, and Methods (Preparation for Infusion)	F
i. HPC for Autologous Transplants	F
ii. HPC for Allogeneic Transplants	F
1. Indications for Plasma, RBC Reduction	F
iii. Preparation for Cells for Donor Lymphocyte Infusion	F
iv. Cord Blood	F
v. Processing of Other CT Products (e.g., Antigen-Directed T-cells, Marrow Stromal Cells)	F
e. HPC Storage and Preservation	F
i. Liquid Storage and Transport -Anticoagulant, Time, Temperature, Preservative, Cell Concentration	F
ii. Rationale for Cryopreservation	F
iii. Cryopreservation Theory and Practice	F
1. Cryoprotectants	F
2. Cryopreservation Techniques -Controlled Rate, “Dump Freeze”	F
3. Storage -Mechanical and Liquid Nitrogen (Vapor vs. Liquid)	F
f. Management of RBC Antigen Incompatibility in Allogeneic Transplantation	
i. Patient Transfusion Management	AR
1. Major or Minor ABO Incompatibility	AR
a. Immediate vs. Delayed Hemolysis	AR
2. Passenger Lymphocyte Syndrome (PLS)	AR
a. Cause, Diagnosis, Course, Therapy, Prevention	AR
ii. Graft Management -Depletion of RBC (Major), Plasma (Minor)	F
g. HPC Assessment – Pre- and Post-Processing and Post Thaw	F
i. Cell Counts and Methods	F

ii. HPC Measurement and Enumeration	F
1. Flow Cytometry	F
2. Non-Flow Methods	F
iii. HPC Viability Assessment Techniques	F
iv. HPC Cell Culture Assays	F
v. HPC Functional and Differentiation Assays	F
vi. HPC Microbial Assessment	F
1. Gram Stain and Cultures	F
h. Cell Selection Methods and Applications	F
i. Positive and Negative Selection	F
1. Techniques, Results, Indications	F
ii. CD34 Cells and Others (e.g., Treg)	F
iii. Tumor Purging and T-cell Depletion	F
i. HPC and CTP Thawing and Post-Thaw Processing	
i. (Apheresis, Marrow, Cord Blood, etc.)	F
ii. Direct HPC Infusion vs. Pre-Infusion Cell Washing	F
iii. Special Considerations for Preparation of Cord Blood HPC for Infusion	F
j. HPC and CTP Infusion	F
i. General Guidelines	F
1. Filters, No Irradiation, Infusion Rate DMOS Limits, Infusion Pumps	F
ii. Adverse Effects and Infusion Reactions	
1. Incidence, Causes, Diagnosis, and Management	F
iii. Management and Infusion of Contaminated Products	F
k. Engraftment	
i. Definition, Chimerism, Relationship to CD34+ Cell Doses	F
ii. Rates – Autologous vs. Allogeneic, Related vs. MUD, HPC Source, Conditioning	F
iii. Engraftment Failure – Causes and Management	F
iv. Immune Reconstitution Post-Transplant	F
v. Donor Lymphocyte Infusion – Rationale, Efficacy	F
l. HPC Laboratory Quality Assurance and Accreditation	F
i. AABB, FACT, CAP, NMDP	F
ii. Regulatory Considerations	F
Federal GMP, GTP, State Supplies, Laboratory Development, Deviations, Non-Conforming HPC and CTP	F
m. Laboratory Administration	
i. Staff Hiring and Training	F
ii. Facilities	F
iii. Equipment and Supplies	F
iv. Laboratory Development	F
v. Deviations, Non-Conforming HPC and CTP	F
n. Experimental Cell Therapies	

i.	Institutional vs. Commercially Sponsored	F
ii.	Types (e.g., Marrow Stromal, Adoptive Therapy with T-cells, Genetically-Modified Cells)	F
iii.	Special Requirements for Processing (Clean Room, etc.)	F
iv.	Regulatory Considerations	F

17. Blood Bank/Transfusion Medicine-Specific Administration and Laboratory Management

a.	Current Legal Issues	
i.	Blood Transfusion Injury Claims	
1.	Informed Consent	C
2.	Blood Shield Laws	F
3.	Negligence	F
4.	Standard of Care	F
5.	Causation	F
ii.	HIPAA Privacy Rule	C
iii.	Donor Injury	F
iv.	Cord Blood	F
v.	Tissue Banking	F
b.	Current Good Manufacturing Practice	
i.	General Overview	C
ii.	Licensing Products and Establishments	AR
iii.	Recalls and FDA Enforcement Activities	AR
iv.	Safety Initiatives	AR
v.	Enforcement Options	AR
vi.	Rationale	AR
1.	Standard Operating Procedures	AR
2.	Record Keeping	AR
3.	Personnel and Training	AR
4.	Calibration	AR
5.	Validation	AR
6.	Labeling	AR
7.	Error Management	AR
8.	Quality Control Unit and Internal Audits	AR
9.	Facilities and Equipment	AR
10.	Process and Production Controls	AR
vii.	Information Management	AR
viii.	Common Violations	AR
c.	Hospital Transfusion Services, Transfusion Committee, and Quality Assurance	
i.	Role of the Medical Director	AR
1.	Administrative	AR
2.	Clinical	AR
3.	Education	AR
ii.	Quality Assurance	AR

1. Process Control AR
2. Error Management AR
3. Improving Transfusion Practice AR

iii. Regulatory and Accreditation Requirements AR
1. Food and Drug Administration AR
2. AABB AR
3. Joint Commission AR
4. College of American Pathologists AR

iv. Transfusion Committee AR
1. Membership AR
2. Functions AR
3. Oversight of Transfusion Policies, Procedures and Guidelines AR
4. Education AR

v. Other Administrative Issues AR

d. Transplant Organizations and Networks in the Regulation of Cellular and Tissue Therapy Programs

i. Hematopoietic Progenitor Cells F
1. Sources F
2. Indications F
3. HLA Matching F
4. Donor Registries and Networks, Outcomes Registries, Professional Associations and Networks F
5. Accreditation Organizations F

ii. Other Cellular Therapies F
1. Organizational Aspects F
2. Accreditation and Regulation F

iii. Tissue Banks F
1. Organizational Aspects F
2. Accreditation and Regulation F

Chemical Pathology

1. Analytical Techniques and Safety

a. Concept of Solute and Solvent
i. Expressing Concentrations of Solutions C

b. Units of Measurement
i. International Units, Decimal Multiples, and Submultiples of SI units C
ii. Problem Areas in the Use of SI Units C
iii. Standardized Reporting of Test Results C

c. Safety C

d. Basic Measurement Techniques and Procedures
i. Centrifugation C
ii. Controlling Hydrogen Ion Concentration (Buffer Solution) C

iii. Procedures for Processing Solutions (Dilution, Evaporation, Filtration)	AR
iv. Viscosity	AR
v. Extraction	F
vi. Gravimetry	F
vii. Measurement of Radioactivity	F
e. Interference with Testing, General	AR
f. Chemicals	
i. Reagent Grade and Analytical Reagent Grade Water	AR
ii. Ultrapure Reagents	F
g. Reference Materials (Primary, Secondary, Standard, Certified)	F

2. Specimen Collection and Processing

a. Patient Preparation	C
b. Handling of Specimens for Testing	C
i. Maintenance of Specimen Identification	C
ii. Preservation of Specimens in Transit	C
iii. Separation and Storage of Specimens	C
iv. Transport of Specimens	C
c. Specimens	
i. Blood	
1. Venipuncture (Prolonged Occlusions; Order of Draw)	C
2. Additives (EDTA, Heparin, Citrate, Fluoride, Oxalate, ACD, Gel)	C
3. Infant (Heel Stick, Small Needles)	C
4. Hemolysis	C
ii. Urine (Timed, Random, Preservatives)	C
iii. Cerebrospinal Fluid	C
iv. Pleural, Pericardial, and Ascitic Fluids	C
d. Feces (Timed, Random)	AR
e. Synovial Fluid	AR
f. Amniotic Fluid (Amniocentesis)	AR
g. Saliva	AR
h. Solid Tissue	F
i. Hair and Finger Nails	F

3. Optical Techniques

a. Nature of Light	C
b. Spectrophotometry (Beer's Law, Wavelengths, Calibration, Performance Checks)	C
c. Fluorometry	AR
d. Chemiluminescence, Bioluminescence, Electrochemiluminescence	AR

e.	Nephelometry and Turbidimetry	AR
f.	Atomic Absorption Spectrophotometry	F

4. Electrochemistry and Chemical Sensors

a.	Potentiometry and Ion-Selective Electrodes	AR
b.	Voltammetry/Amperometry	AR
c.	Conductometry	F
d.	Coulometry	F
e.	Optical Chemical Sensors	F
f.	Biosensors	F

5. Electrophoresis

a.	Theory of Electrophoresis	C
b.	Conventional Electrophoresis (Slab Gel, IEF, 2-D)	C
c.	Capillary Electrophoresis	C

6. Chromatography

a.	Separation Mechanisms and Concepts (Retention Factor, Efficiency)	C
i.	Ion-Exchange Chromatography	AR
ii.	Partition Chromatography	AR
iii.	Adsorption Chromatography	AR
iv.	Affinity Chromatography	AR
v.	Size-Exclusion Chromatography	AR
b.	Column Chromatography	AR
i.	Gas Chromatography	AR
ii.	Liquid Chromatography	AR
c.	Qualitative and Quantitative Analyses in Chromatography	AR
i.	Analyte Identification	AR
ii.	Analyte Quantification	AR

7. Mass Spectrometry

a.	Basic Concepts and Definitions	AR
b.	Clinical Applications	
i.	Gas Chromatography-Mass Spectrometry	AR
ii.	Liquid Chromatography	AR
iii.	MALDI-TOF Mass Spectrometry	AR
iv.	ICP Mass Spectrometry	AR
v.	SELDI Mass Spectrometry	F
vi.	TOF Mass Spectrometry	F
c.	Instrumentation	
i.	Ion Source	F
ii.	Vacuum System	F

iii.	Mass Analyzers, Ion Detectors, and Tandem Mass Spectrometers	F
d.	Proteomics	F
e.	Analytical Problem of Ion Suppression	F

8. Enzyme and Rate Analyses

a.	Basic Principles of Enzymology	C
b.	Analytical Enzymology	
i.	Measurement of Reaction Rates	AR
ii.	Measurement of Enzyme Mass Concentration	AR
iii.	Enzymes as Analytical Reagents	AR
iv.	Measurement of Isoenzymes and Isoforms	AR
v.	Units for Expressing Enzyme Activity	F
vi.	Measurement of Substrates	F
vii.	Optimization, Standardization, and Quality Control of Enzymes	F
c.	Enzyme Kinetics	
i.	The Enzyme-Substrate Complex	F
ii.	Factors Governing the Rate of Enzyme-Catalyzed Reactions (Michaelis-Menton, Temperature, Substrate Concentration, pH, Inhibitor)	F

9. Principles of Immunochemical Techniques

a.	Basic Concepts	
i.	General Characteristics of Antigen-Antibody Reaction	C
ii.	Characteristics of Antibodies (Polyclonal, Monoclonal)	C
iii.	Characteristics of Antigens and Immunogens	AR
b.	Overview of General Principles of Immunoassay	
i.	Classes of Immunoassay	C
ii.	Competitive Immunoassays	C
iii.	Noncompetitive Immunoassay (Sandwich, ELISA)	C
iv.	Interferences in Immunoassays (HAMA, Macromolecules)	C
v.	High-Dose Hook Effect	C
c.	Antigen Antibody Binding	
i.	Antigen Excess	C
ii.	Binding Forces	F
iii.	Reaction Mechanism	F
iv.	Kinetics of Antigen-Antibody Reaction	F
v.	Factors Influencing Binding (Ionic Strength, Polymer Effect)	F
d.	Qualitative Methods	
i.	Immunofixation Electrophoresis (IFE)	C
ii.	Western Blotting	AR
iii.	Dot Blotting	AR
iv.	Principle of Precipitin Reaction	F

e. Quantitative Methods
    i. Turbidimetric and Nephelometric Assay C
    ii. Particle Immunoassay
        1. Latex Turbidimetric Assay C
        2. Latex Agglutination AR
        3. Hemagglutination F
        4. Gelatin Particle Agglutination F
f. Enzyme Immunoassays
    i. Heterogeneous Immunoassays C
        1. Enzyme Immunoassays AR
        2. Fluorescent Immunoassays AR
        3. Chemiluminescent Immunoassays AR
    ii. Homogeneous Immunoassays (e.g., EMIT, CEDIA) C
g. Simultaneous Multiple Immunoassays (e.g., Flow Cytometry, Luminex) AR

10. Point-of-Care Testing

a. Analytical and Technological Considerations
    i. Requirements and Design C
    ii. POCT Applications & Assays C
        1. Drugs of Abuse C
        2. Urinalysis C
        3. Glucose Strips and Meters C
        4. Hematology & Coagulation C
        5. Infectious Disease C
        6. Pregnancy Test C
        7. Blood Gases, Electrolytes, Other C
        8. Transcutaneous Bilirubin F
b. Implementation Considerations for POCT AR

11. Peptides and Proteins

a. Interpretation of Protein Electrophoresis & Immunofixation
    i. Serum, Non-Monoclonal Gammopathy
        1. Hepatic Cirrhosis C
        2. Bisalbumin C
        3. Acute Phase Reaction C
        4. Chronic Inflammation C
        5. Alpha-1-Antitrypsin C
        6. Fibrinogen C
        7. Hypogammaglobulinemia C
        8. Nephrotic Syndrome C
        9. Hemolysis AR
        10. Radio Contrast Dyes F

11. IgG4	F
ii. Serum, Monoclonal Gammopathy (Myeloma, MGUS, Waldenström)	
1. IgG, IgA Paraproteins	C
2. IgM Paraproteins	C
3. IgD, IgE Paraproteins	C
4. Kappa & Lambda Light Chains	C
5. Cryoglobulins	C
6. Therapeutic Antibodies	C
iii. Urine, Non-Monoclonal Gammopathy	C
iv. Urine, Monoclonal Gammopathy	C
1. Intact Immunoglobulin	C
2. Light Chain (Bence Jones)	C
v. Light Chains, Serum	
vi. CSF Electrophoresis	AR
1. Beta-Transferrin in CSF	AR
2. CSF Findings in Multiple Sclerosis (Oligoclonal immunoglobulin bands in CSF, Albumin, IgG)	AR

12. Enzymes

a. Muscle Enzymes	
i. Creatine Kinase	C
b. Liver Enzymes	
i. Aminotransferases	C
ii. Alkaline Phosphatase	C
iii. Gamma-Glutamyl Transferase	C
c. Pancreatic Enzymes	
i. Amylase	C
ii. Lipase	C
d. Red Cell Enzymes	
i. Hexose Monophosphate Pathway (G6PD)	AR
ii. The Embden-Meyerhof Pathway (Pyruvate Kinase)	F
e. Bone Enzymes	
i. Alkaline Phosphatase (Bone Isoform)	F
ii. Acid Phosphatase	F
f. Other Enzymes	
i. Lactate Dehydrogenase	C
ii. Cholinesterase	AR

13. Tumor Markers

a. Clinical Utility of Tumor Markers	
i. Distribution of Tumor Marker Values	C

ii.	Disease Management using Tumor Markers	C
b.	Individual Tumor Markers	
i.	Prostate-Specific Antigen	C
ii.	Alpha Fetoprotein	C
iii.	Beta-2-Microglobulin	C
iv.	Carcinoembryonic Antigen	C
v.	CA 15-3/CA27.29	C
vi.	CA 125	C
vii.	CA 19-9	C
viii.	Thyroglobulin and Antibodies	C
ix.	Calcitonin	AR
x.	S-100 Proteins	F
xi.	Chromogranins	F
xii.	Neuron-Specific Enolase	F

14. Carbohydrates

a.	Chemistry of Carbohydrates, including Disaccharides, Polysaccharides, and Glycoproteins	C
b.	Metabolism of Carbohydrates	
i.	Digestion and Absorption of Carbohydrates	AR
ii.	Intermediary Metabolism of Carbohydrates	AR
iii.	Regulation of Blood Glucose Concentration	AR
c.	Determination of Glucose	
i.	Specimen Collection and Storage for Glucose	C
ii.	Glucose Methods	C
iii.	Glucose Reference Intervals	C
iv.	Measurement of Glucose in Urine	C
v.	Self-Monitoring of Blood Glucose	F
vi.	Minimally Invasive Monitoring of Blood Glucose	F
d.	Diabetes Mellitus	
i.	Classification of Diabetes Mellitus	C
ii.	Pathogenesis of Type 1 Diabetes Mellitus	C
iii.	Pathogenesis of Type 2 Diabetes Mellitus	C
iv.	Diagnosis of Diabetes Mellitus	C
v.	Chronic Complications of Diabetes Mellitus	C
vi.	Role of the Clinical Laboratory in Diabetes Mellitus	C
e.	Glycated Proteins	
i.	Glycated Hemoglobin	C
ii.	Glycated Fructosamine and Glycated Albumin	F
f.	Ketone Bodies	
i.	Clinical Significance of Ketone Bodies	C
ii.	Determination of Ketone Bodies	C
g.	Hypoglycemia	

i. Insulin, C-Peptide	C
ii. Hypoglycemia in Neonates and Infants	AR
iii. Fasting Hypoglycemia in Adults	AR
iv. Postprandial Hypoglycemia	AR
v. Hypoglycemia in Diabetes Mellitus	AR
h. Lactate	
i. Urinary Albumin	
i. Clinical Significance of Urinary Albumin	C
ii. Methods of Measuring Urinary Albumin	C
j. Autoantibodies of Diabetes Mellitus	F
i. Islet Cell Autoantibodies	F
ii. Insulin Autoantibodies	F
iii. Glutamic Acid Decarboxylase Autoantibodies	F
k. Glycogen Storage Disease	F

15. Lipids, Lipoproteins and Apolipoproteins

a. Cholesterol, HDL Cholesterol, LDL cholesterol, and Triglycerides	C
b. Apolipoprotein B	AR
c. Lipoprotein A	AR
d. Apolipoprotein A and E	F

16. Electrolytes and Blood Gases

a. Electrolytes	
i. Specimen for Electrolyte Determinations	C
ii. Sodium	
(Hypo-(e.g., SIADH) and Hypernatremia (e.g., Dehydration)	C
iii. Potassium	C
iv. Electrolyte Exclusion Effect	C
v. Chloride	C
vi. Bicarbonate	C
vii. Anion Gap	C
b. Plasma and Urine Osmolality	C
c. Blood Gases and pH	
i. Preanalytical Issues	C
ii. Cooximetry	C
iii. Determination of pCO_2, pO_2, and pH	C
iv. Temperature Correction of Measured pCO_2, pO_2, and pH	F
d. Sweat Testing	
i. Qualitative Screening Tests	F
ii. Quantitative Confirmatory Tests	F
iii. Reference Intervals for Sweat Chloride	F
iv. Sweat Stimulation and Collection	F

v.	Sources of Error in Sweat Testing	F
vi.	Sweat Testing Quality Assurance	F

17. Hormones

a.	Hormone Classification	
i.	Polypeptide or Protein Hormones	AR
ii.	Steroid Hormones	AR
iii.	Amino Acid-Related Hormones	AR

18. Catecholamines and Serotonin

a.	Clinical Applications	
i.	Pheochromocytoma	AR
ii.	Neuroblastoma	AR
iii.	Carcinoid	AR
iv.	Dysautonomias and Genetic Disorders	F

19. Vitamins and Trace Elements

a.	Individual Vitamins	
i.	Vitamin B12, Cyanocobalamin	C
ii.	Folic Acid	C
iii.	Vitamin B1, Thiamine	AR
iv.	Vitamin B2, Riboflavin	AR
v.	Vitamin B6, Pyridoxine, Pyridoxamine, and Pyridoxal	AR
vi.	Vitamin A	F
vii.	Vitamin E	F
viii.	Vitamin C, Ascorbic Acid	F
ix.	Biotin	F
x.	Niacin and Niacinamide	F
b.	Nutritional Trace Elements	
i.	Laboratory Assessment of Nutritional Trace Element Status	F
ii.	Individual Nutritional Trace Element (e.g., Cobalt, Copper, Zinc, Manganese, Molybdenum, Iodine, Bromine, and Selenium)	F
c.	Iron, Transferrin, Hemochromatosis, Ferratin, and Hemoglobin	C
d.	Hemoglobinopathy Variants and Thalassemias	
i.	HPLC	C
ii.	Capillary Electrophoresis	C
iii.	Alkaline & Acid Electrophoresis	AR
iv.	Isoelectric Focusing	F
v.	Other Hemoglobinopathy Analysis	F

20. Porphyrins and Disorders of Porphyrin Metabolism

a. Abnormalities of Porphyrin Metabolism	
i. The Porphyrias	
1. Acute Intermittent Porphyria	C
2. Porphyria Cutanea Tarda	C
3. Other Inherited Porphyrias	F
ii. Abnormalities of Porphyrin Metabolism Not Caused by Porphyria	F
iii. Pseudoporphyria	F
b. Laboratory Diagnosis of Porphyria	
i. Patients with Symptoms of Porphyria	C
ii. Relatives of Patients with Porphyria	F
c. Porphyrin Chemistry	
i. Structure and Nomenclature, Chelation of Metals	F
ii. Spectral Properties and Solubility	F
d. Heme Biosynthesis	
i. Enzymes of Heme Biosynthesis	F
e. Excretion of Heme Precursors	F
f. Regulation of Heme Biosynthesis	F
g. Analytical Methods	
i. Methods of Metabolites	F
ii. Methods of Blood Porphyrins	F
iii. Analysis of Plasma Porphyrins	F
iv. Enzyme Measurements	F

21. Therapeutic Drugs and Their Management

a. Definitions and Basic Concepts	
i. Mechanism of Action	AR
ii. Pharmacokinetics	AR
iii. Drug Disposition	AR
iv. Clinical Utility	AR
v. Analytical Techniques	AR
vi. Pharmacogenetics	AR
b. Specific Drug Groups	
i. Antiepileptic Drugs	C
ii. Antibiotics	C
iii. Immunosuppressants	C
iv. Cardioactive Drugs	AR
v. Bronchodilators	AR
vi. Antiretrovirals	AR
vii. Antipsychotic Drugs	AR
viii. Antimetabolites	AR

22. Clinical Toxicology

a.	Screening Procedures for Detection of Drugs (General)	C
i.	Immunoassay	AR
ii.	High-Performance Liquid Chromatography	AR
iii.	Gas Chromatography	F
b.	Pharmacology and Analysis of Specific Drugs and Toxic Agents	
i.	Alcohols	C
ii.	Analgesics (Non-Prescription)	C
iii.	Ethylene Glycol	C
iv.	Drugs of Abuse	C
v.	Cyanide	F

23. Toxic Metals

a.	Specific Metals	
i.	Iron	C
ii.	Lead	C
iii.	Arsenic	AR
iv.	Copper, Ceruloplasmin, Wilson Disease	AR
v.	Mercury	AR
vi.	Aluminum	F
vii.	Antimony	F
viii.	Beryllium	F
ix.	Cadmium	F
x.	Chromium	F
xi.	Cobalt	F
xii.	Manganese	F
xiii.	Nickel	F
xiv.	Platinum	F
xv.	Selenium	F
xvi.	Silicon	F
xvii.	Silver	F
xviii.	Thallium	F
b.	Occupational Monitoring	AR

24. Cardiac Function

a.	Cardiac Disease	
i.	Congestive Heart Failure	C
ii.	Acute Coronary Syndromes	C
b.	Cardiac Biomarkers, Analytic Measurement, and Clinical Utility	
i.	Cardiac Troponin I and T	C

ii.	Brain Natriuretic Peptide and NT-proBNP	C
iii.	C-Reactive Protein	C
iv.	Homocysteine	F

25. Kidney Disease

a.	Kidney Function and Physiology	
i.	Endocrine Function	C
ii.	Glomerular Filtration	C
b.	Diseases of the Kidney	
i.	Chronic Kidney Disease	C
ii.	End-Stage Renal Disease	C
iii.	Diabetic Nephropathy	C
iv.	Glomerular Diseases	C
v.	Acute Kidney Injury	C
vi.	Polycystic Kidney Disease	C
vii.	Renal Calculi	C
viii.	Tubular Diseases	AR
c.	Kidney Function Tests	
i.	Creatinine	C
ii.	Urea	C
iii.	Uric Acid	C
iv.	Cystatin C	C
v.	Urinary Osmolality (Assessment of Renal Concentrating Ability)	AR
vi.	Screening for Kidney Disease	C
1.	Urinalysis	C
2.	Microscopic Examination of Urine	C
vii.	Proteinuria (Quantitative Assessment of Glomerular Permeability)	C
1.	Clinical Significance of Proteinuria	C
2.	Specimen Collection for Total Protein and Albumin Measurement	C
3.	Measurement of Urine Total Protein	C
viii.	Estimation of Glomerular Filtration Rate (GFR) (Assessment of Kidney Function)	
1.	The Concept of Clearance	C
2.	Markers Used for GFR	C
3.	GFR at the Extremes of Age	C
ix.	Detection of Acute Kidney Injury	
1.	Neutrophil Gelatinase-Associated Lipocalin	AR

26. Physiology & Disorders of Water, Electrolyte, and Acid-Base Metabolism

a.	Water and Electrolytes-Composition of Body Fluids	C
b.	Acid-Base Disorders	C

i.	Metabolic Acidosis (Primary Bicarbonate Deficit)	C
ii.	Metabolic Alkalosis (Primary Bicarbonate Excess)	C
iii.	Respiratory Acidosis	C
iv.	Respiratory Alkalosis	C

27. Liver Disease

a.	Diseases of the Liver	
i.	Disorders of Bilirubin Metabolism	C
ii.	Hepatic Viral Infections	C
1.	Acute Viral Hepatitis	C
2.	Chronic Viral Hepatitis	C
iii.	Autoimmune Hepatitis	C
iv.	Alcoholic Liver Disease	C
v.	Hyperbilirubinemia of the Newborn	C
vi.	Fatty Liver Disease	AR
vii.	Cholestatic Liver Disease	
1.	Obstruction	AR
2.	Primary Biliary Cirrhosis	F
3.	Primary Sclerosing Cholangitis	F
viii.	Cirrhosis/Fibrosis	F
b.	Diagnostic Liver Tests	
i.	Hepatic Enzymes	C
ii.	Albumin	C
iii.	Prothrombin Time	C
iv.	Bilirubin	C
v.	Antinuclear Autoantibodies	AR
vi.	Antimitochondrial Autoantibodies	AR
vii.	Smooth Muscle Autoantibodies	F
viii.	Liver-Kidney Microsomal Autoantibodies	F

28. Gastric, Pancreatic, and Intestinal Function

a.	Intestinal Disorders and Their Laboratory Investigation	
i.	Celiac Disease (Celiac Sprue, Gluten-Sensitive Enteropathy)	AR
1.	IgA and IgG anti-tissue transglutaminase (anti-tTG)	AR
2.	IgG and IgA anti-deamidated gliadin	AR
ii.	Ulcerative Colitis and Crohn Disease	AR
1.	Anti-Saccharomyces cerevisiae (ASCA)	AR
2.	Calprotectin	AR
iii.	Disaccharidase Deficiencies	F
iv.	Bacterial Overgrowth	F
b.	Pancreatic Insufficiency	AR

c. Investigation of Maldigestion/Malabsorption
    i. Evaluation of Fat Absorption
        1. Fecal Pancreatic Elastase AR
        2. Fecal Fat F
d. Investigation of Chronic Diarrhea (General Considerations)
    i. Laxative Abuse F
    ii. Fecal Osmotic (Osmolal) Gap F
e. Gastrointestinal Regulatory Peptides
    i. Gastrin F
    ii. Vasoactive Intestinal Polypeptide F
    iii. Glucose-Dependent Insulinotropic Peptide (GIP, Gastric Inhibitory Polypeptide) F

29. Mineral and Bone Metabolism

a. Overview of Bone and Mineral Calcium
    i. Biochemistry, Physiology, and Clinical Significance of Calcium C
    ii. Measurement of Calcium C
    iii. Patient Preparation and Sources of Preanalytical Error for Total and Free Calcium Measurements AR
    iv. Interpretation of Total and Free Calcium Results AR
    v. Urinary Calcium F
b. Magnesium
    i. Biochemistry, Physiology, and Clinical Significance of Magnesium C
    ii. Measurement of Total Magnesium C
c. Hormones Regulating Mineral Metabolism
    i. Parathyroid Hormone C
    ii. Vitamin D and its Metabolites C
    iii. Parathyroid Hormone-Related Protein F
d. Phosphate
    i. Measurement of Phosphate AR
e. Biochemical Markers of Bone Turnover
    i. Markers of Bone Resorption AR
    ii. Markers of Bone Formation AR

30. Pituitary Function

a. Prolactin C
b. Corticotropin (Adrenocorticotropin) and Related Peptides C
c. Gonadotropins (Follicle-Stimulating Hormone and Luteinizing Hormone) C
d. Thyrotropin C
e. Growth Hormone and Insulin-Like Growth Factors AR
f. Arginine Vasopressin AR
g. Oxytocin AR

31. The Adrenal Cortex

- a. Adrenocortical Steroids
  - i. General Biochemistry and Metabolism of Adrenocortical Steroids — C
  - ii. The Hypothalamic-Pituitary-Adrenal Cortical Axis — C
  - iii. Regulation of Adrenal Hormones — C
- b. Pre-Analytical Testing Issues
  - i. Hypofunction of the Adrenal Cortex — AR
  - ii. Hyperfunction of the Adrenal Cortex — AR
- c. Disorders of the Adrenal Cortex
  - i. Choice of Specimen (e.g., plasma, saliva) — C
  - ii. Time of Day — C

32. Thyroid

- a. Thyroid Hormones
  - i. Chemistry, Biological Function, & Biochemistry of Thyroid Hormones — C
  - ii. Metabolism and Physiology of Thyroid Hormones — C
- b. Thyroid Dysfunction
  - i. Hypothyroidism (e.g., Hashimoto Thyroiditis) — C
  - ii. Hyperthyroidism (Graves Disease) — C
  - iii. Non-Thyroidal Illnesses affecting Thyroid Function — C
- c. Thyroid Hormones and Binding Proteins
  - i. Thyroid-Stimulating Hormone — C
  - ii. Thyroxine (T4) — C
  - iii. Triiodothyronine (T3) — C
  - iv. Free Thyroid Hormones — C
  - v. Thyroglobulin — C
  - vi. Anti-Thyroid Peroxidase Autoantibodies — C
  - vii. Anti-Thyroglobulin Autoantibodies — C
  - viii. Anti-Thyroid-Stimulating Hormone Receptor Autoantibodies — C
  - ix. Reverse Triiodothyronine (rT3) — F
  - x. Thyroxine-Binding Globulin — F

33. Reproductive Related Disorder

- a. Male Reproductive Biology
  - i. Male Reproductive Development and Abnormalities — AR
- b. Female Reproductive Biology
  - i. Female Reproductive Development — C
  - ii. Female Reproductive Abnormalities — C
  - iii. Normal Menstrual Cycle — C
  - iv. Ovulation — C
  - v. Irregular Menses — AR

c. Reproductive Tests
    i. Total Testosterone C
    ii. Free Bound Testosterone C
    iii. Estrogens (e.g., Estradiol, Estrone, Estriol) C
    iv. Progesterone C
    v. Anti-Mullerian Hormone AR
    vi. Dehydroepiandrosterone Sulfate (DHEAS) AR
    vii. Testosterone Precursors and Metabolites F
    viii. Anabolic Steroids F

34. Clinical Chemistry of Pregnancy

a. Human Pregnancy
    i. Maternal Adaptation to Pregnancy AR
b. Maternal and Fetal Health Assessment
    i. Detection and Dating of Pregnancy C
c. Complications of Pregnancy
    i. Trophoblastic Disease C
    ii. Abnormal Pregnancies
    (e.g., Preeclampsia, Ectopic, HELLP syndrome, Thyroid Disorders) AR
    iii. Preterm Delivery AR
d. Maternal Serum Screening for Fetal Defects
    i. Clinical Application or Prenatal Screening AR
e. Laboratory Tests
    i. Chorionic Gonadotropin C
    ii. Cell-Free Fetal DNA for Aneuploidy C
    iii. Alpha Fetoprotein AR
    iv. Unconjugated Estriol AR
    v. Dimeric Inhibit A AR
    vi. Placental Plasma Protein A AR
    vii. Fetal Fibronectin AR
    viii. Amniotic Fluid Bilirubin F

35. Inborn Errors of Amino Acid, Organic Acid, and Fatty Acid Metabolism

a. Biochemical Diagnosis
    i. Newborn Screening C
    ii. Evaluation of Symptomatic Patients AR
    iii. Prenatal Diagnosis F
    iv. Postmortem Screening F
b. Disorders of Amino Acid Metabolism
    i. Classic Phenylketonuria and Other Hyperphenylalaninemias F
    ii. Tyrosinemia Type 1 F
    iii. Homocystinuria F

iv.	Maple Syrup Urine Disease	F
v.	Urea Cycle Defects	F
vi.	Nonketotic Hyperglycemia	F
c.	Disorders of Organic Acid Metabolism	
i.	Disorders of Propionate Metabolism	F
ii.	Isovaleric Acidemia	F
iii.	Glutaric Acidemia Type I	F
iv.	Ethylmalonic Encephalopathy	F
d.	Disorders of Fatty Acid Oxidation	
i.	Very Long-Chain Acyl-CoA Dehydrogenase Deficiency	F
ii.	Trifunctional Protein and Long-Chain 3-Hydroxy Acyl-CoA Dehydrogenase Deficiencies	F
iii.	Medium-Chain Acyl-CoA Dehydrogenase Deficiency	F
iv.	Short-Chain Acyl-CoA Dehydrogenase Deficiency	F
e.	Disorders of Carbohydrates	
i.	Galactosemia	F

36. Laboratory Evaluation of Immunoglobulin Function and Humoral Immunity

a.	Immunoglobulins	
i.	Immunoglobulin M, IgM	C
ii.	Immunoglobulin G, IgG	C
1.	IgG Subclasses	AR
iii.	Immunoglobulin A, IgA	C
iv.	Free Light Chains, Serum	C
v.	Immunoglobulin D, IgD	AR
vi.	Immunoglobulin E, IgE	AR
b.	Allergic Diseases	AR
c.	Infectious Diseases	
i.	Hepatitis A, B, and C	C
ii.	HIV	C
iii.	Syphilis	C
iv.	EBV	C
v.	Sepsis Evaluation (e.g., Lactate, Procalcitonin)	C
vi.	Lyme Disease	AR
vii.	Toxoplasma	AR
viii.	MMR	AR
ix.	SARS-CoV-2	AR
x.	HSV	AR
xi.	Tuberculosis (Interferon Gamma Release Assays)	AR
xii.	HTLV I/II	F
xiii.	CMV	F
xiv.	*Bartonella*	F
xv.	*Coxiella*	F

37. Mediators of Inflammation: Complement, Cytokines, and Adhesion Molecules

a.	Structure and Function of the Complement System	
i.	The Classical Pathway	AR
ii.	The Alternative Pathway	AR
iii.	The Mannan-Binding Lectin Pathway	F
iv.	Terminal Complement Components	F
v.	Anaphylatoxins	F
vi.	Regulation of Complement Activation	F
vii.	Complement Genetics	F
viii.	Complement and Acquired Immunity	F
b.	Complement in Disease States	
i.	Rheumatologic Diseases	AR
ii.	Hereditary Angioedema	AR
iii.	Infectious Diseases	AR
iv.	Renal Diseases	AR
v.	Hematologic Diseases	AR
c.	Assays of Complement	
i.	Functional Assays	AR
ii.	Antigenic Assays	AR
d.	Cytokines	
i.	General Information	AR
ii.	Interleukin-6	F

38. Immunodeficiency Disorders (e.g., Neutrophil Oxidative Burst Activity) **F**

39. Rheumatological Diseases

a.	Anti-Nuclear Antibody Methods and Interpretations	
i.	ANA by Indirect Immunofluorescence	C
ii.	ANA by EIA	C
iii.	ANA by Multiplex Bead Assays	C
b.	Specific Autoantibodies in Diseases	
i.	Systemic Lupus Erythematosus	C
ii.	Sjögren Syndrome	AR
iii.	Rheumatoid Arthritis (e.g., Rheumatoid Factor, Anti-CCP)	AR
iv.	Polymyositis and Dermatomyositis (Anti-Jo-1)	AR
v.	Antiphospholipid Syndrome (e.g., B2GP1, Cardiolipin, PS/PT)	AR
vi.	Mixed Connective Tissue Disease	AR

40. Vasculitis

a.	Antineutrophil Cytoplasmic Antibody	C

i. c-ANCA (PR3)	C
ii. p-ANCA (Myeloperoxidase)	C
b. Polyarteritis Nodosa	AR
c. Churg-Strauss Syndrome	AR
d. Microscopic Polyangiitis	AR
e. Granulomatosis with Polyangiitis	AR

41. Neurological Autoimmunity

a. Myasthenia Gravis (e.g., ACHR)	C
b. Multiple Sclerosis	
i. Myelin Basic Protein	AR
ii. Oligoclonal Bands on CSF IEF	AR
iii. CSF IgG Synthesis Rate	F

42. Chemical Pathology-Specific Administration and Laboratory Management

a. Administration and Laboratory Management in Clinical Chemistry	C
i. Laboratory Management	F
ii. Rules and Regulations	F
iii. Laboratory Inspections	F
iv. QA/QC Issues	F
b. Automation in the Clinical Laboratory	C
c. Implementation and Management Considerations for POCT	
i. General Considerations	C
ii. Informatics and POCT	AR

Hematopathology for Clinical Pathology

This section is directed toward AP/CP residents. AP-only candidates (i.e., AP single certificate) are expected to focus less on Clinical Pathology components, while CP-only candidates (i.e., CP single certificate) will focus less on tissue-based diagnostics.

1. Testing in Hematology and Hematopathology

a. General Hematology Testing and Hematology Instruments	
i. General Consideration	C
ii. RBC Analysis	C
iii. WBC Analysis	C
iv. Platelet Analysis	C
b. Hemoglobinopathy Analysis	
i. Alkaline & Acid Electrophoresis	AR

- ii. High Performance Liquid Chromatography (HPLC) AR
- iii. Capillary Electrophoresis AR
- iv. Isoelectric Focusing AR
- v. Advance Hemoglobinopathy Analysis F

c. Specimen Handling & Morphologic Methods
- i. Bone Marrow Specimen Collection and Processing C
- ii. Lymph Node Triage and Handling C
- iii. Staining Methods
  1. Romanovsky Type Stains C
  2. Routine and Special Histologic Stains C
  3. Cytochemical and Advanced Hematology Stains F
- iv. Peripheral Blood Smear Review C
- v. Fluid Review C
- vi. Bone Marrow Review C
- vii. Review of Other Tissues in Hematopathology C

d. Hemostasis and Thrombosis Testing
- i. Sample Collection and Processing C
- ii. Coagulation and Fibrinolysis AR
- iii. Platelet Testing, including von Willebrand Disease AR
- iv. Thrombophilia Testing AR

e. Immunohistochemistry
- i. Basic Methods AR
- ii. Pitfalls AR

f. Flow Cytometry
- i. Basic Methodology C
- ii. PNH & Other Non-Neoplastic Disease Testing C
- iii. Lymphoid Testing C
- iv. Myeloid Testing C
- v. Advanced Flow Cytometry F

g. Cytogenetic Testing
- i. Classical AR
- ii. FISH AR
- iii. Other Cytogenetic Techniques (e.g., aCGH, SNP) AR

h. Molecular Testing
- i. Clonality/Lineage AR
- ii. Translocations/Mutations AR
- iii. Other Molecular Assays (e.g., Gene Expression Arrays) AR
- iv. Coagulation-Related Molecular Testing AR

2. Normal Anatomy, Histology, Hematopoiesis and Hemostasis

a. Erythrocytes (RBCs) C

b. Leukocytes (WBCs) C
- i. Myeloid C
  1. Granulocytes C
  2. Monocytes/Dendritic Cells C
  3. Eosinophils/Basophils/Mast Cells C
  4. Other Myeloid Cells C

- ii. Lymphoid — C
  - 1. B-Cells — C
  - 2. T-Cells — C
  - 3. NK-Cells — C
  - 4. Other Lymphoid Cells — C
- c. Plasma Cells — C
- d. Normal Hemostasis & Thrombosis — C
  - i. Platelets & Megakaryocytes — C
  - ii. Coagulation and Fibrinolysis — C
- e. General Hematopoiesis — C
- f. Peripheral Blood — C
- g. Bone Marrow — C
- h. Lymph Nodes — C
- i. Spleen — C
- j. Thymus — C
- k. Other Lymphoid Tissues (e.g., Tonsils) — C
- l. Pediatric Issues, Including Fetal Hematopoiesis — AR

3. Non-Neoplastic Disorders of Erythrocytes

- a. Anemias
  - i. Iron Deficiency and Related Disorders — C
  - ii. Sideroblastic Anemias
    - 1. Acquired — AR
    - 2. Inherited — F
  - iii. Erythrocyte Membrane Disorders
    - 1. Hereditary Spherocytosis — AR
    - 2. Hereditary Elliptocytosis — AR
    - 3. Other Erythrocyte Membrane Disorders (e.g., Spur Cell) — AR
  - iv. Erythrocyte Enzyme Disorders
    - 1. G6PD — AR
    - 2. Pyruvate Kinase Deficiency — AR
    - 3. Other Erythrocyte Enzyme Disorders — AR
  - v. Other Hemolytic Anemias
    - 1. Immune — C
    - 2. Non-Immune (e.g., Thermal Injury) — C
    - 3. Microangiopathic Hemolytic Anemia — C
  - vi. Megaloblastic Anemias — C
  - vii. Aplastic Anemias — C
  - viii. Anemia Related to Chronic Disease & Other Disorders — C
  - ix. Congenital Dyserythropoietic Anemia — F
  - x. Hemoglobinopathies
    - 1. Hb S and Related Disorders — C
    - 2. Hb C Disorders — AR
    - 3. Hb E Disorders — AR
    - 4. Other Hemoglobinopathies — F
  - xi. Thalassemias — C
  - xii. PNH — C

xiii. Porphyrias AR
xiv. Other Causes of Anemia
1. Drugs and Toxins AR
2. Diamond-Blackfan Anemia F
3. Other Nuutritional Deficiencies F
b. Erythrocytosis AR
c. Cold Agglutinin Disease AR
d. Advanced Erythrocyte Abnormalities AR

4. Non-Neoplastic Disorders of Leukocytes

a. Inherited Disorders with Morphologic Correlates
i. Pelger-Huet Anomaly C
ii. Alder-Reilly Anomaly AR
iii. Chediak-Higashi Syndrome AR
b. Neutrophils – Quantitative & Qualitative Aspects C
c. Monocytes – Quantitative & Qualitative Aspects C
d. Histiocytic and Dendritic Disorders
i. HLH/Macrophage Activation Disorders/Hemophagocytic Disorders C
ii. Storage Disorders AR
iii. Other Histocytic and Dendritic Disorders F
e. Plasmacytoid Dendritic Cells F
f. Lymphocytes – Including Quantitative Aspects C
g. Eosinophils and Basophils C
h. Plasma Cells C

5. Multilineage Benign Hematopoietic Disorders

a. Inherited Disorders (e.g., May-Hegglin Anomaly) AR
b. Other Benign Hematopoietic Disorders F

6. Infections with Manifestation in the Peripheral Blood

a. Erythrocyte & Plasma Infections
i. Malaria C
ii. Babesia C
iii. Other Erythrocyte & Plasma Infections AR
b. Leukocyte Infections
i. Infectious Mononucleosis C
ii. Anaplasma & Ehrlichia AR
iii. Other Infections of Leukocytes
(e.g., Fungi including Histoplasma, Pertussis) AR

7. Benign Hematologic Disorders of the Bone Marrow Not Otherwise Classified

a. Infectious Disorders (e.g., Parvovirus) C
b. Therapy Related Effects AR
c. Bone Abnormalities
i. Paget Disease AR
ii. Renal Osteodystrophy AR

d. Other Benign Disorders of Bone Marrow F

8. Benign Disorders of the Lymphoid Tissues

a. Lymph Node
   i. Dermatopathic Lymphadenopathy C
   ii. Cat Scratch Disease AR
   iii. Toxoplasmosis AR
   iv. Infectious Mononucleosis AR
   v. Other Infectious Disorders AR
   vi. Kikuchi-Fujimoto Disease (i.e., Histiocytic Necrotizing Lymphadenitis) AR
   vii. Rosai-Dorfman Disease AR
   viii. Castleman Disease AR
   ix. Autoimmune Disorders AR
   x. Non-Lymphoid Inclusions (e.g., Mesothelial) AR
   xi. Syphilis F
   xii. Drug-Related (e.g., Phenytoin) F
   xiii. Other Benign Disorders of the Lymph Nodes F
b. Spleen
   i. Lymphoid Hyperplasias AR
   ii. Splenic Cysts & Other Non-Neoplastic Proliferations (e.g., Hamartomas) AR
c. Thymus
   i. Thymic Hyperplasia AR
   ii. Other Benign Thymus Disorders (e.g., Thymoma) AR
d. Extranodal AR

9. Fluid Specimens

a. CSF C
b. Other Body Fluids C

10. Immunodeficiency Disorders

a. Primary Immunodeficiencies F
b. Secondary Immunodeficiencies
   i. Viral-Associated F
   ii. Iatrogenic F
c. Immunodeficiency-Associated Lymphoproliferative Disorders
   i. HIV-Associated AR
   ii. PTLD AR
   iii. Other Iatrogenic Lymphoproliferative Disorders F

11. Hemostasis and Thrombosis

a. Coagulation Specimen Collection and Handling C
b. Coagulation and Fibrinolytic Disorders
   i. Factor Deficiency or Functional Abnormalities C
   ii. Factor Inhibitors AR
   iii. Fibrinolysis AR
c. Platelet Disorders and von Willebrand Disease

- i. Qualitative Issues with Normal Platelet Counts — C
- ii. Thrombocytosis — C
- iii. Thrombocytopenia
  1. Immune — C
  2. Inherited — AR
  3. Other Causes of Thrombocytopenia — AR
- iv. von Willebrand Disease — C
- v. Abnormal Platelet Morphology, Not Otherwise Specified — AR

d. Thrombophilic Disorders
- i. Heparin Induced Thrombocytopenia — C
- ii. TTP/HUS — C
- iii. DIC — C
- iv. Thrombophilia Testing — AR
- v. Antiphospholipid Syndrome — AR

e. Antiplatelet and Anticoagulant Drugs
- i. Warfarin and Warfarin Monitoring — C
- ii. Heparin and Heparinoid Monitoring — C
- iii. Direct Thrombin and Factor Xa Inhibitor Measuring — AR
- iv. Antiplatelet Agent Monitoring — AR

12. Myeloid Neoplasms

a. Acquired Myeloid Neoplasm Precursor Conditions (e.g., CHIP, CCUS, VEXAS) — AR

b. Myeloproliferative Neoplasms
- i. CML (BCR-ABL1+) — C
- ii. Polycythemia Vera — AR
- iii. Primary Myelofibrosis — AR
- iv. Essential Thrombocythemia — AR
- v. Chronic Eosinophilic Leukemia, Not Otherwise Specified — AR
- vi. Other Myeloproliferative Neoplasms (e.g., CNL) — F

c. Mastocytosis — AR

d. Myeloid & Lymphoid Neoplasms with Eosinophilia and Tyrosine Kinase Fusions — AR

e. Myelodysplastic/Myeloproliferative Neoplasms
- i. CMML — C
- ii. Other MDS/MPN Disorders — AR

f. Juvenile Myelomonocytic Leukemia — F

g. Myelodysplastic Syndromes — AR

h. AML and Related Precursor Neoplasms
- i. AML with Recurrent Genetic Abnormalities
  1. AML with t(8;21) — AR
  2. AML with inv(16) or t(16;16) — AR
  3. APL with t(15;17) — C
  4. Other AML with Recurrent Genetic Abnormalities — F
- ii. AML with Myelodysplasia-Related Changes — AR
- iii. Therapy-Related Myeloid Neoplasms — AR
- iv. AML, Not Otherwise Specified
  1. Acute Monoblastic/Monocytic Leukemia — AR
  2. Acute Erythroid Leukemia — F

3.	Acute Megakaryoblastic Leukemia	F
4.	Other AML, Not Otherwise Specified	F
v.	Myeloid Sarcoma	AR
vi.	Myeloid Proliferations Associated with Down Syndrome	AR
vii.	Blastic Plasmacytoid Dendritic Cell Neoplasm	AR
viii.	Germline Predisposition to Myeloid Neoplasia	F

13. Acute Leukemias of Ambiguous Lineage F

14. Lymphoid Neoplasms

a.	B Lymphoblastic Leukemia/Lymphoma	
i.	B Lymphoblastic Leukemia/Lymphoma, Not Otherwise Specified	AR
1.	B Lymphoblastic Leukemia/Lymphoma with Recurrent Genetic Abnormalities	AR
ii.	Other B Lymphoblastic Leukemias & Lymphomas	F
b.	T Lymphoblastic Leukemia/Lymphoma	C
c.	Mature B-cell Neoplasms	
i.	CLL/SLL including Monoclonal B-cell Lymphocytosis	C
ii.	MALT Lymphoma	C
iii.	Follicular Lymphoma	C
iv.	Mantle cell Lymphoma	C
v.	Large cell Lymphomas	
1.	Diffuse Large B-cell Lymphoma, Not Otherwise Specified	C
2.	Primary Mediastinal Large B-cell Lymphoma	AR
3.	Other Large B-cell Lymphomas	F
vi.	Burkitt Lymphoma	C
vii.	SMZL	AR
viii.	HCL	AR
ix.	LPL	AR
x.	Nodal MZL	AR
xi.	In situ Lymphoid Neoplasia	F
d.	Mature T- and NK-cell Neoplasms	
i.	T-cell and NK-cell LGL	C
ii.	Extranodal NK/T-cell Lymphoma, Nasal Type	C
iii.	Anaplastic Large Cell Lymphoma (ALK + and ALK -)	C
iv.	T-cell PLL	AR
v.	Adult T-cell Leukemia/Lymphoma	AR
vi.	Hepatosplenic T-cell Lymphoma	AR
vii.	Mycosis Fungoides & Sézary Syndrome	AR
viii.	PTCL, Not Otherwise Specified	AR
ix.	Angioimmunoblastic T-cell Lymphoma	AR
x.	Enteropathy-Associated T-cell Lymphoma and Other Intestinal T-cell Lymphomas	F
xi.	CD30+ Cutaneous Lymphoproliferative Disorders	F
xii.	Other Cutaneous T-cell Lymphomas	F
xiii.	Other Mature T- and NK-cell Neoplasms	F
e.	Hodgkin Lymphoma	

i. Nodular Lymphocyte Predominant C
ii. Classic C

15. Plasma Cell Neoplasms, Paraprotein Disorders, & Amyloidosis

a. Plasma cell Myeloma, MGUS C
b. Amyloidosis C
c. Cryoglobulinemia AR
d. POEMS AR

16. Histiocytic/Dendritic Cell Neoplasms

a. Langerhans cell Histiocytosis/Sarcoma AR
b. Follicular Dendritic Cell Sarcoma F
c. Histiocytic Sarcoma F
d. Other Histiocytic/Dendritic Neoplasms F

17. Metastatic Neoplasms

a. Metastases to the Bone Marrow C
b. Metastases to the Lymph Nodes C
c. Metastases to Other Lymphoid Tissue C

18. Hematology & Hematopathology-Specific Administration & Laboratory Management

a. Laboratory Management F
b. Rules and Regulations F
c. Laboratory Inspections F
d. QA/QC Issue F
e. Other Administration/Laboratory Management Issues F

Medical Microbiology

1. Bacteria, including Mycobacteria, *Nocardia,* and other Aerobic Actinomycetes

a. Optimal Collection Methods
i. Lower Respiratory Tract Cultures AR
ii. Sinus Cultures AR
iii. Urine Cultures AR
iv. Superficial Wound Cultures AR
v. Deep Wound Cultures AR
vi. Stool Cultures AR
vii. Blood Cultures AR
viii. Tissue Cultures AR
ix. Cerebrospinal Fluid Cultures AR
x. Normally Sterile Fluid Cultures AR
xi. Genital Cultures AR
xii. Anaerobic Cultures AR

b.	Principles of Specimen Collection, Transport and Processing	
i.	Principles Regarding the Appropriate Use of Swabs for Bacterial Cultures	AR
ii.	Principles Regarding the Amount of Specimen Required	AR
iii.	Principles Regarding the Use of Broth Enrichment	AR
iv.	Principles Regarding the Cultivation of Fastidious Microorganisms	AR
v.	Principles Regarding the Maintenance of the Specimen during Transport	AR
c.	Safety Issues Regarding the Processing of Specimens for Bacteria	AR
d.	Specimen Rejection Criteria	
i.	Specimen Rejection Criteria for Respiratory Tract Specimens	AR
ii.	Specimen Rejection Criteria for Stool Specimens	AR
iii.	Specimen Rejection Criteria on the Basis of Transportation Delay and Specimen Integrity Issues	AR
e.	Media	
i.	*Campylobacter* Selective Agar	AR
ii.	Cefsulodin-Irgasan Novobiocin (CIN) Agar	AR
iii.	Charcoal Yeast Extract (CYE) Agar	AR
iv.	Chocolate Agar	AR
v.	Colistin-Nalidixic Acid (CNA) Blood Agar	AR
vi.	Hektoen-Enteric (HE) Agar	AR
vii.	MacConkey Agar	AR
viii.	Sheep Blood Agar	AR
ix.	Thayer Martin Agar	AR
x.	Media Selection for:	
1.	Lower Respiratory Tract Cultures	AR
2.	Sinus Culture	AR
3.	Urine Culture	AR
4.	Superficial Wound Culture	AR
5.	Deep Wound Cultures	AR
6.	Stool Cultures	AR
7.	Tissue Cultures	AR
8.	Cerebrospinal Fluid Cultures	AR
9.	Normally Sterile Fluid Cultures	AR
10.	Genital Cultures	AR
xi.	Regan-Lowe Agar	F
xii.	Anaerobic Media	F
xiii.	Other Bacteriologic Media	F
f.	Stains and Direct Examination	
i.	Gram stain	AR
ii.	Artifacts (e.g., crystals)	AR
iii.	Darkfield Examination	F
g.	Identification Methods and Instrumentation	
i.	Culture	AR

ii.	Automated Blood Culture Instrumentation	AR
iii.	Automated Bacterial Identification Systems	AR
iv.	Manual and Automated Bacterial Susceptibility Testing	AR
v.	Mass Spectrometry (MALDI TOF)	AR
vi.	Targeted Molecular Assays (e.g., PCR)	AR
vii.	Sequence-Based Identification	AR
h.	Key Tests in Bacteriology	
i.	Beta-lactamase Test	AR
ii.	Bile Solubility	AR
iii.	Catalase Test	AR
iv.	CLO/Urea Breath Test	AR
v.	Coagulase Test	AR
vi.	Optochin Susceptibility	AR
vii.	Oxidase Test	AR
viii.	PYR Test	AR
ix.	Urease Test	AR
x.	Motility	AR
xi.	Indole	AR
xii.	Bacitracin Susceptibility	F
xiii.	Beta-galactosidase Test	F
xiv.	Bile-Esculin Test	F
xv.	CAMP Test	F
xvi.	Esculin Hydrolysis Test	F
xvii.	Hippurate Hydrolysis Test	F
xviii.	Nitrate/Nitrate Reduction Test	F
xix.	Salt Tolerance	F
xx.	TSI/KIA Slant	F
xxi.	Other Key Tests in Bacteriology	F
i.	Antibacterial Susceptibility Testing (AST)	
i.	CLSI Standards	AR
ii.	Broth Microdilution	AR
iii.	Kirby-Bauer	AR
iv.	Agar gradient diffusion (e.g., E-Test)	AR
v.	Molecular AST	AR
vi.	Interpretation/Reporting AST	AR
j.	Mechanisms of Antimicrobial Resistance	
i.	Beta-Lactamases	AR
ii.	Carbapenemases	AR
iii.	Extended-Spectrum Beta Lactamases	AR
iv.	Inducible Clindamycin Resistance	AR
v.	*mecA* Associated Resistance	AR
vi.	*vanA* and *vanB* Associated Resistance	AR
vii.	AmpC Resistance	AR
viii.	Membrane changes (e.g., porin mutation and efflux upregulation)	F

k. Serologic and Antigenic Tests for Bacteria	AR
l. Molecular Diagnostics for Bacteria	AR
m. Quality Control and Infection Prevention Regarding Bacteria	AR
n. Aerobic Bacteria	
i. Gram Positive Aerobic Bacteria	
1. *Abiotrophia* spp.	AR
2. *Aerococcus* spp.	AR
3. *Arcanobacterium* spp.	AR
4. *Bacillus anthracis*	AR
5. *Bacillus cereus*	AR
6. *Corynebacterium diphtheriae*	AR
7. *Enterococcus faecium*	AR
8. *Enterococcus faecalis*	AR
9. *Erysipelothrix rhusiopathiae*	AR
10. *Gardnerella vaginalis*	AR
11. *Granulicatella* spp.	AR
12. *Lactobacillus* spp.	AR
13. *Leuconostoc* spp.	AR
14. *Listeria monocytogenes*	AR
15. *Pediococcus* spp.	AR
16. *Staphylococcus aureus* complex	AR
17. *Staphylococcus epidermidis*	AR
18. *Staphylococcus saprophyticus*	AR
19. *Staphylococcus lugdunensis*	AR
20. *Streptococcus pneumoniae*	AR
21. *Streptococcus pyogenes*	AR
22. *Streptococcus agalactiae*	AR
23. *Streptococcus bovis* Group	AR
24. *Streptococcus anginosus* Group	AR
25. *Actinomadura* spp.	F
26. Other *Bacillus* spp.	F
27. Other *Corynebacterium* spp.	F
28. *Enterococcus* spp.	F
29. *Facklamia* spp.	F
30. *Gemella* spp.	F
31. *Kocuria* spp.	F
32. *Lactococcus* spp.	F
33. *Microbacterium* spp.	F
34. *Micrococcus* spp.	F
35. *Paracoccus* spp.	F
36. *Rothia* spp.	F
37. Other *Staphylococcus* spp.	F
38. *Stomatococcus* spp.	F
39. *Streptococcus mitis* Group	F

40.	*Streptococcus mutans* Group	F
41.	*Streptococcus salivarius* Group	F
42.	Other *Streptococcus* spp.	F

ii. Gram Negative Aerobic Bacteria

1.	*Acinetobacter baumannii* complex	AR
2.	*Aeromonas* spp.	AR
3.	*Aggregatibacter* spp.	AR
4.	*Bartonella* spp.	AR
5.	*Bordetella pertussis*	AR
6.	*Brucella* spp.	AR
7.	*Burkholderia pseudomallei*	AR
8.	*Burkholderia cepacia* complex	AR
9.	*Campylobacter jejuni*	AR
10.	*Capnocytophaga* spp.	AR
11.	*Cardiobacterium* spp.	AR
12.	*Citrobacter* spp.	AR
13.	*Eikenella* spp.	AR
14.	*Elizabethkingia* spp.	AR
15.	*Enterobacter* spp.	AR
16.	*Escherichia coli*	AR
17.	*Francisella tularensis*	AR
18.	*Haemophilus influenzae*	AR
19.	*Haemophilus parainfluenzae*	AR
20.	*Haemophilus ducreyi*	AR
21.	*Helicobacter pylori*	AR
22.	*Kingella kingae*	AR
23.	*Klebsiella* spp.	AR
24.	*Legionella pneumophila*	AR
25.	*Moraxella catarrhalis*	AR
26.	*Neisseria meningitidis*	AR
27.	*Neisseria gonorrhoeae*	AR
28.	*Pasteurella multocida*	AR
29.	*Proteus* spp. `	AR
30.	*Providencia* spp.	AR
31.	*Pseudomonas aeruginosa*	AR
32.	*Salmonella* Non-Typhi	AR
33.	*Salmonella* Typhi and ParaTyphi	AR
34.	*Serratia marcescens*	AR
35.	*Shigella* spp.	AR
36.	*Stenotrophomonas maltophilia*	AR
37.	*Streptobacillus moniliformis*	AR
38.	*Vibrio cholerae*	AR
39.	*Vibrio vulnificus*	AR
40.	*Vibrio parahaemolyticus*	AR

41. *Yersinia pestis*	AR
42. *Yersinia enterocolitica*	AR
43. *Achromobacter* spp.	F
44. Other *Acinetobacter* spp.	F
45. *Actinobacillus* spp.	F
46. *Alcaligenes* spp.	F
47. *Bordetella parapertussis*	F
48. *Bordetella bronchiseptica*	F
49. Other *Bordetella* spp.	F
50. *Burkholderia mallei*	F
51. Other *Burkholderia* spp.	F
52. *Campylobacter coli*	F
53. *Campylobacter fetus*	F
54. Other *Campylobacter* spp.	F
55. *Chryseobacterium* spp.	F
56. *Comamonas* spp.	F
57. *Cronobacter* spp.	F
58. *Edwardsiella* spp.	F
59. Other *Haemophilus* spp.	F
60. Other *Legionella* spp.	F
61. *Methylobacterium* spp.	F
62. Other *Moraxella* spp.	F
63. *Morganella* spp.	F
64. Other *Neisseria* spp.	F
65. *Pantoea* spp.	F
66. *Plesiomonas* spp.	F
67. Other *Pseudomonas* spp.	F
68. *Roseomonas* spp.	F
69. *Sphingomonas* spp.	F
70. Other *Vibrio* spp.	F
71. Other *Yersinia* spp.	F
o. Procedures for the Isolation and Cultivation of Anaerobic Bacteria	AR
p. Anaerobic Bacteria	
i. *Actinomyces* and Related Taxa	AR
ii. *Bacteroides fragilis* Group	AR
iii. *Clostridium botulinum*	AR
iv. *Clostridium perfringens*	AR
v. *Clostridium septicum*	AR
vi. *Clostridium tetani*	AR
vii. *Clostridioides difficile*	AR
viii. *Cutibacterium acnes*	AR
ix. *Fusobacterium nucleatum*	AR
x. *Fusobacterium necrophorum*	AR
xi. *Anaerococcus* spp.	F

xii.	Other *Bacteroides* spp.	F
xiii.	*Bifidobacterium* spp.	F
xiv.	Other *Clostridium* spp.	F
xv.	*Desulfovibrio* spp.	F
xvi.	*Eubacterium* spp.	F
xvii.	*Eggerthella* spp.	F
xviii.	*Fingoldia magna*	F
xix.	Other *Fusobacterium* spp.	F
xx.	*Leptotrichia* spp.	F
xxi.	*Mobiluncus* spp.	F
xxii.	*Peptostreptococcus* spp.	F
xxiii.	*Porphyromonas* spp.	F
xxiv.	*Prevotella* spp.	F
xxv.	*Sarcina* spp.	F
xxvi.	*Veillonella* spp.	F
q. Mycoplasma and Ureaplasma		
i.	*Mycoplasma genitalium*	AR
ii.	*Mycoplasma pneumoniae*	AR
iii.	*Mycoplasma hominis*	F
iv.	Other *Mycoplasma* spp.	F
v.	*Ureaplasma* spp.	F
r. Spirochetes		
i.	*Borrelia burgdorferi*	AR
ii.	*Leptospira* spp.	AR
iii.	*Treponema pallidum*	AR
iv.	Other *Borrelia* and *Borreliella* spp.	F
v.	*Brachyspira* spp.	F
vi.	*Spirillum minus*	F
vii.	Other *Treponema* species	F
s. Intracellular Bacteria		
i.	*Anaplasma phagocytophilum*	AR
ii.	*Chlamydia trachomatis*	AR
iii.	*Chlamydia pneumoniae*	AR
iv.	*Coxiella burnetti*	AR
v.	*Ehrlichia* spp.	AR
vi.	*Rickettsia rickettsii*	AR
vii.	*Chlamydia psittaci*	F
viii.	*Orientia tsutsugamushi*	F
ix.	Other *Rickettsia* spp.	F
t. Mycobacteria, *Nocardia* species, and Other Aerobic Actinomycetes		
i.	Structure and Biology	AR
ii.	Taxonomy, Runyon Classification, & Nomenclature	AR
iii.	Specimen Collection, Handling, and Processing	
1.	Optimal Methods for Lower Respiratory Tract Specimen	

	Collection for Mycobacteria	AR
	2. Specimens for Mycobacteria	AR
	3. Decontamination	AR
	4. The Use of PANTA	F
iv.	Media	
	1. Principles Regarding the Use of Broth and Solid Media	AR
v.	Stains and Direct Examination	
	1. Acid Fast Stain & Modified Acid Fast Stain	AR
	2. Ziehl-Neelsen & Kinyoun Methods	AR
	3. Fluorochrome Staining	AR
vi.	Identification Methods and Instrumentation	F
vii.	Empiric Therapy for Mycobacterial Infections	AR
viii.	Antimycobacterial and Nocardial Agents	F
	1. Carbapenems and Related Agents	F
	2. Ethambutol and Related Agents	F
	3. Isoniazid and Related Agents	F
	4. Kanamycin and Related Agents	F
	5. Pyrazinamide and Related Agents	F
	6. Fluoroquinolones and Related Agents	F
	7. Rifampin and Related Agents	F
	8. Streptomycin and Related Agents	F
	9. Trimethoprim-Sulfamethoxazole	F
	10. Clarithromycin and Related Agents	F
ix.	Susceptibility Testing	F
	1. Proportion Method	F
	2. Broth Dilution	F
	3. Molecular Susceptibility Testing	F
x.	Mechanisms of Resistance	F
xi.	Skin, Serologic Assays, & Host Response for Mycobacteria and Related Organisms	AR
xii.	Molecular Diagnostics for Mycobacteria and Related Organisms	AR
xiii.	Miscellaneous Topics & Subjects Regarding Mycobacteria and Related Organisms	F
xiv.	Mycobacteria, *Nocardia* species, and Aerobic Actinomycetes	
	1. *Mycobacterium* spp.	
	a) *M. tuberculosis* Complex	AR
	b) *M. bovis*	AR
	c) *M. bovis* BCG	AR
	d) *M. avium* complex	AR
	e) *M. intracellulare*	AR
	f) *M. gordonae*	AR
	g) *M. haemophilum*	AR
	h) *M. marinum*	AR
	i) *M. xenopi*	AR

j)	*M. fortuitum*	AR
k)	*M. abscessus*	AR
l)	*M. chelonae*	AR
m)	*M. leprae*	AR
n)	Other *Mycobacterium* spp.	F

2. *Nocardia* and Other Aerobic Actinomycetes

a)	*Nocardia* spp.	AR
b)	*Rhodococcus equi*	AR
c)	*Tropheryma whipplei*	AR
d)	*Gordonia* spp.	F
e)	*Streptomyces* and Other Aerobic Actinomycetes	F
f)	*Tsukamurella* spp.	F

2. Fungi

a.	Structure and Biology	AR
b.	Specimen Collection, Transport, and Processing	AR
c.	Media	AR
d.	Stains and Direct Examination	
i.	Gram Stain Appearance	AR
ii.	KOH	AR
iii.	KOH-Calcofluor White	AR
iv.	Wet Mount	AR
v.	Mucicarmine	AR
vi.	Lactophenol Cotton Blue	AR
vii.	India Ink	F
viii.	Other Fungal Stains	F
e.	Identification Methods and Instrumentation	
i.	Automated Blood Culture Instrumentation for Yeasts	AR
ii.	Automated and Manual Identification Systems for Yeasts	AR
iii.	Automated Susceptibility Testing for Yeasts	AR
iv.	Mass Spectrometry	AR
v.	Molecular Identification (e.g., Sequence-Based Identification)	AR
f.	Antifungal Agents, Susceptibility Testing and Mechanisms of Resistance	F
g.	Serologic and Antigenic Tests for Fungi	AR
h.	Molecular Diagnostics for Fungi	AR
i.	Advanced Topics in Medical Mycology	F
j.	Specific Fungi	
i.	Yeast and Yeast-Like Fungi	
1.	*Candida albicans*	AR
2.	*Candida dubliniensis*	AR
3.	*Candida auris*	AR
4.	*Candida glabrata* (i.e., *Nakaseomyces glabrata*)	AR
5.	*Candida krusei* (i.e., *Pichia kudriavzevii*)	AR

6. *Candida tropicalis*	AR
7. *Candida parapsilosis*	AR
8. *Candida lusitaniae* (i.e., *Clavispora lusitaniae*)	AR
9. *Candida guilliermondii* (i.e., *Meyerosyma guilliermondii*)	AR
10. *Cryptococcus neoformans*	AR
11. *Cryptococcus gattii*	AR
12. *Malassezia furfur*	AR
13. *Pneumocystis jirovecii*	AR
14. *Prototheca* spp. (Algae but covered in mycology)	AR
15. *Trichosporon asahii*	AR
16. Other *Candida* spp.	F
17. Other *Cryptococcus* spp.	F
18. *Malassezia pachydermatis*	F
19. *Rhodotorula mucilaginosa*	F
20. *Rhodotorula glutinis*	F
21. *Rhodotorula minuta*	F
22. Other *Rhodotorula* spp.	F
23. *Saccharomyces cervisiae*	F
24. Other *Saccharomyces* spp.	F
25. *Sporobolomyces* spp.	F
26. *Trichosporon cutaneum*	F
27. *Trichosporon inkin*	F
28. Other *Trichosporon* spp.	F
29. *Ustilago* spp.	F

ii. Hyaline Septate Molds

1. *Aspergillus fumigatus*	AR
2. *Aspergillus flavus*	AR
3. *Aspergillus terreus*	AR
4. *Aspergillus niger*	AR
5. *Aspergillus nidulans*	AR
6. *Epidermophyton* spp.	AR
7. *Fusarium solani* Complex	AR
8. *Microsporum canis*	AR
9. *Microsporum gypseum* (i.e., *Nannizzia gypseum*)	AR
10. *Paecilomyces* spp.	AR
11. *Penicillum* spp.	AR
12. *Scedosporium apiospermum* complex	AR
13. *Scedosporium boydii* complex (i.e. *Pseudallescheria boydii*)	AR
14. *Trichophyton rubrum*	AR
15. *Trichophyton mentagrophytes*	AR
16. *Trichophyton tonsurans*	AR
17. *Acremonium* spp.	F
18. Other *Aspergillus* spp.	F
19. *Beauveria* spp.	F

20. *Fusarium* spp.	F
21. *Geotrichum candidum*	F
22. *Geotrichum capitatum* (i.e., *Magnusiomyces capitatus*)	F
23. *Geotrichum clavatum* (i.e., *Magnusiomyces clavtus*)	F
24. Other *Geotricum* spp.	F
25. *Malbranchea* spp.	F
26. *Microsporum audouinii*	F
27. Other *Microsporum* spp.	F
28. *Scopulariopsis* spp.	F
29. *Sepedonium* spp.	F
30. *Trichoderma* spp.	F
31. Other *Trichophyton* spp.	F
32. *Trichophyton verrucosum*	F
iii. Dimorphic Fungi	
1. *Blastomyces* spp.	AR
2. *Coccidioides* spp.	AR
3. *Histoplasma capsulatum*	AR
4. *Talaromyces marneffei* (formerly *Penicillium marneffei*)	AR
5. *Sporothrix schenckii* Complex	AR
6. Other *Histoplasma* spp.	F
iv. Mucoraceous Fungi	
1. *Lichtheimia corymbifera* complex	AR
2. *Mucor* spp.	AR
3. *Rhizomucor* spp.	AR
4. *Rhizopus* spp.	AR
5. *Apophysomyces elegans*	F
6. *Basidiobolus ranarum*	F
7. *Basidiobolus* spp.	F
8. *Cokeromyces* spp.	F
9. *Conidiobolus coronatus*	F
10. *Conidiobolus* spp.	F
11. *Cunninghamella* spp.	F
12. *Saksenaea* spp.	F
13. *Syncephalastrum* spp.	F
v. Dematiaceous Fungi	
1. *Alternaria* spp.	AR
2. *Bipolaris* spp.	AR
3. *Cladosporium* spp.	AR
4. *Cladophialophora* spp.	AR
5. *Curvularia* spp.	AR
6. *Fonsecaea* spp.	AR
7. *Phialophora* spp.	AR
8. *Chaetomium* spp.	F
9. *Exophiala* spp.	F

10. *Exserohilum* spp.	F
11. *Piedra* spp.	F
12. *Lomentaspora prolificans* (i.e., *Scedosporium* prolificans)	F
13. *Stachybotrys* spp.	F
vi. Microsporidia	AR
vii. Rhinosporidium	AR

3. Viruses and Prions

a. Structure and Biology	AR
b. Taxonomy, Classification, and Nomenclature	AR
c. Specimen Collection, Transport, and Processing	AR
d. Identification Methods and Instrumentation	AR
e. Serologic, Immunologic, and Antigenic Assays for Viruses	AR
f. Molecular Diagnostics for Viruses	AR
g. Prevention and Treatment of Viral Diseases	AR
h. Quality Control and Infection Prevention with Respect to Viruses	AR
i. Miscellaneous Topics with Respect to Viruses	F
j. Specific Viruses	
i. Adenovirus	AR
ii. Hantavirus (i.e., Sin Nombre)	AR
iii. Seasonal Coronaviruses	AR
iv. SARS-CoV-2	AR
v. Rhinovirus	AR
vi. Polio Virus	AR
vii. Coxsackievirus	AR
viii. Enteroviruses, including Enterovirus D-68	AR
ix. Parechovirus	AR
x. Ebola Virus	AR
xi. Hepatitis C Virus	AR
xii. Yellow Fever Virus	AR
xiii. Dengue Virus	AR
xiv. Zika Virus	AR
xv. West Nile Virus	AR
xvi. Herpesviridae	
1. HSV	AR
2. VZV	AR
3. EBV	AR
4. CMV	AR
5. HHV6	AR
6. HHV8	AR
7. HHV7	F
xvii. Hepatitis B Virus	AR
xviii. Hepatitis D Virus	AR

xix.	Rabies Virus	AR
xx.	Influenza A Virus, including highly pathogenic variants	AR
xxi.	Influenza B Virus	AR
xxii.	Human Papilloma Viruses	AR
xxiii.	Paramyxoviruses	
	1. Parainfluenza Virus	AR
	2. Mumps	AR
	3. Measles	AR
	4. Respiratory syncytial virus	AR
	5. Human metapneumovirus	AR
	6. Hendra	F
	7. Nipah	F
xxiv.	Parvovirus B19	AR
xxv.	Hepatitis A Virus	AR
xxvi.	Polyoma Viruses	
	1. BK Virus	AR
	2. JC Virus	AR
	3. Merkel Cell Polyoma Virus	F
xxvii.	Variola Viruses	
	1. Variola Major	AR
	2. Mpox Virus	AR
	3. Molluscum Contagiosum	AR
	4. Vaccinia Virus	F
xxviii.	Retroviruses	
	1. HIV	AR
	2. HTLV-1	AR
xxix.	Rhinovirus	AR
xxx.	Rotavirus	AR
xxxi.	Lassa Virus	F
xxxii.	Lymphocytic Choriomeningitis Virus	F
xxxiii.	Astroviruses	F
xxxiv.	Bocavirus	F
xxxv.	Rift Valley Fever Virus	F
xxxvi.	SARS-CoV-1	F
xxxvii.	Middle Eastern Respiratory Syndrome Coronavirus (MERS)	F
xxxviii.	Enterovirus	F
xxxix.	Marburg Virus	F
xl.	St. Louis Virus	F
xli.	Chikungunya Virus	F
xlii.	Japanese Encephalitis Virus	F
xliii.	Powassan Virus	F
xliv.	Less Common Influenza Variants	F
xlv.	Hepatitis E Virus	F
xlvi.	Colorado Tick Fever Virus	F

xlvii.	Sapovirus	F
xlviii.	Eastern Equine Encephalitis Virus	F
xlix.	Western Equine Encephalitis Virus	F
l.	California Serogroup Viruses	F
li.	Heartland Virus	F

k. Human Prion Diseases AR

4. Parasites

a. Structure and Biology AR
b. Specimen Collection, Transport, and Processing AR
c. Stains and Direct Examination AR
d. Identification Methods and Instrumentation AR
e. Geographic Distribution AR
f. Antiparasitic Agents, Susceptibility Testing, and Mechanisms

i.	Albendazole, Thiabendazole, and Related Agents	F
ii.	Amphotericin B	F
iii.	Chloroquine and Related Agents	F
iv.	Clindamycin plus Quinine	F
v.	Diethylcarbamazine and Related Agents	F
vi.	Ivermectin and Related Agents	F
vii.	Nitaxoxanide	F
viii.	Pentavalent Antimonials and Related Agents	F
ix.	Primaquine and Related Agents	F
x.	Praziquantel	F
xi.	Quinidine and Related Agents	F
xii.	Trimethoprim-Sulfamethoxazole	F

g. Specific Parasites
   i. Protozoa
      1. Intestinal

a)	*Blastocystis hominis*	AR
b)	*Cryptosporidium* spp.	AR
c)	*Cyclospora* sp.	AR
d)	*Cystoisospora* sp.	AR
e)	*Entamoeba histolytica*	AR
f)	*Entamoeba dispar*	AR
g)	*Entamoeba coli*	AR
h)	*Giardia* spp.	AR
i)	*Trichomonas vaginalis*	AR
j)	*Balantioides* (formerly *Balantidium*) *coli*	F
k)	*Chilomastix* sp.	F
l)	*Dientamoeba* sp.	AR
m)	*Endolimax* sp.	F

n) Other *Entamoeba* spp.	F
o) *Iodamoeba* sp.	F
p) *Pentatrichomonas* sp.	F
2. Blood and Tissue	
a) *Acanthamoeba* spp.	AR
b) *Babesia* spp.	AR
c) *Leishmania* spp.	AR
d) *Naegleria fowleri*	AR
e) *Plasmodium*	
i. *Plasmodium falciparum*	AR
ii. *Plasmodium vivax*	AR
iii. *Plasmodium ovale*	AR
iv. *Plasmodium malariae*	AR
v. *Plasmodium knowlesi*	F
f) *Toxoplasma gondii*	AR
g) *Trypanosoma brucei*	AR
h) *Trypanosoma cruzi*	AR
i) *Balamuthia* sp.	F
j) *Sarcocystis* spp.	F
ii. Nematodes (Round Worms)	
1. *Ascaris* spp.	AR
2. *Enterobius* sp.	AR
3. Filarial Nematodes	F
4. Hookworms and Cutaneous Larva Migrans	AR
5. *Strongyloides* spp.	AR
6. *Trichuris* spp.	AR
7. Anisakids	F
8. *Baylisascaris* sp.	F
9. *Brugia* spp.	F
10. *Capillaria* spp.	F
11. *Dracunculus* sp.	F
12. *Gnathostoma* spp.	F
13. *Parastrongylus* sp. (i.e., *Angiostrongylus*)	F
14. *Toxocara* sp. and Visceral Larva Migrans	F
15. *Trichinella* spp.	F
16. *Trichostrongylus* sp.	F
iii. Trematodes	
1. *Schistosoma* spp.	AR
2. *Clonorchis* sp.	F
3. *Dirofilaria* spp.	F
4. *Echinostoma* sp.	F
5. *Fasciola* spp.	F
6. *Fasciolopsis* spp.	F
7. *Paragonimiasis* spp.	F

iv. Cestodes
1. *Dibothriocephalus latus* (i.e., *Diphyllobothrium latum*) AR
2. *Echinococcus* spp. AR
3. *Taenia saginata* AR
4. *Taenia solium* including Cysticercosis AR
5. *Dipylidium* sp. F
6. *Hymenolepsis* spp. F
7. *Spirometra* spp. F

v. Less Common Parasites F
vi. Arthropods F

5. Microbiology Laboratory Management

a. Safety/Biosafety C
b. Microbiology Laboratory Management F
c. Rules and Regulations F
d. Laboratory Inspections F
e. QA/QC Issues F
f. Other Administration/Laboratory Management Issues F

Management and Informatics

1. Quality Management

a. Preanalytic Risks and Risk Mitigation C
b. Analytic Risks and Risk Mitigation
i. Ongoing Quality Control C
ii. Verification and Validation AR
c. Postanalytic Risk and Risk Mitigation
i. Communication (e.g., Laboratory Reports, Critical Values) C
ii. Interpretation
1. Reference Range Determination C
2. Test Performance Characteristics (e.g., Sensitivity, Specificity, PPV, NPV, etc.) C
3. Advanced Interpretations AR
d. Oversight of Quality
i. Guidelines C
ii. Test Utilization / Laboratory Stewardship C
iii. Quality Assurance, Management, and Improvement AR
iv. Process and Workflow Management AR
v. Management of Non-Conformances, Exceptions, and Incidents AR
vi. Change Control F

2. Safety

a. Patient Safety	
i. Risk Classification	
1. Preanalytic Hazards	
a. Identification Error	C
b. Ordering Error	C
c. Phlebotomy hazards	C
2. Analytic Hazards	
a. Interference	C
b. Interpretive Error	C
3. Postanalytic Hazards	
a. Communication Failure	C
b. Reporting Error	C
c. Interpretation Error	C
ii. Risk Monitoring	
1. Sentinel Events	C
2. Near Misses	C
iii. Risk Mitigation Measures	
1. Failure Mode and Effects Analysis	AR
2. Root Cause Analysis	AR
3. Human Factors / LEAN Design	F
b. Employee and Environmental Safety	
i. Risk Classification	
1. Ionizing Radiation Hazard	C
2. Biological Hazard	C
3. Electrical Hazards	C
4. Fire	C
5. Workplace Violence	C
6. Physical Hazards	C
7. Chemical Hazards (MSDS)	C
8. Repetitive Motion Injuries	C
9. Other Risks to Employees and Environments	C
10. Automotive Accidents (e.g., Specimen Transport Drivers)	F
ii. Risk Monitoring	AR
iii. Risk Mitigation Measures	AR
c. Disaster Management	F

3. Finance, Billing and Coding

a. Accounting and Financial Statements	AR
b. Management of Expenses	F
i. Management of Unit Costs	F

ii. Utilization / Demand Management	F
c. Management of Revenue	
i. Coding, Billing, and Revenue Cycle	AR
ii. Major Payors	AR
1. Federal Government	AR
2. State Government	AR
3. Private Insurers	AR
4. Individuals	AR
iii. Payment Models	F
1. Individual Service Based (i.e., Fee for Service)	F
2. Episode Based	F
3. Capitated / ACO	F
d. Management of Capital	AR

4. Business Strategy

a. Long Term Strategic Planning	F
b. Business Contracting and Negotiating	F
c. Business Models	F

5. Laws and Regulations

a. Laboratories and Testing	
i. CLIA	C
ii. CAP	C
iii. Proficiency Testing (PT)	C
iv. FDA Testing Regulations	C
v. Regulation of Laboratory Financial Practices	AR
vi. Public Health Reporting	AR
vii. Joint Commission	AR
viii. ISO 15189	F
b. Physician Relations (e.g., Specific Laws [i.e., Stark, Anti-Kickback])	AR
c. Environmental and Worker Safety (e.g., OSHA)	C
d. Regulation of Information and Information Management (e.g., HIPAA)	C
e. Tort Law (e.g., Malpractice)	C
f. Employment Law	F
g. Law Pertaining to Charitable (i.e., Non-Profit) Organizations	F
h. Other Bodies of Law and Regulation (e.g., HPDB, OIG)	F

6. Professionalism and Ethics

a. Medical Profession – Professionalism	
i. Autonomy	C
ii. Beneficence	C
iii. Integrity	C
iv. Non-Malfeasance	C

v. Conflict of Interest C
vi. Informed Consent C
vii. Confidentiality C
viii. Justice C

b. Other Ethical Systems
i. Biomedical Ethics
1. Patient Care C
2. IRB / Research / Belmont Report C

7. Informatics

a. The Nature of Information
i. Tracking (e.g., Barcoding) C
ii. Coding (e.g., SNOMED, ICD10, CPT) AR
iii. Types of Data AR
iv. Data Architecture and Management (i.e. Databases) F

b. Electronic Information Systems
i. Types of Systems
3. Laboratory Information Systems (LIS)
d. Use of Search Functions, Various Systems/Modules C
e. Middleware, Data Integrity, Result Reporting AR
4. Other Information Systems (e.g., EMR)
f. Use and Search Functions C
g. Dashboard Generation and Data Mining F
ii. Systems Regulations (e.g., HIPAA) C
iii. System Operations
(i.e., Selection, Verification/Validation, Implementation) AR
iv. Qualities of Information Systems
1. Interoperability (i.e., Standards and Interfaces) F
2. Security, Integrity, Privacy, and Confidentiality F
v. Extracting Data from LIS and/or HER F

c. Digital Imaging
i. Digital Pathology / Whole Slide Imaging AR
1. Basic Use and Z Stacking AR
2. Legality of Restrictions AR
3. AI, Algorithms, and Data Structure F
4. Compression and Decompression Data Integrity F
5. Image Storage and Retrieval F
6. Image Management Systems F

d. Project Management
i. Tools, Critical Path, Interaction of Sub-Projects AR
ii. IT System Lifecycle F

e. Document Control, including Job Aids AR
(i.e., Control of Laboratory Policies, Procedures, and Directives)
i. Document Control Systems F

f. Inferences from Information

i. Statistical Testing

1.	Sensitivity	C
2.	Specificity	C
3.	Positive Predictive Value	C
4.	Negative Predictive Value	C
5.	P values	C
6.	Standard Deviation	C
7.	Coefficient of Variation (%CV)	AR

ii. Decision Models

1.	Computer Algorithms	C
2.	Disease-Specific Testing Algorithms	C
3.	Clinical Decision Support Tools	C