

Revised: Fall 2016

# MDL 236 Parasitology and Virology

## COURSE OUTLINE

### **Prerequisites:**

N/A

### **Course Description:**

This course will introduce the student to human viruses and parasites of medical importance. This course will complement the Clinical Bacteriology Course, since most clinical sites consolidate bacteriology, virology and parasitology in the same lab area. Students will learn the molecular biology of viruses, replication of viruses, and antiviral therapy. Medically important parasites will be discussed, along with their replication cycles and treatment methods.

**Semester Credits: 2**

**Lecture Hours: 1**

VIRGINIA WESTERN COMMUNITY COLLEGE  
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# MDL 236 Parasitology and Virology

## Student Outcomes for the Course:

At the completion of this course, the student should be able to:

- Describe the nature of a DNA or RNA virus and their replication
- Describe the mechanism of antiviral agents
- Diagnose viral and parasitic diseases
- Differentiate between the medically relevant viruses, such as adenovirus, poxvirus, and reoviruses
- Identify viruses in the laboratory
- Differentiate between various human parasites and know the life cycles of each
- Determine the primary organs/systems affected by the various viruses and parasites
- Determine how parasites are transmitted and identify the vector of the parasite
- Study laboratory techniques to isolate viruses and parasites from biological samples
- Differentiate prion diseases from viral diseases

Internet access required

## Textbook:

Medical Microbiology by P. Murray, et al. 8<sup>th</sup> edition; Elsevier (Bundled with Diagnostic Microbiology book by Mahon)

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# Course Outline

## I. Viral Classification, Structure and Replication

- A. Classification
- B. Virion Structure
  - Capsid viruses
  - Enveloped viruses
- C. Viral Replication
  - Recognition of Attachment to the Target Cell
  - Penetration
  - Uncoating
  - Macromolecular Synthesis
  - DNA Viruses
  - RNA Viruses
  - Viral Protein synthesis
  - Assembly
  - Release
  - Reinitiation of the Replication
- D. Viral Genetics
- E. Viral Vectors for Therapy

## II. Mechanisms of Viral Pathogenesis

- A. Basic Steps in Viral disease
- B. Infection of the Target Tissue
- C. Viral Pathogenesis
  - Cytopathogenesis
  - Lytic Infections
  - Nonlytic Infections
  - Oncogenic Viruses
  - Host Defenses against Viral Infection
  - Immunopathology
- D. Viral Disease
- E. Epidemiology
  - Exposure
  - Transmission of Viruses
  - Maintenance of a Virus in the Population
  - Age



- Immune Status
- Other Host Factors
- Geographic and Seasonal Considerations
- Outbreaks, Epidemics and Pandemics

#### F. Control of Viral Spread

### III. Role of Viruses in Disease

#### A. Viral Diseases

- Oral and Respiratory Tract Infections
- Flulike and Systemic Systems
- Gastrointestinal Tract Infections
- Exanthems, Hemorrhagic Fevers, and Arthritides
- Infection of the Eye
- Infections of the Organs and Tissues
- Infections of the CNS
- Hematologic Diseases
- Sexually Transmitted Viral Diseases
- Viruses Spread by Transfusion and Transplantation
- Viruses Spread by Arthropods and Animals
- Syndromes of Possible Viral Etiology

#### B. Chronic and Potentially Oncogenic Infections

#### C. Infections in Immunocompromised Patients

#### D. Congenital, Neonatal, and Perinatal Infections

### IV. Laboratory Diagnosis of Viral Diseases

#### A. Specimen Collection

#### B. Cytology

#### C. Electron Microscopy

#### D. Viral Isolation and Growth

- Cell Culture
- Viral Detection
- Interpretation of Culture Results

#### E. Detection of Viral Proteins

#### F. Detection of Viral Genetic Material

#### G. Viral Serology

- Serologic Test Methods
- Limitations of Serologic Methods



## **V. Antiviral Agents and Infection Control**

### **A. Targets for Antiviral Drugs**

- Virion Disruption
- Attachment
- Penetration and Uncoating
- RNA Synthesis
- Genome Replication
- Protein Synthesis
- Virion Assembly and Release
- Stimulators of Host Immune Response

### **B. Nucleoside Analogs**

- Acyclovir, Valacyclovir, Penciclovir, and Famciclovir
- Ganciclovir
- Cidofovir and Adefovir
- Azidothymidine
- Dideoxyinosine, Dideoxycytidine, Stavidine, and Lamivudine
- Ribavirin
- Other nucleoside Analogs

### **C. Nonnucleated Polymerase Inhibitors**

### **D. Protease Inhibitors**

### **E. Antiinfluenza Drugs**

### **F. Immunomodulators**

### **G. Infection control**

## **VI. Papillomavirus and Polyomaviruses**

### **A. Human Papillomaviruses**

- Pathogenesis
- Epidemiology
- Laboratory Diagnosis
- Treatment, Prevention and Control

### **B. Polyomaviridae**

- Structure and Replication
- Pathogenesis
- Epidemiology
- Laboratory Diagnosis
- Treatment, Prevention and Control



## **VII. Adenoviruses**

- A. Structure and Replication
- B. Pathogenesis and Immunity
- C. Epidemiology
- D. Clinical Syndromes
  - Acute Febrile Pharyngitis and Pharyngoconjunctival Fever
  - Acute Respiratory Disease
  - Other Respiratory Tract Diseases
  - Conjunctivitis and Epidemic Keratoconjunctivitis
  - Gastroenteritis and Diarrhea
  - Other Manifestations
  - Systemic Infection in Immunocompromised Patients
- E. Laboratory Diagnosis
- F. Treatment, Prevention, and Control

## **VIII. Human Herpesviruses**

- A. Structure of Herpesviruses
  - Herpesvirus Replication
- B. Herpes Simplex Virus
  - Herpes Simplex Virus Proteins
  - Replication
  - Pathogenesis and Immunity
  - Epidemiology
  - Clinical Syndromes
  - Laboratory Diagnosis
  - Treatment, Prevention, and Control
- C. Varicella-Zoster Virus
  - Structure and Replication
  - Pathogenesis and Immunity
  - Epidemiology
  - Clinical Syndromes
  - Laboratory Diagnosis
  - Treatment, Prevention, and Control
- D. Epstein-Barr Virus
  - Structure and Replication
  - Pathogenesis and Immunity
  - Epidemiology
  - EBV Induced Lymphoproliferative Diseases
  - Treatment, Prevention, and Control



## E. Cytomegalovirus

- Structure and Replication
- Pathogenesis and Immunity
- Epidemiology and Clinical Syndromes
- Laboratory Diagnosis
- Treatment, Prevention, and Control

## F. Human Herpesviruses 6 and 7

- Pathogenesis and Immunity
- Clinical Syndromes

## G. Other Human Herpesviruses

- Human Herpesvirus 8 (Kaposi Sarcoma-Associated Herpesvirus)

## **IX. Poxviruses**

### A. Structure and Replication

### B. Pathogenesis and Immunity

### C. Epidemiology

### D. Clinical Syndromes

- Orf, Cowpox and Monkeypox
- Molluscum Contagiosum
- Hybrid Poxviruses for Gene Delivery and Vaccines

## **X. Parvoviruses**

### A. Structure and Replication

### B. Pathogenesis and Immunity

### C. Epidemiology

### D. Clinical Syndromes

### E. Laboratory Diagnosis

## XI. Picornaviruses

### A. Structure

### B. Replication

### C. Enteroviruses

- Pathogenesis and Immunity
- Epidemiology
- Clinical Syndromes
- Laboratory Diagnosis
- Treatment, Prevention, and Control



#### D. Rhinoviruses

- Pathogenesis and Immunity
- Epidemiology
- Clinical Syndromes
- Laboratory Diagnosis
- Treatment, Prevention, and Control

### **XI. Coronaviruses and Noroviruses**

#### A. Coronaviruses

- Structure and Replication
- Pathogenesis and Clinical Syndromes
- Laboratory Diagnosis
- Treatment, Prevention, and Control

#### B. Noroviruses

- Structure and Replication
- Pathogenesis
- Epidemiology

### **XII. Paramyxoviruses**

#### A. Structure and Replication

#### B. Measles Virus

- Pathogenesis and Immunity
- Epidemiology
- Clinical Syndromes
- Laboratory Diagnosis
- Treatment, Prevention and Control

#### C. Parainfluenza Viruses

- Pathogenesis and Immunity
- Epidemiology
- Clinical Syndromes
- Laboratory Diagnosis
- Treatment, Prevention and Control

#### D. Mumps Virus

- Pathogenesis and Immunity
- Epidemiology
- Clinical Syndromes
- Laboratory Diagnosis
- Treatment, Prevention and Control





- E. Respiratory Syncytial Virus
  - Pathogenesis and Immunity
  - Epidemiology
  - Clinical Syndromes
  - Laboratory Diagnosis
  - Treatment, Prevention and Control
- F. Human Metapneumovirus
- G. Nipah and Hendra Viruses

### **XIII. Orthomyxoviruses**

- A. Structure and Replication
  - Pathogenesis and Immunity
  - Epidemiology
  - Clinical Syndromes
  - Laboratory Diagnosis
  - Treatment, Prevention and Control

### **XIV. Rhabdoviruses, Filoviruses, and Bornaviruses**

#### **A. Rhabdoviruses**

##### Physiology, Structure and Replication

- Pathogenesis and Immunity
- Epidemiology
- Clinical Syndromes
- Laboratory Diagnosis
- Treatment, Prevention and Control

#### **B. Filoviruses**

##### Physiology, Structure and Replication

- Pathogenesis and Immunity
- Epidemiology
- Clinical Syndromes
- Laboratory Diagnosis
- Treatment, Prevention and Control

#### **C. Borna Disease Virus**

##### Physiology, Structure and Replication

- Pathogenesis and Immunity
- Epidemiology
- Clinical Syndromes
- Laboratory Diagnosis
- Treatment, Prevention and Control



## **XV. Reoviruses**

### A. Structure

### B. Replication

### C. Orthoreoviruses

- Pathogenesis and Immunity
- Epidemiology
- Clinical Syndromes
- Laboratory Diagnosis
- Treatment, Prevention and Control

### D. Rotaviruses

- Pathogenesis and Immunity
- Epidemiology
- Clinical Syndromes
- Laboratory Diagnosis
- Treatment, Prevention and Control

### E. Coltiviruses and Orbiviruses

- Pathogenesis and Immunity
- Epidemiology
- Clinical Syndromes
- Laboratory Diagnosis
- Treatment, Prevention and Control

## **XVI. Togaviruses and Flaviviruses**

### A. Alphavirus and Flaviviruses

- Structure and Replication of Flaviviruses
- Pathogenesis and Immunity
- Epidemiology
- Clinical Syndromes
- Laboratory Diagnosis
- Treatment, Prevention and Control

### B. Rubella Virus

- Pathogenesis and Immunity
- Epidemiology
- Clinical Syndromes
- Laboratory Diagnosis
- Treatment, Prevention and Control
- Congenital Infection



## **XVII. Bunyaviridae and Arenaviridae**

### **A. Bunyaviridae**

- Structure and Replication of Flaviviruses
- Pathogenesis and Immunity
- Epidemiology
- Clinical Syndromes
- Laboratory Diagnosis
- Treatment, Prevention and Control

### **B. Arenaviruses**

- Structure and Replication of Arenaviruses
- Pathogenesis and Immunity
- Epidemiology
- Clinical Syndromes
- Laboratory Diagnosis
- Treatment, Prevention and Control

## **XVIII. Retroviruses**

### **A. Classification**

### **B. Structure**

### **C. Replication**

### **D. Human Immunodeficiency Virus**

- Pathogenesis and Immunity
- Epidemiology
- Clinical Syndromes
- Laboratory Diagnosis
- Treatment, Prevention and Control

### **E. Human T-cell Lymphotropic Virus and Other Oncogenic Retroviruses**

- Pathogenesis and Immunity
- Epidemiology
- Clinical Syndromes
- Laboratory Diagnosis
- Treatment, Prevention and Control



## **XIX. Hepatitis Viruses**

### **A. Hepatitis A Virus**

- Structure
- Replication
- Pathogenesis
- Epidemiology
- Clinical Syndromes
- Laboratory Diagnosis
- Treatment, Prevention and Control

### **B. Hepatitis B Virus**

- Structure
- Replication
- Pathogenesis
- Epidemiology
- Clinical Syndromes
- Laboratory Diagnosis
- Treatment, Prevention and Control

### **C. Hepatitis C and G Viruses**

- Structure
- Replication
- Pathogenesis
- Epidemiology
- Clinical Syndromes
- Laboratory Diagnosis
- Treatment, Prevention and Control

### **D. Hepatitis D Virus**

- Structure and Replication
- Replication
- Pathogenesis
- Epidemiology
- Clinical Syndromes
- Laboratory Diagnosis
- Treatment, Prevention and Control



## **XX. Prion Diseases**

- A. Structure and Physiology
- B. Pathogenesis
- C. Epidemiology
- D. Clinical Syndromes
- E. Laboratory Diagnosis
- F. Treatment, Prevention and Control

## **Parisitology**

### **I. Parasitic Classification, Structure, and Replication**

- A. Importance of Parasites
- B. Classification and Structure
  - Protazoa
  - Animalia (Metazoa)
- C. Physiology and Replication
  - Protazoa
  - Animalia (Metazoa)

### **II. Pathogenesis of Parasitic Diseases**

- A. Exposure and Entry
- B. Adherence and Replication
- C. Cell and Tissue Damage
- D. Disruption, Evasion, and Inactivation of Host Defenses

### **III. Role of Parasitic Diseases**

- A. Summary of Parasites Associated with Human Disease

### **IV. Laboratory Diagnosis of Parasitic Disease**

- A. Parasitic Life Cycle as an Aid to Diagnosis
- B. General Diagnostic Considerations
- C. Parasitic Infections of the Intestinal and Urogenital Tracts
  - Fecal Specimen Collection
  - Techniques of Stool Examination
  - Collection and Examination of Specimens Other than Stool
- D. Parasitic Infections of Blood and Tissue
- E. Alternatives to Microscopy
  - Immunodiagnostics
  - Molecular Diagnostic Approaches



- Culture
- Animal Inoculation
- Xenodiagnosis

## **V. Antiparasitic Agents**

- A. Targets for Antiparasitic Drug Action
- B. Drug Resistance
- C. Antiparasitic agents
  - Antiprotozoal Agents
  - Antihelminthic Agents

## **VI. Intestinal and Urogenital Protozoa**

- A. Amebae
  - *Entamoeba histolytica*
  - Other Intestinal Amebae
- B. Flagellates
  - *Giardia duodenalis* (**G. lamblia**)
  - *Dientamoeba fragilis*
  - *Trichomonas vaginalis*
- C. Ciliates
  - *Balantidium coli*
- D. Sporozoa (Coccidia)
  - *Sarcocystis* Species
  - *Cryptosporidium* Species
  - *Cyclospora* Species

## **VII. Blood and Tissue Protzoa**

- A. *Plasmodium* Species
  - *Plasmodium falciparum*
  - *Plasmodium knowlesi*
  - *Plasmodium vivax*
  - *Plasmodium ovale*
  - *Plasmodium malariae*
- B. *Babesia* Species
  - Physiology and Structure
  - Epidemiology
  - Clinical Syndromes
  - Laboratory Diagnosis



- C. *Toxoplasma gondii*
  - Physiology and Structure
  - Epidemiology
  - Clinical Syndromes
  - Laboratory Diagnosis
- D. *Sarcocystis lindemanni*
- E. Free-Living Amebae
  - Clinical Syndromes
  - Laboratory Diagnosis
  - Treatment, Prevention, and Control
- F. *Leishmania*
- G. Trypanosomes
  - *Trypanosoma brucei gambiense*
  - *Trypanosoma brucei rhodesiense*
  - *Trypanosoma cruzi*

### **VIII. Nematodes**

- A. *Enterobius vermicularis*
- B. *Ascaris lumbricoides*
- C. *Toxocara* and *Baylisascaris*
- D. *Trichuris trichiura*
- E. Hookworms
- F. *Ancylostoma braziliense*
- G. *Strongyloides stercoralis*
- H. *Trichinella spiralis*
- I. *Wuchereria bancrofti* and *Brugia malayi*
- J. *Loa loa*
- K. *Onchocerca volvulus*
- L. *Dirofilara immitis*
- M. *Dracunculus mediensis*

### **IX. Trematodes**

- A. *Fasciolopsis buski*
- B. *Fasciola hepatica*
- C. *Clonorchis sinensis*
- D. *Paragonimus westermani*
- E. Schistosomes
  - *Schistosoma mansoni*
  - *Schistosoma japonicum*



- *Schistosoma hematobium*

## **X. Cestodes**

- A. *Taenia solium*
- B. *Cysticercosis*
- C. *Taenia saginata*
- D. *Diphyllobothrium latum*
- E. *Sparganosis*
- F. *Echinococcus multilocularis*
- G. *Hymenolepis nana*
- H. *Hymenolepis diminuta*
- I. *Dipylidium caninum*

## **XI. Arthropods**

### **A. Mites**

- Itch Mites
- Human Follicle Mites
- Chigger Mites

### **B. Ticks**

### **C. Insecta**

- Bloodsucking Diptera
- Mosquitoes
- Gnats
- Blackflies
- Horseflies and Deerflies
- Muscoid Flies
- Myiasis-Causing Flies
- Sucking Lice
- Fleas





## **Laboratory Schedule**

1. Collecting and Processing Specimens for Parasite Identification
2. Microscopic Methods of Detecting Intestinal Parasites
3. Preparing and Staining Smears for Blood Parasites
4. Parasitic Protozoa
5. Parasitic Worms
6. Vectors of Disease

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