Virginia Western Community College
MDL 261
Clinical Chemistry I

Prerequisites
CHM 101 or equivalent

Course Description
Introduces the basic principles of clinical chemistry, including a description of automation in the laboratory, and clinical chemistry techniques and point of care testing. Focuses on amino acids and proteins, enzymes, lipids, carbohydrates, urea nitrogen, and electrolyte measurement. Also introduces molecular techniques in the modern clinical chemistry laboratory.

Semester Credits: 4 Lecture Hours: 3 Lab/Clinical/Internship Hours: 3

Required Materials

Textbook:
Clinical Laboratory Chemistry 2nd Edition by R. L. Sunheimer and L. GravesPearson ISBN: 978-0134413327

Other Required Materials:
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Course Outcomes

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

- Perform the laboratory mathematics required to prepare solutions and dilutions in the laboratory
- Describe the various types and principles of the automated chemistry analyzers
- Correlate the results of chemistry lab tests to specific disease conditions
- Describe how various enzymes function mechanistically, and which enzymes are associated with various organs in the human body
- Describe the role of various endogenous chemicals in the human body, such as glucose, urea, amino acids, proteins, and electrolytes
- Correlate disturbances in the normal body concentration of electrolytes and endogenous biochemicals (upset of homeostasis) with the onset of pathological states
- Recognize abnormal concentration values for the above substances in a blood sample
- Perform manual and automated test methodologies for select analytes in a blood sample and recognize analytical errors in the generation of results
- Distinguish between normal human physiology and pathological states in the major organ systems

Topical Description

I. Laboratory Basics

A. Introduction
B. Water
C. Chemicals
D. Lab Glassware and Plasticware
E. Measurement of Mass
F. Centrifuges
G. Mixing and Solutions
H. Laboratory Mathematics and Metric System

II. Laboratory Operations

A. Laboratory Statistics
B. Clinical Decision Limits
C. Reference Range or Normal Range
D. Quality Assurance and Quality Control
E. Informatics/Laboratory Information Systems

III. Analytic Techniques

A. Spectrophotometry
B. Electrochemistry
C. Electrophoresis
D. Osmometry

IV. Instrumentation

A. Absorption Spectroscopy
B. Atomic Absorption Spectroscopy
C. Molecular Luminescence Spectroscopy
D. Chemiluminescence
E. Light Scatter Techniques
F. Refractometry
G. Separation Techniques
H. Mass Spectrometry
I. Flow Cytometry
J. Microscale Techniques

V. Principles of Clinical Chemistry Automation

A. Introduction
B. Automated Analysis
C. Preanalytical Stage
D. Analytical Stage
E. Postanalytical Stage

F. Automated System Designs
G. Future Trends

VI. Immunochemical Techniques

A. Introduction
B. Basics of Immunochemical Reactions
C. General Principles of Immunoassays
D. Specific Immunoassay Techniques
E. Other Immunoassays
F. New Developments in Immunoassays

VII. Carbohydrates

A. Biochemistry of Carbohydrates
B. Carbohydrate Metabolism
C. Hormonal Regulation of Carbohydrates
D. Clinical Significance/Disease States
E. Specimen Collection and Handling
F. Glucose Methodologies
G. Other Carbohydrate Related Methodologies

VIII. Lipids and Lipoproteins

A. Classification and Biochemistry of Lipids
B. Lipoprotein Metabolism
C. Hyperlipidemia
D. Cholesterol Methodologies
E. Triglyceride Methodologies
F. High Density Lipoprotein Methodologies
G. Low Density Lipoproteins-Calculated and Direct
H. Metabolic Syndrome
I. National Cholesterol Education Program (NCEP)

IX. Amino Acids and Proteins

A. Protein Structure
B. Protein Metabolism
C. Protein Synthesis
D. Protein Functions
E. Amino Acidopathies
F. Plasma Proteins
G. Hyperproteinemia
H. Hyperproteinemia
I. Total Protein Methodologies
J. A/G Ratio
K. Urine and CSF Proteins
L. Albumin Methodologies
M. Protein Electrophoresis

X. Enzymes

A. Enzyme Biochemistry
B. Enzyme Kinetics
C. Factors Influencing Enzyme Action
D. Diagnostic Enzymology
E. Enzyme Classification/Isoenzymes
F. Cardiac Enzymes
G. Hepatic Enzymes
H. Biliary Tract Enzymes
I. Digestive and Pancreatic Enzymes
J. Other Clinically Significant Enzymes

XI. Non-protein Nitrogen and Renal Function

A. Renal Anatomy
B. Renal Physiology
C. Analytes Associated With Renal Function
D. Creatinine
E. Uric Acid
F. Assessment of Glomerular Filtration
G. Screening of Renal Disease
H. Renal Pathophysiology/Dialysis

XII. Body Water and Electrolytes

A. Body Fluid Composition
B. Colligative Properties
C. Regulation of Water and Electrolytes
D. Sodium, Potassium, Chloride and Bicarbonate

Laboratory Topics

Lab # 1: Introduction to Clinical Chem. Lab, Lab Calculations

Lab # 2: Total Cholesterol

Lab # 3: Uric Acid

Lab # 4: Total Protein-Biuret

Lab # 5: Western Blotting I

Lab # 6 Western Blotting II

Lab # 7: Magnesium Measurement

Lab # 8: Albumin Assay

Lab # 9: Urea Nitrogen

Lab # 10: Lactate dehydrogenase

Lab # 11: Glucose Analysis

Lab # 12: Electrolyte Measurement

Notes to Instructors

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