

SYLLABUS

Name of Course: Clinical Laboratory Diagnosis B Clinical Chemistry – ACS – 346/846

Length of Course: 44 hours (3 hrs lecture, 1 hr lab/week), 3.5 units

Course Description: This course is designed to teach students the proper usage of the clinical laboratory within the practice of chiropractic. Emphasis is placed on hematology, clinical chemistry and urology interpretation and integration with historical physical examination. The laboratory section will train students in laboratory case evaluation and recognition of histological normals and pathologies, as well as their utilization in diagnosis.

Prerequisites: ASC 345

Course Offered by: Department of Associated Clinical Sciences

Required Text: Fischbach F *Manual of laboratory & Diagnostic Tests*.
9th edition 2014.

Recommended Text: Tilkian SM *Clinical & Nursing Implications of Laboratory Tests*.
5th edition 1995.

Reference Texts: Sacher RA *Widmann's Clinical Interpretation of Laboratory Tests*.
11th edition 2000.

Materials: Class notes

Method of Instruction: Lecture-discussion & Lab-CBL (Case Based Learning)

Evaluation/Grading Criteria:

Midterm	50%
Final (comprehensive)	50%

A	90-100%
B	80-89%
C	70-79%
F	below 70%

Grades and the Grading System Final Grades are available online through the CAMS student portal. If there are any questions on grading procedures, computation of grade point average, or the accuracy of the grade report, please contact the Registrar's Office or the Office of Academic Affairs. Grades will be reported and evaluation will be based on the Academic Policies, Procedures, & Services. Please refer to Evaluation Policy (**Policy ID: OAA.0007**)

In order to maintain **Satisfactory Academic Progress**, a student must maintain a 2.0 or better in each and every course. **Any grade less than a C must be remedied by repeating the class.** Please refer to Satisfactory Academic Progress (**Policy ID: OAA.0006**)

Attendance: Please refer to Attendance Policy (**Policy ID: OAA.0002**)

Conduct and Responsibilities: Please refer to the Personal Conduct, Responsibility and Academic Responsibility Policy (**Policy ID: OAA.0003**)

Make-up Exams: Please refer to Make-up Assessment Policy (**Policy ID: OAA.0001**)

Request for Special Testing: Please refer to Request for Special Testing (**Policy ID: OAA.0004**)

Accommodation for Students with Disabilities:

If you have approved accommodations, please make an appointment to meet with your instructor as soon as possible. If you believe you require an accommodation, but do not have an approved accommodation letter, please see the Academic Counselor Lori Pino in the Office of Academic Affairs. Contact info: Lpino@lifewest.edu or 510-780-4500 ext. 2061. Please refer to Service for Students with Disabilities Policy (**Policy ID: OAA.0005**)

Electronic Course Management:

Canvas is LCCW's Learning Management System (LMS). Canvas will be used throughout the quarter during this course. Lectures, reminders, and messages will be posted. In addition, documents such as the course syllabus and helpful information about the class project will be posted. Students are expected to check Canvas at least once a week in order to keep updated. The website address for Canvas is <https://lifewest.instructure.com/login/canvas> Please refer to the Educational Technologies Policy (**Policy ID: OAA.0009**)

Course Goals: The goal of this course is to prepare the student to recognize when laboratory analysis is indicated and how to both order and interpret exams. An emphasis will be placed on how to discuss the findings and their significance with the patient.

Course Objectives:

Week 1:

- List the indications for ordering laboratory tests.
- Define the term "reference range" and explain how it is established.
- List the possible sources of error that affect lab test result (Factors Affecting the Quality of Lab Data)
- Define the terms: Stat values and Panic/Critical Values. Give examples of each term.
- Define the term "Ancillary or point of care testing ". Give example. Mention the advantage and limitations of this testing.
- Define the following terms: Precision, Accuracy, Specificity, Sensitivity, Positive predictive value, Negative predictive value, and Gold standard.
- Explain how sensitivity and specificity are calculated. of defense.
- Describe the blood elements and their functions.

Week 2:

- Describe the criteria for testing for DM in asymptomatic, undiagnosed patients.
- Describe the tests used to measure blood glucose level and diagnose DM:
 - Fasting blood glucose test.
 - 2-Hour Postprandial test.
 - Casual (Random) Plasma Glucose test.
 - Oral Glucose Tolerance Test (OGTT).
 - Screening glucose challenge test (O'sullivan test).
 - Hemoglobin A_{1c}-Glycosylated Hemoglobin test.
- List the common causes of hyperglycemia and hypoglycemia.
- Describe the classification of DM.
- Explain briefly the etiopathogenesis of Type-1 and Type-2 DM.
- Describe the important warning signs & symptoms of DM.
- Describe the diagnosis of DM.
- List the long term complications of DM.
- List the most serious foot complications in DM.
- List the three major components of the treatment of DM.
- Define the term "Lipid Profile" and mention its main use in clinical practice.
- List the types of lipids found in the blood and explain how they are carried in the blood stream.
- Explain why high blood cholesterol and Triglycerides levels are clinically significant.
- List the types of lipoproteins and indicate the bad and good ones.
- Describe the pretest patient care of lipid profile test.
- Describe the results of lipid profile according to the values of American Heart Association.
- Explain how to determine the cholesterol level goal for a given patient.
- List some important causes of hypercholesterolemia.

Week 3:

- Define the terms endothelial dysfunction, endothelial activation, atherosclerosis, arteriosclerosis, fatty streak.
- Classify arteriosclerosis.
- Explain briefly the pathogenesis of Atherosclerosis.
- Describe atheromatous plaque.
- List the complications of the atheromatous lesion.
- Explain the clinical significance of atherosclerotic lesions.
- List the risk factors of atherosclerosis.
- Classify hyperlipoproteinemias and correlate it with atherogenicity.
- Classify disorders of the thyroid.
- List the causes of hyperthyroidism.
- List the causes of hypothyroidism.
- Name the triad of clinical findings in Graves's disease.
- Define the term "goiter" and describe its X-ray findings.
- List the tests included in thyroid panel and mention the use of each test.
- Explain when should a clinician order a thyroid panel test.
- List the conditions that indicate high risk of thyroid dysfunction.
- Interpret the various combinations of results of thyroid function test.
- List the conditions which requires monitoring thyroid function.
- Describe the formation of bilirubin and bile. Define "Direct/conjugated bilirubin",

“indirect/unconjugated bilirubin” and mention how they are measured in the blood.

- Explain how abnormalities in the bilirubin metabolism can produce jaundice.
- Define jaundice, classify jaundice on the basis of biochemical findings.
- List the diseases or conditions which cause unconjugated, conjugated and mixed (unconjugated and conjugated) hyperbilirubinemia.
- Define cholestasis, list the clinical manifestations of cholestasis.
- List diseases or conditions which cause intrahepatic and extra hepatic bile duct obstruction.

Week 4:

- List the indications of renal function test.
- Define the terms: BUN, azotemia, and uremia, acute tubular necrosis, acute renal failure, and chronic renal failure.
- List the conditions associated with increased/decreased levels of BUN and Creatinine.
- List the four stages of the evolution from normal renal function to symptomatic chronic renal failure .
- List the important pre-renal, renal and post-renal causes of acute renal failure.
- List the risks of prolonged hyperuricemia.
- Define the terms: “Gouty arthritis, tophi, pseudogout.
- List the factors contribute to the conversion of asymptomatic hyperuricemia into primary gout.
- Classify gout and list the possible causes of each type.
- List the morphologic changes associated with gout.
- List the four stages of the clinical course of gout.
- Describe the radiological changes of chronic tophaceous gout.
- Define the term isoenzyme.
- List the important uses of enzyme levels measurement in the blood.
- List the conditions associated with elevated blood levels of acid phosphatase (ACP).
- Describe briefly the use of ACP in monitoring patients with prostatic cancer. Mention the other use of ACP in forensic medicine.
- Describe the normal physiological function and the clinical uses of prostatic specific antigen (PSA).
- Define the term “Benign Prostatic Hypertrophy”. Describe briefly its clinical features.
- Describe briefly the risk factors, clinical features, and diagnosis of prostatic cancer.
- Describe briefly the American Cancer Society recommendations for the early detection of prostate cancer.
- Describe briefly the clinical uses of measuring plasma levels of lipase and amylase and mention few examples of conditions associated with their elevated levels.
- Describe briefly the etiology, clinical features, diagnosis, and complications of acute and chronic pancreatitis

Week 5:

- Describe the function, tissue distribution, causes of elevated levels, and the main clinical use of blood tests of each of the following enzymes: ALT, AST, ALP, Aldolase, ACE.
- Describe how ALT, AST, and ALP tests help in diagnosing/differentiating different types of liver diseases.
- Define the term “Sarcoidosis”. Describe briefly its clinical course.
- Define the terms “biomarkers” & “cardiac markers”.
- Describe the role of CK, Troponins, LDH, Myoglobin in the diagnosis of myocardial infarction

Week 5 (CONTINUED):

(MI). Compare between the timings of increase and decline of the levels of each marker following MI. Mention other conditions (other than MI) where some of the markers also increase.

- List the differential diagnoses of chest pain.
- Describe the nature of chest pain of cardiac origin and pulmonary infarction origin.
- List the life threatening causes of chest pain.
- Describe the distribution of calcium and phosphorus/phosphate in the body.
- List the uses of measurements of calcium and phosphorus/phosphate levels.
- List the functions of calcium and phosphorus/phosphate
- Describe the interactions affecting calcium levels.
- List some factors which can increase/decrease calcium absorption and excretion.
- Describe the regulation of calcium in the body.
- List the causes of hypo & hypercalcaemia, hypo & hyperphosphotemia. Mention the health effects of these abnormalities.
- Define pathological calcification, describe its types, and list its causes.

Week 6:

- Describe the distribution of potassium and magnesium in the body.
- List the uses (indications) of measurements of potassium & magnesium levels.
- List the functions of potassium & magnesium in the body.
- List some causes of hypo & hyperkalemia, hypo & hypermagnesemia. List the possible health effects (clinical manifestations) of these abnormalities.

Week 7:

- Describe briefly the composition of urine.
- List the uses (purposes) of urine analysis test.
- List the methods of urine collection and sampling and describe the precautions of storage of urine samples.
- List the different tests used in urine analysis.
- Describe the macroscopical/physical analysis tests (volume, color, odor, clarity) of urine.
- Describe specific gravity test of urine analysis.
- Describe the pH test of urine analysis and explain how the kidneys control the body pH.
- List some causes of increased and decreased urine pH. Explain how manipulation of urinary pH helps in some clinical managements.
- Define the terms “Hematuria”, “Hemoglobinuria”, “Myoglobinuria”, “Proteinuria”, “Microalbuminuria”, “Bence Jones Proteins”.
- List the causes of hematuria, hemoglobinuria, and myoglobinuria.
- List the causes of proteinuria and microalbuminuria.
- List few causes and the clinical features of Nephrotic syndrome.
- Describe briefly multiple myeloma and explain how Bence Jones proteins can help in the diagnosis.

Week 8:

- Define the term “Renal Threshold for Glucose”, and describe the mechanism that leads to glucosuria.
- List few conditions associated with glucosuria. .
- Describe briefly the mechanisms that lead to elevated ketones levels and ketonuria.
- Mention the possible complications associated with increased levels of ketones in the blood.
- List the indications for ketones testing. Mention few conditions associated with ketonuria.
- Describe the clinical significance of positive urine nitrite and leukocytes esterase tests. List the indications of both tests.
- List few conditions associated with positive urine nitrite and leukocytes esterase tests.
- Describe briefly the clinical significance of urine bilirubin & urobilinogen tests and mention some causes of a positive urine bilirubin test.
- Compare between urine urobilinogen & bilirubin values in health condition, hemolytic disease, hepatic disease, and biliary obstruction.
- Describe briefly WBC & RBC casts, Epithelial cast, Granular cast, Hyaline cast, and Waxy cast.
- List few conditions associated with the different casts mentioned above
- Describe briefly the clinical implications of the use of the following tests: ***ESR, C-Reactive Protein (CRP), HLA, Rheumatoid Factor (RF), Fluorescent Antinuclear Antibody (FANA)***. List few conditions associated with the tests mentioned above.

Week 9

- Describe BRIEFLY the following conditions: osteoarthritis, rheumatoid arthritis, infectious (septic)/suppurative arthritis, juvenile idiopathic arthritis, seronegative spondyloarthropathies, ankylosing spondyloarthritis, Reiter syndrome, enteritis-associated arthritis, and tubercular arthritis.
- Describe briefly the collection of synovial fluid.
- Describe briefly the normal & abnormal appearance, clarity, volume, and viscosity of synovial fluid.
- Describe briefly the clinical significance of Ropes and String tests of synovial fluid.
- Classify synovial fluid and describe/compare synovial fluid changes (gross examination & lab analysis) in each class/group of joint disease/conditions.
- Describe briefly crystal induced joints disorders.

Week 10: REVIW/ CBL**Week 11: Final written exam.**

Student Learning Outcomes (SLO)

1. The student will be able to use correct terminology to describe the ordering of specific laboratory tests. (PLO:1)
2. The student will be able to properly interpret laboratory findings and correlate them with the pathogenesis & clinical findings of the disease. (PLO:1)
3. The student will be able to apply the laboratory findings to patient care.(PLO:1)
4. The student will be able to recognize when any additional forms of testing necessary when lab findings are inconclusive. (PLO:1)

Program Learning Outcomes (PLO): Students graduating with a Doctor of Chiropractic degree will be proficient in the following:

1. **ASSESSMENT AND DIAGNOSIS:** An assessment and diagnosis requires developed clinical reasoning skills. Clinical reasoning consists of data gathering and interpretation, hypothesis generation and testing, and critical evaluation of diagnostic strategies. It is a dynamic process that occurs before, during, and after the collection of data through history, physical examination, imaging, laboratory tests and case-related clinical services.
2. **MANAGEMENT PLAN:** Management involves the development, implementation and documentation of a patient care plan for positively impacting a patient's health and well-being, including specific therapeutic goals and prognoses. It may include case follow-up, referral, and/or collaborative care.
3. **HEALTH PROMOTION AND DISEASE PREVENTION:** Health promotion and disease prevention requires an understanding and application of epidemiological principles regarding the nature and identification of health issues in diverse populations and recognizes the impact of biological, chemical, behavioral, structural, psychosocial and environmental factors on general health.
4. **COMMUNICATION AND RECORD KEEPING:** Effective communication includes oral, written and nonverbal skills with appropriate sensitivity, clarity and control for a wide range of healthcare related activities, to include patient care, professional communication, health education, and record keeping and reporting.
5. **PROFESSIONAL ETHICS AND JURISPRUDENCE:** Professionals comply with the law and exhibit ethical behavior.
6. **INFORMATION AND TECHNOLOGY LITERACY:** Information literacy is a set of abilities, including the use of technology, to locate, evaluate and integrate research and other types of evidence to manage patient care.
7. **CHIROPRACTIC ADJUSTMENT/MANIPULATION:** Doctors of chiropractic employ the adjustment/manipulation to address joint and neurophysiologic dysfunction. The adjustment/manipulation is a precise procedure requiring the discrimination and identification of dysfunction, interpretation and application of clinical knowledge; and, the use of cognitive and psychomotor skills.
8. **INTERPROFESSIONAL EDUCATION:** Students have the knowledge, skills and values necessary to function as part of an inter-professional team to provide patient-centered collaborative care. Inter-professional teamwork may be demonstrated in didactic, clinical or simulated learning environments.
9. **BUSINESS:** Assessing personal skills and attributes, developing leadership skills, leveraging talents and strengths that provide an achievable expectation for graduate success. Adopting a systems-based approach to business operations. Networking with practitioners in associated fields with chiropractic, alternative medicine and allopathic medicine. Experiencing and acquiring the hard business skills required to open and operate an on-going business concern. Participating in practical, real time events that promote business building and quantifiable marketing research outcomes
10. **PHILOSOPHY:** Demonstrates an ability to incorporate a philosophically based Chiropractic paradigm in approach to patient care. Demonstrates an understanding of both traditional and contemporary Chiropractic philosophic concepts and principles. Demonstrates an understanding of the concepts of philosophy, science, and art in chiropractic principles and their importance to chiropractic practice.

Week/Date	Teaching Activity	Topic/Description
WK1	Lecture-1	Role of Lab in everyday practice
	Lab-1	Introductory session: How to order a lab test?
	Lecture-2	Blood Glucose Measurement
WK2	Lecture-3	Diabetes Mellitus
	Lab-2	Case-1 & 2 (Blood Glucose)
	Lecture-4	Lipid profile
WK3	Lecture-5	Atherosclerosis
	Lecture-6	Thyroid diseases & Thyroid panel
	Lab-3	Case-3 & 4 (Lipid Profile & Thyroid Panel)
WK4	Lecture-7	Bilirubin, Jaundice & Cholestasis
	Lecture-8	BUN, Creatinine, & Renal function test
	Lecture-9	Uric acid & Gout
	Lab-4	Case-5,6,&7 (Bilirubin & Jaundice, Renal function test, Uric acid & Gout)
WK5	Lecture-10	ACP, PSA, Amylase & Lipase
	Lecture-11	AST, ALT, Aldolase, ACE
	Lecture-12	Cardiac markers: CPK, Troponins, LDH
	Lab-5	Case-8,9,&10 (Amylase & Lipase, PSA & ACP, Cardiac biomarkers)
WK6	Lecture-13	Electrolytes: Calcium & Phosphate
	Lecture-14	Electrolytes: Potassium & Magnesium
	MIDTERM EXAM	
WK7	MIDTERM EXAM FEEDBACK & DISCUSSION	
	Lab-6	Case-11: Electrolytes disturbance
	Lecture-15	Urine analysis-I: Polyuria, oliguria, sp. gravity, color, odor, pH
WK8	Lab-7	Case-12: Urine analysis
	Lecture-16	Urine analysis-II: Hematuria & Proteinuria
	Lecture-17	Urine analysis-III: Glucose, ketones, nitrite, leukocyte esterase, Bilirubin,
	Lecture-18	Urine analysis-IV: WBC & RBC casts, Hyaline casts, Waxy casts
WK9	Lab-8	Case-13, 14, 15: Urine Analysis
	Lecture-19	Arthritis Panel: ESR, CRP, HLA B27, HLA DR4, Rheumatoid factor, FANA
	THANKSGIVING DAY	
WK10	Lecture-20	Types of Arthritis
	Lecture-21	Synovial fluid: appearance, viscosity, mucin clot, special findings
	Lab-9	Case-16: Synovial fluid analysis
WK11	CBL/REVIEW	
	CBL/REVIEW	
FINAL EXAM		

Key: Case Based Learning (CBL)