DOCTORATE IN CLINICAL LABORATORY SCIENCE
Competencies / Model Course Descriptions / Objectives

Approved: 2/9/06; Revised: 4/11/2012

GENERAL COMPETENCIES
Competencies refer to the guiding document (v. 2-9-06) developed by the ASCLS Professional
Doctorate Task Force of the American Society for Clinical Laboratory Science and accepted by
the Graduate Task Force of the National Accrediting Agency for Clinical Laboratory Sciences.
All general competencies to follow shall be achieved in course experiences.

1.0   Patient Care

1.1   Work effectively with all health care professionals to provide patient-centered care
1.2   Create and sustain a therapeutic and ethically sound relationship with patients
1.3   Appropriately adapt communication style and messages to the context of the individual
        patient interaction
1.4   Demonstrate caring and respectful behaviors when interacting with patients and their
        families
1.5   Gather essential and accurate information about their patients
1.6   Provide and coordinate patient and family centered health care services and education
        within inpatient, outpatient, and non-patient settings.
1.7   Provide health care services and education aimed at preventing health problems or
        maintaining health.
1.8   Obtain and apply information about the local/regional population of patients and the
        larger population from which their patients are drawn
1.9   Manage through ordering, interpretation, or supervision laboratory tests that monitor
        physiological function.

2.0   Interpersonal and Communication Skills

2.1   Work effectively with all health care professionals as a member or leader of a health care
        team or other professional group
2.2   Apply an understanding of human behavior to interactions with all health care
        professionals.
2.3   Demonstrate emotional resilience, flexibility, and tolerance of ambiguity
2.4   Accurately and adequately document and record information regarding the care process
        for medical, legal, quality, and financial purposes.
2.5   Use information technology to support local, regional, and national health care decisions.
2.6   Use effective listening, nonverbal, explanatory, questioning, and writing skills to elicit
        and provide information

3.0 Professionalism

3.1 Explain the legal and regulatory requirements, as well as the appropriate role of a Doctor of Clinical Laboratory Science within all healthcare environments.
3.2 Maintain professional relationships with physician and other health care providers
3.3 Be responsive and accountable to the needs of patients, society and the profession
3.4 Treat patients and co-workers with respect, compassion, and integrity
3.5 Abide by ethical principles pertaining to provision or withholding of clinical care, confidentiality of patient information, informed consent, and business practices
3.6 Demonstrate sensitivity and responsiveness to patients' current medical status, culture, age, gender, and disabilities
3.7 Engage in self-reflection, critical curiosity, and initiative in the pursuit of professional improvement education

4.0 Outreach

4.1 Integrate research to promote evidence-based practice for patients with complex acute, critical, and chronic illnesses.
4.2 Integrate the DCLS role into systems, processes, and decision making to function fully within the health care team.
4.3 Serve as a knowledge resource in the design and development of laboratory services for the complex acute, critical, and chronically ill patients.

5.0 Continuous Practice Improvement

5.1 Perform practice-based improvement (evidence based practice) activities alone or in concert with other members of the health care delivery team
5.2 Locate, appraise, and integrate evidence from scientific studies related to patients' health problems
5.3 Apply knowledge of study designs and statistical methods to the appraisal of clinical studies and other information to maximize treatment decisions and patient outcomes using diagnostic and therapeutic laboratory procedures
5.4 Apply information technology to manage information, access online medical information, and support personal continuing education
5.5 Recognize and appropriately address gender, cultural, cognitive, emotional, and other biases; gaps in medical knowledge; and physical limitations in themselves
5.6 Effectively interact with different types of medical practice and delivery systems
5.7 Practice cost-effective health care and resource allocation without compromise in quality of care
5.8 Partner with supervising physicians, health care managers, and other health care providers to assess, coordinate, and improve the delivery of health care and patient outcomes
5.9 Accept responsibility for promoting a safe environment for patient care
5.10 Recognize and correct systems-based factors that negatively impact patient care
5.11 Apply medical information and clinical data systems to provide more effective, efficient patient care

5.12   Utilize principles of case management when overseeing and directing health care services for complex acute, critical, and chronic illness.

5.14   Promote efficient use of resources and provision of quality care to achieve optimal cost-effective outcomes.

COURSE RELATED COMPETENCIES

The following generic course-related competencies apply to all courses in the DCLS curriculum where applicable, based on subject.

Scientific/ Medical Knowledge

- Discriminate among etiologies, risk factors, and underlying pathologic processes for medical conditions.
- Identify signs and symptoms of medical conditions.
- Correlate patient status data in the selection and interpretation of appropriate laboratory tests.
- Manage diagnostic and therapeutic studies through ordering, interpretation, performance, supervision, risk assessment, and cost-benefit analysis.
- Correlate general medical and surgical conditions to include side effects, interactions, and adverse reactions of pharmacologic agents and other relevant treatment modalities.
- Identify the appropriate laboratory methods to detect conditions in an asymptomatic individual.
- Differentiate between the normal and the abnormal in anatomy, physiology, laboratory findings, and other diagnostic data.
- Appropriately use history and physical findings to choose focused diagnostic and therapeutic studies.
- Determine the need for, perform, and/or direct additional testing, based on initial assessment findings.
- Provide for the diagnosis and monitoring of organic disease by assessing laboratory data associated with medical, therapeutic and/or surgical interventions.
- Provide tracking and statistical analysis of procedural outcomes to support evidence based practice.
- Demonstrate an understanding of the funding sources and payment systems that provide coverage for patient care
- Design and utilize operations and capital budgets as well as cost/revenue procedures for optimal efficiency.
- Integrate research to promote evidence-based practice for patients with complex acute, critical, and chronic illnesses.
- Contribute to research that promotes positive outcomes during complex acute, critical, and chronic illness.
- Interpret and advocate the DCLS role to other health care providers and to the public.
- Integrate the DCLS role into systems, processes, and decision making to function fully within the health care team.

- Serve as a knowledge resource in the design and development of laboratory services for the complex acute, critical, and chronically ill patients.

COURSE DESCRIPTIONS

The following are suggested courses and learning objectives to be included in the DCLS curriculum. Each DCLS program may cover the material in a manner which aligned with specific institution student learning outcomes, curricular design guidelines and school policies.

Biochemistry and Cell Biology
The chemistry and reactions of the constituents of living matter, metabolism, genetics, and control mechanisms at levels of biological organization from subcellular to organism will be covered. Emphasis will be placed on medical application.

Behavioral/Learning Objectives:
1.   Apply principles of inorganic and organic chemistry to the structure and processes of living organisms.
2.   Examine the biochemical processes involved in the maintenance of homeostasis and health.
3.   Analyze the role of the chemical principles underlying biological processes in common diseases.
4.   Correlate biochemical and cellular processes with mechanisms of drug actions and appropriate laboratory findings.
5.   Correlate biochemical and cellular processes with appropriate clinical diagnoses and laboratory findings.
6.   Correlate biochemical processes with genetics principles and molecular laboratory findings.

Clinical Immunology
This course will focus on the essential concepts of the human immune system, structure and function, with emphasis on laboratory science diagnosis and treatment using immunological principles.

Behavioral/Learning Objectives:
1.   Examine the cellular and molecular basis of immune responsiveness and their roles in maintaining health.
2.   Analyze the immune system responses contributing to disease and involved in recovery.
3.   Integrate immune concepts and principles of immune function with clinical laboratory applications.
4.   Develop an understanding of the role of the immunology laboratory in the care of patients with immunologic diseases.
5.   Evaluate immunological testing data for clinical significance.

Microbiology and Infectious Disease

This course is designed to familiarize students with the fundamentals of etiology, pathogenesis, diagnosis and prevention of infectious disease. Initially a brief introduction to microbiology concerning microbial physiology and genetics will be followed by host-parasite interrelationships for specific groups of disease-producing agents and appropriate therapeutic agents. Immunologic disorders, as well as the application of immunological principles to diagnoses of diseases, are stressed

Behavioral/Learning Objectives:

1. Develop the laboratory diagnostic and therapeutic interventions necessary for the diagnosis and management of infectious disease.
2. Discuss preventive principles of disease control, prevention of nosocomial infections, and immunization programs
3. Participate in ongoing discussions with Infection Control Epidemiologist regarding inpatient and outpatient issues.
4. Review the pertinent literature (i.e., textbooks, specific current clinical journal articles and existing electronic databases) regarding specific disease states.
5. Evaluate the pathophysiology, natural history, diagnosis and clinical management of the common or important clinical infectious disease syndromes listed below.
6. Explain the principles of antimicrobial therapy using the functional structure and biophysiology relating to the mechanism of action of antibiotics and antimicrobial agents used in clinical medicine
7. Utilize various aspects of pharmacokinetics, pharmacodynamics and costs of commonly used antibacterial, antiviral, anti-parasitic, antifungal, and other agents with respect to infectious disease syndromes
8. Explain the basic mechanisms of microbial resistance.
9. Apply appropriate functions utilization of diagnostic bacteriology, immunology, virology, mycology, and parasitology laboratories to individual cases
10. Participate in clinic and laboratory teaching sessions provided
11. Participate in inpatient and outpatient consultation and review of clinical specimens in the laboratories with the attending physician.
12. Explain the appropriate use of antimicrobial agents in a variety of clinical settings and their potential adverse reactions,
13. Identify and manage microbiological and immunologic factors that determine the outcome of the interaction between host and microbe.
14. Explain the effects of underlying disease states and immunosuppressive therapies on host response to infectious agents.
15. List the mechanisms of enhancement of resistance by active or passive immunization and immunomodulating agents,
16. With respect to specific infectious entities, compare and contrast methods of determining activity of antimicrobial agents and techniques to determine their concentrations in blood and other body fluids.

17. List the indications for specimen collection relevant to infectious diseases and the appropriate culture techniques for and/or methods of identification in tissues and fluids of bacteria, mycobacteria, fungi, viruses, rickettsiae, chlamydiae, and parasites
18. Compare and contrast the principles and practice of hospital epidemiology and infection control, quality improvement, clinical outcomes analysis and cost containment in the clinical practice of infectious diseases
19. Explain the impact of epidemiologic forces outside the hospital environment on potential community and patient outcomes
20. Explain the fundamental principle of public health
21. Identify and take corrective action of adverse events attributed to specific immunizations and immunomodulators,
22. Participate in laboratory rounds, which concentrate on the investigation and evaluation of infectious disease cases
23. Participate in daily rounds of infectious disease cases
24. Provide follow up of outpatient and inpatient laboratory results and pending consultations from other services

Biostatistics

The course provides an introduction to the fundamentals of designing research and using the appropriate statistical methods for laboratory science and evaluation of evidence. The course goal is to help the student/clinician become an informed user and consumer of statistics and research as they pertain to clinical applications in evidence based practices and decision making methods. There is an emphasis on critique of study designs and interpretation and evaluation of the results of current research literature. In order to accomplish this objective, statistics is taught within the context of commonly used research designs. The course culminates with submission of a research project design.

Behavioral/Learning Objectives:

1. Use statistical methods to compare and evaluate findings from studies of different local/regional populations of patients.
2. Determine appropriate outcomes measures, i.e., medical, legal, quality, and financial, for the structure of a study documenting protocol guidelines.
3. Identify and consult healthcare practitioners responsible for local institutional utilization review and outcomes reporting.
4. Demonstrate the use of statistical software in evaluation of laboratory test ordering protocols.
5. Using statistical methods, identify laboratory test ordering protocols related to high risk, high cost, and high frequency diagnostic related groups (DRGs) in the local inpatient population.
6. Using statistical methods, identify protocol variability points.
7. Design a research project and prospectus describing a study to evaluate various protocols.

Hematopathology

This course covers hematological abnormalities and their relationship to blood disorders. The student receives instruction regarding clinical laboratory instrumentation and techniques, such as flow cytometry and genetic analysis, used to diagnose and monitor hematological conditions.

Behavioral/Learning Objectives:
1. Examine the pathophysiology of hematological disorders.
2. Identify general signs and symptoms of hematologic disorders.
3. Develop an understanding of the role of the hematology laboratory in the care of patients with hematologic diseases.
4. Interpret laboratory data and formulate differential diagnoses of hematological disorders.
5. Effectively use the clinical laboratory to manage hematologic disorders.
6. Demonstrate an understanding of the principles of hematologic laboratory technology and their clinical applications.

Immunohematology and Transfusion Services

Transfusion medicine is critical in the treatment of seriously ill patients. In this course students will critically examine the issues of transfusion medicine including testing choices, component therapy and administration of a blood bank and transfusion service.

Behavioral/Learning Objectives:

1. Recognize the situations that warrant blood based component therapy
2. Demonstrate an understanding of the pertinent molecular, biochemical and cellular mechanisms that are important in maintaining body homeostasis, especially of those systems known to be susceptible to volume or component depletion.
3. Demonstrate an understanding of: 1) the molecular, biochemical, and cellular mechanisms of agents known to cause or underlie various pathophysiological states and the mechanism of the components used to combat the major diseases and syndromes through both lectures and small group activities.
4. Select appropriate components for patient improvement on an ongoing or emergent situation
5. Apply all relevant federal, state and local regulations to the correct operation of a blood bank and transfusion service.

Health Informatics and Epidemiology

This course serves as an introduction to types of epidemiological studies and covers modeling of various types of epidemics.

Behavioral/Learning Objectives:

1. Use statistical methods to compare and evaluate findings and health risks from studies of different local/regional populations of patients.
2. Determine appropriate outcomes measures, i.e., medical, legal, quality, and financial, for the structure of an epidemiological study.
3. Identify and consult healthcare practitioners responsible for local institutional utilization review and outcomes reporting.
4. Demonstrate the use of statistical software in evaluation of laboratory test ordering protocols.

5. Using statistical methods, identify laboratory test ordering protocols related to high risk, high cost, and high frequency diagnostic related groups (DRGs) in the local inpatient population.
6. Using statistical methods, identify protocol variability points.
7. Design a research project and prospectus describing an epidemiological study.

Evidence Based Practice in Clinical Laboratory Science I
The first course of a three course sequence designed to teach the student to use the best evidence to make diagnoses, facilitate patients' choices and provide patients with appropriate counseling in the area of the various biomedical technologies. The course consists of three segments in a modular format that is intended to provide a framework for the practice or study of evidence-based medicine as relates to biomedical technologies. In the first segment, the student of evidence-based medicine will be taught to use the medical decision-making techniques of probability, analysis, treatment and testing thresholds, and cost-effectiveness to frame the medical problem. In the second segment, the student will learn to review the current medical literature to retrieve and evaluate relevant information. In the final segment the student will learn to assess the validity of medical information.

Behavioral/Learning Objectives:

1.   Cite a definition of Evidence Based Medicine (EBM)
2.   Cite the fundamental principles of EBM.
3.   Identify the elements of the Hierarchy of Evidence.
4.   Cite practical applications of the principles of EBM in clinical practice.
5.   Describe the components of a Systematic Review of the Literature.
6.   Identify clinically relevant published research to support answering a relevant question.
7.   Summarize data from relevant published research relating to a clinical question.
8.   Structure elements of a systematic review of the literature using data gathered regarding a specific clinical question.
9.   Demonstrate an understanding of the statistical tools of medical decision-making by utilizing current evidence-based databases in analysis of case studies.
10. Discuss and apply principles of medical decision-making, e.g., statistical measures, measures of predictive and causal relationships, meta-analysis, in analysis of case studies.
11. Use laboratory information to assess risk and prevalence in populations of interest.

12. Use risk and cost assessment information to determine cost-efficiency of laboratory testing.
13. Use evidence to evaluate laboratory test ordering protocols associated with commonly utilized preventative assessments, e.g., PAP screens, HBV screens, prostate screens, general chemistry profiles, thyroid profiles, etc.

Issues in Clinical Laboratory Science I
Critical review of clinical services delivery as applied to diagnostic and therapeutic laboratory sciences.

Behavioral/Learning Objectives:

1. Demonstrate honesty and integrity in all interactions with peers, patients, and faculty
2. Demonstrate a compassionate and dignified treatment of patients as required for student questioning of patients
3. Demonstrate an understanding of the pertinent aspects of a focused medical history
4. Demonstrate an understanding of some organ-specific clinical signs and symptoms
5. Demonstrate an introductory understanding of some components of the physical examination
6. Demonstrate an introductory understanding of the kinds of clinical information provided by other units within the healthcare setting useful in differential diagnosis presented for selected disease states in some lectures,
7. Demonstrate the ability to apply deductive reasoning regarding problems in basic and clinical science
8. Demonstrate an understanding of the pathophysiology of selected disease states
9. Demonstrate an understanding of the etiology of selected disease states
10. Demonstrate an understanding of some organ-specific clinical signs and symptoms
11. Demonstrate an understanding of the kinds of clinical information useful in differential diagnosis
12. Recognize the need to develop patient treatment plans cognizant of individuals' beliefs and values to maximize his/her understanding and treatment outcome.
13. Recognize and understand the roles of various health care professionals and the need for collaboration in delivering patient care
14. Demonstrate an awareness of the incidence of disease among various U.S. populations and inter-patient variations in responses to treatments

Issues in Clinical Laboratory Science II
National, state and local health care policy impacts health care at the level of delivery. In this segment of the seminar, students will critically examine clinical issues from an integrated policy and economic perspective as it pertains to management principles, entrepreneurship, and various models of healthcare delivery.

Behavioral/Learning Objectives:

1. Demonstrate an understanding of the ethical issues in relationship to the use of information, information technology, and networks
2. Demonstrate an understanding of the need to engage in lifelong learning to stay abreast of relevant scientific advances
3. Demonstrate the ability to identify information need, locate, critically evaluate and use information effectively
4. Demonstrate the ability to work more effectively through the use of computer systems, networks, and general applications programs
5. Demonstrate an understanding of the use of information technology as it relates to the practice of medicine
6. Demonstrate honesty and integrity in all professional interactions with patients' families, colleagues, and others evidenced by: (1) student to student and student to faculty interactions, (2) student questioning of patients and 3), completing examinations or other assessments.
7. Demonstrate a commitment to continuously improve upon their knowledge and abilities
8. Demonstrate an understanding of basic ethical principles relating to the choices of various pharmacologic, non-pharmacologic and alternative treatments of the major diseases of the various organ systems ((cardiovascular, endocrinologic, gastrointestinal, hematologic, integumentary, musculoskeletal, nervous, pulmonary, renal, and reproductive)
9. Explain the relationship between the U.S. Constitution and the various health care related laws, regulations and agencies
10. Diagram the relationship among the various national and state health care related agencies (e. g., Departments of Public Health, Centers for Medicare Services, etc.)
11. Follow the paper trail necessary for correct billing and compliance responsibilities
12. Conduct an informal audit/inspection for laboratory compliance and billing procedures.

Education Principles in Health Care
Basic educational principles applied to patient education, staff development, continuing education, and clinical education. Principles are evidenced through development and presentation of an educational session.

Behavioral/Learning Objectives:

1. Create and deliver a suite of presentations on the same topic but given to different audiences (patients and their families; staff education and professional colleagues). The criteria for acceptability will include
    A. Bloom's taxonomy to develop behavioral/learning objectives at an appropriate level for each audience
    B. Language and explanation appropriate to each audience
    C. Presentation method, audio-visual or supportive documentation and/or tools
    D. Quality and clarity of summary, recommendations, or conclusions
    E. Creation and implementation of examinations or other methods for ascertaining learning

2.   Evaluate the quality of presentations as given by other students or colleagues
3.   Create a model-structured program for use at a three –day professional meeting
4.   Participate in the development of formal and informal tutorials for improved laboratory utilization

Health Assessment

This course will focus on patient care with emphasis on assessment and medical response in critical care situations. Review and evaluation of patient assessment and treatment protocols, perform physical exams, take medical histories, and use basic hand instruments in performing physical examinations will be included.. Normal findings in these areas will be emphasized.

Behavioral/Learning Objectives:

1. Evaluate a complete medical history and physical to determine the appropriate next step utilizing the laboratory
2. Create a problem list based on history and results of PE and review of preliminary laboratory and diagnostic information.
3. Summarize the HPI, complex history, H & PE examination and problem list using appropriate medical terminology, standard H & P format and sound organization of both subjective and objective data.
4. Present the H & PE findings and problem list as appropriate to the laboratory and to physicians in an organized manner in both oral and written form.
5. Observe a preceptor taking problem focused histories, performing directed physical examinations (PE), formulating diagnoses, and developing management plans.
6. Write the findings of a problem focused history and PE in SOAP format and submit for evaluation

Pathophysiology for Clinical Decision Making I

The first course of a two course sequence exploring pathophysiology of disease processes (physical and mental) and relationships among symptoms and laboratory findings. The course addresses the function and disease associated with the cardiovascular, pulmonary, hepatic, and renal systems.

 Behavioral/Learning Objectives:

1.   Examine the mechanisms of altered physiology and their contribution to pathological states.
2.   Develop a foundation for the proper use of laboratory testing for diagnosis and optimum patient management.
3.   Apply and integrate knowledge of pathologic physiology with laboratory data in the clinical decision making process.
4.   Correlate a history and physical with initial laboratory evaluations,
5.   Based on laboratory data, formulate an appropriate differential diagnosis
6.   Create a protocol for the effective management of the clinical laboratory (to include further diagnostic evaluation and/or possible treatment) that is individualized for each patient

7.   Monitor the course of an illness and appropriately revise the use of the clinical laboratory services.
8.   Apply the psychological, social, and economic principles involved in illness and in the delivery of health care.
9.   Participate appropriately as a non-physician health care professional with other non-physician health care professionals and physicians in the delivery of health care.
10.   Select and utilize the personal educational needs and the appropriate learning resources to meet his or her objectives.

Medical Genetics and Molecular Diagnostics:
This course considers the structure and function of DNA and how these parameters are exploited in molecular diagnostics and therapeutics. The course covers applications of molecular testing by focusing on nucleic acid amplification techniques that are currently being used in the clinical laboratory. The course also focuses on the application of molecular testing in cancer and infectious diseases testing.

Behavioral/Learning Objectives:
1.   Analyze the molecular mechanisms underlying disease.
2.   Demonstrate a working knowledge of molecular technologies.
3.   Apply molecular approaches to diagnosis and treatment.
4.   Interpret molecular data from clinical cases and correlate with morphologic and immunophenotypic findings.
5.   Demonstrate an understanding of the key considerations in the set up and operation of a molecular diagnostic laboratory.
6.   Evaluate contemporary and novel molecular procedures and their application in medicine.

Issues in Public Health

This course will cover topics of public health and newly emerging public health content areas. Students will explore the organization of the U.S. Public Health System and the role of the DCLS in the implementation and assessment of public health programs at the local, regional, state, and local levels.

Behavioral/Learning Objectives:
1.   Use statistical methods to compare and evaluate findings and health risks from studies of different local/regional/national populations of patients in the public health system.
2.   Determine appropriate outcomes measures, i.e., medical, legal, quality, and financial, for the structure of an epidemiological study within the public health system.
3.   Identify and consult healthcare practitioners responsible for public health utilization review and outcomes reporting.
4.   Demonstrate the use of statistical software in evaluation of public health programs outcomes measures.
5.   Using statistical methods, identify protocols related to high risk populations in the public

health system
6.   Using statistical methods, identify protocol variability points.
7.   Design a research project and prospectus describing an epidemiological study in the public health system

Patient Interactions and Health Care Communications
Essential patient care concepts including medical assessment, physical assessment, infection control and aseptic technique, physiologic monitoring, specimen collection, drug administration, patient special needs, psycho-social considerations, and medical emergencies.

Behavioral/Learning Objectives:

1.   Describe a complete medical history and the importance of using good interpersonal skills.
2.   Discuss the contents of a complete physical examination and acceptable techniques.
3.   Create a problem list based on a given history and physical examination and review of preliminary laboratory and diagnostic information.
4.   Write the history of present illness (HPI), complex history and History and Physical (HPE) examination with problem list, using appropriate medical terminology, in standard H&P format, with sound organization of subjective and objective data.
5.   Present the H&P examination findings and problem list in an organized manner.
6.   Observe a preceptor as they take problem focused histories, perform directed physical examinations, formulate diagnoses, and develop management plans.
7.   Describe a problem focused H & PE on an assigned patient and present findings to a preceptor.
8.   Describe a problem focused H & PE on an assigned patient and write the findings, assessment, and plan in the standard SOAP format (Subjective, Objective, Assessment and Plan) and submit the SOAP note for formal evaluation.
9.   Perform specimen collections (blood, body fluids, scrapings, etc.) to obtain valid laboratory specimens.
10. Observe the administration of medications to both inpatient and outpatient populations.

Pathophysiology for Clinical Decision Making II
The second course of a two course sequence exploring pathophysiology of disease processes (physical and mental) and relationships among symptoms, objective and laboratory findings. The course addresses reproductive system function and disease (to include fertility issues) as well as selected neurologic, pediatric, and geriatric conditions.

Behavioral/Learning Objectives:

1.   Examine the mechanisms of altered physiology and their contribution to pathological states.
2.   Develop a foundation for the proper use of laboratory testing for diagnosis and optimum patient management.
3.   Apply and integrate knowledge of pathologic physiology with laboratory data in the clinical decision making process.

4. Correlate a history and physical with initial laboratory evaluations, based on laboratory data, formulate an appropriate differential diagnosis
5. Create a protocol for the effective management of the clinical laboratory (to include further diagnostic evaluation and/or possible treatment) that is individualized for each patient
6. Monitor the course of an illness and appropriately revise the use of the clinical laboratory services.
7. Apply the psychological, social, and economic principles involved in illness and in the delivery of health care.
8. Participate appropriately as a non-physician health care professional with other non-physician health care professionals and physicians in the delivery of health care.
9. Select and utilize the personal educational needs and the appropriate learning resources to meet his or her objectives.

Pharmacology
Focuses on the principles of pharmacology, mechanism of action, toxicology and drug distribution. Special emphasis will be placed on laboratory evaluation of drug regimens used in diagnosis and treatment.

Behavioral/Learning Objectives:
 The student shall be able to

1. Identify the chemical structures of drugs that can provide information about mechanism of action, pharmacokinetics, stability, and metabolic fate.
    A. Structure-Activity
    B. Sites of Action
    C. Pharmacodynamics
    D. Pharmacokinetics
        1. Absorption (oral or parenteral)
        2. Distribution
        3. Metabolism
        4. Excretion
        5. Biological Factors Modifying Pharmacokinetic
    E. Clinical Pharmacology and Therapeutics
        1. Indications and Therapeutic Uses
        2. Contraindications and Factors (e.g., liver disease).
        3. Bioavailability
        4. Drug Nomenclature
    F. Clinical Toxicology
        1. Adverse Drug Reactions
        2. Toxicities
        3. Side Effects
2. Explain the processes and concerns in the development, evaluation (clinical trials) and control of drugs
3. Correlate appropriate laboratory findings with drugs

4.   Justify appropriate medications for inclusion/exclusion to the facility's formulary
5.   Justify selection of medication based on patient history, physical, status and laboratory findings

Clinical Patient Management

Introduction and evaluation of critical pathways of major Diagnostic Related Groups in clinical patient management. Pathway analysis includes pathophysiology of disease processes and appropriateness/efficacy of diagnostic and therapeutic sequencing. Normal findings emphasized.

Behavioral/Learning Objectives:

1.   Create clinical algorithmic pathways for assigned disorders.
2.   Analyze existing algorithmic pathways for assigned disorders for laboratory content/accuracy in the pathophysiology of each assigned disorder.
3.   List appropriate therapy at each stage of a pathway for a given disorder to include pharmacological therapy.
4.   Describe pertinent PE findings at each pathway stage of an assigned disorder.
5.   Diagram pertinent laboratory procedures appropriate for each stage of a critical pathway in a given disorder.

Clinical Project / Dissertation Development (Research Design)

Initiate the project development process by conducting a literature review, formulating research question(s) or hypothesis, designing a study framework, and developing and completing a needs assessment.

Behavioral/Learning Objectives:

1.   Use current literature to formulate research question(s) or an hypothesis.
2.   Choose and review appropriate literature databases for assessment and documentation of need.
3.   Choose appropriate research methodology and design a study to investigate the question or hypothesis.
4.   Design and conduct a needs assessment and/or pilot study in support of the question or hypothesis.

Evidence Based Practice In Clinical Laboratory Science II
The second course of the three course sequence is designed to teach the student to use the best evidence to make diagnoses facilitate patients' choices and provide patients with appropriate counseling in the area of the various biomedical technologies. Students will apply evidence in assessment, the structure of critical paths, treatment protocol review, and evaluation of medical effectiveness.

Behavioral/Learning Objectives:

1. Frame and declaratively state a pertinent clinical question.
2. Demonstrate the ability to systematically locate, appraise, and apply contemporaneous research to a defined clinical problem.
3. Determine the validity and applicability of research findings, and current medical evidence to make informed clinical decisions.
   a. Reviewing each paper for its clinical question, type of study, study design, and ethics.
   b. Analyzing the study methodology and applicability of the methodology.
   c. Reviewing the statistical analysis performed.
   d. Assessing the study results and validity of findings and conclusions.
4. Design and present a clear, concise oral presentation of the researched question and findings in the time allotted and format assigned.
5. Use evidence to evaluate laboratory test ordering protocols associated with high risk, high cost, and high frequency Dregs in local and regional populations.

6. Generate a clear and cohesive written presentation of the clinical literature arguing for or against the use of the reviewed material in decision-making relevant to the clinical question.

Evaluation of Laboratory Technology
This course presents strategies for evaluation of laboratory methods using medical evidence. Objectives will be pursued through patient rounds, interpretation of laboratory data, and participation in patient treatment, the development of tests and their evaluation as to current and future clinical use. Evaluation will include emerging methods and point of care applications in Hematology, Microbiology, Clinical Chemistry, Microscopy, Immunology, Molecular Diagnostics, and Immunohematology and Transfusion Services.

Behavioral/Learning Objectives:
1. Interpret and evaluate a medical history and physical.
2. Correlate data from the history and physical with the ordering of laboratory tests
3. Correlate the results of laboratory testing with the history and physical
4. Justify laboratory testing in terms of presenting signs and symptoms, medical and family history, and laboratory test results and results from non-laboratory tests (e.g. radiological)
5. Communicate in a facilitative, effective, efficient, and educational manner with patients and their families.
6. Identify the social and psychological components of patients' medical problems.
7. Use knowledge of the pathophysiology of signs and symptoms to establish clinical correlation's with disease processes.
8. Develop an accurate and complete problem list.
9. Interpret the differential diagnosis for each problem.
10. Formulate an appropriate laboratory test structure for confirming the diagnosis.
11. Use knowledge of the indications and limitations of clinical laboratory sources to request and interpret data pertinent to problem solving.

12.   Use information from texts, syllabi, journals, and electronic databases to study general topics related to patient's problems.
13.   Observe, review, reassess, and revise clinical laboratory data daily and make a verbal report to the health care team.
14.   Communicate clearly and succinctly to colleagues and other members of the health care team.
15.   Demonstrate independent learning in response to questions raised in the clinical setting by using textbooks, journal articles, media, computer-based tools and other resources.
16.   Interpret such commonly used clinical laboratory tests as cardiac enzymes, complete blood count, urine analysis, gram stain results of body fluids, tests of pulmonary function, arterial blood gas measurements, serum electrolyte measurements and results of body fluid analysis including joint, pleural, peritoneal, and spinal fluids.

Clinical Project / Dissertation Development (Question Development)

Continuation of the project development process by analyzing, evaluating, and reporting needs assessment/pilot study data.

Behavioral/Learning Objectives:

1.   Use statistical or qualitative methods to evaluate needs assessment or pilot study data.
2.   Modify research question(s) and research design based on analysis of needs assessment or pilot study information.
3.   Re-design the research study in support of the question or hypothesis.

Evidence Based Practice in Clinical Laboratory Science III

The third course of the three course sequence designed to teach the student to use the best evidence to make diagnoses, facilitate patients' choices and provide patients with appropriate counseling in the area of the various biomedical technologies. The third course focuses on disease and procedures associated with high risk, high cost, and high frequency diagnostic related groups (DRGs). The course consists of three segments in a modular format that is intended to provide a framework for the practice or study of evidence-based medicine as relates to biomedical technologies. In the first segment, the student of evidence-based medicine will be taught to use the medical decision-making techniques of probability, analysis, treatment and testing thresholds, and cost-effectiveness to frame the medical problem. In the second segment, the student will learn to review the current medical literature to retrieve and evaluate relevant information. In the final segment the student will learn to assess the validity of medical information.

Behavioral/Learning Objectives:

1.   Demonstrate an understanding of the statistical tools of medical decision-making by utilizing current evidence-based databases in analysis of case studies.

2. Discuss and apply principles of medical decision-making, e.g., statistical measures, measures of predictive and causal relationships, meta-analysis, in analysis of case studies.
3. Use laboratory information to assess risk and prevalence in populations of interest.
4. Use risk and cost assessment information to determine cost-efficiency of laboratory testing.
5. Use evidence to evaluate laboratory test ordering protocols associated with high risk, high cost, and high frequency DRGs in local and regional populations.

Clinical Project / Dissertation Development (Data Collection and Evaluation)

The project pertaining to the application of thematic curricular concepts will be developed, implemented, evaluated, and reported. Specific content is to be determined by the faculty course director, faculty advisors, and course participants.

Behavioral/Learning Objectives:

1. Conduct a research study in support of question(s) or hypothesis.
2. Use statistical or qualitative methods to evaluate study data.
3. Communicate the findings of the research study through a formal project report or dissertation, submission of manuscript(s) for publication in peer-reviewed journals, and oral presentation(s) to professional audiences.

Issues in Clinical Laboratory Science IV
Critical review of evidence-based practice, clinical patient management, clinical services delivery, molecular medicine, and basic science topics as applied to diagnostic and therapeutic laboratory sciences.

Behavioral/Learning Objectives:

1. Demonstrate an understanding of clinical management
2. Demonstrate an understanding of signs and symptoms of selected acute life threatening events
3. Demonstrate an elementary understanding of the initial interventions in the management of critical care situations
4. Demonstrate an understanding of the epidemiologic distributions of selected diseases in different human
5. Demonstrate an introductory understanding of disease risk factors
6. Demonstrate the ability to access and employ bioinformatics material through utilization of various websites, library search tools, useful databases and other websites
7. Demonstrate the ability to communicate effectively in small group interactions with patients, peers and faculty

Clinical Project / Dissertation (Final Scholarly Work)

The project will culminate in a final scholarly work pertaining to the application of thematic curricular concepts to be presented to a live professional audience and submitted for publication.

Specific content is to be determined by the faculty course director, faculty advisors, and course participants.

Behavioral/Learning Objectives:

1.	Conduct a research study in support of question(s) or hypothesis.
2.	Use statistical or qualitative methods to evaluate study data.
3.	Communicate the findings of the research study through a formal project report or dissertation, submission of manuscript(s) for publication in peer-reviewed journals, and oral presentation(s) to professional audiences.