computers, analog and digital devices. Weekly: 2 lectures and two 4-hour labs. Prerequisites: CHEM200, MATH142. *Fall*

CHEM441 ✦ $ (1)
Physical Chemistry Laboratory I
Experiments related to the course content of CHEM431. Weekly: one 4-hour laboratory. Prerequisite: concurrent enrollment in CHEM431. *Fall*

CHEM442 ✦ $ (1)
Physical Chemistry Laboratory II
Experiments related to the course content of CHEM432. Weekly: one 4-hour laboratory. Prerequisite: concurrent enrollment in CHEM 432. *Spring*

CHEM470 ✦ $ (2)
Modern Synthetic Techniques
An advanced laboratory course designed to incorporate a wide variety of modern synthetic techniques of organic, organometallic, and inorganic chemistry. Weekly: two 4-hour labs. Prerequisites: CHEM474,415 or concurrent enrollment in CHEM415. *Spring*

CHEM474 (2)
Advanced Topics in Organic Chemistry
Study of the principles of modern synthetic organic chemistry with applications from one or more of the following areas: natural product, medicinal, or polymer chemistry. Weekly: 2 lectures. Prerequisite: CHEM232. *Fall*

CHEM475 ✦ (2)
Advanced Topics in Physical Chemistry
Advanced study of molecular spectroscopy, statistical thermodynamics, chemical dynamics, or the application of quantum mechanics. Prerequisites: CHEM432 or CHEM431 and permission of the instructor.

CHEM495 ✦ (1-4)
Independent Research
An opportunity for chemistry and biochemistry majors to gain research experience by joining with a faculty member in study of an area of special interest.

GRADUATE

CHEM530 (2-4)
Topics in Teaching Chemistry
Each time the course is offered, it treats one of the following areas:
- Concepts in Chemistry
  Fundamental ideas of chemistry
- Demonstrations
  Simple experiments which illustrate chemical principles
- Problem-Solving Strategies
  Exploration into the mental processes and logic behind problem solving.

None of the above areas are to occur twice in one student's program. Prerequisite: CHEM232. Repeatable to 6 credits.

CHEM540 (2-4)
Topics in Chemistry
Independent readings to be chosen in consultation with the instructor. A written report and an oral presentation covering the materials read are required. A minimum of 60 hours of work is required for each credit. Prerequisites: CHEM431. Repeatable to 6 credits.

CLINICAL AND LABORATORY SCIENCES

Halenz Hall, Room 326
(269) 471-3336
cls@andrews.edu
http://www.andrews.edu/ALHE

Faculty
Marcia A. Kilsby, *Chair, CLS Program Director*
Albert W. McMullen
Karen Reiner
Richard D. Show, *Graduate Program Coordinator*

Academic Programs	Credits
BS in Clinical Laboratory Science (BSCLS)	124
BS: Allied Health Administration	65
MS in Clinical Laboratory Science (MSCLS)	32
Biomedical	
Business and Management	
Education	

The Department of Clinical and Laboratory Sciences prepares students who are committed to preserving and protecting the dignity of life and death. They promote values and attitudes consistent with the Seventh-day Adventist Christian lifestyle. They strive to instill in students a life-long personal quest for individual growth and fulfillment and for continual excellence in health-care practice.

Clinical Laboratory Science (Medical Technology)

The degree program includes three years of undergraduate (pre-clinical) studies plus one year (3 semesters) of clinical (professional) education.

Pre-clinical Program. The first three years of undergraduate study include General Education, cognate science, and pre-clinical degree requirements. Program options feature directed elective course work selected in consultation with the faculty advisor according to the student's career goals and interests.

Clinical (Professional) Program. The year of clinical studies is comprised of lectures and student laboratories on the Berrien Springs campus and clinical practica at an affiliated hospital or clinical laboratory site.

Clinical Experience (Practica). Students work side-by-side with practicing professionals in patient health care during the final portion of the clinical year. Andrews University maintains a number of affiliations with clinical institutions across the country. Student preferences for clinical site assignments are solicited and granted when possible. Final site assignments are made at the discretion of the faculty.

Clinical Year Admission Requirements. An independent admissions process is required for university students who wish to enter clinical

studies. Application forms may be obtained from the Department of Clinical and Laboratory Sciences office. Students should complete these applications and return them to the departmental office by January 31st prior to their anticipated clinical-study year.

Admission requires an overall GPA of 2.50. In the admissions process, the GPAs for the cognate science courses and clinical laboratory science content courses are computed together. This combined GPA must also be a minimum of 2.50. Should applications exceed class capacity, preference is given to students with the higher GPAs.

Applicants must be able to meet the program's published *Essential Functions*, copies of which are incorporated into the application packet, and express a willingness to comply with the principles, rules, regulations, and policies of both the university and the program as they relate to the ideals and values of the Seventh-day Adventist Church and the clinical laboratory science profession.

All prerequisite course work, including General Education, cognate science, and pre-clinical courses, must be completed prior to entry into the clinical year. A personal interview may be required at the discretion of the Admissions Committee.

In exceptional circumstances, the Admissions Committee may accept students outside the stated policy.

Student Progression in Clinical Year. The clinical year is highly structured and sequential. Enrolled students may not drop a class, audit a class, or earn a grade lower than C- in any class. Students may enter clinical practica only upon satisfactory completion of on-campus course work. Satisfactory completion is defined as a senior-year minimum cumulative GPA of 2.50 and the recommendation of the faculty. A student receiving a cumulative GPA of less than 2.50 may be allowed to advance if the program faculty identifies exceptional circumstances and recommends that the student continue in the program.

Student continuance in the clinical practica is conditional upon acceptable ethical deportment and exemplary patient-care practices. The hospital supervisors and program faculty are final arbiters in determining student continuance.

Professional Certification. Students who complete the degree program are eligible to write national certification examinations sponsored by the American Society for Clinical Pathology (ASCP) and the National Credentialing Agency for Laboratory Personnel (NCA).

Program Accreditation. The Andrews University Program for Clinical Laboratory Sciences holds accreditation from the National Accrediting Agency for Clinical Laboratory Sciences (NAACLS), 8410 West Bryn Mawr Avenue, Suite 670, Chicago, IL 60631-3415, (773) 714-8880 fax (773) 714-8886, email at info@naacls, or the web at www.naacls.org.

ACADEMIC CALENDAR 2005-2006

2005

July 22	Fri	Senior Summer term (Clinicals) ends
August 1	Mon	Registry Review Week begins
August 6	Sat	Certification ceremony

2006

May 5	Fri	Senior Spring semester (Clinicals) ends
May 8	Mon	Senior Summer semester (Clinicals) begins
July 28	Fri	Senior Summer term (Clinicals) ends
July 31	Mon	Registry Review Week begins
August 5	Sat	Certification ceremony

Undergraduate Programs

BS in Clinical Laboratory Science (BSCLS)—124

General Education requirements—32
(Adjustments for BSCLS)
Directed Electives
Arts & Humanities—3
Language/Communication
Social Science—3
Mathematics—3
AU students—Statistics preferred. Students transferring into clinical program—any college-level course
PE/Wellness—2
HLED120 plus one activity course. Must also pass a physician-administered physical exam before advancement to clinical practica
Physical/Natural Sciences: see cognate sciences below
Religion—12
(or one course per year of residence)
Service Fieldwork—fulfilled through 23 credits of clinical practicum.

Cognate Science Requirements—26
BIOL165: BIOL166 or 111; CHEM131, 132, 231, 232, 241, 242.

Major Requirements—61
Prerequisites—11
CLSC105, 110, 230, 250, 260
Major courses—50
CLSC320, 400, 401, 402, 411, 412, 413, 421, 423, 431, 432, 433, 441, 442, 443, 451, 452, 453, 460, 463, 495.

Directed electives
Students select courses in consultation with and by the consent of their advisors in a planned program to enhance professional preparation. Courses are chosen from biology, business, chemistry, computer science, electronics, and education. Pre-medical/pre-dental students must include PHYS141 142 General Physics (8 credits).

BS: Allied Health Administration—65

This degree is designed for health-care professionals seeking to enhance the knowledge they already have and to help them prepare for future career employment requirements. The degree format features a strong general education and administrative/business component and provides an academic foundation for health-care administrative positions. It is open only to individuals holding an associate degree or a two-year certificate in an allied-health professional area with earned certification where applicable in such areas as diagnostic ultrasound, nuclear medicine, physician assistant, radiation therapy, radiologic technology, respiratory therapy, and special procedures in radiologic technology. Admission to the program is by permission of the Department of Clinical and Laboratory Sciences chair.

Degree Requirements—124
Transfer credits accepted from an AS degree or certificate program—**34**
General Education Requirements—**45**
Complete Bachelor of Science General Education requirements.
Business/Administration Courses—**27**
ACCT 121, 122, BSAD341, 355, 384, ECON226, MKTG310 and management courses selected in consultation with and approval of the advisor.
ALHE480 Practicum in Administration—**4**

Graduate Programs

MS in Clinical Laboratory Science (MSCLS)—32

The Department of Clinical and Laboratory Sciences offers a graduate program leading to the Master of Science in Clinical Laboratory Science. In response to the diversity of career skills required by the clinical laboratory scientist (medical technologist), the degree features a variety of program emphases, including concentrations in biomedical sciences, business and management, and education.

Admission requirements. In addition to the minimum general requirements for admission to a graduate program listed in the graduate admission section of this bulletin, the following are departmental requirements:

- Applicants' previous course work must include 16 semester credits of biological sciences, 16 semester credits of chemistry, and one college-level course in mathematics. Deficiencies must be removed prior to admission to the graduate program.
- Applicants must hold professional certification and/or licensure in clinical laboratory science (medical technology) acceptable to the admissions committee. Certification may be either general or in one of the recognized areas of specialization. Acceptable certification is usually defined as that offered by the American Society for Clinical Pathology or The National Credentialing Agency for Laboratory Personnel sponsored by the American Society for Clinical Laboratory Science.

Individuals lacking professional certification may be granted provisional admission while they pursue the course work required for eligibility to write the national certification examinations. These clinical courses and their prerequisites require a minimum of four academic semesters. The courses include CLSC320, 400, 401, 402, 411, 412, 413, 421, 423, 431, 432, 433, 441, 442, 443, 451, 452, 453, 460, 463, and 495. Students must receive professional certification before completing 9 graduate credits.

DEGREE REQUIREMENTS

In addition to meeting the general requirements for graduate degree programs, students must meet the following departmental requirements:

- Complete a minimum of 32 semester credits including the core of 20 semester credits and 12 semester credits selected from the emphasis chosen.
- Have the graduate program coordinator approve course selections and course sequencing. Students may substitute alternate courses listed in this bulletin with the consent of the coordinator and the approval of the dean of the College of Arts and Sciences.
- No grade lower than C is acceptable in the graduate portion of the program.
- Maintain a minimum cumulative GPA of 3.00 for the graduate portion of the program.

Core courses—20

ACCT500 or 635; BSAD500; CLSC501, 502, 561, 562, 585; plus a minimum of 3 graduate religion credits selected in consultation with graduate program coordinator

A minimum of 12 semester credits from one of the following options:

Biomedical Emphasis: BCHM421, 422, 430; BIOL419, 444, 445, 446, 447, PHTH417, 427, 447, 457, BOT525, ZOOL464, 475, 500

Business and Management Emphasis: ACCT635 (*if not taken as part of the core*), BSAD515, 530, 531, 638, 670, MKTG500, 540, NRSG517

Education Emphasis: EDAL520, EDCI547, 565, 636, 655, EDFN500, EDPC514, EDTE408, 424

Enrollment Continuation Requirements. A student whose cumulative graduate GPA falls below 3.00 in any given semester is placed on academic probation. Academic probation students are not allowed to register for or continue participation in CLSC585.

In consultation with the graduate program coordinator, the clinical laboratory science graduate faculty determines the student's proposed course load for the following semester. The faculty's recommendation is referred to the dean/graduate program coordinator of the College of Arts and Sciences for final approval.

A student who does not raise his/her graduate GPA to 3.00 within one full-time equivalent semester (12 credits) is terminated from the program. Exceptions require the approval of the clinical laboratory science graduate faculty and the dean/graduate program coordinator of the College of Arts and Sciences.

Courses (Credits)

See inside front cover for symbol code.

ALHE440 **(1-4)**
Topics in _____
Repeatable in different areas. Prerequisite: permission of Program Director.

ALHE480 **(4)**
Practicum in _____
Prerequisite: Permission of Program Director.

CLSC105 **(1)**
Introduction to Clinical Laboratory Science
Lectures and/or demonstrations presented by each of the departmental faculty members covering the major disciplines in clinical laboratory science. A field trip to visit a clinical laboratory is also included. Weekly: one lecture.

CLSC110 **(1)**
Medical Terminology
An in-depth study of medical terms and abbreviations relating to diseases, disorders, and drugs. (This course is also available to off-campus students through Distance Learning. Prerequisite: permission of instructor.)

CLSC230 **$ (3)**
Fundamentals of Clinical Microbiology
Orientation to clinical microbiology; specimen selection, collection, and transport; microscopic evaluation; stains and sterilization techniques; media and incubation selections; identification of routine and non-routine microorganisms; susceptibility testing; automation and quality assurance. Weekly: Two lectures and two labs.

CLSC250 **$ (3)**
Fundamentals of Clinical Chemistry
Clinical lab procedures, safety, application of statistical procedures in quality control, and principles of clinical laboratory instrumentation. Topics include carbohydrates, lipids, electrolytes, and hepatic function with selected pathologies. Weekly: Three lectures and one lab.

CLSC260 **$ (3)**
Fundamentals of Human Blood Biology
Introduces the production, maturation, function of normal blood cells and hemostasis; blood group antigen systems, antibody identification and compatibility testing. Selected routine manual hematology, hemostasis, and immunohematology procedures are performed. Weekly: Two lectures and one lab.

CLSC320 **(3)**
Principles of Immunology
Innate and acquired immune systems of the human organism; immunoglobulin production, structure, function, and diversity; antigen characteristics, variety, and specific red cell groups; tolerance and memory; complement structure and function; cell mediated immunity function and regulation; autoimmune disorders; transplantation and tumor immunology; immunodeficiency disorders; principles and procedures of techniques used in modern immunology lab. Weekly: Three lectures.

CLSC370 **(3)**
Principles of Clinical Diagnostics
An introduction to the application of clinical diagnostic data in selected areas of laboratory medicine. Designed for students entering careers in the health professions. Prerequisites: CLSC110 or permission of the instructor.

CLSC400 **(2)**
Specimen Procurement and Processing
Clinical specimen collection and processing; point-of-care testing, professional ethics; phlebotomy practicum. Prerequisite: permission of the instructor.

CLSC401, 402 **(0)**
Clinical Year Seminar I, II
Introduction to educational methodology, team building, clinical laboratory sciences literature and research design and practice. Preparation and delivery of written and oral presentations on current topics. Attendance to all sessions is required. A pass/fail grade is assigned. Prerequisite: permission of Program Director.

CLSC411 **(3)**
Hematology
Cellular elements of the blood, their maturation, functions, and morphologies; abnormal and disease state hematologies; principles and procedures of routine and special hematology assay methodologies; correlation of patient conditions with results of hematology assay results. Prerequisites: CLSC260 and permission of Program Director.

CLSC412 **(1)**
Hemostasis
Hemostasis systems, their function, interaction, and monitoring; correlation of hemostasis assay results with various disorders; thrombosis and anticoagulant therapy; principles and procedures of routine and special hemostasis assays. Prerequisites: CLSC411 and permission of Program Director.

CLSC413 **(4)**
Clinical Hematology & Hemostasis Practicum
Professional health-care laboratory practicum; emphasis in patient-care application of hematology and hemostasis procedures. Prerequisites: CLSC411, 412 and permission of Program Director.

CLSC421 **(2)**
Clinical Immunology
Antigen/antibody functions and interactions; detection and analyses. Basic immunologic mechanisms. Theory of immunologic and serologic procedures. Immunologic manifestations in infectious diseases. Quality control in immunology. Prerequisites: CLSC320 and permission of Program Director.

CLSC423 **(1)**
Clinical Immunology Practicum
Professional health-care laboratory practicum: emphasizes patient-care applications of immunologic and serologic procedures. Prerequisites: CLSC421 and permission of Program Director.

CLSC431 **(4)**
Clinical Microbiology
Simulated clinical practice for the separation of normal flora from pathogenic microorganisms encountered in various body sites; emphasis on identification of pathogens, solving case histories and unknowns; study of antimicrobial mode of action and testing. Specimen collection, culture and identification of mycobacteria. Prerequisites: CLSC230 and permission of Program Director.

CLSC432 **(2)**
Special Microbiology
Study of parasites, fungi and viruses involved in human infections. Emphasis on specimen collection and preservation, culture and identification procedures. Prerequisites: CLSC431 and permission of Program Director.

CLSC433 **(5)**
Clinical Microbiology Practicum
Professional health-care laboratory practicum; emphasis in patient-care applications of bacteriology, mycology, parasitology, and virology. Prerequisites: CLSC431, CLSC432 and permission of Program Director.

CLSC441 **(3)**
Immunohematology
Blood grouping and typing; blood group antigen systems; compatibility testing; antibody identification; quality control and quality assurance; donor recruitment and selection; blood-banking records; grouping and compatibility problem solving; patient clinical state correlations. Prerequisites: CLSC260, CLSC320 and permission of Program Director.

CLSC442 **(1)**
Transfusion Medicine
In-depth study of immunohematology testing results, clinical patient manifestations, blood component therapy and blood product requirements. Prerequisites: CLSC441 and permission of Program Director.

CLSC443 **(4)**
Clinical Immunohematology Practicum
Professional health-care laboratory practicum; emphasis in patient-care applications of immunohematology. Prerequisites: CLSC441, 442 and permission of Program Director.

CLSC451 **(4)**
Clinical Chemistry
Carbohydrate, lipid, enzyme, electrolyte, acid-base balance, trace element, protein systems, and gastric functions; correlation with normal physiology and selected pathological correlations.

Analysis of relevant blood and body fluids constituents. Prerequisites: CLSC250 and permission of Program Director.

CLSC452 **(2)**
Clinical Chemistry and Body Fluids
Liver function, renal function, endocrinology, toxicology, and therapeutic drug monitoring. Analysis of various body fluids such as serous fluids, synovial fluid, amniotic fluid, and urine. Correlations with normal physiology and selected pathological conditions. Prerequisites: CLSC451 and permission of Program Director.

CLSC453 **(5)**
Clinical Chemistry Practicum
Professional health-care laboratory practicum. Emphasis on patient-care applications in clinical chemistry. Prerequisites: CLSC451, 452 and permission of Program Director.

CLSC460 **(2)**
Clinical Laboratory Systems
Survey of current Laboratory Information Systems (LIS) including database design and maintenance, test requesting, result entry, result reporting, quality control applications, and peripheral devices. Discussion in selected areas that include health-care organizational structures; problem solving in the clinical laboratory; development of personnel evaluation procedures; supply and equipment acquisition; budget preparation and analysis; ethics; and regulatory processes. Prerequisite: permission of Program Director.

CLSC463 **(1)**
Clinical Microscopy Practicum
Professional health-care laboratory practicum. Emphasis in patient-care applications of body fluids. Prerequisites: CLSC452 and permission of Program Director.

CLSC490 **(1-4)**
Topics in _____
An in-depth study of selected topics in the clinical laboratory sciences. Repeatable in different specialized areas. Prerequisite: permission of Program Director.

CLSC495 **(1-4)**
Independent Study/Readings/Research/Project
Topics may be from areas relevant to clinical laboratory practice and must be approved by the Program Director. Repeatable in a different subject area. Independent readings earn S/U grades. Prerequisite: permission of Program Director.

CLSC496 **(1)**
Extended Clinical Practicum
A twelve-week professional health-care laboratory practicum. Emphasis in patient-care applications. Subject areas are to be coordinated with the Clinical Site Education Coordinator and the Program Director. Graded S/U. Prerequisites: successful completion of the twenty-week clinical practica of the Clinical-Year Program and permission of Program Director.

CLSC501, 502 **(1)**
Seminar in Clinical Laboratory Science
Introduction to educational theory, teaching methods and assessment. Cooperative research into topics of current interest in the literature. Each semester the student prepares a written and oral presentation based on current readings. Faculty and guest lectures also contribute to the seminar series. Admission by permission of Graduate Program Coordinator.

CLSC561 **(3)**
Laboratory Management Issues and Strategies
The health-care environment is rapidly changing, and will continue to change for the foreseeable future. In the clinical laboratory, ever-changing government regulations and reimbursement policies require a laboratory manager to be flexible and adopt new skills. Issues faced by the manager and styles and strategies used to deal with these issues are explored. Prerequisite: Permission of Graduate Program Coordinator.

CLSC562 **(3)**
Issues in Clinical Laboratory Regulations and Practice
Clinical laboratories are increasingly regulated by state, federal and other agencies. Applicable regulations will be examined and their impact on laboratory operations evaluated. A selected number of laboratory quality assurance procedures, as specified by CLIA ‘88 regulations, will be performed in the laboratory. Prerequisites: Statistics and permission of Graduate Program Coordinator.

CLSC585 **(5)**
Advanced Studies in Clinical Laboratory Science
Designed in consultation with and coordinated by the area specialty advisor. Cumulative report, presentation, and defense required. Prerequisite: Certification and/or licensure as a clinical laboratory scientist and permission of Graduate Program Coordinator. Clinical placement depends on clinical site availability.

CLSC595 **(1-4)**
Independent Study/Readings/Research Project
Topics may be from immunology, immunohematology, clinical chemistry, hematology, microbiology and other areas of patient-care science, clinical laboratory science education, management, or applications specially relevant to clinical laboratories. Repeatable in a different subject area for a total of four (4) credits. Independent readings earn S/U grades. Prerequisite: permission of Graduate Program Coordinator.