

Clinical Laboratory Science/Medical Technology

Includes:

- Clinical assistant
- Clinical laboratory scientist/medical technologist
- Clinical laboratory technician/medical laboratory technician
- Cytogenetic technologist
- Diagnostic molecular scientist
- Histologic technician/histotechnologist
- Pathologists' assistant
- Phlebotomist

Clinical Assistant

Laboratory tests play an important role in the detection, diagnosis, and treatment of diseases. Clinical assistants are formally prepared multiskilled health care providers with a laboratory focus. Clinical assistants are trained to work under the supervision of an appropriately qualified person in chemistry, donor room collection screening, component processing, hematology, immunology, microbiology, phlebotomy, and/or urinalysis.



Career Description

Clinical assistants follow standard operating procedures to collect specimens; prepare blood and body fluid specimens for analysis according to standard operating procedures; prepare/reconstitute reagents, standards, and controls according to standard operating procedure; perform appropriate tests at the clinical assistant level; perform and record vital sign measurements; and follow established quality control protocols. Clinical assistants follow infection control and safety practices and use information systems necessary to accomplish job functions.



Employment Characteristics

Many clinical assistants are employed in hospital laboratories. Others are employed in physicians' private laboratories and clinics; by the armed forces; or by city, state, and federal health agencies.



Salary

Salaries vary depending on the employer and geographic location. Refer to Section IV, Table 5 of this *Directory* for more information, or see www.ama-assn.org/go/hpsalary.



Educational Programs

Length. Approved programs culminate in a postsecondary certificate.

Prerequisites. High school diploma or equivalent.

The applicant must also meet the admission requirements of the sponsoring institution.

Curriculum. Clinical assistant programs are conducted in junior or community colleges, hospitals, medical laboratories, proprietary schools, and other equivalent postsecondary educational institutions.

Clinical Laboratory Scientist/ Medical Technologist

Laboratory tests play an important role in the detection, diagnosis, and treatment of many diseases. Clinical laboratory scientists/medical technologists perform these tests in conjunction with pathologists (physicians who diagnose the causes and nature of disease) and other physicians or scientists who specialize in clinical chemistry, microbiology, or the other biological sciences. Clinical laboratory scientists/medical technologists develop data on the blood, tissues, and fluids of the human body by using a variety of precise methodologies and technologies.



Career Description

In addition to possessing the skills of clinical laboratory technicians/medical laboratory technicians, clinical laboratory scientists/medical technologists perform complex analyses, fine-line discrimination, and error correction. They are able to recognize the interdependency of tests and have knowledge of physiological conditions affecting test results so that they can confirm these results and develop data that may be used by a physician in determining the presence, extent, and, as far as possible, cause of a disease.

Clinical laboratory scientists/medical technologists assume responsibility and are held accountable for accurate results. They establish and monitor quality assurance and quality improvement programs and design or modify procedures as necessary. Tests and procedures performed or supervised by clinical laboratory scientists/medical technologists in the clinical laboratory focus on major areas of hematology, microbiology, immunochemistry, immunology, clinical chemistry, and urinalysis.



Employment Characteristics

Most clinical laboratory scientists/medical technologists are employed in hospital laboratories. Others are employed in physicians' private laboratories and clinics; by the armed forces; by city, state, and federal health agencies; in industrial medical laboratories; in pharmaceutical houses; in numerous public and private research programs dedicated to the study of specific diseases; and as faculty of accredited programs preparing medical laboratory personnel. While many graduates are employed in the clinical laboratory setting, career options are abundant, with opportunities in all areas of health care. As a clinical laboratory scientist/medical technologist, one may decide to specialize in:

- Biomedical research and development
- Andrology and assisted reproductive technology laboratories
- Organ transplantation
- Genetic testing
- Infection control
- Health information management
- Health care industry
- Consultative and entrepreneurial opportunities
- Forensic testing



Salary

Salaries vary depending on the employer and geographic location. Based on a 2005 survey published in *Laboratory Medicine*, median salaries ranged from \$44,500 to \$52,000, and median manager salaries ranged from \$69,500 to \$72,000. Refer to Section IV, Table 5 of this *Directory* for more information, or see www.ama-assn.org/go/hpsalary.



Educational Programs

Length. Programs are at least 1 year of professional/clinical education in conjunction with either a baccalaureate or a master's degree.

Prerequisites. College courses and number of required credits are those necessary to ensure admission of a student who is prepared for the clinical educational program. Content areas should include general chemistry, general biological sciences, organic and/or biochemistry, microbiology, immunology, and mathematics. Survey courses do not qualify as fulfillment of chemistry and biological science prerequisites, and remedial mathematics courses will not satisfy the mathematics requirement.

College/university programs that integrate preprofessional and professional coursework are structured with professional courses in the junior and senior years or at the graduate level.

Curriculum. There must be a structured laboratory program, including instruction pertaining to theory and practice in hematology, clinical chemistry, microbiology, immunology, and immunohematology. The program must culminate in a baccalaureate degree for those students not already possessing the degree but may also culminate in a master's degree.



Salary

Salaries vary, depending upon the employer and geographic location. Based on a 2005 survey published in *Laboratory Medicine*, median salaries ranged from \$37,100 to \$41,000. Refer to Section IV, Table 5 of this *Directory* for more information, or see www.ama-assn.org/go/hpsalary.



Educational Programs

Length. The period of education is usually 2 academic years and culminates in an associate degree.

Prerequisites. High school diploma or equivalent. The applicant also must meet the admission requirements of the sponsoring educational institution.

Curriculum. Associate degree programs are conducted in junior or community colleges, in 2-year divisions of universities and colleges, or in other recognized institutions granting associate degrees. Courses are taught on campus and usually in affiliated hospitals. Classroom and laboratory classes focus on general knowledge and basic skills; understanding principles and master procedures of laboratory testing; and basic laboratory mathematics, computer technology, communication skills, and interpersonal relationships and responsibilities. The clinical courses include application of basic principles commonly used in the diagnostic laboratory. Clinical instruction includes procedures in hematology, microbiology, immunohematology, immunology, clinical chemistry, and urinalysis.

**Clinical Laboratory Technician/
Medical Laboratory Technician**

Laboratory tests play an important role in the detection, diagnosis, and treatment of many diseases and in the promotion of health. Clinical laboratory technicians/medical laboratory technicians perform these tests under the supervision or direction of pathologists (physicians who diagnose the causes and nature of disease) and other physicians, clinical laboratory scientists/medical technologists, or other scientists who specialize in clinical chemistry, microbiology, or the other biological sciences. Clinical laboratory technicians/medical laboratory technicians develop data on the blood, tissues, and fluids of the human body by using a variety of precise methodologies and technologies.



Career Description

Associate degree clinical laboratory technicians/medical laboratory technicians perform all the routine tests in an up-to-date medical laboratory and can demonstrate discrimination between closely similar items and correction of errors by the use of preset strategies. The technician has knowledge of specific techniques and instruments and is able to recognize factors that directly affect procedures and results. The technician also monitors quality assurance procedures.



Employment Characteristics

Most clinical laboratory technicians/medical laboratory technicians work in hospital, clinic, or physician office laboratories.

Cytogenetic Technologist

Laboratory tests play an important role in the detection, diagnosis, and treatment of diseases. Cytogenetic technologists study the morphology of chromosomes and their relationship to disease. Cytogenetic analysis provides important data for the diagnosis, prognosis, and treatment of genetic disorders and malignant diseases.



Career Description

Cytogenetic technologists evaluate the correct method of collection, transport, and handling of various specimen types for cytogenetic analysis; identify culture techniques based on tissue type and reason for referral; and perform chromosomal staining, microscopic analysis, and karyotyping (organizing chromosomes according to a standardized ideogram). In addition to practicing good general laboratory skills, quality assurance principles, and safety protocols, cytogenetic technologists understand the legal implications of their work environment and exhibit appropriate ethical and professional health care standards while demonstrating professional conduct, stress management, and interpersonal and communication skills with patients, peers, other health care personnel, and the public.



Employment Characteristics

Cytogenetic technologists are employed in hospital laboratories, private medical laboratories, and research facilities. They may also serve as faculty in cytogenetic education programs.



Salary

Salaries vary depending upon the employer and geographic location. Refer to Section IV, Table 5 of this *Directory* for more information, or see www.ama-assn.org/go/hpsalary.



Educational Programs

Length. Programs are at least 1 year. Cytogenetic technologists attend a baccalaureate or postbaccalaureate program that includes professional and clinical education. Certification is desired by most employers.

Prerequisites. College courses and a number of required credits necessary to ensure admission of a student who is prepared for the clinical education program. College and university programs that integrate preprofessional and professional coursework are structured with professional courses in the junior and senior years or at the graduate level.

Curriculum. Cytogenetic technology programs are conducted in colleges and universities, hospitals, private medical laboratories, and other equivalent postsecondary educational institutions. The areas of study that must be included in either the professional program or as prerequisites are biology, chemistry, biochemistry or cellular biology, genetics, cytogenetics, hematology, microbiology, immunology, laboratory information systems, laboratory safety, and quality control.

Diagnostic Molecular Scientist

The diagnostic molecular scientist performs diagnostic assay or testing using a variety of manual techniques and precision instruments. The results of these tests are used to detect and diagnose disease and other abnormalities. The main responsibilities of the diagnostic molecular scientist are all aspects of genetic testing, including DNA and RNA isolation, amplification and detection, infectious disease testing, and viral load analysis.



Career Description

Diagnostic molecular scientists provide service in the molecular diagnosis of acquired, inherited, and infectious diseases. This includes researching, evaluating, implementing, and monitoring methods of collection, transport, and handling of various specimen types for molecular analysis; researching and developing principles, practices, and applications of molecular-based testing for laboratory utilization and clinical decisions for client outcomes; and performing appropriate techniques utilizing instrumentation and information management systems for molecular analysis and correlating results with acquired, inherited, and infectious diseases. Finally, diagnostic molecular scientists apply the principles of management and supervision when they function as section supervisors and of educational methodology when they teach students.



Employment Characteristics

Most diagnostic molecular scientists work in hospital laboratories.



Educational Programs

Length. Programs for the diagnostic molecular scientist usually lead to a master's degree.

Prerequisites. College level courses as required by the sponsoring institution.

Curriculum. The curriculum includes both didactic instruction and practical demonstration in the areas of organic and/or biochemistry, genetics, cell biology, microbiology, immunology, diagnostic molecular biology, principles and methodologies for all major areas commonly practiced by a modern diagnostic molecular laboratory, and clinical significance of laboratory procedures in

diagnosis and treatment. It also includes principles and practices of

- Laboratory administration, supervision, safety, and problem solving
- Quality management
- Computer science (including acquisition and evaluation of laboratory information systems)
- Professional conduct

Histotechnician

Physicians (usually pathologists) and other scientists specializing in biological sciences or related clinical areas such as chemistry work in partnership with medical laboratory workers to analyze blood, tissues, and fluids from humans (and sometimes animals), using a variety of precision instruments. The results of these tests are used to detect and diagnose disease and other abnormalities.

The main responsibility of the histotechnician in the clinical laboratory is preparing sections of body tissue for examination by a pathologist. This includes the preparation of tissue specimens of human and animal origin for diagnostic, research, or teaching purposes. Tissue sections prepared by the histotechnician for a variety of disease entities enable the pathologist to diagnose body dysfunction and malignancy.



Career Description

Histotechnicians process sections of body tissue by fixation, dehydration, embedding, sectioning, decalcification, microincineration, mounting, and routine and special staining. They identify tissue structures, cell components, and their staining characteristics and relate them to physiological functions; and institute proper procedures to maintain accuracy and precision.



Employment Characteristics

Most histotechnicians work in hospital or reference laboratories.



Salary

Based on a 2005 survey published in *Laboratory Medicine*, median salaries ranged from \$40,250 to \$40,580. Refer to Section IV, Table 5 of this *Directory* for more information, or see www.ama-assn.org/go/hpsalary.



Educational Programs

Length. Programs for the histotechnician are 12 months, unless the curriculum is an integral part of a college program.

Prerequisites. High school diploma or equivalent.

Curriculum. The curriculum includes both didactic instruction and practical demonstration in the areas of medical ethics, medical terminology, chemistry, laboratory mathematics, computer technology, organic and/or biochemistry, immunology, electron microscopy, management, anatomy, histology, histochemistry, quality control, instrumentation, microscopy, processing techniques, preparation of museum specimens, and record and administration procedures. It is recommended that the curriculum be an integral part of a junior or community college program culminating in an associate degree and that the course of study include chemistry, biology, and mathematics.

Histotechnologist

Physicians (usually pathologists) and other scientists specializing in biological sciences or related clinical areas such as chemistry work in partnership with medical laboratory workers to analyze blood, tissues, and fluids from humans (and sometimes animals), using a variety of precision instruments. The results of these tests are used to detect and diagnose disease and other abnormalities.

The main responsibility of the histotechnologist in the clinical laboratory is preparing sections of body tissue for examination by a pathologist. This includes the preparation of tissue specimens of human and animal origin for diagnostic, research, or teaching purposes. Tissue sections prepared by the histotechnologist for a variety of disease entities enable the pathologist to diagnose body dysfunction and malignancy.



Career Description

Histotechnologists process sections of body tissue by fixation, dehydration, embedding, sectioning, decalcification, microincineration, mounting, and routine and special staining. In addition, histotechnologists perform the more complex procedures for processing tissues. They identify tissue structures, cell components, and their staining characteristics and relate them to physiological functions; implement and test new techniques and procedures; make judgments concerning the results of quality control measures; and institute proper procedures to maintain accuracy and precision. Histotechnologists apply the principles of management and supervision when they function as section supervisors and of educational methodology when they teach students.



Employment Characteristics

Most histotechnologists work in hospital, reference, or research laboratories.



Salary

Based on a 2005 survey published in *Laboratory Medicine*, median salaries ranged from \$44,970 to \$49,360. Refer to Section IV, Table 5 of this *Directory* for more information, or see www.ama-assn.org/go/hpsalary.



Educational Programs

Length. Programs for the histotechnologist are 4 years and lead to a baccalaureate degree.

Prerequisites. High school diploma or equivalent.

Curriculum. The curriculum includes both didactic instruction and practical demonstration in the areas of medical ethics, medical terminology, chemistry, laboratory mathematics, computer technology, organic and/or biochemistry, immunology, electron microscopy, management, anatomy, histology, histochemistry, quality control, instrumentation, microscopy, processing techniques, preparation of museum specimens, and record and administration procedures. The baccalaureate-level program includes coursework designed to provide supervisors and teachers with advanced capabilities.

Pathologists' Assistant

Anatomic pathologists are physicians who examine tissue specimens from patients and perform autopsies to diagnose the disease

processes involved. Pathologists' assistants participate in autopsies and in the examination, dissection, and processing of tissue specimens. They function as physician extenders.



Career Description

The following services are provided under the direct supervision of a licensed and board-certified pathologist and should include, but not be limited to, the following:

Surgical pathology. Assisting in the preparation and performance of surgical specimen dissection by ensuring appropriate specimen accessioning, obtaining pertinent clinical information and studies, describing gross anatomic features, dissecting surgical specimens, preparing and submitting tissue for histologic processing, obtaining and submitting specimens for additional analytic procedures (immunostaining, flow cytometry, image analysis, bacterial and viral cultures, toxicology, etc), and assisting in photographing gross and microscopic specimens.

Autopsy pathology. Assisting in the performance of postmortem examination by ascertaining proper legal authorization; obtaining and reviewing the patient's chart and other pertinent clinical data and studies; notifying involved personnel of all special procedures and techniques required; coordinating special requests for specimens; notifying involved clinicians and appropriate authorities and individuals; assisting in the postmortem examination; selecting and preparing tissue for histologic processing and special studies; obtaining specimens for biological and toxicologic analysis; assisting in photographing gross and microscopic specimens and photomicrography; and participating in the completion of the autopsy report.

Additional duties. Assuming duties as may be assigned relative to teaching, administrative, supervisory, and budgetary functions in anatomic pathology.



Employment Characteristics

Pathologists' assistants are employed in a variety of settings, including community and regional hospitals, university medical centers, private pathology laboratories, and medical examiners/coroners' offices.



Salary

Salaries vary with geographic location and type of employing institution. Entry-level salaries average \$55,000-\$75,000. Refer to Section IV, Table 5 of this

Directory for more information, or see www.ama-assn.org/go/hpsalary.



Educational Programs

Length. Minimum of 22 months.

Degree. Most programs are at the master's level.

Prerequisites. Variable among programs and dependent on the degree offered. Baccalaureate programs require a minimum of 60 hours of acceptable credits, with variable specific requirements.

Curriculum. The curriculum includes both didactic and practical training to provide a sound background in the basic medical sciences and the necessary skills to work in an anatomic pathology laboratory. Coursework includes anatomy, physiology, and medical terminology, as well as general, systemic, pediatric, and forensic pathology. Clinical training includes autopsy pathology, surgical pathology, forensic pathology, and medical photography.

Phlebotomist

Laboratory tests play an important role in the detection, diagnosis, and treatment of diseases. Phlebotomists collect blood specimens for many of these tests. Phlebotomists practice safe blood collection and handling techniques that protect patients from injury, safeguard themselves from accidents, and produce high-quality specimens while demonstrating compassion for the patient.



Career Description

Phlebotomists collect, transport, handle, and process blood specimens for analysis; identify and select equipment, supplies, and additives used in blood collection; and understand factors that affect specimen collection procedures and test results. Recognizing the importance of specimen collection in the overall patient care system, phlebotomists adhere to infection control and safety policies and procedures. They monitor quality control within predetermined limits while demonstrating professional conduct, stress management, and communication skills with patients, peers, and other health care personnel as well as with the public.



Employment Characteristics

Many phlebotomists are employed in hospital laboratories. Others are employed in physicians' private laboratories and clinics; by the armed forces; by city, state, and federal health agencies; in industrial medical laboratories; in pharmaceutical houses; in numerous public and private research programs; and as faculty of approved programs preparing medical laboratory personnel.



Salary

Salaries vary depending on the employer and geographic location. Based on a 2005 survey published in *Laboratory Medicine*, median salaries ranged from \$24,315 to \$29,120. Refer to Section IV, Table 5 of this *Directory* for more information, or see www.ama-assn.org/go/hpsalary.



Educational Programs

Length. Approved programs contain at least 100 hours of clinical practicum and culminate in a postsecondary certificate.

Prerequisites. High school diploma or equivalent. The applicant must also meet the admission requirements of the sponsoring institution.

Curriculum. Phlebotomy programs are conducted in junior or community colleges, hospitals, medical laboratories, proprietary schools, and other equivalent postsecondary educational institutions. The curriculum includes didactic instruction and 100 hours of applied experiences, performance of a minimum of 100 successful unaided collections, and instruction in a variety of collection techniques, including vacuum collection devices, syringe, and capillary/skin-puncture methods.



Inquiries

Careers/Curriculum

American Society for Clinical Laboratory Science
7910 Woodmont Avenue, Suite 530
Bethesda, MD 20814

301 657-2768
301 657-2909 Fax
E-mail: ascls@ascls.org
www.ascls.org

American Society for Clinical Pathology
33 West Monroe, Suite 1600
Chicago, IL 60603
312 541-4999
E-mail: info@ascp.org
www.ascp.org

Association of Genetic Technologists
Executive Office
PO Box 15945-288
Lenexa, KS 66285
913 541-9077

National Society for Histotechnology
4201 Northview Drive, Suite 502
Bowie, MD 20716-2604
301 262-6221
301 262-9188 Fax
E-mail: histo@nsh.org
www.nsh.org

American Association of Pathologists' Assistants
8030 Old Cedar Avenue, Suite 225
Bloomington, MN 55425-1215
800 532-AAPA
E-mail: mspindler@mn.state.net
www.pathologistsassistants.org

Certification/Registration

American Society for Clinical Pathology
Board of Registry
PO Box 12270
Chicago, IL 60612
312 738-1336, Ext 1341
E-mail: bor@ascp.org
www.ascp.org

National Certification Agency for Medical Laboratory Personnel
PO Box 15945-289
Lenexa, KS 66285
913 438-5110
E-mail: nca-info@goamp.com
www.nca-info.org

American Association of Bioanalysts
Board of Registry
906 Olive Street, Suite 1200
St. Louis, MO 63101-1434
www.aab.org

American Medical Technologists
710 Higgins Road
Park Ridge, IL 60068-5765
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