SURVEY OF MEDICAL TECHNOLOGY

ROGER W. COLTEY

SURVEY OF MEDICAL TECHNOLOGY

ROGER W. COLTEY, B.S., M.T.

Bio-Medical Laboratory,
Wichita Falls, Texas

WITH 138 ILLUSTRATIONS

THE C. V. MOSBY COMPANY

Saint Louis 1978

Printed in the United States of America

Distributed in Great Britain by Henry Kimpton, London

The C. V. Mosby Company
11830 Westline Industrial Drive, St. Louis, Missouri 63141

Library of Congress Cataloging in Publication Data

Coltey, Roger W 1931-
Survey of medical technology.

Bibliography: p.
Includes index.
1. Medical technology. 2. Diagnosis, Laboratory.
I. Title.
RB37.C64 616.07'5 77-2155
ISBN 0-8016-1020-6

GW/M/M 9 8 7 6 5 4 3 2 1

SURVEY OF MEDICAL TECHNOLOGY

PREFACE

Just a few years ago many of the test procedures now performed in clinical laboratories were merely research tools and so complicated in technique and interpretation that only highly skilled persons could perform them. Yet certain clinical aspects and observations relating to the laboratory in general have been known for a long time. Today, diagnosis based on the results of clinical laboratory tests is commonplace and, indeed, a medical necessity.

The purpose of this book is to present a survey of medical technology and thus give the aspirant in this field knowledge of the techniques involved in testing various specimens as aids to diagnosis. Some of the methods presented are traced back through the various procedures they have replaced to engender an appreciation of the simplicity of the techniques used today and to inspire students with what can be accomplished through dedicated efforts and in this way further scientific progress.

It is hoped that after reading this material the reader will become a more knowledgeable and more professional worker.

The material presented leaves many questions unanswered. The curious will find the answers in more advanced material or through their association with experienced technologists and their instructors.

Roger W. Coltey

SURVEY OF MEDICAL TECHNOLOGY

CONTENTS

Chapter 1

INTRODUCTION

Simply defined, medical technology is the branch of medicine concerned with the performance of laboratory test procedures and analyses used in the diagnosis, treatment, and prognosis of disease, and the maintenance of health. Through the use of modern equipment and techniques, laboratory-trained personnel are able to provide medical data that the physician can use in assessing the clinical condition of the patient, allowing diagnoses to be more easily made and prognoses more readily obtained. Today, with the advent of and the accent on preventive medicine and the coming of age of federal health-care delivery systems such as Health Maintenance Organizations (HMO) and Health Service Areas (HSA), the clinical laboratory is playing a greater role in maintaining the health of communities than ever before. Through routine screening efforts, trends in disease and health are being detected, which in the long run can only mean better health care for everyone.

Medical technology has not always been the complex science it is today. Literature dating back to 1550 contains references to roundworms such as *Ascaris* and to tapeworms such as *Taenia* infesting the body, or, as was then believed, "possessing the spirit." Some 300 years ago Hindus noticed and recorded the fact that some urine had the capacity to attract ants and had a rather sweet taste. They had thus discovered an elementary means for diagnosing diabetes on the basis of body-fluid examination. Today urinalysis is probably the most frequently requested laboratory test and has become an essential part of the admitting ritual of most hospitals.

From the eleventh to the fifteenth century, diagnosis by urinalysis was quite common. Quacks, then called "pisse prophets," reaped fortunes from the sick and supposedly sick. Legitimate medical technology is dated from the early fourteenth century. There are references in the literature of Italy of that period to a certain Alessandria Gilliani being hired to perform some of the tasks that today would be considered those of the medical technologist. However, his tasks were simple, as were his tools.

The microscope, invented by Anton van Leeuwenhoek in the seventeenth century, has done the most to advance the progress of clinical laboratory work. Marcello Malpighi (1628–1694) used the microscope to study and perform research in the fields of anatomy and embryology. He and Rudolf Virchow (1821–1902), a German pathologist, are considered the founders of modern pathology. Research has resulted in the production of dyes that provide means for staining and studying bacteria and tissue cells. The classification of bacteria had its beginning in the morphology of van Leeuwenhoek and the various staining reactions of Hans Christian Joachim Gram (1853–1938) and others.

The first clinical laboratory devoted to clinical medicine in the United States, was founded in 1875 at the University of Michigan. From this meager beginning has sprung the multitude of clinical laboratories, personnel, and regulations found in the United States today. These laboratories have become an integral part of the health-care delivery systems known today. The census of 1900 showed that there were 100 technicians in the United States, all men, employed at various hospitals and clinics. Most of these technicians had trained themselves, were apprenticed, or were chemists by trade. Each worked independently in achieving test results. To help standardize laboratory test procedures and to attempt to get some order out of chaos, Dr. Todd in 1908 produced his *Manual of Clinical Diagnosis*. This book later became known as the "Todd and Sanford." It remained the laboratory bible for many years and practically every laboratory owned one. Today we hear of standard references such as Bauer, Hepler, Gradwohl's, and Henry.

Inevitably, interest in the clinical laboratory and its technology grew, and out of this growth came the first laboratory training school, created at the University of Minnesota in 1922. World War I saw great strides in research and the use of the clinical laboratory for diagnostic purposes. Military and federal funds were made available for research and development and, more important, patients were in adequate supply. Out of this beginning development continued and reached its peak during World War II. Out of this continued growth emerged the present-day clinical laboratory with all of its diversified and complicated equipment, a far cry from the taste-and-tell days of early urinalysis and the trial-and-error days of direct transfusions.

PROFESSIONAL ORGANIZATIONS

As a result of laboratory developments, there has been a tremendous increase in the number of medical technologists, professional societies, and registries. To regulate the quality of personnel and the training being given to the large number of persons entering the medical technology profession, a form of registry was devised. The term "registry" is gradually being dropped for the more inclusive term of "certification." Registry, as the name implies, refers to the simple act of placing a name in a register. Certification, aside from having the name placed in a register, implies that a group or organization, in registering the name,

PROFESSIONAL ORGANIZATIONS*
(Registry of personnel began about 1928)

A. American Medical Technologists (AMT)

1. National organization founded in 1939 as a member-owned and -operated registry.
2. Has MT and MLT certification and memberships.
3. Sponsors Accrediting Bureau of Medical Laboratory Schools. The ABMLS is an independent agency of the AMT and is responsible for evaluating and accrediting medical laboratory technician and medical assistant schools and programs. The ABMLS is a nationally recognized accrediting agency.
4. Publishes *Journal of the American Medical Technologists*.
5. For information write
   American Medical Technologists
   710 Higgins Road
   Park Ridge, Ill. 60068

*The various organizations are listed alphabetically.

B. American Society of Clinical Pathologists (ASCP)

1. Professional organization devoted to promoting pathology and encouraging research in the clinical laboratory.
2. Full membership granted to pathologists. (Fellowships.)
3. Junior memberships to physicians with two years pathology training.
4. Physicians and nonphysicians may become associate members.
5. Persons certified in one of the technical categories may become affiliated members. (Medical technologists.)
6. Publishes own journal *Laboratory Medicine*. (For technologists.)
7. For information write
   American Society of Clinical Pathologists
   Registry of Medical Technologists
   P.O. Box 4872
   Chicago, Ill. 60680

C. American Society for Medical Technology (ASMT)

1. Organized in 1933 as American Society of Clinical Laboratory Technologists. (Name changed in 1936.)
2. Has active, associate, and student member categories.
3. Collaborates with the Council on Medical Education of the American Medical Association to evaluate and establish minimal educational standards, termed "essentials," for AMA-approved programs for medical technologists. This is accomplished through the activities of the National Accrediting Agency for Clinical Laboratory Sciences (NAACLS).
4. Publishes *ASMT News* and *American Journal of Medical Technology*.
5. For information write
   American Society for Medical Technology
   5555 West Loop South, Suite 2000
   Bellaire, Tex. 77401

D. International Society for Clinical Laboratory Technology (ISCLT)

1. Founded in 1962 as Registry of Medical Technologists International, changed to International Society of Clinical Laboratory Technologists in 1964 and International Society for Clinical Laboratory Technology in 1974.
2. Has registrant, regular, student, educational, and sustaining memberships.
3. Establishes requirements for certification and accreditation and maintains examination records for schools and applicants. Cosponsors a variety of seminars and workshops on both the state and national level. Cosponsors a proficiency examination review for individuals wishing to take the Department of Health, Education, and Welfare's proficiency examination, registry examinations, or state licensing examinations.
4. Publishes *Newsletter*.
5. For information write
   International Society for Clinical Laboratory Technology (ISCLT)
   411 N. 7th St., Suite 805
   St. Louis, Mo. 63101

E. Other no less important specialty groups are many and include

1. American Association of Bioanalysts (AAB)
2. American Association of Clinical Chemists (AACC)
3. American Association of Pathology and Bacteriology
4. American Society for Microbiology (ASM)
5. American Society of Parasitologists (ASP)
6. International Association of Medical Laboratory Technologists (IAMLT)

certifies that the individual's credentials have been checked and that the individual meets all the requirements demanded by the certifying group. Today many professional organizations represent medical technologists. Even the concept of national certification for health personnel is being explored through the Bureau of Health Manpower. A few of the more common registry groups for medical technologists and technicians are shown in the boxed material. In addition, even medical assistants with little knowledge of clinical laboratory work are being registered.

RULES OF CONDUCT

Whether or not a medical technologist belongs to a professional society, as a professional, his or her conduct will be judged by the people with whom he or she comes in contact during the working day. As human nature would have it, medical technology, like all other professions, is judged by the conduct and activity of a few. Rules of conduct have been established to provide guidelines and are accepted as basic to the conduct of all medical technologists. In essence, the rules of conduct are really a list of common-sense items that most people exercise without having to be reminded. The most important items would include the following in one form or another: neatness, cleanliness, punctuality, dependability, dedication, knowledgeableness, meticulousness, cooperation, and professionalism.

Neatness and *cleanliness* are important to the medical technologist in creating an air of professionalism in a field of endeavor thought of as antiseptic and sterile. These traits give the impression that the technologist is a conscientious worker.

Punctuality is an important trait of daily living. If a technologist is scheduled to be available for ward rounds at 6:00 AM, then the technologist should be there. Nursing care, feeding, medication, the patient's comfort, and many of the ancillary services provided by the hospital depend on cooperation.

Dependability is an important virtue. The technologist must be reliable enough to make and carry out day-to-day decisions that are part of the routine workday. Other staff members should not have to wonder what the technologist is going to do next or whether or not they should even count on anything being done at all. Knowing that the work will be done as scheduled allows supervisors to pursue their own jobs.

Dedication to the profession should be a primary attribute of the medical technologist. Without it, every day becomes just a routine day where every job becomes just another task, and as a result, personal conduct can and will suffer. This will manifest itself by poor work habits and unreliable test results. Without dedication, the technologist becomes just a "person off the street."

To be *knowledgeable* means that the technologist is keeping abreast of new developments in the profession and is working in such a manner as to gain the maximum benefit from this knowledge. It takes more than just the knowledge of how to read and perform a cookbook procedure to make a professional. Thinking is an ingredient that adds spice and variety to the daily routine.

A technologist should be *meticulous* in every daily task. With all of today's demands for accountability, it is essential that neat, accurate records of all work performed be kept so that if the need ever arises, reference to past records will yield accurate, reliable, reproducible results that will substantiate the reported result.

Cooperation is also an essential aspect of everyday conduct because of the technologist's working environment. The medical technologist must cooperate with every department in the hospital and with all sections in the laboratory itself. Cooperation between physician, nurse, patient, and technologist must take a high priority if the patient is to realize the full benefits of a smooth, efficient, dedicated health-care delivery team. Cooperation is a basic part of the rules of conduct and an essential part of professionalism.

Professionalism implies the best in a given field, and society tends to separate the professional from others considered less skilled. To be a professional requires diligent and careful observance of the rules of conduct. It requires self-sacrifice and a willingness to subscribe to a program of advancement and critique such as that found in continuing education meetings and the more formalized advanced training obtained at the graduate and postgraduate levels in universities. Professionalism is partly learned and partly earned and is essential to all medical technologists who wish to be classified as professionals. Professionalism is what the medical technologist should strive to reach. It should not be something to hide behind or stand above. The shield of professionalism is not so thick that it cannot be penetrated by misconduct to the detriment of the entire profession.

PROFESSIONAL ETHICS

Ethics can be defined as a set of standards of conduct and moral judgment and as the system or code of morals of a particular philosopher, religious group, or profession. In medical technology we are primarily concerned with the system or code of morals of individuals as professionals. Most health-related professions have endorsed a Code of Ethics to which members must subscribe. Two typical codes are shown below:

Being fully cognizant of my responsibilities in the practice of Medical Technology, I affirm my willingness to discharge my duties with accuracy, thoughtfulness, and care.

Realizing that the knowledge obtained concerning patients in the course of my work must be treated as confidential, I hold inviolate the confidence placed in me by patient and physicians.

Recognizing that my integrity and that of my profession must be pledged to the absolute reliability of my work, I will conduct myself at all times in a manner appropriate to the dignity of my profession.

Courtesy American Society for Medical Technology, Bellaire, Texas.

Recognizing that the American Medical Technologists seeks to encourage, establish and maintain the highest standards, traditions, and principles of our profession as a condition of Registration and maintaining membership in good standing in the American Medical Technologists, I pledge myself to practice Medical Technology in strict accord with the principles, standards, traditions and regulations of the American Medical Technologists and in accordance with the laws of the state in which I practice.

While engaged in the Arts and Sciences which constitute the practice of Medical Technology, I shall practice with thorough self-restraint, always placing the welfare of the patients, entrusted to my care for tests or examinations, above all else, with full realization of my personal responsibility for the patients' best interests.

Realizing that it is incumbent upon me, as a Medical Technologist to continually keep abreast of the times, I pledge myself to strive constantly to increase my technical knowledge of Medical Technology and to participate in the interchange of knowledge with other competent practitioners of Medical Technology and/or other para medical Arts and Sciences that our joint knowledge shall benefit the profession and my practice.

I pledge accuracy and reliability in the performance of tests and to seek competent professional council when in doubt of my own judgment or competence in a particular test or examination.

As a further consideration for registration, I pledge myself to avoid dishonest, unethical or illegal compensation for such services as I shall render to the patients in my charge and I shall shun unwarranted professional publicity or unjust discrimination among the patients in my charge.

I pledge myself to protect the judgment of the attending physician in all cases in which I am directed to make laboratory tests or examinations, and to report the results of my findings free from all personal opinion to the attending physician only. I shall not make or offer a diagnosis or interpretation unless I be a duly licensed physician, except as the results of the report may of itself so indicate, or unless I am asked to by the attending physician.

I pledge myself to protect the identity and the integrity of all patients placed in my charge and to make only such reports public as shall

be required by me by the laws of the state in which I practice or as the patient's physician shall direct.

As a final condition of Registration and Membership in the American Medical Technologists, I pledge my honor and my integrity to cooperate in the advancement and expansion, by every lawful means within my power, of the influence of the American Medical Technologists and to defend its principles.

Courtesy American Medical Technologists, Park Ridge, Ill.

It is not only the practicing medical technologist who is governed by or who subscribes to a Code of Ethics. Many technologist schools across the country also have their students subscribe to a code. For example, the Class of 1967 at the University of Florida developed a Code of Ethics for the students in its medical technology course:

As professionals we will

1. Assume a professional manner in attire and conduct.
2. Establish a rapport with hospital staff, supervisors and physicians.
3. Hold in confidence information relating to patients.
4. Strive for increased efficiency and quality through organization.
5. Be willing to accept responsibility for our own work and results.
6. Strive to learn the theories of laboratory determinations.
7. Establish confidence of the patient through kindness and empathy.

In personal conduct we will

1. Achieve the highest degree of honesty and integrity.
2. Maintain adaptability in action and attitude.
3. Establish a sense of fraternity among fellow students.
4. Strive to have a pleasant manner in the laboratory and with the patients.

Professional status

Professional status is obtained only through possessing the many attributes determined to be essential to the professional. To remain a professional, the technologist must be aware of developments in the medical technology field. The technologist must attend scientific meetings, read current literature, be able intelligently to communicate with other professionals in the field, and should belong to one or more professional organizations. The technologist must not become stale or rely only on cookbook techniques. As new and improved methodology becomes available, the technologist must be able carefully and intelligently to evaluate the procedure for implementation. The professional technologist must also carefully observe and adhere to the rules of conduct and ethics as subscribed. The public has come to expect more from the professional and in fact demands more.

Because of the medical technologist's professional status, the technologist is subject to all of the laws inherent in being a professional. Such laws, be they personal or legislated, are important watchdogs over the medical technology field and the medical technologists working in it. Licensing, a reality in some states and a constant prospect in others, appears to be inevitable. (A knowledge of licensure is essential. A copy of a licensure bill prepared for the legislature of the state of Texas is shown in Appendix C. At this writing, the bill has not become law.)

Malpractice insurance

Traditionally technologists have felt that they do not need malpractice insurance coverage because, as employees, they felt that they were covered. However, things have changed and this reasoning can no longer be accepted.

More and more technologists are being named codefendants with the hospital in lawsuits involving negligence. Typically, hospitals have been liable for their employee's actions. The hospitals liability is derived from a common law doctrine known as *respondeat superior*, meaning that the master is responsible for the acts of his servants. The hospital is now in the position where it must defend itself, so no medical

technologist should assume coverage by malpractice insurance by virtue of being employed by the hospital. Most basic hospital liability policies cover the hospital and its officers but not the employees. A hospital insurance carrier may well pay for a settlement but have such strong feelings that there was negligence by a medical technologist that the carrier may attempt to regain some of its losses from the technologist. This subrogation action is becoming more and more common. It appears that anyone with some kind of a license or certification of professionalism is holding himself out as a skilled professional and as such appears to be fair game for anyone wishing to take advantage of what appears to be negligence.

There are several areas in which the medical technologist can become liable. These include but are not limited to the following:

1. Consent—Consent to perform a certain procedure must be obtained from the patient or from someone legally able to give it. Consent can be obtained orally, in writing, or by implication. The extension of the arm to permit the venipuncture after the technologist has informed the patient of what is to be done is accepted as implied consent. It is important that the patient know and understand what is happening.
2. Venipuncture—Any injury caused as a result of a venipuncture or even a capillary puncture, such as hemorrhage, permanent injury, or infection, can result in a law suit. Fainting during the venipuncture, for example, is a good starting point for a lawsuit because in fainting the patient can easily hit his head, break an arm, or even tear tissue as he falls away from the needle. The patient often gives a warning about fainting, and the technologist should respond to such warnings.
3. Lost specimens—Although not many specimens become lost, this does happen on occasion and as a result the patient has to spend more time in the hospital and away from the job or suffer some other personal inconvenience. Treatment may be prolonged, and even worse, a diagnosis may be several days in the making. A routine procedure for specimen processing and handling should be established and followed.
4. Improper identification of patient or specimen—This happens on occasion through pure negligence. The patient must be properly identified before any specimen can be collected. Name tags should be consulted, some person should identify the patient for the technologist, and if the patient is conscious and responsive, the patient can be asked to identify himself. One should not simply assume that the patient in a particular bed is the patient one is looking for. Check it out. There is no excuse for not identifying the patient or for not properly marking the specimen with the patient's name and other particulars. Just as important is the proper identification of the specimen. The source of the specimen should be clearly indicated. This must be done before the specimen is removed from the patient's bedside. Errors resulting from mislabeling specimens or misidentifying patients can result in catastrophies. There is no legal defense against this type of negligent error.
5. Wrong report on patient's chart—It happens on occasion that for some reason, the wrong report gets posted to the patient's chart. Although the nurse and physician should notice this error, the results of interpreting the laboratory findings in terms of the wrong patient's clinical condition can result in much pain and discomfort to the patient. Death can result from erroneous treatment. Reports should be double-checked. It is not enough to place Mr. Roberts' laboratory results on Mr. Roberts' chart, particularly when Paul

Roberts' results are placed on Peter Roberts' chart.

6. Delay in reporting results—There is usually no acceptable excuse for a delay in reporting laboratory results. If for some reason the report cannot be delivered or posted as scheduled and promised, it becomes necessary to notify the patient's physician, and if the physician thinks it necessary, the patient. If another specimen must be obtained, it is the laboratory's responsibility to track down and communicate with the patient about obtaining another specimen after consulting with the physician. This requires tact and honesty.
7. Lack of report accuracy—All laboratory calculations and results should be doublechecked. The fewer number of persons who have to record results, the less chance there will be for committing the unforgivable error of reporting the wrong results. As for the figures used for calculating the results, the law requires that the figures and calculations be kept for a minimum of three years. In case of a lawsuit or some question about a previous result, calculations and answers can be easily verified. All laboratory report forms should be carefully checked before the results leave the laboratory to become a permanent part of the patient's record.

With careful attention to routine procedure, there is no reason why any medical technologist should suffer the indignity of a lawsuit. It is primarily through carelessness and negligence bred by contempt or familiarity that most malpractice lawsuits occur.

EMPLOYMENT OPPORTUNITIES

Unlike the situation in many professions and the labor market in general, there are usually more employment opportunities in the medical technology field than there are technicians or technologists to fill them. Choice is influenced by the individual desire to work in a certain geographic area or with a particular type of laboratory. There are many advertisements for technologists in all sections of the United States, and each advertisement is a little different. Some extol the virtues of a particular locale, such as its nearness to skiing or swimming or horseback riding facilities; others mention the availability of a variety of churches and schools; still others mention opportunities to advance and become an integral part of the organization. Each advertisement should be read and examined on its own merit and the reader should determine to his own satisfaction that the advertiser is indeed promoting the particular laboratory position to be filled. The advertisement may be merely a come-on to get someone interested in a particular area involved in poor and unsuitable working conditions.

The greatest number of jobs for technicians and technologists exist within the hospital setting. For purposes of this writing, hospitals may be divided into three major groups, depending upon the number of beds the hospital has. Each group has employment advantages and disadvantages. Job opportunities also exist within private laboratories, independent laboratories, public health laboratories, sales, industry, research, the military, and in some other more diversified areas. Again, there are advantages and disadvantages to employment in each, and the technologist should consider all the merits of each job opening before deciding where to work.

Hospitals

The small hospital is one with 75 beds or less. In this size hospital there may be employed anywhere from one to five technologists, depending upon the number of beds and the number of physicians on the hospital staff, as well as on the work load. To some persons there are definite advantages: the salary may be better than average, and a small laboratory, particularly one where one or two technologists are employed, allows for a certain degree of self-

reliance. The disadvantages, however, are several. Small hospitals usually mean small towns where social and cultural activities are limited. Time off for meetings and vacations may be difficult to arrange. The supervision is usually very minimal and usually only the basic or routine tests are performed. Because the laboratory is within a hospital and the hospital must operate 24 hours a day, the laboratory must also operate 24 hours a day, which means that the technologist may have to be available for work on off hours ("pulling call") all of the time. Free time is in fact limited.

The medium-size hospital is one which has up to 300 beds. In this size hospital, the laboratory usually shows some signs of departmentalization and may employ 20 or more persons. The technologist might be able to obtain well-rounded exposure to all of the clinical laboratory disciplines through a rotation system within the laboratory. Upward mobility is also a factor. In the smaller hospital where there is but one or two technologists, upward advancement is rather limited. In the medium-size hospital, however, the laboratory equipment may not be as modern as in larger hospitals. In addition, rotation of workers to the evening and night shifts may also be required because of the increased patient admission work load. In addition, some weekend work may be required, but not to the degree at the small hospital.

The large hospital, that with more than 300 beds, employs many classifications of clinical laboratory workers. The laboratories are generally departmentalized, with department chiefs, a chief technologist, a laboratory administrator, and a pathologist. There are some long range advantages to working in a large hospital laboratory. There is usually some sort of retirement plan. In addition, laundry, meals, insurance, tuition, and meeting expenses are sometimes paid. However, the take-home pay may be less than in the smaller hospital, primarily because if one or two technologists quit, their absence wouldn't affect the work load very much, and also because larger hospitals are generally near or within large metropolitan centers, where there is a large labor pool from which to draw technologists. In the large hospital, the technologist may become isolated in one department, particularly if the technologist has no desire or initiative to advance.

Private laboratory

The private laboratory may be located in a physician's office or even in a building separate from where the health delivery service is located. It may be under the direction of physician or pathologist. Even nonmedical persons sometimes direct a private laboratory. Some private laboratories are private business ventures of dedicated and knowledgeable technologists.

There are several advantages to working in a private laboratory. In the smaller ones, the satisfaction of being the boss is often a great incentive. The salary is generally good and there are regular hours, limited weekend work, and no night call.

Among the disadvantages is the added burden of fiscal management. Because the laboratory is privately owned and the clientele is limited, the variety of test procedures performed is limited and geared to the needs of the physicians who use the laboratory services.

Public health laboratory

The public health laboratories around the country may be under city, county, state, or federal control. They offer many interesting and challenging job opportunities. While some laboratories may be confined primarily to performing serologic and bacteriologic testing procedures, others can offer diversified and rewarding work.

An advantage to public health laboratory work as a career is that the position is usually in the civil service and as a result is generally quite secure. However, advancement may be slow and the technologist may get stuck in one area or discipline of the laboratory department.