MEDICAL LABORATORY TECHNOLOGY INSTRUCTION IN NOVA SCOTIA

A Thesis written in partial fulfillment of the requirements for the degree of Master of Arts

Dhirendra Verma,
Saint Mary's University,
School of Education,
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CONTENTS

LIST OF TABLES

LIST OF ILLUSTRATIONS

INTRODUCTION

The greatly increased demand for medical laboratory technologists[1] in the last few years has made it necessary to seriously consider methods of enhancing the supply. The processes of daily life are speeding up continually and many tasks which were carried out successfully by human hands and brains in the past must now be carried out by automatic means. What the implications of automation are for the training of medical laboratory technologists is thus another area of concern.

The existence of these problems should not be allowed to obscure the fact that the instruction of medical laboratory technologists in Nova Scotia has been developed into a well-organized program, markedly in contrast with the on-the-job and apprenticeship training of the past. This noteworthy development deserves to be put upon record. This thesis is an attempt in this direction.

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[1]According to American Bureau of Medical Technology Schools:

> "a medical technologist is a person who, having completed certain formal training and internship or residency, has passed a qualifying examination and is certified as competent to perform the tests and do the work usually performed in clinical laboratories."

(Medical Technology. A Recruitment Pamphlet.)

The objectives of the present study are (a) to trace the origin and evolution of Nova Scotia's medical laboratory technology instruction in the context of Canadian and regional developments; (b) to examine the problem of the recruitment of laboratory personnel in Nova Scotia; (c) to examine the curriculum and teacher training in the medical laboratory technology field; and (d) to analyze the effects of technological advance and automation on present and future needs for laboratory personnel.

The study is presented in four chapters. Chapter I includes the historical development of medical laboratory technology instruction in the provinces of New Brunswick, Prince Edward Island, Newfoundland, and, more extensively, Nova Scotia. The evolution of the Canadian Society of Laboratory Technologists--the registering body for this profession--is also outlined. Chapter II deals with the present program of instruction in Nova Scotia. Current problems such as student recruitment, curriculum content and teacher training are discussed at length. In Chapter III a critical analysis is made of the effects of modern technology and automation on present and future needs for laboratory personnel. Finally, Chapter IV presents the summary and conclusions of the study.

The material for this thesis is collected from personal interviews, questionnaires, periodicals, conventions, annual reports, and correspondence with the Directors of various hospital laboratories.

CHAPTER I

THE DEVELOPMENT OF NOVA SCOTIA'S MEDICAL TECHNOLOGY INSTRUCTION IN ITS CANADIAN CONTEXT

This chapter traces the origin and development of medical laboratory technology instruction in Nova Scotia against the background of developments in other parts of Canada and particularly in the other Atlantic Provinces. For convenience, the chapter is divided into five sections. The first of these traces the evolution of the Canadian Society of Laboratory Technologists--the central qualifying and registering body for the students of this profession. The section begins with an outline of the functions of this organization, followed by a description of its establishment, aims and objectives. The next three sections deal with the history of medical laboratory technology in New Brunswick, Prince Edward Island, and Newfoundland in that order.

With respect to Nova Scotia itself, the history of the profession is dealt with in detail, from the establishment of the first diagnostic laboratory in 1895 to the establishment of the School of Medical Technology in the Nova Scotia Institute of Technology, Halifax, N. S., in 1964.

The Canadian Society of Laboratory Technologists

The members of the medical laboratory technology profession are qualified by the Canadian Society of Laboratory Technologists. This is the only registering body in Canada for medical technologists. The Society operates to enforce and develop professional standards for the certification of its members. It has a well-formulated code of professional ethics for the guidance of its membership.

The Society was established in May, 1937, in Hamilton, Ontario. The objectives, for which the Society was incorporated under Dominion Charter, are as follows:

(a) To improve the qualifications and standing of medical laboratory technologists in Canada;
(b) to promote research endeavours in all branches of medicine;
(c) to promote a recognized and professional status for medical laboratory technologists;
(d) to promote closer co-operation between the medical profession and the medical laboratory technologist; and
(e) to aid more efficiently the physician in the diagnosis and treatment of disease.[1]

The history of the Society indicates that it has successfully approached the fulfilment of these objectives. The Society has also developed effective communications with other organisations such as the Canadian Society of Clinical Chemists, the Canadian Association of Medical Bacteriologists,

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[1] Submission to Committee on the Healing Arts, Province of Ontario, A Report Prepared by the Canadian Society of Laboratory Technologists (Hamilton: The Society, 1965), p. 1.

and particularly the Canadian Medical Association, as will appear below. These communications have greatly aided the general program of the Society.

The Society's major interest has been in initial and advanced training and certification of the medical laboratory technologists. It has developed training programs in co-operation with the Canadian Medical Association and the various hospitals. In 1939, the Society was granted approval, by the Canadian Medical Association, to train medical laboratory technologists. The training of laboratory technologists up to that time had been quite informal. Young high school graduates were chosen by hospitals, shown how to perform various tests in the laboratory, and were appointed permanently as regular laboratory technologists. The Society decided that the training should be of a more formal nature. The technologists were trained in an employment situation for a definite period of time during which they rotated throughout the laboratory. The Society set examinations for certification. With varying modifications, both in the duration and the content of the program, this system continued till the late 1950's. In 1957 the Society strongly recommended the establishment of a didactic[2] portion of

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[2]In the terms of medical laboratory technology instruction, "didactic" pertains to a concentrated course of lectures and practical work preceding the clinical experience in the hospital laboratory.

training in conjunction with the usual apprenticeship program. The main hospitals in Nova Scotia, however, had already introduced this concept to their training program.

The present training program across the nation is usually a standardized bi-phasic program--the first phase being an entirely academic-type situation, followed by a second phase of in-hospital practical laboratory experience. In British Columbia, all training is centralized at the British Columbia Institute of Technology, Burnaby. The training consists of an academic year at the Institute plus twelve months in a hospital. In Alberta, the program starts with an academic year at the Northern Alberta Institute of Technology in Edmonton, followed by twelve months' further training in an approved hospital. In Saskatchewan, the didactic training is still offered at the hospitals but there are indications that from September, 1968, the Saskatchewan Institute of Applied Arts and Science will start training medical laboratory technologists and centralize the program for the province. These two prairie provinces also offer courses leading to a Bachelor's degree in medical laboratory technology. In Manitoba, the Manitoba Technological Institute imparts a year of didactic training, after which the students go to the hospitals for internship. In Ontario, the Hamilton Institute of Technology imparts the didactic training for 11 months, following which the students rotate for another year in the provincial hospitals. In Quebec,

the universities of Montreal, Laval, Sherbrooke, and Trois Rivieres offer two-year courses consisting of one academic year at the university and one year of practical experience in an approved hospital laboratory. The course in each of these universities, however, is offered only in the French language. The training program in the Atlantic Provinces follows the pattern very closely and is discussed in greater detail in the subsequent sections. Thus the preparation of medical laboratory technology exhibits a common pattern from coast to coast.

The Society till the late 1950's offered the certificate only at the R.T. (Registered Technologist) level. The certification was done in two areas: the general area and the subject area.

> The General Certificate, R.T., is conferred on an eligible candidate who has taken training in a Program approved by the Canadian Medical Association and the Canadian Society of Laboratory Technologists, and who has successfully completed the certification examinations presented by the Society. The Subject Certificate, R.T.(Subject), is conferred on an eligible candidate who has completed a Training Program which has been approved by C.S.L.T. in one of the disciplines of Medical Laboratory Technology and who has subsequently passed the examinations for the certification.[3]

This distinction still continues. In 1960, the A.R.T. (Advanced Registered Technologist) and the L.C.S.L.T. (Licentiate of the Canadian Society of Laboratory Technologists) programs came into existence with a prescribed credit

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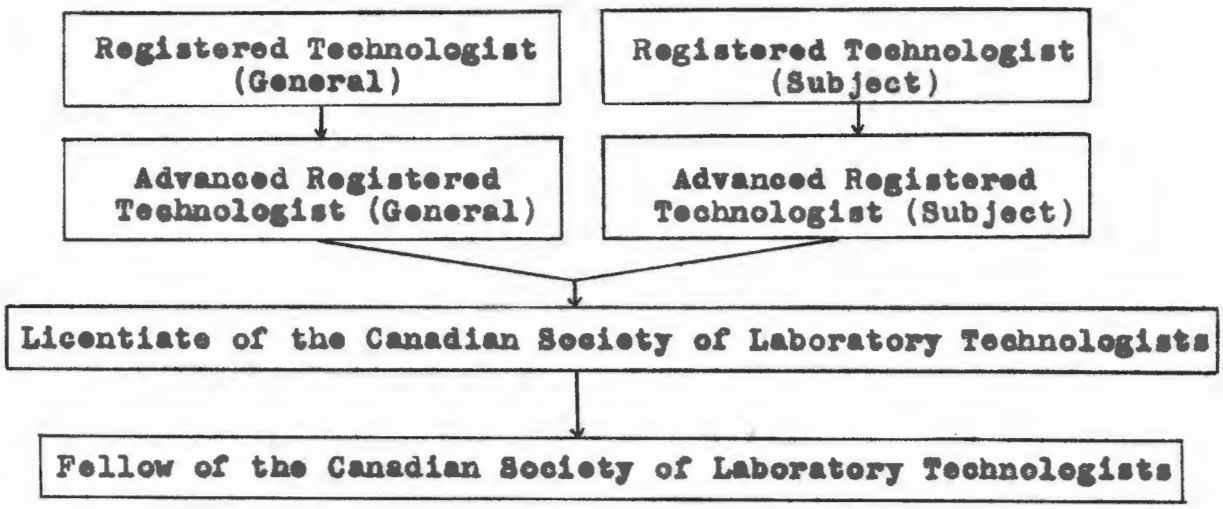
[3]Canadian Society of Laboratory Technologists, Personnel Policies and Recommended Employment Policies (Hamilton: The Society, March, 1967), p. 4.

system for progression from one level of certification to another. These higher qualifications are based on examination at a higher standard, and successful candidates are enabled to act in a supervisory capacity. The Society also grants Fellowships but these are conferred only by nomination of eligible candidates of outstanding abilities and knowledge. The academic steps and channels of progression are charted as follows:



The Society's enrolment has been constantly on the increase. In 1960 there were 3,053 registered members; the number now stands at 8,257.[4] For the benefit of the members, the Society publishes a bimonthly journal,[5] both in English and French. The Society also publishes a bimonthly News

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[4]Interview with Archie Shearer, Executive Secretary, Canadian Society of Laboratory Technology, Halifax, October 17, 1967.

[5]The Canadian Journal of Medical Technology, now in its 30th year of publication.

Bulletin, which carries items relating to Society news and programs, as well as technical notes and advice.

In brief, as we can see from above, the Society helps to keep a uniform standard of training for medical technologists across Canada. By providing systematic guidelines for initial and advanced training of the medical laboratory technologists it has constantly aided the hospitals and technical institutes in all the provinces of Canada. The following sections will bear witness to its influence on the development of medical laboratory instruction in the Atlantic Provinces.

New Brunswick

The training of medical laboratory technologists in New Brunswick began in 1919. Under the direction of Dr. Abramson, Provincial Pathologist (1918-1933), technologists were trained in a laboratory situated within the Saint John General Hospital. The students were taught by the pathologist to do the specific laboratory work required at that time. In the 1930's it was possible for them to qualify to write the examinations given by the American Society of Clinical Pathologists and thus obtain their M.T. (Medical Technologist) certificate. When the training program received C.S.L.T. affiliation under the directorship of Dr. McKeen, the trained technologists were eligible to write R.T. examinations and became registered with their own society in Canada.

As of 1939-40 senior matriculation has been requisite for entrance to the medical laboratory technology course offered by the Saint John General Hospital. Entrance requirements have always followed those stipulated by the Canadian Society of Laboratory Technologists.

In 1940 there was no definite entrance time for the course. The students were taken in for training whenever room became available, and they spent one year on an apprentice-type program with no formal lectures. They stayed a certain length of time in each department, working along with the technologists. At the end of this period they wrote R.T. examinations.

The 12-month apprenticeship training, with a small number of students being trained at a time, continued through the 1940's. Only a few formal lectures were given during this time. All training was centralized in Saint John, with students coming from other parts of New Brunswick, and some from Prince Edward Island, the Annapolis Valley of Nova Scotia, and Newfoundland.

In 1952 a provincial laboratory was built adjacent to the Saint John General Hospital, and one room in this building was designated for student training. In 1956 an 18-month course was begun with students entering the school the 1st of October each year. Some lectures were given in Haematology, Chemistry, Blood Banking and Bacteriology. Under Dr. Bird C.S.L.T.-C.M.A. (Canadian Medical Association)

training program was carried out without any major change.[6] In 1965 the length of the course was increased to 19 months in duration.

In 1967 under the directorship of Dr. Ian MacLennan the course was lengthened to 20 months, with 23 students (approximately half English- and half French-speaking students) entering the school on September 1.[7] The students spend six months in Chemistry, two months in Blood Banking, four months in Bacteriology, three months in Haematology, two months in Histology and six weeks in Serology. A systematic lecture program is carried out, and tests are given throughout the course with final examinations at the conclusion of the training. Those who pass these examinations graduate from the school. R.T. examinations are written in the spring after graduation.

Elsewhere, the Department of Veterans' Affairs Hospital in Saint John West trains a maximum of three students each year. These students rotate through the various departments in the D.V.A. Hospital laboratory and come to the

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[6]From 1959 to 1962 due to a shortage of technologists within the province, a 12-month course--post-junior matriculation--was set up along with the regular post-senior matriculation 18-month course. The students were given certificates at the end of their training which specified the tests which they were trained to perform. Many of the technicians thus trained have since achieved senior matriculation and returned for an additional six months' training in order to write their R.T. examinations.

[7]Letter from Dr. Ian MacLennan, Director, Provincial Laboratories, Saint John, New Brunswick, November 2, 1967.

Provincial Laboratory for most of their lectures.

Most of the students trained at the Provincial Laboratory obtain a federal health bursary of $150.00 per month, in return for which they must work in the province of New Brunswick for a minimum of two years. A $40.00 book allowance is given to each student at the beginning of the academic term. There is no tuition fee. A combined program this year conducted in association with Mount Allison University leads to a B.Sc. degree and R.T. diploma. The students in this program spend three months in the summer at the Provincial Laboratory following their Freshman, Sophomore, and Junior years, and five months following their senior year. These students then write their R.T. examinations, usually in the fall.

Prince Edward Island

The first laboratory on Prince Edward Island was established in 1925 by a community of French Sisters from Quebec under the supervision of Sister St. Hugh. Other than this group there were no technologists on Prince Edward Island at that time.

In August, 1925, the New Charlottetown Hospital came into existence. It was quite modern according to the prevailing standards and Sister St. Hugh was able to perform tests on blood sugars, Blood Urea Nitrogen, and Bilirubin.

No significant development occurred during the years 1926-30.[8]

In the spring of 1931 the Provincial Sanatorium was built. It had a capacity of 60 beds and was provided with a well equipped laboratory, which was under the care of Mrs. Esther Campbell. For five busy years Mrs. Campbell did the routine tests in the laboratory all alone. They included urinalyses, sedimentation rates, WBC's, RBC's, haemaglobins, CSF's, cell counts, sputum smears, and films for diphtheria. In addition, she examined the water and ice used by the railway, the city water, and the city milk. Mrs. Campbell was succeeded by Mrs. Mildred Archibald, who was trained in Saint John, New Brunswick. Sister St. Hugh was back by this time from Halifax after graduating in Pharmacy. When the Canadian Society of Laboratory Technology was organized, she wrote the examinations and became the first registered laboratory technologist of the province.

As time went on, many changes were being made in all fields of laboratory work. This was especially so with blood

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[8]During the years 1928-32, Sister St. Hugh was taking a course in Pharmacy at Dalhousie University, Halifax. Her position was filled by two unregistered technicians--Miss Helen Lawson and Miss McMillan. The Canadian Society of Laboratory Technology was not yet incorporated.

In 1930 the new Prince Edward Island Hospital was opened. The first technician at the new hospital was a Mrs. Mary Pines. During the Second World War she went overseas to drive a Red Cross truck and was killed on the battlefield, having left very little record of the equipment and techniques she used.

transfusion work. Dr. J. S. Jenkins performed the first blood transfusion on Prince Edward Island. At this time, however, no Rh typing was done and the blood was given directly from the donor to the patient. Work and research continued to progress, and by 1937 Rh investigations were carried out.[9]

The year 1946 saw a big step forward in laboratory training on Prince Edward Island--the establishment of the Division of Clinical Laboratories of the Department of Health under the direction of Dr. J. W. Shaw, with the laboratory being set up in the Provincial Sanatorium. Soon thereafter, Dr. Shaw opened a training school for laboratory technologists with the approval of the Canadian Society of Laboratory Technologists. Dr. Shaw sent Sister St. Hugh to the Laboratory of Hygiene in Boston where she studied Serology, Parasitology, and Haematology, and on returning to the Island she helped to teach in the laboratory school for some time.

In 1958 Dr. John Craig was appointed Director of the Division of Clinical Laboratories. Training under his

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[9]At this time, to meet the ever-increasing need for a ready supply of donor blood, a club known as the Charlottetown Hospital Blood Donors' Club was formed under the direction of Father George McCormack, who was the Curate at St. Dunstan's Basilica in Charlottetown. This was the first voluntary blood donors' club in the Maritime Provinces. The club continued to function until 1948 when the Canadian Red Cross assumed all responsibilities for the service.

direction at first was entirely of the apprenticeship type, although it gradually became more and more formal. It was only in 1966 that the province provided actual teaching laboratories for students. The number of students has varied, largely because of difficulties of recruitment.[10] Since 1958 the laboratory has averaged about five graduates per year.

This is the only technologist training program in the province. Lectures and tutorials, classroom laboratory work, and service laboratory work, both in the Division and in the hospital laboratories, are included. The course is conducted according to the standards set by the Canadian Society of Laboratory Technologists. The duration of the total program is 21 months.

Newfoundland

The first clinical laboratory in Newfoundland was established in 1910, on the premises of St. John's General Hospital, St. John's, by Dr. R. A. Brehm. He recruited two high school students as technicians and taught them to perform a few simple tests such as blood counts, urinalyses, and bacteriological diagnoses. In 1936 Dr. Brehm retired and his place was taken by a trained pathologist who stayed in the province only for one year. During his short stay,

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[10]Letter from Dr. John Craig, Director, Division of Clinical Laboratories, Department of Health, Prince Edward Island, Charlottetown, October 10, 1967.

however, this pathologist was able to train two more technicians who were needed badly by the expanding laboratory.

In 1938 Dr. J. E. Josephson was appointed as Director of the laboratory. The laboratory at this time was poorly equipped and the staff scanty. Dr. Josephson helped in improving conditions by purchasing modern equipment, modernising the techniques and methods, and training additional laboratory technologists.

In 1941 a new three storey laboratory was built on Water Street East in St. John's.

> In these new quarters with about 4,500 square feet of space, development of laboratory services was for the first time placed on a realistic basis. An educational program dealing with medical laboratory science was initiated and the expanded services were offered to all hospitals, physicians, and public health personnel throughout Newfoundland. A wide variety of testing in clinical and sanitary Bacteriology, Chemistry, Pathology, and Serology were made available; and mailing-outfits were issued for use in submitting specimens to the laboratory from any doctor or hospital in the island. New technicians were trained, and the technical staff was appreciably increased to cope with the increasing volume of work.[11]

The same year, the Canadian Society of Laboratory Technologists granted its approval to the St. John's General Hospital as the training center for the medical laboratory technologists. In 1947 and 1960, additional wings were added to the St. John's General Hospital to accommodate the expanding laboratory.

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[11] J. E. Josephson, "Toward Rapid Laboratory Service", Canadian Hospital (February, 1962), p. 65.

In 1960 the laboratory services of the Department of Public Health were wholly transferred from their Water Street location to the new diagnostic wing of the St. John's General Hospital. The training of laboratory technologists was thus centralized in the St. John's General Hospital. The hospital operated a 10-month combined training course in Medical Laboratory and X-ray Technology designed for technologists who staffed the smaller or "cottage" hospital system of the province. While taking the course the students received a monthly in-training bursary.

In early 1964 the new College of Trades and Technology was completed in St. John's. The didactic portion of the medical technology was transferred to this school. The first class in medical technology at the College of Trades and Technology started in September, 1964. The course is a combined effort on the part of the College of Trades and Technology and the hospital laboratories of the province.

The course is a three-year program from matriculation (Newfoundland Grade XI). The first two years of the course are spent at the College of Trades and Technology, during which time the students receive a thorough didactic training.

In the third year the students spend a period of internship in the disciplines of Histology, Microbiology, Clinical Chemistry, Haematology, and Immuno-Haematology in a hospital laboratory. The Canadian Society of Laboratory Technologists allows the student, after successful completion

of the three years, to write the R.T.(General) examinations. The College also presents a Diploma of Technology to each successful student at the end of the period.

Nova Scotia

The first public health laboratory in Nova Scotia was established in Halifax in the year 1895 under the directorship of Dr. W. H. Hattie. It was located in a small room on the ground floor of the Victoria General Hospital. The finances were scanty as can be realized by noting the director's salary of four hundred dollars a year, which was intended also to cover the cost of apparatus and supply.

> Equipment was extremely meagre and for some years the only microscope available was the personal property of the director. During the first two years there was no incubator for the culture of bacteria and the hospital interns during that period acted as human incubators, incubating their culture tubes overnight in the pocket of their nightshirts.[12]

In 1900 Dr. Hattie moved the laboratory to the Nova Scotia Hospital in Dartmouth, accepting a position there. He resigned in 1901 and the laboratory was again transferred to Halifax. It was housed in a new building at the junction of College and Carleton Streets and renamed "The Nova Scotia Laboratory of Science". Dr. Andrew Halliday was appointed as the Director. Dr. Halliday was succeeded by Dr. L. M. Murray,

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[12]D. J. Mackenzie, "The Origin and Development of a Medical Laboratory Service in Halifax", The Nova Scotia Medical Bulletin, XLIII (June, 1964), 180.

under whose directorship the laboratory was removed to Nova Scotia Technical College in 1910. In 1911 Dr. M.A. Lindsay was appointed as the first full-time pathologist and Director of the Public Health Laboratory. The Laboratory once again shifted its quarters to the newly constructed Pathology Institute in 1914. The same year Dr. Lindsay died in a ship disaster on his way to England.

Prior to 1914 laboratory work was carried on by a succession of directors who were mainly occupied with clinical work, assisted by a final-year medical student--a laboratory intern who spent six months of his intern year in the laboratory. From 1914 to 1922, young women were trained in the laboratory to conduct a few simple tests. There was no definite pattern of training. In 1921, Dr. D. J. Mackenzie joined the staff as Assistant Pathologist. He writes about the early situation:

> In addition to routine work, my first problem was to set up a more convenient blood transfusion service than the simple major and minor cross matching until a suitable donor was found. In 1922 insulin became available in Halifax, and it became necessary to organize a new service that was called Blood Chemistry. The range of tests at first was modest, blood sugar, urea, chlorides, creatinin, uric acid and carbon dioxide combining power completing the list. The following year we trained the first group of technicians for a laboratory other than our own--The class was composed of two students, one from the Glace Bay General, the other from St. Martha's.[13]

It was due to Dr. Mackenzie's pioneering efforts that a formal training scheme for laboratory technologists was

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[13] Ibid., p. 182.

inaugurated in 1931. The duration of the course was eight months. Instruction in Bacteriology and Serology was done in the Public Health Laboratory, and instruction in Histology, Haematology, and Biochemistry in the Department of Pathology. Training in the Public Health Laboratory was offered free, but in the Pathology Department a small fee of $50.00 was charged until 1943. Instruction was of the apprenticeship type without any didactic training. In 1940 the duration of the course was lengthened to ten months. In 1946 the course was affiliated with the Canadian Society of Laboratory Technologists.

The Halifax Infirmary started a formal training course for laboratory technologists in 1946. The course was approved by the Canadian Medical Association-Canadian Society of Laboratory Technologist Joint Committee in September, 1947. The Infirmary joined with the other hospitals of the province in sending its students for the didactic portion of their training to the Pathology Institute in 1954-55.[14]

Elsewhere in the province, St. Martha's Hospital, Antigonish, applied to the Canadian Society of Laboratory Technologists in 1948 for approval as a training center for laboratory technologists. Dr. O. C. MacIntosh was the Pathologist there at that time. The approval was granted, and the first class started in 1949 with two students. At

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[14]Letter from Dr. O. C. MacIntosh, Director of Laboratories, Halifax Infirmary, Halifax, June 2, 1967.

that time the Pathology Institute, Halifax Infirmary and St. Martha's Hospital were the only institutes in the province which were authorised by the Canadian Society of Laboratory Technologists to give the complete course.

At the Pathology Institute lectures were started in the various subjects in 1950. Prior to this, the training was purely of the apprenticeship type. For the first two years the lectures occupied two afternoons a week, the period of training having been extended from ten months to one year. In 1952 a change was made in the system. An entire period of four months, from September to December, was devoted to lectures. In the remaining months of the year the students received practical training in the various laboratory divisions of the Pathology Institute.

Later, certain hospitals (other than the two already approved by the C.S.L.T.) were permitted to give the practical portion of the course, which followed the didactic portion completed at the Pathology Institute in Halifax. The students sponsored by the Pathology Institute itself stayed there for their practical training.[15]

In 1957 the Federal Government made health grants available to the province. These grants provided, for the first time, bursaries to assist the training of laboratory

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[15]Interview with Dr. O. D. MacIntosh, May 25, 1967.

technologists, with the understanding that the individuals receiving the grant would have to work in the province for a period of time equal to that for which they were given the financial assistance. A considerable number of students did not accept a bursary for that reason.

In 1962 Dr. Mackenzie retired, and Dr. W. A. Taylor was appointed as Provincial Pathologist. Although a new addition to the Pathology Institute was built in 1961, problems of overcrowding were rising. The number of laboratory services was on an increase. This was due to the development of medical science and the provision of free inpatient and outpatient laboratory services throughout the province. With these demands came the necessity to train more qualified technologists. The space at the Pathology Institute was not adequate to handle a training program involving a large number of students. There also was a shortage of qualified teaching personnel. In March, 1964, a joint committee of the Nova Scotia Department of Public Health, Nova Scotia Hospital Insurance Commission, and Nova Scotia Hospital Association was formed to report on the training of laboratory technologists in the province.

The Committee noted its findings as follows:

> The space available for laboratory demonstrations and exercises at the Pathology Institute in Halifax, where the centralised portion of the course is currently conducted, is only designed for thirty trainees, whereas during the present year sixty students are being trained and it is projected that between seventy-five and one

> hundred students will have to be trained annually by 1969. . . . There is no space available for expansion of the area provided for laboratory demonstrations and exercises for these students within the Pathology Institute. . . . Under present circumstances pre-university subjects such as Mathematics, Biology and Chemistry are being taught by the staff of the Pathology Institute who have to be drawn from other urgent duties for this purpose and are not particularly qualified to undertake this type of teaching.[16]

There was a growing state of concern over these issues during this time. Hospitals' role in educating the technologists was seriously questioned.

> Hospitals are criticised by many organizations and authorities for attempting to be educational in certain areas BUT unless they did carry out such training the public would be in a very poor position to receive the best in hospital care. Hospitals would be very happy to drop such work and admit that they are not equipped to do justice to it, if some satisfactory alternative could be found.[17]

The Joint Committee after surveying the entire situation recommended the establishment of a course in medical laboratory technology at the Nova Scotia Institute of Technology--a vocational and technical institution opened in Halifax in 1963. The committee reported in the following words:

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[16]Joint Committee on Medical Technology Instruction, Laboratory Technician Training, A Report Prepared by the Joint Committee consisting of the Nova Scotia Department of Public Health, the Nova Scotia Hospital Insurance Commission, and the Nova Scotia Hospital Association (Halifax, March, 1964), p. 1.

[17]H. F. Mckay, The Training of the Laboratory Technician, A Report to the Nova Scotia Hospital Association's Meeting, Halifax, July 10, 1964, p. 2.

> Having considered the various alternatives presenting themselves, it is felt that in the province of Nova Scotia there is no agency other than the Vocational Training Division of the Department of Education that has an adequate program for the training of this type of personnel. It is, therefore, strongly recommended that provision be made within the Nova Scotia Institute of Technology, Halifax, for facilities and personnel to undertake with the cooperation of the staff of the Pathology Institute and others, to provide a course of didactic instruction in laboratory technology of ten months duration for the requirements of the province. It is considered that this course of didactic training should be complemented by a period of one year's practical internship training in hospital laboratories approved by the Canadian Medical Association for this purpose, throughout the province.[18]

On the recommendation of the Committee, a School of Medical Technology was established in the Nova Scotia Institute of Technology on Leeds Street, Halifax,[19] in 1964. Its intended purpose was to give the didactic part of the training leading toward the qualifications required to write the R.T. examinations of the Canadian Society of Laboratory

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[18]Joint Committee on Medical Technology Instruction, op. cit., p. 8.

[19]In 1958 an interdepartmental committee consisting of members of the Department of Labor and the Department of Education determined the nature of training needed to serve both the student and industry in the province.

On the recommendation of the Committee plans were made to establish a vocational center in Halifax where training could be given to apprentices, unemployed, and disabled persons. Plans were also made to impart advanced training on a technical level in certain fields. The field of medical technology unfortunately was not included in the plans. Part of the financial help was provided by the Federal Government and in 1961 the construction work was started. The building was completed in the spring of 1963 and was named the Nova Scotia Institute of Technology.

Technologists. The course began operation on September 28, 1964, with a staff of six full-time instructors and a part-time medical director. By April, 1965, the School came under the supervision of a full-time medical director. On August 1, 1965, the course was taken over by the Vocational Division of the Nova Scotia Department of Education. Prior to this date the training program was controlled by the Department of Public Health.

The School has a total capacity of teaching ninety students. The responsibility of student recruitment lies with the Hospital Insurance Commission. A representative of the Commission travels throughout the province and visits high schools for the purpose of recruiting the prospective candidates. The students receive ten months' didactic training at the Institute. The practical internship is conducted at approved hospital laboratories and varies in duration from 8 to 12 months. At the end of this period the students are eligible to write the R.T.(General) examination of the Canadian Society of Laboratory Technologists.

Since its establishment as part of the program of the Nova Scotia Institute of Technology in 1964, the School of Medical Technology has attempted to serve the needs of the provincial hospitals by supplying qualified medical laboratory technologists.

The foregoing, in brief, is an account of the development of Nova Scotia's medical technology instruction in its Canadian context. The developmental trends seem to have followed a similar pattern throughout the Atlantic area. In all the provinces, the training is biphasic in nature. The first or the didactic phase of the training in Nova Scotia and Newfoundland is offered at the provincially operated technical institute. In New Brunswick and Prince Edward Island, it is still provided at the provincial clinical laboratories. The second or the internship phase, in all provinces, is completed at the hospital laboratories. In Nova Scotia the total length of training varies from 18 to 22 months compared to 20 months in New Brunswick, 21 months in Prince Edward Island and 3 years in Newfoundland. The didactic part of the training in Nova Scotia is of 10 months' duration while in Newfoundland it is two years.

During the course of its evolution, the instruction of medical technology in Nova Scotia underwent certain changes:

(a) simple on-the-job training was replaced by a systematic apprenticeship-type training,

(b) a formal program of instruction, biphasic in nature, took the place of the apprenticeship-type training,

(c) the didactic portion of the biphasic program was shifted from the hospital laboratory to the Institute of Technology.

Similar changes occurred in the remaining Atlantic Provinces

with the exception of (c) in New Brunswick and Prince Edward Island.

The need for a formal instructional program was recognized a long time ago by those concerned with the profession in some way. The nature of the services provided by the technologist demanded a systematic and well organized education of the individual. The on-the-job and apprenticeship type of training failed to provide such an education. The challenge was met by the Canadian Society of Laboratory Technologists which helped considerably in the establishment of a more organized and formal instructional program.

The transfer of the didactic portion of the training from the hospital laboratory to the technological institute was the outcome of several factors. Chief amongst them were the lack of space and a shortage of qualified teaching personnel in the hospital. In the Atlantic Provinces, Nova Scotia took a lead in establishing the program at the Nova Scotia Institute of Technology. Newfoundland followed by transferring its training program to the College of Applied Arts and Technology at St. John's. Prince Edward Island has yet to establish a provincial technical institute. In New Brunswick there are strong indications that in the near future the training program

will be shifted from the Provincial Laboratory to the New Brunswick Technical Institute at Saint John.[20]

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[20]Interview with Margaret Dunn, Acting Assistant Director, New Brunswick School of Medical Technology, Halifax, February 12, 1968.

CHAPTER II

CURRENT PROBLEMS: RECOGNITION AND SUGGESTIONS TOWARD THEIR SOLUTION

Chapter II deals with current problems associated with medical technology instruction in the province of Nova Scotia. The chapter is divided into two broad divisions. The first division provides a background for the discussion of the problems by describing the present program in medical laboratory technology offered at the Nova Scotia Institute of Technology, Halifax, Nova Scotia. The second division deals with the problem of student recruitment, problems related to curriculum, and problems related to the quality of teachers.

The factors contributing to the problem of student recruitment are social, psychological and financial. The psychological attitude of the recruits, comparatively inadequate salary scales, and lack of publicity keep the potential laboratory workers from entering the profession.

The second category of problems concerns the actual teaching-learning situation. The need for the inclusion of liberal arts courses in the present curriculum is analysed.

With regards to teachers, it is found that recruitment is as acute a problem here as it is in the student area.

To acquire highly qualified teachers with adequate training in pedagogy as well as in the technical subjects is a grave problem. The writer advances two ways of meeting this situation.

The Present Program

At the present time the instruction of medical laboratory technology in the province of Nova Scotia is centralized at the Nova Scotia Institute of Technology, Halifax. The School of Medical Laboratory Technology offers a 10-month didactic training course starting in the first week of September. The students arrive from more than 30 sponsoring hospitals of the province. Lectures and laboratory exercises are given in the faculties of Clinical Chemistry, Haematology, Blood Banking, Histology, Microbiology, and Physiology. Tests are given throughout the course with final examinations at the conclusion of training. Those who pass these examinations graduate from the School. After graduation they return to their sponsoring hospitals for practical experience. During their apprenticeship year, students are rotated through the various departments of the laboratory in order that experience may be gained in every branch of Clinical Pathology under actual working conditions. At the end of their internship year they become eligible to write the R.T. (General) examination of the Canadian Society of Laboratory Technologists.

In order to be eligible for admission to the course in medical technology, a student should possess Senior Matriculation (Nova Scotia Grade XII), including Mathematics and two sciences, one of which must be Chemistry. They must also be sponsored by any of the hospitals of the province. In this way they automatically become eligible for bursary support. This support amounts to $150.00 per month. In return for this financial support, they must work in the province of Nova Scotia for a period of two years. There is no tuition fee for the course.

The complete instructional program at the School of Medical Laboratory Technology is presented in three academic terms. The curricular subjects offered at the School and the class hours designated to each are listed in Table I.

TABLE 1

TIME ALLOTTED FOR THE SUBJECTS OFFERED AT THE SCHOOL OF MEDICAL TECHNOLOGY[1]

Subject	Lecture Hours	Laboratory Hours
Anatomy and Physiology	75	0
Clinical Chemistry	190	220
Haematology & Immunohaematology	100	220
Histology	60	90
Microbiology	120	160

[1]Nova Scotia Institute of Technology, Halifax, N. S., Information--Post High School Courses, 1967-68, pp. 41-42.

The instructors in each of these subject areas have developed a curriculum which is in accordance with the C.S.L.T. syllabus and meets the aims and objectives of vocational-technical education. The course contents are constantly being revised in view of new methods and techniques.

The instructional staff is employed under the regulations of the Civil Service Commission. The teaching staff consists of a Medical Director, a Chief Instructor, and a number of Instructors specifically responsible for student training in each discipline. In addition, qualified laboratory personnel are employed as Demonstrators to assist the Instructors in the laboratory. Recently a revision in the classification for medical technology staff was announced. The main objective of this revision was to provide, by classification, an opportunity for the instructors to improve their teaching efficiency and to receive financial recognition for this improvement.

Current Problems

Student Recruitment

The critical shortage of medical laboratory technology personnel is cause for concern both for the hospitals and the training institutes. That the shortage of technologists is becoming more acute cannot be denied. Well-documented studies on medical technology education and technologist

population in the past few years show that if present trends continue, neither the quality nor the quantity of technologists will be sufficient to meet future needs.[2]

An examination of the number of students taking the medical technology course at the Nova Scotia Institute of Technology, Halifax, for the last four academic years reveals a serious situation (see Figure 1, p. 34). The number of students enrolling in the course has steadily declined during these four years. The school started imparting education in this field in 1964. One would expect the enrolment to have increased as the program became more established and known.

The situation leads one to think that the program was perhaps inadequately publicised in the province. Publicity for recruiting candidates for the training is carried out in the province by the counsellors of the Nova Scotia Hospital Insurance Commission. They participate in career counselling by invitation from the provincial schools and by the presentation of career shows, where career pamphlets and films are used as the media for recruitment.

To test the assumption that this recruitment plan has been ineffective a survey was made. A questionnaire was

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[2]Henry Bauer, "The National Laboratory Crisis", Hospital Practice, II (February-March, 1967), p. 6; and

M. D. West, "Manpower for the Health Field", Hospitals, XXXVII (September 16, 1963), 83.

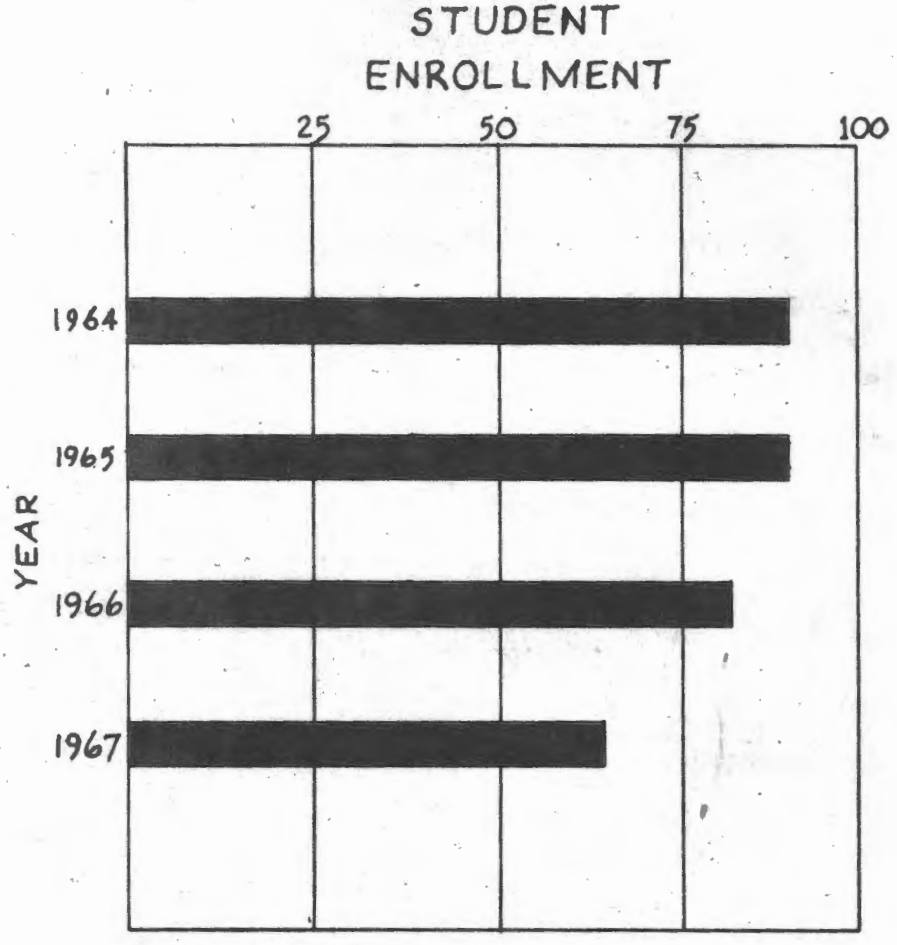

FIG. 1. STUDENT ENROLLMENT IN THE SCHOOL OF MEDICAL TECHNOLOGY OVER A FOUR YEAR PERIOD.

circulated to the students of this year's class, asking the following two questions:

1) Were you exposed to any recruitment activity provided by any agency depicting medical technology as a career in your junior or senior high school years?

2) How did you come to know that a course in medical technology was in existence in the province?

The response obtained for the first question is presented in Figure 2, page 36. Over 60% of this year's class population was never exposed to any recruitment methods. Of the remaining sample, only 14.3% were given a recruitment pamphlet for examination; 12.5% saw films; 3.9% slides; and 5.9% television programs on the subject.

In response to the second question, a majority of the students mentioned a close friend as the chief source of information regarding a career in medical technology. A little more than one-tenth were approached by their guidance counsellor. See Table 2.

TABLE 2

INFORMATION SOURCE IN THE STUDENT'S CHOICE OF MEDICAL TECHNOLOGY AS A CAREER

Information Source	Student Percentage
Guidance Counsellor	11.8
Immediate Relative	16.0
Career Conference	8.9
Minister	1.7
Laboratory Visitation	3.9
Teacher	3.2
Friend	42.9
Failed to Answer	11.6

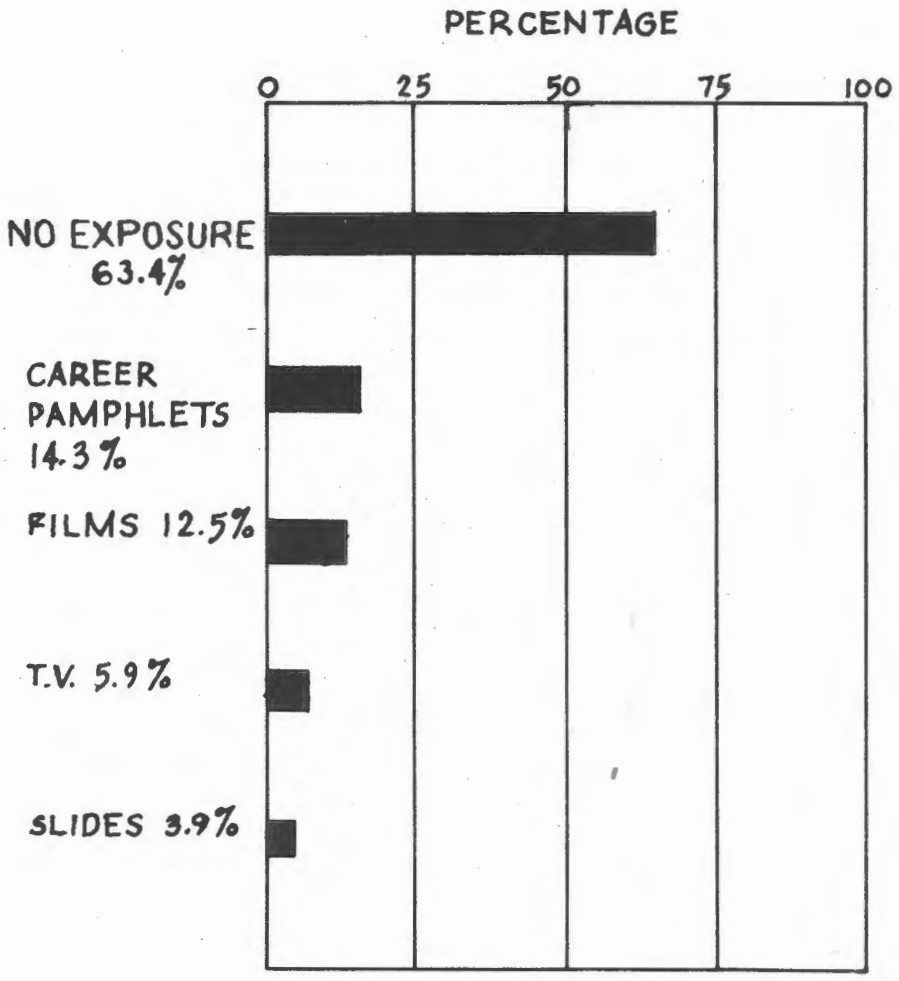

FIG. 2. EXPOSURE TO RECRUITMENT METHODS

It is obvious from the foregoing that much more can be done by way of improving the existing recruitment program, both qualitatively and quantitatively. A sound vocational guidance program is an important factor in a successful vocational training program. At present, as the study shows, this service is inadequate and will have to be improved.[3]

Besides ineffective recruitment policies, certain socio-economic factors also seem to contribute to the acute manpower shortage in the clinical laboratory. The two major ones are: low salary scales and a shortage of male technologists.

Low salary scales tend to discourage recruits from entering the medical technology course, which requires extensive education. Although the preparation is much more complex and the educational requirement is much higher than

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[3]During the last few months, however, there has been increased activity to introduce a plan to enhance the recruitment of laboratory technology students in the province. Amongst the suggestions put forth were the extending of an invitation to the public through the mass media (Letter to Dr. H. J. Brown, Medical Director of the School of Medical Technology, by A. Sobanski, Secretary, N. S. Branch of C.S.L.T., February 13, 1968, in the files of the School) and an invitation extended to "interested" candidates from hospitals within the immediate area (Memorandum to the Medical Technologists, School of Medical Technology, from the Chairman, Education Committee, N. S. Branch of C.S.L.T., February 27, 1968, in the files of the School). However, there seems to be a need to reach the students directly on a more practical level particularly during the various stages of their formative career decision years.

before, the notion still exists in the minds of the administrators that the laboratory technologist's work does not involve much skill, and that his salary scale is reasonable for his services.[4] In the province of Nova Scotia, the average monthly salary of a beginning medical laboratory technologist is $380.00. For an equivalent preparatory training general duty nurses get $400.00, and physiotherapists $455.00. The growth of the medical technology profession in the Atlantic Provinces has been plagued by a long history of substandard salaries. In an era of limited professional opportunities for women, this situation could be tolerated. That era is past. Most professions are now open to women, and to obtain an adequate number of qualified members, the medical laboratory technology profession must offer rewards comparable to other professions available to women.

The next problem is a more serious one. We still experience difficulty in attracting men to enter the laboratory field as a profession. As evidence, the relative percentages of males enrolled in the medical technology course at the Nova Scotia Institute of Technology during the last four years is presented in Figure 3, page 39.

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[4] J. A. Edwards, Laboratory Management and Techniques (London: Butterworths, 1960), p. 189.

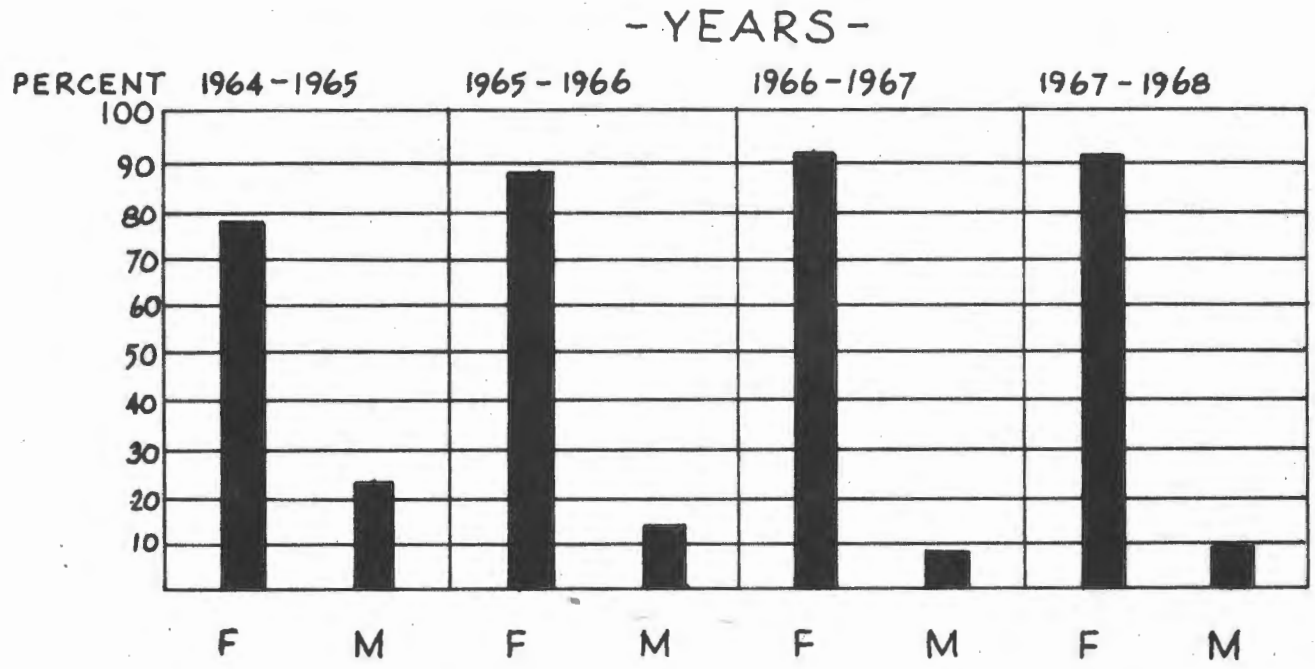

FIG. 3. COMPARISON BETWEEN MALE AND FEMALE ENROLLMENTS IN THE SCHOOL OF MEDICAL TECHNOLOGY.

The field clearly seems to be dominated by female workers. This poses certain problems. The high attrition rate of female personnel is a constant concern of everyone involved in laboratory services. The problem is well stated by Henry Bauer:

> Most certified medical technologists, . . . continue to be women. After three or four years of training in a medical technology school, they make fine workers, but they have a tendency to get married, have children and drop out of the laboratories. . . . The average female medical technologist has an active "half life" of two years. Few return to laboratory work after bearing their first child.[5]

Two factors seem to be responsible for the fact that men shy away from careers in hospital laboratories. The first and the most important one is that salaries paid to medical technologists do not begin to match those prevailing for technologists in other fields. With a Grade XI education and two years of training at a technical institute, an electrical technologist receives a starting salary of $460.00, a mechanical technologist $465.00, and a computer technologist $475.00 a month.[6] While there has been some improvement in the salary scales, they still remain far below the average salaries paid to male technologists in electrical, mechanical, computer, and civil technologies.

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[5]Bauer, op. cit., p. 7.

[6]Department of Manpower and Immigration, Career Outlook, Technological Institute Graduates, 1967-1968 (Ottawa: Queen's Printer, 1967), p. 51.

The second factor is purely psychological. For long, many paramedical professions like medical laboratory technology, medical record librarianship, medical social work, and nursing have been regarded as exclusively women's professions. There is a tendency among male high school graduates to equate the desire to enter these fields to an index of effeminacy. This is unfortunate, especially for the future, because with increasing automation the laboratories of tomorrow will employ more complex analytical machines, and men, because of their greater mechanical orientation, would likely prove to be in a better position to conduct the tests than women.

There is a necessity to obliterate the notion that medical laboratory technology is strictly a profession for females. Mass campaigning and subtle recruitment policies may have to be designed to attract, and appeal to, the male audience. The attitude of women technologists will also have to change if men are to be encouraged to undertake the career. The situation tends to be like that in law where one sex constitutes so predominant a majority that the other finds extreme difficulty in making more than a very modest place for itself. Because of the relative smallness of the male population, administrative and supervisory responsibility in most hospitals and leadership in the profession are vested in women, who often needlessly overlook the

justifiable desire of men for advancement within laboratory service and for a larger share in policy-making.[7]

Curricular Problems

This section deals with the problems of the actual teaching-learning situation. A major portion of the section is devoted to critical analysis of the medical technology curriculum being taught in Nova Scotia. It is noted that the program offered is strictly scientific-technical. The need for the inclusion of liberal arts courses is argued and recommendations for extending the duration of the course

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[7]Apart from new recruits, a source of trained laboratory personnel which lies beyond the scope of this study is the so-called "retired" group of medical technologists. There are many qualified medical technologists who renew their registration annually but are not active laboratory workers. A majority of these are women who have families but continue to renew their registration as an inexpensive form of insurance. If these former or retired women technologists could be persuaded to return to work, they might constitute a source of laboratory manpower. It might mean giving them a short-term refresher course, either at the School of Medical Technology or in the hospital laboratory, to provide practice in more modern procedures, but it would be eminently worthwhile in alleviating the great shortage of qualified medical technologists in the province. Many experiments of this nature have been carried out in the United States and the results obtained have proved to be highly encouraging. See A. D. Needs and D. Bromson, "Refresher Program for Medical Technologists", The American Journal of Medical Technology, XXXIII (September-October, 1967), 208-16; and

C. Martin, "A Program of Refresher Training of Medical Technologists in Georgia", The American Journal of Medical Technology, XXI (March-April, 1955), 75-78.

made. The desirability of integration and localization of the didactic and practical portion of the training is also discussed.

The present curriculum comprises courses in Anatomy and Physiology, Clinical Chemistry, Haematology and Immunohaematology, Histology, and Microbiology. Nowhere in the Atlantic Provinces, with the exception of Newfoundland, does the program include courses in the humanities or behavioral sciences. In Newfoundland, English, Mathematics, and Psychology are taught in the first year of the three year sequence. This situation necessitates a closer examination.

Some would argue that liberal education has no place in a vocational setting. In the opinion of H. R. Beatty, a leading educationist in the field of vocational-technical education:

> Most students now attending technical institutes have chosen the form of educational preparation rather than the liberal arts college program because they are more interested, at this particular time of their life, in the technical-vocational aspects of making a living than they are in the broader studies of man as a social, spiritual and intellectual animal striving to perfect himself. . . . Therefore it would appear to be better for technical institute educators to devote themselves to producing vocational competence in their students while this motivation is prevalent.[8]

The concept of a strictly job-oriented professional training, however, would seem to neglect important areas of the worker's development. McGrath lends support to this

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[8]H. R. Beatty, "The Place of General Studies in a Technical Institute Program", Technical Education News (May 1, 1954), p. 15.

point of view when he states:

> Every professional man should have a sufficiently comprehensive general education to strengthen his effectiveness as a worker, but more importantly to cultivate the qualities of mind and character essential to an informed and participating citizenship. . . . All professional programs should include a sufficiently broad component of general studies to prepare students for the responsibilities outside their profession.[9]

A combination of general and professional elements is especially desirable in education for the paramedical professions. Professionals in these fields interact with humans and human problems to a greater extent than in any other field. Stressing the need for a liberal education for nursing, Bridgman writes:

> Educators and leaders in many occupational areas are realizing that mere technicians, however, have serious limitations. Without the intellectual or moral vision gained from sharing in the cultural heritage of the liberal arts, and without the basis for interpreting their function in terms of ideal aims and of service to society, graduates are not prepared to meet the demands of professional and social life and intelligent citizenship.[10]

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[9]E. J. McGrath, "The Ideal Education for the Professional Man", Sixty-first Yearbook of the National Society for the Study of Education, Part II (Chicago: University of Chicago Press, 1962), p. 300. See also:

Paul L. Dressel, "Liberal and Vocational Education", College and University Bulletin (Association for Higher Education), XI (May, 1959), p. 4; and

C. H. Russell, Liberal Education and Nursing (New York: Bureau of Publications, Columbia University, 1960), p. 117.

[10]M. Bridgman, Collegiate Education for Nursing (New York: Russell Sage Foundation, 1953), p. 136.

Speaking with reference to the field of medicine, Griswold states:

> The apprenticeship of doctors is the longest and hardest of any profession. It has been said for these reasons that it would be impractical to burden this apprenticeship with the liberal arts. Yet as medicine has enlarged . . . to include behavioral with the natural sciences, and shifted its emphasis from the patient as a disease to the patient as a human being, it too has made articulate its demands for liberal education.[11]

A similar need is present in the case of medical laboratory technologists. The technologist performs his duties in a social setting. He is constantly involved in social and interpersonal relationships with his fellow workers, supervisor and patients. From these considerations the need for liberal arts courses, such as Psychology, Sociology and Philosophy, as part of his professional preparation becomes evident.

The key to the situation seems to be an enriched instructional program--a program which offers the student not only scientific-technical but also cultural training. It is especially important because courses such as Psychology, Philosophy, and Sociology are not offered to the student in the secondary school system. Merging such studies with the technical courses would achieve the end of educating the whole

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[11] A. W. Griswold, Liberal Education & the Democratic Ideal (New Haven: Yale University Press, 1959), p. 17.

individual, not merely "training" him.[12]

It is fitting to indicate here that a humanistic background acquired at this stage will be of advantage to the students in some other ways. A majority of students are unlikely to go beyond the level at which they graduate and are thus unlikely to be able to attain the intellectual virtues offered by humanistic education. To these students, a balanced professional training at the time when they are being educated at the School of Medical Technology will certainly be of life-long importance.

The subject of humanistic education leads naturally into the next step, viz., its implementation. Since the 10-month period at the Institute is the minimum required for the education in the professional subjects, it would very probably have to be extended for another 10-month term. The first year could include courses in English,[13] Psychology, and Anatomy and Physiology. In the second year instruction could be given in Clinical Chemistry, Histology, Microbiology,

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[12]Sister M. Alcuin Arens, "Medical Technology--Educational Problems", The American Journal of Medical Technology, XXI (March-April, 1955), 7.

[13]In discussing the importance of an effective course in English in the training for nurses, Bridgman writes: "English composition is universally recognized as a basic tool for all college courses, but has never been included in hospital school curricula. As a result many nurses have been badly handicapped. Unfortunately, the deficiencies of many high-school graduates are only too-well known, deficiencies to which various causes contribute." See Bridgman, op. cit., p. 158.

Haematology and Immunohaematology, Sociology and Philosophy. The third year, then, would become the internship year.

This brings into focus the concept of a three year program rather than a two-plus-one program. The time has come to seriously consider the advantages of this arrangement over the present. So far, the clinical or hospital year has been considered as a separate entity, as something completely unrelated to the first segment of the training. It would seem worthwhile to localize the didactic and the practical portion of the training at the same institution. The hospital does not seem to be the place for clinical education. In the history and development of paramedical education, the hospital, whose task is primarily to provide care for the sick, has been given a job for which it never was intended.[14] The education programs often are not systematic and the standard of apprentice training differs widely from hospital to hospital.[15] The localization of training in the Institute of Technology would help fulfill the need for a systematic well rounded, and fully academic approach in clinical teaching.

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[14]"Unloading the Second Function", editorial, Hospitals, XXXIX (November 16, 1965), 7.

[15]Ruth Hovde, "The Dynamics of Education in Medical Technology", Canadian Journal of Medical Technology, XXIV (December, 1962), 176.

Teacher Problems

The recruitment of the teaching staff in medical laboratory technology is another serious problem. The question here is of quality, not of quantity. The effectiveness of any department of organized education depends on the training, knowledge, and personality of the teachers. In a vocational setting the teacher is expected to have undertaken courses that deal with the art and science of teaching vocational subjects.[16] Unfortunately the teachers of medical technology have little or no such training. To illustrate the point, out of nine instructors and six demonstrators employed at the School of Medical Technology in the Nova Scotia Institute of Technology, only two members possess a teaching qualification. Four members are in the process of acquiring teacher's certificates and the remainder do not have any training whatsoever in the principles of teaching (see Figure 4, page 49).

There is a difference of opinion in the educational sphere regarding the merits of professional teacher training. The range of opinions varies from one extreme to another. Some maintain that all a teacher needs is a good general education without any professional training.

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[16]Nova Scotia, Commission on Teacher Education in Nova Scotia (Halifax: Department of Education, 1950), pp. 5-16, 121.

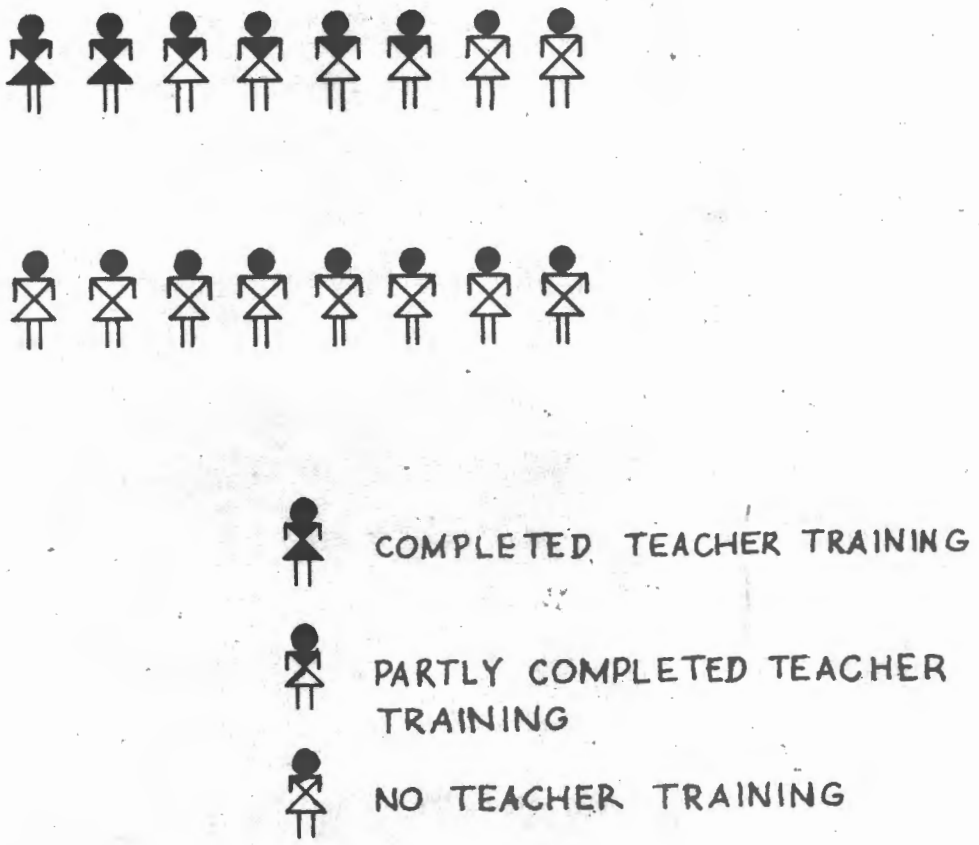

FIG. 4. TEACHING QUALIFICATIONS OF THE STAFF IN THE SCHOOL OF MEDICAL TECHNOLOGY.

> According to a former president of the University of Chicago, "all there is to teaching can be learned through a good education and being a teacher." In context, Hutchins clearly meant that all the education a person needs to be a teacher is the same general education that anyone ought to have, that no professional training of any kind is required for teaching.[17]

Others hold that in order to teach effectively a teacher must have, in addition to a sound general education, a good knowledge of teaching methods and techniques. According to the advocates of this position, "a teacher cannot know what to teach unless he has a mastery of his subject matter; he cannot know how to teach unless he has a mastery of the techniques."[18]

During recent years, however, there has been much criticism of the professional courses in teacher training programs. It is maintained that most education courses are vague, time-wasting and irrelevant to academic teaching. As one prominent educationist put it:

> Typical teacher-training programs are littered with time wasting, repetitions, and obvious courses in "know-how", many of which could be eliminated without loss except to entrenched instructors of these courses.[19]

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[17]Myron Lieberman, The Future of Public Education (Chicago: Phoenix Books, The University of Chicago Press, 1962), p. 148.

[18]G. K. Hodenfield and T. M. Stinnet, The Education of Teachers (New York: Prentice Hall Inc., 1961), p. 22.

[19]Theodore Brameld, Cultural Foundations of Education (New York: Harper & Bros., 1957), p. 256.

Koerner, in reporting the results of his carefully conducted study, states:

> It is assumed that the best pedagogical preparation for such people lies in a series of specialized courses in subjects that teachers are most in need of, such as educational psychology, the history and "philosophy" of education, and the methods of teaching various subjects. Finally it is assumed that people who have not had this orthodox training are incompetent to teach. The trouble is that so little evidence is available to support any of these assumptions. Considerable evidence exists to refute them.[20]

Although he attacks the "orthodox" nature of Education programs, Koerner does not discredit the study of Education as such:

> All this is not to say that Education as an academic enterprise is illegitimate, or any more out of place in universities than schools of business administration or social work. No standards exist that determine the degree of legitimacy of an academic discipline. But it is to say . . . that educationists ought to abandon the manifestly absurd claim that people can become competent teachers only when they have been through orthodox training programs, and its corollary that all teachers, before the advent of professional Education, must have been blithering idiots who knew nothing about their job.[21]

Other educators emphasize the necessity of a teacher's having had a minimum amount of supervised practice teaching before he steps into the classroom in his own right. Through practice teaching, writes Robert H. Beck, a teacher can:

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[20] J. D. Koerner, The Miseducation of American Teachers (Boston: Houghton Mifflin Co., 1963), p. 50.

[21] Ibid., p. 34.

> try out what she has learned on a sort of internship, under the direction of already qualified teachers. . . . The candidate thus not only adapts theory to practice but also learns whether she can teach or is suited to teaching. Without this trial period, a teacher would have to dive blindly into a profession for which she might have neither aptitude nor zeal.[22]

Arthur Mays, an eminent educationist in the field of vocational education, suggests that for effective teaching the teacher should be aware of the basic principles of learning. According to him the vocational teacher:

> should know how the mind learns and how skills are developed. Extended courses in psychology are not necessary to acquire this knowledge but the vocational teacher must possess a usable knowledge of the psychology of learning and be able to teach by means of scientifically tested procedures.[23]

Perhaps there is such a thing as a born teacher, but it would seem that, normally speaking, a candidate for teaching should be prepared for his work by certain studies and experiences of the type suggested in the two foregoing citations. This conclusion becomes more evident when one considers the work of a vocational teacher as analyzed by Thayer and Jones in their book, Vocational Teacher Education

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[22]Robert H. Beck, The Great Debate: Our Schools in Crisis, edited by C. W. Scott, et. al. (New Jersey: Prentice-Hall, Inc., 1959), p. 106. See also:

J. B. Conant, The Education of American Teachers (New York: McGraw-Hill Co., 1963), p. 113.

[23]Arthur B. Mays, Essentials of Industrial Education (New York: McGraw-Hill Co., 1952), p. 218.

and Certification.[24]

In their job analysis, Thayer and Jones divide the work of a vocational teacher into the following six activities: individual and group instruction, by means of lecture, demonstration, discussion, and conference; guidance, by appraisal, counselling, assistance, and follow up; administration, by keeping student reports and records; management, by supervising the laboratory and maintaining financial records; co-ordination, by maintaining cordial relations with industrial organizations and assisting in industrial training programs; professional responsibilities, of reading professional literature and attending professional conferences; and community activities by participating in social and civic organizations.

In view of these complex and varied tasks assigned to the teacher it would seem impractical for him to enter the profession without any prior professional training. At the very least, practice teaching and a grasp of basic teaching techniques would seem to be prerequisites for teaching subjects systematically and effectively. Courses in pedagogy, such as Educational Psychology, Philosophy and Sociology, if adequately conceived, would well be of

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[24]H. C. Thayer and W. B. Jones, Vocational Teacher Education and Certification (Organization for Economic Cooperation and Development, Paris: O.E.C.D. Publications, 1962).

added value to the teacher by helping him to perform his tasks with greater insight.

Turning back to medical laboratory technology instruction, the policy of the Institute of Technology in Halifax has been to employ instructors who are either university science graduates who have a teacher's diploma but no experience in medical laboratory technology, or experienced technologists with an interest in teaching but no training in pedagogy. Indeed, the possibility of finding qualified laboratory technologists with teacher training, or qualified teachers with a knowledge of laboratory technology, is rather limited. However, this situation is perhaps not as difficult as it seems.[25]

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[25]One way of solving this problem is to recruit and train individuals who are practicing laboratory technologists in the various laboratories of the province. They could be hired before the beginning of the summer vacations, preferably a month before the termination of the academic year. This would acquaint them with the teaching-learning situation. As soon as the summer vacations begin these candidates should be given an introductory course in educational Psychology, course construction and educational philosophy. This course could perhaps best be given at the Nova Scotia Institute of Technology itself by a staff selected by the Vocational Division of the provincial Department of Education. By the time the new academic year begins the candidates would have had the fundamentals of pedagogy and be in a position to take their place in the instructional program. Nevertheless, it is suggested that they attend two more summer sessions, taking advanced courses in pedagogy, leading to a certificate of teaching.

Another way of meeting the situation is to select a few bright and promising new graduates in medical laboratory technology with a desire and aptitude for teaching and to send them to a teacher training institute for a diploma in

Before this section on teacher training is concluded, it is pertinent to mention teacher updating. The concept of teacher training not only implies the initial training acquired before the teacher steps into the classroom but also includes continuing education. The vocational teacher has a tremendous obligation, not only to himself but to his profession, to keep himself up-to-date with advances in pedagogy and technology in his particular field. In medical technology, as in many other fields, it is entirely feasible for one to teach methods and tests only to find that these tests have been discarded in favor of newer, more accurate ones. Teaching techniques are also subject to changes. All this means is that the teacher must take measures to keep himself abreast of the latest innovations which occur in both fields.[26]

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teaching. The Department of Education could bear the cost of their training. After the conclusion of their training they could join the teaching staff in the capacity of laboratory demonstrators. Actual classroom teaching could be assigned to them after they had advanced their qualifications at least to the A.R.T. level.

[26]It is fortunate that the instructors have the opportunity to continue their education by attending the Vocational Teacher's Summer School held at the New Brunswick Technical Institute in Moncton, N. B., during the summer vacations. The Nova Scotia Institute of Technology in Halifax can also help in organising annual workshops and demonstration sessions. Workshops can provide opportunities to the instructors to try new methods and discuss the difficulties of these methods with colleagues who are using them. Demonstration sessions can provide exposure to new equipment, teaching aids and latest research tools employed in the field.

CHAPTER III

TRENDS FOR THE FUTURE

Having considered the past and the present of medical laboratory technology education in Nova Scotia, it is only appropriate to have a look into the future. The instruction of this particular paramedical group has come a long way since its beginning in Dr. D. J. Mackenzie's small laboratory in 1917. The methods, techniques, curricula, and settings all have changed remarkably over this period. The personalized education of the student which existed in the days of "see and do" apprenticeship training has changed to a much more formalized training. In earlier days the education for this group was regarded as a mechanical exercise not requiring much thinking. It took a long time before this concept was changed. Now, the education in medical laboratory technology in Nova Scotia is a well-established program which takes into consideration not only the practical but the theoretical aspects of the training. Is the progress made so far going to come to a standstill? Even with the improvement in curriculum and teacher qualification called for in Chapter II, will the ultimate have been reached? What does the future hold?

One major factor which is definitely bound to alter the existing educational pattern is automation. During recent years phenomenal developments have taken place in the automation of laboratory procedures. The use of prepared test tablets, chemically impregnated papers, and preformed testing tools has completely changed the patterns of the technologist's work. The application of automatic testing of blood samples has been found to be quite useful both in ambulatory populations[1] and in hospitals.[2] The introduction of automated equipment is welcomed by the technologist's world. The following body function tests can now be done automatically in the clinical laboratory: Heart, Liver, Pancreas (Glucose, Amylase, Bilirubin, Cephalin Flocculation, Thymol Turbidity, Alkaline Phosphatase, G.O.T., LAP,

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[1]M. F. Collen, Computers in Preventive Health Services Research, A Paper Presented at the seventh IBM Medical Symposium, Poughkeepsie, New York, October, 1965; and

G. Jungner and I. Jungner, A Pilot Study on Mass Screening Application of a Chemical Test Battery, A Report to the Regional Committee for Europe of the World Health Organization, 14th Sess., Prague, September, 1964.

[2]D. M. Young and N. Drake, "Unsolicited Laboratory Information: Preliminary Efforts to Study its Effects on Patients and on their Physicians", Automation in Analytical Chemistry, ed. L. T. Skeggs, Jr. (New York: Technicon Symposia, 1965), p. 47; and

D. B. Bryan et al., "Profile of Admission Chemical Data by Multichannel Automation: An Evaluative Experiment", Automation in Analytical Chemistry, ed. L. T. Skeggs, Jr. (New York: Technicon Symposia, 1965), pp. 423-426.

Creatine Phosphokinase); Kidneys (Creatinine inorganic phosphorus, BUN); Thyroid and Parathyroid glands (Calcium, Phosphorus, Alkaline Phosphatase, Cholesterol, PBI, T-3); Proteins (Albumin, Globulins, Gamma, Beta, Alpha 1, Alpha 2); Storage Diseases (Cholesterol and Uric Acid); and Electrolytes (Na, K, Cl, CO_2). These tests can all be done in 12 minutes after the specimen is received in the laboratory. To emphasize the economy of time, one liver function test, the Cephalin Flocculation Test, has been cut from 24 to 4 hours. In Notre Dame Hospital, Montreal, the largest automated computerized hospital laboratory in Canada, 384 biochemical tests are performed and recorded each hour, including regular quality control checks every 20 minutes.

This rapid analysis is proving a boon to the hospital laboratories, which have been increasingly overworked during the past few decades. Emson has described the growth of the laboratory of a Canadian hospital and noted that "the average volume of laboratory work per patient doubled between 1924 and 1944 but increased 10-fold between 1944 and 1964."[3] In 1956 112,000 tests were performed in the Halifax Infirmary laboratory; in 1966 the number rose to 643,000--a fantastic increase in only ten years' time. The situation is more serious in the United States. In 1966 more than 14,000 hospitals and commercial laboratories in the United States

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[3]H. E. Emson, "The Growth of a Laboratory", Canadian Medical Association Journal, XCIII (1965), 211.

performed at least half a billion clinical diagnostic tests. "According to one conservative estimate the number of analyses performed in clinical laboratories will grow to approximately 100 million per month by 1970."[4]

Because of this increased laboratory work over the past decades, more and more clinical laboratories are in the process of becoming completely automated. This total dependence on machines is due to a host of reasons. The clinical world is realizing the importance of laboratory tests in diagnosis and treatment of disease. Out of this realization has come an increased demand for more and more complex and difficult procedures. Unfortunately, there is an unavailability of qualified technologists to perform these procedures accurately and economically. Insufficient funds and poor remuneration are keeping away talented persons from entering this field. Also, there has been a considerable public and professional concern with laboratory accuracy over the past few years.

The growth of the computerized laboratory is the direct outcome of the above-mentioned problems. In recent years it has been shown that automatic and semi-automatic machines can perform repetitive tasks more accurately and economically, and that industrial techniques can easily be

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[4]Rex Sterling, "Instrumentation for Clinical Laboratories", Lab World (April, 1967), p. 384.

adapted to laboratory technology with substantial advantage. The computer in the laboratory now produces raw data faster than the technologist can record and interpret the results. It can receive testing instructions, start and stop instrumentation, analyze the data, correlate the data with other physiological information, send the correct information to a ward, coordinate with other departments, and keep accurate and complete records.

How is this automation going to affect the technologist of the future? Is it going to replace him in the laboratory? A pessimistic concern has been expressed by some. As Michael points out, "service activities will also tend to displace workers by becoming self-service, by becoming cybernated, and by being eliminated."[5] Others, however, are a bit optimistic about automation. According to Bolz, there are too many self-appointed prophets who create a false picture of automation as an uncontrolled giant. He states: "For our own good, we must remove automation technology from the realm of science fiction and reveal it for what it really is--nothing more than down-to-earth continuation of our basic manufacturing

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[5]D. N. Michael, Cybernation: The Silent Conquest (Santa Barbara, California: Center for the Study of Democratic Institutions, 1952), p. 15.

tools and methods."[6]

According to a recent report prepared by the U.S. Department of Labour, despite continued expansion of automation in the clinical laboratory, the demand for laboratory personnel is expected to increase rapidly during the next ten years.[7] To meet a rapidly expanding demand for laboratory tests, the report estimates the number of laboratory workers will probably need to be increased by 60 per cent over the figure of 100,000. Since the growth in demands for clinical laboratory tests will continue, the labor-saving effects of automated equipment have offset only partially the continuing shortage of medical technologists.

In brief, computers have taken over the routine work and have freed the technical staff for important new tests and more difficult patient problems. They hold tremendous promise for use in medical laboratory technology. But, in the writer's opinion, they cannot replace the human individual they serve; they can only increase his efficiency and output of valuable work.

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[6]Roger W. Bolz, Automation in the Sixties--A New Era in U. S. Economics, Testimony before the Sub-Committee on Automation and Energy Resources of the Joint Economic Committee of the U. S. Congress (July 1, 1960), p. 1.

[7]U. S. Department of Labour, Report Prepared by the Manpower Administration, March, 1966.

To meet the future challenges of automation we shall have to make some changes in our present educational program. A continuing education is indicated as the primary response to the challenges of automation and technological change. In the past, the assumption was made that it was possible to acquire basic laboratory techniques and practice them till death.

> This conviction stemmed from the fact . . . that methodology would not change appreciably during the working life of the person. . . . But almost overnight the overwhelming demands and developments in all aspects of technology and science have changed the roles and responsibilities and demands in medical technology. The diversity of needs is so great . . . that no single pattern of what medical technology education ought to be or will be is now sufficient.[8]

With very slight modifications it still continues to be the same. Today, education is regarded as both the root of technological change and the basis for successful adaptation. The technologist who has been educated in 1967 and has not gone on with his self-education beyond his immediate day-to-day activities will be uneducated in 1977. "In our dynamic society the acceleration and accumulation of knowledge is proceeding in geometrical progression."[9]

> Although the volume of work has vastly increased, the growth in complexity of the tests being performed is even more striking, as the research investigations of a few years ago have become routine tests. The demand

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[8]Hovde, Op. cit., p. 172.

[9]Ibid., p. 171.

> for "tests" seems almost insatiable, and it often seems to the director of laboratories that just as the laboratory appears to be catching up with current demands, the chief of medicine comes back from a convention in Atlantic City demanding half a dozen new and highly involved tests which he swears are being done routinely in Boston.[10]

While the machine can produce more test results, in less time, more cheaply, using less manpower of lesser technical training and operating in smaller spaces, it is only effective in a specific clinical situation. Each day a host of new tests are devised. The commercial firms keep pace by inventing new machines which are utilized to perform these tests.

To keep up with such developments in technical methods alone, the technologist would require refresher or extension courses at regular intervals. No matter how willing the technologist may be in trying to keep up with the changes in laboratory techniques, on a personal basis, he will have the need of systematic organized educational experience to assist him.[11] Educators of medical laboratory technology will have to think in terms of revising the curriculum, along with the whole scheme of work, to make possible a life-time education. To maintain a high level

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[10]"Medical Laboratory Technology as a Profession", (editorial) The Canadian Medical Association Journal, March 12, 1966, p. 553.

[11]Adam Smith, "The Education of the Worker", Of Men and Machines, ed. A. O. Lewis, Jr. (New York: Dutton Paperback Originals, E.P. Dutton, 1963), p. 19.

of technical efficiency, the profession may even have to organize sabbatical years for study after a laboratory service of five years or even less.

Another change in the existing educational program which is needed to cope with the challenge of automation in the future is a greater emphasis upon principles, rather than techniques. Greater stress should be put upon a deeper understanding of basic technical concepts rather than the methodology, for even an exhaustive training cannot cover all the known and needed techniques in detail.[12] In addition, mere procedures increasingly become obsolete before they can be taught, much less applied.

Parenthetically, it may be noted that the ability to comprehend the underlying principles can be used as criterion to distinguish a technologist from a technician. A technologist not only does things but also knows the reason for doing them. A technician does things but can expect to have the decisions ready-made by others.

Because of a greater emphasis on principles, the technologist of tomorrow will have to face increased prerequisite educational requirements. As in the past, the future of the medical laboratory technologists will remain

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[12] P. Hug, "Medical Technology and the Human Factor", The American Journal of Medical Technology, XXX (July-August, 1964), 279.

very closely associated with the changes in laboratory medicine. The technologist of the future will be working with more complex techniques, such as immunoelectrophoretic studies, autotransfusions via freezing techniques, comprehensive hormone analyses, etc. Mostly all the tests will be partially mechanized, and the automation will provide greater availability of the test, a more rapid processing of the tests, reduction in cost, and greater accuracy. Apart from changing in response to automation and scientific advances medical laboratory instruction is also likely to adopt new instructional aids and procedures.

As R.T.'s become obliged and able to undertake new, more sophisticated, complicated procedures, it is inefficient to have them do certain routine tests that cannot be, or at least have not been, automated but could be done by lower level personnel. In the near future there are possibilities of the establishment of a Laboratory Assistant program. The need for such a program has long been recognized. In a recent article Dr. Reginald Bromfield of the Royal Hampshire County Hospital, Winchester, England, has suggested the establishment of a Laboratory Assistant course in England to alleviate the shortage of qualified technologists. He writes:

> Is it really necessary for a qualified technologist to stain blood films, set up sedimentation rate tubes, perform hundreds of routine dilutions for the auto-analyser or test urines with clinisticks? My personal

> opinion is that we should support the policy of C.N.A.A. degree courses for the future medical laboratory technologists' qualifications, backed by a lower standard of more elementary science and technique for a new grade of laboratory assistant.[13]

In a recent letter to A. R. Shearer, Executive Secretary, C.S.L.T., by Dr. vanRooyen, Director, Division of Laboratories, Victoria General Hospital, the need has been clearly stated:

> Our second problem is a question of providing some form of official recognition in the form of Laboratory Assistant (L.A.). This group may have to be created in order to meet the needs of laboratory technical personnel employed in standard repetitive procedures, who will work under the supervision of an R.T.[14]

If established, this program will provide qualified assistants who will relieve the overworked technologist from many tedious routine jobs and will permit him to perform more complicated procedures in the laboratory.

Finally, in future, televised instruction will regularly be employed to teach the routine procedures. Already it has been used, on an experimental basis, in some institutes and the results have been found

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[13]Reginald Bromfield, "Trends in the Training of Medical Laboratory Technologists in Britain", Das Medizinische Laboratorium, XIX (1966), 227.

[14]Copy of the letter sent to Dr. H. J. Brown, Medical Director of the School of Medical Technology, by Dr. C. E. vanRooyen, January 3, 1968 (in the files of the School).

encouraging.[15] The advantages of teaching laboratory technique with closed circuit television will more than justify its installation costs. It would enable all students to see the demonstrations well, regardless of their position. In addition, it would greatly reduce the number of demonstrations and aid in teaching more students at one time.[16]

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[15]F. L. McGuire, et al., "The Efficiency of Television as Applied to Use of Laboratory Demonstration in Teaching", Journal of Medical Education, XXXVI (November, 1961), 715-716; and

D. S. Rube, Television in Medical and Professional Education, A Report to the International Committee on Instructional Television (Lafayette, Indiana: Purdue University, 1961), pp. 152-154.

[16]Mary Jean Long, "Teaching Laboratory Techniques with Closed Circuit Television", American Journal of Medical Technology, XXXIII (May-June, 1967), 253-257.

CHAPTER IV

SUMMARY AND CONCLUSIONS

A primary object of the thesis was to trace the origin and evolution of medical laboratory technology instruction in Nova Scotia. It was considered useful to sketch the development of the program against a background of the history of medical laboratory technology instruction in the other Atlantic Provinces.

In the early days, the hospital laboratory contained two kinds of practitioners: the pathologist himself, and the student, freshly graduated from the high school, whom he employed and taught to perform certain routine procedures in Clinical Chemistry, Haematology, and Histology. The training which the student obtained was purely of the on-the-job type. There was no registering body for the technologists and therefore the standards of laboratory performance varied from one hospital to another. As the need for accurate laboratory diagnosis in the treatment of the sick was recognized, more and more reliance came to be placed on the medical laboratory and the medical laboratory technologist. Soon it was realized that the technologist had to be educated thoroughly in the practice of his

profession. Out of this realization the Canadian Society of Laboratory Technologists was born.

Soon after its birth, the Society organized a syllabus of studies for the medical laboratory technology profession and conducted certification examinations. The training at this time was at the apprenticeship level without any provision for formal lectures in the various disciplines. Later the need for a systematic lecture program was realized and the hospitals began to impart lecture courses in medical laboratory technology. This was the beginning of the didactic training and the establishment of medical technology instruction as an organized program.

The didactic phase of the training program was soon shifted from the hospitals to the provincial technical institutes in many cases; this was necessitated by the fact that the hospitals were overcrowded and had little staff who could afford the time to give lectures. In Nova Scotia, the didactic phase is completed at the Nova Scotia Institute of Technology in Halifax under the Division of Vocational Education of the Nova Scotia Department of Education. The course is of 10 months' duration and comprises training in Anatomy and Physiology, Clinical Chemistry, Haematology, Histology, and Microbiology.

This study has noted that the program lacks any liberal arts courses. The medical technologist works in a

social setting and constitutes an important member of the clinical team designed for the care of the sick. His duties call him to deal with humans and human problems. The need for behavioral science courses in the curriculum of medical laboratory technology becomes obvious. Courses in fields such as Psychology, Sociology and Philosophy would be especially beneficial.

This study has further disclosed that amongst the instructors of medical laboratory technology at the Nova Scotia Institute of Technology a majority lack any kind of formal teacher training. Most instructors do have ample experience in the medical laboratory but to be really effective in classroom instruction they should also have a background of basic principles and techniques of teaching. As the possibility of finding qualified medical technologists with a training in pedagogy is rather limited, suggestions have been advanced for meeting the need in other ways.

It has also been seen that the student enrollment at the Institute has been steadily declining over the past four years. Many factors, psychological, social, and financial, seem responsible for this decrease. The conclusion was reached that the current recruitment program is ineffective and has to be improved to alleviate the shortage of laboratory manpower in the province.

The study ends with a look into the future. During the past few years tremendous developments have taken place in the automation of laboratory procedures. These developments will very probably continue and the role of the technologist within the laboratory will be challenged. His education as a technologist will have to be modified to meet this challenge. Greater emphasis has to be placed on principles and basic technical concepts, rather than on methods and techniques. Continuous education would be essential to keep up with the latest advancements in the field.

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