



**Committee for the Evaluation of Medical Laboratory Sciences  
Study Programs**

**Technion - Israel Institute of Technology  
Program in Medical Laboratory Sciences  
Evaluation Report**

**November 2016**

**Contents**

**Chapter 1:** Background.....3

**Chapter 2:** Committee Procedures.....5

**Chapter 3:** Evaluation of Medical Laboratory Sciences Study Programs at the Technion - Israel Institute of Technology .....6

**Chapter 4:** Summary of Recommendations.....22

**Appendices:** Appendix 1 – Letter of Appointment  
Appendix 2 - Schedule of the visit

## **Chapter 1: Background**

The Council for Higher Education (CHE) decided to evaluate study programs in the field of Medical Laboratory Sciences during the academic year of 2016.

Following the decision of the CHE, the Minister of Education, who serves ex officio as Chairperson of the CHE, appointed a Committee consisting of:

- **Prof. Anat Roitberg-Tambur**- Feinberg School of Medicine, Director, Transplant Immunology Laboratory Northwestern University, committee Chair.
- **Prof. (Emeritus) Michael Mayer**- Clinical Biochemistry, Faculty of Medicine, Hebrew University.
- **Prof. (Emeritus) Ben-Ami Sela**- Director of the Institute of Chemical Pathology, Sheba Academic Medical Hospital.
- **Prof. Maja Nowakowski**- Pathology and Medicine, SUNY Downstate Medical Center.

Ms. Inbal Haskell-Gordon served as the Coordinator of the Committee on behalf of the CHE.

Within the framework of its activity, the Committee was requested to:<sup>1</sup>

1. Examine the self-evaluation reports, submitted by the institutions that provide study programs in Medical Laboratory Science, and to conduct on-site visits at those institutions.
2. Submit to the CHE an individual report on each of the evaluated academic units and study programs, including the Committee's findings and recommendations.
3. Submit to the CHE a general report regarding the examined field of study within the Israeli system of higher education including recommendations for standards in the evaluated field of study.

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<sup>1</sup> The Committee's letter of appointment is attached as **Appendix 1**.

The entire process was conducted in accordance with the CHE's Guidelines for Self-Evaluation (of July 2012).

## **Chapter 2: Committee Procedures**

The Committee held its first meetings on May 29, 2016, during which it discussed fundamental issues concerning higher education in Israel, the quality assessment activity, as well as Medical Laboratory Science Study programs in Israel.

In May-June 2016, the Committee held its visits of evaluation, and visited Ben-Gurion University of the Negev, The Technion – Israel Institute of Technology, and Hadassah Academic College. During the visits, the Committee met with various stakeholders at the institutions, including management, faculty, staff, and students.

This report deals with the programs of Medical Laboratory Sciences Administration at the Technion - Israel Institute of Technology. The Committee's visit to the Technion took place on June 1, 2016.

The schedule of the visit is attached as **Appendix 2**.

The Committee thanks the management of the Technion - Israel Institute of Technology and the Technion's Department of Medical Laboratory Sciences for their self-evaluation report and for their hospitality towards the committee during its visit at the institution.

## **Chapter 3: Evaluation of Medical Laboratory Sciences**

### **Study Programs at the Technion - Israel Institute of**

### **Technology**

*This Report relates to the situation current at the time of the visit to the institution, and does not take account of any subsequent changes. The Report records the conclusions reached by the Evaluation Committee based on the documentation provided by the institution, information gained through interviews, discussion and observation as well as other information available to the Committee.*

It is important to mention that our report is based on a self-evaluation report that was prepared in 2013. Additional material was provided for some topics. In addition, the committee members had the opportunity to meet with the school leadership, faculty, students and alumni and formulate their opinion based on this on-site visit and responses to questions discussed during the one-day interviews.

The school should be complimented for presenting the committee with an excellent, thoughtful, clear and effective self-evaluation report. We would also like to acknowledge the warm hospitality and open environment that made our visit very pleasant and collegial.

#### **1. Executive Summary**

The committee met with the Technion President (Prof. Peretz Lavie), Senior Executive Vice President (Prof. Moshe Sidi), Deputy Senior Vice President (Prof. Daniel Rittel), and Dean of Undergraduate Studies (Prof. Yachin Cohen). Since the Program for Medical Laboratory Sciences falls under the jurisdiction of two faculties, we also met with the Deans of the Faculty of Medicine (Prof. Zaher Azzam) and Faculty of Biology (Prof. Yehuda Assaraf).

The leadership representing the Laboratory Medical Sciences Program included the academic and administrative heads – Associate Prof. Debbie Lindell, Assistant Prof. Marielle Kaplan, and Prof. Benjamin Horwitz.

It is the committee's impression that the Technion leadership is not certain whether there is a need and justification for the medical laboratory sciences program in their institution. Indeed, in its current format, we have asked ourselves the same question (*vide infra*). It is very clear that a profound dedication of the

program leaders and faculty, as well as many resources are incorporated into this program. However, the very high dropout rate, the very high level of demands and requirements imposed on students with intended professional future as medical laboratory technologists, and the apparent lack of interest and support from the Medical School, are all impeding the success of the program. It seems that a lot of energy, funds and other resources are invested in a cause about which the Technion at large is quite ambivalent.

## **2. Mission and Goals**

### Observations and findings

As stated in the self-evaluation report – “The basic mission of the program is to produce B.Sc.-level medical laboratory workers with a strong background in exact and biological sciences. Furthermore, as this background is optimal for pursuing a Ph.D., these graduates will have a great advantage in becoming laboratory managers. Thus, we see this program as the source for future laboratory managers”.

“The goal of this program is to educate graduates who have:

- 1) Excellent scientific background in biology and in exact sciences;
- 2) Advanced knowledge in human health and diseases;
- 3) Significant experience in medical laboratories which will qualify them as medical laboratory workers”.

The impetus for setting up this program was to create a program that would combine the increasing technological advancement in this field together with the clinical background needed by clinical laboratory sciences/scientists. The first initiative came from Prof. Oren Zinder, then head of the Clinical Biochemistry Department in the Rambam Medical Center and faculty member of the Technion School of Medicine. While a noble goal, it seems that there is a gap between the program’s aspiration to generate leaders in the field of Laboratory Medical Sciences and the need for day-to-day technologists who perform much of the bench-work. Since the Technion strives for excellence, it seems that the program’s students do not only receive an excellent exposure to clinical laboratory medicine

but are also required to uphold the very high standards of the Technion for excellence in basic (and exact) science. This is apparent mostly in the demanding admission criteria and the very rigorous curriculum that is geared to fulfill the above-mentioned mission.

In discussions with the Technion leadership, it was quite clear that they struggle with “branding” of the program and the profession. It appears that there is some hesitation concerning the objectives, goals and focus of the program. The program in its present structure and content appears to lack an unambiguous and clear focus: It seems that the curriculum attempts to combine two approaches that cannot be easily combined, namely to provide professional training of laboratory technologists, as well as to provide a comprehensive academic education that is required for future studies and research related to human bio-medical sciences.

The committee is particularly concerned with the very high dropout rate. The leadership disclosed a struggle in identifying appropriate admission criteria to help minimize this dropout rate. In its current format, the program seems to attract mainly students from minority sectors and it is not clear whether the high dropout rate is due to cultural barriers, language barriers, or selecting students who are not truly prepared for the rigor of studying in the Technion (potentially having Sechem scores that are not good representations of their academic knowledge).

### Recommendations

#### **Advisable:**

- The Technion is encouraged to re-evaluate the program and clearly define whether it should be geared towards professional training of laboratory technologists – or towards provision of a strong academic basis for succeeding studies towards higher education and a projected future academic career in science and research. Since the Technion is a world-renowned leader in its teaching of engineering, innovative technologies and ingenuity, an interesting possibility to consider may be to change the concept of the program towards a new direction that will better suit the

general philosophy and exceptional strengths of the Technion. Such a potential direction could be aiming to train high-level engineers in the arena of advanced medical and bio-medical laboratory technologies, including the domains of laboratory automation, genetic engineering machine technologies, etc.

### **3. Organizational Structure**

#### Observations and findings

The Medical Laboratory Sciences program is an integral part of the Faculty of Biology, with student curriculum nearly identical to that of the parental unit, providing the strong basic research/science knowledge. The Faculty of Medicine is a second parental unit and the students of the Medical Laboratory Sciences program participate in some classes with medical students. The program does not have a separate representation in either parent unit's decision-making; it is represented together with all other study tracks. The only part that is dedicated to students of the Medical Laboratory Sciences program is the very well designed internship.

The fact that the students are taught by professors from two different faculties, residing in two physically separated campuses, dictates very careful design of the study program. While currently most classes during the first and second years are provided in the Neve Shaanan campus and the third year classes are provided mostly in the Bat Galim campus, our impression is that significant compromises had to be made to accommodate the physical distance.

Most classes and laboratories are taken together with biology students. Given the socio-economic background of the vast majority of students in the Medical Laboratory Sciences program, there is a significant concern that the students of the program are significantly less prepared to the rigor of classes in the Technion. Another concern stemming from this scenario is the fact that the students are not likely to have a clear vision of the uniqueness of the program until they reach their third year of studies in the program.

## Recommendations

### **Essential:**

- Currently there is very little interaction between faculty members of the program. This is likely due in part to the fact that these faculty members belong to different parental units. It is very important that faculty members will have a good appreciation of the work-place requirement expected from graduates of this program to help align it with their course curriculum. At this point, each faculty member observes students of the program in different settings. Discussing these issues through a retreat process may help specifically address issues associated with admission criteria relevant for these students, academic expectations, and potentially designing a more program-specific curriculum.

### **Advisable:**

- It may be worthwhile considering having the faculty travel for some of the frontal classes from the Bat Galim campus to the Neve Shaanan campus. This will obviously necessitate providing the Medical Laboratory Sciences students classes dedicated to them rather than sharing the teaching resources with the Medical School students. However, it may help design a curriculum that is more specific to laboratory workers. It might be informative for the faculty and students to visit currently active hospital or community and private health organization medical laboratories to gain a better understanding of the profession.

## **4. Study Programs**

### Observations and findings of the study program

The curriculum is in line with the Technion tradition and philosophy, but probably not best suited to this particular study program. The curriculum contains very demanding basic courses in mathematics and physics, equal in complexity and level of demand to the same courses given to students of engineering at the Technion. For example: 5.0 points of differential and integral calculus I, 4.0 points of linear algebra, 5.0 points of differential and integral calculus II, and 4.0 points of introduction to computing with MATLAB. While this strong mathematical basis is a treasured cornerstone of the Technion training programs for engineers and

scientists, it may be beyond the necessary provisions of the program of laboratory medicine, and may impose exaggerated loads on the students. These courses may be a contributing factor to the extremely high rate of academic failure and students' dropout rates.

In its present arrangement the program clearly sustains difficulties as a result of the divergent stance of the two faculties that jointly provide the curriculum. It seems that there is a significant difference in involvement, participation, and commitment of the two faculties that are involved in the program, and a resulting academic, administrative, and geographical dichotomy is evident. It appears that the faculty of biology presently takes the leading interest in this program. Clearly, a stronger involvement of the other faculties, and chiefly the faculty of medicine, is critical for designing an enriched program and curriculum as well as its successful implementation.

### Recommendations

#### **Advisable:**

- As indicated in the general comments, this program in its present structure deviates from the traditional mission of the Technion, namely education of the future leading generation of innovative excellence in the domains and frontiers of technology, engineering, and science. Possibly, defining a new goal and mission for the present program, and a revision of its teaching objectives, and as a result also a new branding is warranted.
- It is important to evaluate and study the nature and characteristics and reasons for the extremely high dropout rate, possibly reflecting academic failures and move of students to other study tracks, preferably biology and medicine. On the basis of this evaluation, necessary measures can be taken to tackle this problem, such as improved student selection for the program, improved tutoring support for students, inspection, interviewing and scrutinized admission system to assess suitability of the applicants for the program. Introduction of a preparatory course for applicants that will include a tangible exposure to professional work in a clinical laboratory would be helpful. In consideration of the high dropout rates, it may also be

helpful to include a personal interview to the student selection process. The interview may assist in recruiting only those students that see laboratory medicine as their primary career preference. Also, enabling and arranging meetings of potential applicants with students in the advanced stages of their study in the program, and/or graduates of the program, may give the potential applicants a realistic and useful understanding of the profession, the demands and constraints of the program, and its expected requirements. Hopefully, such an introductory acquaintance will empower the student and ascertain that this is indeed the subject that they would like to pursue and realize as their professional future.

**Desirable:**

- It appears that the program needs a strong and assertive academic and administrative leadership. Towards this objective, it is suggested to appoint an active, leading faculty committee with senior members from the medical school and the faculties of biology and basic studies (mathematics, physics, etc.) to critically review the curriculum and improve the syllabi and to coordinate all teaching activities in the two campuses to prevent overlaps and eliminate duplications. Indeed, the self-evaluation report presented by the Technion rightfully specifies this necessity (pp. 24, 55, 70, 71). Examples that may be considered are to carefully coordinate/merge the courses of histology and general pathology laboratory, and the immunology laboratory with the course on basic immunology. Incidentally, a logical merger of the courses of parasitology and mycology that is also recommended was already implemented as stated in the update report of the school, April 20, 2016. Several courses offered by the medical school are out of scope and clearly irrelevant for the school of laboratory medicine, and seem to be offered simply because they are available for medical students.
- A reduction in the amount and depth of the mathematic studies or an adjustment of the content of the mathematic courses to laboratory-relevant elements needs to be considered. This should include consideration of statistics within the program. It is regretted that the course on research methodologies and data analysis was recently

withdrawn from the program. This course undoubtedly provided important elements towards research and science endeavors. It is recommended to (re)-introduce courses on research methodologies and data analysis, guided critical reading of scientific and clinical research results, as well as courses on laboratory quality control, laboratory safety and security, and standards of work, and a course of pharmacology. To strengthen the clinical orientation of the students it is also suggested that courses that teach biological subjects such as physiology and pharmacology would be taught in and by the faculty of the medical school instead of the faculty of biology – to underscore and emphasize the medical/clinical laboratory aspects of these subjects.

#### Observations and findings of the internship

##### *Strengths:*

The committee was impressed with the thoughtfulness of the leadership overseeing the Internship program. The design and the content of the internship program, as well as the active participation of the students in the practical training, are adequately governed, controlled and monitored by a senior faculty member (Prof. Mariel Kaplan). The internship is well structured, involves three rotations of 4-weeks each in a principal laboratory discipline (biochemistry, hematology and microbiology), followed by a 2-week internship in a clinical specialty laboratory (immunology, blood bank, genetics). In each of the three main rotations the students present a seminar on a professional subject related to what they experienced in the laboratory. Assignment of the rotations is performed by the school coordinator, which facilitates and simplifies this process for the students.

##### *Weaknesses:*

The internship as presently carried out does not match the requirements of the licensing regulations. According to the regulation, the internship requires full time training of 6 months. The Technion internship period is significantly shorter than required, namely 14 weeks of training in a clinical laboratory - instead of 24 weeks as specified (6 months) of full time training in a clinical laboratory. (See our general comment for all programs).

## Recommendations

### **Advisable:**

- Revise the length of internship to fit the requirement of the regulation of the Ministry of Health.

### **Desirable:**

- Establish a reporting system by which the students summarize the value and assess the quality of the internship, and take the required measures to correct any faults and prevent flaws that are discerned.
- The Technion is encouraged to take all appropriate measures to obtain proper and suitable insurance liability coverage for any adversity or accident that may happen during internship in a clinical laboratory.

## **5. Human Resources / Faculty**

### Observations and findings

Currently, the body of educators contributing to the study program is composed of a mix between members of the Faculty of Medicine and the Faculty of Biological Sciences. None of these individual is specifically dedicated to teach the Medical Laboratory Sciences programs. In fact, for most of them, interacting with Medical Laboratory Sciences students is solely in the context of teaching a class to a much larger and diverse student-body. Consequences of this arrangement have been detailed in the section on the Study Program

The need for students of the Medical Laboratory Sciences to travel for their clinical courses brings about an additional issue of the secretarial/administrative support available for them at the Bat Galim campus. This appears to be a critical issue that significantly impacts the smooth operation of the study program. There seems to be a significant lack of administrative support dedicated to this program in the Bat Galim campus, leading to situations in which students cannot find the relevant classrooms, are not informed on changes in the program, etc.

Administrative support is lacking also in providing follow-up and support to students with educational or personal difficulties. Indeed, there is a mechanism in place for some academic mentorship but this is very minimal and does not pertain to any other issues (e.g. financial, social, personal, etc.)

### Recommendations

#### **Advisable:**

- It was stated that only two academic positions are presently allocated for faculty of the program at the medical school. It is advisable to provide more academic position for the team of teachers involved in the teaching at the medical school, thereby increasing their motivation, involvement and devotion to the program. This will also enable the relevant faculty members to guide students undertaking research projects, apply for research funds, and encourage their involvement in teaching and in research.
- Dedicated administrative assistance is required at the Bat Galim campus. Establish a branch office and engage administrative/secretarial support to provide students that attend courses at the Rambam campus with all the organizational support and assistance that is required to facilitate effective teaching and to assist the students in solving organizational as well as personal difficulties.
- It is recommended to strengthen the support offered to graduates towards finding appropriate jobs, possibly by providing this important service through the placement center of the Technion (p.54).

## **6. Students**

### Observations and findings

The student applicant pool and resulting student population at Technion –MLS program are fairly homogenous geographically and with respect to background. Current students and alumni praised the program for high academic quality. The

students gave an example of course excellence –Metabolic Pathways, which included exams using clinical cases and laboratory test results.

Admission requirements are high, and so are drop-out rates (reaching 50%). Table 3.3.3 (page 51 of the report) indicates that on average, 32 students per year started studying and on average 16 students per year graduated between 2008/9 and 2012/13. It appears that the leadership at Technion struggles to find good predictors of student retention and success within the MLS program. The total number of students admitted per year (about 32) apparently is limited by the capacity of teaching laboratory facilities and the number of internship slots available.

### Recommendations

#### **Advisable:**

- To increase the number of applicants, promote enrollment and thereby facilitate improved selection of appropriate candidates that will be able to complete their studies, it is recommended to publicize and promote public knowledge of the profession and activities of laboratory medicine and of this particular study program. Increased awareness of potential students through improved public relations, effective publicity and proactive marketing of the profession in general and the specific program, will inevitably upgrade the pool of applicants. Among the possible activities aimed to increase awareness of potential candidates to the program, it is suggested to reach out to high schools and to expose high school students to the profession and the study program. The committee was informed that this outreach exists informally.

## **7. Teaching and Learning Outcomes**

### Observations and findings

The program continues to have a strong emphasis on mathematics and physics – reportedly, this is a result of a government agency recommendation. As stated on p.18 of the report, “the mathematics and physics level ...was upgraded... to the all-

Technion level (taken by several engineering study programs as well as the faculty of Chemistry.” This very ambitious approach may not be suitable for the MLS program, given its short duration (3.5 years total) and important time and effort commitment to the internship component. The high requirements and expectations lead to academic failure among MLS students; surprisingly, the committee was told that genetics and biochemistry are problem areas in this respect, rather than the intense mathematics.

A summary of program changes introduced between 2013 and 2016 showed a concerted effort to shift the emphasis from general biology to medical laboratory (for example, a Bacteriology course worth 5 credits was replaced with General Bacteriology (2 credits)+ Medical Bacteriology and lab (2.5 credits). New, relevant electives (total of four) replaced a number of cancelled electives (four in Biology and four in Medicine). The Committee supports these thoughtful changes.

Most courses and laboratories are taught with Biology or Medicine, and there are very few MLS-specific courses (Pathology, part of Hematology). The committee had the impression that MLS students often feel they are a small “outsider” group within large medical student classes. There are two courses dedicated to MLS in the 3<sup>rd</sup> year: Introduction to Laboratory Medicine, which includes methods and instrumentation, and a course covering disease correlations, sample quality requirements and other aspects of medical laboratory practice.

The course syllabi provided to the committee were of uneven quality and perhaps did not reflect the full content of the courses. Little information was provided about exam preparation and assessment.

Laboratory instruction represents challenges because of limited time, space, and equipment. Laboratory sessions are split in two because the space available cannot accommodate all students at once. Instructors do not get credit for laboratory teaching, and TA/student ratios are variable.

The teaching faculty is not a well-integrated group and lacks unified leadership. Most teachers from Medicine have Adjunct status, and so do heads of laboratories participating in MLS.

In contrast, the leadership and organization of the Internship component is impressive. The structured rotation system provides the students with a broad and comprehensive exposure to major areas of medical laboratory practice. The heads of the five laboratories currently offering internships coordinate their syllabi with the Director of internship program, and internship evaluation includes a meeting with each student. The only limitation is the total number of participating laboratories and slots for internship students.

### Recommendations

#### **Essential:**

- To strengthen the MLS program at the Technion, it is recommended that a leadership position be established dedicated to the integration and alignment of the MLS curriculum in the first two years with the overall program mission and goals.
- It is recommended that the MLS program of instruction undergo a review to assess the quality and alignment of courses taught with the needs of professional Medical Laboratory Technologists and Laboratory Directors.  
Timeline: one academic year.

#### **Advisable**

- It is suggested that the examinations written by the faculty members be submitted to professional examination evaluation by the Technion center for promotion of teaching. This should reduce complaints concerning quality, fairness, clarity and structure of the examinations (p.54).
- Several courses offered by the medical school are out of scope and clearly irrelevant for the school of laboratory medicine, and seem to be offered simply because they are available for medical students. It is suggested to consider cancelation of the elective courses of physical chemistry, Ubiquitin and protein turnover, sleep medicine, high pressure and diving physiology, hormones and animal behavior. Even though these are

undoubtedly important subjects, they do not seem to be justified components of the curriculum of this program. On the other hand, it is regretted that the course on research methodologies and data analysis was recently withdrawn from the program. This course surely provided important elements towards research and science endeavors. It is recommended to (re)-introduce courses on research methodologies and data analysis, guided critical reading of scientific and clinical research results, as well as courses on laboratory quality control, laboratory safety and standards of work, and a course of pharmacology. To strengthen the clinical orientation of the students it also suggested that courses that teach biological subject such as physiology and pharmacology be taught in and by the faculty of the medical school instead of the faculty of biology – to underscore and emphasize the medical/clinical laboratory aspects of these subjects.

- The teaching laboratory facility is outdated, with an obsolete setup in terms of design and construction. It lacks modern equipment, and is located in a remote building, away from the main site of teaching. Provision of a new and updated laboratory facility is highly recommended. Also, the number of assigned teaching assistants (TAs) has declined and requires correction toward the desired ratio of 1 TA per 8 students in the laboratory. A need was also expressed to appoint a capable laboratory technologist person to administer and supervise all teaching activities and functions of the laboratories.
- Early exposure to medical laboratory practice (perhaps with visits to active hospital, HMO's or private clinical laboratories) would help students identify with the goals of the program.
- Introduction of laboratory safety and security as topics of instruction (possibly as a seminar or mini-course) would be helpful.

## **8. Research**

### Observations and findings

For all graduates of the Medical Laboratory Sciences Program who choose to pursue a research career rather than a professional work in a clinical lab, graduate studies at the Technion Faculties of Biology and Medicine provide a natural sequel to the program. The faculty of Biology at the Technion, with its Nobel Prize laureates, is a leading body in the biological and biomedical sciences. Several members of the Medical Laboratories Program are outstanding researchers and renowned for their achievements in a variety of bio-medical areas.

The committee learned that a rather high percentage of graduates prefer to pursue research avenues toward higher degrees, and that some of those who acquired MSc & PhD degrees have eventually returned to the clinical labs in various hospitals as lab directors, or holding higher-ranked positions in the clinical labs.

The self-evaluation report on the subject of Research in the "Medical Laboratory Sciences" program by the Technion is rather concise. The Technion's statement is the following: The Research chapter is not relevant here, because this is an undergraduate track, not a department or other academic unit. It is noteworthy, though, that for graduates who choose to pursue a research career rather than professional work in a clinical lab, graduate studies at the Technion Faculties of Biology and Medicine provide a natural sequel to the program.

### Recommendations

#### **Advisable:**

- The Technion's report lists over 40 members of the Faculty of Biology and Medicine who are affiliated to the "Medical Laboratory Sciences" program, whose research interests cover a wide array of biological and medical topics without describing them specifically. Not having a real glimpse at the specific research projects that students of this program participate in, the committee expresses its desire to see more research subjects that are related to the "clinical laboratory" per se incorporated into the list of these research subjects.
- The clinical literature is loaded nowadays with research on numerous diagnostic aspects in many avenues of Medicine. Research on tumor

markers, markers for accurate and fast diagnosis of cardiac infarction, hormonal changes in ample pathologic events, lipids related to cardiovascular diseases etc., and it would fit both the "practical" spirit of the "Medical Laboratory Sciences" school and that of the "research aspirations" of some of the students, if a greater emphasis would be given to research topics related to the "clinical laboratory" core of the program.

## **9. Infrastructure**

### Observations and findings

The infrastructure of classrooms, auditoria and instruction halls is adequate and all of these facilities are well maintained. However, the teaching laboratories are outdated and provide insufficient space, thereby causing inconvenience and creating greater work burden on the teaching assistants and laboratory personnel. Shortage of laboratory space requires more shifts of students that attain laboratory exercises (and thereby requires more TA's and technologists), and impairs the effectiveness of the teaching activities. Furthermore, the equipment of the laboratories is imperfect and often outdated. It appears necessary to upgrade the physical infrastructure, including laboratory room spaces, teaching tools, and laboratory equipment. Due to present unfavorable condition the teaching and the practical laboratory work in the laboratory segments of the study program is hindered and impaired.

The academic level of technical staffing for the laboratories is suitable, but the number of TA's is not always adequate to meet the desired TA/student ratio of 1/8.

The library services, including the access of students to books, journals and databases, the availability of computers, printers, copy machines etc. is satisfactory.

### Recommendations

#### **Essential:**

- The teaching laboratory facility is outdated, with an obsolete setup in terms of design and construction. It lacks modern equipment, and is located in a remote building, away from the main site of teaching. The laboratories need reconstruction, more space and extensive renewal. Provision of a new and updated laboratory facility is highly recommended. More advanced laboratory tools such as mass spectrometer, real time PCR, modern separation technologies, etc. need to be introduced into the laboratories to enable state-of-the-art instruction and provide hands-on experience of the students with modern laboratory technologies.
- The number of assigned teaching assistants (TAs) has declined and requires correction toward the desired ration of 1 TA per 8 students in the laboratory. A need was also expressed to appoint a capable laboratory technologist to administer and supervise all teaching activities and functions of the laboratories.

## **Chapter 4: Summary of Recommendations**

### **Essential Recommendations:**

- Currently there is very little interaction between faculty members of the program. This is likely due in part to the fact that these faculty members belong to different parental units. It is very important that faculty members will have a good appreciation of the work-place requirement expected from graduates of this program to help align it with their course curriculum. At this point, each faculty member observes students of the

program in different settings. Discussing these issues through a retreat process may help specifically address issues associated with admission criteria relevant for these students, academic expectations, and potentially designing a more program-specific curriculum.

- To strengthen the MLS program at Technion, it is recommended that a leadership position be established dedicated to the integration and alignment of the MLS curriculum in the first two years with the overall program mission and goals.
- It is recommended that the MLS program of instruction undergo a review to assess the quality and alignment of courses taught with the needs of professional Medical Laboratory Technologists and Laboratory Directors.

**Timeline: one academic year.**

- The teaching laboratory facility is outdated, with an obsolete setup in terms of design and construction. It lacks modern equipment, and is located in a remote building, away from the main site of teaching. The laboratories need reconstruction, more space and extensive renewal. Provision of a new and updated laboratory facility is highly recommended. More advanced laboratory tools such as mass spectrometer, real time PCR, modern separation technologies, etc. need to be introduced into the laboratories to enable state-of-the-art instruction and provide hands-on experience of the students with modern laboratory technologies.
- The number of assigned teaching assistants (TAs) has declined and requires correction toward the desired ration of 1 TA per 8 students in the laboratory. A need was also expressed to appoint a capable laboratory technologist to administer and supervise all teaching activities and functions of the laboratories.

**Advisable Recommendations:**

- The Technion is encouraged to re-evaluate the program and clearly define whether it should it be geared towards professional training of laboratory technologists – or towards provision of a strong academic basis for succeeding studies towards higher education and a projected future academic career in science and research. Since the Technion is a world

renowned leader in its teaching of engineering, innovative technologies and ingenuity, an interesting possibility to consider may be to change the concept of the program towards a new direction that will better suit the general philosophy and exceptional strengths of the Technion. Such a potential direction could be aiming to train high-level engineers in the arena of advanced medical and bio-medical laboratory technologies, including the domains of laboratory automation, genetic engineering machine technologies, etc.

- It may be worthwhile considering having the faculty travel for some of the frontal classes from the Bat Galim campus to the Neve Shaanan campus. This will obviously necessitate providing the Medical Laboratory Sciences students classes dedicated to them rather than sharing the teaching resources with the Medical School students. However, it may help design a curriculum that is more specific to laboratory workers. It might be informative for the faculty and students to visit currently active hospital or community and private health organization medical laboratories to gain a better understanding of the profession.
- As indicated in the general comments, this program in its present structure deviates from the traditional mission of the Technion, namely education of the future leading generation of innovative excellence in the domains and frontiers of technology, engineering, and science. Possibly, defining a new goal and mission for the present program, and a revision of its teaching objectives, and as a result also a new branding is warranted.
- It is important to evaluate and study the nature and characteristics and reasons for the extremely high dropout rate, possibly reflecting academic failures and move of students to other study tracks, preferably biology and medicine. On the basis of this evaluation, necessary measures can be taken to tackle this problem, such as improved student selection for the program, improved tutoring support for students, inspection, interviewing and scrutinized admission system to assess suitability of the applicants for the program. Introduction of a preparatory course for applicants that will include a tangible exposure to professional work in a clinical laboratory would be helpful. In consideration of the high dropout rates, it may also be

helpful to include a personal interview to the student selection process. The interview may assist in recruiting only those students that see laboratory medicine as their primary career preference. Also, enabling and arranging meetings of potential applicants with students in the advanced stages of their study in the program, and/or graduates of the program, may give the potential applicants a realistic and useful understanding of the profession, the demands and constraints of the program, and its expected requirements. Hopefully, such an introductory acquaintance will empower the student and ascertain that this is indeed the subject that they would like to pursue and realize as their professional future.

- Revise the length of internship to fit the requirement of the regulation of the Ministry of Health.
- It was stated that only two academic positions are presently allocated for faculty of the program at the medical school. It is advisable to provide more academic position for the team of teachers involved in the teaching at the medical school, thereby increasing their motivation, involvement and devotion to the program. This will also enable the relevant faculty members to guide students undertaking research projects, apply for research funds, and encourage their involvement in teaching and in research.
- Dedicated administrative assistance is required at the Bat Galim campus. Establish a branch office and engage administrative/secretarial support to provide students that attend courses at the Rambam campus with all the organizational support and assistance that is required to facilitate effective teaching and to assist the students in solving organizational as well as personal difficulties.
- It is recommended to strengthen the support offered to graduates towards finding appropriate jobs, possibly by providing this important service through the placement center of the Technion (p.54).
- To increase the number of applicants, promote enrollment and thereby facilitate improved selection of appropriate candidates that will be able to complete their studies, it is recommended to publicize and promote public knowledge of the profession and activities of laboratory medicine and of

this particular study program. Increased awareness of potential students through improved public relations, effective publicity and proactive marketing of the profession in general, and the specific program, will inevitably upgrade the pool of applicants. Among the possible activities aimed to increase awareness of potential candidates to the program, it is suggested to reach out to high schools and to expose high school students to the profession and the study program. The committee was informed that this outreach exists informally.

- It is suggested that the examinations written by the faculty members be submitted to professional examination evaluation by the Technion center for promotion of teaching. This should reduce complaints concerning quality, fairness, clarity and structure of the examinations (p.54).
- Several courses offered by the medical school are out of scope and clearly irrelevant for the school of laboratory medicine, and seem to be offered simply because they are available for medical students. It is suggested to consider cancelation of the elective courses of physical chemistry, Ubiquitin and protein turnover, sleep medicine, high pressure and diving physiology, hormones and animal behavior. Even though these are undoubtedly important subjects, they do not seem to be justified components of the curriculum of this program. On the other hand, it is regretted that the course on research methodologies and data analysis was recently withdrawn from the program. This course undoubtedly provided important element towards research and science endeavors. It is recommended to (re)-introduce courses on research methodologies and data analysis, guided critical reading of scientific and clinical research results, as well as courses on laboratory quality control, laboratory safety and standards of work, and a course of pharmacology. To strengthen the clinical orientation of the students it also suggested that courses that teach biological subject such as physiology and pharmacology be taught in and by the faculty of the medical school instead of the faculty of biology – to underscore and emphasize the medical/clinical laboratory aspects of these subjects.

- The teaching laboratory facility is outdated, with an obsolete setup in terms of design and construction. It lacks modern equipment, and is located in a remote building, away from the main site of teaching. Provision of a new and updated laboratory facility is highly recommended. Also, the number of assigned teaching assistants (TAs) has declined and requires correction toward the desired ratio of 1 TA per 8 students in the laboratory. A need was also expressed to appoint a capable laboratory technologist person to administer and supervise all teaching activities and functions of the laboratories.
- Early exposure to medical laboratory practice (perhaps with visits to active hospital or private clinical laboratories) would help students identify with the goals of the program.
- Introduction of laboratory safety and security as topics of instruction (possibly as a seminar or mini-course) would be helpful.
- The Technion's report lists over 40 members of the Faculty of Biology and Medicine who are affiliated to the "Medical Laboratory Sciences" program, whose research interests cover a wide array of biological and medical topics without describing them specifically. Not having a real glimpse at the specific research projects that students of this program participate in, the committee expresses its desire to see more research subjects that are related to the "clinical laboratory" per se incorporated into the list of these research subjects.
- The clinical literature is loaded nowadays with research on numerous diagnostic aspects in many avenues of Medicine. Research on tumor markers, markers for accurate and fast diagnosis of cardiac infarction, hormonal changes in ample pathologic events, lipids related to cardiovascular diseases etc., and it would fit both the "practical" spirit of the "Medical Laboratory Sciences" school and that of the "research aspirations" of some of the students, if a greater emphasis would be given to research topics related to the "clinical laboratory" core of the program.

**Desirable Recommendations:**

- It appears that the program needs a strong and assertive academic and administrative leadership. Towards this objective it is suggested to appoint an active, leading faculty committee with senior members from the medical school and the faculties of biology and basic studies (mathematics, physics, etc.) to critically review the curriculum and improve the syllabi and to coordinate all teaching activities in the two campuses to prevent overlaps and eliminate duplications. Indeed, the self-evaluation report presented by the Technion rightfully specifies this necessity (pp. 24, 55, 70, 71). Examples that may be considered are to carefully coordinate/merge the courses of histology and general pathology laboratory, and the immunology laboratory with the course on basic immunology. Incidentally, a logical merger of the courses of parasitology and mycology that is also recommended was already implemented as stated in the update report of the school, April 20, 2016. Several courses offered by the medical school are out of scope and clearly irrelevant for the school of laboratory medicine, and seem to be offered simply because they are available for medical students.
- A reduction in the amount and depth of the mathematic studies or an adjustment of the content of the mathematic courses to laboratory-relevant elements needs to be considered. This should include consideration of statistics within the program. It is regretted that the course on research methodologies and data analysis was recently withdrawn from the program. This course undoubtedly provided important elements towards research and science endeavors. It is recommended to (re)-introduce courses on research methodologies and data analysis, guided critical reading of scientific and clinical research results, as well as courses on laboratory quality control, laboratory safety and security, and standards of work, and a course of pharmacology. To strengthen the clinical orientation of the students it is also suggested that courses that teach biological subjects such as physiology and pharmacology would be taught in and by the faculty of the medical school instead of the faculty of biology – to underscore and emphasize the medical/clinical laboratory aspects of these subjects.

- Establish a reporting system by which the students summarize the value and assess the quality of the internship, and take the required measures to correct any faults and prevent flaws that are discerned.
- The Technion is encouraged to take all appropriate measures to obtain proper and suitable insurance liability coverage for any adversity or accident that may happen during internship in a clinical laboratory.

**Signed by:**

*Anat R Tambur, DMD, PhD*

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Prof. Anat Roitberg-Tambur - Chair

*Michael Mayer*

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Prof. Michael Mayer

*B. Sela, Ph.D*

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Prof. Ben-Ami Sela

*Maja Nowakowski*

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Prof. Maja Nowakowski

## Appendix 1: Letter of Appointment



April 2016

Prof. Anat R Tambur,  
Director, Transplant Immunology Laboratory  
Comprehensive Transplant Center  
Feinberg School of Medicine, Northwestern University  
USA

Dear Professor,

The Israeli Council for Higher Education (CHE) strives to ensure the continuing excellence and quality of Israeli higher education through a systematic evaluation process. By engaging upon this mission, the CHE seeks: to enhance and ensure the quality of academic studies, to provide the public with information regarding the quality of study programs in institutions of higher education throughout Israel, and to ensure the continued integration of the Israeli system of higher education in the international academic arena.

As part of this important endeavor we reach out to world renowned academicians to help us meet the challenges that confront the Israeli higher education by accepting our invitation to participate in our international evaluation committees. This process establishes a structure for an ongoing consultative process around the globe on common academic dilemmas and prospects.

I therefore deeply appreciate your willingness to join us in this crucial enterprise.

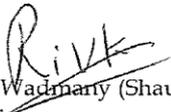
It is with great pleasure that I hereby appoint you to serve as a member of the Council for Higher Education's Committee for the Evaluation of the study programs in **Medical Laboratory Science**. In addition to yourself, the composition of the Committee will be as follows: Prof. Michael Mayer, Prof. Ben-Ami Sela, and Prof. Maja Nowakowski.

Ms. Inbal Haskell-Gordon will be the coordinator of the Committee.

Details regarding the operation of the committee and its mandate are provided in the enclosed appendix.

I wish you much success in your role as a member of this most important committee.

Sincerely,

  
Dr. Rivka Wadmanany (Shauman)  
Vice Chair  
The Council for Higher Education (CHE)

*Enclosures:* Appendix to the Appointment Letter of Evaluation Committees

cc: Dr. Varda Ben-Shaul, Deputy Director-General for QA, CHE  
Ms. Inbal Haskell-Gordon, committee coordinator

**Appendix 2: Site Visit Schedule**

**Department of Medical Laboratory Sciences**

**Schedule of site visit**

**Technion - Israel Institute of Technology**

**Wednesday, June 1<sup>st</sup>, 2016**

**הישיבות יתקיימו בחדר המועצה בפקולטה לביולוגיה**

<b>Time</b>	<b>Subject</b>	<b>Participants</b>
09:30-10:15	Opening session with the heads of the institution and the senior staff member appointed to deal with quality assessment	Prof. Peretz Lavie, Technion President Prof. Moshe Sidi, Senior Executive Vice President Prof. Daniel Rittel, Deputy Senior Vice President Prof. Yachin Cohen, Dean of Undergraduate
10:15-11:00	Meeting with the Deans of the Faculty of Medicine and the	Prof. Assaraf Yehuda Prof. Azzam Zaher
11:00-11:45	Meeting with the academic and administrative heads of the Program of <b>Medical Laboratory</b>	Lindell Debbie, Associate Prof Kaplan Marielle, Assistant Prof Horwitz Benjamin, Professor
11:45-12:30	Meeting with senior academic staff	Yoav Arava, Associate Prof Zilberstein Dan, Professor
12:30-13:30	Lunch (in the same room)	Closed-door working meeting of the committee
13:30-14:15	Meeting with Junior academic staff	Kaplan Marielle, Assistant Prof Sarig Galit, Assistant Prof Cohen Shenhav, Assistant Prof
14:15-15:00	Meeting with BSc students** (up to 8)	
15:00-15:30	Open slot	
15:30-16:00	Meeting with Alumni** (up to 8)	Dr Elada Isakov Yulia Schneider Hazam Sapori Etab Higazi

		Nora Nasser
16:00-16:30	Closed-door working meeting of	
16:30-17:00	Summation meeting with heads of institution	Prof. Peretz Lavie, Technion President Prof. Moshe Sidi, Senior Executive Vice President Prof. Daniel Rittel, Deputy Senior Vice President Prof. Yachin Cohen, Dean of Undergraduate

\* The heads of the institution and academic unit or their representatives will not attend these meetings.

\*\* The visit will be conducted in English with the exception of students who may speak in Hebrew and anyone

else who feels unable to converse in English.