

# Guidelines for Programs and Departments in Undergraduate Medical Technology Sciences

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## ABSTRACT

*The Faculty of Medical Technology at Tripoli University is the oldest undergraduate medical school in Tripoli, it was established in 1986, as a higher institute in the fields of Medical Laboratory, Nursing and Pharmaceutical Technology. The Bachelor degree of Medical Technology was introduced in 1996, profession for health science-based academic qualification in the various laboratory technology disciplines, especially in the fields of Medical Laboratory, Dental Technology, Intensive care & Anaesthesia, Pathology and Public Health. The purpose of this paper is to give faculty readers an overview of educational and study activities, including development in study plans, training, research methods for preparing the students for their future career of undergraduate medical technology education in Tripoli University. We made a general survey of the different departments in the faculty to demonstrate an in depth knowledge of their activities so that we focused on the educational and research methods at the faculty. We analysed the development in theory and clinical modules, research and clinical training programs in the different fields. We found despite the great improvement in the learning methods, increasing the numbers of the qualified teaching staff, but the faculty has to cooperate with the international scientific community to develop the teaching and research activities.*

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## INTRODUCTION

The Bachelor degree of Medical Technology was introduced in 1996, to meet the needs of the medical diagnostic laboratory profession for health science-based academic qualification. The four-year programme includes a comprehensive grounding in health sciences and specialised training in the various laboratory testing disciplines, at medical laboratory, dental technology, intensive care & anaesthesia, pathology and public health department. In 1986, higher institute of medical technology at the Tripoli University, was established under the supervision of ministry of higher education, and began accepting students with secondary school certificate for a three-year long program in which students earn a higher diploma degree in the field of; pharmacy, medical laboratory, nursing, and physical therapy <sup>[1-4]</sup>.

After 10 years from foundation that institute progressed to become a faculty with four-year bachelor degree program in different fields composed of number of modules thought

theoretically and clinically <sup>[6]</sup>. Medical laboratories domain started in Libya for 30 years ago as one of the medical technology branches, it was first established in 1977 in Brack city, named as higher institute of medical technology, and provide student graduates with a bachelor a degree in three years, in the field of medical laboratory <sup>[6]</sup>. Since 1996 the four years bachelor degree in medical laboratories at the faculty of Medical Technology, Tripoli University, composed of a number of modules thought theoretically and clinically. The first year contains non-specific, general modules which include; zoology, medical physics, statistics, general chemistry, English language and Arabic language. From second year begin the students to study more concentrated courses that come close to the medical laboratory field <sup>[3, 4]</sup>.

In 1994, the physical therapy department at the faculty of medical technology, Tripoli was established. This appeared to acknowledge the need for highly educated graduates to fulfill the increasing demands for a professional physical therapy and rehabilitation specializations. The bachelor degree program is designed to prepare students for careers in the disciplines of physical therapy science. Thus, graduates of the program will be able to: demonstrate an overall understanding

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of the theoretical bases of physical therapy science, demonstrate an in depth knowledge of their areas of specialization, identify major research issues and questions in physical therapy science [4].

In 1996, new departments such as pathology, dental technology and physical therapy were opened [3]. In 2002, new departments such as intensive care & anaesthesia and public health were added. This appeared to acknowledge the need for highly educated graduate to fulfil the increasing demands for these fields [1,2,4].

### General Idea

The four years bachelor degree program in all departments comprises of number of modules thought theoretically and clinically. The first year is general and shared for all students which include some basic, cultural and medical sciences. From second year to the fourth year all the modules are specialised and focused on the required modules to prepare the students to careers in all their specializations.

Thus, graduates of the program will be able to; demonstrate an overall understanding of the theoretical bases of different specialities, demonstrate an in depth knowledge of their areas of specialization, identify major research issues and questions in these related medical sciences.

### Survey

General survey of different departments in the faculty of medical technology was made to demonstrate an in depth knowledge of their activities [1-3].

In this overview, the focus is made on the educational and research activities at the faculty of medical technology, Tripoli University in Libya. Analysis has been done for: development in theory and clinical modules, research and clinical training programs in different fields [5].

### Scientific departments

In the faculty of medical technology there are six scientific departments with four years bachelor degree program which designed to prepare students for careers in their specializations. These departments are: Laboratory medicine, Physiotherapy, Dental technology, Intensive care& Anaesthesia, Pathology and Public health. Table 1.

**Table 1** Scientific department

No	Department	Abbreviations	Code of courses
1	General department (first year)	GD	001-010
2	Medical laboratories	ML	011-041
3	Physiotherapy	PYH	042-072
4	Dental technology	DT	073-103
5	Intensive Care and Anaesthesia	ICU	104-134
6	Pathology	Pa	135-165
7	Public health	PH	166-196
8	Postgraduate study & Training	POG	197-212

### General department (First Year)

All the students with secondary school certificates or specialized secondary schools could be accepted for one year before they divided in different specialization after they pass the admission examination in the faculty. Table 2.

**Table 2.** Study modules for the first year (general department)

No	Subject	Code no.	hours/week		Total hours/week	Total hours / year
			Theory	Practical		
1	Medicinal physics	001	2	3	5	160
2	Zoology	002	2	3	5	160
3	Statistics	003	2	2	4	128
4	General chemistry	004	2	3	5	160
5	English language	005	2	-	2	64
6	Arabic language	006	2	-	2	64

### Medical laboratory (1986-2017)

The bachelor degree program of medical laboratories is designed to prepare students for careers in this science and the graduates of the program will be able to demonstrate an overall understanding of the theoretical and practical bases of Clinical Chemistry, Immunology, blood bank, Parasitology, Microbiology and Histopathology. Graduates could work in medical laboratories in public and private hospitals and also in research centres. Table 3.

**Table 3** Study modules for the Medical laboratory department

Second Year	Third year	Fourth year
Biochemistry	Immunology& Serology	Blood bank
Analytical chemistry	Parasitology	Clinical chemistry II
Pathology	Microbiology	Psychology
Histopathology	Haematology	Management

Physiology	Clinical chemistry I	Occupational ethics
Medical laboratory instruments	Public health	

**Physiotherapy department (1996-2017)**

The bachelor degree program of Physiotherapy is designed to prepare students for careers in the disciplines of physical therapy science. Thus, graduates of the program will be able to: demonstrate an overall understanding of the theoretical bases of physical therapy science, identify major research issues and questions in physical therapy science. Graduates could work in physical therapy or in different medical departments in an interdisciplinary team in public and private hospitalize and also in sports society as supervisor of the sports teams. Table 4.

**Table 4** Study modules for the Physiotherapy department.

Second Year	Third year	Forth year
Physiology	Gynaecology & obstetrics	Physiotherapy for orthopaedics II
Histology	Psychology and ethics	Physiotherapy for neurology II
Pathology	Orthopedics & orthopaedic surgery	Physiotherapy for internal medicine
Anatomy	Physiotherapy for orthopaedics I	Rehabilitation
Biochemistry	Neurology & neurosurgery	Physiotherapy for pediatrics
Biomechanics	Physiotherapy for neurology I	Physiotherapy for burns & plastic surgery
Tests & measurements	Surgery	Research methods
Therapeutic exercises	Internal medicine & geriatrics	-
Electrotherapy & hydrotherapy	Pediatrics & pediatric surgery	-

**Dental technology (1996-2017)**

The bachelor degree program of dental technology is designed to synthesis and renew of teeth. Graduates could work in dental laboratories in public and private hospitals and clinics.

**Table 5** Study modules for the Dental technology department

Second Year	Third year	Forth year
Descriptive anatomy	Orthodontics I	Orthodontics II
Materials Properties	Artificial replacement I	Artificial replacement II

Physiology	Haplodont & Bridges I	Haplodont & Bridges II
Biochemistry	Oral histology	Face & Jaws replacement
Laboratory safety	Public health	Pharmacology
Microbiology	Psychology	Biostatistics
Pathology	-	Research Methodology

**Intensive Care and Anaesthesia department (2001-2017)**

The bachelor degree program of Intensive care and anaesthesia is designed to prepare students for the careers in this field and the graduates of the program will be able to demonstrate an overall understanding of the theoretical and practical bases of Intensive care and Anaesthesia in different hospitals and clinics.

**Table 6** Study modules for the Intensive Care and Anaesthesia department

Second Year	Third year	Forth year
Biochemistry	Microbiology	Internal medicine
Anatomy	Care I	Care II
Physiology	Pathology	Research methods
Computer	Pharmacology	Orthopaedics & orthopaedic surgery
Histology	Parasitology	Instruments
-	Anaesthesia I	Anaesthesia II
-	-	Paediatrics

**Pathology department (1996-2017)**

The bachelor degree program of Pathology is designed to prepare students for careers in this field and the graduates of the program will be able to demonstrate an overall understanding of the theoretical and practical bases of clinical chemistry, immunology, blood bank, parasitology, bacteriology, virology and histopathology. Graduates could work in medical laboratories in public and private hospitals and also in research centres. Table 7.

**Table 7** Study modules for the Pathology department

Second Year	Third year	Forth year
Histology	Clinical chemistry I	Clinical chemistry II
Pathology	Histopathology II	Public health
Biochemistry	Haematology	Blood bank
Analytical chemistry	Parasitology	Mycology
Physiology	Immunology & Serology	Molecular biology
Histopathology I	Virology	Molecular pathology
Cytology	Bacteriology	-

### Public health department (2001-2017)

The bachelor degree program of Public health is designed to prepare students for careers in this field and the graduates of the program will be able to demonstrate an overall understanding of the theoretical and practical bases of healthy nutrition, therapeutically nutrition, primary care units, health in schools, international health, health education and preparation of programs of protection from infectious diseases.

**Table 8** Study modules for the Public health department

Second Year	Third year	Forth year
Physiology	Medical microbiology	Quality control & food safety
Anatomy& histology	Environment Health	Therapeutically nutrition
Microbiology& immunology	Public health	Occupational safety& health control
Biochemistry	Pharmacology & toxicology	Politics & healthy programs
Parasitology	Infectious and epidemic diseases	General health problems
Healthy nutrition	Psychology& sociology	Care of Mother & child
Healthy education	Ethics & health laws	Health& life style
Computer applications & healthy systems	International health	Research methods& digital analysis
-	School health	Healthy engineering

### Postgraduate study & Training department

In this department, the best graduates in all scientific departments were prepared to be qualified demonstrators. They help the students in their practical lectures and clinical practice program. In addition, the post graduate department help also for the supporting and offering scholarships to those want to pursue further education to gain masters and doctorates degrees in and outside Libya <sup>[1]</sup>.

### Clinical practice

In the faculty of medical technology, the training program of students is done in special laboratories and in part in general hospitals in Tripoli. The practical course is very important part of the final evaluation of the students. Some experiments in haematology, microbiology, blood bank, parasitology, analytical chemistry, immunology, clinical chemistry, biochemistry and histopathology are done in prepared laboratories. Also there are specialized laboratories prepared for synthesis and repairing of teeth. Other fields which need more complicated instruments, the students sent to the research centres and central hospitals.

### The marks distribution according to practical and theoretical modules

In the first and second year, the students are prepared to make final theory and practical exam. The student who gets 50% of the whole marks can pass the exam. See table: 9. In the third and fourth year, the students must pass the practical exam before they can pass the theory exam. Table 10

**Table 9** Marks distribution in the faculty of medical technology

Year	Midterm exam in %	Practical exam in %	Final exam in %	Oral exam in %	Total Marks in %
First year	20	30	50	-	100
First year (without practical)	30	-	70	-	100
Second year	20	30	50	-	100
Second year (without practical)	30	-	70	-	100
Third year	20	30	50	-	100
Third year (with oral)	20	20	50	10	100
Third year (without practical)	30	-	70	-	10
Fourth year	20	30	50	-	100
Fourth year (with oral)	20	20	50	10	100
Fourth year (without practical)	30	-	70	-	100

**Table 10** The final grades will reflect the student's performance basing on the following general grading scale

Performance	85-100%	75-85%	65-74%	50-64%	< 50%
Grade	Excellent	Very good	Good	Pass	Fall

### RESULTS

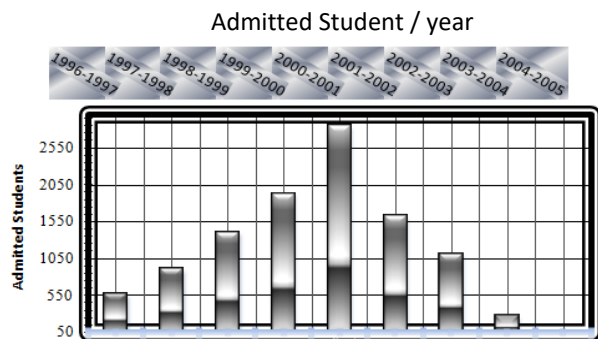
From our survey from registration and examination department at the faculty, we observe that only one type of bachelor degree typical offered is B.S. Degree (Bachelor of Medical Technology Science Degree. More specialized bachelor degree include Bachelor of Medical Technology in medical laboratory, dental technology, physiotherapy, pathology, public health and intensive care & anaesthesia. A student who passes the final licensing examinations is awarded a BS degree to practice Laboratory medicine. Graduates are authorized to use the Libya professional title (Technician), Following graduation from undergraduate studies, many

students choose to go on to earn a graduate degree. Undergraduate education is the post-secondary education previous to the postgraduate education. It includes all the academic programs up to the level of a bachelor's degree. For example, in the United States an entry level university student is known as an undergraduate,[ 7,8] while students of higher degrees are known as graduates.[8, 9] In some other educational systems and subjects, undergraduate education is post-secondary education up to the level of a master's degree; this is the case for some science courses in Britain and some medicine courses in Europe.

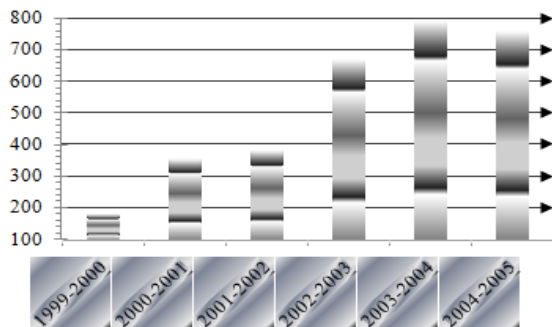
The BSc graduates from the faculty of medical technology from all scientific departments: We observe significant drop in number of the students they admitted in the faculty of medical technology from 2003 to 2005 because the faculty did not accept any new students these years [1].

**Table 11** Number of admitted students in the faculty of medical technology between 1996-2005

Year	Number of admitted students
1996-1997	567
1997-1998	902
1998-1999	1402
1999-2000	1924
2000-2001	2847
2001-2002	1622
2002-2003	1109
2003-2004	266
2004-2005	65



**Fig. 1.** Number of admitted student in the faculty of medical technology between 1996 -2005



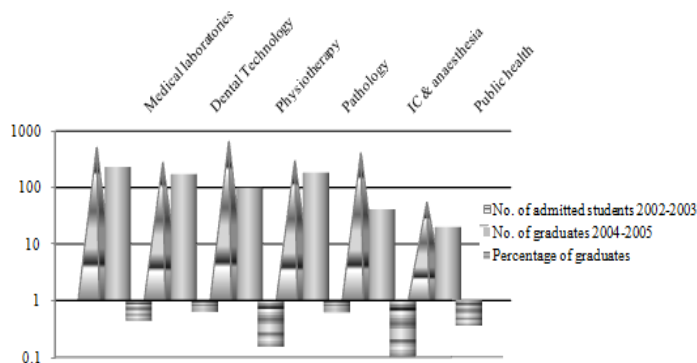
**Fig 2.** Number of graduates between 2000-2005

**Table 12** Number of graduates between 2000-2005

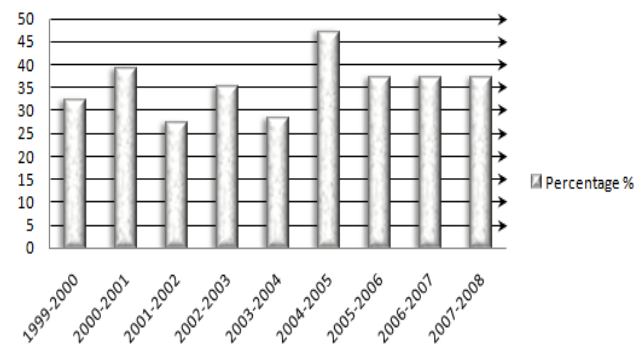
Year	BSc graduates
1999-2000	179
2000-2001	354
2001-2002	383
2002-2003	671
2003-2004	792
2004-2005	759

**Table 13** Number & percentage of admitted and graduates from each scientific department between 2002 and 2005

Scientific department	Number of admitted students 2002-2003	Number of graduates 2004-2005	Percentage of graduates
Medical laboratories	524	232	44%
Dental Technology	281	174	62%
Physiotherapy	670	99	15%
Pathology	301	183	61%
IC & anaesthesia	416	41	10%
Public health	56	20	36%



**Fig 3** Number of admitted; BSc graduates in percentage (Logarithmic Scale) from different departments.



**Fig 4** Percentage of BSc graduates from the faculty of Medical Technology in 1999-2008

## CONCLUSION

An admission criteria for medical students with few exceptions, the General Certificate of ability for Higher Education is a prerequisite for admission to higher education in the faculty. It usually requires 12 years of schooling. Overview of the general structure of undergraduate medical education in the faculty seems to be as, basic science (1 year); preclinical science (1 year) and clinical year (2 years). Structure of the curriculum in Libya, during the period from 1996 to 2017: the medical education is structured in years like many other countries, but in semesters started since 2014 in some departments which it takes four years (6 semesters) and three months to complete the curriculum.

The future goal of the faculty of medical technology is the development of its research and education methods

- Initiation of different training courses and workshops to graduate groups or trainees that coming for scientific research, reasoning skills and innovation.
- Borrowing the experiences in scientific research area to help the trainees.
- Develop methods of learning and follow up all new information and materials that help the students for better understanding of lectures.
- Cover the need of the Libyan ministry of health by the required number of very qualified technicians of all specializations.
- Better relationship between the faculty of medical technology and the rehabilitation centres and youth programs.
- Create a group of specialists who have an ability to engage in the scientific research.
- Welcome students to engage in scientific research during and after completion of their studies.
- Advance the theory and practical course contents for the sake of improving and developing the profession and gaining autonomy.
- Cooperate with the international scientific community to develop in the near future correct and modern learning facilities.
- Commencement of an international medical conferences and activities in Libya.

## Conflict of interest

Authors declare that there were no conflict of interest.

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