

Education of Biomedical Engineering in Taiwan

Kang-Ping Lin, Tsair Kao, Jia-Jung Wang, Mei-Jung Chen, Fong-Chin Su

Abstract—Biomedical Engineers (BME) play an important role in medical and healthcare society. Well educational programs are important to support the healthcare systems including hospitals, long term care organizations, manufacture industries of medical devices/instrumentations/systems, and sales/services companies of medical devices/instrumentations/system. In past 30 more years, biomedical engineering society has accumulated thousands people hold a biomedical engineering degree, and work as a biomedical engineer in Taiwan. Most of BME students can be trained in biomedical engineering departments with at least one of specialties in bioelectronics, bio-information, biomaterials or biomechanics. Students are required to have internship trainings in related institutions out of campus for 320 hours before graduating. Almost all the biomedical engineering departments are certified by IEET (Institute of Engineering Education Taiwan), and met the IEET requirement in which required mathematics and fundamental engineering courses. For BMEs after graduation, Taiwanese Society of Biomedical Engineering (TSBME) provides many continue-learning programs and certificates for all members who expect to hold the certification as a professional credit in his working place. In current status, many engineering departments in university are continuously asked to provide joint programs with BME department to train much better quality students. BME is one of growing fields in Taiwan.

I. INTRODUCTION

With the booming technology development, medical devices and engineering resource applied in a hospital have increased. Biomedical Engineers play an important role in medical care service in our society. The first medical engineering department was established in 1972; subsequently, similar education institutions increased. The latest biomedical engineering department was built in 2010. Currently, there are biomedical engineering programs in the universities in Taiwan including 8 undergraduate programs, 17 master's programs and 11 doctoral programs. There are about thousands people holding a biomedical engineering degree including 5300 people holding a bachelor's degree, 2900 people holding a master's degree and 370 people hold a doctoral degree [1]-[4].

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II. DISTRIBUTIONS OF BME

According to each institute's report of graduates from biomedical engineering in July, 2013, there are 400 people holding a bachelor's degree, 250 people holding a master's degree and 35 people holding a doctoral degree, including 26% in the field of biomedical electronics, 25% in the biomaterial, 20% in the biomechanics, 10% in the bio-imagine, 7% in the biomedical information and 12% in the others (see Fig. 1). There are 160 full-time and 110 part-time biomedical engineering lecturers in Taiwan including 21% in the field of biomedical electronics, 16% in the biomedical materials, 14% in the biomechanics, 12% in the biomedical imagine, 7% in the biomedical information and 30% in the others [5]. The education goal of most biomedical engineering departments is that students are trained to have techniques and fundamental knowledge of biomedical engineering, to be manual, to have practical and realistic attitude towards work, to have ability to practice interdisciplinary teamwork and to have the spirit of medical and engineering ethics and to be internationalized. Most graduates from the biomedical engineering department are advised to have basic ability to maintain biomedical devices, to analyze biomedical signals/images, to fix rehabilitation devices and to have biomedical data analysis techniques.

III. CONTENTS OF BME PROGRAMS

Currently, graduating credits for undergraduate programs are around 128 ~ 138 credits including 54% required professional courses, 24% elective professional courses and 22% required general courses (Fig. 2). Students from undergraduate programs, in about half of the universities in Taiwan, are required to meet professional competencies requirements or complete a report of project laboratory. Students are required to have internship in related institutions out of campus for 320 hours before graduating. Almost all the

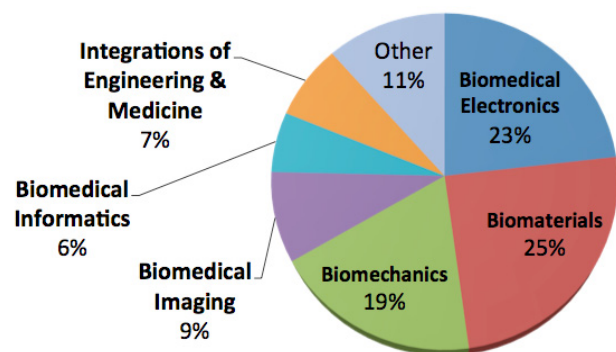


Figure 1. Distributions of BME specialties in Taiwan.

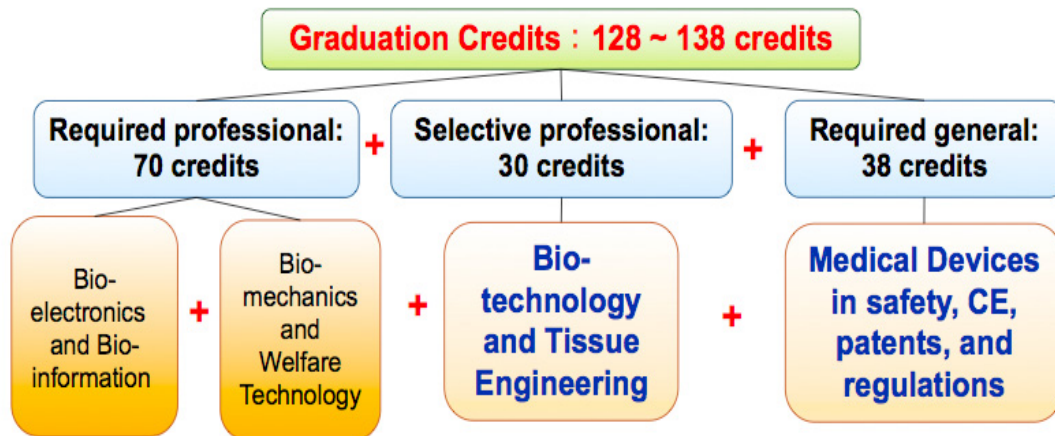


Figure 2. An example of BME course plan and composition. [2]

biomedical engineering departments are certified by IEET (Institute of Engineering Education Taiwan), and met the IEET requirement in which required mathematics and fundamental engineering courses take up 25% of all courses, professional courses of engineering take up 38%, and general courses take up 20% [1]-[5].

Modularizing the elective courses as a study package has applied in most biomedical engineering departments to develop students' specialty. The combination of bio-electrical specialty, bio-material specialty and bio-mechanic specialty are the fundamental modules. After completing ~18 credits of elective courses (6~8 courses) of specialty, students will be offered a certificate of the specialty in addition to their diploma. All specialty courses include physiology, internship in a hospital, biomedical engineering project study and regulations of biomedical instruments.

IV. JOB MARKETS OF BME

Around 30% students who have completed their bachelor's degree choose to pursue a higher degree in graduate schools. The other graduates, around 30~40%, may stay in the field of biomedical engineering and work as an engineer (R&D, sales, or service engineer) in the industry of biomedical devices, bio-materials, biomechanics, biomedical information, clinical services and patent [6].

According to the latest research by the Taiwan Medical and Biotech Industry Association regarding the lack of human resource in biomedical engineering, above 75% companies are desperate for R&D biomedical instruments engineers and half of the companies are seeking for biomedical engineers who have basic knowledge of patent application, regulation certification or/and production.

V. CONTINUOUS LEARNING PROGRAMS OF BME

Taiwan Society of Biomedical Engineering (TSBME) provides many continue-learning programs (Fig. 3) and certificates for all members who expect to hold the certification as a professional credit in his working place.

According to the requirement of the TSBME, juniors in college, graduates, and those who have working experience are eligible to take the biomedical engineer certificate test. Those who practice clinical work in a hospital can attend the test for clinical engineer certificate. The TSBME also provides training opportunity for graduates. TSBME members can receive one of the following certificates, which include Biomedical Engineer, Biomedical Equipment Technician and Clinical Engineer. They can also renew the certificate after completing 60 education credits. Over the years, 60% of applicants qualified for the certificate and 90% of them qualified to renew the certificate. Certificates issued by TSBME are certified by the Taiwan Joint Commission on Hospital Accreditation (TJCHA) as a compulsory requirement to work as a biomedical engineer in a hospital. Over the past four years, the TSBME, education institutions and industries in the field have worked hard to communicate with the government to complete biomedical engineer laws.

VI. SUMMARY

In current status, many engineering departments in almost all university are continuously asked to provide BME related courses by students. Jointed programs with BME department to train much better quality students are highly expected from BME industry. BME is one of growing fields in Taiwan.

REFERENCES

- [1] www.be.cycu.edu.tw/, 2014
- [2] www.bme.isu.edu.tw/, 2014
- [3] www.hk.edu.tw/~bme/, 2014
- [4] www.mcu.edu.tw/department/mcubme/, 2014
- [5] www.bmes.org.tw/, 2014
- [6] www.tmbia.org.tw/, 2014

Time	Agenda	Host
8:30-9:00	Registration	
9:00-9:10	Guest Speech	
9:10-10:10	Clinical Device Electrical Safety Testing and Practice IEC-60601-1: Electrical safety testing for medical equipment	SHIH-MING CHANG, Electronics Testing Center
10:10-10:30	Discussion	
10:30-11:30	Medical equipment report for adverse drug reaction (ADR analysis)	WEN-HSIEN HSU, NTUH Department of Medical Engineering
11:30-11:50	Updated information of TSBME	Kang-Ping Lin, TSBME
	Break	
13:00-14:00	Healthcare IT solution	CHENG-CHIEH PAN, Philips HealthCare
14:10-15:00	Specific cases and experience sharing for installing medical equipment	SHAO-LIANG CHANG, Luodong Poh-Ai Hospital Medical Engineering
15:00-15:20	Discussion	
15:20-16:40	Clinical Safety: Risk & Prevention on Electrosurgery Unit	JEN-HE LIU, Tyco Electronics
16:40-17:00	Q&A Discussions	

Figure 3. An example of the continuous learning program for BME after graduation. [5]