

# **Biomedical Engineering Education in India**

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## **Abstract**

The importance of education lies in its scope which should be well-matching with the growing technology. The paper here discusses about the Biomedical Engineering Education. The interface between electrical engineering and the life sciences has grown enormously. The biomedical engineering program has become a globally expanding discipline with time. The BME education in India needs proper planning and designing. In this paper, we discuss the scenario of BME in India and give suggestion for a successful future.

## **Introduction**

Biomedical Engineering has the concept of interdisciplinary engineering which portrays the modern engineering concept. The engineering has been widely accepted in the world and hence may be considered to a globally acceptable discipline. The BME has a strong multidisciplinary integration which involves the electrical, chemical, mechanical, computer and civil engineering. According to NIH, Bioengineering integrates physical, chemical, mathematical, and computational sciences and engineering principles to study biology, medicine, behavior, and

health. It advances fundamental concepts; creates knowledge from the molecular to the organ systems levels; and develops innovative biologics, materials, processes, implants, devices, and informatics approaches for the prevention, diagnosis, and treatment of disease, for patient rehabilitation, and for improving health (NIH definition). BME is a constantly changing field. Hence such a discipline requires careful planning when designing BME educational programs which may produce successful professionals.

These professionals often work in tandem with other life scientists, chemists, and medical scientists to aid the cause of preventive and curative medicine. Whereas biomedical engineers develop devices, systems and procedures to aid medical research or help solve health and medical problems. The sudden spurt in radical research concepts that have lent a whole new direction to treatment modalities is essentially due to developments in this field.

In this paper, scenarios of Indian university have been given. The objective of this paper is to briefly present the India scenario of BME education, the challenges it faces and the future steps towards the appropriate education of BM engineers for the region.

Biomedical engineering has immense scope for path breaking research.

### **Scenario of Indian Universities with BME Education**

Previous days, the graduation in a related subject such as electrical, chemical or mechanical engineering and then team this up with a specialization in biomedical engineering.

Generally, biomedical engineers may seem like an elite class of practitioners, the ever-increasing Biomedical engineers who are considered to be the specialists or experts have all had humble beginnings, which can be traced back to an ordinary engineering degree.

However, recently there have been several Bachelor courses in Biomedical Engineering but are less popular as compared to the main stream engineering. In order to specialize in this field most Indian students opt for masters programs. There is also a provision of pursuing master in Biomedical Engineering after completion of their medical degree. But the Ph.D programs in India are very few in number.

Some of the renowned institutes providing BME at the masters and doctoral levels at IIT Mumbai. Banaras Hindu University, Varanasi 221005 (UP) and Birla Institute of Technology and Science, Vidya Vihar, Pilani 333031 (Rajasthan) offer an M.Tech in biomedical engineering.

The chief specialities in this field include bioinstrumentation, biomaterials, biomechanics, cellular, tissue and genetic engineering; clinical engineering; rehabilitation engineering; orthopaedic surgery; medical imaging; and systems physiology.

### **Challenges for BME in India**

Engineering education in India faces some classic and some new challenges. Most of these challenges are common to all engineering disciplines, including biomedical. In the era of the Internet and telecommunications changes, as Gupta et al. [3] point out, the major challenges of engineering education are: a) the need for formalized lifelong learning; b) the need to broaden “engineering fundamentals” beyond mathematics and physics; c) inadequacy of the first professional degree for engineering careers; d) need for engineering practice.

The Biomedical Engineering education in India is generally a part of an interdisciplinary field. Some courses have been adapted from Biosciences, Biotechnology, Electrical engineering, Computer Engineering, Mechanical Engineering etc. The programs run in different institutes have no standardized syllabus. At times, it does not meet the requirements for the jobs because of the lack of latest knowledge.

### **Suggestions for improvement of BME in India**

Presently, the BME in India needs a lot of improvement in order to compete globally. Bioengineering education presents special interdisciplinary programmes. The most important is to educate students in basic knowledge and improve their skills needed. The context of Bioengineering in India is not meeting the demands of the companies and is still under-development. There is a need to increase the knowledge by improving the learning technologies. This is a significant pedagogical challenge. Hence some suggestions are quoted in the text:

#### *i) Using several internet tools*

The use of web-based tools is of prime-importance. The web, information media or using CD-ROMs, DVDs, etc.. Online free library access with Medical journal accessibilities in the university.

#### *ii) Increase the number of Undergraduate programs and students*

There is a need for introducing new technologies in the curriculum with increase in undergraduate programs. The curriculum must involve the theoretical and practical learning [5].

The need for biomedical engineering education should be emphasized at this level to increase the number of Biomedical Engineers.

*iii) Specialized graduate programs should introduced*

The students should be taught advanced courses. They can be several company scholarship programs for having several track program which may be more skill oriented. Graduate studies should be complimentary to undergraduate and must have in-depth knowledge.

*iv) Continuing Education*

This is most important to have a continuous study by updating the knowledge time to time. Especially the practicing engineers must be stay in touch with the latest developments.

*v) Recruitment possibilities for Biomedical Engineers*

Generally in India the job prospects of Biomedical Engineers are not up-to the mark. The students have several problems attaining the job. Most importantly for the Engineering institutes have very little collaboration with medical hospitals and health companies. Hence the university or the institutes must strengthen relationships with health care networks.

*vi) Internship programs/ Joint Ph.D programs*

There is a need for having several internship programs in order to have a better practical knowledge of the subject. The joint Ph.D programs can bring a difference in research and

high-class Ph.D. Hence such internship programs and Joint Ph.D programs must be encouraged.

*vii) Government funding opportunities*

There is a need for increase in government funding opportunities in biomedical Education in India. The increase in funding in biomedical R&D field may help in better health care educations.

### **Future Perspective of BME in India**

The Biomedical engineers must recognize the place of work after their graduation. There is a possibility of working in a variety of settings, from hospitals, research institutes and facilities, educational institutes, and pharmaceutical companies to government establishments, and regulatory agencies. The Biomedical Engineers can also work as counselors in medical firms or consultants. The scope for further progress therefore seems infinite.

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