

Recommendations for comprehensive translational medicine education and training.

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Abstract

The gap between basic research and its practical application is ever widening. Translational research promises to bridge this gap with the added potential to accelerate product R&D in both pharma and biotech industries by supplying the field with well-qualified 'Medical Translators.' To ensure proper training, both comprehensive educational and corporate mentorship is needed. This training program should cover all aspects of translational medicine. Herein, we propose recommendations for a comprehensive translational medicine educational and training program to meet industry requirements. Both the curricula and practical aspects of this program are also discussed.

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Why are TM programs needed?

In recent past, translational medicine has gained significant importance due to its promising role for accelerating product R&D in pharma and biotech industries. [1, 2] Despite large budgets and infrastructure advancements, new drug approvals have declined.[3-5] Translational medicine approaches have the potential to guide all stages of product development leading to rapid and effective product development. [6, 7] However, the general scientific community is not fully aware of the concept and objectives entailed in Translational medicine/Translational research. To achieve the full benefits and promising applications from translational medicine, a specifically tailored translational medicine educational/training program must be developed. [8, 9] Herein, we discuss such a program.

Aims and objectives

The main goal of any translational medicine educational/training program is to produce a force of highly skilled, professional 'Medical Translators'; key players involved in accelerating product R&D in the health care, biotechnology and pharma industries. TM program will provide curricula focusing on translation of scientific discoveries into practical application either for diagnostics, therapeutics, and treatments purposes.

Program level & entry requirement

TM program is ideally suited for the master's level. To increase diversity and spectrum of the TM program, candidates from medical, biotechnology, pharmacy, chemistry, biophysics, molecular biology and genetics fields are encouraged to enter the program.

TM curricula

Medical Translator must gain a full understanding of human medicine principles including disease progression, basic and human pharmacology, along with an in-depth knowledge of clinical trials, regulatory agencies and industrial business affairs. TM curricula will address these areas with special emphasis given to cellular and molecular medicine, drug discovery and development, molecular imaging, omics science, regenerative medicine, biomaterials and clinical application, neurosciences, and oncology.

Cellular and Molecular Medicine, a critical discipline in TM, forms the basis in the development of devices and assays used in most field within molecular diagnostics, bioengineering, and nanotechnology. *Drug Discovery and Development* subject involves target identification and validation, drug screening

and pharmacology, pharmaceutical science, vaccines, pharmacogenomics, and clinical trials. *Omics Science*, another important TM discipline, involves the science and technology related to genomics, proteomics, metabolomics, cellomics, and bioinformatics. *Molecular Imaging* includes medical physics, diagnostic radiology, biotechnology, chemical pathology, histopathology, and cytogenetic biology. *Regenerative Medicine* focuses on the science and biotechnology associated with stem cells, tissue repair and remodeling, along with tissue engineering. *Biomaterials and Clinical Application* involves TM relevant biophysics, mechanical, physical, chemical and biological properties, design and production characteristics of devices. *Neuroscience* is a board discipline including the science related to cognitive science, psychiatry, neurology, neurosurgery, and neuropathology. *Oncology* study concentrates on target identification, validation, targeting therapy, intervention, biomarkers, gene therapy and related science.

Specialized tracts

- 1. Drug Discovery & Development** is suited to students looking for a career in pharma industry. TM offers great potential to accelerate drug D&D. Students in this tract will gain detailed knowledge and understanding concerning all stages and phases of drug discovery & development. They will also become familiar with regulatory and safety regulations and affairs essential and specific to the pharma industry. They will learn how to develop promising surrogate biomarkers. In principle, they will be trained to become future leaders and key players essential to the pharma industry.
- 2. Biotechnology** tract is suited to those looking for a career in the biotech industry. TM courses are specifically designed to provide detailed knowledge concerning product development, regulatory agencies and business affairs related to biotech. Through industry rotation, students will observe, first-hand, the hurdles encountered in product development and learn from experts how to design potential solutions. Students will obtain extensive training in the disciplines which are necessary for product development: omics, biomaterials and clinical application.
- 3. Academic research** tract is suited to those who wish to establish themselves as group leaders in research field. Students will obtain comprehensive knowledge of clinical terminology and will learn research techniques and skills essential for successful laboratory research careers. These skills will help the student bridge basic and clinical fields. Upon completion, the student will be able to translate effectively the basic research studies into useful clinical diagnostic or therapeutic products.

Rotations/Internships

Rotation and internships in pharma, biotech industry and clinics are compulsory parts of the TM program. During clinics rotations, candidates become familiar with patient interviews: obtaining patient history, developing differential diagnosis, developing decision making skills pertaining to tests relevant to various clinical disorders and understanding various therapeutic approaches. Through their interaction with different patient groups, students will be trained to understand diverse clinical problems/questions and which can be addressed with further laboratory research. Student rotation and internships in industry will provide the venue to translate theoretical knowledge into practical environments. Students will observe all stages of product R&D including the practical hurdles encountered along the way. Regulatory and safety issue awareness will also be covered. In the industry setting, the students will enhance their interpersonal communication skills.

Research Stay Abroad

International Society for Translational Medicine (<http://www.stmed.org>) under its 'ISTM collaborative centers program' has established various academic, clinical, and industrial collaborations around the globe. The participating prestigious academic institutes and hospitals will actively contribute to TM advancement and progress by offering short term/semester research opportunities where students gain international professional and cultural experience.

Role of Industry

Pharma and biotech industry will be involved in the TM educational program and training. Industry will provide internships and rotation opportunities, as well as student scholarships and awards. International Society for Translational Medicine provides industry sponsorship opportunities for various affiliated TM educational and training programs. As Future Medical Translators, successful TM students will obtain advance job placement opportunities from industry.

Role of International Society for Translational Medicine

A major goal of the International Society for Translational Medicine (ISTM) is to produce future TM leaders through education, training, and internship programs. ISTM consists of high profile clinician/scientist from around the globe who provide expert faculty for TM programs and training activities. Additionally, ISTM hosts a job bulletin where candidates submit detailed CVs, and where employers find qualified applicants. The Society functions as a bridge between Future Medical Translators and industry to the success of all involved.

Key point for an ideal Translational Medicine Program

A. Education

- Cellular and Molecular Medicine
- Omics Science
- Drug Discovery and Development
- Molecular Imaging
- Regenerative Medicine
- Biomaterials and Clinical Application
- Neuroscience
- Oncology
- Regulatory and Safety affair

B. Training

- Rotations in clinics.
- Industry internships.
- Research stay abroad in Academic centres.
- Involvement of Pharma and Biotech industry as program co sponsors

C. Advantages

- Comprehensive Medical Translators
- Advance job placement arrangements

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