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# A World Transitioning to Translational Medicine

The failure rate for new drugs and therapies under development exceeds 95%. For the other 5%, it takes at least 14 years and more than $1 billion to develop a successful candidate into a product that can be delivered to patients. The field of translational medicine aims to improve these statistics to get new treatments and cures to patients faster. Translational medicine combines expertise, resources, and techniques from a variety of disciplines to translate scientific discoveries made in the laboratory into usable medical therapies for patients.

Translational medicine is a hot topic in the U.S. and other developed nations because of its potential to improve patient outcomes. The National Institutes for Health (NIH) created the National Center for Advancing Translational Science (NCATS) in 2012 to enhance the translational process. NCATS has identified five stages of translational medicine:

1. *Basic research* is scientific exploration to reveal fundamental mechanisms of biology, disease, and behavior.

2. *Preclinical research* connects basic research with human medicine through the development of model therapies that provide further understanding of the disease and treatment methods. In this stage, researchers create simulations of drug treatments, often on mammalian cells lines or on animal test subjects.

3. *Clinical research* studies the disease in humans and relates this knowledge to the findings of the research that used cell or animal models. The knowledge gleaned from this stage helps in the development of new treatments and safety procedures for the therapy. The main objective of clinical research is to generate data to support regulatory approval.

4. *Clinical implementation* deploys the treatment developed in the previous stages. During this stage, routine clinical studies are conducted of the general population.

5. *Public health* is the stage in which researchers study health outcomes of the entire population to determine the effects of diseases and prevention, diagnosis, and treatment efforts. The findings help guide analyses of the effects of current treatments and the development of new ones.

The U.S. is not the only country investing in translational medicine. Biologists in China have made impressive progress in genome sequencing and analysis of protein structures, but only minor breakthroughs in drug development and other medical products. Some argue that the investment China has made in translational medicine is not reaping the expected rewards. To silence critics, China's National Development and Reform Commission announced a plan in 2014 to build five new translational medicine research centers where scientists and clinicians can work side-by-side.

China's translational medicine community faces different challenges than its counterparts in the U.S. Chinese institutions have been successful at attracting basic science researchers but not physicians. In China, physicians working in research are paid significantly less than research physicians in the U.S. Cost and availability of treatments is also an issue in China, because large populations are located in remote areas. The large population is also an advantage, because it is easier to find patients for statistical studies. An abundance of funding is a draw for many, especially younger scientists looking to establish labs.

Translational medicine in China must address different needs than in the U.S. For example, China has a higher incidence of stroke and certain cancers of the digestive system.

Europe is also addressing patient needs through investment in translational medicine. In an effort to help move biomedical innovations from the lab to the clinic more quickly, the European Commission formed a consortium in 2013 called the European Advanced Translational Research Infrastructure in Medicine (EATRIS) program. EATRIS includes more than 80 European institutions and centers and offers support for translational scientists and companies. The regulatory environment in Europe presents a challenge, as regulations vary from country to country.

Because nations are prioritizing translational medicine, grant funding is more likely to go to proposals with significant translational components. Researchers could capitalize on this by specializing in translational medicine or adding more translational medicine components to their research programs. Some experts, however, emphasize the importance of basic research, claiming this research is the main driver of discoveries that lead to useful therapies. Development of basic research and translational research in parallel could help to translate an abundance of scientific discoveries into therapies.

To support this growing research community, AIChE and the Society for Biological Engineering (SBE) publish with Wiley the journal *Bioengineering & Translational Medicine*. This peer-reviewed, online, open-access journal (http://onlinelibrary.wiley.com/journal/10.1002/(ISSN)2380-6761) focuses on the fundamental ways chemical and biological engineering can drive and provide innovative technologies and solutions that impact clinical practice and commercial healthcare products.

SBE held the first Bioengineering and Translational Medicine Conference in November 2016. To participate in the second Bioengineering and Translational Medicine Conference in October 2017, submit your abstract at www.aiche.org/translational. CEP