FOCUS: TRANSLATIONAL MEDICINE

Introduction

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Amid the feverish pace of biomedical research in the United States and abroad, one might assume that scientists are fast approaching cures for every disease affecting mankind. The U.S. federal government alone funds more than $30 billion annually to biomedical research, which is distributed through the National Institutes of Health (NIH\textsuperscript{†}) [1]. However, cures for all human diseases remain more of a dream than reality — of the 4,400 conditions with known molecular causes, treatments are only available for 250 [2]. To increase the pace of developing clinically relevant diagnostics and therapeutics, the NIH recently underwent a sweeping restructuring to establish the National Center for Advancing Translational Sciences (NCATS) [1]. Ultimately, the goal of translational medicine is to reduce the time from identifying the molecular causes of a disease to designing an effective diagnostic or treatment.

Yale University has been at the forefront of translational research efforts. As one of the original awardees of the NIH’s Clinical and Translational Science Awards (CTSA), the Yale School of Medicine established the Yale Center for Clinical Investigation in 2006 [3]. The mission of the Center is both to train the next generation of translational clinicians and scientists and to promote translational research. This past year, Yale was one of three institutions in the United States to receive funding from the NIH for the study of rare diseases, which collectively affects the lives of more than 25 million Americans [4].

In light of the growing emphasis on clinically relevant biomedical research, the Yale Journal of Biology and Medicine presents a special section on translational medicine. The reviews highlight the various stages of going from “bench to bedside” and the implications faced by clinicians, scientists, and patients.

On the basic research side of the spectrum, Clark and colleagues review recent advances in the understanding of dengue virus. The authors discuss the existence of alternative viral morphologies of dengue virus, which may facilitate the development of medical interventions for dengue virus

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\textsuperscript{†}Abbreviations: NIH, National Institutes of Health; NCATS, National Center for Advancing Translational Sciences; CTSA, Clinical and Translational Science Awards; PET, positron emission tomography; SPECT, single photon emission tomography.
infection. Additionally, Go and colleagues give an overview of the LDL receptor family, focusing on the lesser-known members and their recently discovered role in hyperlipidemia and atherosclerosis. These articles highlight the importance of basic research as a jumping-off point for future clinical treatments.

Further along the spectrum toward the clinical side, Fendos and Engelman articulate how a well-known biomarker for many cancers, localized cellular acidity, can be exploited for tumor identification with a pH-dependent peptide, pHLIP. In diabetes-related research, Jamiołkowski and colleagues revisit pancreatic islet transplantation, a controversial type I diabetes mellitus therapy, as a potentially promising treatment for patients.

We often think of translational research and drug discovery as a one-way street, starting with the identification of a molecular mechanism and eventually leading to a drug that can specifically target a component of the pathway. However, drugs often have unexpected effects, which can lead to the discovery of unknown pathways. Here, Arstäten and Jin provide a historical review of the discovery of Guanfacine and its unexpected effects in the prefrontal cortex, which ultimately led to its use as a treatment for cognitive disorders.

Additionally, cutting-edge advances in medical technology can lead to improvements in patient care. Paulo and colleagues provide a technical review on modern peptide mass spectrometry and discuss the future of these techniques in the discovery of clinically relevant biomarkers. Stacy, Maxfield, and Sinusas review recent advances in the imaging techniques of positron emission tomography (PET) and single photon emission tomography (SPECT), particularly as they relate to cardiovascular disease. Rapidly developing fields, such as personal genomics, can have far-reaching implications for patients, clinicians, and society at large. Kung and Gelbart highlight the importance of genetic education in light of personal genome sequencing. Additionally, they offer perspective on issues associated with genetics education and describe their experiences developing the Personal Genomics Education Project at Harvard Medical School.

We hope these articles offer a glimpse into both the scientific complexities and clinical challenges faced in translational medicine. Additionally, we must consider how advancing technologies, such as personal genomic sequencing, may affect individuals and society. As the urgency of developing novel diagnostics and treatments remains, the renewed focus by the NIH marks the beginning of an exciting era in translational medicine.

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