

**Editorial:****Translational research in neglected tropical diseases: looking beyond the boundaries!**

Infectious diseases have been greatest killers of the human kind since ancient times. The phenomenal medical, social and economic impact of the "big three", namely, malaria, human immunodeficiency virus (HIV) infection/acquired immunodeficiency syndrome (AIDS) and tuberculosis (TB) continues to threaten health care systems across the globe.<sup>1</sup> Molyneux, Hotez and Fenwick<sup>2</sup> are credited with the first published paper using the full term "neglected tropical diseases" in the title of the article in PLoS One in 2005. In 2006, PLoS One carried another key paper on the same topic.<sup>3</sup> Thereafter, a landmark review titled "Neglected tropical diseases" was also published in the New England Journal of Medicine in 2007<sup>4</sup> followed by another article in 2009.<sup>5</sup> Since then, the term "neglected tropical diseases" became established in mainstream medical literature.

The expression "neglected tropical diseases" refers to chronic, debilitating, stigmatizing common infections affecting the world's poorest people often living in rural, deprived urban areas in the tropical and sub-tropical regions of the world in order to highlight the serious impact of these diseases on global health. Currently, this term encompasses over 40 helminth, protozoal, bacterial, fungal, viral and ectoparasitic infections, among others. Some workers have estimated that the collective global burden due to 13 of the most important neglected tropical diseases exceeds that of malaria and TB and is almost equal to the burden of HIV/AIDS.<sup>6,7</sup> In India, neglected tropical diseases along with the "big three" (malaria, HIV/AIDS, TB) constitute a major public health problem.<sup>8</sup> The solution to such a grave problem cannot and will not lie in the domain of medicine alone. One is required to broaden the frontiers to find a sustainable solution.

Translational research refers to the application of scientific concepts and procedures to facilitate interaction between apparently disparate scientific disciplines as well as the integration of the exchange of information to advance knowledge that can improve the patient care. It facilitates bridging the gap between experimental findings from the laboratory bench to the patient's bed-side (and vice-versa) and involves ongoing, active collaboration between scientists and clinicians.<sup>9,10</sup> Translational research rises above the artificial boundaries across various disciplines and has the potential to address novel research questions, integrate, innovate and improvise the scope of research. There is a pressing need for insights into better understanding of underlying pathogenetic mechanisms, newer reliable point-of-care diagnostic tests, biomarkers of disease risk, therapeutic response, prognosis and outcome of these neglected tropical diseases in order to achieve control of these diseases. Also, carrying out research on infective pathogens requires sophisticated laboratories with advanced safety features and an animal house with adequate availability of experimental animals. Translational research promotes integration of research and research methodologies occurring across various platforms.

Translational research is not abundant due to several daunting challenges. Three such challenges exist in the context of bridging the gap between disciplines, such as, engineering and clinical research. The first among them is the "lost in translation" syndrome. The languages and terminology in varied disciplines to relate to similar physical effects is different, owing to their different etymology. This is the least worrisome of the three challenges and can be overcome with sustained interdisciplinary conversation. The second challenge is the "lost in idealization" dilemma. The laws of science that form the basis of engineering are generally posed and presented in the context of idealized systems that rely on a certain sense of determinism and awareness about the system under

investigation. However, natural systems and human anatomy in particular are notoriously non-ideal and seldom completely characterized. The degree of idealization that would render the system amenable to a scientific study while retaining essential effects is a dilemma that is to be resolved. The third challenge is the lack of fora to bring together scientists from varied disciplines. Disciplines that have capacity and experience to carry out translational research are seldom found under one umbrella in India.

In order to achieve progress in the applications of translational research, there is a need for meaningful collaboration and co-operation between medical and other disciplines across institutions. For example there is abundant availability of clinical material, dedicated medical researchers and a well-structured and actively functioning Institutional Ethical Committee is usually in place in teaching hospitals attached to reputed medical institutions. But, barring a few well-established medical institutions, such as, the All India Institute of Medical Sciences (AIIMS), New Delhi and Postgraduate Institute of Medical Education and Research (PGIMER), Chandigarh, basic science research facilities and research capacity is not available in majority of the medical institutions across the country.

Similarly, disciplines such as Biomedical Engineering, Robotics, Applied Mechanics, etc., exist in the Indian Institutes of Technology (IITs); state-of-the art molecular biology research facilities are found for example, in Centre for Cellular and Molecular Biology (CCMB), Hyderabad. But in these centres of excellence, there is no access to clinical material and very few medical doctors are based there. This lack of colocation has hampered translational research in India significantly.

There has been a paradigm shift in the efforts at fostering translational research. Innovative measures such as IIT Kharagpur's plan to start the Bidhan Chandra Institute of Medical Sciences after obtaining necessary regulatory approvals from Medical Council of India (MCI) reflects "looking beyond boundaries" and has the potential to facilitate translational research.<sup>11</sup> The Sri Venkateswara Institute of Medical Sciences (SVIMS), Tirupati, established in 1993, has also taken the lead in this direction and has been fostering translational research. SVIMS is credited to be the first of its kind to start postgraduate course in Bioinformatics in the state of Andhra Pradesh and promotes research and developmental activities in major thrust areas like sequence analysis, molecular modelling and drug designing.<sup>12</sup> These efforts are now expanding into establishment of molecular biology facility to promote basic research.<sup>13</sup> Similarly, the Sri Venkateswara University, Tirupati also has taken a step in this direction by entering into a memorandum of understanding with SVIMS in an effort to bridge the gap between basic and clinical research.<sup>14</sup> The effort by Government of India to initiate Translational Health Science and Technology Institute (THSTI) in Faridabad in the year 2010 which has established partnership with Harvard Massachusetts Institute of Technology (MIT) Health Science Technology, which integrates science, engineering and medicine is also another move towards the goal of promoting translational research in India.<sup>15</sup>

However, such capacity enhancement is not easy to replicate at other places. In order to take translational research forward it is more meaningful to integrate the ongoing research efforts across institutions with an ultimate goal of passing on the benefits of research to the primary health care.

Achieving this integration across various disciplines between institutions or even between several departments in the same medical college/institution in the Indian scenario has been an uphill task with regulatory, administrative and fund-flow problems. These and other bottle-necks, such as, problems related to storage and logistics related to transport of clinical specimens need to be addressed to and innovative solutions need to be found. Joint translational research proposals from medical institutes and research institutes of excellence need to be evolved. Governmental funding

agencies can consider promoting inter-discipline research with suitable incentives to encourage such efforts. The yawning gap between the bench and bedside, especially in the "big three" (namely, malaria, HIV and TB) and the neglected tropical diseases is a stark reminder for renewed efforts in innovative research that can be applied in the bedside and in the field setting.

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