

## Translational Research

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Singapore has identified the biomedical sector as a key engine of economic growth and has invested heavily in promoting biomedical research. The Agency for Science Technology and Research (A\*Star), in implementing this strategy, has provided state-of-the-art facilities, attracted, and developed talents and generously supported deserving research projects. Substantial progress has been made in many critical areas of basic biomedical science, and this effort has earned wide international recognition and acclaim. The quality and range of research output achieved speak for themselves, and basic biomedical research in Singapore is poised for vigorous growth.

However, the ideal outcome of our biomedical ambition has yet to be realised, that is, a vibrant cutting-edge biomedical sector, in which the output of strong basic research feeds freely into clinical medicine and brings about advances in medical care. The precious fruits of much of our basic research remain to be translated into valuable outcomes at the clinical level. Bridging this gap in the value chain is actually a universal challenge, chiefly because there exists a cultural hiatus between the clinician and the basic scientist; the former is focused on solving individuals' medical problems, while the latter is primarily concerned with the discovery of broadly applicable principles, knowledge and methods. Much of the latter may find application in the clinics, and such applications would be eagerly embraced by the clinician. However, if any potential benefit is to be realised, a special kind of research must focus on two areas: (a) the application of new scientific knowledge and technology to specific clinical problems, and (b) work intended to enhance understanding of the causes and mechanisms of diseases, to help prevent diseases, and to improve their diagnosis and treatment. Such research has been appropriately called "translational research". The people able to conduct such research are usually clinicians who have been trained in research, and who are therefore able to relate to, and collaborate productively with, the basic scientists. Such people, the clinician-scientists, are generally in short supply because of a number of reasons.

Medical schools traditionally do not include research training in the undergraduate curriculum, being more concerned with teaching the established applications of science in patient care. To build a cadre of clinician-scientists to drive translational research, it is necessary to start at the undergraduate level, as has already been initiated in the Yong Loo Lin School of Medicine at the National University of Singapore. Offers of scholarships for the MBBS-PhD programme in the School, funded by A\*Star, have been implemented; the scheme should gather momentum as students' interest in research is further nurtured.

The parallel scheme of supporting selected clinicians for training in translational research should also be enhanced. Many clinicians are already involved in what is known as clinical research, in which clinical problems are investigated using established technologies and method, and carried out largely within the clinical departments. Such activities usually take second place to the call of clinical commitments and duties, and do not include a significant input from scientists working on cutting edge research. On the other hand, the clinician-scientist, through his familiarity with the trends and methods of current biomedical research and by his networking with the community of scientists, can catalyse fruitful collaborations between the physicians and scientists. He or she can also conduct research that straddles the clinic and the laboratory. The ability to attract young people to commit themselves to translational research depends to a great extent on the conditions of work and the career prospect offered, bearing in mind the established, stable and relatively well remunerated, albeit hectic, career of the clinician. The hospitals are, rightly, primarily concerned with providing health care. However, to accommodate and promote the development of translational research, such research activity should be strictly shielded from the inexorable pressure of clinical work, and the teaching hospitals should accord it recognition and importance equal to clinical duties. The important move has been made to clearly establish the percentage of working

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time – 75% – which the clinician-scientist should devote strictly to research. The special clinician-scientist investigator awards by A\*Star, which reimburse hospitals for clinicians' time away from clinical duties and thus ensure protected time for research, are laudable and should be stepped up in the future. To attract talented doctors to pursue a clinician-scientist career, a clearly defined and attractive career structure must be mapped out and, not least, their remuneration should not be any less than that of clinicians of equivalent seniority and experience. The recently introduced clinician-scientist career track for staff in the clinical departments of the Medical School is therefore most timely. With substantial time clearly marked out and protected for research activities, and their career progression based mainly on research performance, academic clinicians who are talented and interested in research now have the opportunity to realise their full potential as researchers, and to enlarge the much needed pool of clinician-scientists in Singapore. Productive collaborations between scientists and clinicians would set a new benchmark for multidisciplinary research, showing the way for moving discoveries and technologies from the laboratory to the real world, and making a difference to society at large.

For obvious reasons, we urgently need to strengthen translational research in the highly competitive biomedical science environment. If the constraint on the growth of clinician-scientists is the shortage of medical manpower in Singapore, it may be necessary to recruit from overseas, either directly into the clinician-scientist scheme, or to take up the slack in clinical manpower resulting from conversion

of full-time clinicians to clinician-scientists. In leading research universities with medical schools, the ratio of clinician-scientists to clinicians in a teaching hospital should be about one to seven.

Funding for both programmatic and investigator-initiated research should clearly be stepped up in proportion to the increase in available research manpower. While top-down programmatic research can readily find strong advocates, small investigator-initiated research projects should also be widely supported, provided they have been rigorously reviewed. This will give breadth as well as depth to the growth in research activities and further strengthen the research culture among doctors. Given the unpredictable nature of shifting research trends, some of the investigator-initiated research projects may well turn out to be the forerunners of new major research thrusts of the future.

To maximise the clinical value of strong growth in basic biomedical research and to realise our goal of becoming a significant biomedical hub in the world, translational research requires to be significantly strengthened. This involves the training and development of a sizeable pool of clinician-scientists, and a greater and wider awareness at all levels, including clinical colleagues, of the value and critical importance of translational research. Ultimately, adequate resources must be provided to support the desired level and range of translational research, and to ensure the protected time needed to carry out such research. A start in the right direction has clearly been made. The process needs to be strongly accelerated if we are to succeed in the highly competitive world of biomedicine.