Cost effective utilization of existing resources for biomedical research in India

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Development of novel therapies and diagnostic procedures for hitherto incurable diseases, in a cost-effective manner, is a pressing need of medical research. The postgraduate medical institutions in the country, with rich and varied clinical material, and research infrastructure offer a unique opportunity for multidisciplinary applied research to address these problems. These institutions also have manpower with appropriate qualifications, training and experience in biomedical research, and well-established departments of basic sciences. However, the scientific community is not making optimum use of these opportunities. It is quite common to hear that 'the scientists in India are handicapped in their pursuit, primarily due to lack of facilities for research'. Recently, a critical assessment of scientific research in the country, using SWOT (Strengths, Weaknesses, Opportunities and Threats) analysis has been reported[1]. Briefly, the strengths include, among others, infrastructure facilities built to desired levels, availability of top most expertise in many research areas, high-quality library facilities with modern communication technologies, and fairly adequate funds. Under-utilized scientific manpower and imbalances in research priorities have been stated as the top weaknesses. The opportunities include scope for reorganizing scientific manpower, vis-à-vis organizations, and promotion of team spirit with scientific temper; whereas personality clashes affecting the progress of research have been mentioned as one of the threats. The above-mentioned strengths can be taken as true in respect of the medical research institutions in India. Here an attempt has been made to analyse the possible causes, and their genesis, leading to ineffective utilization of existing resources by the scientists working in these institutions. A feasible approach has also been outlined for further improving the output of biomedical research – even with the existing infrastructure facilities and manpower.

Evolution of disciplines in biomedical sciences

There has been a tremendous increase in knowledge in every field of science. Starting with the landmark findings of DNA structure and the genetic code, there has been an explosion of information in biological and medical sciences in the past 50 years. As a result, the four traditional science subjects – zoology, botany, chemistry and physics – have evolved into a number of overlapping disciplines (biochemistry, genetics, molecular biology, immunology, biophysics, biotechnology and genetic engineering, to name a few). And there are well-established 'boundary disciplines' which are closely aligned to various specialties of medicine. The illustrative examples are radiation biology and radiation/medical physics, which overlap with genetics, chemistry, biochemistry and physics (among others), and are closely linked to radiation oncology, radiodiagnosis and nuclear medicine. Research and teaching in such disciplines is important for further progress in the fields of radioisotopes, radiosensitization and radioprotection, in relation to medicine, agriculture and defence. Cooperation among scientists across disciplines would lead to rapid overall development. On the contrary, no meaningful progress can be made by 'discipline focused approach to research'.

Dichotomy between placement and scope of research

The most plausible explanation for this situation can be found in the discipline-oriented approach to employment and job expectations vs the broad scope of biomedical research. Appointments in most of our institutions are made within the framework of specific departments – on the basis of academic degrees in particular disciplines. The ever-increasing body of information has given rise to specialization, and further super specialization of areas of research in each discipline. The research interests of scientists even from the same discipline could be different, which require specific equipment and facilities. Biomedical research activity has gone hi-tech, often requiring expensive equipment. Equitable sharing of equipment and facilities is the real issues in most of our academic and research institutions, which cannot be brushed aside or wished away. Moreover, scientists often prefer to use model systems with certain 'constant biological characteristics', which provide 'reproducible experimental conditions'. On the contrary, clinical material, coming from different patients could 'introduce large variations' or provide unpredictable results, complicating the tasks of interpretation, availability of specific reference literature and publication of the data. Above all, the intellectual satisfaction of 'doing one's own thing' would be much more, compared to 'the routine type of work'. Therefore, it is not uncommon to hear expressions like 'scientists should better pursue basic research', and 'no meaningful contribution can be made by getting involved in applied research'. There are additional factors, such as peer pressure to carry out research related to 'one's own discipline' and the related concerns for career advancement. Consequently, there is a lack of active interest – among some of the basic scientists from these institutions – in undertaking collaborative research in an area 'not directly related to their own discipline'. This could obviously lead to a situation wherein the other scientists – who might be constrained to fit in a given situation, or conform to 'certain prevailing norms' – get dissuaded from carrying out interdisciplinary research. It is common knowledge that the number of patients seeking subsidized healthcare in government-funded institutions like the National Institute of Mental Health and Neuro Sciences (NIMHANS), Bangalore and All India Institute of Medical Sciences (AIIMS), New Delhi is significantly higher than those seeking health care in medical centres in developed countries like USA, UK and western Europe. Therefore, the clinicians, in our medical institutions are mostly preoccupied with their clinical duties. In the absence of any initiative from basic scientists, active collaborations for preclinical research do not develop to an optimum level, leading to under-utilization of the overall available resources. This kind of situation might not be all-pervasive, but these contradictions do exist, to varying extents, in a majority of our academic and research institutions.

Basic or applied vs relevant research

It would be pertinent to discuss, in passing, a few points related to 'basic (or fundamental) vs applied research' in biomedical sciences. Is it possible to draw a definite line between the two? If so, at what point? And why make such an unrealistic attempt? For example, working with established cell lines derived from tumours in the laboratory can be (and is) considered 'basic research', whereas using cells from fresh tumour biopsies obtained from the operation theatre is not. This kind of straight-jacketed thinking is in total contrast to the 'multidisciplinary approach', which is indispensable to application-oriented research in medicine. An important contributory factor for this situation could possibly be the limitations imposed by persisting archaic notions, for example, 'academic disciplines have defined boundaries'. Therefore, it is imperative to dispense with this kind of contradiction between 'basic vs applied' research. The relevance and potential clinical application of research in a medical institution should be the primary objective of scientists working in medical institutions.

It would be relevant here to cite a few examples of scientist–clinician collaborations. Scientists from the Indian Institute of Science and Jawaharlal Nehru Centre for Advanced Scientific Research, Bangalore have been working on problems related to medicine, and also collaborating with clinical/laboratory medicine departments at NIMHANS. Some of the recent illustrative examples of patient-oriented collaborative research between basic sciences and clinical departments at NIMHANS include: stroke research (Neurochemistry and Neurology)[2], epilepsy and affective disorders (Neurophysiology with Neurology and Psychiatry respectively)[3,4]. Earlier, a multicentric phase I/II clinical trial on patients with malignant brain tumours was carried out in which clinicians and scientists from four institutions, including NIMHANS were involved[5].

It would appear, therefore, that the kind of research a scientist might choose – rather prefer – to pursue would depend on a variety of factors. Apart from the academic background and expertise, the mindset of an individual would obviously play an important role in this preference. The usually talked, and touted refrain of 'lack of facilities for quality research' would not be a critical factor, because preclinical research does not require significant additional inputs, as discussed briefly in the next section.

An approach for cost-effective preclinical research in medical institutions

The output of patient-oriented preclinical research could be further improved by creating a separate set-up for this purpose. An outline for setting up such an entity in a phased manner, without compromising the ongoing programmes is suggested here (Figure 1).

(1) In the first phase, one or more faculty members from basic sciences with research experience in area(s) relevant to the clinical specialties should be identified. These scientists must have the inclination to develop collaborative programmes with the clinicians. They should have a clear mandate, and submit outline of plans for research in association with other members from laboratory medicine and clinical departments.

(2) To facilitate cross-departmental interactions, some appropriate administrative coordination mechanism should be devised. For example, such scientists could be given functional autonomy, while being attached to any other department, purely for administrative purposes. Creation of an autonomous 'Unit', with clinician(s) as 'adjunct faculty' could also facilitate infrastructural support from national agencies.

(3) To facilitate the starting of preliminary experimental work without much delay, they might require certain basic facilities in addition to their existing resources. This could include certain small laboratory equipment and accessories, especially for extensive use on a routine basis. A research grant to cover initial requirements of specific consumables, etc. and some project staff for an initial period of one year would go a long way. In the meantime, they should be expected to get research grants for new research programmes from funding agencies.

(4) For cost-effective utilization of institutional and national resources, relatively more expensive equipment if required for occasional use and is accessible in the other laboratories, could be very helpful. The basic philosophy should be 'not to duplicate equipment and facilities from institutional resources'.

(5) In the next phase, more than one 'preclinical research laboratories or units', with functional autonomy, could be integrated into one entity. It could be named as 'Applied Research' or 'Experimental Medicine and Biology Section/Department', with an overall Coordinator.

The suggestions outlined here are also in line with some of the 'opportunities' mentioned in the SWOT analysis. Scope

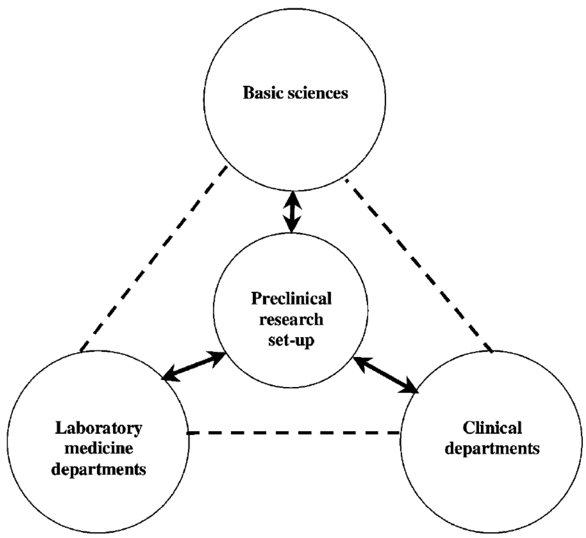

Figure 1. Stimulation of multidisciplinary preclinical research by a well-defined laboratory set-up in a medical institution.

for reorganizing manpower vis-à-vis organizations, promotion of team spirit with scientific temper, providing opportunities for achieving excellence, and accelerating inter- or multidisciplinary research are some of the relevant recommendations. Interestingly, such entities exist in virtually all the medical institutions in the developed countries. An illustrative example is the Brain Tumor Research Center, in the Department of Neurological Surgery, Medical School, University of California at San Francisco. The Post Graduate Institute of Medical Education and Research, Chandigarh, also has a Department of Experimental Medicine.

Outcome

This set-up will facilitate a comprehensive approach to pre-clinical research, rather than subject-specific investigations. It will lead to: (1) Systematic pre-clinical research in certain areas, and expansion of the existing programmes. (2) Evaluation of new ideas through exploratory experiments for pilot projects. (3) Such a set-up could result in active collaboration with, and financial inputs from the pharmaceutical industry. These entities will thus act as nucleus for application-oriented laboratory research, with minimum additional financial burden on the institutions. Moreover, establishment of such a set-up would ensure continuity of clinically relevant research with progressive modernization, as new facilities get added and more scientists join the institutions. The onus, however, is on the basic scientists, who opt to work in these institutions – to introspect and take the initiative for developing comprehensive research programmes. While those with relevant training and experience, as well as flair for preclinical research develop the laboratories, they would need all possible cooperation from their peers in several other ways.

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