GUEST EDITORIAL PREFACE

Challenges for Indian Medical Education in the New Millennium: A Concept Note

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The past 30 years have seen an exponential increase in new knowledge as it pertains to basic biomedical sciences. The genomic revolution is at hand and concepts derived from basic sciences are rapidly being translated into therapeutic approaches to cancer, heart disease and infectious disorders. Every medical professional is laboring under information overload. How should the medical education system handle the continuing increase in new knowledge in the basic sciences? Hence it is essential for medical educators to ask the question: "Is our medical curriculum adapting to these new realities?" A related but somewhat distinct issue is whether we are taking steps to educate and create a cadre of physician-scientists who are sufficiently adept in cutting edge research to take the lead in biomedical research? Each of these two issues is discussed separately.

ACTIVE LEARNING

The traditional curriculum in medical schools has been driven by the philosophy that physicians in training must acquire as much knowledge as possible during their training. This is based on the "noble" assumption that a physician must be able to handle any one of myriads of diseases that may be encountered .In practice this has meant that curricula, especially in pre clinical training, are heavily based on lectures. Typically, lectures are followed by memorization of notes by students. Of note, as will be addressed in more detail below, this method is based on "passive learning" where the Professor is the source of information and the student is a passive recipient, absorbing like a "sponge", and then regurgitating when examined. While this philosophy has served the medical profession for many years, it is no longer tenable since (1) it is clear that passive learning is not long lasting, and (2) it is virtually impossible for a medical student in 2011 to learn all that he or she may encounter in practice.

Medical educators around the world have been trying to come to grips with this problem in the past 15-20 years, and in many countries, particularly in USA, there has been a radical change in the way basic biomedical sciences are taught. In response to a rapid growth in

medical knowledge, the driving philosophy has shifted from trying to "stuff" facts into medical students to teaching them skills for lifelong learning. This is based on the premise that as medicine advances facts will change and hence those who have learned *how to acquire new* knowledge will be far more successful than those who have spent their time and effort in trying to master details that will be outdated within few years of completion of medical training. These considerations require that the teaching model be changed from "passive learning" to "active learning". *Active learning is not based on memorization of passively acquired factual information but application of self learned information in solving clinical problems*.

In this method the role of the teacher changes from a purveyor of facts to a facilitator of problem solving. The student is provided with a set of key resources (e.g., texts, internet), and clearly defined learning objectives. In such active learning the teacher generates learning objectives that serve as road maps for the student as he/she navigates through the texts and other resources. After such preparation the student is challenged to apply the knowledge in solving realistic clinical problems ("cases"). It is in the problem solving phase that the teacher plays an active role since he/she can bring to bear years of experience that cannot be acquired form text books. This method sometimes called "case based learning" forces the student to actively acquire factual information and then apply it in a setting that simulates practice of medicine. This case based model incorporates the principles that were initially developed for the so called "problem based learning" developed at McMaster in Canada. However, case based learning does not require a complete breakdown of discipline based methods. Furthermore, personal communications from many institutions suggests that unless PBLs are supplemented with lectures, basic science education tends to slip through the cracks. In addition, proper delivery of the PBL technique is very faculty intensive since ideally the small groups should not have more than 5-6 students.

Several questions arise when one thinks of implementing such a curriculum. Some are listed below: (1) how will the students learn without lectures? This is a common misgiving and is based on the assumption that students need spoon feeding. Firstly, the active learning method reduces but does not eliminate lectures. Secondly, the selection of medical students is intensely competitive and only the best are admitted. Experience (see below) has shown that if provided with clear objectives and good resources the students have no need for spoon feeding. In fact while this method is more demanding of the students it is also more satisfying since the student feels a sense of accomplishment upon completion of the course. (2) How will students complete the course of this intensity in the allocated time? This is indeed a time consuming process and the time involved in such preparation by the student will require the content of the course to be reduced. This is correct. The teachers will have to make judicious choices recognizing that if the students learn the tools for self education they will continue to add to their repertoire all their life. The objective is lifelong learning since no one can teach or learn all that needs to be known.

To understand why I am motivated, I would like to provide a personal background. I came to the USA in 1972 after having completed my MD in pathology under the tutelage of the late Prof. V. Ramalingaswami and Prof. MG Deo, by all accounts giants in Indian Medicine. I was fortunate in getting a faculty position immediately on arrival with no further training in USA and hence I have been actively teaching (and doing basic research, see below) in US medical schools for the past 39 years. Thus, I am a product of the Indian system but my thoughts have evolved. In 1979, I became coauthor of Robbins and Cotran Pathologic Basis of Disease (Kumar, Abbas, Fausto, & Aster, 2009) and Robbins Basic Pathology (Kumar, Abbas, & Aster, in press); together,

these are the most widely used pathology texts in India as well rest of the world. Currently, I am the senior editor/author of both.

After teaching for 23 years by the traditional method, in 1995, as the Associate Dean for Medical Education at University of Texas I along with my colleagues completely reorganized the teaching of pathology. I lead an 18 month effort by 12 professors to create an active, objective driven, case-based teaching model. In the process we created 100 electronic cases of common diseases as the substrate for teaching pathology and medicine. Each case has learning objectives, reading resources, a clinical history and images (Pathology, radiology, molecular biology) and serves as an electronic, interactive self learning tool. Because of requests from colleagues at other US, European and Australian institutions these cases are now available (on line) as a part of the two text books mentioned above. Two questions often arise when one considers electronic delivery of curriculum: the role of the faculty and other modalities of education such as bedside teaching. The curriculum we developed did not reduce the need for faculty since case discussions in small groups (10-15 students) requires faculty as facilitators but the role of faculty changes from lecturers to discussion leaders. This and other electronic curricula do not replace bedside teaching since the principles learned by such methods have to be practiced at the bed side.

It is my desire and hope that with the help of colleagues in India, a system that follows this teaching philosophy and is suited for needs of India can be evolved. The existing course work that I and others have used in the US over the past 15 years can be refined or modified to suit local resources and circumstances. I would seek to engage colleagues in India and start a local prototype project with the support of the Health Ministry and Medical Council of India. It could then evolve into a more complete project for use across the country and South East Asia.

TRAINING OF PHYSICIAN SCIENTISTS

Biomedical research is vital to the health of our nation and hence its growth and development need careful attention. It is heartening to note that after establishing itself as world class power in information technology India is beginning to invest in biotechnology. The model currently being followed is to establish Centers and Institutes of Excellence that are free standing (e.g., NCBS, TIFR, IISc, NIA). These institutes are populated by outstanding individuals with advanced degrees (PhD) in basic sciences and only infrequently by physicians. They offer world class PhD courses.

In addition to training superb PhD scientists it is also essential to train a subset of motivated medical students in basic research and create an elite cadre of physician scientists within the medical colleges. Such individuals would go through a special curriculum modeled after the MD/PhD program in the US. Under this a select group of highly accomplished and motivated students would be admitted into a combined MBBS-PhD program taking anywhere from 8-9 years to complete. While in the US students choose the MD/PhD pathway at the time of admission, it is proposed that in India the selection of such candidates should occur after the students have completed basic science courses since students in India unlike their counterparts in the US enter medical colleges at an early age before they have obtained a college degrees and are thus somewhat less mature. The number of the MBBS/PhD students would be restricted to about 10% of the class. Experience in the US has shown that no more than 10-15% of the students entering medical schools have the aptitude for such a track. Having an MBBS/PhD program does not obviate the need for modern basic science education for all MBBS students. Many such efforts, pioneered by my mentor, Dr. MG Deo are taking root in India and ICMR is supporting such

efforts. There is additional need to strengthen the training of every medical student in modern biology and sciences. Although not every MBBS should become a basic researcher but every one of them should have an enquiring mind and be inquisitive.

Those with dual degrees would be uniquely qualified to apply the power of modern biotechnology to understanding of disease mechanisms and formulating novel therapies. On the one hand as physicians they would have a deep understanding of human diseases and on the other hand as professionally trained scientists they would have had hands on training in basic biomedical research that can be applied to solve medical problems. Their insights would be unique and not shared by those trained only as physicians or as scientists. Eventually one hopes that the next generation of leaders of biomedical research would emerge from the ranks of this group.

How could such a program be implemented in the Indian context? Given that the resources that the country can devote to biomedical research must be wisely spent, one would not copy the US system where elite medical schools have invested considerable resources in building the infrastructure for research. It would be more cost effective to team the free standing research institutes (such as NIA, TIFR, NCBS, CCMB, Certain IITs) with those medical colleges that have some infrastructure and human capital. The medical training would occur at the medical institution whereas research would take place in the laboratories of the research center.

Such pairing could be, for example, between NCBS and Bangalore based medical colleges, CCMB and Osmania. There are other examples as well. The participating institutes would not dilute their agenda but instead create something new and exciting by synergy. Such a program would require a new curriculum but since there are many such programs in the US, this should not be hard to create. I believe all the important ingredients are already in place and the major effort will have to be to ensure inter-institutional alliances in which all stakeholders commit to the development of such a program.

As indicated earlier these ideas have emerged from personal experiences starting from my training in India. Prof. Ramalingaswami was a model physician scientist, having been trained as a physician in India as a scientist with a PhD from Oxford. I could see the power of such training in his career and he went on to influence Indian biomedicine beyond the narrow confines of his personal training in nutritional biochemistry. Having learnt both pathology and research from him was a privilege. Despite the fact that my research with him was on malnutrition, the principles that I learned from him and my co guide Dr. MG Deo (another superb physician-scientist, former Director of Tata Institute for Cancer Research Mumbai) served me well as I started my own laboratory in US devoted to basic immunology research.

In the past 39 years I have trained not only many PhD students but also MD-PhD students. I have personally seen how my training in research and medicine has benefited me. I am active in the MD-PhD program at University of Chicago and truly believe that a physician-scientist training program will provide immense benefit to India and ensure that the link between the practice of medicine and modern biomedical research is maintained.

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curriculum and translational research have been addressed in published scholarly papers. These issues have not been discussed in this commentary for sake of brevity and focus. Conflict of interest: Some content of this paper has been shared with different stakeholders in the past (such as Indian medical educationists, government and public) and will be shared widely also in the near future strictly to promote further progress of medical education.

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