2005 Runme Shaw Memorial Lecture: Training Doctors for the 21st Century – A Global Perspective

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Introduction

Over the last 200 years, Western medicine has gradually spread across the globe, and has either been replaced or become integrated with traditional systems of medical care. Much of this expansion occurred during the colonial times. For example, Western medicine was introduced to Singapore by Thomas Prendergast, a surgeon who accompanied Sir Stamford Raffles when he landed on the island in 1819. In 1905, the Straits and Federated Malay States Government Medical School was founded in Singapore. In 1912, the School received support from the King Edward VII Memorial Fund and in 1921, it became the King Edward VII College of Medicine. In 1949, the College of Medicine amalgamated with the Raffles College to become the University of Malaya, and became its Faculty of Medicine. In 1959, the University of Malaya established two autonomous divisions, one in Kuala Lumpur, the other in Singapore. Further changes occurred after Singapore became an independent republic in 1965.

Medical education evolved in a similar way throughout Southeast Asia, with the possible exception of Thailand. Here, through the efforts of Prince Mahidol of Songkla and his successful negotiations with the Rockefeller Foundation, medical practice and teaching became more closely related to the American rather than the British pattern, although basically they are much the same.

Although Western medicine, because of its strong scientific tradition, has led the way towards many medical advances over the last 100 years, the evolution of medical education under this system has left in its wake a number of problems, particularly as we move into the new millennium. I shall touch on only two of these briefly: the role of science for the education of doctors of the future and, perhaps more importantly, how in training young people we can develop a more global view of medical research and patient care.

This lecture is based in part on a recent article on the relation between science and medical education, which discusses some of these topics in greater detail.[1]

The Development of the Scientific Basis of Medical Education

To fully appreciate the troubled partnership between science and clinical practice in Western medical education in the 20th century, it is helpful to trace the way in which medical schools and the education of doctors evolved in this period. It will only be possible to outline some of the major changes here; an excellent account of these developments is given in the monograph of Bonner.[2]

Beginnings

In the second half of the 19th century, particularly in France and Germany, major developments occurred in the organisation of the medical sciences. University-based laboratories were springing up in which men and women could devote their time to research and teaching in the blossoming basic sciences, notably anatomy, physiology and, later, biochemistry. In 1867, Johns Hopkins, a rich businessman in Baltimore, USA established Johns Hopkins University, whose first President was Daniel Gilman. Gilman had spent time in the University of Berlin and was later responsible for initiating the Johns Hopkins Hospital and its medical school, designed along the lines that he had observed in Europe. Departments covering the basic medical sciences were developed and a well-organised premedical and graduate training course followed, named the Chemical/Biological Program. Pre-medical students at Johns Hopkins were advised to complete courses in physics and chemistry before proceeding to the course in biology. Later, outstanding clinicians like William Osler were recruited and the concept of specialist clinical departments with full-time professors was established.[3]

In 1910, the American educator, Abraham Flexner, who had also travelled widely in Germany, wrote a withering critique of medical education and science in North America on the basis of his visits to German universities. Apart from Johns Hopkins, he felt that the organisation of medical education in American schools was falling far behind that in Germany. His report recommended that medical

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education begin with a strong foundation in the basic sciences, followed by the study of clinical medicine in an atmosphere of critical thinking with adequate time and facilities for research. Flexner's views on medical education in Britain were equally jaundiced, with the possible exception of the University of Cambridge, where early developments in some of the basic biological sciences, if not clinical teaching, may have impressed him.[4]

There was little progress in applying Flexner's model in Britain until after the First World War, at which time George Newman, the Chief Medical Officer of both the National Board of Education and the Ministry of Health, made a strong case for a university course in medicine requiring an effective interrelationship between studies of laboratory science and the clinical practice of medicine. He stressed that both activities must take place under the same roof and be conducted by university professors.

But although the establishment of distinct departments in the individual basic sciences undoubtedly had a major effect in developing medical science, it tended to dissociate the scientific basis of medicine from clinical practice, particularly in the minds of medical students.

In the period after the Second World War, the pattern of Western medical education was more or less the same across most medical schools. There was a first MB course which covered chemistry, zoology and botany, although students who had reached high grades in these subjects at school were often exempted and went straight into the second MB course. They then spent 2 years during which they dissected the whole body and received instruction in physiology, biochemistry and, in some cases, psychology and related subjects. Those who managed to survive the rigours of the second MB examination then proceeded to the final MB course, which was divided into various stages, starting with pathology and bacteriology and proceeding to clinical training on the wards. The situation in some USA universities was slightly different, in that students had 1 year of the basic biological sciences and 3 years of clinical training, during which there was an effort to integrate physiology and biochemistry with their clinical applications.

Overall, this approach to training doctors did not provide them with a genuine understanding of the importance of the basic medical sciences for clinical practice. Because very little effort was made to relate physiology or biochemistry to disease, many students felt that their first few years at medical school were wasted; they had come to be trained as doctors and yet their lectures and practical classes seemed to have no relevance whatsoever to sick people.

There was another difficulty with this dissociation between teaching the basic sciences and clinical medicine that has not been widely discussed. Possibly because many of those who taught the preclinical sciences to medical students perceived the lack of interest or understanding of their relevance, they often presented their fields in an over-simplified and didactic way. This approach often left students with the impression that the basic biological sciences comprised a well-defined base of solid and completely substantiated knowledge. Hence, they were often totally unprepared for the complexities and uncertainties that they encountered in sick people as they entered their clinical years. In short, they moved from a tidy, well-defined world into one in which the infinite and often inexplicable manifestations of illness seemed completely at odds with what their narrow perception of the biological sciences would have predicted.

Curriculum Reforms

In the latter part of the 20th century, there was a major rethinking about medical education. In the USA, Case Western Reserve University initiated an organ-system-based curriculum, in which the old divisions between pre-clinical and clinical teaching were swept away and attempts were made to integrate the teaching of both the basic and clinical sciences throughout the students' careers. And there were other major changes in the patterns of medical education. Pioneered by McMaster University in Canada, and based loosely on modern educational theory, students were encouraged to teach themselves with the support of the faculty using a problem-based approach. One of the major objectives of problem-based teaching has been to present the basic sciences from a clinical viewpoint through a process of small-group, self-directed learning. In the early 1980s, Harvard Medical School developed a completely new curriculum based on these principles called the "New Pathway Project". As well as a problem-based approach, it offered those students who were appropriately motivated the possibility of a considerable exposure to research during their training.[5] Similar approaches to a more integrated type of medical education were developed in the UK at the same time, particularly in some of the more recently established medical schools.

On both sides of the Atlantic, there were other developments which encouraged a more focused interest in the scientific basis of medicine on the part of students. Many medical schools in the UK provided intercalated BSc courses between the pre-clinical and clinical years, a facility which had been available for many years in Oxford and Cambridge, and so-called "MD-PhD programmes" were developed in the USA. These involved a truncated period of clinical teaching combined with several years of research and research training directed towards the PhD part of the qualification. A few courses of this type were subsequently offered in British medical schools. One of the worrying features of the MD-PhD programmes, particularly in the USA, was that many students trained in this way went into full-time research and the objective of producing physician-scientists was not always achieved. Although a great deal of thought was given to establishing such courses in Oxford, we felt that it was better for young people to complete their formal medical training, gain a few years of clinical experience, and then return with a research fellowship to work towards a PhD, once they had developed some ideas about the direction of their future careers. This approach has certainly produced some outstanding clinical scientists who have remained in touch with medical practice.

Based presumably on increasing concerns about the more humane and pastoral aspects of medical care, the UK General Medical Council (GMC), in 1993, under the title *Tomorrow's Doctors: Recommendations on Undergraduate Medical Education*, demanded sweeping changes in the way in which doctors are trained in the UK.[6] While incorporating some of the reforms that had been initiated in the USA, this report went much further: exposure to patients and their families from the beginning of the course; more emphasis on communication skills, ethics, social sciences, and the humanities; less emphasis on the basic medical sciences, which should be spread right across the course; and much more emphasis on the pastoral aspects of medicine and medical care. Although admirable in many ways, the GMC's requirements, coming as they did at a time of rapid expansion in the basic medical sciences, posed increasing problems for medical schools that wished to maintain a very strong science base.

The Future

It seems important to re-examine the belief that exposure to science is important in training and doctors of the future. If it really is, and particularly in the light of the massive expansion of scientific knowledge in the biomedical field, we will have to try to define those areas that are of genuine importance, and to ask, yet again, whether we are pursuing the most effective way of combining the education of science with clinical practice. Even more important, we need to discuss how we can produce more caring doctors with a much more global perspective of medical care.

The Role of the Basic Biological Sciences

The standard answer to why students need a strong base of biological sciences is that it is not possible to understand the pathophysiology of disease without some perception of normal function. In addition, an early exposure to basic science provides them with a lifelong critical approach to medical advances and their application. While there is a good deal of truth in both these arguments, they are only part of the story.[7,8]

Modern developments in the study of disease at the cellular and molecular level have emphasised the quite remarkable individuality of our genetic make-up and hence our responses to our environments. Particularly in a world dominated by medical information derived from mega-trials, the central importance of the patient as an individual is often lost; surely this is far less likely to happen if doctors really appreciate the evidence for biological individuality.

The other issue that has been highlighted recently by the biological sciences is the multi-layered complexity of all living things; sick people are no exception. As pointed out by Francis Crick,[9] unlike in the physical sciences, Occam's razor, that is, taking the most straightforward route to solving a problem, is an extremely blunt instrument when applied to biological systems. We still understand very little about the infinite diversity and stochastic basis for many biological processes that surely must be even more complex in sick organisms. If students can understand these uncertainties early in their careers, it should engender a state of humility in their approach to sick people and, *pari passu*, reduce the degree of self-certain pomposity that has characterised the medical profession over many centuries, and which, incidentally, has been the basis for much of the criticism to which it has been exposed of late.

In short, a sound knowledge of scientific methods, combined with an appreciation of the extreme complexity of biological systems, should provide an adequate background for students entering any branch of medical practice and, at the same time, offer stimulation to that small handful of young people who will go on to become medical scientists and help to develop clinical practice in the future.

What Kind of Science?

Although many of the basic medical sciences can be integrated into organ- or problem-based approaches to learning, there is a good case for a short introductory programme in molecular and cell biology, information technology and the social sciences. During this period, it would also be extremely valuable to provide students with some inkling of the history of the medical and biological sciences. For example, if they were exposed early in their careers to simple accounts of the changes in medical practice that followed the development of vaccines and antibiotics in the mid-20th century, and to the famous study of Comroe and Dripps,[10] which showed that a high proportion of the remarkable advances in cardiological care in the latter part of the century were based on curiosity-driven science that was not directed at particular clinical goals, they might appreciate much better the value of the basic sciences for medical practice. Similarly, if at the same time, they were exposed to the work of authors like Ernst

Mayr,[11] who defined the central questions of biological knowledge as a series of layers of increasing complexity, they would undoubtedly be better prepared for the problems that will face them in the wards.

There is no reason why an introductory course of this type should not be combined with early exposure to patients, the acquisition of communication skills, and other early experiences directed at turning students into caring doctors. Nor is there any reason why some clinical examples should not be integrated into their basic training in molecular and cell biology. A short period of focus on science, combined with some exposure to the history of the medical and biological sciences, would give them a much better appreciation of the importance of science in the integrated courses which were to follow.

Ideally, the basics of anatomy, physiology and biochemistry should be integrated in a problem- or organ-based approach. Although this is very demanding on staff time and organisation, it is the only way forward if we are to try to integrate the basic and clinical sciences in the future. However, although this should be the central model of medical education, there are many ways in which this type of integration can be achieved; medicine is such a diverse profession that it would be wrong to drive our medical schools into a state of stultifying uniformity. And in attempting to develop a core of knowledge based on integrated teaching of this type, it is vital that the curriculum does not become so overcrowded that students lose those valuable hours spent on the wards talking to their patients and their relatives; communication can only be learnt by talking to real people, not actors in studios.

In short, as well as early exposure to patients, students need a short background course in the history of biological and medical research, combined with a basic understanding of the principles of molecular and cell biology and information technology. After this, in one way or another, they should learn the principles of pathophysiology using an organ- or problem-based approach or some modification of these well-tried methods. Throughout their training, they must be given the time to spend with their patients and families, both in hospitals and communities.

The Caring Doctor

As the molecular era adds further layers of complexity to our understanding of both normal biological function and disease mechanisms, and with the development of increasingly complex information technology, we will no doubt go on meddling with the medical curriculum year by year. Some years ago I tried to summarise our problems as follows: "The principal problem for those who educate our doctors of the future is how, on the one hand, to encourage a life-long attitude of critical, scientific thinking to the management of illness and, on the other, to recognise that moment when the scientific approach, because of ignorance, has reached its limit and must be replaced by sympathetic empiricism. Because of the dichotomy between the self-confidence required at the bedside and the self-critical uncertainty essential in the research laboratory, it may always be difficult to achieve this balance. Can one person ever combine the two qualities? Possibly not, but this is the goal to which medicine must aspire".[7,8]

Certainly in the UK, and in many other countries, there has been increasing concern about the lack of sympathy, ability to communicate, and all the other skills that make up a good doctor. In part, this undoubtedly reflects the enormous increase in workload on doctors, and the fact that no country has developed a simple healthcare plan which has been able to deal with its spiralling costs, particularly in the elderly populations. Thus, as well as developing a strong science base, it is vital that our students of the future are exposed to the teaching of the skills of communication, good clinical methods, and all the other things that go to make a good doctor. Although there are many reasons why the quality of medical practice seems to have declined, it is undoubtedly true that medical education has not focused enough on these issues over recent years. But each society, according to its own cultural differences, will have to decide how best to put things right.

Globalisation of Medical Education

Hitherto, medical education has been directed at the narrow needs of the particular communities that the doctors will serve in the future. As we enter the new millennium, this is not good enough.

As we enter the new millennium, about 70% of the 40 million people affected by HIV/AIDS live in countries with completely dysfunctional healthcare systems. Tuberculosis has re-emerged with 9 million new cases and 2 million deaths each year, and similar death rates are occurring from malaria. Although the gross domestic product in the developing countries grew by 1.6% per year in the 1990s, most of this progress occurred in Asia. In other regions, the level of poverty increased, and it is estimated that 150 million children in low- and middle-income economies are suffering from malnutrition, and unless the situation improves, a similar number will be underweight in 2020. To add to these problems, countries that have passed through the epidemiological transition from infectious to non-infectious disease are already encountering major epidemics of the diseases of Westernisation; it is estimated that by 2025, there will 300 million people worldwide with type 2 diabetes, yet less than 10% of global spending on medical research has been devoted to diseases that account for 90% of the global disease burden.

As I pointed out recently,[12] the time has come for the medical schools of the richer countries to start to broaden their education programmes to take account of the problems of the poorer countries. Unfortunately, however, with a few notable exceptions, there is still little evidence that this is occurring.

It is vital, therefore, that the curriculum of medical schools everywhere takes on a much more global approach to medical education. Students should be taught the principles of global health, particularly, the public health and epidemiological aspects. And they should be encouraged to spend time in different countries during their period at medical school. To this end, the most effective approach would be the development of sustained partnerships between universities in the rich and poor countries with constant exchange of staff and students. If these partnerships also contain a strong research element, certainly from our experiences with several of these developments in Oxford, they will be of enormous mutual benefit to both parties. Of course, programmes like these will need some funding and it is vital that our universities make the case to their particular governments about the value of sustained partnerships of this type as part of overseas aid programmes.

The current divide between healthcare in the rich and poor countries is a disgrace to mankind. Our students of the future must be made to appreciate this and, by developing sustained partnerships of this kind, medical schools in the richer countries can do a great deal to help to improve the situation, provided their governments see the value of this approach.

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