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# THE FUTURE OF MEDICINE

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**M**Y theme is time and change—those aspects of the practice of medicine which change, which fail to change and which perhaps must remain unchanging. This is the oldest Pathological Society in Great Britain. When it was formed in 1841, the partnership between basic scientist and inventor was transforming our society in an unprecedented way; 10 years later, in 1851, the Great Exhibition was staged in celebration of the new technology. The growth of this technology had altered for all times the way men lived, the way they related one with another, the way they experienced the world.

### Morbid anatomy and medicine

The medicine of the mid-nineteenth century was dominated by the study of morbid anatomy; France was the intellectual capital and, under the influence of Bichat and those who followed him, the march was on to classify diseases by morbid anatomy. Diseases were no longer named after their visible manifestations, like scarlet fever or smallpox, nor after the theories which it was believed caused them, like rheumatism or malaria. Diseases were now named after their internal and hidden appearances, and words like emphysema, lobar pneumonia and aortic stenosis came into fashion. Morbid anatomy and pathology dominated the thinking of the medical profession.

#### *Mr Lydgate*

George Eliot's Lydgate in *Middlemarch* (1871) might easily have been a founder member of this Society. She writes of him: "Of this sequence of Bichat's work, already vibrating along many currents of the European mind, Lydgate was enamoured; he longed to demonstrate the more intimate relations of living structure . . . and the dark territories of Pathology were a fine America for a spirited young adventurer."

Lydgate was a man of the future, a man of professional enthusiasm driven on by the spirit of his times.

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\*Based on the Annual Oration of the Reading Pathological Society, delivered October 1980.

He wished above all things to be rational, to be scientific, to move away from the red-bottle and blue-bottle dispensers who believed in either the strengthening regime or the lowering regime. George Eliot describes the discoveries of pathology in the nineteenth century in terms of the coming of light to the dark streets of Victorian England. She wrote: "And the conception wrought by Bichat . . . acted necessarily on medical questions as a turning of gaslight would act on a dim oil-lit street, showing new connections and hitherto hidden facts of structure." Like a true visionary, she saw beyond the pathology of tissues the hope of another pathology, cellular structure; she wrote: "Here would be another light, as of oxyhydrogen showing the very grain of things and revising all former explanations." This was the hope which George Eliot held out for Lydgate, the new general practitioner. How far has the hope been fulfilled? To what extent did that hope, shared so widely by the profession, work out in the development of medicine as a whole and general practice in particular?

Lydgate's hopes were vested in a view of medicine from the post-mortem room and the microscope. For the rest of medical history until the present day, the great discoveries of medicine were to be made largely in relation to these preoccupations. The thrust of medical thinking and research was henceforward to be vested in enlightening the structure and function of diseases defined by pathology.

### A seminar in 1980

During a seminar on general practice held in my department last month, the following two stories were presented. I want you to read these two case histories with an eye to something more than diagnosis and management. I want you to hear the music of our times in the stories that they tell. These cases are modern. They are as contemporary, as resonant of our culture as the image of the singer Hazel O'Connor, or the music of The Jam.

Bella is a young woman of 18. Her periods began when she was 15, and a year later she went to see her doctor because they had become irregular, painful, sometimes heavy, sometimes scant. He gave her some norethisterone tablets, but these

made her feel uncomfortable and her periods then became much heavier. At the consultation, which was witnessed by my student, the doctor suggested that he could regularize the periods and reduce the loss by giving her an oral contraceptive. Bella refused.

Amy is 38. She is a self-contained woman, very down to earth, asking only for a repeat prescription of her tranquillizer. Her notes revealed that in her early 20s she was thought to be suffering from anorexia nervosa. Eventually she had a child. There followed a series of consultations concerned with recurrent migraine: she was taking an oral contraceptive and, despite many changes in the combination of drugs, her migraine became insupportable. Three years ago, at the age of 35, she underwent a tubal ligation. After this her periods became heavy, although physical examination revealed no abnormality. The laboratory revealed no anaemia and, after a curetting, histology showed only a normal endometrium. She underwent a hysterectomy a year later. The ovaries had been described as "looking cystic" and had been removed. Since then she has been a less frequent attender at the surgery, feels that she copes with life better, but needs to go on taking a small dose of tranquillizer.

Consider the problems facing a small group of 1980 medical students struggling to come to terms with Bella and Amy. What are the conceptual tools which a modern medical education has given them? How will they understand Bella's faltering menstruation, or the reason why Amy, in her mid-30s, was first sterilized and then given a hysterectomy? What is the disease for which Bella would not take an oral contraceptive? What is the disease which was answered for Amy by 2 mg diazepam at night?

The structure and function of the modern medical school was determined long ago. It was not the Apothecaries' Act of 1815, setting up a closed shop for medicine in the name of a rational training, which set the seal on the educational experience which now prepares my students for practice in the twenty-first century. Nor was it the professional structures created and the quiet arrangements and deals struck by the 1858 Medical Act. The true origins of the modern medical school lie in the eighteenth century and in the development of the hospital as the major location of medical care and medical thinking. Foucault (1973) describes the hospital not only as a place where sick people may be gathered together and studied, but also as the origin of a method, a medical way of looking at illness. This method was put to good effect by François Bichat, that same Bichat whom George Eliot describes as lighting the path of the young Lydgate, and who succeeded in explaining diseases in terms of the pathology of tissues. Sydenham had first directed the gaze of the doctor to the external surfaces of the patient and to the rapid march of events in the fevers. Now Bichat showed that there were many interior surfaces which the doctor must observe—although the observation at first could only be made in the corpse. It was Laënnec, with his invention of the stethoscope, who began to open up these interior surfaces.

Medical education began with walking the wards. Clinical method, still little changed today, begins with

careful observation of the sick person; it proceeds to a search of the hidden and interior surfaces of the patient. Yet, in essence, "This medicine could only fully develop its language and its imagery in the dead body revealed in the post-mortem room" (Foucault, 1973). It is the inability of this imagery and language to describe the illnesses of Bella and Amy that constitutes one of the major challenges of contemporary medical education.

Just when this became a challenge for medical school teachers is difficult to date. It is clear from the descriptions of Lydgate and his fellows that no such disjunction between medical education and medical practice existed in the nineteenth century. But by the 1920s James Mackenzie could write (Mair, 1973):

"I left college under the impression that every patient's condition could be diagnosed. For a long time I strove to make a diagnosis . . . without avail. For some years I thought that this inability to diagnose my patient's complaints was due to personal defects, but gradually through consultations and other ways I came to recognise that the kind of information that I wanted did not exist."

### *Culture shock*

Contemporary sociology, not medicine, has given a name to this phenomenon—culture shock. By this, sociologists mean that persons who are rapidly transported from one culture to another may become disoriented and distressed by the absence of familiar social landmarks. Expectations about roles, relationships, obligations and rights must be relearned and renegotiated. Old assumptions do not hold; the very rules of the game have been changed.

The contemporary tradition of medical education is still rooted in Lydgate's hope that the gaslight would give way to the oxyhydrogen light, and that more would be revealed of man's dark interior. The prizes which medicine has won from this belief have been impressive. These modes of medical thought have made possible the chemical control of metabolic disease, surgery of the deepest reaches of the body, the unravelling and control of infection and so on. Yet even as we are dazzled by the successes, the journey from the hospital ward to the general practitioner's consulting room leaves the medical student and the general practitioner searching desperately for that scaffolding of pathology without which the hospital could not have been built, nor modern medicine imagined.

### **The future**

Alvin Toffler (1970) has published his predictions for the future of our society under the title *Future Shock*. His thesis was that technological changes on a hitherto unprecedented scale are about to change the lives of us all. His writings suggest that there are three aspects of this change that should command our attention.

First, the technical innovations which we are exper-

encing in the last decades of the twentieth century are of a new and different order from the technologies of the last 200 years. Second, because of the nature of these technologies, the spread of their effect may be different from what we experienced in the first industrial revolution. Then, technology began to make itself felt in the areas of work and transport. Our concepts of home and family changed as a secondary effect of this industrialization. The new technologies, like charity, may begin at home. Third, again as a consequence of the nature of these new machines, the pace of change will be unprecedented. All of us have begun to absorb this steep geometric progression of change into our ways of looking at the world and dealing with it.

If we look at the future simply as an extension of the past, then Charlie Chaplin's prophetic film *Modern Times*, made in the 1930s, and George Orwell's satanic *Nineteen-Eighty-Four* are precisely what we may expect. But Toffler and other interpreters of our current situation, like McLuhan (1962) and Stonier (personal communication), give us a totally different vision of what is to come. I find their arguments persuasive, and I want to look now at the implications for medicine and medical education of these coming events.

When I visited America in 1973, most of the medical academics whom I met were agog with what Toffler had to say about our futures. My response then was disdainful. I had just been appointed to a chair in England's newest medical school, and I told them that I was far too preoccupied with the problems of the present to worry about the worlds of science fiction, or about Toffler's prophecy of future shock. The future, I said, will have to look after itself: it has been doing so for a very long time. What I had not yet perceived, what now preoccupies much of my thinking as a medical school teacher, is that the future, already so different from anything that we had experienced in the past, was no longer obeying the chronological laws of history. The future had already begun a little time ago.

### *Predictions*

For me the arrival of the new age is celebrated in a recent television commercial for the Fiat Strada. Two stunning events collide in those few seconds of television imagery and are changing our society. No teacher of future doctors dare ignore either the medium or the message.

The advertising sequence shows the assembly of the new motor car executed almost entirely with computer-controlled robotic tools. The message is clear. In the future, productive industry will require very few people. Opinions on how these changes in our manufacturing industries will affect society differ widely. My readings so far suggest that futurologists can be divided into two camps.

The scientists and technologists are full of hope. They see a society in which there is a mass migration from productive to service industries. Stonier (personal communication) has gone

so far as to predict that some 50 per cent of employees in our society will in some 20 or 30 years' time be working in services concerned with health. He sees health as the growth industry of the next decades. These techno-forecasters go on to describe a world in which most of the problems of production which have dominated our thinking about the shape of society, our relationships with one another, our economic planning and our political affiliations can already be solved. Experiments being carried out now suggest that wave power, wind power and, to a lesser extent, solar energy will allow us to conserve our fossil fuels as a chemical resource. Increasingly the production of new materials will depend less on chemical engineering and more on genetic engineering. The coliform bacillus will be transmuted into the new production plants of ICI Limited. These predictions are contained within current research and development. They are short linear extrapolations from what has already been achieved. The predictions of the techno-futurologists suggest a world in which all our old preoccupations will change. Something will replace the archaic dialogue between food and hunger, wealth and poverty, employment and unemployment, resources and production. We are promised a world of unlimited plenty and its achievement is predicted almost within the lifetime of those students who enter medical school this year.

But there is another, darker vision of the future. It is made by the socio-futurologists, who present us with a disturbing and more immediate scenario. In discussing this I shall be talking about our own society, although there are larger and more terrifying implications for the developing world.

It may be that our present level of unemployment in the United Kingdom is an economic artefact. However, as the new technologies continue to make redundant not only unskilled labour but also those crafts and skills without which the first industrial revolution would have been impossible, it is likely that unemployment will grow exponentially. In contrast with the optimism of the technologist, the social scientist views the coming decades with foreboding (Donnison, 1980). The post-war development of tower-block neighbourhoods has created satellites around great cities which are in the process of becoming alien states. The tower blocks themselves are built out of all scale to man's biological and social development and appear as alien to us as the nineteenth-century city slums did to the Victorians.

The neighbourhoods of high-rise flats, satellites disconnected from the amenities of the city centre, often miles from the industrial estates, have become penal colonies for the long-term unemployed. The gutters between the mean and overcrowded back-to-backs of the first industrial revolution were slippery and stinking of ordure underfoot. In the high-rise flats of today, the wind howls down the vertical shafts, the lifts break down or are vandalized and, in place of King Cholera, alienation and disaffection breed a new disease for the end of the twentieth century. When winter comes and the underfloor electric heating is disconnected, the most expensive sort of heating which we have so far been able to devise, there are no fireplaces to burn the furniture nor chimneys to carry away the smoke. As the violence which society inflicts on these people is translated into outbreaks of personal and mob-hooliganism, what role will medicine have to play? Where is the Chadwick of the 1980s?

### *The information revolution*

Both these visions of society are implied in the Fiat Company's television advertisement. Yet in many ways these pictures and messages are much less important than the impact of the medium, of the television screen itself. It is for this reason that I wanted to use the Strada

advertisement as a symbol for the future which has already begun. What I have just described, the growth and possibilities of technology, the dangers of a fragmented and warring society, provide a backcloth for the medicine which our 1980 medical students will practise. But the medium itself, the electronic images on the screens in our living-rooms, contains the biggest surprise of all.

The decision taken in the 1970s by the French Telephone Company to scrap their printed directories will certainly seem, to future medical historians, a much more important event in the development of the new medicine than, say, Christian Barnard's first heart transplant operation. In the future French telephone subscribers will be able to parley directly with an electronic communications system capable of furnishing them with directory information on a video screen. The introduction into this country of Prestel and similar systems will have the same effect of allowing home access to a vast and increasing library of data through the medium of the television screen. What is prophetic about the French innovation is the scale of their operation. Once telephone numbers and addresses can be accessed, so can any other kind of information.

The parallel development of the micro-computer is already with us. Quite small general practices are already experimenting with primitive models—more advanced hardware and software are announced almost every week. Projections suggest that the acquisition of these micro-computers for the home has already begun and will follow a very similar trajectory to the sales in past decades of colour televisions and hi-fi. They will become the norm in middle-class homes within a decade, and within most homes a few years after that. The effect of this new information explosion is likely to be more widespread and have more social impact than the invention of the Gutenberg press. So important is the development of this new information technology that I want now to spell out six key aspects and consider their relation to the development of medicine.

### *1. Scale*

First, information which will be available on our television screens through Prestel and the micro-computer will have enormous depth and range. The technology already exists to transfer every printed page in the British Library to our television screen. I make no mention of the prodigious problems in indexing and handling such an encyclopaedia, but I want to look for a moment at the range of medical information which can now be available to us by manipulating a handful of keys. It now becomes possible for the practising doctor to see at a glance the descriptions of clinical phenomena, the range and characteristics of all current medication, the range and interpretation of laboratory investigations and so on. Two things change: first, the concept of the library and, second, the importance of memory. Memory played, and still plays, a very large part in medical education. The non-surgical specialist is largely valued for his ability to remember and correlate data in relation to his specialty. What happens to this expertise, how do clinical skills change, when the electronic recall of facts becomes infinitely superior to cerebral recall?

### *2. Updating*

The second key aspect concerns the up-to-dateness of the information. For a long time we have been aware that the textbook cannot keep up-to-date with current medical discoveries. The review article in journals presents us with problems of retrieval; the attempt to provide loose-leaf textbooks which are updated two or three times a year is a brave but transitory attempt to solve the problem. With systems like Prestel, new information can be constantly fed into the system.

### *3. Interaction*

The third aspect concerns the interaction between the information and the person who wishes to be informed. Electronic information will allow a new dialogue between the perceiver and what is perceived. A simple example is the taking of history by computer. Experiments have already shown the high degree of reliability and validity of this method. Parallel with these experiments has been the construction of diagnostic programs—for example, concerning problems like abdominal pain or thyroid disease. The evidence here is that the computer, interacting with a relatively inexperienced doctor, is able to produce results comparable with those of an experienced doctor, working without a computer. An experienced doctor working with the computer achieves very enhanced results.

More exciting still has been the development of interactive learning with the computer. Here it is not only facts which the learner can access, but his problem-solving skills can also be developed and assessed. Our children are already learning to use these machines; our own inability to use them and to shift the mode of our thinking from an essentially literate to an essentially numerical language creates a gap between learner and teacher which widens into a gap between cultures.

### *4. Access*

The fourth aspect is the universality of this information. The television screen is already a part of almost every home in this country. High court judges or presidents of Royal Colleges may count themselves among the non-viewers, but there are few others. The importance of the French government's decision to install Prestel-type apparatus with every telephone is that it points to a new universal access to information. The whole of our society can now have a library ticket to the British Library and the Library of Congress. For medicine this has a particular implication: although efforts may be made by the invention of secret codes to keep medical information from the lay public, these exclusions are unlikely to succeed. The intelligent layman already has, if he wishes it, free access to the whole of the medical literature, but he does not have it so easily at his finger tips as he will when the new electronic library is wired to his home. The layman of the future will be able to have access to electronic information and to handle an electronic dialogue with the teaching machine as easily as today's children are learning to use the pocket calculator and the video-cassette. The level of medical information and the extent of clinical problem-solving to which the layman chooses to go will have the profoundest effects not only on the future of the doctor/patient relationship, but on the very institutions in which we currently practise medicine.

### *5. Ownership*

In the electronic age, information will no longer be a commodity in the way in which it once was. The public library created a problem about copyright which is still unresolved, but it is essentially a resolvable issue. So was the recent strike of Hollywood actors about their rights for royalties in the video-cassettes of their performances. Already, however, pirated cassettes have flooded the market and it seems unlikely that

there will be any way of controlling this, even if we invent an entirely new electronic police force to do so. Even after Gutenberg, information remained a commodity. In the electronic age, once information has been generated it ceases to have a market value.

It is hard to foresee the implications of this for the practice of medicine, but it is not unreasonable to speculate that, in the future, the patient will possess much more information about himself, about the probabilities of his illness and about the data bases on which doctors solve problems than we could have imagined hitherto. In the same way, those aspects of the practice of medicine which depended so heavily on the doctor's acquisition of specialized knowledge may become either less important or rather more widely shared. In this other sense, then, special information will no longer be the valuable commodity that it once was.

#### *6. Location*

The sixth key aspect which has, I think, an important bearing on medicine is the location of this information. Children from the earliest age will come to see the television screen as the focal point of much that they learn about the world. If this happens, the whole concept of school will change. School may become a place for play, for social learning and for experiment in relationships. The playground will come inside the walls of the new school and will be taken really seriously for the first time. What are the implications then for further education? It seems likely that the traditional boundaries between primary, secondary and tertiary education will finally disappear under any such system. It is difficult to conceive of the concept of a minimum school leaving age when the school no longer exists. Rather we may move into an era when learning takes place throughout the lifetime of the individual, and when the pace, intensity and timing of such learning will be much more idiosyncratically varied than anything that has been possible in a system which is tied to institutions, curricula and full-time academic staff.

The effect of this on medical education is likely to be fundamental. The medical school as the central place of instruction will disappear and, in the new age of electronic information and communication, the student will acquire much of this instruction from his or her personal machine and much of his or her education will be based in the home rather than in the university. If this were to happen, then the university may become at last what Cardinal Newman hoped for: a gymnasium of the mind. Medical students may then be freed from a slavery to the retention of facts, and liberated to pursue excellence in creative and critical thinking.

#### **Crisis in the medical schools**

The medical school and the teaching hospital suited admirably the needs of Victorian society and Victorian medicine. They were the inevitable consequence of seeing medicine in the context of the first industrial revolution. The teaching hospital became, within the sense and imagination of that age, a repair factory for defects in human bio-engineering. This bio-engineering approach to medicine has, as Powles (1973) points out, affected not only the way in which medicine is practised and researched, but also those aspects of health and illness which students are taught to observe and, more importantly still, those which they are taught to ignore. Foucault (1973), looking back over three centuries of the development of clinical medicine and the hospital, writes that:

“Medicine made its appearance as a clinical science in conditions which define . . . the structure of its rationality. A new experience of disease [which] is coming into being will make possible an historical and critical understanding of this old experience.”

There is a crisis in medical education which concerns the survival of the medical school and of the teaching hospital. This crisis is articulated most often in terms of money, so that there are endless debates about salaries, staffing levels and the formidable cost of technology and technological research. These undercurrents have come to the surface in public enquiries, in the Flowers Report and in the recent debates about the heart transplant programme. Just as the medical philosophy of the teaching hospital predetermines both the tasks and the values of medicine, so the escalating cost forces uncomfortable questions about utility and progress. Tensions are not least felt in the tug of war between the university and the medical school. Indeed, in this country the link between medical school and university has often become a structural fiction and a fiscal nightmare.

A fundamental critique of our school system was that the declared intention of teaching reading, writing and arithmetic hid an even more urgent curriculum which was concerned with the needs of the first industrial revolution; these hidden lessons concerned punctuality, obedience and the skills needed to operate machines. In the reforms of the nineteenth century, the franchise of education for all distracted our attention from the truth that the school had become a factory for the service of the factory. The medical school today remains a production line for training junior hospital doctors.

In 1910, following the Flexner Report, there was an important shift of emphasis from walking the wards and attending the post-mortem room to learning in the laboratory. But, so far, the introduction of community-based teaching and the behavioural sciences has not had a comparable effect. The appearance of departments of general practice in the medical school has been largely a political victory; it has changed nothing. It has not created an educational shift because such a shift would require not simply a modification of the production line, nor even a general agreement by the curriculum committee on a new type of product—a different style of doctor. It would require a change in the first industrial revolution concept of the medical school as a factory. The new information technology may help to bring about that change.

The television screen is capable of producing a much greater range of information than the written page and can communicate all those goals of medical education which Bloom (1956) describes as belonging to the ‘affective domain’ in a form much stronger than words. We are only now at the threshold of exploiting this kind of learning. The recent setting up of the MSD Foundation has given educators in general practice the opportunity of developing films and video-recordings which may have the effect of revolutionizing this side of our

teaching. Many of us are already experimenting with similar techniques in our own departments.

The new communications technology is therefore capable of changing the whole balance of educational goals in the training of doctors. By extending the simple rational discourse of the written word, it may change for all time the values which the medical student attaches to the affective components of the doctor's task. It is no accident that these aspects of the doctor's task may become increasingly important in a world in which the acquisition and retention of medical information is, as we have seen, no longer a professional monopoly.

### **The future of medicine**

Let me try to summarize some cautious predictions for the future of medicine.

With the growth of the new information technology, patients will be capable of informing themselves about their symptoms, how they might be explored and what sort of responses will be available. In future the consultation will begin on a quite different basis from what we have been used to. The distribution of power and control between patient and doctor will thus be radically shifted towards a new equilibrium. The patient will be capable of making choices which are much more informed than we now believe either possible or prudent.

The doctor will no longer need to rely, as before, on a prodigious memory. His or her mind will be concerned not so much with remembering facts as with the skills of interacting with a machine which can supply those facts and help him or her to interpret them. The computer will extend the doctor's intellectual processes in exactly the same way as his car extends his muscles. When this happens, the values which we attach to aspects of character, personality and problem-solving in the clinician may change. Skills in empathy, in forming and using a therapeutic relationship, in thinking divergently over large and changing aspects of the patient's life, may become the hallmark of what patient and doctor may value most.

You may be forgiven for thinking that this is a piece of special pleading for the future of general practice. But I would deny this. Paradoxically, the growth of the new technology and the change in the characteristics of the doctor may either enhance the development of a new general practice or have the reverse effect. If patients are well enough informed, they may be able to perform for themselves most of the functions of the generalist. The decision to seek medical care may already be made at the level of selecting a specialist doctor. Whether the primary care doctor of the future is generalist or specialist, he or she will require problem-solving skills which in present-day terms are still largely taught, researched and sometimes practised by general practitioners.

### **Conclusions**

I have tried in this oration to peer a little way ahead, to wonder where my students will be going and how they in their turn will advance the cause of medicine in the service of society. I have suggested that not only will our concepts of pathology change, but even more fundamentally the nature of our society will change. Even if we cannot predict the direction or sequence of those changes, the contemporary potential for universal wealth and the power and character of the new information technologies make one thing certain: society is

about to change and will go on changing at a breathtaking pace. The very concept of society will change too.

Our society will be pluralistic, and small groups of people will be freed to develop different life-styles, scenarios for work and leisure and modes of human relationship and experience which are still only a part of our imaginings. With the disappearance of the monolithic state and monolithic industry will come the breakup of a monolithic medical profession. The 1815 and 1858 solutions to the current problems of medical education and medical practice already seem to bear little relationship to our contemporary preoccupations. The cardio-thoracic surgeon in London has more to share with his cardio-thoracic colleague in Madrid than with the London general practitioner who referred his patient. A small society like this one was created for a different sort of professional discourse from that which characterizes the modern medical multinational.

Last year the examination board in my medical school met to discuss the professional examination which our students sit at the end of their first two years. A number of the academic clinicians were unable to understand a majority of the terms used in the questions in the biochemistry and genetics papers. There was similar bafflement when we came to the paper concerned with the behavioural sciences. The credibility gap between teacher and teacher had widened into a chasm.

The idea of a common training for all doctors, and of a common form of selection for future general practitioners, ophthalmic surgeons and histopathologists, has more to do with archaic systems of belief than with an analysis and interpretation of contemporary medical tasks. A pluralistic society and an education made open in the style of the Open University creates many exciting possibilities for a modular system of medical training. Entrance into such a system can occur at a diversity of ages and after a variety of life experiences. Training may be concentrated over only a few years before independent practice of some sort is allowed, or may take half a lifetime. Of course the hospital ward and its laboratories will remain important locations for apprenticeship learning, but the whole of the community must at last come to play its part as an arena for medical teaching as well as medical care.

The artificial and arbitrary boundaries between undergraduate training, vocational training and continuing medical education will dissolve. Other boundaries will also shift and change with a rapidity and surprise of direction which will make it difficult for the medical profession to erect and sustain vast, powerful and long-term institutions. These relics of the first industrial revolution are unlikely to survive into the next century.

When Bella came to her doctor and complained that her periods were disturbed, she was offered, and refused, an oral contraceptive. Had she consulted Mr Lydgate, she was likely to have been given the best of modern treatment—that is to say, good advice about healthy living. Yet on Lydgate's bookshelf there would probably have been a copy of *Principles of the Theory and Practice of Medicine* by Marshall Hall.



The treatment which he offered for Bella's condition was "local blood-letting, cupping over the sacrum, and leeches to the pudenda or os uteri". The paragraph ends: "It is astonishing what perseverance in these measures will effect."

When Bella is offered, and refuses, an oral contraceptive, we are not considering simply an updated and improved prescription. It is not only the treatment which has changed, but the character and identity of women, the shape and responses of society. How could Lydgate encompass within his own lifetime the end of the era of bleeding and cupping, and the invention of the oral contraceptive, with all the shattering changes implied by this invention? Yet this is the order of change which awaits our medical students today. I give the oral contraceptive as only one example, although it is perhaps the most important one. This and other medical inventions are already changing our definitions of health, our expectations of life, our criteria for death and the very possibilities of human relationships.

Mrs Casaubon told Lydgate: "You may still win a great fame like the Louis and Laënnec I have heard you speak of." But Lydgate's professional ambition floundered with his relationships. It was the dark currents of feeling between the men and women of Middlemarch which defeated Lydgate—not a failure of a promised future for the pathology of tissues in which he had placed such hope. Early in the novel Eliot says ironically of Lydgate that he brought:

"a much more testing vision of details and relations into his pathological study than he had ever thought it necessary to apply to the complexities of love and marriage, these being subjects on which he felt himself amply informed by literature and that traditional wisdom which is handed down in the genial conversation of men".

In the finale, she describes Lydgate's retreat from his ideals and his last prosperous years in London. The bitterness he felt for his wife Rosamond, Eliot describes thus: "He once called her his basil plant; and when she asked for an explanation said that basil was a plant which flourished on a murdered man's brains."

Rosamond was a child of her time, as Bella is a child of ours. Yet the limitations of thinking and feeling which George Eliot describes in Lydgate still determine the responses which the doctor today can make to patients like Bella. These limits will determine, as much as any new technology, the quality of medicine's response to the patients of tomorrow.

Our medical students now need courses concerned with the processes of thinking and with the strategies of adaptation rather than the curriculum which is currently on offer. If it is true that we can teach only from our own past, at least we should do so as historians who try to understand the processes and springs of change.

More than ever before medical students will need to understand the processes of science, its philosophy and morality, if the machines which they invent and use are to augment and not diminish our humanity. This means that the medical curriculum of tomorrow must pay much sharper attention to history and philosophy than has so far been true in the twentieth century.

In responding to Bella and Amy, medical students of today must develop their own critical strategies for dealing with uncertainty. Only in this way can they prepare themselves for the history of tomorrow.

Thomas Kuhn (1963) makes the point that innovations in science are largely the prerogative of the young

scientist. Perhaps innovations in training for the tasks of medicine will become largely the province of those whom we are now beginning to train. Some of us are beginning to devise 'future games' in which groups of students may be asked to look anew at the tasks of medicine, and to devise new strategies and forms for their own training. Among all the other boundaries which shift and change in our accelerating world, the boundaries between teachers and learners may shift further and most radically.

Above all, it will remain important to show today's student that human communication is not simply a necessary vehicle for good clinical method—it is the very stuff of medicine. When Bella and Amy meet their doctors, the medium is the message.

Much of my own professional lifetime has been concerned with the development of general practice. There have been battles for recognition, for curriculum time and for resources which are still being fiercely waged in Royal Colleges, in Royal Commissions, in government departments and universities. But already the battles seem irrelevant, the disputed territories no longer strategically important and the outcomes surprising and quite different from what is intended by all the well-intentioned protagonists. Perhaps those outcomes will be revealed to us in the Annual Oration of this Society in the year 2010. I look forward to hearing it. Perhaps one of my own students will have earned the honour of your invitation to give it.

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