

12 The Changing Role of Pathology in the Undergraduate Curriculum

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INTRODUCTION

In November 1906, Hubert Maitland Turnbull, a founder member of The Pathological Society, was appointed Director of the Institute of Pathology at the London Hospital. He recalls in his memoirs that shortly after taking up the post ‘I realised how greatly handicapped my students were by having no knowledge... of what for instance a solid lung or fibrotic liver was like or even understanding pathological terms’ (Turnbull, 1953). He goes on to describe how ‘... we persuaded the College Board that pathology in its most elementary form should be added to the introductory course’ (Turnbull, 1953). A century later, Turnbull’s words strike a familiar chord with pathology teachers nationwide. The difference between then and now is that it is no longer so easy to persuade the ‘Board’ that pathology teaching should be increased.

In the last 100 years, the role of pathology in the undergraduate curriculum has turned full circle – from being a supporting act, to playing a major role, to being a bit-part player once again. In this chapter I will give an overview of how pathology teaching has changed in the 20th century in the context of the overall development of medical education. I will also discuss the possible impact of modern medical curricula on recruitment in pathology and try to predict what the future holds for pathology teaching and its teachers.

THE GOALS OF PATHOLOGY TEACHING

Pathology bridges the gap between basic sciences and clinical medicine, so a proper understanding of pathological processes is vitally important for medical practice. This tenet is as true today as it was in Turnbull’s time. The main goals of undergraduate pathology teaching have always been to provide a language or framework for the description of disease and to provide students with knowledge of the functional and structural changes in disease so that clinical signs and symptoms can be understood and interpreted.

The question ‘should medical students be taught pathology?’ has provoked much debate in the pathology popular literature. Arguments for and against the motion that ‘Doctors don’t need to know about the pathological basis of disease’ have been vociferously argued (Jackson *et al.*, 2003; Wright 2003). The proponents maintain that ‘medicine comprises more than a science and that more attention must be given to the humanist elements of medical practice and medical education’ and that ‘greater understanding of the pathological basis of disease has not contributed substantially to improved morbidity and mortality rates’. Opponents, on the other hand, respond that proper communication with colleagues and patients depends on a proper understanding of pathological language, that evidence-based practice depends on the scientific basis of medicine

and that many advances in public health have been based on understanding of the underlying pathology of a disease.

There is little doubt that most pathologists would oppose the motion, but what about the ‘consumers’, the doctors of the future? It is interesting that a first-year student at one of the new medical schools has placed himself firmly in the opponents’ camp (Jackson *et al.*, 2003), arguing that it is unethical for doctors to treat diseases that they have not been properly taught about: ‘Not understanding how these diseases arise, present and are treated would be a criminal flaw. Ignorance is no defence.’ Good communication skills are a *sine qua non* for tomorrow’s doctors, but they must also have a sufficient knowledge base to communicate about.

PATHOLOGY TEACHING IN THE 20TH CENTURY

Information on pathology teaching prior to the 1980s comes solely from archival material, because the literature contains virtually no publications on teaching and learning in pathology before this time. The archives at St Bartholomew’s and the Royal London Hospitals are a rich source of information on this particular subject and I have used them extensively to put together the description of early pathology teaching at their associated medical schools that follows. Other medical schools would have had their own approach to pathology teaching, and there would undoubtedly have been differences in course content and structure, but there is no reason to suppose that the progression of pathology teaching was significantly different from that at the Medical College of St Bartholomew’s Hospital (Barts) and the London Hospital Medical College (LHMC).

The Early Years

At the end of the 19th century medical students at Barts and the LHMC were taught precious little pathology and what little teaching there was tended to be haphazard and disorganised. This was not surprising because the widely held view at the time was that ‘morbid anatomy was defunct: Virchow had exhausted the subject’ (Russell and Innes, 1956). By the start of the 20th century, the importance of applying science to medicine had begun to gain acceptance. The successes of bacteriology in diagnosing and controlling the spread of disease gave reformers a persuasive argument for placing greater emphasis on science in the medical curriculum, contradicting the prevalent view at the time that medicine was an ‘empirical art’ (Waddington, 2003a).

The real revolution in pathology teaching began in the early 1900s when, spurred on by increasing understanding of disease mechanisms, pathology began to be accepted as a specialty in its own right. Before Turnbull’s appointment at the LHMC in 1906, surgeons gave the lectures in surgical pathology and also examined the specimens removed at surgery. At Barts, too, the surgeon Sir James Paget had ‘held students captive with his lectures on surgical pathology’ (Waddington, 2003b). Visiting physicians carried out the hospital autopsies and demonstrated their findings to medical students on an ad hoc basis. Turnbull soon realised not only the importance of having high-quality pathology teaching in the medical curriculum, but also the added value of pathologists actually carrying out the teaching themselves.

The Age of Reform

Turnbull’s reform of the LHMC pathology course started in 1907. His first step was to introduce daily post-mortem demonstrations to clinical medical students, which he carried out himself for many years. Students were expected to attend these demonstrations whenever possible (Fig. 12.1) and were also encouraged to conduct autopsies themselves (London Hospital Medical College, 1936). There was certainly no lack of autopsies for the student to practice on, e.g. there were 3486 in 1938 (Turnbull, 1953).



Figure 12.1 Turnbull demonstrating an autopsy, ca. 1930.

In 1909 Turnbull began a course of Directors' Lectures on the subject of 'special morbid anatomy and histology', supplemented by macroscopic and microscopic preparations to illustrate the conditions discussed. At first a single hour-long lecture was given once a week, increasing to twice a week to accommodate growing demand. The aim of the lectures was to 'treat individual organs and tissues in succession and introduce relevant general pathology as it occurred in the series' (Turnbull, 1953). Attendance at these lectures was voluntary and open to students of all years. Despite the fact that this was a new course whose importance may not have been immediately obvious to the students, its popularity grew rapidly. In typically meticulous manner, Turnbull kept an attendance sheet for all his lectures, and was able to demonstrate a steadily increasing number of students attending the lectures in the first few years.

Turnbull's style of teaching mirrored that of his own pathology teacher at Oxford, Professor Gotch, from whom he had learned meticulous attention to detail. Before the lecture started he would copy a list of headings onto a blackboard in order to jog his own memory and to help the audience follow the lecture – the forerunner of the modern-day lecture handout. Turnbull was a great believer in studying histology and pathology together and so 'made coloured diagrams of the histology of organs and other illustrations for the lectures, often enlarged pictures of actual microscopic fields, which I suspended from lattice of transverse laths behind the lectern' (Fig. 12.2) (Turnbull, 1953). Another blackboard was free for Turnbull to draw on with coloured chalks during the lecture.

Rather than use an 'epidiascope and lantern slides' to supplement his lectures, Turnbull preferred to lay out macroscopic specimens and glass slides under a microscope, which could be examined by students before or after the lecture (Fig. 12.3). Notes on the patient, their disease, and arrows to draw attention to particular points of interest accompanied the slides and specimens (Fig. 12.4). Turnbull's justification for what he himself called 'these somewhat antiquated methods' was that 'actual study of a section with a microscope is obviously better than a sight of it upon a screen' (Turnbull, 1953).

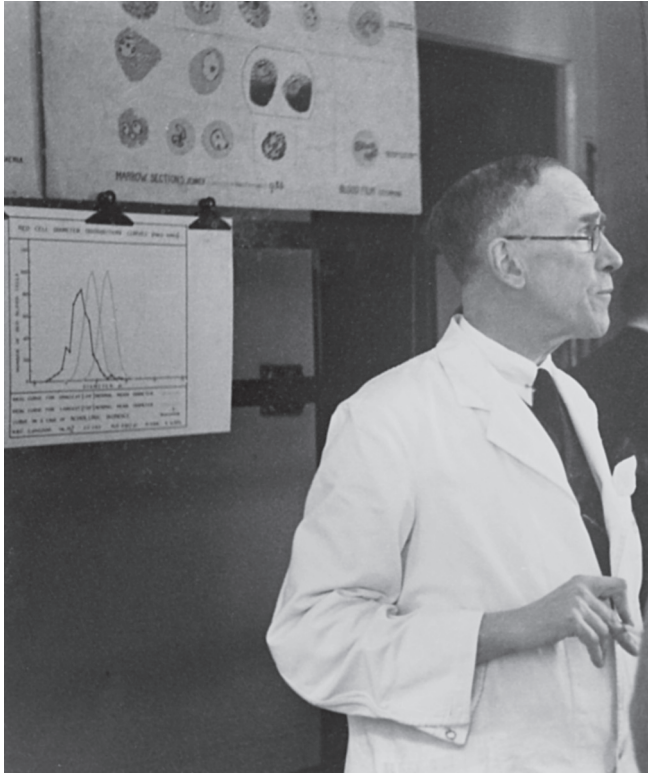
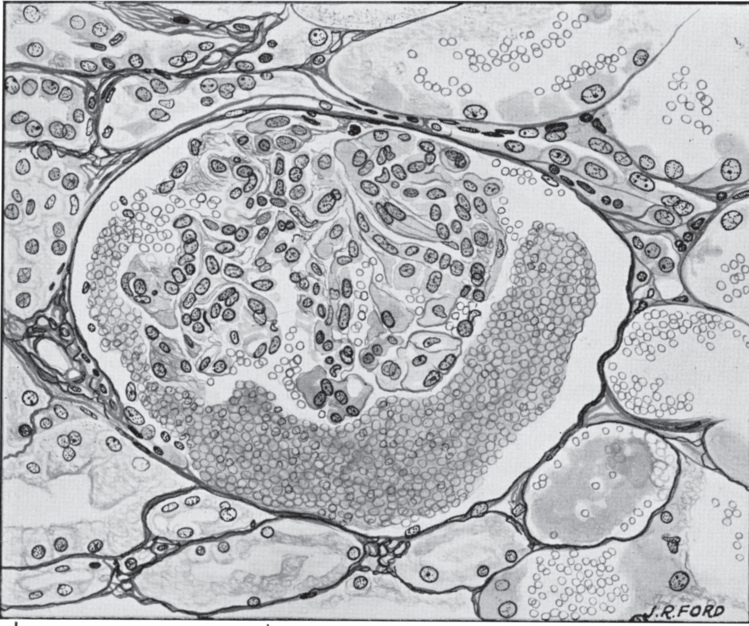


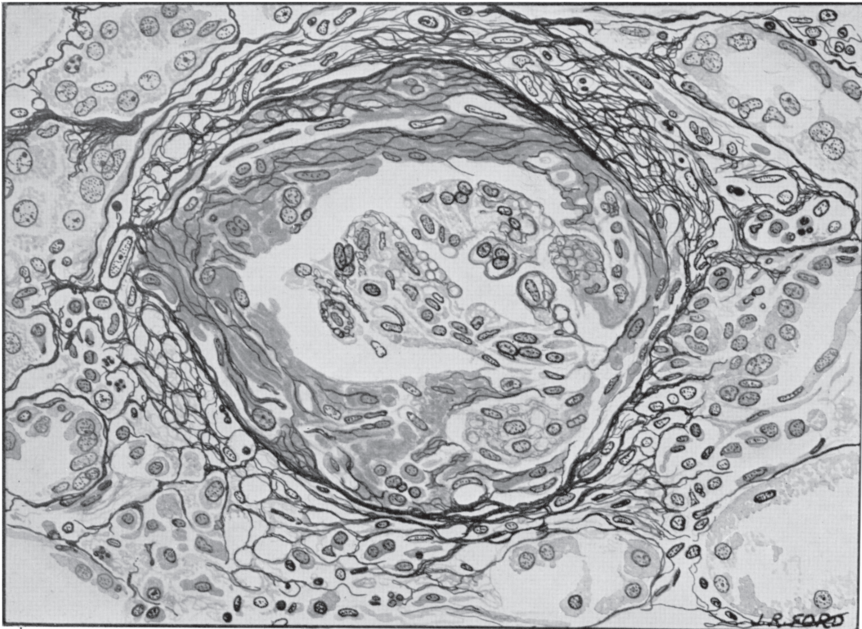
Figure 12.2 Turnbull lecturing, ca. 1925.



Figure 12.3 Medical students looking at Turnbull's macroscopic preparations, ca. 1925.



100 μ



100 μ

Figure 12.4 Turnbull's meticulous drawings of a diseased renal glomerulus. All his lectures and demonstrations were similarly illustrated.

There was no official feedback given to teachers in those days, but there is little doubt that Turnbull's lectures were well received. Clark-Kennedy, a future Dean of the LHMC, wrote of Turnbull's teaching 'the least intelligent of us perceived the truth which pervaded his lectures and the wealth of personal knowledge this contained' (Ellis, 1986a). Turnbull's scholarly authority and passion for his subject made him a highly effective role model, as demonstrated by the large number of his pupils who went on to be pathologists themselves, including Donald Hunter and Dorothy Russell.

In 1926, Donald Hunter became curator of the pathology museum at the LHMC and, together with Turnbull, completely reorganised the museum, discarding many older specimens and replacing them with new ones, rewriting the old museum catalogue at the same time. During the 1930s, pathology museums were in their heyday and remained so for the next few decades. Nearly all teaching hospitals had a pathology museum of some sort and the specimens therein were used widely during teaching. At the LHMC, the newly stocked museum became an important learning resource for medical students, and, benefiting from the 'imaginative and energetic care' of Donald Hunter, was said to 'augment all teaching' (Ellis, 1986a).

Pathology Teaching in the Clinical Course

At the LHMC, pathology teaching in the second and third clinical years was expanded in 1911 to include a compulsory three-month course devoted entirely to pathology. The first six days were spent learning staining techniques, ranging from haematoxylin and eosin to Schmorl's stain, and the remainder of the three months combined lectures in pathological histology (given by the Senior Assistant Director) with 'clerking in the post-mortem room, and with microbiology, chemical pathology and haematology in the clinical laboratory' (Turnbull, 1953). Interestingly, the course also included visits to the local Fever Hospital to receive instructions on fevers, and visits to the local asylum for instruction in 'lunacy' (London Hospital Medical College, 1936).

The introductory course in pathology that Turnbull had been so keen on when he was first appointed did not actually get off the ground until 1925. Until then, students entering their clinical years were given an introductory course in medicine and surgery in which they were taught 'percussion, other physical signs, how to examine medical and surgical patients and write clinical histories and notes' (Turnbull, 1953). The new introductory pathology course aimed to give early exposure to pathology and to 'establish not only a process of thought but also a basis of factual knowledge which should enable the student to learn more readily and think more independently during his first clinical year' (Turnbull, 1953). The course lasted for one month and was taught by the Junior Assistant Director. The students were given one hour's lecture every weekday on topics in general pathology, supplemented by examination of macroscopic specimens, 'especially those of which they would be taught the clinical signs, such as consolidation of the lung or valvular diseases of the heart' (Turnbull, 1953). Three afternoons a week were spent in the post-mortem room and other times were divided between the clinical laboratory and the wards. Through this course, students were encouraged to appreciate the pathological basis of clinical symptoms and signs, clinicopathological correlation and the importance of pathology to clinical medicine.

At Barts, a new scheme of pathological clerkships was adopted in 1912, mainly at the insistence of William Girling Ball, who had recently been appointed senior demonstrator in pathology. This scheme was greatly aided by the construction of a new pathology block with separate diagnostic and teaching laboratories. Before 1912, students working in the pathology department had been unsupervised and their work had often been 'unreliable'. Under Girling Ball's scheme, students were placed under the supervision of the demonstrator (pathologist) on duty in the hope that they would receive training in 'direct reference to individual patients'. As a result, 'clinical teaching was reorganised and a system of practical lectures and demonstrations introduced with clinical practice in mind' (Waddington, 2003c).

Despite the introduction of this scheme, the pressure on students at Barts to gain the widest possible clinical experience meant that pathology tended to be overlooked. By 1927 it was recognised that pathology had been inadequately taught with ‘new classes added here and there whenever necessity arose’ (Waddington, 2003d). To resolve this, pathology teaching was restructured, the teaching staff enlarged and more demonstrations organised. By 1931 a three-month full-time pathology course had been introduced into the final clinical year, similar to that already in place at the LHMC, thus preventing pathology teaching from being diluted.

The Influence of Flexner and Haldane

At about the time that Turnbull was transforming pathology teaching at the LHMC, several reports on medical education were sending shock waves through the medical establishments on both sides of the Atlantic. In 1910, Abraham Flexner published a scathing report on behalf of the Carnegie Foundation for the Advancement of Teaching on the standard of medical education in the USA and Canada (Flexner, 1910). Two years later, he published a similar report on medical education in Europe (Flexner, 1912). Flexner’s reports triggered much-needed reforms in the standards, organisation and curricula of North American medical schools, which until then had operated more for profit than for education. With respect to the curriculum, Flexner advocated strong emphasis on biomedical sciences, to meet society’s expectations that medical care be more scientifically based. He also proposed that clinical training should follow the model of clerkships introduced at Johns Hopkins by the renowned clinician and teacher William Osler.

In 1913, the Royal Commission on University Education in London, established years previously and chaired by Lord Haldane, published its findings (Haldane, 1913). Like Flexner, Haldane stressed the need to raise the level of science in the medical curriculum and called for the strengthening of traditional scientific departments (Haldane, 2005). Osler too, on a visit to the UK in 1911, had noted the ‘glaring defects in provision of teaching of laboratory based medicine’ and pleaded for ‘more funding to support hospitals’ scientific work’ (Osler, 1911).

The effects of the Flexner and Haldane reports were felt worldwide. Turnbull and Girling Ball’s attempts to increase pathology teaching were taking place at the very same time that there was rising momentum for greater scientific content in the medical curriculum. Consequently, they found no great obstacle to achieving their aims.

THE PERI- AND POST-WAR YEARS

The idea of a National Health Service had first been proposed by the Dawson Committee of 1920 (Dawson, 1920) but it was not until 1941 that the government announced plans for a post-war state hospital service. In 1942, the Goodenough Committee was established to look at the organisation of medical schools, their facilities for clinical training and research and their relationship to hospital services. The report, published in 1944 (Goodenough, 1944), recognised that doctors of the future would need to be able to think and reason things out for themselves and acquire even greater command of the scientific method. In essence, they would need education as well as training. This was the first time that such an approach had been proposed, and the authors realised the difficulties it might pose – after all, education encourages students to question what they are told while training requires students to do what they are told without question. The Goodenough report was published in the midst of the Second World War, and as a result its far-sighted recommendations went largely unnoticed. It was, however, to have substantial influence on medical education in later years.

By the time of Turnbull’s retirement from the LHMC in 1946, pathology was an important part of the medical curriculum. Turnbull’s successor as Director of the Institute of Pathology was Dorothy Russell, by then a distinguished neuropathologist. She continued to give the Directors’

Lectures in the same style and manner that Turnbull had. Her teaching was said to be 'less inspiring' than Turnbull's but certainly not less detailed – indeed, students felt that if they copied a full cycle of Russell's lectures from the blackboard they would have 'an entire textbook' (Ellis, 1986c). The compulsory pathology courses in the clinical years had also been continued after Russell's appointment, so that post-war medical students undoubtedly had significant exposure to pathology teaching.

A New Health Service for All

With the creation of the National Health Service in 1948, however, the environment in which medical students were taught began to change (Ellis, 1986b). Poor patients, who had previously been in receipt of charity and had been grateful for their care, were now entitled to expect the best treatment available free of charge. Duties such as surgical 'dressing', which were previously carried out by students, now had to be performed by qualified staff. Teachers, many of whom had previously been unpaid, now received a salary from the medical school, but teaching was becoming less of a priority against the new commitment to healthcare. Medical science was rapidly gathering pace. Not only were new drugs being licensed, but surgical sub-specialties were developing, obstetric services were improving and general practice was gaining influence. Consequently, the content of the clinical course changed repeatedly as new subjects were added and others were removed.

Throughout the 1950s, debate took place about the type of doctors the medical curriculum was producing. Reformers stressed the importance of an integrated approach that took account of the whole patient. The notion that a five-year undergraduate education could no longer hope to produce a complete doctor, as had been suggested in the Goodenough report, was accepted and the concept of a basic medical education as preparation for vocational training gained ground. Encouraged by a greater emphasis on social medicine arising from the birth of the NHS, a greater need was identified for training in a non-hospital environment, particularly in general practice.

With regard to pathology teaching at this time, the Professor of Pathology at Barts, John Blacklock, together with his colleague Alfred Stansfeld, argued for pathology lectures to be correlated with teaching in medicine and surgery. This did not happen until 1951, when yet another revised scheme was adopted and the amount of pathology in the clinical course was increased. The rationale behind this was to make students familiar with 'more complex tests which they might be expected to ask for and interpret' after they had qualified (Waddington, 2003e).

By the time Dorothy Russell retired from the LHMC in 1960, the practice started by Turnbull of teaching histology and pathology together had been discontinued. Instead, histology was taught alongside anatomy by anatomists in the preclinical course alone, emphasising the perceived scientific nature of these subjects. Lectures were given in both anatomy and histology but practical teaching was also provided. In anatomy, students worked in small groups dissecting a cadaver, whereas in histology each student had their own microscope, which they used to study the structure of tissues in detail.

Pathology was still prominent in the clinical course but the methods of teaching were beginning to change. The lectures and formal demonstrations so beloved of the old-school pathologists were giving way to small-group teaching. The LHMC prospectus from 1965 states: 'After his first clinical firm the student joins the clinicopathological course, which is designed so that pathology and clinical work are taught in close relation to one another; in this way the effect of disease on the structure and function of the various organs in the body may be illustrated... patients are demonstrated by individual students to their colleagues; teaching takes the form of discussion of the student's findings and conclusions' (London Hospital Medical College, 1965). This approach was the forerunner of modern-day integrated teaching. Pathology museums continued to be an important learning resource and the daily autopsy demonstrations remained popular with the students.

THE PRE-MODERN YEARS

The 1960s saw attitudes to education shift. Traditional divisions between the humanities and the sciences were starting to be questioned and the notion that medical graduates should have a wider educational experience, as had first been proposed by the Goodenough report, was increasingly promoted.

The Todd Report

In 1968 the Report of the Royal Commission on Medical Education, headed by Lord Todd (Todd, 1968), was published. This report proposed a five-year undergraduate course consisting of three years of basic medical sciences and two years of clinical work. The most radical proposal was that the preclinical course should be flexible and modular with students studying subjects of their choice in greater depth. In this aspect, Todd was the first to suggest that the undergraduate curriculum should include selected study modules. It also recommended that general pathology, which it termed a 'paraclinical' subject, should be included in the compulsory part of the preclinical course. To achieve these changes, the report called for the reduction of curriculum time devoted to traditional subjects such as anatomy, and the adoption of new teaching methods with less emphasis on didactic teaching. The report also saw continuing education as vital for medical graduates, to equip them 'with an understanding of medicine as an evolving science and art, and to provide the basis for future vocational training'. In this respect, the Todd report was confirming a shift in emphasis from a primarily vocational to an essentially educational course.

A Changing Curriculum

Throughout the 1970s, the preclinical–clinical divide continued but there began to be more emphasis on the humanities as applied to medicine – sociology, psychology, statistics and community medicine. Despite this, students (who had only recently been included in the debate on medical education) still perceived the preclinical teaching as boring and unrelated to medicine. There was no doubt that teaching concentrated on rote learning with assessment geared towards compartmentalisation of knowledge (Waddington, 2003f).

Pathology teaching at this time remained fairly 'traditional' at both Barts and the LHMC, with the bulk of the teaching occurring in dedicated blocks in the clinical years. Both lectures and small-group tutorials were given and daily autopsy demonstrations continued. The stand-alone pathology exam was a formidable hurdle and a potent driver for learning pathology.

The curriculum was under strain, however. New subjects had been introduced into both the preclinical and clinical courses without a sufficient reduction in existing subjects, so that students felt under increasing pressure. Curriculum overload was not a new concept; indeed, as early as 1876 Thomas Huxley had stated that 'the burden we place on a medical student is far too heavy ... a system of medical education that is actually calculated to obstruct the acquisition of knowledge and to heavily favour the crammer and grinder is a disgrace' (Huxley, 1876) but it now became the stimulus behind major curriculum reform.

THE MODERN YEARS

Although 'medical educationalists' had been around for many years – indeed Turnbull and Russell were considered by their students to be enthusiastic and highly effective educationalists – it was not until the 1980s that medical education really began to be accepted as a speciality in its own right and departments of medical education were created in most medical schools.



Figure 12.5 An autopsy demonstration, ca. 1980. David Levison is the pathologist.

Students were now being actively encouraged to participate in their own learning. The principles behind medical education, following on from the Todd report of 1968, were now not only to teach the fundamentals of medicine but also to encourage students to think and lay down the foundations of lifelong learning. New methods were required to enable students to develop critical reasoning and apply the knowledge they had learned. Self-directed learning (SDL) and problem-based learning (PBL), the latter developed in North America and The Netherlands, gained popularity.

The Turning Tide

By the late 1980s, significant change had taken place. In many medical schools, to counteract the criticism that preclinical teaching had little clinical relevance, the traditional preclinical course had been abandoned in favour of a systems-based approach. Emphasis on lectures was reduced, seminar-based work and small-group teaching was increasingly used and SDL became a key part of teaching practice. Despite this change in philosophy, individual departments were still reluctant to give up teaching time and there remained a feeling that the curriculum required an unrealistic degree of completeness.

Pathology teaching began to change to reflect these new ideas. In some medical schools, pathologists became involved in teaching histology, often alongside pathology to highlight its clinical relevance. Overall, however, pathology was looked upon as a fact-based science and so in most medical schools the pathology teaching time was cut. Instead, SDL packages were developed to supplement the pathology course content. Autopsy demonstrations, which had been so popular with generations of medical students, were becoming irregular and less well attended. The reasons for the decline in autopsy numbers are well documented and beyond the scope of this chapter, but there is little doubt that the impact was to reduce students' exposure to macroscopic pathology and clinicopathological correlation. Pathology museums were still functioning in most medical schools but their relevance to the new style of undergraduate course was beginning to be questioned and funding to maintain them was in short supply.

Tomorrow's Doctors

In 1991, the General Medical Council began a major review of medical education that culminated in 1993 with the publication of *Tomorrow's Doctors* (General Medical Council, 1993). The drivers behind this review were numerous. Firstly, the preceding years had brought significant changes in patterns of disease and in the way that healthcare was organised. Secondly, the public now had a heightened expectation of doctors, which had led to a change in the doctor–patient relationship. Increasingly, doctors were being faced with difficult ethical and moral issues without sufficient instruction in how to manage these problems. Thirdly, despite the repeated recognition that curriculum overload was detrimental to medical education, not enough had been done to reduce the burden of factual information on students.

Tomorrow's Doctors sought to 'promote an approach to medical education... which differs substantially from that of the traditional curriculum' and to 'provide recommendations for a course which will produce graduates whose fitness to practice as pre-registration house officers is better assured' (General Medical Council, 1993). In 2003, the guidelines were updated to 'put the principles set out in Good Medical Practice at the centre of undergraduate education' and to 'identify the knowledge, skills, attitudes and behaviour expected of new graduates' (General Medical Council, 2003).

The main recommendations of *Tomorrow's Doctors* were that the medical curriculum should be organised around a core of essential knowledge and skills, augmented by a series of options (or selected study modules) that allowed students to study areas of particular interest to them in depth. The core curriculum should be integrated, with loss of the traditional divide between preclinical and clinical years and systems-based rather than discipline-based. The course should emphasise clinical, communication and practical skills and should instil into the student the professional attitudes of mind and behaviour befitting of a doctor and expected by the public. More emphasis should be put on the teaching of public health, ethics and law, and more of the curriculum should be taught in the community. Self-directed learning and critical evaluation should be encouraged, thereby preparing the student for life-long learning. In all areas of the curriculum, the burden of factual information on medical students should be substantially reduced.

Tomorrow's Doctors was to cause a seismic shift in the objectives of the undergraduate medical curriculum, away from the scientific basis of medicine – a sound knowledge of which had been repeatedly advocated since Flexner's report of 1910 – towards patient-centred doctors, who had better communication and practical skills but whose knowledge of the basic medical sciences was inevitably much reduced. The effects on pathology teaching were profound.

The Effects of *Tomorrow's Doctors* on Pathology Teaching

In 2001, Professor Sir James Underwood carried out a survey on pathology teaching on behalf of The Pathological Society and presented the findings at a meeting on the future of academic pathology (Pathological Society, 2001); see also Appendix (11). This survey showed that in the preceding decade 10 of 19 medical schools in the UK (53%) reported a reduction in pathology teaching time, with only one medical school reporting an increase. Despite the fact that this study was not peer-reviewed, it does suggest, along with anecdotal evidence from individual lead teachers in pathology, that there has been a real reduction in pathology teaching time since the publication of *Tomorrow's Doctors*.

The aspects of pathology teaching that have suffered most from this reduction no doubt vary from school to school, but it would seem that the axe has fallen most heavily on histology and general pathology (personal observation). These two subjects were traditionally considered to be basic medical sciences and so were drastically cut in efforts to reduce factual overload. Systemic pathology has fared somewhat better, but even so, teaching on the morphological changes in disease is often neglected in favour of epidemiology and public health issues.

The teaching of pathology in blocks to 'avoid fragmentation' has all but disappeared, as has the traditional practice of teaching general pathology in the first two years and systemic pathology in the clinical years. Instead, pathology teaching is integrated throughout the course. A consequence of this is that in many medical schools 'pathology' is no longer a recognised subject. The multidisciplinary approach to teaching and learning is reflected in the modern-day integrated assessments, and the pathology exam, once a tough hurdle, is a thing of the past. In effect, pathology, which in Turnbull's time was as important as medicine or surgery, is no longer felt to be a core subject, although most medical schools will offer selected study modules in pathology to students who wish to study it in greater depth.

It is in teaching methods, however, that perhaps the biggest changes have been seen. The emphasis in medical education has switched from teaching to learning, which means that most of the curriculum is now student-centred rather than teacher-centred. Didactic instruction and tutor-led tutorials have given way in varying degree to SDL and PBL, and pathology tutors have been converted to PBL facilitators. Students no longer attend practical classes or look down microscopes, instead computer-assisted teaching has mushroomed and web-based learning is now the norm.

The organ retention affairs at Bristol and Alder Hey had several deleterious effects on pathology teaching. Firstly, the closure of pathology museums, which were already under threat by lack of funding, was hastened. Secondly, the number of consented autopsies, which had been in decline for some time, fell even further so that autopsy demonstrations have now become exceedingly rare. Consequently, the opportunities for today's medical students to observe real-life macroscopic pathology have virtually disappeared. Instead, partly through choice but largely through necessity, this aspect of pathology teaching has been devolved to computer-based learning packages.

The undergraduate medical curriculum has thus evolved from being teacher-centred to student-centred, from discipline-based to integrated core and options-based and from passive acquisition of knowledge imparted by real teachers to active problem-based learning with reliance on computers. Pathology learning has changed from seeing pots in pathology museums and real organs at autopsy to looking at images on CDs and websites: from daily contact with pathologists, to irregular interaction with anonymous computer screens. Both models have their good and bad points. Modernists maintain that the current curriculum better prepares students for modern medical practice whereas traditionalists complain that 'the baby was thrown out with the bathwater'. The challenge for medical educationalists of the future is to strike a balance between best practice and achievability.

THE IMPACT OF CHANGING CURRICULA ON RECRUITMENT IN PATHOLOGY

The changes in medical education outlined above have evolved over a number of decades, although the pace of change has undoubtedly accelerated in the last 15 years. During that time, the number of consultant vacancies in all the pathology specialties has risen substantially, resulting in a significant recruitment crisis. In histopathology particularly, the rise in vacancies has been rapid and spectacular, from 4 in 1992 to 219 in 2004 (figures supplied by the Royal College of Pathologists). This huge increase in vacancies is partly explained by early retirements, but until recently it has not been known whether it was also accounted for by a fall in the number of medical graduates entering pathology.

A recent study looking at the career choices of medical graduates showed that the number of newly qualified doctors selecting pathology as their first choice of career halved between 1983 and 1993 and has remained static ever since (Lambert *et al.*, 2006). The reasons behind this worrying trend were not specifically sought by the study, but there was evidence that 'experience of the subject as a student' and the influence of 'a particular teacher or department' are more important

in encouraging students and junior doctors to enter pathology than they are for other medical careers. Although the impact of *Tomorrow's Doctors* cannot *per se* explain the substantial drop in pathology as a career choice, there is no doubt that the current medical curriculum, in which pathology is low profile and there is virtually no exposure to charismatic pathologists acting as role models, will do nothing to remedy the situation.

THE FUTURE FOR PATHOLOGY TEACHERS

Despite recommendations for proper government funding of medical schools going back to the Goodenough report of 1944, continued funding cuts in higher education in the last few decades have meant that medical schools have struggled to maintain sufficient staffing levels to sustain the major curricular changes adopted. In particular, the savage funding cuts instigated by the last Research Assessment Exercise (RAE) have hit academic pathologists particularly hard. Whole departments have disappeared, with individuals retiring early or being re-badged as NHS consultants. Those who have survived the cuts have had the strongest research output but, not surprisingly, their enthusiasm for undergraduate teaching is sometimes poor.

A recent survey by the Council of Heads of Medical Schools (CHMS) has highlighted the dramatic fall in the number of clinical academics in pathology (Council of Heads of Medical Schools and Council of Heads and Deans of Dental Schools, 2005). Between 2003 and 2004 there has been a 40% drop in total number of academic pathologists, and there are now only 45% of the numbers that there were in 2000. The situation with clinical lecturers in pathology is even worse. Numbers have dropped by 64% since 2003 and now stand at only 19% of their 2000 numbers. These figures are the worst for any of the medical specialties and prompted the CHMS to state in their commentary on the survey that 'a shortage of academic pathologists at all levels will compromise medical training as well as the UK's medical research capacity'.

The widespread dearth of academic pathologists has left pathology teaching in crisis, particularly as NHS consultants have been reluctant to take on the teaching mantle due to their own burgeoning workload and generally low morale. The result is that in several medical schools pathology is no longer taught by pathologists – whatever pathology remains in the curriculum is incorporated into PBL scenarios and is supervised by PBL tutors. The argument that in PBL-based curricula students should 'learn' and not 'be taught' could be used to justify the rejection of teaching by all but the most committed pathologists. There is little doubt, however, that students prefer to be taught (or supervised) by experts in the subjects they are learning. So, in the ideal world, pathologists should 'teach' pathology, just as surgeons should 'teach' surgery and psychiatrists should 'teach' psychiatry.

At the same time as the number of academics is falling, the number of medical students is continually increasing – by 40% since 2000, buoyed by the opening of four new medical schools. More students need more teachers, particularly in PBL-based curricula where the small-group nature of the teaching means that the teacher:student ratio is necessarily high.

But where will the teachers needed come from? The practice long-held by most 'traditional' universities of appointing academics on the basis of research profile and then expecting delivery of a significant teaching workload is no longer acceptable. It is being increasingly recognised that many of the skills required for research and teaching are different: good researchers do not necessarily make good teachers, and vice versa. The rapidly diminishing number of research academics is under greater pressure than ever, driven by the financial impact of the RAE, to obtain grant funding and publish papers in high-impact journals. This is particularly true of research-active pathologists, who, due to the 'unsexy' nature of much of their research, often have to work very hard to secure high-profile grants. Is it any wonder, therefore, that teaching comes low in their list of priorities? Until now, universities have not had to face financial consequences as a

result of teaching quality assessments, but this may well change in the future as students switch from 'learners' to 'consumers' following the introduction of tuition fees. If this does happen, it is likely that good teachers will bring funding to universities, in the same way that good researchers currently do.

It is high time, therefore, for universities to recognise that these two academic pathways are fundamentally different, and to appoint not just high-profile researchers but also specialist teachers. Such a policy would allow committed teachers the time and resources to develop not only their courses but also their own careers, in the hope that they will eventually be recognised and promoted on the basis of their teaching portfolio alone. The effect on the pathology specialties, suffering as they are from chronic staff shortages and an ever-increasing clinical workload, would be dramatic.

PATHOLOGY TEACHING IN THE NEXT 100 YEARS

There is no doubt that the main objective of pathology teachers in the 21st century must be to raise the profile of pathology teaching in the undergraduate curriculum back to somewhere near its former level. This needs to be done not only to equip modern medical graduates with an understanding of disease mechanisms, but also to stimulate interest in pathology as a career. In order to do so, however, several issues need to be tackled. Firstly, the loss of pathology from modern curricula must be corrected, and, secondly, the pathology teaching workload must be adequately managed.

There is no doubt that managing the teaching workload will be a particularly difficult challenge for pathologists in the future and that novel solutions will need to be found. Given the savage loss of academic pathologists, unless the trend is reversed it will be impossible for universities to deliver pathology teaching without the help of NHS colleagues. Academic and NHS pathologists will need to work together to agree a model for delivering teaching. This might involve negotiation of job plans at a departmental level with protected time for teaching. Development of formulae for calculating the time required for teaching and its preparation will be particularly important, as will identifying and obtaining appropriate funding. Other ways of spreading the load include involvement of non-consultant staff in teaching, such as trainees, clinical scientists, postgraduate students or retired pathologists.

Raising the profile of pathology teaching depends on active involvement by pathologists in curriculum design and planning at a local level. As well as inclusion in the core curriculum, ways of incorporating pathology include offering selected study modules and clinical attachments or research projects in individual departments. Using multidisciplinary team meetings as an opportunity for teaching is another example of how pathologists can be actively involved in teaching without the need for substantial additional resources. Intercalated degrees in pathology are an important way of exposing interested students to pathology and, in the author's experience, provide a strong stimulus for eventual choice of pathology as a career.

The Pathological Society has been active in trying to re-invigorate pathology teaching. An Education subcommittee has been formed, chaired by the author, to tackle educational issues. This includes development of a database of e-resources, including images, tutorials and other computer-based teaching materials for use by hard-pressed pathology teachers nationwide. A joint project is ongoing with the Royal College of Pathologists to develop a realistic core curriculum in pathology. More importance will be given during Pathological Society meetings to research and innovation in medical education. Grants from the Open Scheme have been awarded for educational projects, one successful example being for the modernisation of the Crane Pathology Museum at the University of Sheffield (Bury and Burton, 2005). The existence of funds for supporting students in intercalated degrees in pathology will be advertised more widely and available funds may be increased. A student essay prize on a topical pathology title will be offered annually.

Through these initiatives, it is hoped to stimulate medical students' interest in pathology over the next 100 years!

CONCLUSIONS

Major reforms in medical education have led to a shift away from didactic discipline-based teaching with 'factual overload' towards integrated, systems-based education with an emphasis on SDL. Rightly or wrongly, pathology tends to be perceived as a fact-based science, and so has suffered the same fate as many of the basic science subjects in having teaching time drastically cut. From the position in Turnbull and Russell's time of pathology underpinning much of the medical curriculum, there is concern nowadays that pathology is disappearing from undergraduate curricula, especially those that are centred on PBL.

The problems facing pathology teaching and pathology teachers mirror those of most other medical disciplines, namely a lack of time and money, and competing pressures from many other sources. Academic pathology is in particular danger of extinction, however, so the questions must be asked: who will teach medical students pathology in the future and who will be the role models from whom the future generations of pathologists will come?

Teaching is a task that requires enthusiasm and time, but one that, if done properly, is greatly rewarding. If pathology teachers of the future can restore the profile of their subject there is hope that newly qualified doctors will understand the mechanisms of disease, use laboratories properly and be stimulated to become pathologists themselves. If not, there is the danger of producing doctors who cannot explain disease to their patients, who abuse laboratories and who have no interest in pursuing pathology as a career, leading to a slow and possibly irreversible decline in pathology as a medical profession.

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