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Education of the thoracic surgeon

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It is always a pleasure to participate in a Thoracic Surgical Conference in Coventry. This is the fourth time I have been so fortunate, but today I feel extraordinarily grateful for having been invited by you to be the honoured guest of your distinguished Society. It is a great honour and privilege, and I hope that in return what I have to say about the education of the thoracic surgeon will be of interest to you.

I use the term "education" rather than "training" for I prefer to think of us as educators rather than instructors of a special technical skill. The term "training" seems to me to define the development in the trainee of a desired standard of efficiency in a proper skill by virtue of proper instruction and practice. "Education," on the other hand, has distinct academic overtones involving what I consider to be the important development of a student's intellectual and critical faculties so essential to the developing thoracic surgeon if the technical skills which are acquired are to be used appropriately. Let us consider training then as only a part of the overall education of a thoracic surgeon. If overemphasised, it will relegate our specialty to a secondary role in the academic community. On the other hand neglect of the purely technical aspects of our specialty will result in an inadequately qualified person who will not fulfil his or her total responsibility either to the profession or to the general public. Let me first review for you the development of our specialty before discussing what I consider to be some of the essentials of its educational requirements.

Specialisation in surgery

The twentieth century can with justification be viewed as an age of specialisation, for this characteristic permeates our society whether in the professions, the trades, or in other walks of life. Specialisation has occurred in response to society's complexity and the proliferation of new technology which has multiplied limitlessly the body of knowledge that must be assimilated by each succeeding generation. No longer can any single individual emulate the Renaissance man, and efforts to do so lead to the fallacy of dilettantism.

The development of specialisation in the medical sciences has been particularly dramatic but it has not always been a response to valid needs nor have all specialties prospered and endured. A specialty may be based on too circumscribed a body of knowledge to have hope of enduring as a valid effort. Specialties may develop for purely political reasons and are thus doomed to failure as was the ill-conceived effort to develop an American Board of Abdominal Surgery in the United States some years ago. Other specialties, developed for valid reasons, die of attrition because the subject of their concern diminishes in importance. An excellent example of this is the specialty that concerned itself with tuberculosis. Now that this disease has all but disappeared from the Western World, the specialty of phthisiology no longer exists. The enduring specialties developed gradually as a result of the legitimate need for the orderly accumulation of new knowledge about a subject previously unexplored, and the concentration of this new knowledge in the hands of interested individuals dedicated to the solution of new problems. Such is the case with thoracic surgery, which profited from the development of techniques that permitted the reasonably safe performance of operations within the chest, and later from the accelerated experience in the management of thoracic and cardiac injuries gained during the second world war, combined with simultaneous advances in the surgery of the great vessels of the heart. Whether the specialty lives or dies depends upon the need for its continuation and the vitality and productivity of those involved in it. That the specialty of thoracic and cardiovascular surgery has grown

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Table 1 *Development of thoracic surgery in the USA*

1917	New York Society for Thoracic Surgery
1918	American Association for Thoracic Surgery
1928	First Thoracic Surgical Training Programme
1931	Journal of Thoracic Surgery
1936	Symposium on Thoracic Surgical Training, Rochester, Minnesota
1948	Board of Thoracic Surgery
1964	Society of Thoracic Surgeons
1967	Residency Review Committee for Thoracic Surgery
1971	American Board of Thoracic Surgery

and prospered is self-evident, and I am sure all of us are grateful for the wisdom of those who, in 1965, did not follow the advice of a previous president of this organisation who said, "thoracic surgery should be integrated with the rest of surgery . . . Thoracic surgery has had a brilliant past, but it will soon become an error."[1]

The specialty of thoracic surgery dates back to the turn of the century and perhaps earlier, for it was Sauerbruch who, while an assistant of Mikulicz at Breslau, first began work on the negative pressure chamber in an effort to permit the thorax to be opened safely, work which was published in 1904.[2] Subsequently he and students of his became leaders on the Continent of this new special field, though still remaining fundamentally general surgeons. Others took up a similar interest and in Great Britain, such men as Morriston Davies, Tudor Edwards, and Grey Turner are remembered as among the early pioneers of the new specialty. Because the specialty of thoracic surgery developed along more structured lines in the United States than elsewhere, I have chosen to describe its development there in some detail, particularly in its relation to education in the specialty (table 1).

Disappointed at the negative reception he received after delivering a paper on resection of the oesophagus for cancer at the 1913 meeting of the American Medical Association and recognising that a new specialty was in need of support, Willy Meyer of New York, attending surgeon at the German Hospital (later to become the Lenox Hill Hospital), became determined to establish a national society for thoracic surgery. As an initial step, he and some 20 New York friends, including Howard Lillienthal, Frank Torek, and Sam Meltzer, met in 1917 and founded the first thoracic surgical society in the world, the New York Society for Thoracic Surgery, which continues to thrive today.[3] Its first function was to establish a national society, and the American Association for Thoracic Surgery was founded later that year, all but one of the New Yorkers being founder members. The first meeting of this new society took place in 1918 and the first president was Dr Samuel Meltzer who, with John Auer in 1909, described the endotracheal tube, a development crucial to our specialty.[4] The early membership exemplified the need for a special organisation concerned with all aspects of thoracic surgery, for surgeons, internists, phthisiologists, radiologists, anaesthetists and endoscopists were included.

Soon after the society was formed, a supplement to the Archives of Surgery devoted to thoracic surgical subjects was published, and this led indirectly to the development of a specialty journal first called the *Journal of Thoracic Surgery* which appeared in October 1931.[5]

In 1936 at the May meeting of the American Association for Thoracic Surgery held at the Mayo Clinic in Rochester, Minnesota, a symposium on thoracic surgical training was held which undoubtedly affected the future of education in this specialty in the United States. At that meeting a need for and interest in special training in thoracic surgery was clearly identified, for most of the members of the society had not received special training in this discipline. In fact, only 18 surgeons limited their practice to thoracic surgery in the United States at that time.[5]

A thoracic surgical training programme had already been established by Dr John Alexander at the University of Michigan in 1928. Originally a one-year programme, it was expanded to two years by 1932, and Dr Alexander described its content at that May 1936 meeting.[6] Men were accepted into the programme after an internship and at least two years of general surgical training. To quote Dr Alexander: "It has been my experience that less than two years of intensive training in a very active thoracic surgery clinic is insufficient to give a student the necessary self-confidence later to manage the problems of his practice and to serve as a competent consultant whose opinions and surgical ability internists will respect. Throughout the two years of training the students read widely in the literature of thoracic surgery and are expected to have a reading knowledge of medical German, and it is hoped they may also be able to read French, Italian, and Spanish." How our requirements have changed since those early days!

During this symposium, Dr Evarts Graham spoke on *The training of the thoracic surgeon from the standpoint of the general surgeon*, pointing out that the American Board of Surgery was about to be formed and that there might be

a possibility of certifying trainees in thoracic surgery either through the American Board of Surgery or through the American Association for Thoracic Surgery.[7] In response to this, a committee under the chairmanship of Dr Carl Eggers was appointed by the Association to investigate the matter and reported that there was no need for certification of thoracic surgeons by a separate Board.

More than 10 years later, however, after the impetus provided to thoracic surgery by the second world war, the importance of Board certification was raised again, and another committee chaired by Carl Eggers was established. This time his committee's favourable report was accepted by the American Association for Thoracic Surgery, and the Board of Thoracic Surgery was established in 1948 as an affiliate of the American Board of Surgery for the purpose of certifying competence in the specialty. Status as a primary Board was achieved on 1 January 1971, the certifying group becoming known as the American Board of Thoracic Surgery. At first candidates could qualify for examination through a number of routes. The requirements gradually became more rigid, and now only those candidates who have been certified by the American Board of Surgery and have successfully completed two years in an approved thoracic surgical training programme are accepted for examination.

Evaluation of training programmes, which had been the prerogative of the Board of Thoracic Surgery since 1950, became in 1967 the responsibility of the Residency Review Committee for Thoracic Surgery, a tripartite committee composed of representatives from the American Board of Thoracic Surgery, the American College of Surgeons, and the American Medical Association. This committee is responsible for approving programmes in thoracic surgery, which now number approximately 100. A total of 3768 surgeons, including the founder members, has been certified in thoracic surgery in the United States since the origin of the Board over 30 years ago. Currently, approximately 160 thoracic surgeons are certified each year.

It is nearly impossible to determine how many of those certified are actually engaged in the practice of thoracic surgery, though according to a survey by the American Medical Association,[8] 2036 thoracic surgeons were then practising in the United States, a ratio of approximately one thoracic surgeon per 100 000 population, five times the ratio of thoracic surgeons to population that you in Great Britain currently enjoy. Another survey carried out by the Society of Thoracic Surgeons under the direction of Dr Paul Adkins disclosed that nearly 20% of thoracic surgical procedures are still performed by non-certified surgeons in the United States.[9] I leave you to draw your own conclusions from these numbers.

The Society of Thoracic Surgeons was founded in 1964 in order to provide all qualified thoracic surgeons in the United States with a voice in the future of their specialty, an opportunity denied to many by the more rigid membership requirements of the American Association for Thoracic Surgery. Open to all certified thoracic surgeons after three years of practice who restrict their activities to the specialty, its membership now totals 1821. How different from 1936 when only 18 men in the entire country restricted their work to thoracic surgery!

Challenges remain to be faced and problems to be solved. The content and the format of the educational programme is undergoing constant scrutiny and change, and the American Board of Thoracic Surgery is now seeking solutions to many of these questions, some of which I am sure also confront you in this country. Questions such as, how much general surgical training should be required before admission to a thoracic surgical programme? How long a period should be allocated to thoracic surgical education? Should it include exposure to vascular surgery? Should programmes be flexible enough to accommodate those who might wish to restrict themselves to non-cardiac surgery as well as those who might wish to go further into the more complex practice of paediatric cardiac surgery? These questions have been answered differently by different English-speaking countries, as indicated in table 2. In the United States, previous certification by the American Board of Surgery is required, which usually implies five years' training in general surgery. Two

Table 2 *Educational requirements for thoracic surgery*

	General surgery	*Cardio-thoracic surgery*	*Vascular surgery*	*Certification by examination*
United States	4–5*	2	±	+
Canada†	2	3	+	+
Australia, New Zealand	2‡	4	—	+
Great Britain	3–5‡	4	—	—

*Years of education required.
†Certificate of special competence in non-cardiac thoracic surgery available.
‡After first postgraduate year.

years in an approved thoracic surgical programme are then required before the candidate can be accepted by the American Board of Thoracic Surgery for examination. Nearly two-thirds of approved thoracic programmes also include vascular surgery in their training. In Canada, specialty training in thoracic and cardiovascular surgery requires two preliminary years in general surgery followed by three years in the specialty, two of which are in the fields of cardiac and thoracic surgery and one year of which is optional. This may also include vascular surgery. A certificate of special competence may also be provided in thoracic surgery alone. In Australia and New Zealand, two years of basic surgical training is also required, but training in cardiothoracic surgery extends for four years, two of which are in cardiothoracic surgery, one year in open-heart surgery, and one optional year. As you know, in Great Britain a different format has been adopted. The preliminary training in general surgery lasts from three to five years followed by four years in specialty training, one of which is in cardiac surgery, one in thoracic surgery, and two in the area of the candidate's special interest. Only in Great Britain is no formal examination of the candidate's qualifications made, a certificate of special competence being issued on the recommendation of the Joint Committee on Specialty Training for Thoracic Surgery.

Such a varied approach to the educational requirements of thoracic surgeons is understandable when one reflects on the ways in which the specialty has developed in different countries and the special requirements which may exist in each. This variety of approaches to a common goal is a healthy thing, for it indicates that flexibility in developing any programme is important and should be encouraged. There are, however, certain general features of the thoracic surgeon's education which I wish to discuss in more detail and which I consider fundamental.

The educational process

Two fundamental elements are necessary for the educational process to proceed. First and foremost is the student, without whom the system would not exist. Second is the environment in which the educational process takes place, an environment subject to many influences. Both elements require our attention, and excellence in both is essential for the educational process to proceed productively. Finally, proper evaluation of the end product of the process is essential if the undertaking is to be fruitful. While currently we as thoracic surgeons seem to be preoccupied with details of what to teach, or how many students to teach for how long, to me these are minor matters which in the long run have a tendency to sort themselves out. Preoccupation with these details can distract us from the essentials.

THE STUDENT

It must be obvious to all that the education of the thoracic surgeon begins long before he or she is exposed to a thoracic surgical environment, and we as teachers of the specialty have delegated to others the important role of establishing priorities for these important preparatory years. Somehow we should as teachers involve ourselves in these matters, perhaps most effectively at the medical school level, but hopefully even earlier. I am concerned that today's medical student has been so programmed in the sciences from an early age that the doctors of the future may lack those important human qualities so essential in a doctor-patient relationship. The undergraduate students of today wishing to enter medical school, particularly in the United States, seem to be compelled to concentrate on science. They believe, with some justification, that chances of entry into their chosen profession are measurably enhanced thereby. While medical schools used to say they wanted applicants as broadly educated as possible, and some still do, nobody really seems to mean it and certainly premedical students are well aware of this. This is sad indeed, for now more than ever is there a need for a broad background in the humanities and social sciences in someone seeking a future in medicine. Too early an emphasis on specialism and concentration on limited skills, while hastening the educational time schedule, will inevitably occur at great expense to the student who is denied thereby the immediate pleasure and later benefits of the broader exposure.

While Lewis Thomas in his engaging essay on *How to fix the premedical curriculum*[10] makes a strong plea for restoring classical Greek and Latin to a primary place in premedical education, some might say this would substitute one tyranny for another. As a former student of the classics, I cannot entirely agree, yet his emphasis on the importance of a sound background in English, history, philosophy, and the literature of at least two foreign languages would seem essential if we are to "look forward to a generation of doctors who have learned as much as anyone

can learn, in our colleges and universities, about how human beings have always lived out their lives."

Such a background would help to rectify what I have found a frightening deficiency in students of thoracic surgery, namely, their inability to use the English language understandably and intelligently. It has been said with some justification that Great Britain and the United States are two countries separated by a common language. There is no question in my mind that you British are, as a group, better writers and speakers than are Americans. Your writing is simpler, clearer, more direct and understandable. Your felicity of speech and expression accompanied by a penetrating wit is widely admired but rarely duplicated. Unhappily, however, I have noticed in recent years that these important qualities seem to be less evident in your younger colleagues, so perhaps the same invidious influences are now at work in Great Britain as they have been for too long in the United States. Whether this is a reflection of the mesmerising influence of television on our intellectual capacities or whether the increased numbers of students has influenced adversely the preparation provided by our schools and colleges, who have had to resort to multiple-choice examination questions in lieu of the traditional essay response, I cannot say, but I am not alone in this observation. Sir George Pickering in his recently published monograph entitled *Quest for excellence in medical education: a personal survey*[11] states: "It would seem obvious that undergraduate education should have as its principal aim the training of the student's mind so that he knows how to learn, that he has acquired the basic discipline of scholarship and the habit of self-education. My survey has revealed that this is far from the case. Indeed, in many schools these attitudes and habits are encouraged very seldom or not at all. In many schools the student who graduates has had little or no training in how to express himself lucidly and grammatically in speech or writing. He has not the habit . . . of asking questions and gathering material so that those questions can be answered. Indeed, literacy and scholarship are on the decline in our medical schools."

In medical schools the emphasis is almost totally on the physical and biological sciences. Important as they may be, there is increasing need for emphasis on the social sciences with inclusion of such subjects as psychology and ethics, which are so important in our everyday dealing with patients. The demands on today's medical student from traditional university departments give little time for exposure to the important field of the social sciences as they bear on medicine.

Whatever influence we, as thoracic surgeons, may have on these preparatory years, we must make discriminatory decisions in the selection of candidates applying for a position as a resident or registrar in thoracic surgery. "If only," as Lewis Thomas has said, "there were some central core discipline, universal within the curricula of all the colleges, which could be used for evaluating the free range of the student's mind, his tenacity and resolve, his innate capacity for the understanding of human beings, and his affection for the human condition."[10] If indeed there were, the selection of proper candidates for an education in thoracic surgery would be a simple task. Perhaps all of us engaged in this selection process would perform our task better were we exposed to training in interviewing skills, which might permit us to make more intelligent judgments on the capacity, motivation, and ultimate potential of men and women applying for training in our specialty.

THE EDUCATIONAL ENVIRONMENT

It is essential that during the thoracic surgeon's residency years the educational environment be favourable for the successful conduct of the educational process even though the best students will make the most of even the worst environment. Such a favourable environment, I believe, is best provided in a university setting where the learning process is constantly encouraged, curiosity and initiative of the student are fostered, and openness between student and staff is complete. In non-university programmes, service functions can become the main concern, the spirit of inquiry is quelled, and motivation stifled. The development of qualities of critical analysis and judgment should play a more important role than the mere acquisition of facts, and a programme emphasising service and not education cannot foster these qualities in the student. Student motivation has been much discussed and yet, in the long run, is it not up to the teacher to be responsible for such motivation? Wangensteen has said that "the only striking feature common to all successful surgical training programs is complete, loyal, undivided, and enthusiastic commitment of their mentors to the discipline of surgery."[12]

The teacher

The teacher of thoracic surgeons would seem, therefore, to be the vital element in establish-

ing the educational environment in which the student may flourish or perish. What qualities distinguish a good teacher from an ineffective one? First and foremost, the teacher of thoracic surgery should be an active clinical surgeon. His impact on his residents will be greater if he has won their respect by example, not merely by having achieved a lofty title. He must in addition forever remain a student, alive to his own ignorance but ever aware of the need for assimilating new knowledge and acquiring even greater wisdom. A teacher who is aware of his own shortcomings and admits to error attracts the respect of his students. Perhaps in this lies part of the secret, for a teacher who is successful in conveying attitudes will survive longer than one who merely transmits facts. In the long run, the student prospers if the learning process is enjoyable. The good teacher conveys to the student the joy of learning and the joy that comes from a job well done.

Role of research

An environment that combines teaching and research in a setting where there is clinical service of high standing creates an ideal atmosphere for learning. Research is many things, not only serious and original laboratory investigation but also the accumulation of new knowledge, the synthesis of already existing knowledge, even the reinterpretation or re-evaluation of existing knowledge. A student benefits immensely in an atmosphere where research is occurring, for a spirit of inquiry and curiosity is aroused by the excitement which surrounds the development of new knowledge that accompanies research activities. Millis perhaps put it best when he said research is "the necessary, the indispensable ingredient for the environment of learning . . . There is one skill we can give to every practitioner of a learned profession, and that is the skill of learning. The vehicle of such learning is . . . scholarly inquiry, which is research."[13]

Should the thoracic surgical student play an active part in research activities during the educational period? The amount and importance of the clinical material which young men and women entering thoracic surgery today must absorb and master is so voluminous that at least laboratory research should not in my opinion form an integral part of the student's curriculum. If the student is so inclined and exhibits an interest in laboratory research, a period of time, no less than 12 months in duration, should be set aside for investigation. During this period, the student should not be involved in any clinical responsibilities. Only in this way can training in the scientific method be accomplished and an investigative project of any consequence be properly pursued and brought to fruition. If the student, however, wishes to progress further and become a surgical scientist, then further research training is a necessity.

Students' research interests should be encouraged but not overemphasised. Overemphasis on research is unwise for it forces students with basically no research interest to fulfil their chairman's conscious or unconscious desire to be a leader of a school of surgical scientists. This occurred after the second world war in the United States and the accumulation of grant monies became a necessity for professional advancement in the academic community. Salaries were partially subsidised thereby, and the "teacher" or professor became further and further removed from patients and students. There developed particularly in the academic halls of medical departments a new academic breed spawned in the image of what has unhappily been called the "Harvard model." While one would hope that the educational environment should seek teachers that inspire students, house staff, and colleagues by the demonstration of skills in all areas including research, unfortunately research capacity became the most dominant factor in faculty selection. Some who were lacking in surgical skills and whose research interests were far removed from clinical surgery achieved chairs of distinction. Fortunately, these influences affected our specialty less than that of general surgery, and indeed are waning now as funds become less and professors of surgery are returning to their main responsibilities—namely, their patients and their students.

Training in technical skills

An essential part of the education of a thoracic surgeon is the learning of surgical skills. The proper educational environment, therefore, for a student of thoracic surgery is not one which only teaches him to think, reason clearly, and develop good judgment but one which is successful in teaching surgical skills. In this we in the United States seem to have been less successful than you. It has been my observation and that of others that many clinical surgeons in Great Britain and on the Continent perform standard surgical operations more expeditiously and with considerably more skill than their American counterparts. Professors of surgery in the United States, particularly since the second world war, have been more interested in their research image

than their technical skills. Too many have heeded the admonition of one of our famous teachers of surgery who has repeatedly, and I think purposely, tried to denigrate the importance of being able to do an operation. The attitude seems to be that the budding surgeon will eventually teach himself during his professional lifetime. This is a fallacy, for it is extraordinarily difficult to increase one's technical skills after training, since the practising surgeon, particularly in the United States, usually has relatively little opportunity to exercise his operative skills in the early years after completion of his formal education.

Overemphasis and misinterpretation of the essentials and goals of the "Halsted System" may to some extent be responsible for deficiencies in our training of technical skills. Using the German system as a model, William Stewart Halsted established in the late 1800s at Johns Hopkins Hospital a residency programme based on excellence which provided a milieu primarily designed to develop teachers of surgery, much in need at that time in our country.[14] The house surgeon was the director of the training programme and in terms of experience and length of training was comparable to an assistant or associate professor in today's academic environment. The technical skills of surgery were passed from the house surgeon to the younger men in the department; staff surgeons were rarely if ever called upon to participate except in dire emergencies.

The success of this system depended in no small part on the extraordinarily high quality of those students accepted into it. Further, the system was based on the existence within society and within the hospital of a financially underprivileged group of patients, most of them of an ethnic minority group, with whom the residents could work.

Because the system was so successful in producing teachers of high calibre, it was widely adopted often by the wrong institutions, particularly institutions designed to provide practising surgeons for the community. When the calibre of residents is unexceptional and the chief resident's tenure is short, the system does not work. With staff surgeons all but excluded from the resident's operating room, succeeding generations of residents compound the technical errors imparted to them by their immediate predecessors so that many American surgeons today are ignorant of the technical skills of their profession for they were never taught them. Recent emphasis on the research capabilities of surgical department chairmen has only added to the problem for even when called upon by the resident for technical help, as often as not the chairman is less capable of doing the operation than the resident.

Fortunately these trends are being reversed in the United States mainly because the pool of "charity" patients has dried up with the increasing involvement of the American public in health insurance plans. American surgeons are gradually accepting the concept that all segments of the population are entitled to the same standard of care, and the American teaching surgeon is again in the operating room, increasingly involved in participating in the technical aspects of our specialty.

The terms "apprenticeship" and "preceptorship" have pejorative connotations in university surgical departments, yet some have always believed that an apprenticeship system is the best way to teach technical surgery. The Mayo brothers employed such an approach, and many universities have found modifications of the Mayo method to be viable and productive ways of teaching the technical skills of surgery. Closely supervised by the teacher, today's student can, first by observation then by increasing responsibility for the technical conduct of operations, progress with confidence and skill enhanced by the repetitive performance of parts of operations before undertaking complete operations. Supervision at all levels of training is the key, and the student's natural inclination to embark independently prematurely should be tempered until the teacher is convinced that sufficient skill has been acquired to justify this final step.

Evaluation of the student

Probably the most difficult task for directors of thoracic surgical programmes is to evaluate the product of the programme. Theoretically, if candidates are properly selected, placed in an appropriate environment, and provided with proper intellectual stimulation and instruction in the technical skills of the specialty, the end result should be a finely educated thoracic surgeon. Unfortunately, human nature being what it is, this may not necessarily be the case. It is important, therefore, to determine somehow what the student actually learns. One way of evaluating this is by formal periodic reviews by the thoracic surgical faculty of the student's performance. This not only acts as a constant reminder to the staff of the importance of their teaching responsibilities but also alerts the staff to potential deficiencies in the programme, and

the student to gaps in his own knowledge and deficiencies in judgment and decision-making abilities, which are so hard to evaluate by written examination. Obviously, the results of these periodic reviews should be discussed openly with the student.

Unfortunately, examinations are still the best yardstick for measuring a student's qualifications. The "in-service" examination has become popular in the United States and is a worthwhile but limited instrument. It can be given during or at the end of the educational programme. As currently used in the United States, a written examination made up of questions similar to those used by the American Board of Thoracic Surgery is given to the student in training. The results are intended primarily to be educational. The programme director is informed of his resident's performance in relationship to his peers throughout the country. A further breakdown of the resident's performance on cardiac and non-cardiac questions is made to identify the strengths and weaknesses of the programme.

Only in Great Britain is final certification of the potential thoracic surgeon determined without a formal examination, and I admire your courage in having selected this route. Personally, I prefer a certifying process, such as yours, which evaluates the programme and the programme director. A student who is educated in a programme evaluated in such a fashion and supported by his teachers should be eligible to practice the specialty. Such a concept of qualification is, of course, easier when the number of programmes and their graduates is small. In the United States the number and variety of programmes and trainees make such a mature and sophisticated approach all but impossible, so we are forced to rely on examinations as the best yardstick for measuring students' qualifications. By constant improvement, the written and oral examinations of the American Board of Thoracic Surgery are now so structured that all candidates are given an equal and fair opportunity to demonstrate their learning. Testing for factual knowledge alone is but one part of the testing process. The oral examination provides greater opportunity to test the individual's analytical skills and critical and decision-making abilities in hypothetical standardised clinical situations.

Unhappily, the failure rate of American- and Canadian-trained candidates taking the examination for the first time remains more than 10%. Ideally no one should fail these examinations. One reason for these failures is the lack of responsibility on the part of some programme directors in identifying and dealing with the problem of the student who is not qualified and never will be qualified to become a thoracic surgeon. This is a hard decision to make and harder to act upon, but, once made, it should be implemented decisively and the individual concerned counselled on alternative avenues of interest. This is the real way of ensuring that the educational process produces properly qualified individuals to serve the public.

Curriculum

I have purposely left discussion of the curriculum of the programme until the end for I think it is less important than much of what I have already said. These details will ultimately sort themselves out depending upon the interests of our specialty, the needs of our public, and the future developments in our field. I am not alone in this view. Dr J Englebert Dunphy in an address entitled *Not from a curriculum* quotes Jacques Barzun in saying "The virtues which we hope to instill in the minds of our students 'come not from a course, but from a teacher; not from a curriculum, but from a human soul.' "[15] And from Sir George Pickering comes the following: "My survey has convinced me of what my experience as a Professor of Medicine has suggested, namely that far more important than details of the curriculum is the attitude of mind of the teacher. Learning is easy if it is a pleasurable experience and if the student finds the process interesting and exhilarating . . . His [the teacher's] attitude should be that of kindling a flame rather than filling the pot."[11]

Nonetheless, we as teachers of thoracic surgery must make some substantive decisions regarding the nature of our specialty if we are to teach it and if we are to exert a positive and beneficial influence on the talents and abilities of those who follow us. First, let me say that I firmly believe in a thorough background in general surgery for thoracic surgeons. Our specialty should not be divorced from general surgery, not because most older thoracic surgeons started as general surgeons, but because general surgery remains the core of our specialty, for it embraces the fundamentals of all that is important in a specialty such as ours—as, for example, such basic matters as wound healing, the metabolism of illness and convalescence, fluid balance, hyperalimentation, endocrine influences, and infection. The list is limitless. Furthermore, non-cardiac thoracic surgery should not revert to general surgery, a move that would result in the

remainder of our specialty, cardiac surgery, finding its home among cardiologists and cardiac physiologists, much as neurosurgeons are the bedfellows of the neurologists. I cannot envisage a similarly restrictive home for our specialty and hope that we can remain in the mainstream of surgery as a subdivision of general surgery. Moreover, education in general thoracic surgery should be required of all including those who hope ultimately to restrict their activities to cardiac surgery.

Perhaps the current time requirements of preliminary training in general surgery are excessive in the United States and may be inadequate elsewhere. They have been so in the United States because general surgical programmes usually provide the period of senior responsibility for the general surgery resident during the last year of a five-year programme. I would propose that ideally three years of general surgical education should suffice, provided those planning a career in thoracic surgery are permitted a proper period of growth in experience and responsibility to furnish them with a sound background in the general principles of surgery. Some of the specialty rotations that are now part of the usual general surgical programme would naturally have to be abandoned in such an abbreviated programme, and time spent on thoracic surgical rotation should be minimal except perhaps for those as yet undecided about their future.

The period of organised education in thoracic surgery should not exceed three years, one of which should be devoted to non-cardiac thoracic surgery and one to cardiac surgery. The division need not be this arbitrary and the two years could be spent in a mixed programme. A final elective year should be devoted to the field of the student's chief interest. If it should be paediatric cardiac surgery, then the entire final elective year should be spent in this specialty. If other interests appeal to the student, some flexibility in the elective year might be encouraged. No more than six months of the three years should be spent solely in non-clinical activities, such as cardiac catheterisation, pulmonary function testing, experience in oesophageal motility, and the like.

During this three-year period of education, the resident or registrar should be encouraged to become involved with one or more clinical research projects even if it merely concerns a case report or two or a review of the literature on a specific topic. In this way, the broader academic aspects of the specialty are emphasised, and by such involvement the young thoracic surgeon can better assess the literature and keep abreast of future developments in this field. Those with strong laboratory interests should take time out from the formal clinical programme and devote at least 12 months to the research laboratory, longer if the student's goal is to become a surgical scientist or teacher.

While the future role of vascular surgery in the training of thoracic surgeons is uncertain, in all likelihood it will not become a formal part of the training programme unless the programme director or one of his faculty is especially skilled and interested in this special field.

Continuing education

The continuing education of the thoracic surgeon is as much our responsibility as is his initial education. It has been said that the man who graduates today and stops learning tomorrow is uneducated the day after. In the United States since 1976, certificates awarded by the American Board of Thoracic Surgery are valid only for 10 years. A voluntary recertification examination will be available in 1981 to all board certified surgeons and in preparation for the formal recertification process which will begin in the late 1980s, an educational syllabus is being prepared by a special committee. The final recertifying process will actually involve three phases —a formal written multiple-choice examination, an audit of the surgeon's clinical experience over the previous several years, and presentation of evidence of yearly attendance at approved educational activities.

While the actual format of the recertifying process will undoubtedly change as experience dictates, its main purpose, which is to ensure that the established surgeon is well informed about recent advances and changing practice and keeps up to date, will not.

Conclusion

And so, as thoracic surgeons responsible for the education of our successors, let us heed the words of Kingman Brewster, currently the United States Ambassador to the Court of St James, who, when President of Yale University some 10 years ago, said "The door of choice closes quickly once a person chooses a specialised calling or profession. Each step forward seems to burn more bridges than it opens."[16] Aware of the potential dangers of overspecialisation, I think we can cope more effectively and intelligently with the educational requirements of our

profession. First and foremost, selection of candidates whose intellectual capacities have been stretched and enriched by exposure to the humanities, history, philosophy, and languages should provide the raw material best suited to benefit from the educational years in thoracic surgery. These years should be spent in an environment that will stimulate the student's interest, curiosity, imagination, and joy of learning so that maturity and wisdom as well as knowledge will be acquired. Aided by a concerned faculty and benefiting from the preceptor method, the young thoracic surgeon's technical skills will grow as increasing operative experience is acquired. The desired product of these years, an accomplished thoracic surgeon, will have completed only one educational phase. Recognition that education continues after certification is an essential part of our continuing responsibility to the education of the next generation of thoracic surgeons.

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