Undergraduate Surgical Education for the Twenty-first Century

RICHARD W. SCHWARTZ, M.D.,* † MICHAEL B. DONNELLY, Ph.D.,* BYRON YOUNG, M.D.,* PHYLLIS P. NASH, Ed.D.,† FLORENCE M. WITTE, M.A.,* and WARD O. GRIFFEN, Jr., M.D., Ph.D.§

This article addresses the problems associated with current undergraduate surgical education and discusses the requirements necessary for its improvement during the third and fourth years of medical school. It asserts that, coincident with the emphasis on faculty research and publication and expanded resident patient care duties, teaching, particularly medical student teaching, has assumed a very low priority. Third-year medical students are attached to surgical teams, where their education is haphazard and disorganized. Furthermore, because any teaching that occurs is teacher oriented rather than student centered, knowledge is accumulated passively and is not well retained. Traditional evaluation using shelf multiple choice examinations and ward ratings by residents and faculty may provide inaccurate assessments of the students' performance. The undergraduate surgical education program should be directed by a faculty member who has been grounded in educational techniques and research and supported by a department chairman committed to bettering the program. In the clerkship, medical students should be assigned to faculty rather than to services and should be presented problems that require solution. Students also should be provided with the resources to solve the problems and should be given sufficient time to solve them. Some operating room experience and bedside teaching should occur during the clerkship. A variety of evaluation and testing methods based on the learning objectives of the clerkship should be used. Third-year students should not be promoted until they have demonstrated their acquisition of appropriate knowledge and skills. During the fourth year of medical school, students should be supervised as they repeatedly practice basic skills during mandatory acting internships: history taking, performing physical examinations, acquiring data about the patient, and developing a management plan. When the basic skills are complemented with an adequate knowledge base, the student can be graduated to practice medicine under ever-decreasing supervision during residency.

Fundamental reforms in undergraduate medical education have been advocated for nearly 100 years. In 1899, Sir William Osler realized that the complexity of medicine had already progressed beyond the ability of the faculty to teach everything that students would need to know. He recommended abolishing the lecture method of instruction and allowing students more time for study; furthermore, he emphasized the important role of faculty in helping students learn to observe and reason. In 1932, the Commission on Medical Education of the Association of American Medical Colleges stated that medical education should develop sound habits as well as methods of independent study and thought which will equip the student to continue his self-education throughout life. This can be brought about only by freeing medical education from some of its present rigidity, uniformity, and overcrowding and by articulating it more closely with the educational needs of the student.

The 1984 AAMC Panel on the General Professional Education of the Physician and numerous other medical educators also have advocated similar fundamental reforms in both the process and the content of undergraduate medical education.

Dr. Richard Varco, in his presidential address to the Society of University Surgeons (1955), eloquently defined both faculty and student goals for undergraduate surgical education:

Some faculties rely on concentrated didacticism to talk the subject into the student's mind. . . . With his critical thinking regularly done by others, our student never acquires a working familiarity with the art and science of education. Only from sound beginnings devoted to acquiring a self-sufficiency in learning techniques can he ultimately hope to acquire knowledge and, perhaps in time, wisdom. . . . If a person is to read and think critically in later life,
these habits must be initiated and fostered during the formative years.

Although change is needed in all areas of undergraduate education, this paper deals primarily with suggestions for the reform of third-year surgery clerkships.

**Weaknesses of the Traditional Surgery Clerkship**

Folse et al. have concisely described the traditional surgery clerkship with its many associated problems as:

- a group of students assigned to a resident service who work up patients, receive lectures, attend conferences, and participate in rounds and operations with residents and attending physicians. Educational research indicates that this format of clinical education is frequently unstructured, skill acquisition is left largely to chance with little quality control, students are inadequately monitored, and feedback is seldom given.

Technological and therapeutic advances, increased specialization, current socioeconomic considerations, and competing demands for faculty time, as well as the tertiary and intensive care nature of the patient population at university hospitals in particular, have altered the original student–physician relationship and its environment. These alterations, many of which are certainly beneficial to patient care and resident training, have been detrimental to medical student education.

**The Changing Roles of Faculty and Residents**

One significant element that influences the quality of surgery clerkships is the changing role of the faculty in student education. Originally, clinical clerkships were problem solving in nature, using the time-honored preceptor model. Although this type of relationship still flourishes between surgery faculty and residents, the interactions between faculty and medical students are infrequent and hardly qualify as preceptorships.

In most medical schools, excellent faculty teaching is not highly rewarded, either financially or by academic promotion or tenure. There is no doubt that excellent patient care and scholarly research or publication are required for promotion or tenure. Teaching thus loses out to other, more highly valued activities, and faculty–student contact is rare. Although many surgery faculty members are highly skilled surgeons, few are willing or able to spend sufficient time with students to provide role model or mentor relationships that can influence students’ professional mores permanently. This trend toward less faculty involvement in student education reinforces a growing consensus that the current methods of teaching medical students are not providing the knowledge, clinical skills, learning skills, and role modeling necessary to prepare students adequately for the challenges that will face physicians in the 21st century.

Most of the few faculty–student encounters consist of lecture presentations concerning the faculty member’s favorite subject. The student is a passive recipient of this information. Although the lecture can be an efficient means of transmitting information, the faculty member, not the student, assumes the primary responsibility for learning. Students’ retention of material presented in lectures diminishes from 60% within a few days of the lecture to 23% 8 weeks later. Enforced student passivity, however, represents the fundamental problem with the lecture method: it fails to reinforce the fact that students, whatever teaching approach is used, are ultimately responsible for their own learning.

Faculty have tended to shift their responsibilities for student education to residents. Traditionally, a high percentage of medical students’ clinical education has resulted from student–resident interaction. Currently, however, residents are burdened by an ever-increasing workload, which limits both teaching time and effectiveness. Additionally, the teaching performance of residents is at best inconsistent, due in part to their lack of instruction in educational methods, the variability of their interest in teaching, and their research commitments.

**The Ward Team and the Operating Room**

Knowledge gained from lectures and study is applied on the ward and in the operating room. This active mode of learning is meant to complement the essentially passive lecture. Participation on a patient care team provides students with the opportunity to apply knowledge actively. The patient care team is designed primarily for patient care, however, not for medical student education. Moreover, most students perpetuate the passive behavior that was expected of them in their previous learning experiences and become intellectually passive members of the ward team, performing tasks without understanding the purposes behind them. Usually, attending physicians and residents do not challenge this passive role. Thus, the team often functions as a convenient “baby-sitter,” freeing the faculty member to pursue other activities. To meet the primary goal of the team, “scut” activities (rounds, charting, obtaining results) are stressed and labeled as a primary method of student “learning.” Overemphasis on students’ service obligations and inefficient time management by both students and their supervising residents lead to inadequate time for student self-education.

The role of the operating room in undergraduate surgical education is certainly controversial. Questions such as “how much time should neophyte physicians spend in the operating room?”, “how much teaching of medical students actually takes place?”, and most importantly, “how much learning takes place?” are very difficult to answer. In the operating room students can learn how
operations are performed, how adequate resources and personal commitment together can produce successful outcomes, and how important it is to observe directly the pathologic condition and its correction.

Beyond these primary educational goals, the premise that it is productive for third-year students to spend most of the day in the operative arena is debatable. A variety of factors detract from the learning environment in the operating room. These factors include the students' inability to actually view the procedure, the technical aspects of the procedure itself, the necessary intensive interaction between faculty and residents combined with the indifference often shown to students, and the fact that teaching is not as important as patient outcome. In defense of faculty, leading the resident staff through procedures and providing optimal patient care can be very difficult and often require the faculty's undivided attention. Should the faculty also have to contend with student education at a very basic level? Nevertheless, a recent survey of all North American surgery clerkships (78% response rate) by the authors demonstrated that, in terms of the various activities included in the clerkship, students spent more time in the operating room than in any other clerkship activity.

The Inpatient Setting

Although the ward team provides a very rich learning environment, the learning of "bread-and-butter" pathophysiology related to surgery that occurs in this environment is neither systematic nor balanced, especially when it occurs in a tertiary care, teaching hospital. Students in tertiary care centers suffer from a progressively decreasing exposure to basic, commonly occurring disease processes and insufficient exposure to the outpatient clinical setting and outpatient surgery. The students' education is dependent on the luck of the draw in having available the patients with diseases and illnesses that are concurrent with the reading materials assigned to the students.

With the advent of restrictive reimbursement practices such as diagnosis-related groups, long hospitalizations and their related opportunities for student contact with the patient no longer exist. Traditionally, the considerable time and attention given to long-term patients allowed students not only to build a knowledge base of surgical pathophysiology through background reading, but also to interact with these patients and gain experience in communicative skills. As the length of hospital stays continues to decrease, students will have fewer opportunities to develop the basic skills of history taking, physical examination, data analysis, and treatment plan formation in the hospital. Many operations that used to require long-term hospitalization are today being performed in the outpatient setting. Because of this, inpatients are not representative of the patients that nonsurgeon physicians will examine and treat in their practices.

Weaknesses of Evaluation Methods

Typically, student performance is evaluated by means of multiple choice tests and ward rating forms. Although multiple choice tests provide an objective assessment of student knowledge, the typical surgery educator does not have the psychometric background to determine the quality of the examinations. Multiple choice tests, as frequently used in clinical clerkships, are neither valid (they do not measure what they should measure) nor reliable (they do not provide precise estimates of student knowledge). Rarely, if ever, are the content validity and reliability of these examinations determined in a routine, systematic fashion. Passing or failing a student is not justified if a test does not have the necessary psychometric properties. Multiple choice tests can be an appropriate testing mechanism; however, in practice they are seldom appropriate when used in clinical clerkships, not only because faculty do not spend the considerable time necessary for developing a reliable and valid test, but also because the test items usually measure isolated facts rather than the application of knowledge.

Ward rating forms are the most common tool used to evaluate the students' clinical activity. Even when these rating forms are constructed using the best psychometric principles, their use is open to criticism because not every rater will apply the same criteria with the same level of stringency. Correlations among raters are typically low, and ratings usually reflect one or two underlying factors on which the students are being evaluated. At best, these forms identify the outstanding students and, perhaps, the emotionally unstable ones. Only rarely are the clinically incompetent students identified.

There are several reasons for the limited utility of these rating forms. First, faculty may not spend enough time with students to know them well enough to make the complex ratings they are being asked to make on a wide variety of scales. Often, when completing these forms, faculty need to see photographs of the students to ensure that they are rating the correct student. Second, because of legal considerations, the considerable time and emotional commitment necessary to justify a negative decision, and the reluctance to "ruin" a young person's career, faculty rarely give students low ratings even when clearly unacceptable behavior has been observed. Third, faculty are not trained to use rating forms in a valid and reliable manner. Fourth, they are asked to evaluate students on an impossibly large number of characteristics, many of which could be evaluated better by other evaluation methods. Fifth, even if the faculty are knowledgeable about how to complete evaluation forms, the low priority of this activity results in hastily completed forms, often
delivered many weeks after contact with the student. If ratings forms are to be useful, they must be completed promptly, as soon as the student–faculty contact ends and only by faculty who know the students well. If faculty members do not know or remember a student, they should not fill out a form concerning that student. In addition, students should be evaluated only on personal behaviors, clinical activities, and communication activities that the faculty member has observed.

As the preceding discussion illustrates, traditional clerkships suffer from a number of weaknesses. These problems ultimately produce exhausted, cynical, indifferent students with deteriorating clinical and inter-relational skills. The undergraduate surgical education program, one of the primary responsibilities of the academic surgeon, needs to undergo thoughtful, educated, and innovative reform.

Welcome to the Twenty-first Century

The first step in modifying an undergraduate medical education experience is the examination and adoption of principles of learning based on adult learning theory. As has been so aptly phrased by Knox in reference to the incorporation of adult learning principles in undergraduate medical education, “when all is said and done, there is much more said than done.” According to Knowles et al., the adult learner “1) is self-directed, 2) is experienced, 3) has a need to know, 4) is attracted to problems, and 5) is internally motivated.”

A second step in clerkship modification is a systematic examination of recent progress in medical education research, especially that which pertains to the clinical sphere. Rogers notes that most medical school faculty . . . are startlingly unaware of research in medical education and of curricular experiments under way at medical schools. Although faculty members strive to stay abreast of new work in their own scientific fields, they almost universally fail to recognize education as a respectable research discipline.

Once this background work has been completed, the structure of the clerkship curriculum can be addressed. According to the curriculum committee of the Association for Surgical Education, the initial step in the development of an undergraduate surgery curriculum is determining what the student should learn. This emphasis places importance on what students need to learn rather on what the faculty would like to teach. Four goals of third-year clinical education are important: 1) developing self-directed learners who are excited about their profession, 2) re-establishing the faculty–student preceptor relationship, 3) re-emphasizing those inter-relational clinical skills basic to the competent practice of medicine, and 4) implementing evaluation or testing methods relevant to these concepts.

Developing Self-directed Learners

First, the emphasis needs to shift from the teacher to the learner. As the 1932 AAMC report states, “medicine must be learned by the student, for only a fraction of it can be taught by the faculty.” The primary responsibility of students, then, is to educate themselves. Self-learning is best accomplished through an active, problem-solving approach. Such an approach places students in an environment where they “need to know,” an essential stimulus for learning. It should not be assumed that all physicians either inherently develop or use problem-solving skills by the time they graduate from medical school. In fact, McPherson asserts that teaching students to think will be the primary goal of medical educators in the 21st century.

Current research into the cognitive psychology of the medical reasoning process indicates that there is no universal problem-solving skill that is broadly applicable to every clinical situation. Knowledge and experience are the keys to developing clinical expertise. Problem-based learning (PBL), because of the problem-solving skills it fosters, offers an opportunity for students not only to acquire knowledge but also to develop problem-solving abilities that will serve them in their later professional lives.

We do not simply retain isolated facts in our memory. Instead, memory structures, or schema, are created that cluster information into meaningful, functional units. In medicine, schema are developed best by actively solving clinical problems in a clinical context. Problem-based learning functions well in this regard because it encourages students to develop the schema necessary for memory recall. Problem-based learning has been described in detail elsewhere; basically, it is a teaching–learning method specifically designed to emphasize problem-solving skills, self-educational techniques, self-motivation, and self-direction. The problems discussed in PBL sessions serve as a framework for the recall of essential facts. Lectures, however, produce poor long-term recall because schema are not developed. To be useful, schema also must be repeatedly used. Along with a systematic presentation of disease processes appropriate for the third-year medical student, PBL provides a structure for such repeated utilization. In brief, the activation and development of clinical reasoning is best facilitated by participation in a PBL format containing numerous clinical problems that stress relevant knowledge and are properly sequenced. Theoretically, such an approach, when accompanied by progressive clinical exposure and responsibility, should initiate pattern recognition, which is the sine qua non of clinical expertise.

In several recent studies, we have tested the cognitive theory outlined above in our clerkship. In one study, we compared the performance of students who had been
randomized to either a PBL or a Socratic instructional format during their surgery clerkship. These two groups did not differ in their basic science grade point average or on their National Board of Medical Examiners (NBME) Part I examination. We found that the Socratic group performed better on two multiple choice quizzes (measures of knowledge) than did the PBL students. The groups did not differ, however, on the final multiple choice examination. The PBL group performed significantly better on a five-problem modified essay examination (measures of the ability to apply knowledge to a clinical situation—clinical problem solving). There was also a strong trend for the PBL students to perform better on a five-problem standardized patient examination \(p = 0.056\). In a second study, we compared the subsequent performance of the aforementioned PBL and Socratic groups on Part II of the National Board of Medical Examiners examination. The two groups did not differ on total NBME-II score, but the PBL group scored significantly higher than the Socratic group on the Surgery subtest.

In a third study, we examined the students’ acquisition of basic surgical knowledge in a PBL clerkship using a pre–post-test study design. National Board of Medical Examiners Surgery shelf examinations were used as the pre- and the post-tests. On average, the students gained 150 scale points (1.5 standard deviations) between the pre- and post-test examinations. The post-test mean was not significantly different from the normed mean of 500 (normed on a national sample of senior medical students). It should be noted that this knowledge gain correlated significantly with peer evaluations and performance on OSCEs (Objective Structured Clinical Examinations), the modified essay examination, and the standardized patient examinations. Only tutor and preceptor (faculty) evaluations did not correlate significantly with the demonstrated student knowledge gain. Taken together, these three studies provide strong support for effectiveness of PBL as an instructional method in a surgery clerkship.

If an educational method such as problem-based learning is introduced into a clerkship, faculty members must realize that the self-education process requires the protection of a significant amount of time for the students to use for procuring, synthesizing, and reflecting on both didactic information and patient data. The time constraints imposed by the heavy service work load of the traditional surgery clerkship allow almost no time for the student to develop and practice independent learning skills. There must be an abundance of free time in each student’s daily schedule so that independent learning can occur.

Re-establishing the Preceptor Relationship

In a preceptor program, one or two students are assigned to a faculty member for a set period during the clerkship. The faculty member and the student together assume the responsibility for planning and implementing an appropriate clinical experience for the student. The faculty serve as role models; students follow their preceptor’s patients, participate in their operative cases and outpatient clinics, and make rounds with them. The preceptor relationship enables students to concentrate, with appropriate guidance, on developing clinical and learning skills appropriate to their neophyte level of medical education.

The preceptor program allows students to participate in the outpatient setting under direct faculty supervision. Students examine and help care for their preceptor’s patients. As surgical therapy becomes more outpatient- and same-day oriented, this faculty–student relationship still can be used, with excellent educational results.

Re-emphasizing Basic Clinical Skills

Students are in the earliest stage of their development as physicians. These students need to gain mastery of essential clinical skills such as the development of a disease-related knowledge base, proficiency in the history and physical examination, the ability to communicate effectively with patients, and the ability to integrate information into a logical diagnosis and management plan. It has been demonstrated that, even if a student possesses basic clinical skills, they actually deteriorate during the third year of medical school. A significant percentage of medical students graduate without ever having a faculty member witness their performance of a routine history and physical examination. Practicing these basic components of patient care without corrective feedback is not an effective model for learning. All too often, the clinical skills necessary for success as a surgical team member are not those that should be emphasized during third-year clerkships. Such patient care skills as venipuncture, nasogastric tube placement, or intravenous access are important and should be learned well; in fact, performance of these skills by medical students eases the often overwhelming burden of work placed on surgery residents. Performing these tasks, however, should not consume so much of the students’ schedule that they do not have time to learn the skills of obtaining a thorough history, performing a proper physical examination, developing the art of patient–physician communication, and practicing both appropriate acquisition and logical synthesis of the medical database. These latter skills must be mastered before the physician can practice medicine.

Faculty can re-emphasize student acquisition of basic inter-relational clinical skills. Some medical schools are introducing clinical skills workshops in which faculty members use patients, simulated patients, or dummy models to demonstrate essential physical examination skills inherent in the competent practice of their particular specialty. Students practice these skills under the direct
supervision of the faculty. Such workshops represent an ongoing course in physical diagnosis and re-emphasize skills that may be neither supervised nor directly taught by faculty.

A systematic approach to observing students’ performance of clinical skills should be a part of the curriculum of each third-year clerkship.

Implementing Appropriate Evaluation and Testing Methods

Testing is an integral part of learning. What students expect to be tested on determines what they study. For this reason, tests need to be designed to reflect the learning objectives of the clerkship. In addition, evaluation should provide feedback to students about their strengths and weaknesses and provide a basis for a department to assess whether a student has learned essential clinical skills and developed an appropriate medical knowledge base. Evaluation methods also may be used to determine the level of the student’s inter-relational and communication skills and the maturity of his or her clinical judgment.

Evaluation and testing must reflect the changes in the curricular content and goals of the clerkship. We recommend that the emphasis be placed on proving clinical competency rather than on testing discrete knowledge or evaluating team performance. We emphasize that frequent evaluative measures with accompanying, timely feedback have been correlated with both student achievement and student satisfaction.27 Given the extensive types of testing mechanisms available, ward ratings should be de-emphasized, although it would be undesirable to discard them completely. When faculty members have the opportunity to directly observe students in action, they can make the sophisticated judgments that no test or simulation can. Judgments that only an experienced observer can make include students’ characteristics such as intellectual curiosity, professionalism, and ethical behavior. If these traditional evaluative techniques continue to be used, they should constitute only one component of the overall evaluation and should be critically reviewed for reliability and validity. This is especially true of evaluations completed by residents. Because they most often relate to students as members of a ward team, residents tend to reward work performance rather than educational progress in their evaluations.

Clinical skills should be evaluated in four domains: (1) knowledge; (2) problem-solving and clinical judgment; (3) technical skills; and (4) inter-relational skills. It is best to evaluate factual knowledge in the context in which it will be applied. Thus, the use of clinical problems to test factual knowledge is recommended. Problem-solving and clinical judgment can be evaluated in several ways, using written or computer simulations or simulated patients. Written or computer simulations can be used to measure students’ abilities to gather appropriate information in the medical history and physical examination, request the proper laboratory and diagnostic studies, and make logical diagnostic and treatment decisions. In the simulated patient format, a trained patient actor takes the place of the test booklet/computer, adding the dimension of human interaction. Technical skills can be best evaluated by an OSCE. In this procedure, students move from one station to another. At each they perform certain physical examination procedures on a patient or model, interpret radiographs or tracings, or carry out other basic technical skills. Evaluation of inter-relational skills can be achieved by observing or videotaping students’ interactions with a real or simulated patient. Later, the taped student–patient interview can be evaluated by an interaction analysis procedure that identifies the positive and negative characteristics of the interview.28

Another novel evaluative technique currently being developed is “search path mapping.”29 This technique can generate graphic representations of student search paths through different computer-based problems. Faculty members then can visualize how students have organized, focused, and applied knowledge to different content-specific clinical problems. Major misconceptions, organizational and content deficits, and proper knowledge links between content subdomains can be identified. This type of testing will be essential as medical educators evaluate new curricular methods such as PBL.

The psychometric characteristics of the evaluation measures used for the third-year clerkship at the University of Kentucky were examined.30 First, a determination was made of whether our evaluation measures assess different aspects of performance or one underlying dimension. A hierarchical cluster analysis indicated that the evaluations assessed two dimensions. The first cluster contained the multiple-choice tests that were used—a knowledge dimension. The second cluster was composed of a modified essay examination, a standardized patient examination, and evaluations of attending physicians and student peers—the ability to apply knowledge. Thus, knowledge and the ability to apply that knowledge represent different aspects of performance and need to be assessed independently. The reliability of the scores making up these two clusters also was examined. The knowledge cluster had a reliability of 0.78, indicating that it was possible to provide relatively precise estimates of student knowledge. The reliability of the cluster concerning the ability to apply knowledge was 0.64. This is a relatively low reliability and indicates the difficulty of assessing clinical performance precisely. Increasing the number of measures in the application of knowledge cluster can increase the precision of estimates of students’ abilities in this dimension.
Recommendations for Administration, Personnel, and Training

Once chairman support has been obtained and the clerkship coordinator has been chosen and educated, senior faculty members must be convinced to devote more time to and do a better job of teaching. No single faculty member is expected to perform all the surgery in a given department; neither should a single faculty member be responsible for planning and implementing all departmental educational programs. The entire faculty should be involved. The chairman must set the departmental tone for quality and time commitments by including educational endeavors as a factor in promotion, reward, and tenure decisions; by allocating financial resources for educational efforts; by giving unsatisfactory faculty evaluations when teaching is unsatisfactory; and by setting a personal example.

Another change necessary for improving medical education is providing an ongoing medical education program for the faculty in every department of surgery. This will help the faculty (1) to become knowledgeable about the process of medical education, (2) to know and support the educational goals of the department, and (3) to develop, implement, and practice state-of-the-art techniques in both teaching and learning. To accomplish this recommendation, surgical education as its own discipline should be given just recognition, and each department should have at least one clinician with a concentration in medical education. As is the case in other surgical specialties, the surgical educator should demonstrate appropriate education and skills before such recognition is rendered. The appointment of such a faculty member is of immense benefit to both undergraduate and graduate medical education and demonstrates to all concerned that the department is as serious about the education of its students and residents as it is about patient care and research.

Clinical bedside rounds conducted by faculty are vitally important to student education; however, they are not to be confused with problem-based learning. Faculty-led clinical rounds resemble Socratic teaching in that they are faculty centered and often can be stressful to the student. Both faculty-led rounds and Socratic sessions, when properly conducted, force the students to respond actively and quickly to faculty queries. In contrast, PBL not only allows the students to establish their own learning issues from each problem but also gives them both time to explore these issues and a forum for interpersonal communication that encourages professional agreement and disagreement. This type of curricular format thus encourages active, independent learning habits. Problem-based learning sessions are also different from Socratic sessions in that PBL tutors do not deliver didactic information; they guide group and individual learning processes. Although the two instructional formats are inherently different, Socratic and PBL sessions, with their contrasting emphases, are complementary.

The role of the surgery house staff in the undergraduate educational program should be defined at the departmental level. In the past, most student clinical learning was gained through "osmosis" in interactions with the house staff (the immersion theory). Although almost all departments of surgery expect that the house staff will be a major participant in the education of medical students, few define this role clearly. In the rare department in which role definition has occurred, it is often not explicitly communicated to the residents. Without proper guidance, which includes dissemination of departmental educational goals to the house staff and ongoing instruction in current educational techniques, it can no longer be anticipated that both teaching and learning will occur when house staff and students are together.

Ongoing instructional programs in medical education for the house staff can increase residents' understanding and acceptance of the departmental goals for undergraduate surgical education. Such programs will both edify the house staff and improve their teaching and learning skills. Instituting innovative programs such as problem-based learning while at the same time de-emphasizing the role of the traditional third-year clerk can lead to resident dissatisfaction. The service burden ("scut" work) previously borne by the third-year student must be assumed by the already overworked junior house officers. Only when the department educates the house staff, requires their participation in innovative educational programs, and advocates the hiring of additional personnel to lighten their service responsibilities will residents' attitudes and perspectives change so that they can skillfully and willingly contribute to the department's educational program.

Recommendations for Educational Settings

Many surgery clerkships focus almost exclusively on the inpatient experience, to the obvious detriment of student outpatient experience. With the advent of same-day surgery, most preoperative evaluation and preparation, which is far more essential to the introductory clinical education of the generic physician than is exposure to the tertiary nature of an university hospital inpatient surgery service, is practiced in the outpatient setting. Reasons for a renewed emphasis on the outpatient setting include (1) medical socioeconomic factors such as abbreviated inpatient stays, same-day surgery, third-party insurance carrier guidelines, etc.; (2) the push toward producing primary care and other nonsurgical physicians, who function mainly in the outpatient setting; and (3) the increasing tertiary and technical nature of the university hospital.
The ambulatory setting also offers students the opportunity to see the types of patients they will most often see in practice and the chance to participate in the continuity of care (from the clinic through surgery and back to the clinic for postoperative care). Even though most (90%) of medical school graduates will not be surgeons, all graduates must learn to recognize surgical disease at the primary care level.

Certainly, there is increasing emphasis at the national level on student exposure to teaching in the outpatient setting. Deveney and Trunkey at the University of Oregon have developed a surgery clerkship using small group learning techniques in which all 6 weeks in the third year are spent in the outpatient setting; students spend 6 weeks in their fourth year on an inpatient surgery service. While students are on their inpatient surgery services, attempts must be made to make the operating room a more productive educational experience and to ensure that a high correlation exists between the time spent in that arena and the new knowledge acquired.

Recommendations for the Fourth Year of Medical School

Although the primary thrust of this paper is the modification of the third-year clerkship, the clerkship changes described above will necessarily have an impact on the structure of the fourth year of medical school. We do not advocate that the student should never participate in a team during medical school matriculation; on the contrary, an "acting internship" experience during the fourth year of medical school can be an effective learning experience. An acting internship logically follows the development of essential clinical skills and should be mandatory.

The traditional fourth year consists mainly of elective course work; Griffen terms this year an "educational disaster." Theoretically, the year should be used to hone clinical skills and fill in knowledge gaps. Most students, however, even when "advised" by a faculty member, use this time to "audition" for residencies or as a year of rest and relaxation between a junior year of exhausting clerkship experiences and a first year of residency, which will be equally or even more demanding.

The fourth year is the logical time during which students should function as acting interns; in doing so, they will learn how to function as team members, continue to develop their clinical skills, and begin to develop responsibility for patient care. The fourth-year student should be treated, whenever possible, as a team member equal to an intern in terms of call schedule, patient care responsibility, and operative exposure. In providing this fourth-year educational experience, some of the case load can be shifted from residents to these advanced students. This type of experience will demonstrate to students and faculty alike the readiness of each student to perform competently as a physician. Furthermore, from an educational perspective, the evolution from student to physician will occur more logically if the acting internship experience follows a clerkship stressing the acquisition and development of both inter-relational clinical skills and active, lifelong learning skills.

Summary

In summary, undergraduate surgical education, like any other educational program, needs ongoing improvement to meet the changing demands of medical practice in the 21st century. Although the complexities of medical care have increased dramatically over the last century, the methods of teaching medicine have rarely changed. Appropriate educational techniques, as advocated by Osler early in this century, have not been implemented. Clerkship coordinators need appropriate support in accomplishing their important role. All faculty, including the clerkship coordinator, need to learn about the latest techniques and theories of both adult and medical education. Surgical education should be given the same emphasis as research and patient care. Instructional methods such as PBL, which emphasize active, student-directed, lifelong learning principles, should be implemented. Surgery faculty should re-establish their preceptor role with students; desired role-modeling then will occur. Essential clinical skills such as the history and physical examination, communication skills, data assessment, and treatment plan formulation should be emphasized instead of the "clerk" role. Performance-based testing should be employed so that both knowledge acquisition and its application can be properly evaluated. Acting internships in the fourth year of medical school should be made mandatory to continue the development of active learning and clinical skills and to provide students an opportunity to practice progressive clinical responsibility. The third and fourth years of medical school should be seen as a continuum in the initiation and development of clinical skills and patient care responsibility. The mandating of acting internships and their proper evaluation will serve as a bridge to graduate medical education (i.e., residency). Surgery faculty should begin to interact to a much greater degree at both the institutional and national levels in undergraduate medical education. Their decisiveness, energy, and problem-solving abilities are needed in this arena.

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