INDIVIDUALIZED MEDICAL EDUCATION

Report of a Workshop held March 30-31, 1973*
at the Mayflower Hotel, Washington, D. C.
Sponsored by the Council of Academic Societies
of the Association of American Medical Colleges
Edited by L. Thompson Bowles, M. D., Ph. D.
and Mary H. Littlemeyer

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C O N T E N T S

DISCUSSION GROUP REPORTS

INTRODUCTION

L. Thompson Bowles, M.D., Ph.D., and Mary H. Littlemeyer /*

Flexibility in academic programming for undergraduate medical students is becoming the rule rather than the exception. Tailoring education and training to the needs of the student is also spreading into graduate medical education. While absolute course requirements diminish, elective opportunities increase so that some schools allow students to arrange individual programs to accommodate their own pace of learning. These changes enhance individualization of medical education and training.

In view of these current trends, the Council of Academic Societies (CAS), representing a membership responsible for the education and training of America's physicians, sponsored an invitational workshop on Individualized Medical Education, March 30-31, 1973. The major purpose of the workshop was to assess the current state of individualized programming for undergraduate and graduate medical students. A primary focus of the workshop was the development of ideas and recommendations to insure that individualization does not compromise the quality of the student's preparation for a medical career.

Over 100 persons, representing 70 medical schools and 10 CAS member

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societies, participated in the workshop. The workshop consisted of three half-day sessions devoted first to major presentations and discussion in plenary session, followed by simultaneous small group discussions around defined topics, and concluding with reports from the small groups and a final plenary discussion.

This report includes the papers presented in the workshop and the small group reports.

FLEXIBILITY AND VARIABILITY IN U.S. MEDICAL EDUCATION

L. Thompson Bowles, M.D., Ph.D.

Curriculum change has been a faculty indoor sport for generations, and the present time is no exception. Although not every medical school is educationally innovative, a growing number of medical schools have reviewed their academic programs leading to the M.D. degree and decided to change for a variety of reasons, among which are educational philosophy and economic pressure. Increasingly, for better or worse, the M.D. degree signifies neither a uniform set of competencies nor a common knowledge.

Debating the merits and liabilities of some curricula is a perfectly legitimate activity for this workshop; however, in opening this workshop, I will not try to evaluate current curricula as much as to describe the extent of flexibility and variability that now exists in the medical schools of the United States.[1]

To date, no one has been very successful in identifying causal relationships between student experience in medical school and physician performance in practice. In part, the absence of such an identifiable relationship is due to the complexity of defining physician competence. Medical schools cannot control all the components that maintain high-quality

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1. Data cited in this paper are from Bowles, L. T. (Ed.). *AAMC Curriculum Directory, 1972-1973*. Washington, D.C.: Association of American Medical Colleges, 1972.

health care because social, economic, and political factors are beyond the schools' influence and expertise; however, medical faculties must assume responsibility for the clinical performance of their graduates, particularly those who finish their residency programs. This responsibility begins with and carries important implications for admissions committees as well as for curriculum committees, but for the purpose of this presentation, remarks will be directed at the curriculum.

THREE-YEAR PROGRAMS

Of the 108 M.D. degree-granting medical schools in the United States, 15 utilize a three-year program as the regular time span from medical school entry to graduation. Those three academic years vary in calendar time from 32 months to 36 months and in weeks of instruction from 129 to 152.

In addition to the 15 schools now using the three-year curriculum, 23 medical schools provide a three-year option for at least some medical students. The option is created by cutting down on vacation time and diminishing the time allocated for electives.

BASIC SCIENCE EDUCATION

In designing a program for the education of the primary physician, one could make a persuasive case for admitting Eagle Scouts into a one-month course for reading the *Merck Manual* and providing telephone consultation thereafter. In fact, the Peoples' Republic of China appears to have chosen that option with considerable success. It may well be that we too, in

time, will decide that most primary health care should be provided by professionals with significantly different preparation than is now conventional. For the present, it seems probable that most medical schools will continue to operate on the premise that a sound basic science understanding is of critical importance to the evolution and continuing education of the future physician, whichever pathway the individual selects for his or her medical career. Identifying that core basic science and subsequent clinical pathways is an educationally and politically difficult exercise. Curriculum, after all, is designed by faculty whose frame of reference has evolved in a lifetime of secondary and tertiary care with, perhaps, a short stint in the military as an exception. Input from the nonteaching, general physician 10 years out in practice is minimal in educational planning even though many such practitioners have a more accurate appreciation for the necessary segments of medical education than some faculty.

Wide variability in basic science curricula is evident from an examination of the number of hours used in different departments around the Nation to present the information required in each institution. If the review of hours is confined to those schools which utilize departmentally organized courses, it is possible to compare the most and the least hours used for anatomy, physiology, biochemistry, pharmacology, microbiology, and pathology. For anatomy, extremes range from 100 hours to 275 hours. For the purpose of this paper, anatomy is considered to include histology but exclude neuroanatomy. In physiology, the range is from 90 to 350. In biochemistry, the range is 60 to 270 hours. In pharmacology, the range is 60 to 270 hours, and in microbiology, the range is 60 to 300 hours. In pathology, the range is from 100 hours to 650 hours. If one correlates these time ranges with

Part I National Board scores, no significant relationship is identifiable, a fact which reconfirms earlier observations on the absence of positive correlation between hours of instruction and measurable learning.[2]

Without describing the possible explanations for differing time commitments in curricula, it seems clear that many schools have diminished teaching hours to less than traditional levels without sacrifice of learning. In addition, many schools have decided that the student will learn much of the required material outside the classroom. A reduction in the hours of formal presentation does not necessarily mean a reduction in the time spent by the student on the course. Most basic science faculty accept the impossibility of learning all the knowledge of basic science, and there appears to be an increasing appreciation for the value of teaching some basic science during the residency training portion of medical education when the student has a clearer picture of career choice and when basic science takes on a more clinically related and, hence, more important role in the average student's self-identified needs.

The style of presenting basic science material has also been at issue at least since Western Reserve initiated its program of integrated teaching of the basic sciences. At this time, 21 medical schools use primarily integrated teaching while 15 combine integrated and departmental styles in approximately equal proportions. A number of additional schools are now examining the possibility of developing an integrated teaching program, but the exact number ultimately deciding to use this style is not known. While

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2. Sanazaro, P. J. *Educational Self-Study by Schools of Medicine.* Evanston, Illinois: Association of American Medical Colleges, 1967.

most data comparing integrated teaching to departmental teaching have failed to identify any significant difference in measurable learning between schools, recently Doctors Hogan, Gallagher, Donnelly, and Hess, at Wayne State demonstrated that their "new" integrated teaching program was followed by improved measurable learning as determined by comparative scores on the National Board Mini Tests.[3] Just what this comparison means in terms of future clinical competence is hard to say. The integrated teaching system is generally quite popular among students, though a more mixed faculty response is understandable because of the additional work in creating and maintaining well-organized interdisciplinary material. As the number of hours diminish in the curriculum and research priorities change, lowering dollar amounts in many research areas, basic scientists are expressing a growing concern that their value in the schools' scholarly mission may be underestimated. One can certainly hope that this situation will be avoided.

CLINICAL SCIENCE EDUCATION

The basic sciences are not alone in change. Clinical education, too, is taking on a more variable and flexible nature. The recognition that different student interests may be optimally served in a variety of formats has stimulated experimentation in clerkships and residency. Sixty schools offer an all-elective final year. There is controversy over the value of a year of electives, but many schools still believe that this open year, designed

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3. Hess, J. W. (Ed.). Evaluation of the New Curriculum: A Progress Report. *Wayne State University School of Medicine Medical Education News*, April, 1973.

by the student under faculty supervision, is an important precursor to house officer education. Fourteen of the 60 schools with an all-elective final year, plus one other school, permit their fourth-year students to take an internship instead of the elective year.

Thirty-one medical schools offer at least one track which permits the medical student to begin his or her chosen field during the clinical clerkship part of medical education. Criticism of tracks has largely centered on the theoretical objection that a track will tend to narrow the student's focus too early and preclude the growth of a broadly educated physician who later specializes. Actually, no tracks now in existence are designed to exclude a broad clinical education. The student who has selected a specialty may go through a broad range of clinical training experiences with a specialty perspective inflicted by his own personality. For example, surgical house officers will see and manage patients in diabetic coma and congestive heart failure as well as those with appendicitis and gastrointestinal bleeding. House officers in internal medicine also manage patients with acute cholecystitis, frost bite, and colon malignancy. There is much cross-over in specialty interests, and tracking need not necessarily herald the onset of a narrow view of medical practice. Some budding surgeon may, as a medical clerk, believe that all patients bleeding from their duodenal ulcer for the first time, should have a gastrectomy, but this kind of decision-making probably reveals more about the first four years of the student's life than about his 10-week clerkship in general surgery.

Virtually every medical school has accepted the fact that nearly all medical graduates pursue some residency training. Many schools have not

altered their undergraduate academic program even with this knowledge though the data already cited in this presentation suggest that many schools are in the business of preparing their graduates for their residency training rather than for the independent practice of medicine.

CURRICULAR MODELS

During the closing moments of this presentation, it might be worthwhile to review a variety of models of both three- and four-year schools as well as a school providing the option of a three- or four-year program.

Model "A" is a privately endowed three-year medical school, which has recently converted from a two-year program to a three-year M.D. granting school. The first year begins in August and is 43 weeks in duration, including vacations, and covers the basic sciences with departmental presentations. The second year begins in June and is 50 weeks, also including vacations, and utilizes integrated systems teaching. The third and final year begins in July and lasts 44 weeks. Twenty-two weeks are spent in medicine-surgery clerkship. Seven-and-a-half weeks are spent in a maternal-child health service, and a similar time is spent in psychiatry. Seven weeks are left open for electives. This three-year program has placed heavy emphasis on basic science learning as preparation for a clinical career with the assumption that the final one year of clinical education will be followed by additional years of clinical experience at the housestaff level prior to independent practice.

Another three-year format, or Model "B," is a privately endowed midwest medical school with a long tradition as a four-year school. Its new

program begins in September with a 44-week first year which encompasses all the formal basic science education. The second year begins in August after a month of vacation, and for 42 weeks, five required clinical clerkships are given. The third (final) year of 42 weeks begins in August after a month of vacation and requires a second clerkship in internal medicine but leaves the remaining 30 weeks for electives. In this format, it is assumed that additional basic science learning will occur during clerkships and final-year elective experiences.

Model "C" is a state-supported new medical school in the southwest offering a basic four-year program with a three-year option. This program requires a heavy academic schedule though there are 20 hours per week open for electives or independent study. The first year begins in June and lasts 52 weeks with a long list of integrated systems courses focused on normal human biology. After a month of vacation, the second year of 40 weeks begins in August and focuses on abnormal biology, again using the integrated systems format. The third year begins in June and lasts 49 weeks involving a series of required clerkships in the five major specialty areas. The final 49-week year begins in June and allows all electives. The accelerating student can combine some of the first and second year and eliminate most electives and complete requirements in three calendar years, or 36 months of instruction.

Model "D" is a privately endowed four-year medical school offering a three-year option. The first year begins in August, lasts 37 weeks, and offers all the required basic sciences presented in departmentally organized courses. A month of vacation then precedes the beginning of the second year,

also in August, of five required clerkships, seven weeks each. There are no required courses thereafter, and students may opt for one or two years of electives. When two additional years are taken, the third year is generally devoted to basic science study programs, while the fourth year tends to emphasize clinical electives. The presumption at this institution is that each student should have a core exposure to basic science and clinical specialties and then be relied upon to select learning opportunities which are most important for growth.

A final model, Model "E," is a very traditional privately endowed school using a standard four-year program. The first year begins in September and extends over 34 weeks devoted to departmentally organized basic science courses. The second year involves an introduction to clinical sciences but still focuses on basic science over another 34 weeks beginning in August. The third year begins in July and consists of six required clerkships over 48 weeks. The fourth year begins in August and is 42 weeks consisting of 30 weeks of required clerkships and 12 electives. This format is a fairly traditional program similar to the curriculum which trained most of the members of this audience, though many of us may have had no electives.

CONCLUSION

There are other and more extreme variations from conventional curricula, but for the purpose of this workshop, these few already described will serve. At present, I know of no way to judge one better or worse than another nor any way to determine which is best for any given institution. It may be a

good thing that these academic programs are changing constantly; however, in reviewing the wide spectrum of academic programs, how does one decide that curricular change has resulted in better education and better graduates?

Is it significant that after all the years most schools have existed, after the thousands of graduates who have gone on to serve the public, a phantom list of schools with scientific excellence has evolved as a rarely named but quietly understood elite among academic medical centers? No such list has ever developed with respect to schools turning out the best practicing physicians. There appear to be many types of experiences through which the capable and committed student can pass and learn to practice effectively. And if this is in fact true, and acted upon, variability and flexibility in curricula are likely to increase, and the problems for both admissions committees and evaluation agencies will become even more staggering than is now the case.

Perhaps more important than any particular sequence of courses or of total hours is the student's commitment to providing good medical care and learning to do so in an environment of concerned and capable faculty who all contribute to the scholarly examination of problems and their solutions. The student who has not learned to manage his own learning, including self-assessment of his own clinical competence, is not likely to continue to utilize new and improved techniques of patient management after graduation. Flexibility and individualized curricula offer the prospect of allowing the medical student to begin responsibility for his or her training early in medical education and to continue to do so for a professional career.

AN EVALUATION OF EXPERIENCES AT THE OHIO STATE PILOT MEDICAL SCHOOL

*Robert L. Folk, M.D.**

The purpose of this paper is to describe a new educational program for medical students developed at the Ohio State University College of Medicine. Our major goal was to show the applicability, acceptability, and feasibility of utilizing independent study techniques for the teaching of the entire preclerkship clinical curriculum to medical students.

HISTORY OF PROGRAM

The first serious efforts at independent study started approximately 10 years ago when Dr. Grant Graves began to experiment with independent study techniques in the Department of Anatomy. After some initial success, this program was further refined over the next couple of years. Student responses gathered during these early years of experimentation pointed to a need for a readily available, standardized self-evaluation for students. The computer seemed to be a likely possibility for serving this purpose, and experimentation with computer-assisted instruction began. Over the ensuing couple of years, a small group of persons interested in computer-assisted instruction and capable of managing the hardware was forming at

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Ohio State. Establishment of the Division of Medical Education Research in the mid-60's provided further impetus to the pursuit of independent study. This early experimentation in a couple of disciplines appeared promising, but evaluation was difficult when only parts of the curriculum were taught in this fashion.

Therefore, in the late 60's, it was felt desirable to attempt to develop a complete curriculum taught by independent study methods. Consequently, a project proposal for the Independent Study Program (formerly known as the Pilot Medical School) was written in 1968. The Bureau of Health Manpower funded the program for approximately 1.1 million dollars in direct costs to be budgeted over a three year period. The goal was to define, implement, and evaluate an independent study program for medical students in their basic science training. The project objectives were to develop a modularized horizontally and vertically integrated curriculum, written instructional objectives, specially designed learning resources, computer-based self-evaluation exercises, and evaluation procedures and to carry out a cost:benefit analysis. The program was to permit independent rates of advancement, defining the constant as a given level of mastery and time the variable.

The project got under way in July of 1969 when one faculty member was recruited from each of the basic science disciplines, and I was assigned as director. This group of seven persons, during the summer of 1969, crystallized their concept of independent study, defined the role that each of the components of the system would play, and designed the superstructure of the curriculum. The actual authoring of materials began early in the fall of

1969. Clinical faculty were added early in 1970 as the development of pathophysiology modules began.

FUNCTIONS OF COMPUTER

It was determined that the computer would continue to serve primarily the role of self-evaluation. It was not felt desirable to consider it as a primary instructional resource. Our form of computer-assisted instruction is called the tutorial evaluation system. It embraces the following educational principles: *(a)* active student involvement; *(b)* corrective feedback for wrong answers; *(c)* coaching statements for unanticipated answers; *(d)* necessity for the student to discover the correct answer; and *(e)* reinforcement statements in response to the correct answer.

From the standpoint of faculty management and administration, the computer serves another function. From each student's interaction with the terminal the computer generates a series of faculty reports. These reports indicate any student's location at present, his track through the curriculum, the first and last date on the system, the total computer time logged, the response time per question, and efficiency identification (the last through the mechanism of programming of study prescriptions). When one considers the logistical nightmare of management of any significant numbers of students on independent study progressing at individual rates of advancement, a management system of this sort can become exceedingly helpful.

ENTERING STUDENTS

Thirty-two students began the Independent Study Program in July of 1970. They were selected as follows: The 216 entering students at Ohio State were mailed descriptions of the two tracts available through the basic sciences and were asked to elect which program they felt most desirable. From these 62 volunteered for independent study. These students were then stratified into four quartiles and ranked upon a weighted formula, utilizing the premedical point "r" ratio and the MCAT Science score. Students were then randomly taken from each of the four quartiles to make up the class of 32. Match control groups were then identified.

Let me give you some parameters which seemed to separate entering students electing independent study versus the typical lecture format. The students electing independent study had higher MCAT Verbal and Quantitative scores. On the Omnibus Personality Inventory, they ranked higher in aestheticism, complexity, autonomy, impulse, and expression. The ranking was lower on intellectual disposition, and they tended toward the femininity end of the femininity-masculinity scale. On the 16 Personality Factor Inventory, they tended to be assertive versus humble, conscientious versus expedient, tender-minded versus tough-minded, self-sufficient versus group-tied, casual versus controlled, independent versus dependent, and low-leadership versus high-leadership. On the Opinion, Attitude and Interest Survey, they ranked higher in achiever personality, intellectual quality, humanities interest, and social science interest. On the Meyers-Spriggs, the shift was toward an N and P rating on the SN and JP scales.

THE CURRICULUM

The curriculum consists of 33 modules of education, each considered to be a self-contained unit of instruction. There are three major segments to the curriculum. The first is the normal body systems, which is an integrated approach to anatomy, physiology, and biochemistry. The second major segment is the introduction to pathophysiology. This embraces the principles of pathology, preventive medicine, microbiology, and pharmacology. The third segment is the pathophysiology of the body systems. This is an integrated approach to pathology, pharmacology, and microbiology with a very heavy emphasis on disease mechanisms. The only formal sessions are a series of ethical issues seminars which later in the curriculum are replaced by basic clinical correlation sessions and physical diagnosis, which is taught as a parallel course.

The process begins with a separate packet of written objectives for each of the 33 modules. Upon request, the student receives his own copy for the module which he is beginning to study. Although we have found it impossible to write objectives in strict behavioral terms, they have become progressively more specific. They have been revised annually, and the students now find them very helpful.

The second step is pursuit of learning resources. Attached to the packet of learning objectives is a list of carefully selected learning resources available to the students. All of these learning resources are housed in a library restricted to the use of these students. It is located in the same building and very close to their study rooms in which each student has an assigned desk with a locking file drawer. The students are in-

structed in the use of all of the audiovisual equipment with the exception of videotapes and operate this equipment themselves.

The major method of obtaining information is reading. We still believe that this is a good mechanism for knowledge transfer, and the students find it acceptable. However, both would agree that further development of materials in the audiovisual area is desirable. We do utilize color and black and white closed circuit TV which is available throughout the basic science building. In addition, there are study carrels with unsynchronized sound-slide programs, 16mm films, and sound-on-slide presentations, all utilizing rear screen projection units. As has always been true, the students utilize the mechanism of small-group discussions among themselves.

Laboratory time is minimal within this educational system. Gross anatomy is taught entirely by prosection, and a student will experience approximately 12-14 hours of structured prosection time. He will experience a further 12-15 hours of microbiology and basic immunology laboratory. All of these sessions are repeated on several occasions, so that a student may have this experience at the time that is most appropriate for his rate of advancement in the curriculum. Basic histology is taught by sound-slide programs. Histopathology is taught by a combination of sound-slide programs and review of glass slides at the microscope. The sound-slide programs are designed not only to point out the salient features of the Kodachrome slide but also to instruct the student in the techniques by which he can then use the class slides on an independent basis. There are no biochemistry, physiology, or pharmacology laboratories. The last but very critical learning resource is the faculty member himself. Since faculty are not involved in design and delivery of lectures, their primary function is as tutors. In

the vast majority of instances, these are individual sessions which are initiated by the students.

The computer-based, tutorial evaluation system completes a module of education. The student interacts with a typewriter terminal. Six of these are available approximately 22 hours a day and are located in the immediate vicinity of the students' study rooms. Rear screen projection units are used in conjunction with the terminals to permit the utilization of graphs, charts, and photographs. Each student retains his own hard copy of the self-evaluation for review purposes.

Internally generated written examinations are administered at seven points in the curriculum. In addition the students will take the first three sections of Part I of the National Board at the end of the normal time sequence and will take the entire Part I of the National Board at the completion of the entire curriculum. At these two points, each student is also given a combination essay-oral examination by a team of faculty members. On all of these evaluations, the student is informed of his areas of weakness. If in the judgment of the faculty, there are significant deficiencies, the student is requested to stop at that point, review, and be re-examined.

EVALUATION OF PROGRAM

The faculty is impressed that there is better academic performance on internally generated tests with each subsequent class. National Board scores have progressively improved, and the student means with the last class are at or above national candidate means. Evaluations from the clinical ser-

vices are available only for the first class. From those we can discern no substantial difference between these students and those pursuing the regular curriculum.

We have administered the Medical School Environment Inventory with some additions of our own. Responses of students in the Independent Study Program versus those in the regular program are as follows: *(a)* higher scores in practical orientation of the curriculum; *(b)* higher scores in breadth of interest; *(c)* higher scores in general esteem; *(d)* higher scores in encapsulated training; *(e)* higher scores in team-work and student cohesiveness; *(f)* lower sense of student competition; and *(g)* higher scores in attitudes toward faculty. In summary, the program is highly acceptable to students.

When comparing the rate of progress of three different classes, we have seen a considerable acceleration with each succeeding class. Factors thought to contribute to this include refinement of objectives, better selection of learning resources, student feedback from previous programs, and more realistic data regarding the average amount of time necessary for completion of each module.

CONCLUSION

We feel that the Independent Study Program at Ohio State University College of Medicine is a viable system of education for some portion of the class of entering medical students. It has enjoyed a high degree of acceptance by both students and faculty. From preliminary estimates, we believe that it will be economically feasible.

EXPERIENCE WITH AN INTEGRATED PRECLINICAL CURRICULUM WHICH PROVIDES SUBSTANTIAL TIME FOR ELECTIVES

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Substantial public and legislative attention is being focused on the medical profession, and there are demands for significant changes. It is alleged that medical care is too expensive, unavailable to a large segment of the population, and not responsive to the needs of the individual. The following legislation would appear to be a direct result of these criticisms: *(a)* legislation to set standards through physicians' service review organizations which are to monitor not only what is done but also how effectively; *(b)* legislation to make health care available to all by establishing a national health insurance program; *(c)* legislation to encourage increased output of physicians by existing medical schools and to encourage establishment of new institutions; and *(d)* legislation to facilitate the development of academic departments of family medicine. It should be clearly noted that these are largely pressures generated outside of the medical profession and its schools.

The evolution of a medical educational system into a highly specialized

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and impersonal affair which is remote from the community at large is well documented. The virtual explosion of pertinent medical information over the past 35 years has resulted in a trend for specialization and increasing faculty size in medical schools. This has been most dramatic in the clinical faculty where there has been not only an increase in size but also a marked trend toward full-time appointments. The expanded size facilitates specialization (even subspecialization) and little or no dependence on part-time community physicians (and their patients) for the medical student's education. Thus, the training of physicians has come full-swing from an environment of an individualized community general medical apprenticeship to a highly specialized, isolated university experience. The change in environment can and has influenced the product of the system, the physician, in the way outlined above. Public expectations, however, are that medical care must be personal as well as expert, and general as well as specialized.

As a major, if not the primary, agency responsible for medical education, these factors must impinge on the medical schools. Furthermore, it is clearly the business of the entire faculty, not just the clinical staff. The challenge is to provide an educational program of sufficient breadth, depth, and flexibility to produce faculty, generalists, or specialists who are continual learners and who are sensitive to the needs of the individual.

The concept upon which medical education has been based since the early 1900's is that each student should be firmly grounded in the basic sciences before exposure to patients. Following this priesthood is a servanthood on the hospital ward from which the student emerges as a physician. This method ignores the reality that the body of basic information is so

large that no one individual can master or retain it and that the "basic facts" are largely obsolete by the time the student receives the medical degree. It is, therefore, surprising indeed that medical school faculty, most of whom have Ph.D. programs, have tenaciously clung to the notion that all medical students must be exposed to the same rigidly structured basic and clinical programs. So deeply engrained is this "philosophy" that the current cutback in federal support has caused clamors for reversal in programs which had undergone some liberalization!

Medical education thus is grappling with its image. Is it a graduate or professional school? Most would agree that its primary role is to prepare physicians to become scholars. They must develop a clinical, questioning attitude and a thirst for assimilating and integrating new information. This, by definition, demands an individualized program since each student has different patterns of learning, motivations, goals, and aspirations. The array is finite and manageable, however, since there is a commonality of purpose, i.e., the care of patients.

It was on these realities that a basic curriculum with provisions for early career tracking was developed at the University of Washington in 1968. In this paper we will describe this program.

OVERALL PROGRAM

A total of 180 quarter credits is required for graduation of which 90 are in a basic curriculum and 90 are electives. Of the elective credits, 72 are clerkship or free and 18 are nonclinical. The minimum time to complete this lecture-discussion program is 10 quarters. This may be shortened

somewhat in an optional Independent Study Program.

BASIC CURRICULUM

The basic curriculum, required of all students, occupies the afternoon of the first six quarters in medical school. In principle, it was conceived as providing for the development of a fund of basic information and integrative skills to apply it in the domain of human biology. The three main divisions are: *(a)* an introductory segment of approximately one and one-half quarters which aims to provide the background in basic human biology necessary to study rationally integrated organ physiology and pathophysiology; *(b)* an organ systems segment which deliberately integrates basic and clinical sciences and challenges the student to develop his own system of data retrieval and integration (problem solving); and *(c)* a segment, beginning on the first day of medical school, devoted to the development of the humanistic attitude, skills in interviewing and physical examination, and ultimately an application of these skills and those in *(a)* and *(b)* in the care of the total patient.

Several important changes have been made in the basic curriculum since its inception. When the programs began it was considered unnecessary to provide an anatomy course, if embryology and histology were taught. Two years experience with this assumption led to the establishment of an anatomy course of 70 hours during the first quarter. The institution of this brief course has not significantly decreased the involvement of the biological structure faculty in the organ systems; rather it has facilitated their participation. The introductory clinical experience has moved from the end

of the second year to encompass the whole experience. This provides the student with continuous feedback as to the relevance of basic sciences and their integration in the setting of clinical medicine. It also provides the opportunity and the necessity for continuous development of a critical, problem-solving approach. One spinoff of this program is that it provides students with sufficient background that they can pursue medically related activities during their first summer even if they are not able to get a laboratory position. Their skills in interviewing and physical examination allow access to certain clerkships especially those dealing with organ systems they have covered. They also become employable in a medical setting rather than being forced into the common labor market.

A more subtle, but equally important, change in the basic curriculum has been a reordering of priorities with respect to basic and clinical science material. The initial aim was to provide input at a ratio of three to one, basic to clinical medicine. During the first year or two the balance shifted markedly in favor of the clinical side. The balance is now near the initial goal, principally because of the ability of the faculty to work together and determine the appropriate blend of the two. The success of these efforts can best be measured by output of integrated syllabi and books. Books have been published or are in press for four of 11 organ systems and the introductory clinical experience. Syllabi published by the local university press are available for an additional four organ systems. Of the remainder only the endocrine and head and neck systems have not provided a published work, and of these two there are quite satisfactory texts in endocrinology.

ELECTIVE CURRICULUM

The elective part of the curriculum occupies the morning of the first six quarters and the subsequent entire period to graduation. The provision of this time allows the student to explore areas in which he desires more depth or perceives personal deficiency. The availability of this time during the first six quarters allows flexibility to explore career opportunities.

The success of this program depends on the provision of meaningful electives by the individual departments. Those who have simply continued the previous medical school courses and offered them as electives have been sorely disappointed following student registration. Those who have offered students the option of segments or subsegments of the previous courses and the opportunity to study in depth on a human biology topic have consistently attracted students. A case in point is the Physiology-Biophysics Department which has just recently reorganized its whole elective offering to complement the basic curriculum and to offer additional topics in correlative physiology directed toward medical students. This department had not previously successfully competed for student involvement but is now finding a rapid upsurge in interest. Such electives are also becoming popular with other health science professionals. The students have not elected courses outside the medical program in great numbers, but 15 percent have taken at least one course such as history or law.

PATHWAY OPTIONS

There are four pathway options: Behavioral Specialist, Clinical Specialist, Family Physician, and Medical Scientist. The student selects a pathway during the fifth quarter and plans a program for the rest of his medical school career. Each student is matched with an adviser in the area of his career aspirations. A student may change his pathway at any time, without penalty, except that he must satisfy the graduation requirements of that pathway before a petition for graduation will be honored.

The distribution of pathway selection by students is given in Table 1. As might be suspected, relatively few students select the Medical Scientist Pathway. Somewhat surprising is the small number of students selecting the Behavioral Specialist Pathway. One postulate has been that the requirements were so stringent that students interested in this pathway selected the Clinical Specialist Pathway to meet their needs. Evidence from student

TABLE 1

PATHWAY SELECTION

	Number of Entering Students			
Pathway	1968	1969	1970	1971
Behavioral Specialist	4	3	1	3
Clinical Specialist	89	36	55	65
Family Physician	9	40	38	35
Medical Scientist	3	5	2	3
Total	105	84	96	106

polls validates this argument. The establishment in 1970 of the Family Medicine Department explains the small number of students in that pathway in the 1968 entering group.

As shown in Table 2, the requirements for the Clinical Specialist and Family Physician Pathways are not strikingly different. Those for the Behavioral Specialist and Medical Scientist are quite dissimilar from the first two. It should be noted, however, that most students graduate with 206 credit hours rather than the minimum 180.

TABLE 2

PATHWAY ELECTIVE REQUIREMENTS

Pathway	Basic Science		Selectives		Clinical Clerkships	
Behavioral Specialist	Physiology through Psychiatry	24*	Clerkships	18	Neurology Neurosurgery Psychiatry Outpatient Clinic	-- 9 9 6
Clinical Specialist	Offered by Basic Science Departments	18	Clerkships	21	Clerkships (Medicine & Psychiatry strongly advised) Outpatient	45 6
Family Physician	Offered by Basic Science Departments	12	Any course numbered 300 or above	21	Family Medicine Internal Medicine Psychiatry Other	9 9 6 21
Medical Scientist	Research & related courses	72	---		Clerkships (no more than 18 in any one area)	36

*Quarter hours

ADVISING SYSTEM

The crux of a meaningful elective program is the presence of an informed, interested faculty who are willing to spend time in advising students. Considerable effort is expended in orienting faculty, providing them data about curriculum options and revisions, and reviewing student problems. It has only very slowly evolved into a strong system in all pathways over a period of five years with the strongest impetus being provided by the Family Physician and Medical Scientist Pathway.

The present curriculum has been in operation for five years. As noted previously, some changes have been made in its structure, but it remains basically intact. A number of faculty still yearn for the "good old days," but their numbers steadily decrease as the program matures and the arguments are unveiled as being primarily emotional and/or parochial.

The following discussion will consider the benefits and costs of an early tracking curriculum from the standpoints of the students, the faculty, and the institution and the actual flexibility allowed in this period. This flexibility, as earlier described, refers to the elective program which occupies the mornings of the first two years and the rest of the time to graduation. There is no flexibility in the core curriculum.

BENEFITS OF INDIVIDUALIZATION

To students.--Curriculum flexibility has considerable potential advantage in that it permits the student to structure his or her premedical and medical school academic program. After meeting the basic academic require-

ments, the student's motivation to broaden himself or herself in a particular area, remedy deficiencies, or explore new areas should dictate the program. The extent to which this is done depends on the strength of the advisory system and ability of the students to assume responsibility for their self-education.

Theoretically, individualization should facilitate admission and progression of students with varying backgrounds in meeting the demands of medical education. This, of course, depends on the competition for admission and the confidence of the Admissions Committee in this concept of medical education.

Another advantage should be in flexibility in the undergraduate program of admitted students. A comparison of the undergraduate academic program of admitted students before and after the curriculum revision, however, has shown no significant shift in this area.

Individualization has the major advantage of allowing the student access to several optional programs. The Medical Scientist Pathway offers the option of a pathway to a combined M.D.-Ph.D. under the auspices of an NIH Training Grant. The program is quite flexible and requires a minimum of six years to complete. This represents a considerable time savings to both students and faculty. Nineteen students are currently in the training program, and one will receive his M.D.-Ph.D. in June 1973.

Ten students have taken advantage of the elective time to pursue a Master's Degree in Public Health. A number are pursuing early graduation and are electing graduation at all times of the year. Many have been able to find internships or residencies immediately upon graduation. Others have taken time for travel, study in other areas, or medical studies abroad.

It was anticipated that students, especially science majors, would take advantage of this vast elective time to broaden their academic experience. The extent to which this is done has varied over the years, but the expectations of the faculty who designed the curriculum have not been reached. Again, the strength of the advisory system becomes important if this goal is still considered to be desirable. Curiously, it would appear that students feel these experiences are unimportant since the faculty has not included them in the requirements for graduation.

An Independent Study Program is available to the students. When this option was offered, 43 students selected it as their first choice. From that group the admissions committee eliminated eight. The remaining group was randomized, and 20 were selected. This program allows nearly complete flexibility of time rather than content. Six of nine students in the Medical Scientist Pathway (MSTP) have elected this method of study, since it allows them to attend graduate courses and seminars and work in the laboratories without the restraint of an inflexible lecture schedule.

The WAMI (Washington, Alaska, Montana, Idaho) program is an experiment in peripheralization of medical education which allows considerable flexibility. There are two phases, the university and clinical. The university phase exists at the University of Alaska, Montana State University, University of Idaho, and Washington State University. At the present time, approximately 10 students in each location receive the first quarter of instruction at that location. The students then finish the preclinical curriculum and the Basic Hospital Clerkships in the University of Washington. Following this, they may elect clerkships in community clinical units at various sites. At the present time there are clerkships in Family Medicine,

Internal Medicine, Pediatrics, and Obstetrics and Gynecology. In the future there will be clerkships in Psychiatry and Surgery as well.

It is hoped that through this mechanism students from localities who would otherwise not have had access to a medical education will have this opportunity available. Another major objective is to familiarize students with medical practice in medically underserved areas. Through this mechanism a direct effect on the distribution of health care deliverers is anticipated.

To faculty.--The advantages to the faculty are clearly in the areas of curricular flexibility, contact with the students, and an opportunity to teach in an elective curriculum. Integrated teaching has served as a major communication branch between departments on the educational and personal level. The success of this aspect of the program is best documented by the demonstrated ability to develop integrated published work in nearly all of the organ systems. The natural spinoff of this cooperation has included collaboration of research and integrated teaching in the elective program. More importantly, however, has been a clear understanding of the unique strengths and weaknesses of basic and clinical sciences by one another.

We are convinced curricular flexibility is a state of mind. The mere fact that curriculum changes occurred led to major shifts in faculty attitudes toward students and content. Evaluation of course content, methods of instruction, and even instructors was instituted. New ideas such as WAMI and Independent Study Program were conceived, developed, and are now in operation. Each offers a unique opportunity for the faculty to explore their teaching ability. For instance, the Independent Study Program has proven to be a very effective forum for faculty who function better in the

seminar or small group arena than in the lecture format.

The faculty contact with students has increased substantially for some departments. This has opened communication channels that did not otherwise exist. For some faculty the elimination of required laboratory exercises has decreased contact. For most of these, however, this has been balanced by offering electives. It should be noted that the difference in student attitude toward a course they elect versus those required makes the elective program a sheer joy.

To the institution.--There are also advantages to the institution in individualized instruction. The presence of a flexible program facilitates the recruitment of new faculty. The absence of rigid interdepartmental barriers allows the institution to respond more easily to the community. Examples of this are the Preceptorship and WAMI programs which are placing students in communities which are medically underserved and providing opportunities for medical education to students of neighboring states who might otherwise have been denied this possibility. A more subtle but demonstrable effect of this change in attitude is a softening of the isolation which the institution has from the community. This trend is an absolute necessity in these times.

COSTS OF INDIVIDUALIZATION

To students.--Individualization places substantial pressure on the students for their own education. Few have been in this position before medical school. Coupled with the size of the data base in human biology, this is a substantial hazard for some students, especially those in the minori-

ties. This flexibility also adds a note of uncertainty to the student's perception of the completeness of his education. Previously the whole program was prescribed, and students knew they were prepared when this was completed because the M.D. was awarded. Under the flexible curriculum, the program is relatively unstructured for more than one half of the time. Most students take advantage of their advisers and curricular opportunities to explore career avenues and establish a firm foundation. Some, however, cannot handle this situation and either demand early graduation or take an excessive number of electives, to the point of spending an additional year in medical school.

The main question to be asked of curricular flexibility is whether the students are better or less well prepared for their ultimate goals. As mentioned before, they must assume more responsibility for their own education and thus are on the road to becoming scholars. Another way of ascertaining whether the students have sufficient background if only the basic curriculum is elected is to assess the impact of the elective program on National Board of Medical Examiners (NBME) Parts I and II. Two elective programs which more than 50 percent of the students elect are shown in Table 3. Students electing any anatomy elective obtain a higher score than students not electing this choice. It is significant that it made no difference which elective the student chose, and exposure to more than one did not alter his performance. Pharmacology electives did not seem to influence the students' performance on the examination. It should be stated that pharmacology is perceived by the students to be inadequately covered in the basic curriculum. These data for anatomy and pharmacology lend strong support to the idea that students can and do study independently in an effec-

TABLE 3

CORRELATION BETWEEN ELECTIVES AND NBME PART I SCORES

Discipline Elective	Number of Students	NBME Part I Score
Anatomy		
Thorax-Abdomen	67	540
Head & Neck	66	555
Both	28	541
None	96	478
Pharmacology		
General	52	472
Autonomic	41	471
Both	32	487
None	17	448

tive manner. The data in anatomy suggest that when stimulated in a particular area, the students explore broad aspects of the discipline, not just that presented in a formal course. This, of course, is very satisfying.

The correlation of Part II of the NBME with length of exposure to clinical electives is also quite interesting. Students who elected an abbreviated clinical program had a significantly lower score than did those who selected a standard program. The mean score of those entering in 1968 and tested in April 1972 was 502 with 98 percent passing. For those who entered in 1969 and were also tested in April 1972, the mean score was 404 with 90 percent passing.

Internship selection and acceptance is also affected by the students' and hospitals' perception of the program. In 1972, 67 percent of the students received their first choice as compared to 47 percent in 1971. Additionally, a larger number of students were accepted into highly competitive programs as compared to previous years.

To faculty.--The cost to faculty is in time expended in the basic curriculum, preparation for teaching in an integrated program, and the elective program. The total involvement of the basic science departments in the basic and elective curriculum initially dropped precipitously and has now stabilized at the previous level. Significantly, the commitment of the several clinical departments has increased markedly during the first two years.

A major increase in the teaching load of all medical school departments has occurred. In the basic sciences this has been due, in the main, to increased commitments to other health science disciplines and to arts and sciences. As pointed out above, the clinical departments have assumed a major share of the teaching load in the basic curriculum.

CONCLUSION

Curricular flexibility allows individualization of the medical education of a given student. It has proven not to be significantly more expensive of faculty time, once established. It was initially feared that students would make poor use of their elective time, but the majority appear to spend it either in independent study or electives.

INDIVIDUALIZATION OF MEDICAL EDUCATION FOR STUDENTS WITH UNUSUAL BACKGROUNDS AT U C S F

*John S. Wellington, M.D.**

If students with diverse backgrounds are selected for medical school, it is likely that they will want, benefit from, and perhaps require diverse programs of medical education.

This is the premise on which this paper is based. It is the premise that has led us to examine the possibilities of individualization at UCSF. By individualization I mean the process of creating and/or providing sequences, tracks, courses, pathways, and curricula for some undergraduate medical students that are different from those provided for others. The purpose of this is better to serve differences in the aspirations, needs, or backgrounds of individual students.

The question arises, why select students with different backgrounds in the first place? If all medical students came from similar backgrounds, it would be much simpler and more economical to provide a uniform basic medical education for them. I propose that there are at least three broad categories of reasons adopted by medical schools for selectively admitting students with dissimilar backgrounds. These are: *(a)* to provide equal educational opportunity; *(b)* to contribute to the provision of better health care

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for presently underserved groups that are culturally, socially, or economically different from the majority; and *(c)* to allow for the enrichment and development of medical education and of the medical profession by providing for diversity of input. The goals of individualized programs to serve such a diverse medical student body might be termed the 3 R's--Retention, Relevance, and Renewal.

The particular focus here is on unusual backgrounds. I will attempt to relate these three reasons for purposeful selection and admission of students with different kinds of backgrounds to the goals of programs to individualize medical education for them. The paper will conclude with a brief description of individualized programs in progress or planned for implementation.

STUDENT CHARACTERISTICS

To describe and have some understanding of the unusual, it is first necessary to define the usual. It does not take much sophistication to say that the usual, the archetypal medical student, is a white male from a well-to-do urban family who has just graduated from one of the so-called better universities in America. The unusual student, then, is one whose background does not fit this description in one or perhaps more ways. Recent years have seen a conscious effort by many medical schools to alter this stereotype, particularly by effecting an increase in the number of medical students who are ethnic minorities and an increase in the number who are women.

In the entering class of 1971-72, there were, nationally, more minority students and more women than in any other entering class in U.S. history.

But still there was a wide discrepancy between different schools. In that same year, the 15 traditionally white schools with the highest proportion of minority students reported percentages of the student body who were minorities ranging from eight to 17, but there were 16 schools at the other end of the spectrum with one percent or fewer minority students. Similarly, the 10 schools with the highest proportion of women in the entering class of 1971-1972 ranged between 20 and 24 percent women, with the exception of the Medical College of Pennsylvania with 70 percent, and the 10 with the lowest ranged from four to eight percent.[1] At the same time, there has occurred in many medical schools an increased consciousness of the extent to which poverty has been a barrier to medical education for men and women of all races. This has been recognized by the AAMC in its efforts to bring to the special attention of medical schools students from low-income backgrounds.

There seems to have been, at least in California, an increase in still another category of "unusual" student seeking admission to medical school. This student's main claim to unusual background is age, and he or she is in the 25-to-30 year-old group, with widely variable academic background beyond the bachelor's degree, ranging on the one hand from simply having returned as a special student, often in a two-year or state college, to complete the year of physics, chemistry, and biology required by most medical schools to the other extreme of having attained the Ph.D. in one of a variety of fields. What all of these individuals have in common beside greater age is a change in career goals. The choice of medicine has been made much later,

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1. Wilson, V. L. (Ed.). *Medical School Admission Requirements, 1974-1975, U.S.A. and Canada.* Washington, D.C.: Association of American Medical Colleges, 1972.

and only after a previously made choice has been examined and discarded. Just how large this group of students may be nationally is not known, but however large or small, it is quite clearly another group for whom the opportunity of individualization of medical education should be considered.

ADMISSIONS CRITERIA

Given these unusual backgrounds, all of which are quite liberally represented at UCSF, what should be the goals of the individualized programs that could be made available to them? Clearly, individualized programs will be quite different from each other--that is why they are called individualized--but will the goals of all of them be the same? To answer this question, one must return to the question asked earlier. Namely, what, in the first place, *are* the goals of increasing the number of students with unusual backgrounds? The first of these broad categories of reasons, equal educational opportunity, expresses itself in the desire to ensure that all individuals have a real rather than merely a pro forma assurance of equality of access to medical education. In order to take the necessary affirmative action to accomplish this end, institutions have had to take a new look at how they select medical students. The selection methods used in the past had resulted in the near exclusion from U.S. medical schools of students from all four of the groups defined above as being from unusual backgrounds.

Why was this so? Was it because of systematic exclusion on the basis of race or sex? Hopefully not. A closer look at the admissions process showed that grade point average and MCAT scores, especially in the sciences, were playing a major part in the admissions process. The system used by

most schools for applying and weighing these admissions factors stems from an attempt made during the 1940's and 1950's to reduce medical school attrition. Since nearly all medical school failures occur in the preclinical years in courses that are most like premedical science courses, it is not surprising that selection on the basis of the degree of mastery of a restricted body of scientific knowledge should have resulted in a decline in academic attrition. It did just that, but it did so at the cost of selecting student bodies which were remarkably similar in many unexpected aspects of their lives as well. It did so at the expense of diversity of medical schools' input and directly resulted in the nearly exclusive selection of the archetype described above as the usual student. Much as some schools might have wanted to change the composition of their student body, continuing use of the same old criteria in the same way precluded it. But were these old criteria all that good? What relation did they have to subsequent performance as a physician? We are still awaiting an answer.

Trials began in a number of schools of adding other information to the admissions procedure, such as more heavily weighing information about the applicant's motivation and persistence, and considering the difficulty under which the individual might have labored to achieve the results he or she did. Thus there began to be admitted to medical schools some students who were considered to have high potential but who had academic backgrounds and records different from those of the usual students. Individualization of programs offers a way of shaping parts of the medical curriculum to meet the particular needs of students with different educational backgrounds, and of assuring maximum retention of students in the process so that the students may continue to gain the skills and knowledge necessary to become

physicians, while still permitting a diversity of input for the schools.

RETENTION PROGRAMS

Retention (the first of the 3 R's), with its connotation of requiring remedial and/or tutorial assistance in some instances, is thus likely to be the goal of individualized programs for many students with unusual backgrounds who are admitted when admissions criteria are modified as the result of an effort to promote equal educational opportunity.

Individualized programs cannot work without strong faculty support and participation in their design, execution, and evaluation. Unless faculty members become motivated to participate in these ways, there will be no programs. Faculty motivation is closely linked to the goals of admitting groups of students with unusual backgrounds, whatever these goals may be, and ordinarily has its origins in faculty participation in the decision process that led to admission of a wider spectrum of students in the first place. In other words, unless there has been broadly-based faculty support for changes in the admissions process designed to widen the socio-cultural-economic base of medical student bodies, it is unlikely that there will be faculty support for individualized programs that may be desirable for these same students after they have been admitted. The first step in building an effective retention program is to make sure that there exists from the beginning faculty support for any program to admit students with unusual backgrounds.

Retention programs designed and constructed for the purpose of aiding the academic progress and eventual graduation of students with widely dif-

fering, hence unusual, backgrounds will be directed almost exclusively toward the preclinical sciences. The level of achievement in these science courses attained by medical students with a long past history of outstanding success in *college* science courses will be very high, and students without similar backgrounds are likely to have difficulty achieving this same high level.

Two ways to create retention programs are apparent. One is to begin the tracking of students--the individualization--at the very beginning of medical school. To do this, the notion must first be adopted that students with different career goals do not all need to have precisely the same basic science background. This idea is not accepted by many faculties, including UCSF, who have established a basic science core, mastery of which is required of all students.

The second way is to provide for flexibility in the timing of courses, in particular to allow students more time in which to attain a given level of competence. Such a program is described below.

RELEVANT PROGRAMS

A second reason that medical schools may have for increasing the number of students with unusual backgrounds is to accomplish the goal of providing increased services to particular groups in the population at large that are both underserved medically and underrepresented in the health professions. To accomplish such a goal will almost certainly require much more than just admitting, for example, more students who are underrepresented minorities. If minority and other students have been selected for admission to medical

school partly on the basis of their interest in and commitment to providing health care for particular underserved segments of the population, individualized programs to reinforce this interest and commitment are a most desirable part of their medical education.

Individualized programs can be developed that will allow any students with the commitment and desire to learn in much greater depth the problems of underserved segments and to study and to research ways of meeting these problems. The programs can provide for continuing reinforcement and familiarization for the student. The goal of such individualized programs will then be much different from the goal for individualized programs to promote equal educational opportunity. The goals of programs to increase services to underrepresented and underserved groups are more likely to be reinforcement, familiarization, and gaining the knowledge and skills to solve special kinds of problems, and they will be focused on clinical years. The second of the 3 R's, then, is relevance--relevance to particular cultures.

PROGRAMS FOR RENEWAL

A third reason for selecting students with so-called unusual backgrounds is to provide a broader base for what John Gardner has called Renewal.[2] This, the third of the 3 R's, is not as widely discussed as the first two, and perhaps not as widely accepted, although its implications must be apparent to many. Students, and hence doctors, with different backgrounds will

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2. Gardner, J. W. *Self-Renewal: The Individual and the Innovative Society.* New York: Harper and Row, 1965.

bring new and different dimensions to medical care, and eventually to medical education as well. In what way can goals for individualized programs of medical education be defined so as to provide for the optimum utilization and development of the skills and talents of these groups of students, unusual in that they represent a quite new set of values and personal objectives that reflect a wider range of societal values? How, for example, can programs be developed that will nurture and develop the particular kinds of skills and abilities that may be unique to women? The goals for these kinds of programs have not yet been established, and in establishing them, the students themselves have not only a role, but also a strong interest. There exists here a unique opportunity to develop programs that will result in enrichment of teaching and learning for all students and for the continuing renewal of the profession.

THE U C S F PROGRAM

How has the development of individualized programs for students with unusual backgrounds proceeded at UCSF? How do they relate to the goals for admitting a class with quite diverse backgrounds?

First, the attainment of diversity has resulted in the admission of students with wide differences in their academic background. Programs to narrow this gap have been concentrated on the preclinical basic science courses and have consisted of ongoing tutorial assistance from faculty on an individual and small-group basis, taking place weekly on the elective day reserved for first- and second-year students, and at other times. Beginnings have been made in providing assistance in planning time management

and in developing study skills as well as in improving student skill in exam taking to the level achieved by the more usual premed who is now the classmate. These have usually been seminars on a one-time or occasional basis. A greater commitment has gone into providing for the offering of some basic science courses a second time per year during the summer. This permits students to spread the work of three quarters over the time of four quarters. It works toward the ideal of making the amount learned the constant and time the variable, rather than making time the constant and learning the variable that characterizes the usual tightly-packed medical school curriculum. It should be pointed out that these additional course offerings can also serve quite another goal--that of permitting students to complete the requirements and graduate in as little as three years by taking course work during the summers before and after the first year and after the second. The course work itself is not individualized by doing this, but the sequence and the concentration is. It is of interest to note that a preponderance of the students who have elected the speeded-up variant in the past year have been those with the sort of unusual background defined above, minority students in their 30's. Students who have spread out their course load into the summers have had significantly less difficulty in maintaining their academic performance than those who have not. Evaluations of that program indicated that being a member of a much smaller group (± 25 instead of 130 or 140 in the whole class) was important to the students; they had the feeling of being individuals--they were somehow important to the faculty who were teaching them. Their performance indicated that they did benefit academically from the experience; and, perhaps more importantly,

they have--over a four-year period--been retained.

Provision of individualization of clinical studies is related, as stated previously, to the goal of providing for a diverse group of students, the kind of experiences which relate closely to their individual goals. In the case of minority students who were selected for admission because, among other reasons, they evinced a strong motivation to provide better health care for minority communities, these individual goals can be anticipated to include experience in those communities.

The question of how to prepare students for alternative cultures--how to provide experiences that will reinforce their interest and allow continuing growth of their knowledge of the problems of these cultures--is a difficult one for predominantly white medical schools to solve. Achievement of the solution requires substantial input into planning and execution by members of these cultures who are presently even more underrepresented in medical school faculties than in medical student bodies.

The mechanism for flexibility is provided for in the UCSF curriculum which is made up of a 15-month core of preclinical courses and a 12-month core of clinical clerkships. An additional 12 months of medical school work which must include at least three months in some advanced clerkship is required for graduation, and it is this 12 months that offers further opportunity for individualization. Students must use a part of this time to satisfy the requirements of whichever of the Major Pathways they choose from among the following: Medical Specialist, Surgical Specialist, Behavioral Specialist, Medical Scientist, Social and Administrative, and Family Medicine. Depending on the Pathway chosen, this may take three to six

months of the 12 required. The remainder of the students' work is at his or her own election and can include clerkships or other course work in a wide variety of subjects. Some students have used this time to work for a Master's of Public Health degree; some have done bench research; some have spent time abroad in the University of California International Center for Medical Research and Training (ICMRT) and other programs in Malaysia, Mexico, and elsewhere; and others have pursued clinical training in depth in selected clinical clerkships at the University of California.

With faculty participation and approval, truly individual courses have been established so that blocks of time could be used for specified learning experiences--such as guided reading. Student interest has resulted in establishing other elective offerings--a multi-disciplinary course in nutrition is one. Courses on other campuses--particularly U.C. Berkeley, which is about 30 minutes away from the San Francisco Health Sciences Campus--are available.

The mechanism is there, but much more remains to be done in developing the variety of possible situations, environments, and experiences necessary to allow for continuing development of individualized programs that relate to individual goals and needs.

It is in the planning and operation of programs to provide relevant experiences, particularly as they relate to alternative cultures, that our school is experiencing difficulty in providing individualization. It is not lack of mechanisms but rather the lack of contact with and even knowledge of the alternative cultures and the resources within these cultures that makes this the hard problem it is. Certainly our minority students

continue to let us know that from their point of view the problem is not solved.

It is out of the more diversified input of students into medical schools that fresh and diversified input of ideas into creation of individualized programs with the goals of relevance and renewal may be expected to come. Let us hope it comes soon enough.

It is not entirely unexpected or undesirable that planning of this type of individualization with the goal of achieving relevance and growth of medical education is flexible and open. It is for the health professionals who will be in practice 10, 20, and 30 years hence that the educational plans are now being laid, and we must expect that continued input will result in continuing rethinking and revision of plans. Much of this input that is new will come from that group of health professionals that is new--the "students with unusual backgrounds" of today.

SUMMARY

Diversity in the students selected for admission is a goal which medical schools may have several reasons for adopting. To achieve such diversity will require modification of admissions criteria. Individualized programs are desirable--perhaps necessary--for this increasingly diverse student population in order to promote the following:

Retention.--to maximize the number of students who will successfully complete the preclinical basic science portion of the curriculum.

Relevance.--of clinical experience for students from alternative cultures.

Renewal.--of the goals and directions of medical education and practice.

DISCUSSION GROUP REPORTS

GROUP 1 / *Developing an Array of Electives which Meet Student Needs**

This group focused on five questions:

Are electives desirable?--The group decided electives definitely are desirable since they are one of the major tools for individualization of the curriculum. Individualization seemed necessary and desirable since students of more varied backgrounds are being accepted and since "premed" education is changing. Electives involve the student in the planning and management of his own education and as such should better equip him for later involvement in his continuing education while in practice. Electives, in the later part of the curriculum, allow the student to investigate and prepare for different career opportunities. Electives also allow the faculty some "error margin" in what is perceived as mandatory in the core curriculum.

How can a medical school best go about developing an elective program?--Neither the administration nor "super faculty" committees can decree the creation and/or effective functioning of a general elective program. Such

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*Report submitted by Oleg Jardetzky, M.D., Ph.D., Chairman, and Parker A. Small, Jr., M.D., Recorder.

a program can best be evolved by a broadly based curriculum planning committee which should include students and other relevant groups. This committee should be charged with both planning and implementation to insure a "reality base." For any elective system to function properly, there must be a good adviser system. Such an adviser system is usually both formal (e.g. faculty knowledgeable about the elective system and interested in the student and his career meeting with the student) and informal (e.g. students evaluating specific electives for other students). Periodic changes in faculty assignments to specific electives help keep the faculty's approach fresh.

There is the recurring problem of avoiding a plethora of offered electives and insuring quality in those elected by the students. Some institutions have found that both problems can be approached by requiring each elective to publish its educational objectives and subsequently relate student and faculty evaluation to the progress students make in achieving the published objectives. It is, of course, crucial to have the active support of the administration, so that faculty are selected and rewarded at least in part for their effective participation in the elective program. The problem of getting faculty to specify their educational objectives can sometimes be helped by having students who are taking or have recently completed the course, list the objectives they think the teacher was trying to teach, and then let the teacher modify this list, rather than produce one himself.

What determines whether students take a specific elective?--Students take electives which they perceive to be relevant to their career goals,

not covered adequately elsewhere in the curriculum, and well taught. They are less likely to elect courses which are scheduled during "crowded" times or run "parellel" to core (afraid they may miss something), or which they perceive as irrelevant and/or poorly taught.

What effect do electives have on the faculty and the institution?--One of the major effects of a good elective program is that it allows faculty to teach the core program in good conscience. It also helps to better define the core program and serves as a conduit for introduction of new material into core. Further advantages to faculty are that they can "do their own thing," respond to student needs, and take advantage of the positive attitude most students bring to an elective program.

A major advantage to an institution is that a good elective program helps recruit good students. A potential disadvantage is that a weak elective program or one judged to be "Mickey Mouse" may cause students to push for a shorter M.D. program, pointing out that a fraction of their total curriculum is of questionable value and therefore could be eliminated.

How much latitude should students be given in elective programs?--Some students use elective programs to take a series of unrelated, highly specialized, short electives (berry picking) while others build a coherent and diversified program aimed at a specific career objective. Both behaviors fulfill student needs. The first allows for investigating a variety of careers, while the second allows the student who knows what he wants to do to pursue that goal. Both types of activities should be possible in a good elective program.

Some institutions offer the student great freedom in his choice of

courses, while others offer the student a choice of courses within a given area (e.g. student must select a given number of basic science courses from a given list). This latter approach has been called a selective rather than an elective approach and can be used to insure breadth while still maintaining some freedom of choice for the student.

SUMMARY

Elective programs serve many useful functions. Perhaps most important, they allow for individualization of the student's curriculum. Unfortunately, proof of the value of the total program is very hard to come by, since evaluation of the total program is so difficult. However, evaluation of individual courses is quite feasible, and the effect of the total program on specific issues seems clear from anecdotal data.

GROUP 2 / *Academic and Career Counseling**

Opening the discussion, each of the participants presented a typical problem related to medical school counseling. The group then attempted to define the basic issues of advising and counseling and to relate them to differing institutional situations.

The role of faculty in counseling was explored at the outset. Coun-

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*Report submitted by John S. Wellington, M.D., Chairman, and Roy K. Jarecky, Ed.D., Recorder.

seling students for a senior year elective program presumes that faculty members have sufficient breadth of accurate information to be helpful, that counseling will not become salesmanship, and that maximum faculty participation can be secured. Even assuming positive responses to these presumptions, it is often true that, as a result of shortened curricula, faculties have less contact with students and therefore know them less well than in the past.

The group then considered philosophical points relating to the objectives of counseling. Should societal need, for example, be allowed to function as a factor in counseling, thus perhaps influencing a student's choice of specialty? What sort of physicians does society really need? Should students be counseled out of one specialty into another if the former is overcrowded and the latter underserved? Is the current arrangement of laissez-faire choice rational, or should career choice be specifically directed? But career choice, whether directed or not, presumes the student's readiness to make such a choice. The group considered when and how this might occur. One member said that medical school fosters dependency, that no matter how far along the educational pathway, students are always given the impression that they do not know quite enough and that they are not quite ready to take on real responsibility. He felt that the length of training is too long, and that as a result, the student's capacity to make good decisions, with or without counseling, tends to be stifled.

Another area for philosophical consideration is the relationship of counselors to society's expectation that only competent physicians are graduated. Should students always be advanced simply because they have done well on the requisite formal examinations?

Notions about career choice as a counseling problem led to a brief review of research studies suggesting that knowledge of students' personality traits is a useful basis for determining their probable areas of specialization after graduation. It might actually be possible to determine the proportions of each class which would enter various specialities by accepting applicants with the specific traits presumed to be characteristic of practitioners in selected fields. The legitimacy of such manipulation of the admissions process was questioned.

After some conversation focusing on the differences between advising and counseling, and between assessment and counseling, the group was once again ready to consider ways in which counseling and the student's progress through school should intertwine. Clearly, a desire for counseling depends on the atmosphere of the school. If a student is stimulated to consider his personal experience as important and worthy of consideration without penalty, he is more likely to make use of opportunities for self-inspection than if the milieu is viewed as hostile or even dangerous. The effective use of course and clerkship evaluations as part of the permanent record was considered as primary material for self-assessment. The group discussed student records in relation to counseling and the importance of having students describe their own performance at the same time that faculty comments are relayed to them. This technique permits a comparison of perceptions and enables the faculty counselor to gain a definition of reality from the student's point of view.

The group considered the difficulty of determining what is really happening to all students at any given time, how to determine when a student

is getting into deep trouble, and particularly what to do when such a student does not seek help. One approach is to make sure that class members recognize their responsibility for one another and thus are willing to advise an appropriate faculty member when something seems to be seriously wrong with one of their classmates. Illustrations of various student problems suggested the continuous need in counseling situations for reassurance. In addition to reassurance, truth in counseling is an absolute requirement. The faculty counselor or assessor who is not perfectly straightforward does real damage if students are not made aware of things about their performance that they must know in order to improve or change their behavior in some specific way.

Different counseling organizational patterns such as rotating versus full-time counselors, upperclassmen as counselors, or house staff as counselors were considered. It was questioned whether one or two student deans can possibly provide even minimal counseling services to increased numbers of students, to say nothing of giving individualized attention to each one's program. It was thought that some sort of counseling "network," coordinated by the student dean, is probably necessary.

The group then turned to questions of role conflict. Can a student dean be both counselor and administrator? Can he counsel with students on the one hand and pass judgment on the other? What should his role be in referral situations, particularly where psychiatric assistance may be required? The need for maintaining student confidences was stressed. Other questions raised had to do with whether departments should be aware of the ratings of students by other departments. Who should be responsibile for

developing internship letters--what checks and balances should be brought to bear?

SUMMARY

Counseling with students really cannot be left to chance. It is important for students to engage in consultative processes, and whatever organizational pattern is chosen, faculty who serve as counselors should be very carefully selected and well-informed so as to maximize the students' chances for pertinent decision making about career development and personal growth.

GROUP 3 / *The Present Need and Future Means for Assessment of Achievement**

Discussions on this topic opened with the Chairman exhorting the participants to give the necessary consideration in their discussions to program evaluation as well as to individual student evaluation. He further identified his perceptions of the proceedings as having two objectives: first, the sharing of experiences, problems, and possible solutions; and second, an experience which would sensitize the participants to the need for evaluation. It was agreed to define achievement in its broadest sense rather than to restrict its interpretation to progress in an academic program.

The session then opened up with the identification of a variety of

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*Report submitted by William Schofield, Ph.D., Chairman, and James B. Erdmann, Ph.D., Recorder.

perceived needs for assessment that can be categorized as follows:

There was immediate consensus on the need for more planned and systematic studies of curriculum change. There was concern that the studies involving "hard" data are not as plentiful as they should be.

The next issue involved needs related to the ways of interpreting measures. Specifically, discussion focused on criterion referenced evaluation versus normative evaluation and appropriate uses of each. There seemed to be general agreement that criterion referenced evaluation is preferred when evaluating student progress.

To conduct evaluation properly requires a great deal of effort by faculty. Accordingly, they must be willing to make this commitment and be able to invest time in developing an appropriate evaluation system.

Proper evaluation, especially at the admission stage, is necessary since in the eyes of this group admission to medical school is tantamount to graduation. Thus, faculty need to identify those characteristics which are less amenable to modification and to make sure that appropriate selection based on these characteristics is accomplished in light of their ultimate goals.

The pluralistic nature of evaluation during a student's training should be emphasized. Therefore, evaluation involving knowledge, skills, attitudes, and information processing are all essential.

Criteria for evaluation of students and programs clearly should be related to expected physician performance. Such evaluation should involve the assessment of outcomes whenever possible, recognizing that some of these outcomes would be necessarily intermediate.

Following from the previous point, a job description of the "good" physician as a basis for developing the objectives of the educational program and as a mechanism for assessment is needed.

Specifically, the need for better evaluation for clinical behavior was emphasized during the discussion of clinical behavior. Various approaches were considered which involved to varying degrees the influence of skills such as association and memory on the one hand, and problem solving on the other, in the clinical diagnostic situation.

Having identified the needs for assessment of various kinds, the group began a discussion of future means for accomplishing the objectives implied by these needs.

The problem-oriented record was considered as one mechanism for looking at certain clinical behaviors. It was felt that this is no panacea with respect to evaluating clinical behavior, but it does provide the opportunity to measure certain behaviors, for instance, the manipulation of data.

The whole category of noncognitive assessment was given in-depth discussion. For the purposes of the discussion, the cognitive area was defined to deal with such things as information acquisition, storage, and processing, while noncognitive deals with attitudes, personality traits, temperament, etc. In the discussion of the broad category of noncognitive variables, it was felt important to differentiate between those which were changeable and those less changeable. The important implications of this relate to selection decisions as well as to the objectives of the educational experience. In general, the group saw the noncognitive variables as holding important potential for broadening the definition of "best class" beyond those stu-

dents with the highest GPA's and MCAT's. The group also felt that noncognitive assessment provides perhaps some of the best potential in the area of selection of educationally disadvantaged students. As a final comment, the group agreed that it was not a question of whether or not to conduct measurement in the noncognitive area but to improve the conditions under which noncognitive assessment takes place.

GROUP 4 / *Self-Instructional Program Development**

Each participant in the group worked through one example of a self-instructional unit in order to have a point of reference for the ensuing discussion.

The group then analyzed the required components and strategies of the individual self-instructional program. Those characteristics of applied educational psychology essential to any learning unit include: *(a)* statement of the objectives; *(b)* content input; *(c)* practice or involvement of the learner; *(d)* feedback to provide reinforcement; and *(e)* posttest designed to evaluate accomplishment of the stated objective. Of these, practice and feedback are the components most often absent in instructional units.

There was general agreement that the self-instructional approach can be used to assist in achieving skill learning. The learning principles are

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*Report submitted by Merrel D. Flair, Ph.D., Chairman, and William G. Cooper, Ph.D., Recorder.

the same despite the additional needs for wider applications of educational technology. Self-instructional units can be self-standing in addition to which they can be potentiated by faculty-student interactions.

A discussion of experiences of faculty utilization of self-instructional units ensued during which it was pointed out that self-instructional units are usually made available for student use on a voluntary basis. In the Southern Consortium they are used to augment the curricular offerings of the individual schools.

The objectives of the use of self-instructional materials are: *(a)* to provide materials for student use which do not require immediate contact with the instructor; *(b)* to provide materials which are self-paced, interactive, and relevant to the prescribed learning needs; *(c)* to assist in instructor education; and *(d)* to free the faculty members to spend more time in implementing their educational programs and function as managers of the teaching-learning system.

The roles of the teacher in the use of self-instructional material are: *(a)* as a content expert; *(b)* as a learning program manager; *(c)* as an evaluator; and *(d)* as a change agent in the development of skills of self-education and self-evaluation.

Evaluation of self-instructional materials should contain: *(a)* demonstrated evidence that students learn by using them; *(b)* assurances that the content is accurate as established by experts in their respective disciplines; *(c)* evidence of good technical qualities in their production and convenience in their retrieval; and *(d)* information describing the degrees of flexibility of format with possibilities for adaptation for local use as

well as the relative costs for their use.

Evaluation of existing audiovisual multimedia materials will be a difficult task, and there is a significant difference between the self-instructional materials described above and most audiovisual multimedia materials generally available for use today.

The group expressed general agreement with the recommendations of the AAMC committees on educational technology and offered assistance in the achievement of the stated goals.[1,2]

Unresolved issues that the group had insufficient time to discuss included: *(a)* the faculty reward system in relation to authorship and development of self-instructional material; *(b)* copyright problems; and *(c)* details of the program manager functions of the instructor.

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1. Stead, E. A., Jr., Smythe, C. McC., Gunn, C. G., and Littlemeyer, M. H. Educational Technology for Medicine: Roles for the Lister Hill Center. Recommendations for a National Biomedical Communications Network. *Journal of Medical Education*, 46: July, Part 2, 1971.

2. Educational Technology for Medicine: Academic Institutions and Program Management--Recommendations of a Committee of AAMC to the Medical School Faculties. *Journal of Medical Education*, 48:203-226, 1973.

GROUP 5 / *Articulation with the Undergraduate College Experience**

Three major types of articulation were considered by this group:

1. Traditional--for the typical premedical student moving from a four-year college to a four-year medical school.

2. Special--e.g. articulation for minority students and for other students from varying socioeconomic and educational backgrounds.

3. Nontraditional--but a formal interface which was subdivided into: *(a)* integrated--such as the programs at Northwestern, Brown, and the University of Missouri at Kansas City; *(b)* geographically dispersive--such as the programs at Indiana and Illinois; *(c)* shortened college plus conventional medical school--such as the programs between Penn State and Jefferson and between RPI and Albany; and *(d)* conventional length of undergraduate college but shortened medical school--such as the new program at Florida State University, Florida A & M, and the University of Florida.

Although this group focused on the third or nontraditional articulation problems, many of the recommendations could also be applied to improving articulation between traditional programs and for students from special backgrounds.

Based on the above discussions, the group produced the following suggested guidelines for the development and implementation of an articulated program between a medical school and an undergraduate college.

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*Report submitted by Paul R. Elliott, Ph.D., Chairman, and Davis G. Johnson, Ph.D., Recorder.

Suggested Guidelines for the Development and Implementation of an Articulated Program Between a Medical School and an Undergraduate College

1. Planning must be joint and continuous.

2. Each party must study and know the objectives and resources of the other parties.

3. Parties should be honest with each other concerning: *(a)* advantages of articulation to their institutions, to their students, and to society; *(b)* disadvantages of articulation to their institutions, to their students, and to society; and *(c)* comparative costs of articulation versus non-articulation regarding faculty salaries, facilities, supporting services, etc.

4. The need must be recognized for reaching "quid pro quo" agreements (e.g. parties should make early and equitable arrangements regarding admissions, curriculum, funding, financial aid, faculty, granting of degrees, etc.).

5. Academic planning should be separated as much as possible from such political problems as which departments would be strengthened or weakened or which institution would get the best publicity from the program. Politically, it may be easier to articulate with colleges geographically distant from the medical school.

6. Governance and administration policies and procedures must be clearly delineated.

7. Major attention should be focused on how the program can best benefit the student regarding flexibility, acceleration, reduction of anxiety, etc.

8. An effective evaluation system should be built into the program--both regarding its short-term success and its longitudinal outcomes.

9. Licensure requirements should be reviewed but one should not be overly influenced by them if one is confident of the quality of the proposed articulated program.

10. The experiences of other past and present articulated programs should be reviewed. (The last formal review was published by the AAMC over 10 years ago--Lee, P. V. *Medical Schools and the Changing Times: Nine Case Reports on Experimentation in Medical Education, 1950-1960.* Evanston, Illinois: Association of American Medical Colleges, 1962.).

Finally, two major specific recommendations for action were formulated:

1. The AAMC should sponsor an updated review of current (and defunct) articulated programs and should make the results of this review readily available to interested parties.

2. On the basis of the above review, the suggested guidelines should be modified, made more explicit, and included in published results.

GROUP 6 / *Extending Individualization Across the Boundary Between Medical School and Graduate Medical Education**

The session began with a description by Dr. Enneking of the orthopedic track at the University of Florida. At Florida, a specialty track is chosen by about 20 percent of the students, many of whom are older and have a fairly specific career commitment.

The first year of the orthopedic track begins with a year of basic science. The second year requires all the standard clerkships. Following the second year there are three six-month periods: the first is focused on basic science, the second on orthopedics, and the third six months is divided into two three-month rotations in medicine and pediatrics. In basic science the student is encouraged to stress anatomy and pathology. In the medicine and pediatric clerkships, the student is encouraged to take rota-

*Report submitted by William F. Enneking, M.D., Chairman, and L. Thompson Bowles, M.D., Ph.D., Recorder.

tions relevant to orthopedics with emphasis on congenital and developmental abnormalities, arthritis, and rehabilitation. Following this clerkship, the student receives the M.D. degree and can take the state license exam receiving one year's credit toward orthopedic board eligibility.

The student then takes six months as an assistant resident in orthopedics and six months of general surgery, emphasizing plastic surgery in this rotation.

There follows a three-year program of straight orthopedics, including two six-month elective rotations during which the resident may choose areas of particular interest that are useful to his career goals. Thereafter, the resident is board eligible in orthopedics.

Following this program description was a general discussion of the Florida orthopedic track and other tracks. Major problems are seen in the following needs: *(a)* mobility between tracks; *(b)* options for the late deciding student; *(c)* counseling available for students; *(d)* school approval for educational innovation; *(e)* in some states, modification of licensure requirements; and *(f)* specialty board approval if the track extends through to board eligibility.

In the discussion of these points, reactions were mixed with some consensus for the desirability of tracking in many schools providing the student retains an option for a general track. It was generally acknowledged that some departments should not try early tracking of the kind used in orthopedics at Florida.

It was further brought out that this kind of debate over curricular models did not identify the important factors in curriculum design which

are student needs and student goals. Tracking could be oblivious to student needs if an educational sequence was planned without specific concern for each individual student.

Discussions on basic science requirements resulted in a consensus that basic science is important, but no general agreement evolved on how much basic science should be taught or when it should be taught, although there was a general approval of basic science learning during the residency portion of education.

The advisability of sharing educational programs among several schools was mentioned as a method for saving money and expanding educational opportunities for residents.

There was discussion of a surgical core, and its adequacy as preparation for all surgical specialties was questioned. The question of regional cooperation for teaching was discussed. The complexity of defining core became apparent in the discussion.

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