Orthodontic Education: A Panel Discussion

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MODERATOR

It is quite surprising to see so many present at a meeting about education. In a meeting of any professional group there are a number who are interested in various techniques, there are those who are interested in research, but very few who are interested in education. This is usually left to the so-called "educators."

In Article I of the Constitution of the Edward H. Angle Society of Orthodontia you will find that one of the three reasons that the society is in existence is to "promote orthodontic education." As you will hear later from the panelists, education today at all levels is undergoing a tremendous change. And yet, as you look back, no matter whether you graduated ten years ago or fifty years ago, you will find that there has been very little change as far as dentistry is concerned. Orthodontics, educationwise, has probably progressed further than any other specialty or than dental training in general today. We have various forms of orthodontic training or, if you please to call it, education. The demand for orthodontic service is such that men are scrambling wherever they can to get pointers. When I say men, I mean men who are in general practice and are interested in doing what is called "a little orthodontics."

Given before the Angle Society, Palm Springs, November, 1961.

Political pressure is being felt to provide more orthodontic service for people away from large communities. One state university has been forced to give a course of one day a week for two years to men in general practice. The American Association of Orthodontists has developed a supervised preceptorship program with which all of you are, I think, familiar. The number of men who are presently enrolled in this course is one hundred and twenty, which is the equivalent of one class of average size in twelve dental schools giving graduate work. Now where are we, as a specialty, going? What is the outlook for the future? In the discussion to follow, we propose to explore this. The four men here will approach the subject from different angles. After the formal papers have been presented, there will be discussion among the members of the panel. Should time permit, questions will be received from the floor.

Our first speaker this morning is Dr. John Saunders, a man I have known since he first came to the University of California, thirty years ago. Dr. Saunders was born in South Africa. He attended Rhodes College and from there went to the University of Edinburgh where he received his medical degree. He is a Fellow of the Royal College of Surgeons. He is Provost of the Medical Center of the University of California, Chairman of the Department of Anatomy, and Dean of the

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College of Medicine. Dr. Saunders has written extensively on anatomy, orthopedic surgery and education.

Education In General

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Some two thousand years ago the pre-Socratic philosopher and curious misanthrope, Heraclitos of Ephesus (fl 504 B.C.), expressed the idea that a perpetual and continuous change was the dominant and characteristic feature of our universe. As was his wont, he presented his thoughts in the form of an aphorism παντα ῥεί, "everything flows", likening the concept of continuous change to the flowing of a river within the controlling and modifying forces of its age-old banks. The illustration of Heraclitos is an apt one for education since it recognizes that in intellectual history we are always prisoners of the past and that, if we are to make progress and avoid a static position, we must escape to a degree. Consequently, every educational enterprise must continually measure the pace of that flowing river, re-examining its eddies and repairing its banks against too great an erosion lest its enterprise diffuse in uncontrolled meandering or the flow be stemmed into a static placidity. Therefore, it is important for professional education that we examine the rate of change so that our objectives may be given an accommodating direction. All education is of the past but for the future; hence the direction and magnitude of change must be always under surveillance.

We recognize that the present is an era of revolutionary change — an era which can be most appropriately called the scientific revolution. However, I believe that it requires to be emphasized that this revolution which is upon us is of very recent origin. It is not discovery or new generalizations which initiate a revolutionary change. The revolution comes only when there is a general acceptance of the new ideas by a wide segment of society and its political, industrial and other leaders to implement that change. Were this not so, the modern position would have been achieved long ago. The late Charles Singer, the eminent historian of science, contends that the dawn of modern science actually occurred in the thirteenth century through the labors of Robert Grossteste, Bishop of Lincoln (c. 1175-1253), John Pecham, the Archbishop of Canterbury (ob. 1292), Adam Marsh (fl. 1257) and, above all, of Roger Bacon (1214-1294). A great case can be made for regarding Roger Bacon as "the first man of science in the modern sense" who left as a legacy to future generations the foundations upon which could be erected the edifice of science by his insistence upon accuracy of method, criticism of authority and reliance on experiment. And, if this was too early for a beginning, lacking a program or prospectus for the development of inductive thought and research, this was provided by his Elizabethan namesake, Francis Bacon (1561-1626), in his two books *"Advancement of Learning"* and *"Novum Organum"*. Yet, despite the magnificence and munificence of this inheritance, how long was the future delay.

An excellent example of the delay between the conception and acception is seen in the case of the Industrial Revolution. This revolution was initiated with the invention of the flyshuttle by Kay in 1733 and enormously advanced by the introduction of Watt's improved steam engine in 1769. The concept of industrialization was well understood by the middle of this century, but more than half a century

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passed before general acceptance of its principles led to the transformation of the agricultural, commercial, economic and social life of the British nation and eventually that of the whole of the western world.

The full flood of the scientific revolution of which dentistry and the health sciences are but a part has in reality only just begun. I believe it can be maintained that we entered the scientific revolution scarcely ten years ago. Although the philosophic principles establishing the scientific revolution have been fully recognized for over fifty years, nonetheless the general political and social acceptance of science as a method for human advancement is extremely recent. How recent can be established and illustrated by some startling figures.

For example, if we were to begin with the earliest scientist known to us, namely, Thales of Miletus who flourished in 585 B.C., we would discover that "ninety per cent of all scientists who have ever lived are alive today". Likewise it can be said, "In the last decade more scientific literature was published than had been published in all time before the beginning of the decade." Indeed sixty million pages of technical and scientific literature are published annually throughout the world today which is the equivalent of approximately one hundred sixty-eight massive folio volumes per day.

The above statements alone are sufficient to emphasize the magnitude and explosive growth of science during the past few years. But, if not, let us consider the figures of federal expenditures on scientific and technological research. The growth has been fantastic. Up to the year 1954-55, the amounts made available for research in all fields, including health, had shown a progressive and steady increase of a few per cent per year. The continued growth at this rate would have been cause for congratulation among scientists who could expect necessary levels of support for their endeavors. Suddenly in 1954-55 Congress and the people had become aware of the enormous significance of science in national life and appropriations since then have increased at the astonishing rate of thirty per cent per year on the average with no diminution of this rate in sight. The total in 1960-61 amounts to eight billion dollars and in the health sciences to five hundred million. These extraordinary levels of support have applied to all phases of scientific effort, both the physical and natural sciences, as well as those related to health. We can anticipate that further extensions will occur.

The greater burden of these investigations will fall upon the universities—a point of greatest importance to those concerned with both general scientific and professional education. Many are deeply concerned that these vast and increasing levels of support in the physical and life sciences may distort and change the entire character of education, both general and professional, to the detriment of age-old but equally important values. The greatest vigilance, self-discipline and control are needed to maintain balance in our educational processes. There is no need to belabor the point any further. The slowly moving river of science has now become a surging cataract of explosive force which will dominate and determine much of the future. However, in the case of the health sciences, there can be little doubt that not only are we an integral part of the scientific revolution but we have also reached a point where our direction is changing with equal rapidity.

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Up to the middle of the eighteenth century, biology and the health sciences were concerned with the human and other living organisms in wholistic terms. Hence, the general biologist was, in essence, a natural historian and the physician was concerned with the intact individual as a historian of derangement and disability. The advent of the pathological approach introduced by Morgagni in his epoch making book *"On the Seats and Causes of Diseases Investigated by Anatomy"* (Venice, 1761) changed all thinking radically. The individual was now thought of as a set of functioning organs. The physician would increasingly think of derangements as related to specific organs; of diseases of the stomach, liver, pancreas, kidneys, etc., rather than of the illness of a patient. The biologist would begin to compare animal life in terms of a comparative anatomy based upon structural differences of organs which led to the great generalizations of evolution.

A century later, at the end of the first third of the nineteenth century, an evolving concept of tissues refined by Bichat and Cruveilhier suddenly blossomed into the cell theory of Mathias Schleider and Theodor Schwann and passed into the cellular pathology of Virchow and corresponding developments on the nature of generation and the meaning of germ plasm in general biological thought and philosophy.

The next great meander in the history of biological and medical thought came with the synthesis of urea at the hands of Friedrich Wöhler to initiate the overthrow of vitalism, to introduce a new biochemistry, and establish the new possibility of combining separate and diverse phenomena under one common point of view. This movement, by bringing the natural sciences into immediate relationship with the investigation of living things, made it inevitable that thenceforth advances in physicochemical thought would have an immediate impact upon every phase of biological endeavor and its professional applications.

Hitherto the biochemical approach, in its attempt to simplify, has been analytical and, valuable though this approach has been and will continue to be, it has tended to look beyond the chemical organizational aspects of the organism and thus has concentrated upon the trees rather than the wood. The newer physicochemical concepts initiated scarcely thirty years ago have provided us with the opportunity of investigating biological phenomena in terms of physicochemical transactions at various levels of molecular size and organization. Consequently, physiological functions and their derangements will come to be examined more and more as systems whose effects overlap in several, rather than in the individual, organs of the body. It has become increasingly clear that in the large or macromolecular organization of the body reside such phenomena as biological specificity, species differences, immunity, antibody production and the storage of memory. Molecular organization is concerned with the permeability of cell membranes, therefore with the transmission of the nerve impulse, epilepsy and anesthesia, with the utilization of insulin and the control of diabetes, with drug action and idiosyncrasy, with enzymatic action, and with the action of genes and the problems of heredity. Thus, our understanding of such diverse phenomena as morphology and growth, metabolism and nutrition, the viruses and cancer, antibiotics and bacteria is dependent upon our appreciation of similar fundamental principles of macromolecular structure. We can only conclude that now is a momentous period in which a massive change in the direction of the

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stream of biological knowledge is taking place.

In biology and the health sciences we are passing from the cellular to the molecular age. It is not difficult to predict that this change in direction will produce a revolutionary reorientation in all fields dependent upon the biological sciences. The present monolithic and highly organized departments and branches of professional schools will discover a unity in a common base for the interpretation of their activities. They will need to develop mutual relationships with one another as they begin to perceive that fundamentally they pursue common goals and derive sustenance from common principles. Eventually, this changing direction will alter the face of professional education more radically than any change since the Renaissance.

Every intellectual advance raises a constructive problem in education; hence, it has been necessary to examine, however briefly, both the magnitude and direction of the revolutionary changes which are upon us. Let us look at some of these problems.

First, we must ask ourselves where to get the young men of high intelligence who will be needed in the health professions of the future. It has been commonly said that owing to the opening-up of the new professions both the quantity and quality of those being recruited is falling off. This may be so, but let me remind you that less than twenty per cent of the high schools of the nation supply over eighty per cent of all college graduates. We have scarcely tapped the intellectual resources of the nation. The waste of human resources through lack of guidance is immense. We do little to excite the young minds and provide them with insight into the challenges of the future. We offer no answer to the economic problems which beset the youth who must find the resources to support the long period of training required by the professions.

Secondly, the professions must recognize and actively participate in demanding high standards of preliminary education. The failure of primary and secondary education to provide an intellectual experience of high enough content is a byword. This is a scientific age and the language of science is mathematics. Yet the majority of students entering the health professions are mathematically illiterate. The arithmetic of growth and shape, of motion and change, of dynamics and power, of integration and social efficiency, is the calculus. This should be with the necessary physics, chemistry and general biology a minimum requirement for those who are to enter the new age of the health professions.

At the professional level itself, I should like to make one or two observations. First, we must recognize that the only way in which the student can keep up with a swiftly-changing, dynamic situation is to develop a critical mind which rests upon solid foundations of fundamental principles. Secondly, that a profession has responsibilities and therefore must demand of its membership a professional discipline rooted in its culture and its standards of performance. These two aspects are philosophically in conflict with one another since the critical mind must learn to roam, to reject, to change, whereas professional discipline requires a degree of authoritarianism. The future of a profession in the revolution of the scientific era will be dependent upon the preservation of the right relationship between these two aspects, between a swiftly-moving, dynamic science and the problems of a patient who must be understood in terms of an age-old ethic and high

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principles. To follow the image of Heraclitos as expressed in Virgil's song, we must learn to confine "the living rivers that flow beneath the hoary walls" ("flumenaque antiquos subter labentia muros"). The dynamic rivers of progress must be contained within the hallowed channels of professional responsibility.

Finally, there is need to remind ourselves that the professions, like any corporate body, need leaders. Good leadership is more likely to be the possession of those who have had access to the wisdom literature of mankind, those who not only possess appreciation of humanistic culture but have had access to criticism. "For neither in public nor in private life can science establish an ethic. It tells us what we can do, never what we should. Its absolute incompetence in the realm of values is a necessary consequence of the objective posture," writes C. C. Gillispie, a noted historian of science. A continuing exposure to the liberal arts is a mandatory requirement.

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Thoughts On Orthodontic Education

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I should like to begin by pointing out that the word "education" has come to mean different things to different people. To some it means going to some sort of school, to others it has a narrower connotation. By strict definition it means to prepare or bring up a child, to prepare it for a life work. Thus training in the use of the hands could be classified as a form of education although the lathe operator in a factory is not usually thought of as educated. At the opposite pole stands the lawyer, the writer, the philosopher, educated but not necessarily trained. Between these two extremes are the sculptors and artists, the musicians, the surgeons and dentists whom society expects to be both educated and trained. They are supposed to be educated to a degree where their knowledge influences or directs what their hands are trained to do.

Even a cursory study of the dental curriculum of the past half century reveals that dentistry has viewed the training of the hands as of far greater importance in the preparation of the dentist than the cultivation of his mind. Such a survey shows that upward of sixty-five per cent of his time is devoted to technical or clinical training and that this percentage has been maintained, within a per cent or two, for thirty years. And this in spite of the fact that during this same period scientific progress has been greater than at any time within the memory of man. One cannot but wonder why this should be.

Undoubtedly one of the impelling reasons has been the nature of the services rendered by the dentists. These are highly individualized, i.e., rendered only to individuals. The same sort of relationship formerly governed the physician until the rapid expansion of his field through research drove him into the hospital and into contact with his fellow practitioners. Dentistry has not been similarly forced out of its highly individualized way of thinking although there are signs of beginning realization that group practice has certain advantages. To date, these advantages have not been sensed by the dental schools which still follow a program designed to equip a man for practice, alone and unassisted.

Doggedly hanging on to this insist-

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ence on making the future dentist completely independent, by training him to the highest possible degree of skill, they have resisted all suggestions of the use of auxiliary help for him although it is well known that he will use them freely as soon as he is graduated. This same drive to make him technically skillful has been responsible for the jealousy with which his time is guarded against the inroads of the "impractical" science courses. Thus, the dental student throughout some of his most impressionable years is kept isolated from the general field of scientific education.

The effects on the student of this type of curriculum are about what should be expected. Entering the dental school from liberal arts college he anticipates ever-greater intellectual challenges and sometimes finds these during his first two years in dental school. But even now he may sense what is coming, for he is usually subjected to technic bench drills which require that he perform the same exercise, over and over again, until it passes the standard of some instructor. He is not even allowed the stimulation of judging his own work or that of his peers. It is at this point that some of the brightest students drop out.

From now on things go from bad to worse. With his entrance into the clinic his time is completely occupied with the performance of the same operations, over and over again, and his goal becomes the accumulation of sufficient units to graduate. By the time he has done this he is a thoroughly-bored individual, devoid of motivation for self-improvement in anything other than techniques. These he well-nigh worships. Trained in largely empirical procedures he protects himself by avoiding scholarly interests in even his own field and he refuses to examine objective evidence that challenges his laboriously memorized concepts.

I make no apologies for this consideration of the dental curriculum. I am sure you all recognize that it is appropriate since the orthodontist must first be a dentist and orthodontic students must be recruited from dental graduates. The training and quality of such graduates constitute the largest single influence on the quality of service that the orthodontist will render.

The deficiencies of the dental course of training as a preparation for the practice of orthodontics has been recognized for over one hundred years. In 1819 Delabarre wrote:

"The laws that govern the expansion, growth and arrangement of the teeth are properly the patrimony of the physicians who should understand them in order to direct the dentist whenever (which unfortunately is too frequently the case) he is not furnished with sufficient information on all the duties of his profession."

"He that is nothing more than a mechanician ought not to be admitted into the sanctuary of Aesculapius, his duty here should be confined to those machines with which alone he has the right to interfere."

This was written before there was any formal course of study in dentistry. Since then numerous leaders have voiced the same thoughts; you are all aware of Dr. Angle's lifelong efforts in this field. Indeed the major interests of his last years were directed toward the complete separation of orthodontia from dentistry. As witness of this, permit me to quote from a letter he wrote to me in 1929. Speaking of a certain professor of orthodontia he put down his thoughts quite characteristically,

"Notwithstanding all he has seen and all his experience and his failures in teaching orthodontia, he still believes

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that through some magic of degrees or college spirit or college fraternities or college flubdubbery he can make orthodontists after the present plan of teaching. Or, in other words, that he can grow an indifferent pumpkin and then take the said pumpkin and grow out on the side of it in ever enlarging proportions, an apple or an orange of the Delicious or Navel variety respectively, the outgrowth wholly different in all its anatomy, functions and importance from the pumpkin."

If we pause to question the justice of these criticisms we cannot help but ask why the dental course is not as good preparation for the orthodontist as it is for the specialist in any other dental field. The answer lies in the nature of the structures upon which the dentist works. Most dental work is done on teeth, almost inert bodies, which permit the dentist to work his will with bur and chisel. The preparation and filling of a cavity, the making of a denture, crown or bridge is accomplished in a matter of minutes or days. Each constitutes a unit of experience for the student. Before such a unit of experience can be gained by the orthodontic student he must take records, analyze the case, treat it, retain it and then watch it for several years. Furthermore, he soon finds that he is not able to ignore the responses of the living object of his treatment. He must respect them if he is to be successful. This, in turn, requires knowledge which he did not acquire in his dental course, although he may have been exposed to it.

It is extremely interesting to scan the contents of *The American Orthodontist,* the first specialty journal in the dental field. It was published by the Alumni Society of the Angle School of Orthodontia from 1907 to 1912. Among the fifty odd articles contained therein only two or three even mention appliances. None of them mention techniques. The subjects covered range from anatomy to histologic research on tissue responses, comparative anatomy, rhinology, heredity, paleontology and subjects of a similar nature. These represented the interests of the specialists of that period. What has happened to change such conditions to the present, when a speaker on a biologic subject speaks to dwindling audiences while the advocate of a new "system" or even a new gadget plays to a full house.

Again, I believe it can be laid at the door of the dental course which has persisted in inculcating an almost exclusively mechanical point of view. This false sense of values is carried over into postgraduate work by the dental graduate where, unfortunately, it is too often strengthened by instruction which centers around appliances and their manipulation. Thus there is a perpetuation of the idea that it is more important to know *how* to do something than it is to know *why* it is done. Again one wonders what caused this marked change in the interests of the orthodontist from those that prevailed fifty years ago.

It should be recalled that prior to that time, orthodontic mechanisms were of a very simple nature. The man interested in correcting an irregularity first studied a case in order to determine what needed to be done. He then designed the simplest means to accomplish it. With him the means of execution were placed secondary to the end sought. With the development of increasingly complex appliances, which by this time required only the assembling of prefabricated parts, he rapidly reversed his values and came to pay a major portion of his attention to means, frequently forgetting the aim.

What has been said regarding appliances here is not intended as a crit-

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icism of the devices or of their inventors. Behind practically every innovation there has been logical reasoning based either on observation or upon investigation. Thus the introduction by Kingsley of means to jump the bite in Class II malocclusion or by Baker of the intermaxillary elastics to accomplish the same end through tooth movement were based on sound work in comparative and human anatomy. Similarly, the observations by Angle which led to the introduction of his root moving appliances were based on his interpretation of Wolff's Law of the Transformation of Bone. These men sought to find mechanical means to solve biological problems.

I look upon those early days of this century as "The Golden Age" of orthodontia. Although the general level of clinical results was probably not as high as it was to become, there were men who were then accomplishing results that would compare favorably with the best today. In addition to this, they were vigorously pursuing studies designed to unravel the mysteries of the biological aspects of their problems and were packing the programs of their meetings with scientists who could bring them the results of research in other fundamental fields. Their researches led the dental field from which they were rapidly separating.

It is disturbing to note the degree to which these conditions have changed. Today, research in dentistry rarely carries an orthodontic implication. Of the many Senior Fellowships awarded by the National Institutes of Health, only four or five have been granted to men with the D.D.S. degree, none to an orthodontist. The reason seems plain: today's orthodontist is absorbed in the mechanical aspects of his field, that is, *how* things are done, and has little or no interest in determining *what* should be done, or *why*. We have replaced an attitude of inquiry with one of empiricism. Our treatment is limited by the limitations of our appliances. Let me cite a few examples familiar to all:

1. The dental arches cannot be successfully widened or lengthened.
2. There is an optimal age for treatment and an optimal duration of such treatment.
3. It is possible, by linear measurement, to determine whether a tooth will have sufficient room for its accommodation to the arch.
4. Those ill-defined characteristics called balance and harmony can be derived from a scrutiny of planes and angles of the facial skeleton.
5. Function is secondary to beauty.
6. It is possible to reduce all generalities to rules, i.e., one can disregard variation.

If this presentation has sounded like scolding, I assure you that it is not directed at any audience in orthodontia or in dentistry. It *is* directed at the dental curriculum which has made present concepts almost inevitable. The most recent Survey of Dentistry published only this year, as well as A Course of Study in Dentistry published in 1935, reveals in charts and tables the causes for the stagnation in dental education. Both made recommendations for improvement that have been all but completely ignored. They sought to point out, too diplomatically for effectiveness, the following needs:

1. The de-emphasis of techniques, the teaching of fundamental mechanical principles instead of minute details; the elimination of duplication; the employment of the same degree of auxiliary help that the dentist will use in prac-

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tice; and the de-emphasis of *teaching* in favor of *learning* through the use of visual aids, film strip, et cetera.

2. Increased emphasis on scholarship by allowing more time for study and reflection; insistence on thorough mastery of biologic subjects such as anatomy and physiology, both human and comparative, chemistry, bacteriology, pathology, embryology, and growth.
3. Increased effort to make these subjects more meaningful by keeping the student in close contact with patients throughout his entire four years to the end that he might observe the causes and effects of normal and abnormal functions as well as the changes that accompany development.

I am under no illusion that these changes would result in a class of super dentists or even in a uniformly higher level of graduate. In spite of the change in emphasis from the mechanical to the biological there will be those who will still be mechanical in their point of view. Those, however, whose interest is aroused by the biological subjects will be encouraged, rather than thwarted, as they now are. This should augment the number drawn to teaching and research pools which dentistry needs most desperately. These will be responsible for further progress in the field. Both groups should be better prepared by this foundation for advanced training.

But the reform of the dental curriculum will be a long time coming if we can judge from history. What can we do to help our own cause in the meantime? Here, some of the reforms suggested for the undergraduate curriculum are equally pertinent.

Again, there is the necessity for de-emphasizing the technical aspects of the work and again this should be accomplished by the accentuation of principles instead of minute details.

There must likewise be an insistence on a thorough mastery of anatomy and physiology, both human and comparative, paleontology, embryology, histology and growth, particularly as these pertain to the head and neck. Learning should be encouraged through the assignment of pertinent original sources and seminar discussions.

The material studied should be made meaningful by contact with a wide variety of patients on whom the student conducts examinations and makes recommendations. For this purpose every clinic should attempt to maintain a large sample of children on whom records are taken periodically without regard to treatment.

Orthodontic staffs should be expanded by engaging men trained in basic science fields that are supportive to orthodontia and by retaining men trained in orthodontia who have become interested in basic science through their thesis work. Such men can be highly effective on even a part-time basis. Finally, all graduate students should have the opportunity to do some teaching so that those who have aptitude for it may be permitted to discover their talents.

My entire plea therefore is for the orthodontist to show some concern for true orthodontic education and to attempt to regain for orthodontia the pre-eminent position among the dental specialties that it once enjoyed. Failure to do so can only lead to his identity with the facetious definition of the specialist, "One who knows more and more about less and less." A definition that *should* characterize him as a specialist would be "a broad man sharpened to a point."

808 South Wood St.

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Graduate Orthodontic Education: An Appraisal of its Purpose and Course Content

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Graduate orthodontic education has had its thirtieth birthday at the University of Illinois. From the pilot course given at this University many schools have evolved their variations of how best to present the study of this subject. Systems used by the American Dental Association to rate the different methods of teaching in many schools have proven to be inexact. What constitutes satisfactory and unsatisfactory courses of study in graduate orthodontic education is still in question. To seek the solution to this problem requires honest, rigorous introspection.

Evaluation of techniques being used is made more difficult by reason of the fact that graduates of particular schools are drawn to each other and automatically seem to arrive at the conclusion that the particular techniques which they themselves utilize should be the standard. Thus, instead of having a survey to determine the ideal goal, we find a variety of systems and techniques which can only result in graduates inadequately educated and trained. It is difficult to conceive of an engineer graduating from a recognized engineering school who is not qualified to cope with normal engineering problems in a manner which, at the same time, does credit to him and to his Alma Mater. Certainly these standards in graduate orthodontics should be no less exacting. A reasonably uniform course of study is therefore desirable.

Orthodontists certainly cannot be satisfied with the existing training procedures and multiple standards of the specialty but they themselves must be motivated to effect the necessary changes. In a transfer case, method of treatment and records of that method should be standard operating procedure. Unfortunately, too often in the case of a transfer patient, adequate records are not forwarded. The accurate record so commonly spoken of is actually quite uncommon. A complete and careful analysis prior to treatment thus too often becomes extremely difficult. The development of a carefully formulated treatment plan is frequently not presented and records of retention plans seem to be almost nonexistent.

The science of cephalometry is as old as the study of graduate orthodontics but it is still not commonly used. Occasionally head films are made as part of a case study. The usual practice of having an assistant take the x-ray, develop the film, make the graph, and place it in the patient's folder should not be called cephalometric analysis. A careful study by the orthodontist himself should be made at every step and an analysis to predict facial developments should be imperative. The true value of serial cephalometric analysis has been appreciated by relatively few.

Progress in our field could be stimulated by better cooperation with program chairmen. Volunteers should be secured to present cases two years out of retention. Magazine editors could assist by having a concise editorial policy dealing with case reports and treatment procedure.

It is apparent that after many years, the profession as a group still has not adopted universally high scientific standards. The necessity of such standards becomes apparent when some general practitioners, after examining a number of their patients who have been treated by orthodontists, sincerely believe that comparable results might have been obtained if they themselves

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had done the work in cooperation with a commercial laboratory.

Twenty-five years ago, the applicants for admission to courses in orthodontia were so few in number that scarcely anyone was denied admission. Today the picture has changed. Applications are numerous and the facilities limited. With so many applications to choose from there should be no difficulty in being able to select those with outstanding talent, those with ability to be superior academically and in practice.

We do well to conclude that although much progress has been made there is still much to be done. We must select our candidates for the study of orthodontics wisely. We must provide them with an effective and efficient curriculum. After their graduation the experienced orthodontist should give of his time to assist the new graduate in starting his career properly. Failure to follow such procedure may unduly multiply the difficulties which a beginner would normally encounter.

Orthodontic history includes several instances of schools with impressive courses of study and imposing lists of faculty members that apparently never developed outstanding orthodontists. This would imply that, educationally, they either didn't know where they were going or didn't know how to get there. In logical sequence came a period in which we used to joke about the catalogue entries and even the matriculation data being something we did to please the people in the front office; after the course was under way, we did what was necessary and what seemed indicated at the time. This may be necessary to some extent even now, especially in certain school situations, but there are more orderly ways of transforming the young man from dental student to orthodontist. To illustrate the point, a good young man, working with a good cephalometrist, can learn the head and neck anatomy he needs better than he formerly did in a time-consuming course that reeked with morbidity. Dental morphology, especially at the histological level, in most dental schools has reached such a point where brief reviews are sufficient to carry the student into the study of histophysiology of tissues. Most dental colleges have initiated dental material courses which are effective and can be used to build on in a regular course. Dry bone anthropology and its profound evolutionary excursions may have been cultural and interesting to some, but was very time-consuming and not as well-linked to clinical work as it could have been.

One important aspect of the orthodontic course that might be overlooked is the number of clock hours and work hours that can be grossly allocated to the transformation of the individual from dental student to full-fledged orthodontist. All the experiences that contribute to his education and training should be considered. Students having "bull sessions" can be participating in intramural learning. Getting a clinic ready for a dental meeting can be valuable. Preparing for a state board examination during the course can be beneficial. Visiting an orthodontist's office is frequently an eye-opening experience for a young man. Serving as a demonstrator in an undergraduate orthodontic technique course may be helpful. Preparing a lecture for an undergraduate course can be a rewarding experience. Attending dental or orthodontic meetings may be a maturing experience. These are sometimes helpful adjuncts to the prescribed course of study, yet they encroach on an 80 hour work week, a 3000 to 3600 hour work year and, before the student is finally dismissed, he may have logged anywhere from 6000 to 7000 clock

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hours. It goes without saying that a given student will have to put in more or less hours than his classmates. Illness, family problems, confusion and worry can be factors in the student's effectiveness. At any rate, it is a challenge that poorly selected candidates cannot meet properly and the staff is obligated to play a part in budgeting work time.

Our efficiency has improved since we realized that seminar and class room work can, and must be, correlated with what the student sees and does in the clinic. We will continue to move away from the situation in which the work on the blackboard is scientific while the work at the chair and laboratory bench is unscientific. The better this idea is executed the more fruitful will be the staff and student time. This thought is not meant to imply that the next decade will see complete disappearance of non-credit courses or elective courses because such a curriculum would lack required flexibility to qualify as graduate in intent, and would fail to satisfy the varying appetites of the young men in current and future classes.

No course can be well organized nor properly executed which fails to leave its young graduates with a clear concept of what his end-results ought to be. However, a clear concept does not have to go to the point of being stereotyped—he must learn the width of the road by knowing where the two ditches are, rather than the center line. As the calibre of students improves so can the latitudes of concept be widened without inviting confusion, because of the resourcefulness with which we can employ accepted standards. We note this dramatically when we compare the artificial dentures constructed by the average general practitioner, though conscientious, as compared with those planned and fabricated by a full denture prosthodontist.

The thinking student is bound to raise questions about variations from the mean concept because his imagination is working. Such mental excursions should not be discouraged by the faculty personnel but rather handled as if they were ideas coming from an inquisitive teen-age child, else initiative be crushed or a rebellious reaction invited, neither of which could be accepted as good development trends. We will do well to remind ourselves that the student must not only be ready to produce acceptable results on most malocclusions immediately after graduation, but also have the potentialities required to eventually surpass those who were his superiors while he was in school. If the practice of orthodontics is going to progress as it should, then all graduates of accepted courses should excel according not only to postgraduate standards but also to graduate standards.

A group of students brought together directly from dental colleges and obviously the product of undergraduate disciplines will display confusion for all the term implies. A metamorphosis to the new environment and climate is imperative. To expect them to adapt to classical graduate routine without minor incidents is unjust. Considering them as postgraduate students for at least part of the first semester may prove to be excellent therapy for their immaturity. In time, attitudes and disciplines of true graduate work can be invoked which realize their zenith at the time that the student gains clearance from all departments and submits his thesis in its final form.

It was formerly found advisable to teach self-discipline by much hard work such as exact filing technique, challenging soldering exercises, hand mixing and trimming of plaster and the like. The greatest objection to such an

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approach was the great amount of time required which prevented early entrance into the clinic. There is evidence to indicate that little is lost by decreasing some of these assignments providing all faculty personnel will assume the responsibility of holding the line on anything contributing to the student learning self-discipline, whether it be in the gathering of records for cases to be treated, the tracing of cephalograms or the mounting of intraoral radiographs. It goes without saying that a high-type young man who excelled in demanding clinical work as an undergraduate while attaining a high academic level should find it easy to adjust to self-disciplining exercises and experiences.

We have yet to see the ultimate benefits to be derived from the development of studies in biomechanics and its sequel, theoretical biomechanics. The orderliness with which facts can be imparted to the student can minimize confusion in the student's mind. It can conserve the time of the student and staff by cutting down on trial and error methods. Like cephalometry it contributes much to bridging the gap between clinical and nonclinical subjects. It is conducive to more scientific treatment planning and is a basis for improved communications between student and instructor by offering a better common denominator early in the course. It offers a method whereby the student with a fine imagination can test the preliminary steps in a new and better way to solve problems.

The implication has been made that a modern orthodontist can teach head and neck anatomy surprisingly well because of the vitality with which the living factor can be injected. By the same token, developing a statistician out of a resourceful young orthodontist not only tells him how to do the mathematics of his thesis but actually contributes to the maturation of his thinking habits, the level of his judgment and his mode of expression. This is particularly beneficial if the discipline dictated by a study of biological statistics is not violated by the faculty members in their relationships with the students.

The student has the right to know fairly early in the course the stated objectives of the gross concept he is asked to accept so that he has ample time to become a believer for all that the term implies, by exploring all facets of each concept during all his experiences throughout the course. When we speak about good esthetics he should be given the standards or encouraged to explore the literature to find them. Merely telling the student that the denture should be beautiful and look natural after treatment is not sufficient. He should be shown a statistically sound sample or be given adequate time to check for himself. If denture stability is claimed as important, he must be presented with proof in enough cases with complete records which extend over sufficient time to remove doubt.

If conservation of tissues is an objective he should be given the opportunity to examine hundreds of post-treatment intraoral x-rays from a random sample. Superbly functioning occlusion in end-results should resemble the standards of other branches of dentistry and he should eventually come to realize that variance of opinion can and does exist but, like the ditches along the highway, he appreciates where they are. As a part of his growth he may as well realize that some so-called end results are accomplished at the expense of the development of another portion of the denture or face.

The greatness of an orthodontic teacher may be put to the supreme test

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when a well-meaning and certainly a thinking student wants to discuss why the objectives and results of treatment can vary so much from one part of the country to another, between different appliance groups. The student's curiosity is as genuine at that moment as the young teenager inquiring about sex and should be met with equal intelligence. Segregation in orthodontics has tended to prevail as it has in racial and social problems and all graduates should be coached as to how they can play a part in minimizing its upsetting influences.

In spite of careful student selection and course processing, conspicuous variations in levels of knowledge, skills and interests are sure to manifest themselves. Hence it is folly to expect that electives can ever be eliminated. The intramural learning that results from the intermingling of the students will make known their relative knowledge of radiology, endocrinology, biological research, metallurgy or physiology. Such appetites or needs should be satisfied, if at all possible, by the student being allowed to choose, with the help of a suitable counselor, the subject or subjects which will be most fruitful in the time allotted.

The real justification for extra work above and beyond minimal requirements for the advanced degree is evidenced in the fact that some graduate orthodontic students accumulate considerable excess credit hours. This matter of doing more, of doing work usually better, has become a part of the tradition and rightfully so. Graduate orthodontics has been chosen as the standard in the college for not only other departments in dentistry to measure up to, but also for other schools and colleges to use as a level of attainment. It is gratifying to note that orthodontics enjoys acceptance at the graduate level above and beyond that of any other phase of clinical dentistry.

The additional work, as elective courses or noncredit courses, round out a proper orthodontic curriculum and can be received in one of three or all three ways: 1. It is evidence of inadequate preparation of students at the predental or professional school level. 2. By relative standards a few graduate orthodontic academic standards are too high or the remaining graduate courses are inadequate in some way. 3. The trend in the next decade is toward merging with a part of the dental curriculum or a Ph.D. degree plan. It must be felt that our current standards being too high is retrogressive thinking and the matter of adding additional years of study is impractical thinking, so it would appear that we must demand better predental results and more effective dental teaching to prepare men for orthodontic courses. The latter trend has already manifested itself clearly and we should offer additional impetus.

There are several arguments in favor of state board examinations but the one that is most apropos is that throughout the dental course both student and faculty are repeatedly reminded of the postgraduate certification tests. Teacher would like to have his students do well for obvious reasons. Student, on the other hand, will do almost anything within reason to avoid failing these special examinations. Teachers and students in graduate orthodontics are not enough different to say that this is not a truth in their instance. It has proven desirable to have comprehensive oral and written examinations of all subjects with which the student is expected to be familiar. As a precursor to society and board examinations, it has been shown to be a maturing experience.

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Along the same vein can be recommended a formal defense of the student's choice of a research problem and method of preparation into theses form for the graduate body which is to recommend him for a degree.

The importance of learning and training to launch a graduate into orthodontic society as a fully qualified member has been stressed. The point has been made that he must also learn to do things proficiently — the opposite of the young dentist who placed his first private-practice gold foil with his college notebook open in the patient's lap. We envision the orthodontist of the next generation having to properly finish one hundred or more major treatment cases per year. Needless to say, to accomplish these objectives, efficiently planned and operated offices will be mandatory, staffed with four or more well chosen and trained auxiliary personnel for each orthodontist. The use of more male assistants is probable in order to gain stability of the practice. Indirect procedures will undoubtedly be used more extensively to conserve the chair time of the orthodontist.

It is most logical to assume that the schools will be expected to play a part in the basic training of such auxiliary personnel since the cost of doing so in private practice may become prohibitive because of rising overhead. Even with the schools doing a splendid job, however, one would expect additional training at the private practice level.

If we accept the fact that offices of this type and efficiency are on the way with gross incomes over one hundred thousand dollars per orthodontist per year, it follows in logical sequence that courses in the curriculum that touch on orthodontic economics, practice management, accounting, etc., must be evolved in the forseeable future. While it is true that one can never learn everything about such matters in short periods of time, it is antiquated to assume that the young orthodontist will by chance learn these facts as needed or that commercial concerns will tell him all he has to know. Professional men have never been recognized as born business men and the problems of business are becoming more complex each year. It is not undignified to teach the young man how to do things well for many people, after he has learned properly what he is to do.

The orthodontist who enjoys a splendid income and community acceptance has no moral right to be unduly selective in his choice of cases to be treated because of their difficulties or complexity. Although it is impractical or impossible to assign the severe and challenging case to the graduate student for treatment, it is important that he study and practice the management of such problems to a degree that he can envision actual care of such patients earlier in his orthodontic career than now occurs. Such work in the final stages of the course will test his imagination, resourcefulness and judgment to a proper degree. Like the fine athlete being called on in a supreme test, he can be reminded of the satisfaction and personal reward of helping the patient who needs it the most, of overcoming the very challenging, of doing something well that only he or a few can do. Without appearing as too noble a gesture he can envisage making a major contribution to his chosen field and thereby playing a part in leaving it on a higher level than he found it.

The student who delves into detailed analyses of mixed dentures and has an opportunity to thoroughly study serial records of such cases will, in due time, develop a better appreciation of what growth can and does do, what growth can't do, how much variation

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can occur in appliance response, the inconsistency of eruption rates and sequence, the variation of soft tissues and other critical factors. Graduate students exposed to such discipline should become more mature; anyone of them is potentially a source of new ideas that can be made workable to push back the horizons of orthodontics. Our successors are destined to cope with problems now thought to be unsolvable; we must introduce them to any theory which can be the groundwork for such progress. If we do not, we are not progressive at the graduate level and we will slip back to what is more properly called postgraduate instruction and training. We can total the thought by stating that no graduate course should be rated as outstanding unless each one of its students is potentially capable of surpassing those who taught it.

It goes without saying that, irrespective of the care with which a course is planned, certain minor elements may not be included such as paper-writing, how to present a clinic, the elements of good instructorship, etc. The faculty will do well to watch for ways of overcoming any insufficiency which may appear. It is also important that certain elements offered by one course must thereafter be worked into the general atmosphere of the student. I refer to items such as the development and sustaining of patient cooperation, the many facets of the field of occlusion, the importance of serial appraisals from accurate records, and the teaching of beauty and denture stability, to mention a few. Auditing of the students' progress in each or all of these factors may be time well spent to avoid the shocking experience of realizing too late that satisfactory levels have not been attained. A utopian situation would be one in which each member of the class came to realize his own insufficiencies and took steps on his own initiative to overcome them.

Thinking along progressive lines should not result in good, old-fashioned ideas being discarded. It is well that a student realize that he will have to get formal clearance from every staff member, and that every staff member is empowered to make the student complete well whatever is important for good standing and adequate preparation. Such a policy will tend to neutralize an egotistical trend as more and more freedom is granted. It is a final experience in discipline which he will no doubt transcribe into self-discipline. It eventually becomes a part of the tradition of the department and a very good one. A department operating on such a policy can expect its approval of a student to be accepted by higher echelons without question so far as orthodontic education and training are concerned.

Hume Mansur Bldg.

Orthodontic Education

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Not long ago an earnest orthodontic student wanted to know, "What is the single most important factor in becoming a good orthodontist?" Not being sure that particular year whether electromyography or tongue training was at the height of fashion, I replied, "The capacity for self-criticism." It is a pretty safe generalization and I am now prepared to extend it to orthodontic education. Since 1955 when fifteen hundred hours of university instruction briefly became the sole means of gaining membership in the American Association of Orthodontists, there has been an unending airing of opinions as to

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what constitutes the best way to produce an orthodontist.

At a time when two factors combine to create a serious shortage of orthodontists, namely, an increasing awareness on the part of the public of the value of orthodontic services, and secondly, population growth, we should uncover all the facts we can with the purpose of developing a program for training as many competent orthodontists as possible. The alternative to this is to welcome onto the scene men with no training at all; all too soon, then, we shall have to share their reputation with them.

It seems important to me at this juncture to recognize opinions as shoddy substitutes for facts, because a concerted effort is being made to regulate specialties. If these regulations are arbitrarily rigid, they may seriously restrict the number of orthodontists we can produce in the decades ahead of us and lead to consequences which later we might regret. Until recently I have never seriously challenged *opinions,* because the one who held the opinion influenced only his own course of action by it and imposed no restrictions on others. But now our men of influence are formulating and re-formulating resolutions with such rapidity that I would implore them to take it easy and take a look at the record. I think if they do they might not have to switch quite so often. Their virtuosity in thinking up new regulations recalls a quip aimed at me a few years ago at an orthodontic meeting. I had given a paper at 10:00 a.m. and then was obliged to leave at noon for San Francisco. A bright young man came on at 2:00 p.m. and said, "Now, we know what Dr. Wylie thinks about this subject — or rather, we know what he thought this morning."

While we frequently hear free-wheeling opinions regarding the competence of an individual orthodontist, or the products of a certain school, the truth of the matter is that it is difficult to be really well-informed on the competence of other orthodontists, particularly when one is considering them as a group. If you are a member of a study club or an invitational organization limited in membership, you may know fairly well the competence of your fellow members. You may find them vastly superior to all others, but really this is a limited point of view. You are still deprived of a real understanding of the general situation in orthodontics. Possibly because of the traveling and snooping I have done in recent years, I am frequently asked by other orthodontists for a firm generalization as to the competence of graduates of a certain school, or products of a certain kind of training. No reliable answer can be provided. To me the individual talent and perseverance of a person so far transcends the type of training he has had that I distrust all sweeping statements concerning orthodontic education. Real disappointments come out of what I consider good schools and, fortunately, other men industriously overcome the handicap of having picked a poor one. Some of our very best orthodontists were preceptorially trained and, in some instances, a great distance from the preceptor.

For these reasons I would implore those who set about to control the activities of others, first of all to get all the facts they can and in doing so assume, as the lawyer says, the burden of proof. Of them I would ask these questions:

Are the observations which you cite really adequate in amount?

Are the interpretations which you draw from these observations the only possible ones, or are you pursuing too avidly the interpreta-

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tion you like best?

Have you set up formal, strict controls against bias?

Are you pushing this position because of economic advantages, real or imagined, or for the purpose of enhancing your prestige?

One unsubstantiated opinion which is seldom openly expressed, but indicated tacitly in many ways, is that a dental specialist is somehow inherently better than a general practitioner. It goes without saying that *in his special field* he should have a competence beyond that of a general practitioner and beyond that of those in other specialties, but this does not make him a superior person in any but this one area. The flaunting of this point of view has come to haunt the specialty groups as they have tried to further their own interests in the American Dental Association and, to me, it is the worst public relations maneuver they could possibly make.

Another opinion which deserves scrutiny is that the graduate course or postgraduate course across the country has attained such a level of perfection that it should become the sole means of training specialists in the field. So long as they are not too adamant about it, I can readily forgive my friends for clinging to this point of view, for it is apparent to me that they are innocently basing this assumption on what they have seen in a handful of good schools. The fact that a number of other schools are superficially imitating these leaders should not entitle them to the same measure of approval.

Experience has shown that the phrase "graduate or postgraduate instruction" covers a lot of territory and gives countenance to procedures which may be dubious. One is the easy delegation of responsibilities for instruction in the basic sciences as they relate to orthodontics. There are several possible consequences of this. The instructor may conveniently ignore that he is supposedly functioning at the graduate level and give what is largely a repetition of the basic science content taught at the undergraduate level in dental schools. This frustrates the bright students and breeds a cynical kind of anti-intellectualism in the complacent ones. On the other hand, one may send the orthodontic class off to take a course in genetics, a field which undeniably has growing importance in orthodontics. However significant this subject may be, it is a formidably large one and the student may come out with a rather good knowledge of the coat-color of rabbits, but with no insight whatsoever concerning craniofacial morphology. The value of these courses will depend largely upon how the orthodontic department seeks to integrate them into the major field of learning. One sure way to thwart this noble objective is to staff the clinic with fellows who cheerfully say they know nothing about the basic sciences but "here's how I do it at the office."

Cephalometrics, when taught properly, is today indispensable to orthodontics. But when one sets up a graduate course for credit in this field and announces that this serves the purpose in indoctrinating the graduate student in research, he may have badly overinflated what he is using as a utilitarian commodity. I was told not long ago by a developmental biologist that it takes about eighteen months to train a man in the techniques of electron microscopy. It then takes another eighteen months to convince him that this in itself is not research. Cephalometrics, useful though it may be, is but a technique and can well be taught in such a way that it is entirely devoid of intellectual content.

The phrase "intellectual content"

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may cause a few of the pragmatic members to wince, but I would remind you that if you are to give a Masters degree in a reputable university, you must respect the phrase.

These wandering observations are made only to stress the fact that it is not the form that counts but the substance. We must avoid the parlous example of some of our public school systems which show more concern for a teacher's transcript than they do for what he knows. If we should rigidly adopt a narrow view of orthodontic education, the next step would likely be the stylized listing of courses which every department would have to teach to meet the criteria of some regulatory agency. In several of the graduate courses with which I have some familiarity, it is evident that certain schools are particularly well qualified to explore certain intellectual disciplines with real competence while other schools do equally well, but in quite another field. The core of instruction, of course, must be orthodontics. But since so many of the related scientific fields are really nothing more than intellectual venture capital, a wide amount of latitude should be allowed and the resources of the individual school should be fully exploited.

These critical remarks asserting that decisions are not frequently enough based on facts are not leveled at dental education alone. As a matter of fact, the whole field of education is dominated too much by fixed ideas which have prevailed over the years, handed down from one generation to another. Here is a good authoritative quotation, "Twenty-five students are to be enrolled in one class period. If there are from twenty-five to forty, an assistant must be obtained. Above forty, two teachers are engaged." You may have heard this dictum rather recently in the field of education; let me tell you now the real source. It comes from Rabbi Raba who uttered this pronouncement in the third century. This concept was actually developed long before there were printed books, yet it is still a tenet of education today.

The determination to get real facts has had some extraordinary benefits in fields other than education. In 1888 agricultural experiment stations were attached to land-grant colleges. At that time it took about fifty per cent of the nation's population to raise the food they needed; today it takes only about eight and we are producing great surpluses. Industry regularly plows back a substantial portion of its profits into research and development; one major corporation actually has more than nine thousand people working on new developments alone. Finally, we have the field of health sciences with its large corps of research workers and, in one area alone, the field of drugs, it may be said that ninety per cent of the drugs at our disposal today were unknown twenty years ago. But education simply plods along operating on tired clichés and opinions.

One of the real shortcomings of modern education is that it places too much emphasis upon a rigid pattern of organization, failing to appreciate that learning works best when real responsibility is placed on the student. No teacher can learn for the student; the student must learn it himself. Programs of independent study are infrequently found in liberal arts colleges, but they have worked well in places like Princeton, Swarthmore, Wooster and Reed. It is in this area where the dental schools have been particularly timid; every student must follow the same rigid pattern of work, overlooking entirely the individual capacities and interests of students.

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I am happy to report that Dr. West, Chairman of the Division of Orthodontics at the University of California, has proven to be a notable exception to the rule. As you know, the undergraduate orthodontic major at California has been, for most of its thirty years, simply a program whereby a man could drop most of his Prosthetics and Crown & Bridge at the end of his freshman year and get, in his last three years, the same number of hours of instruction in orthodontics he would otherwise get in a postgraduate program. Dr. West has adroitly modified this since he took charge five years ago. He began by admitting one or two men who had completed not one but two years of dental school, men who were willing to spend five years instead of four to enter the specialty. These individuals had special problems because they had completed their sophomore year and, in reverting to sophomore status as orthodontic majors, there were large gaps of time simply going to waste. Somewhat to the annoyance of the director of clinics and some other department heads, through cajolery and persuasion, Dr. West insisted that these men be treated as juniors wherever possible, and as sophomores only with respect to the orthodontic curriculum. This enabled them to get into the operative clinic sooner and to complete those requirements by the end of their fourth year. By this kind of strategy, Dr. West has eliminated the waste of time in the sophomore year and freed time in the fifth year, their last in the orthodontic major. This time is now available for independent study or for research projects, and this constitutes an imaginative and constructive means of putting a student's time to best advantage.

In October, 1961 the House of Delegates of the American Dental Association passed Resolution 2, which provides that no one can, three years from now, designate himself as a specialist unless he has had "two years or more of advanced academic education." Since the Council on Dental Education has said over and over again that this action is to promote the public welfare, I think it is about time the public knew what beneficial things are being done in its behalf.

We might start out, for instance, with the National Health Council's Commission on Health Careers, whose chairman stated[1] that the improvements of health services were frozen on a plateau of inaction, and went on to say, "but the ground is beginning to crack. We laymen as never before are deeply concerned about individual health. We are keenly aware of spectacular medical advances. Our expectations for the health professions could not be higher. But we have a growing anxiety. If we are to move constructively, we need more reliable information, a down-to-earth analysis of the problems we face, and realistic plans for action. ... Unless both the public and the health professions take special note of this impending manpower shortage and begin doing something about it, we cannot possibly fulfill our goal for improving health care in the near future."

It would be both entertaining and educational if those laymen, "deeply concerned about individual health," were to call for evidence clearly indicating that all graduate or postgraduate courses in orthodontics turn out better products than, say, preceptorships. It would certainly be nice to think so, but can it be documented?

Real progress in orthodontic education can come only when we abandon the frequently unsupported opinions of "authorities", and search out the facts; only then will we be complying with

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the scientific attitude to which so much lip service is given by the authorities themselves.

The Medical Center

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DISCUSSION

Dr. Saunders

I have been most interested in listening to this symposium since it has provided me with some insight into some of the educational problems with which you are faced. There seems to be at least pretty general agreement among the various speakers as to what is required to face the educational problems of the future in dentistry, and in orthodontia in particular. You are at one with medicine in your feeling that we are in such a dynamic age that every aspect of the health sciences is undergoing rapid change so that the development of the student in his critical abilities becomes one of the leading factors in a good educational program. With this I am in full agreement.

In listening to the several papers, I notice a very close affinity between the problems which the orthodontist has had in the development of his specialty and the problems which medicine has in the development of its series of specialties. It is obvious that both medicine and dentistry have to find new and better ways of providing the necessary training and educational experience. Frankly, I am appalled that in medicine today it takes an individual until he is well into his thirties before he becomes a contributing member to the economy. I do not believe that this is necessary and concur with Dr. Brodie that this is due in part to those educators who believe that simple repetition is the key to all education, instead of emphasizing principles. It is the affinity of the ideas expressed that I find so very refreshing. I cannot speak for orthodontia as I know very little about it, but I am most impressed with the emphasis given to principles in your attempts to develop a program of orthodontic education.

Dr. Brodie

I should like to arrange my discussion of the remarks of the various panelists in the order in which they were made, i.e., in which they appear in the program.

I was particularly impressed by Dr. Saunders' remarks on the necessity of keeping the mind free for inquiry at all costs. I inferred that he believed that this could best be done through the medium of the liberal arts aspects of education. But in a conversation with him before the panel started, I had asked him if such preparation would be equally beneficial to all students and I was not surprised when he said "No", for I have observed that there are men whose interests simply are not attracted in these directions. Such men, although perhaps brilliant in their own fields, are of a pragmatic turn of mind and work without regard to relationships to other fields. Nothing in the way of educational experience is going to change them. I should have to place the majority of students in this category.

But the demands placed on our educational system by this overwhelming majority should not be allowed to stifle the opportunities of development of those few individuals who have the

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imagination to do fundamental work however impractical it may seem at the moment. Individuals of this type have been responsible for all progress in all fields and it is imperative that they be protected at all costs.

This is very hard to do in our American culture because of the misinterpretation of the word "democracy." We have adopted as a precept the idea that every individual is entitled to an education, but we have never sought to answer the question of, "To how much education is each entitled?" In a system based on the premise that the majority should rule, it becomes extremely difficult to promote the interests of a small minority, especially when the views of that minority are at variance with widely held concepts.

Since college degrees have become status symbols, the obvious democratic solution is to educate all people to a higher and higher degree. Dr. Saunders referred to the overwhelming demand facing our educational facilities by the population explosion. By now this is being felt at the highest levels of education.

It is easy enough to shrug this off with "let the government do it," but it must be remembered that *we* are the government. We, the people, must pay for it and we, the people, are showing signs of resistance. Bond issues for the building of new schools have begun to be rejected by the voters in contrast to the ease with which they were passed only five or six years ago.

As the load on the taxpayer becomes heavier, it seems inevitable that restrictions will be imposed at all educational levels above the high school at least. A number of civilized countries recognized, years ago, the unfeasibility of attempting to educate everyone beyond the grade school level. Students are passed through finer and finer screens as they advance and those who fail to pass this screening do not go on from there. They may be taken out of the stream and put into other fields, vocational or others, that better fit their talents. I cannot help but believe that just the force of our increasing population will sooner or later bring this to pass here, whether the people interpret it as democratic or not.

Passing now to Dr. Adams: you made a statement, Bill, that the students who come to you and your staff should be congenial with the aims and traditions of the department. I think this has been one of the greatest brakes on dental education.

Furthermore, it has been carried over to the selection of staff members who had to be graduates of the same school so that the ideas, teachings and traditions of that school would be perpetuated. As a result of this inbreeding, dentistry has repeatedly witnessed the rise of various dental schools to positions of pre-eminence only to have the group that gave them pre-eminence resign, retire or die within a relatively short period and leave the school without replacements of similar stature. A graduate of such a school was heard to comment, "They thought they were pretty 'hot' so they sat down to allow the rest of the world to catch up and they never heard it when it went by."

This fate has overtaken some of the proudest dental schools and it is bound to happen wherever inbreeding is the rule. Every school, yes every department, needs at least one gadfly. Persons who do not agree with the traditional order of things and have *good* reasons for such disagreement are the yeast of progress.

I would also disagree with you, Bill, on the tight scheduling of courses shown by your charts. Merely because a student takes a course in anatomy, histology or speech for the purpose of

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supporting his major field is no sign that he has benefited from it. There must be free time for digestion. I am sure that if I were to ask Dr. Saunders' opinion of a four year college schedule of 4400 assigned hours he would say that it was an educational monstrosity! The idea that every minute of a student's time must be assigned in order to forestall curbstone conversation is one of the best devices to prevent him from thinking for himself.

There was little that Dr. Wylie said with which I could not heartily agree. A point which he did not mention specifically but which I believe should be stressed is the position of the educational institution in society. By tradition and custom education has been allowed to be aloof in order that the teacher and student be not constantly pulled hither and yon by the ever-changing swing of popular opinion. Therefore, I believe that whenever any political body steps into such a situation as he referred to in an effort to dictate what educational institutions can or cannot do, it is high time the brakes were put on the politicians.

All of the older dentists here will remember what happened a number of years ago when Harvard and Columbia, individually, set out to reform their dental schools by stressing the biological content of their courses and deemphasizing techniques. They were promptly told by the examining boards of certain eastern states that they would no longer examine their graduates for practice. This, to my mind, is as bad as anything repressive that Russia ever did. When any institution which has contributed so much to the cultural thought of this country as either Harvard or Columbia is denied the privilege of educational experimentation it verges on dictatorship.

Finally, I agree with Wendell that it is neither necessary nor wise to freeze instruction into one formal course, whether it be for postgraduate, graduate or preceptor training. In education, as in anything else, the coat must be cut according to the cloth. The student is more important than the course of instruction and if emphasis were placed on *learning* rather than on *teaching* it might eliminate the curse of minimum requirements and encourage the student to approach his individual potential.

Dr. Adams

I have two remarks I would like to dwell upon. The first alludes to Dr. Saunders' remarks relative to the population explosion. I think this is no time for us to panic. I think we should face it realistically and my feeling is that during the time when this tremendous growth of population does increase we may have a pseudo-orthodontist on almost every street corner. I don't know whether you are aware that even the so-called pedodontic groups are now split on this very point as to whether it is ethical for them to do orthodontics or not. My feeling is to encourage men to be proficient and produce more clinical work than they are doing with our 1925 methods and that's why I set the objective of one hundred major treatment cases per year which, according to my modest poll, represents twice as much work as the average man is now doing.

I also put in a strong plea for auxiliary help because I think this is the only way that our objectives can be accomplished and get the orthodontist away from old tasks which normally should not have to be done by a man of his development and training.

The second point is that Dr. Brodie

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misinterpreted my remarks about tradition. We would be the last ones to take such a course for our students which is in direct conflict with what we intend to produce. When I gave the number of hours it was not meant that these are assigned hours. I asked a group of students how long they worked and this is what they told me. This includes library work; this includes outside reading; nobody told them they had to do this work after the regular school. They elected to work this number of hours. I was surprised at its length and I was surprised at its variability. It was not taken from a huge sample but from enough to simply give a figure that could be passed on to you. We would be the last to tell a young man how to spend so many hours per year, because this is in conflict with graduate teaching.

Dr. Wylie

After the perceptive comments of the three men who preceded me, there is little more that I can say about the talks presented by Drs. Saunders, Brodie and Adams. And so I shall do what so often happens in a situation like this, capitalize on the discussion time to extend the length of my original paper.

I want to expound a long-standing dream of mine, because I think I can see its realization in the immediate years ahead.

I would like to see our undergraduate majors, after they have received simultaneously their dental degree and their specialty training in orthodontics, treated as a graduate on the Berkeley campus who majors in physics, gets his bachelor degree, and goes on to graduate school. These graduate schools might take from time to time a Curriculum II graduate, treating him not as if he knew nothing about orthodontics, but giving him an advanced training in orthodontics and a thoroughgoing preparation f or research and teaching.

I can say that one of my dreams has been fulfilled not once, but twice, for we have sent two of these people, one in 1956 and one in 1961, to the National Institute of Dental Research for two years doing research in the Clinical Center. This leads to no degree which doesn't disturb me at all, and I hope doesn't disturb them. It is evident that the first man back from that experience has become an excellent teacher, has a continuing interest in the field and is already a productive writer.

I also think that Dr. West's plan can really exploit opportunities for creative young men. By freeing this fifth year, we can not only exploit the opportunities which exist in the Medical Center, but use the Berkeley campus as well; there are departments at Stanford where I think we might get similar cooperation.

So this program need not be looked upon as completely a pragmatic way of training good orthodontists in the most rapid way possible, for it does afford further opportunities for education experimentation.

Dr. Brodie

In connection with what Wendell has just said I should like to comment on our relationship with dentistry. For too long we have gone on the assumption that dental education in this country is as nearly as perfect as it can be made. This smacks of the same condition referred to previously where,

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"We never heard them when they went by."

The application of the techniques and findings of the basic sciences have been largely responsible for whatever progress orthodontics has made. I believe that a like application of the same techniques and of even the same findings to general dentistry would be equally beneficial. More than once I have had a student say upon completing his course of orthodontic training, "Now if I were to return to the general practice of dentistry I think I could practice intelligently." Or, during discussions in seminar on matters concerning the head and neck, the question would be asked, "Why on earth isn't this sort of material taught to dental students?" It is this neglect of fundamental material that has caused orthodontics to draw away from dentistry.

Orthodontics is going to stay apart until the dental curriculum is so reorganized that it affords a broad foundation for either general practice or for advanced work in any of its specialties. It does neither of these things at present. In order to accomplish these ends it will have to take cognizance of the lesson that the Curriculum II of California has demonstrated, viz., that it is not necessary to spend the inordinate amount of time on technical training that is now demanded. Time thus freed can be spent to much better advantage on basic subjects.

Dr. Saunders

I was very interested in some of the things Dr. Wylie had to say, especially on the need for flexibility in educational programs. I can look back over a great number of years in medical education and I think that most of the programs with which I have had experience, although initially praiseworthy, have tended to become more rather than less rigid with the passage of time. I would just like to comment on the degree of freedom afforded me in my medical education. I do not often introduce the personal factor but I think this is quite interesting. I entered medical school having had a classical education which included a rather broad exposure to mathematics, a pursuit from which I derived much intellectual satisfaction. Although a medical student, I encountered no difficulty in getting permission to be absent in order to travel to England and participate in a course on a new concept in mathematics propounded by a little-known and relatively obscure mathematician, Albert Einstein. Likewise, as a medical student, it was not difficult to receive encouragement from one's teachers and to receive permission to be absent while attending Sir Charles Sherrington's lectures on the integrative action of the central nervous system. It was even more satisfactory to have the professor of physiology give credit to a student for having the gumption to go and listen to such an outstanding scientist. What would happen today? Undoubtedly I would be reprimanded for failing to record so many attendances at classes, rather than be examined to see whether or not I had profited educationally from the experiences.

Having been accorded, with great personal profit, this much freer type of educational philosophy, I have made it a practice never to ask any student to register attendance. I have never felt it necessary to inquire of a mature student whether or not he profited himself more by playing golf, by enjoying his fellow students, or by attending my class. In dealing with intelligent stu-

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dents, particularly where selection has been exercised, it is more important to stimulate an intellectual interest in the subject to the degree that they wish to gain knowledge for itself. I do not believe you can make better students simply by saying you have to jump over so many hedges. Whether you label them as a 6-unit hedge or an 8-unit hedge, provided they are properly led, students will perform creditably in the end.

At the same time I believe in discipline; I mean self discipline, intellectual discipline, which is associated with a sense of responsibility. In a profession, as distinct from general academic work, a sense of individual responsibility must be developed early in order that the student may make good with the intellectual freedom afforded him. In this way it is possible to stimulate individuals to better performance and the method need not be reserved for the so-called geniuses. I have observed rather unpromising individuals develop themselves to an astonishing degree when afforded a measure of liberality in their approaches to their subjects.

When any student comes to me saying he wishes to do "research" I promptly show him the door on the grounds that he does not know what he wants to do. On the other hand, I pay attention if he says, "I have a problem which interests me; how do you think I can go about learning more about it or attempting to solve it?" Today too many of our students think in terms of clichés and the status value associated with research. Today the research worker is often regarded as seated upon a sort of pedestal; the only trouble is that many of those pedestals are made of a very inferior grade of clay.

Dr. Hahn

From what Dr. Saunders and Dr. Brodie have already said, I think possibly a little bit more from each of them would answer the majority of the questions that have been sent from the floor. I shall put them in the form of this combined question and ask either or both for their answers. "Why is it not possible to develop a program for the training of teachers and research workers and is it not possible to make it financially attractive to them?" And the last is added because we hear so much that men do not go into teaching or research in our universities because they cannot afford to.

Dr. Brodie

Fundamental to this entire question is the vast change that has taken place in our sense of values. Until the close of World War I, a young man, contemplating his future, asked himself what sort of life he wished to lead. Since that time this question has become, "How much money can I make at it?"

With values based on the dollar and material things there is inevitably a comparison among peers, classmates or neighbors, and backs are turned on fields less remunerative, such as teaching and research. Few seem to realize that more true happiness can lie in such creative fields than in the pursuit of the dollar.

But there are signs that even here a change is on the way. It may not be too long before the monetary returns from teaching and research will be more nearly commensurate with the efforts put into such endeavors. For the past seven years the National Institutes of Health, through a program of Postdoctoral and Senior Fellow-

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ships and Career Development Awards, have offered adequate support for the young M.D., D.D.S., or Ph.D., to continue his research until he has his feet on the academic ladder. This is one of the programs that has shown the remarkable rise indicated by Dr. Saunders' slide. So it may be that the professional man may be bought back into his proper sphere.

Dr. Saunders

The problem of developing basic scientists in the health professions is largely one of creating an interest in the basic sciences by exposing an individual to its challenges. Some years ago my department had a program permitting a student to drop out for a year during his medical course. It is very interesting to see what happened to these students. About ninety per cent of them now occupy professorial positions in some basic science or clinical department. All we did was to give them a year's experience in a basic science to learn what a basic science was like, and give them an opportunity to develop some skill in research. Invariably these students, on completion of their M.D., would return to obtain a Ph.D. degree and then go on to an academic career. Of course there is a very limited number of individuals who will want to follow this kind of course. However, they must be given this exposure, for once their imaginations have caught fire the possibilities of greater financial rewards in practice become unimportant.

The department must have enough teaching assistantships to make this kind of thing possible. What killed this program was the loss of the intern year as an integral part of the graduation requirement. The intern year was done away with during World War II, so that the drop-out year, which was a substitute for the intern year, disappeared in order to meet the requirements of military service. In the meantime the increasingly lengthy requirements for specialty training made the drop-out year less and less attractive when the student contemplated the length of time, now almost fourteen years, before he could qualify for modern practice.

The new NIH program will help a great deal in making it possible for a student, through a drop-out year, to develop along the lines in which his inclination and his talent should lead him.

I would like to make another comment on student finances. Everyone recognizes that we are in an inflationary economy and everyone recognizes that it is preferable for a student to live at a reasonable level. This is recognized in the case of graduate students, for recent surveys show that eighty per cent of all graduate students received some kind of financial support while pursuing their studies. The average level of this support is approximately $1,200. In the case of medical students, and I am sure this is also true in the other professions, only about fifteen to twenty per cent in the survey year 1960 received financial support, and that financial support averaged about $400 per annum. In other words, the average graduate student receives in a single year more support than an individual in the health sciences receives in the four years of his training. A graduate student is paid to go to school. A student in the health professions is dependent either on his family or on his own earning ability. Further examination shows that eight per cent of all medical students require from $2,000 to $3,000 a year, on the average, from their parents.

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This, of course, is utterly wrong since it means that only those with adequate parental income can afford to go into the health field. It is my conviction that in the health professions scholarship support is badly needed. Lack of such financial support is responsible for the loss to the health professions of many brilliant students.

I know of an outstanding young man, one of the most brilliant young minds among the high school students of the period. At the University he was encouraged to enter physics, a subject in which he eventually majored. However, he was highly motivated toward medicine. Nonetheless, when the time came for him to make up his mind whether to enter medicine or elect physics he decided that he could not afford to go into medicine (his parents are people in very modest circumstances). He became a graduate student in physics because of the availability of financial support. Fortunately, his motivation toward medicine was so strong that at the end of the year he elected to enter medical school. This was for him an unduly costly procedure since he had not only to make up deficiencies in his training but he had to find a school which would give him adequate financial support. With a young man of such exceptional talent, more should have been done. There is a crying need today for the support of the exceptional student, especially during this period of economic inflation.

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