JOURNAL OF THE AMERICAN COLLEGE OF DENTISTS

Vol. 10 . . . . MARCH, 1943 . . . . No. 1

Contents

Published quarterly at 99 South Van Ness Avenue, San Francisco, California

By THE AMERICAN COLLEGE OF DENTISTS

Office of Publication: 350 Post Street, San Francisco, California

Subscription Price: $2.00 per Volume

Entered as Second Class Matter July 13, 1940, at the Post Office at San Francisco under the Act of March 3, 1879

AMERICAN COLLEGE OF DENTISTS

Convocations have been held on this schedule (since organization in *Boston*, Aug. 20 and 22, '20): (1) *Chicago*, Jan. 26, '21; (2) *Milwaukee*, Aug. 13 and 18, '21; (3) *Montreal* Jan. 25, '22; (4) *Los Angeles*, July 16 and 19, '22; (5) *Omaha*, Jan. 23, '23; (6) *Cleveland*, Sep. 12, '23; (7) *Chicago*, Mar. 5, '24; (8) *Dallas*, Nov. 12, '24; (9) *Louisville*, Sep. 22, '25; (10) *Philadelphia*, Aug. 22, '26; (11) *Chicago*, Jan. 26, '27; (12) *Detroit*, Oct. 23, '27; (13) *Minneapolis*, Aug. 19, '28; (14) *Chicago*, Mar. 24, '29; (15) *Washington*, D. C., Oct. 6, '29; (16) *Denver*, July 20, '30; (17) *Memphis*, Oct. 18, '31; (18) *Buffalo*, Sep. 11, '32; (19) *Chicago*, Aug. 6, '33; (20) *St. Paul*, Aug. 5, '34; (21) *New Orleans*, Nov. 3, '35; (22) *San Francisco*, July 12, '36; (23) *Atlantic City*, July 11, '37; (24) *St. Louis*, Oct. 23, '38; (25) *Milwaukee*, July 16, '39; (26) *Baltimore*, March 17, '40; (27) *Cleveland*, Sep. 8, '40; (28) *Houston*, Oct. 26, '41; (29) *Boston*, Aug. 23, '42, cancelled; Regents met in St. Louis, Aug. 27-28, '42. [Next Convocation to be announced.]

Sections and dates of meetings in College year of 1942-43 (between convocations):—(1) *Kentucky:* Sep. 14, '42. (2) *Northern California:* Sep. 17, '42. (3) *Maryland:* Sep. 18, '42. (4) *New York City:* Sep. 18, Dec. 6, '42; Feb. 19, May 21, '43. (5) *Minnesota:* Sep. 19, Dec. 9, '42; Feb. 19, May 5, '43. (6) *New England:* Sep. 17, '42. (7) *Wisconsin:* Sep. 16, '42; Mar. 21, '43. (8) *Colorado:* Sep. 14, '42. (9) *Pittsburgh:* Sep. 16, '42. (10) *Iowa:* Sep. 20, '42; May 4, '43. (11) *Illinois:* Sep. 16, Nov. 30, Dec. 18, '42; Feb. 21, '43. (12) *St. Louis:* Sep. 15, '42. (13) *Oregon:* Sep. 19, Dec. 19, '42; Feb. 6, Mar. 13, June 12, '43. (14) *Texas:* Sep. 19, '42. (15) *Florida:* Sep. 19, Nov. 10, '42. (16) *Indiana:* Sep. 17, '42. (17) *Southwestern:* Sep. 16, '42. (18) *Washington (D.C.):* Sep. 17, '42; Jan. 19, '43. (19) *New Jersey:* Sep. 18, Oct. 30, '42; Jan. 14, Apr. 27, June 3, '43. [Revised as of March 11, 1943.]

Objects: The American College of Dentists "was established to promote the ideals of the dental profession; to advance the standards and efficiency of dentistry; to stimulate graduate study and effort by dentists; to confer Fellowship in recognition of meritorious achievement, especially in dental science, art, education and literature; and to improve public understanding and appreciation of oral health-service."—*Constitution, Article I.*

Classes of members (each member receives the title of Fellow—"F.A.C.D."): (1) "The *active* members consist of dentists and others who have made notable contributions to dentistry, or who have done graduate, scientific, literary, or educational work approved by the College." (2) "Any person who, through eminent service, has promoted the advancement of dentistry, or furthered its public appreciation, may be elected to *honorary* membership."—*Constitution, Article II.*

Forfeiture of membership: "Membership in the College shall be automatically forfeited by members who (a) give courses of instruction in dentistry, for *remuneration*, under any condition other than those of an appointed teacher serving publicly under the auspices of a dental school, dental society, hospital, or other accredited professional or educational agency; or (b) give courses of instruction in dentistry in a privately owned undergraduate or postgraduate dental school; or in a school that is associated with an independent hospital or dispensary but is not an organic part of it; or (c) exact exorbitant fees for courses of instruction in dentistry under any auspices." . . . —*Constitution, Article II.*

ARE UNIVERSITIES ON THE WAY OUT?[1]

ROBERT GORDON SPROUL, B.S., LL.D., Litt. D.
President of the University of California, Berkeley, California

The times in which we are living are uneasy with portent. It is not a passing squall on a summer sea; it is a cosmic change of seasons. The thunders of battle in every part of the world, the crash of falling nations and the grinding roar of civilization as it tumbles toward the yawning crevasse presage a new and difficult age for higher education, as for all the activities of men. Breasting the forefront of the onslaught stands higher education. It is not without significance that Nazi despotism, as one of its chief policies, muzzled and debauched the German universities, so long the honor and glory of the German nation. On every hand today we read and hear that a revolution is about to be worked in colleges and universities, that very shortly all higher education is to become wartime education, if not, indeed, war education; that it will bear little resemblance to peacetime education; and that there will be no turning back to the good old days when the war is over. As plans are now shaping up, we are told (and by high authority), the men who will go to college after February 1, 1943, or June 1 at the latest, will be men chosen by the Army and Navy, on the basis of military estimates of aptitude. These men will be furloughed from active duty, and given brief, vocational training for technical, professional jobs in the services. Everywhere there will be telescoping and speeding up of courses. Doctors may be graduated in four years instead of eight, engineers in one or two years instead of four or five. Liberal arts will be thrown out the window. Degrees are likely not to be granted. These are far-reaching changes, indeed, and those who are interested in colleges and universities and who know best their capacities and limitations may be pardoned, perhaps, if, even in a national emer-

[1] Speech delivered on December 5, 1942, at the University Club, New York City. Published in the JOURNAL by special permission. Abstracts only appear in the *California Monthly*.

JOURNAL OF THE AMERICAN COLLEGE OF DENTISTS
VOL. 10, NO. 1.

gency, they speak up before sentence is pronounced upon them. For, to preserve and strengthen higher education in a world of brutal war and revolutionary change may prove, in the long record of time, to have been the most fundamental even of our immediate and urgent necessities.

I shall not, of course, plead for universities "as usual" at a time when the very survival of our country, as well as civilization, literally hangs in the balance. That would be quite as fatal as business "as usual." As a matter of fact, universities have been among the first of American institutions to receive the full impact of war's heavy demand, through conscription and increased production, for the services of youth. For the modern university does not withdraw from life—always, it is out in front, leading. Its administrations have not only shared the present common concern about the future; they have already acted to adapt their institutions to shifts in emphasis that can only be described as seismographic. Together with all the other instrumentalities of our national life, the American university accepts the tragic hazards of war and its complex economic and social consequences, and endures the challenge of rapid and fundamental change. There has been no retreat to ivory towers.

Readjustment in American higher learning is not a new phenomenon; it is a normal, gradual process in a continuing growth. But in wartime, acceleration of this normal process is imperative, and already important shifts are taking place. Undergraduate degrees can now be earned in nearly all colleges and universities in three years or less. Such acceleration has been hastened by the war, but the shift was certainly coming even before Pearl Harbor. The schedule of American higher education has for some time been wasteful of the lives of our young people, and particularly those preparing for the professions. It is not reasonable that the M.D. degree, for example, should be unobtainable for the greater number before they have passed twenty-five years of age. If a man is to be of maximum utility to himself and of maximum advantage to society, he should be married and at work long before this age is reached, and he can be if educators will concentrate on the *instru-*

ments by which he can make his *whole* life and education, instead of assuming that he will never learn anything after he graduates. Even on the undergraduate level, the most sanguine must admit, not all majors nor all curricula, contribute substantially to the attainment of sound educational objectives, such as (1) the laying of a cultural foundation on which one may build a rich, abundant, useful life, (2) the development of civic consciousness and of the capacity to meet the responsibilities of a democratic citizen, and (3) the acquisition of the knowledge and skills essential to vocational and professional success in specific fields. Throughout the whole gamut of university education, there has been need for more intensive presentation of course material, for the elimination of elementary recitative methods of teaching, for the closer articulation of disciplines with vocational and professional preparation, including preparation for citizenship, for the more conscientious assumption of academic responsibilities by faculties, and for the discontinuance of unnecessary and preventable waste.

Even a casual glance at the offerings of American universities indicates clearly the extreme limits to which specialization, for example, has been carried. The multiplication and proliferation of courses which swell the catalogues of our colleges have resulted partly because each specialist added to a faculty strongly believes that he must teach one or more courses in the minute area of knowledge with which his Doctor's dissertation was concerned. Consequently, curricula have been burdened with courses for the production of minute specialists, instead of being strengthened with courses for the educational needs of the overwhelming majority of students, even of our good students, few of whom will become academic specialists. Specialization has its function, of course, but all too frequently the rounded educational development of men and women is sacrificed to the particular interests of the specialists, who insist on offering courses so restricted in scope as to contain relatively little value for the normal student.

As I have already said, however, changes along these lines were coming anyway, war or no war. More is certainly demanded of universities now. In this critical crisis, in this national emergency, the American nation, together with its allies, is faced with an imperative first: the defeat of Germany, Italy, and Japan. It must be the immediate job of every individual, every organization, and every institution in the United States to do its bit to bring these enemies of human freedom to their knees. First, therefore, universities today must concentrate specifically on the preparation of men and women for more effective service in the armed forces and in war industries. They must conserve material by prudent consumption and salvage. They must help to raise funds to finance the national effort. They must promote the health and physical efficiency of our youth. They must build intelligent loyalty to American democracy. They must increase effective manpower by correcting educational deficiencies.

These immediate positive acts are required of universities, as similar acts are required of each one of us, because our country is engaged in a contest which is too vitally important to take even the smallest chance upon its outcome. Consider the stakes that wait on the issue: government of the people, for the people, by the people: will it perish or survive? Consider, again, the human liberties which men have established by blood and iron and vigilance, and which it is the avowed purpose of the totalitarian powers to banish forever: will they remain or will they disappear?

Neither a university, nor a college, nor a church, nor a club, nor any other institution directly or indirectly dedicated to the cause of peace and truth can give less than everything it has, and even all that it is, in defense of these things and in support of those ideals which are essential to the dignity of the human spirit: that men may read and teach the truth unafraid; that even the least of them may have an unsmothered voice in the determination of his destiny; that youth may be trained as free citizens not as janissaries; that the state may exist for men, not men for the state; that honor and decency and justice may prevail. For these things, our men are fighting today in steaming jungles, on icy seas, on burning sands, to these ideals Americans again are pledging their lives, their fortunes, and their sacred honor. Universities can make no choice but to see that fight through with all the resources at their command, whatever may eventually become of them.

But universities are still under solemn obligation to see that *all* the resources at their command are used, and not merely those resources which the men on horseback, with their necessarily limited perspective, demand. The objection of unselfish educators (and most of them are unselfish and patriotic) to the present plans is not that they will shake the colleges to their ivy roots, but that they will prune them back so severely that they will no longer be able to grow the fruits that they alone can produce and that the nation so direly needs. All university administrators accept without question the principle that their institutions must be used to train the men the armed forces need for the jobs they want them to do, as thoroughly and as quickly as possible. They recognize that, in this respect, universities are uniquely essential to the whole war program. They question, however, the necessity and the wisdom of restricting the universities to this one task and no other, and no data have yet been given them that justify such a necessity. They question, too, nature being what it is, the possibility of an impartial judgment by the military of the relative needs of the armed forces, of industry, and of agriculture, and they point out the tragic results that will follow if industry and agriculture fail to get their annual transfusion of fresh blood from the campuses of America. They ask if the three, or five, or whatever number of men is needed behind each man at the front, can be maintained without these trained youths, and they answer "No." They doubt if older work forces, even with the help of women, are qualitatively or quantitatively equal to the task. If these doubts are justified, the university administrators are quite sure that the denial of young men to industry will have a cumulative effect, which may well become disastrous as the war continues. The specialized talents required to operate our highly technical civilization, and to meet the emergencies of its recurrent wars and other dislocations are not to be produced by *ad hoc* directives or by last-minute educational improvisations. No amount of pressure or patriotism can create overnight a supply of physicists, mathematicians, chemists, biologists, economists, and political scientists. Yet, without the trained intelligence of these classes of men, a modern war cannot be won nor a lasting peace achieved. Such men are the fruits of long, patient, sustained effort, and of no other process.

As one "foreign" educator, a college president from Brooklyn (President Gideon) has said: "Young manpower is as scarce a resource as steel, rubber or scrap iron—and it is more precious. It is a measure of the extent to which emotion has crept into a discussion that should be dominated by reason, that it should be necessary to stress that there is no reason why we should turn all the manpower over to the armed forces when we do not turn over all the raw materials. The Army has to establish its needs for priorities for rubber before a civilian War Production Board. It should establish its needs for manpower relative to civilian needs before a civilian manpower authority. . . . If the war should last five years—as some of the Army people say—a policy of drawing all young people into active service at once would result in utter chaos in industry, in the technical professions and in the Army's own supply of trained manpower for the younger ranks of its officers.

"Education is concerned with the fullest utilization of the potential ability of every age group. That is its war function. Manpower utilization in industry has thus far drawn its resources from a large pool of idle labor, or unskilled labor that could be graded up. With the expansion of industry, and with the new age limit in the selective service system, we have, so to speak, reached the bottom of the barrel, and the supply of skilled workers and technicians will only increase from now on if specific provisions for selection and training are made as the age group becomes available for induction. If careful and well designed measures are not taken at that time to safeguard civilian manpower reserves, we shall discover that resources have been assigned to specific military duty which should have gone to the training of new talent for agriculture, industry and professional service in sciences, medicine, etc. We should have a priorities system for young manpower as we have it now for essential raw materials."

The British experience and example, by the way, confirm both the doubts and the judgments of American educators. In England and Canada, colleges and universities are still running full blast and under educational, not military, control. A Joint Recruiting Board, on which the Army is represented, has been set up for each institution. This Board examines the records of applicants for college admission and decides who should be inducted by the armed forces and who should be matriculated in college. Successful applicants are divided into three classes: liberal arts, technical or engineering, and medical. Those who wish to pursue liberal arts courses are allowed one year's attendance. Those who wish to study technical subjects are allowed two years' attendance, subject to the Board's approval after the completion of the first year. Those who choose and who qualify for engineering or medicine are permitted to complete a full course, somewhat condensed and accelerated because of the urgent need for their services. All students receive military training, with liberal arts students getting more than the others. In addition to the regular curricula, which I have sketchily described, a rather large number of short war courses is given at the universities and these are supported by *state bursaries*, or scholarships, for training men in radio, radio physics, and other technical fields in which there are deficiencies. The nature of the courses to be given to all these types of students is determined by the educators, after industry and the Army have made known their wants. The products of both short courses and longer curricula go to industry and the armed forces under allotment by an over-all board.

So much for the essential, immediate tasks of universities. But universities are not only under solemn obligation to use all their resources, and with the highest efficiency, for the prosecution of the war effort. They are summoned, also, to set up objectives farther on and to see that the necessary blueprints are drawn to make these objectives visible and at least potentially realizable. Confronted with a world in which ruthlessness must be employed to destroy a far more dangerous kind of ruthlessness, universities must continue to affirm and reaffirm their undiscourageable belief in the ultimate power of man's higher faculties. As Alvin Johnson says: "The rules of civilization, wrought out on Sinai and the Areopagus . . . are prior to the bomber and poison gas, and will survive beyond them."

I would add this further statement. The Declaration of Independence and the Constitution of the United States are prior to and will outlast *Mein Kampf*; and the scientist's objective search for truth will outlive all the regimented thinking of totalitarianism. Temporarily obliterated, the proud universities of Paris, Prague, Louvain, Warsaw, Leyden, and Heidelberg and Bologna as well, will once again stand up and be counted on the side of truth; once again they will be centers of candid thinking and fearless expression, homes of the untrammelled and the unafraid, where there is liberty to learn, opportunity to teach, and the ability and the desire to understand. And our universities must remain free to carry on their proper functions, in order that they may make certain, so far as they can, that the streams of culture and learning and civilization, wherever they may be found, or however deeply underground they may be flowing, shall not be blocked and disappear completely.

If we are to have a durable peace after the war, if out of the wreckage of the present a new, world-wide cooperative life is to be built, as the poets and the prophets and the statesmen, and even the politicians, seem to agree, the essential part that universities, through advancing knowledge, will play in that building cannot, must not, be overlooked. Wars and economic rivalries may, for longer or shorter periods, isolate nations and split the world into numerous, separate units, but the process never reaches completion. The indivisibility of the human mind surmounts all barriers of geography, race, or color, and science and culture have long since woven their indelible patterns of unity into the society of all mankind. Elsewhere brotherhood may seem an idle and utopian dream but in the world-wide fraternity of universities, where scholarship is the password, it has long been an established and accepted fact.

Whether they have to do with poems or projectiles, a new device for making artificial silk or a cyclotron for studying atomic structure, ideas cannot be cribbed, cabined, or confined. Thought never has been successfully nationalized. All peoples are beneficiaries of contributions to knowledge made by men from every nation of the world: American soldiers wounded on Guadalcanal will owe their lives to Kitsata, a Japanese scientist, who isolated the bacillus of tetanus. In this sense, the things that divide men are trivial by comparison with the things that unite them. The foundations of a cooperative world have already been laid by patient scholars, building brick by brick, the ultimate structure of a civilized human society. The age of distinct human groups, indifferent to the fate of one another, is actually already over, although its passing is momentarily obscured. Tomorrow is even now dawning, and we cannot too soon make ready the techniques that will fit the realities of twentieth century international interdependence. We need rallying points, functioning centers, where the human race can pool its brains toward the common well-being. They are not lacking, these essential rallying points and centers. Through centuries of varied vicissitudes, they have persisted and grown strong. They are the communities of scholars that are called universities.

This responsible concern for the future cannot be dismissed as academic idealism born of life in cloistered seclusion, for it is the utmost, the sternest of practical sense. This is not an easy time, of course, to talk of ideals, new buildings, and a better world. We have heard all that before; look at us now. Yet the cynicism of easy disillusionment is no less sophomoric than the earlier optimism against which it is a protest. It is the glory of man, not that he has ever triumphed completely or ever will, but that, in the face of defeat and disappointment, the collapse of old assurances, the failure of long-held hopes, he goes on fighting. His weapons change and his battlefronts, but he fights always against the same enemies: greed and arrogance, stupidity and fear. So, too, he goes on building in art, in knowledge, in just social relationships, and in all those good things by which life is justified and made complete. To maintain that glory of man, that Promethean fire, there is laid upon him the unending obligation to promote liberal education, nurture the appreciation of imaginative scholarship and, above all, to foster that urge to gain new knowledge which is the essence of research. These, at least, must be steadfastly sponsored lest our vital intellectual resources fail and we fail with them.

Finally, universities should command a place among the essential industries because of their contributions, present and potential, to democracy's continuing vitality through education for citizenship—education which has been badly neglected to our great cost, since World War I. Fascist Italy understands the importance of this sort of education; Nazi Germany understands it; Communist Russia understands it. If the United States does not yet understand it, perhaps it is because we are less certain than these peoples about what we believe. What is the democratic tradition? What is the American way of life? Exactly what do the four freedoms mean? We are engaged in a war of conflicting philosophies, conflicting social patterns; but precisely where do the differences lie? If the universities did nothing more for the national war effort than to make clear to all who will listen both within and without the campus gates, the nature of the fundamental choice now before the peoples of the world, they would be making a priceless contribution. They are, as a matter of fact, doing far more than that. In war as in peace, a university serves by rallying intelligent men and women around ideas and institutions worth fighting for. In a democracy, the best propaganda is truth, and one of the best services that universities can perform is to make the truth available in order that our people may be strong in conviction and determined in purpose.

For democracy on the home front must renew its ancient hardihood if it is not to lose all that gives it meaning in Pyrrhic victory on the field of battle. Government in a democratic society cannot become static. By its very nature it is a constant and dynamic challenge to the intelligence of its citizens, for, by definition, the people of a democracy are not puppets or sheep, but active, political participants. The very term, republic connotes power of the people. That power may be used wisely or unwisely, or, which is most unwisely, not at all. Of course, teaching a student about his country and its institutions is no guaranty that he will become an intelligent and patriotic citizen. But if that teaching is done inspiringly by men with a real understanding of, and devotion to, democracy, the effect cannot but be beneficial. Moreover, I believe, personally, that no youngster of intelligence, hearing or reading the epochal history of the birth and growth of this country and achieving familiarity with the ideals which have given direction to that story, can come through the experience without a greater devotion, a deeper loyalty, and a clear conception of his responsibilities as a citizen of his nation and of the world.

As I conclude, let me remind you of the premise with which I began, namely, that the events of today force American educators to review and reappraise the means and ends of their teaching. My argument, founded upon this premise, has been that the review and reappraisement can best be made by the educators and not by the military, for the changes made will affect not only the university graduates and ex-students of 1942, together with the armed forces that nearly all of them will enter, but will also affect even more the school children of tomorrow, the graduates of 1962. If political and social realities deserve more attention in wartime than they have been getting, they will deserve even more urgently, attention when peace comes. If the dignity and worth of the individual are worth fighting for, they are worth our study and our understanding. If the humanities, the liberal arts, are indispensable in peacetime, they are far from useless now. If our universities have not been producing all that the democratic state needs for its survival, let us overhaul them rapidly and drastically, but let us not deliver them into the hands of men unacquainted with education who would come in and destroy them. Let us rebuild them. In our unseemly haste to get immediate results let us not unfit them for their vitally important task, the task described by the man who omitted from his epitaph his presidency of the United States but included his founding of the University of Virginia, namely, the training of leaders—leaders who, in Jefferson's own words, "are rendered by liberal education worthy to receive, and able to guard, the sacred deposit of the rights and liberties of their fellow citizens." The roster of university-produced leaders in American history short though that history is, is long and honorable. Let us not rashly discard a tried and tested instrument, that with all its self-acknowledged deficiencies, has nevertheless served us so well. Let us, rather, in this time of stress, rebuild it where need be, not only for the war years, but for the long-term national welfare as well.

The front-line trenches of democracy can only temporarily be held by the machinery of war. Democracy's citadel is built in the hearts and minds of men who have caught the contagion of truth, who have learned to think, and who value the dignity and worth of the individual man. There is a wide and deep chasm between the two, great warring forces in the world today, between those of high ideals who believe that the true values of the world are spiritual and those who, yielding to primitive instincts, see in the world nothing more than an accumulation of things. This warfare is not a mere gymnastic of theoretical philosophy; it drives deep into men's emotions and molds their actions. In a very solemn sense, the issue before us is whether the world of our children is to be a world of super-animals or a world of men and women who, in the old Puritan phrase, are the children of God. Humbly, but in all sincerity, I believe that the United States will meet the issue squarely and successfully, and will continue to blaze the trail toward the world of justice and the world of liberty, from which alone can rise in all its beauty a world of peace.

We live today in a world of war. We live to see helpless civilian populations blotted out in a rain of death from the sky. We live to see the sanctity of treaties and contracts violated at the caprice of willful men. We live to see the culture and art of nations profaned and perverted to distortions that outmode even the Dark Ages. We live to see honesty, sincerity, and character caricatured at the behest of brutal military power. In the midst of such chaos, when, as Emerson said, "things sit in the saddle and ride men," then it is that universities, above all other of America's democratic institutions, should be permitted to contribute to her salvation the best and highest that is in them. Thus, like a steady beacon, they will light our way and give us power to make effective in world society, not by compulsion but by example, the principles that are our American heritage, and will bring to reality the dreams that lie hidden within our hearts.

AMELOGENESIS[1]

(A Critique and a New Concept)

BALINT ORBAN, M.D., D.D.S.
Professor of Oral Pathology and Research
HARRY SICHER, M.D.
Associate Professor of Anatomy, Histology and Research
JOSEPH P. WEINMANN, M.D.
Assistant Professor of Oral Pathology and Research

INTRODUCTION[2]

In a paper on amelogenesis Saunders, Nuckolls and Frisbie[3] presented a concept of the histogenesis of enamel which differs in essential details from the generally accepted viewpoint. This paper deserves earnest attention because the opinion expressed therein is based on the application of techniques hitherto not employed in the study of this subject. We welcomed the request of the editor of the *Journal of the American College of Dentists,* to present a critical review of the paper by Saunders, Nuckolls and Frisbie, and to give an account of our findings. We are indebted to the authors for giving us access to their material and for their discussion of our respective findings.

MATERIAL

The investigations, presented in this paper, are confined to the early stages of enamel matrix formation and are based mainly on investigations of the rat incisor. The material was fixed in Zenker-formol, decalcified in 5 per cent nitric acid for twenty-four hours and embedded in celloidin. The sections were stained with hematoxylin-eosin, Mallory-azan and impregnated with silver after Gomori. Some specimens were stained with chrome hematoxylin and P.W. hematoxylin. Sections of developing teeth of other animals,

[1]The Foundation for Dental Research of the Chicago College of Dental Surgery, Chicago, Illinois.

[2]We are indebted to Dr. G. Gomori for preparing some of the special stainings.

[3]Saunders, J. B. de C. M., Nuckolls, James, and Frisbie, Harry E.: Amelogenesis. *J. Am. Col. Den.; 9,* 107; 1942.

such as dogs and pigs, were also studied and compared with human material. We selected the rat incisor for our studies because this continuously growing tooth shows all the stages of enamel development in one and the same longitudinal section. Furthermore, in central sections, parallel to the long axis of the tooth, the arrangement of the enamel rods is very regular and, therefore, easily analyzed.

In addition to our material we had the opportunity to study the material of Saunders, Nuckolls and Frisbie. This consisted of undecalcified and partly and fully decalcified sections of rat molars and incisors.

FINDINGS

The formation of enamel begins when a thin layer of dentin has been formed. The ameloblasts are lengthened at this stage. The wide, nucleus-free zone of protoplasm at their basal end[4] contains fine basophilic granules. The narrow nucleus-free zone at the peripheral end is eosinophil,[6] due to the presence of acidophil granules.[3, 7] The basal ectoplasmatic zones of the ameloblasts fuse and, thereby, form a continuous layer which is superimposed on the basement membrane of the dental papilla.[7] The fusion between basement membrane and this uniform cuticular product of the ameloblasts may be termed dentino-enamel cuticle, *Figure* 1. This can be seen at a later stage in continuation with the interprismatic substance.

The following stage in amelogenesis is the simultaneous formation of the Tomes' processes and terminal bar apparatus, *Figure* 2. The Tomes' process is a granulated, protoplasmic projection of the

[4]The terminology of the two poles of the ameloblasts is contradictory. The ameloblasts develop from the basal layer of the oral epithelium. It seems therefore justified to call the basal end that end of the cell which rests first on the connective tissue, then on the dentin, and lastly on the enamel; the peripheral end is in contact with the stratum intermedium (Renyi[5]).

[5]Renyi, George S. de: *Am. J. Anatomy*; 53, 413; 1933.

[6]Orban, B.: "On the Development and Finer Structure of the Enamel" (Zur Entwicklung und feineren Struktur des Schmelzes). *Ztschr. f. Stomat*, 23, 599-622; 1925.

[7]Held, Hans: "On the formation of the Enamel" (Ueber die Bildung des Schmelzgewebes). *Zschr. f. Mikrosc. Anat. Forschg.*, 5, 668; 1926.

cytoplasm of the ameloblast. It is hexagonal prismatic, corresponding to the shape of the ameloblast. In well-fixed specimens there is no space between the adjacent Tomes' processes; they are separated from each other by thin projections of the terminal bars. The terminal bar apparatus is a thickening of the intercellular substance and marks the end of the cell body. In a surface view, *Figure* 3, the terminal bar apparatus can be seen as a regular hexagonal framework of dark lines thickened at the point of intersection. In longitudinal sections of the ameloblasts it appears as a sequence of thick dark staining dots and thinner connecting bars. This substance is argyrophobic, *Figure* 4.

When the Tomes' process has reached a certain length its dentinal end undergoes a transformation. It becomes denser, almost homogenous, more basophil, *Figure* 5, and argyrophil. Almost simultaneously, small triangular very dense areas appear at the dentinal end of the homogenized processes, *Figure* 5. Following the further development of these structures it becomes evident that they originate from the homogenized processes by a transformation of their dentinal ends and that part which is directed toward the apical end of the incisor.[8] This substance is markedly basophil and strictly argyrophobic; it may be termed *pre-enamel matrix*.

The unilateral transformation of the homogenized Tomes' processes into pre-enamel matrix causes the peculiar "picket fence" formation of the cellular ends of the rods in longitudinal sections. Each rod consists of two triangles: one, at the incisal side of the rod turning its apex toward the dentin, is the homogenized Tomes' process; the other, at the apical side of the rod turning its apex toward the surface, is the pre-enamel matrix, *Figures* 5 and 6.

The transformation of the homogenized Tomes' processes into pre-enamel matrix occurs not continuously but by formation of segments. The first sign of the formation of a segment is a septum-like thin bar of pre-enamel matrix in the homogenized substance, *Figure* 6. These cross bars are formed at regular distances. Each

[8]In all figures the apical end of the incisor is at the left side of the illustration.

segment consists of a framework of pre-enamel matrix and a core of homogenized material. The excentric transformation of the core into pre-enamel matrix is also shown in *Figure* 6. This segmentation in the developing rods persists as the cross striation of the rods. The transformation of the homogenized part of the Tomes' processes into pre-enamel matrix is characterized by a striking reversal in the reaction of these substances in silver impregnated sections, *Figure* 7. The homogenized Tomes' process is markedly argyrophil, the pre-enamel matrix strictly argyrophobic. Sections treated with silver appear like a negative of hematoxylin-eosin preparations, *Figures* 6 and 7.

The ameloblasts are at a right angle to the dentinal surface; the rods are at an angle to the ameloblasts and Tomes' processes, *Figures* 5, 6, 8. Therefore, the rods and dentinal surface form an acute angle which is open toward the incisal edge of the tooth.

The Tomes' processes retain their approximate length throughout the formative period of amelogenesis. The terminal bar apparatus sends projections, toward the forming enamel, which are continuous with the inter-rod substance. The terminal bars are prominent throughout the formation of the enamel matrix, *Figures* 5 and 8. The Tomes' processes and terminal bar apparatus develop with the formation of the enamel matrix, and disappear when the matrix is fully formed, *Figure* 9.

From these observations it would seem evident that the Tomes' processes are a necessary intermediate structure which is continuously secreted by the ameloblasts and, at the same time, transformed at the dentinal end into the rod primordium. The terminal bar apparatus participates in the enamel formation by giving rise to the inter-rod substance.

After formation of four to five segments of pre-enamel matrix, *Figures* 6 and 7, equal to a thickness of 16 to 20 microns, the pre-enamel matrix suddenly undergoes a further transformation. It becomes acidophil and stains brown in silver impregnation. The difference between rod and inter-rod substance is diminished so that, in

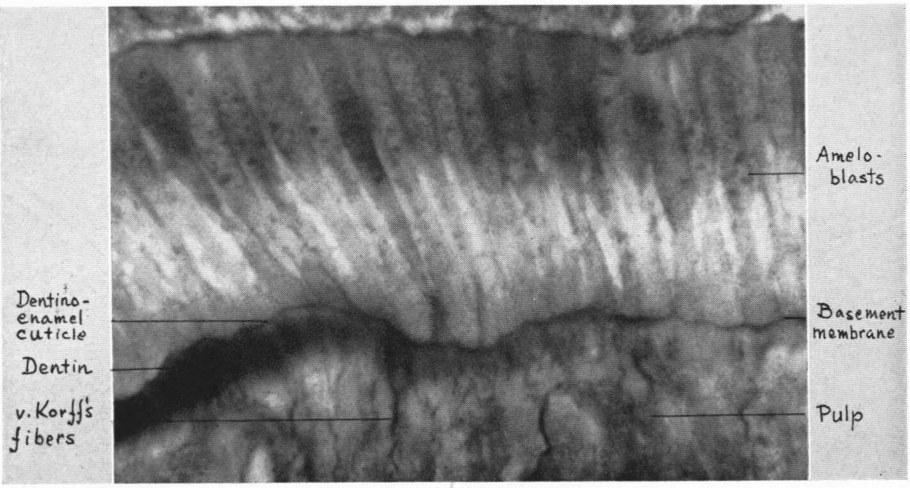

FIGURE 1. TOOTH GERM OF A DOG. MALLORY-AZAN. THE BASEMENT MEMBRANE OF THE DENTAL PAPILLA CAN BE FOLLOWED ON THE OUTER SURFACE OF THE DENTIN. HERE IT WILL LATER BE STRENGTHENED BY THE BASAL ECTOPLASMATIC LAYER OF THE AMELOBLASTS TO FORM THE DENTINO-ENAMEL CUTICLE.

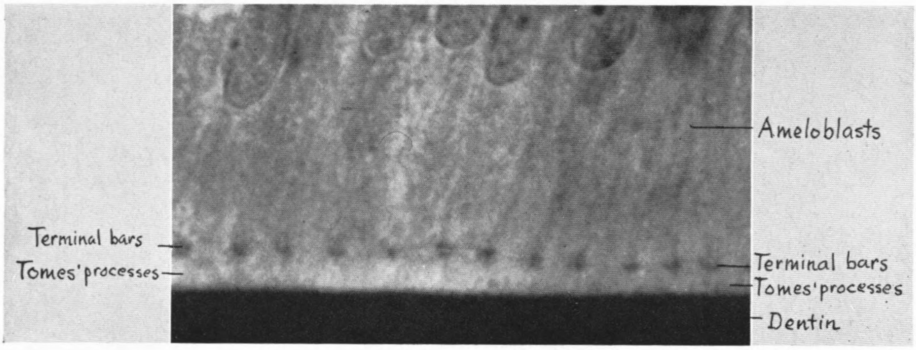

FIGURE 2. RAT INCISOR. MALLORY-AZAN. FORMATION OF TOMES' PROCESSES. TERMINAL BARS IN CROSS AND LONGITUDINAL SECTION.

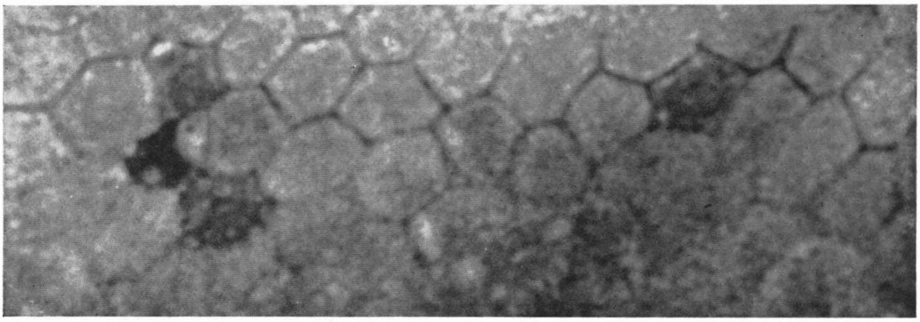

FIGURE 3. RAT INCISOR. H & E. TERMINAL BAR APPARATUS OF AMELOBLASTS IN SURFACE VIEW.

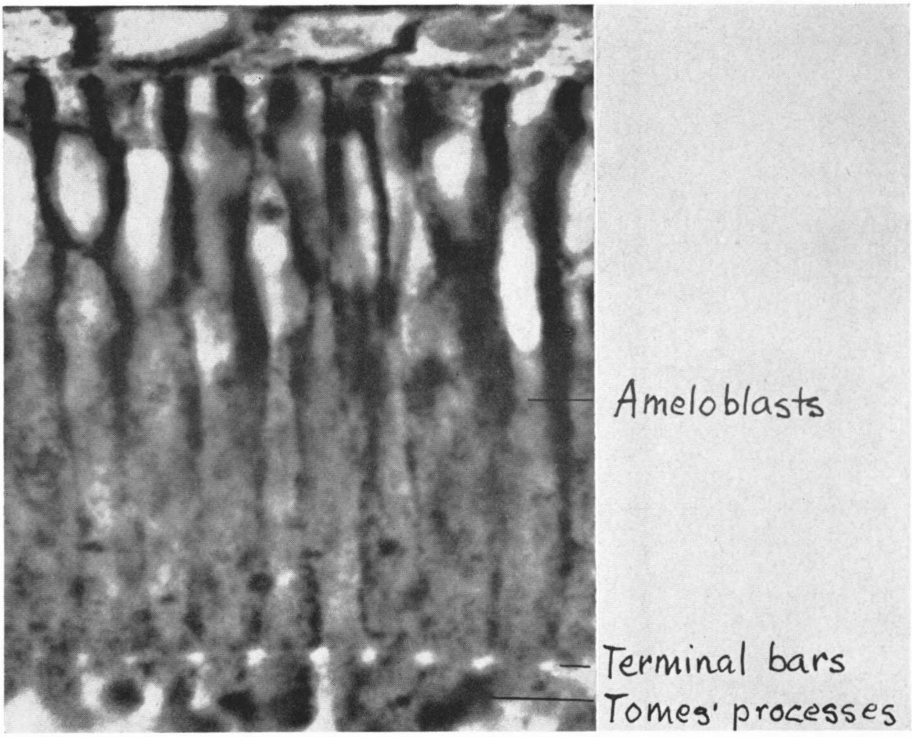

FIGURE 4. RAT INCISOR. SILVER IMPREGNATION (GOMORI). TERMINAL BARS ARGYROPHOBIC.

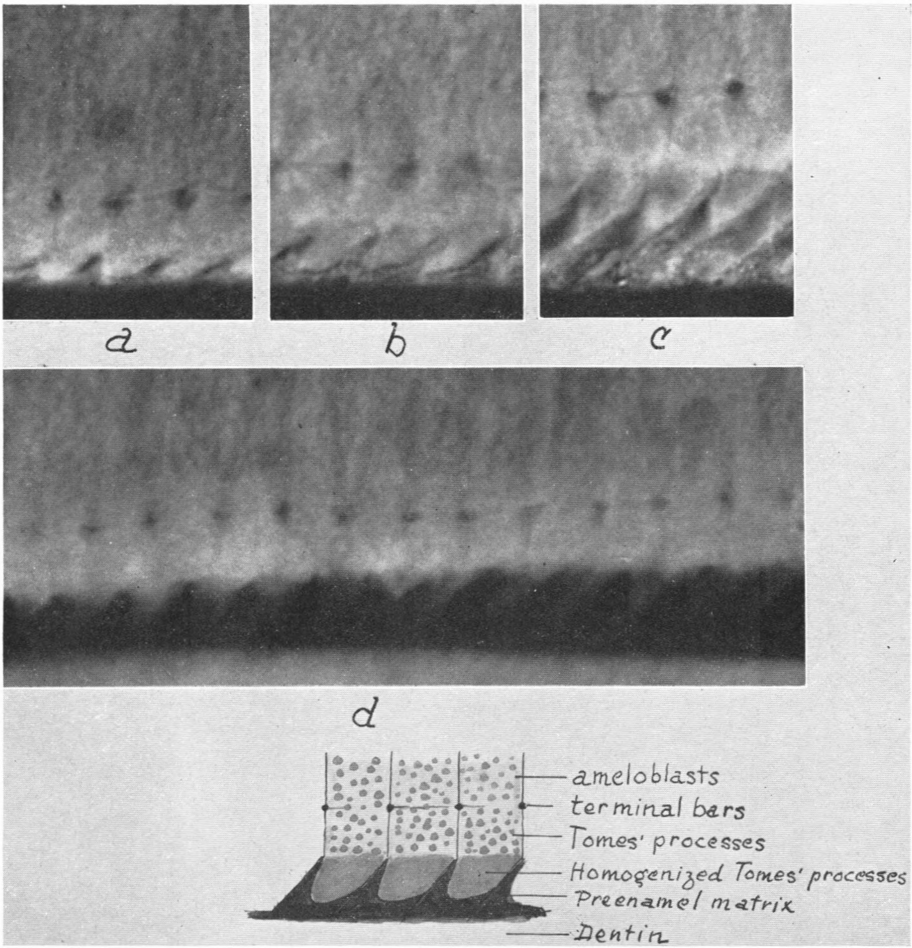

FIGURE 5. RAT INCISOR. EARLY STAGES IN AMELOGENESIS (a. b. c. MALLORY-AZAN, d. H & E). HOMOGENIZATION OF THE DENTINAL ENDS OF TOMES' PROCESSES AND THEIR TRANSFORMATION INTO PRE-ENAMEL IN A PICKET FENCE ARRANGEMENT. THE RODS AT AN ANGLE TO AMELOBLASTS AND TOMES' PROCESSES. TOMES' PROCESSES REMAIN OF APPROXIMATELY EQUAL LENGTH.

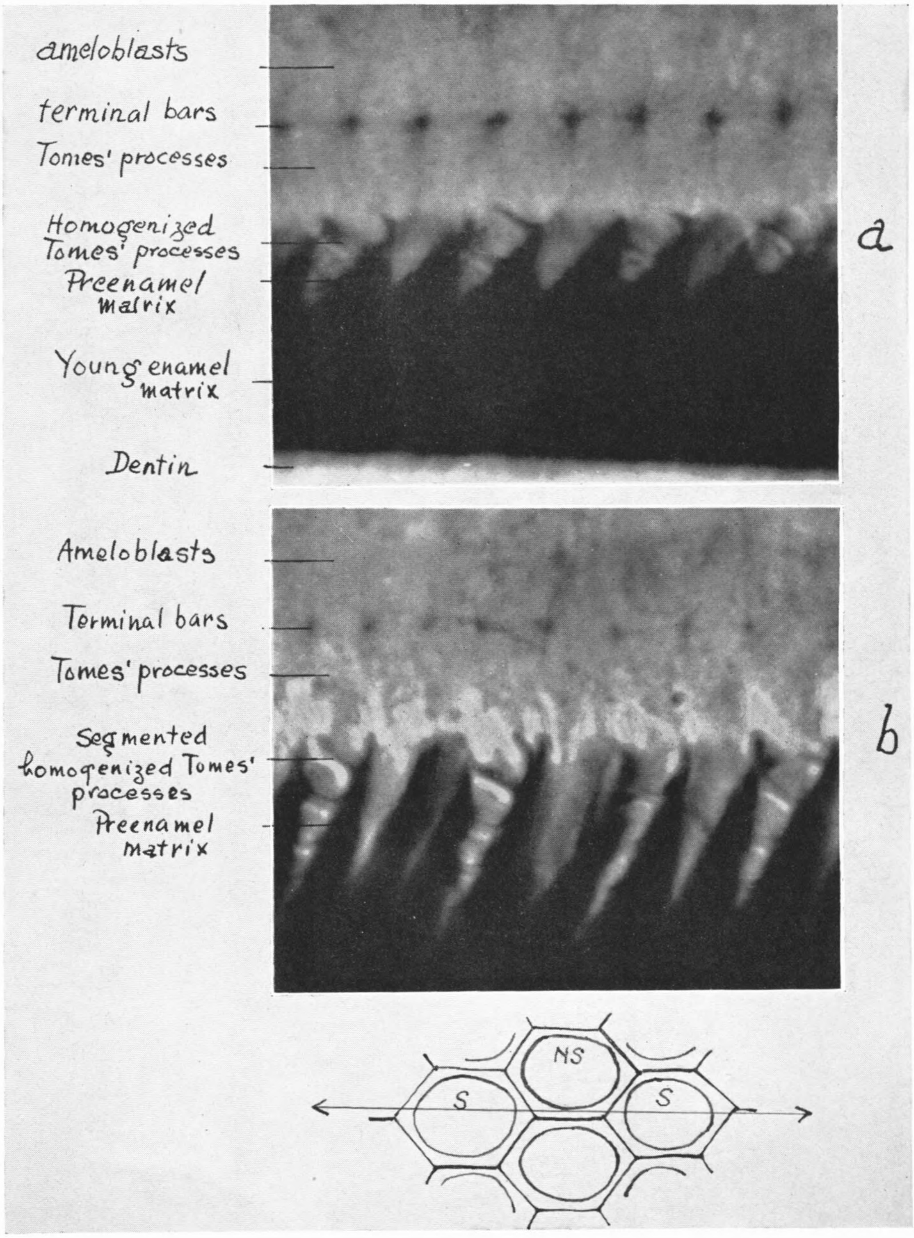

FIGURE 6a. RAT INCISOR. H & E. LATER STAGE IN AMELOGENESIS. FORMATION OF ROD SEGMENTS. THE ALTERNATE APPEARANCE OF SEGMENTED AND NON-SEGMENTED RODS IS DUE TO THE HONEYCOMB ARRANGEMENT OF THE HEXAGONAL PRISMATIC RODS. THE DIAGRAM REPRESENTS THE CROSS SECTION OF A GROUP OF HEXAGONAL RODS. THE ARROW INDICATES THE PLANE OF SECTIONING. ROD S WILL APPEAR SEGMENTED; ROD N S WILL APPEAR SOLID.

FIGURE 6b. REPRESENTS AN ADVANCED STAGE.

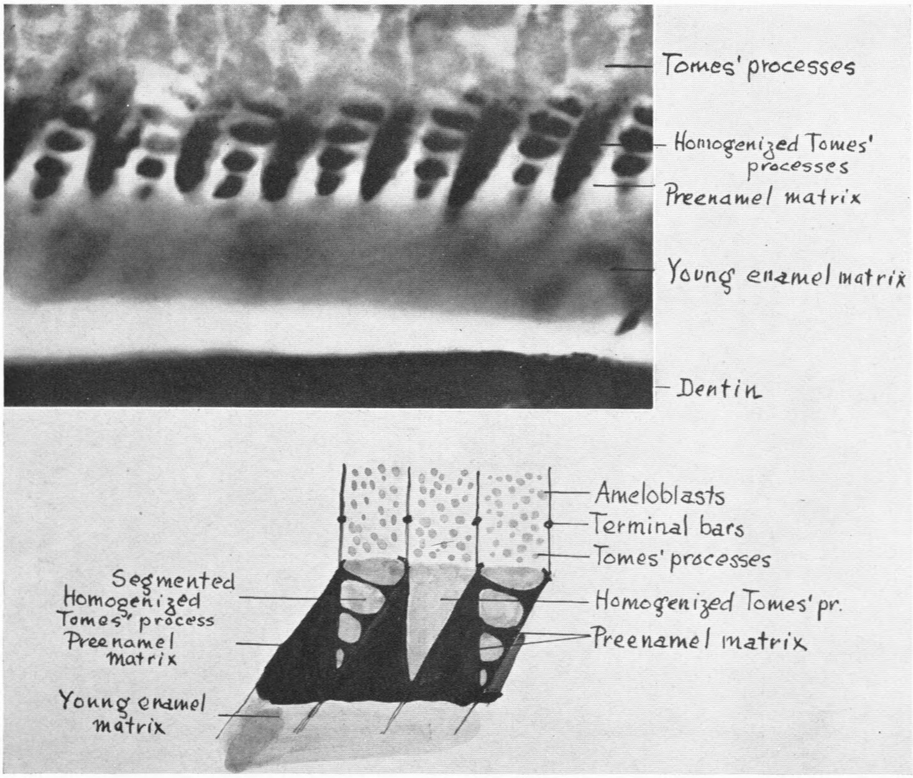

FIGURE 7. RAT INCISOR. SILVER IMPREGNATION. HOMOGENIZED TOMES' PROCESSES ARGYROPHIL, ALTERNATINGLY SEGMENTED AND NON-SEGMENTED. PRE-ENAMEL ARGYROPHOBIC. YOUNG ENAMEL MATRIX APPEARS HOMOGENOUS AND STAINS SLIGHTLY BROWN. FOR COMPARISON A DIAGRAMATIC DRAWING OF THE SAME STRUCTURES STAINED WITH H & E.

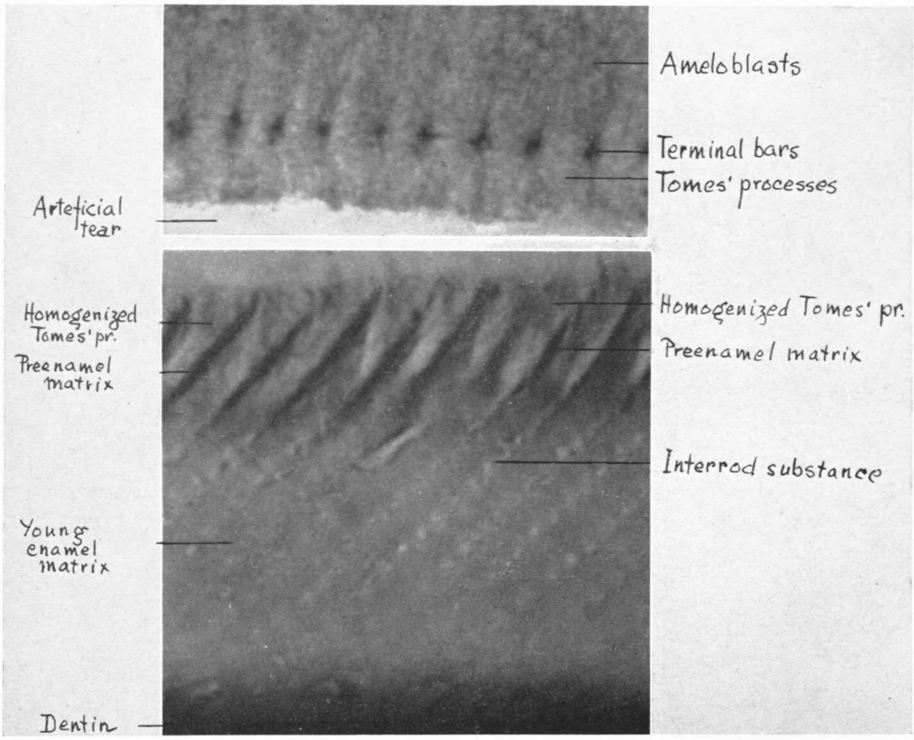

FIGURE 8. RAT INCISOR. MALLORY-AZAN. ADVANCED STAGE OF AMELOGENESIS. THE TOMES' PROCESSES ARE NOT "PULLED OUT" OF THE RODS BUT ARE TORN AWAY FROM THE HOMOGENIZED PARTS.

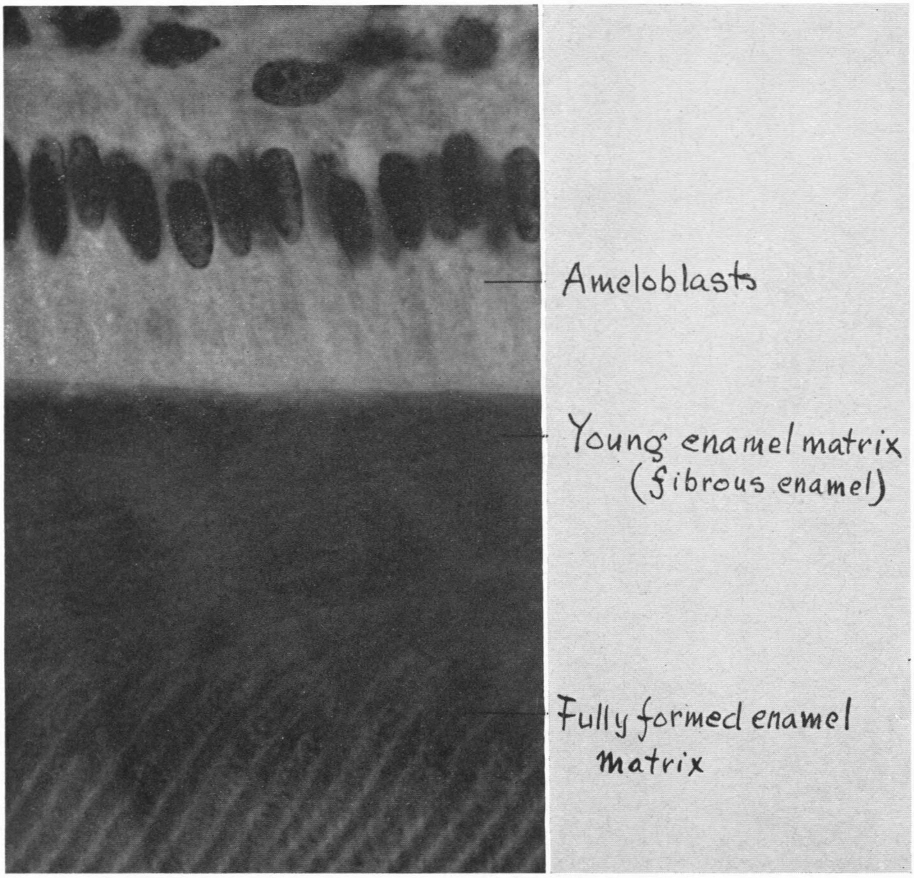

Figure 9. Rat incisor. H & E. Ameloblasts on the surface of the enamel after the formation of the matrix has ceased. Terminal bars and Tomes' processes have disappeared. Regular arrangement of rods in the deeper layers of enamel and irregular arrangement in the surface layer (fibrous enamel of Owen).

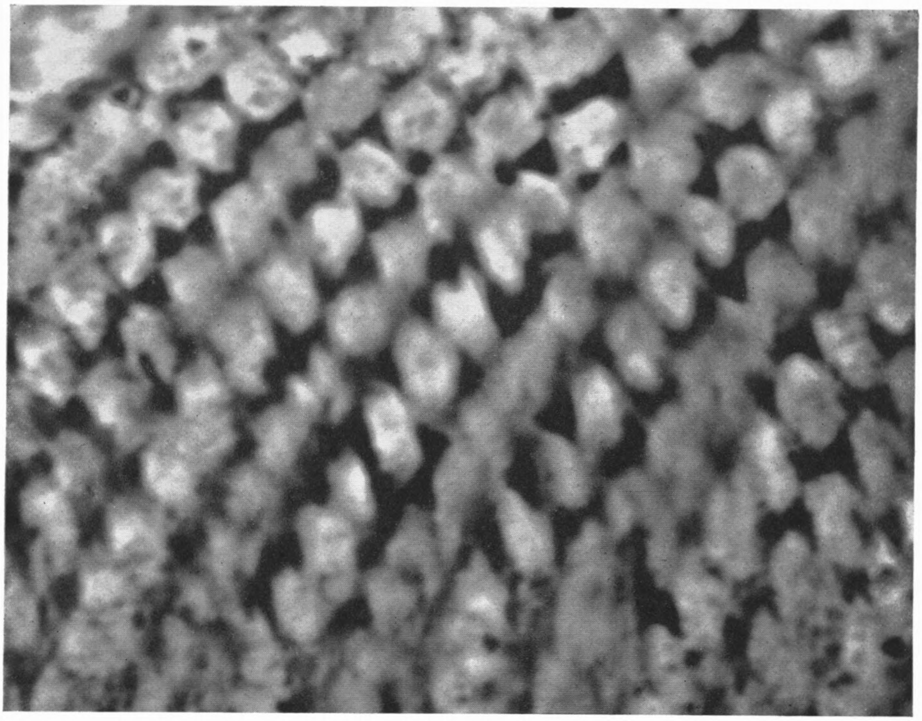

FIGURE 10. RAT INCISOR. SILVER IMPREGNATION. CROSS STRIATION OF RODS AND INTER-ROD SUBSTANCE ARE ARGYROPHIL IN THE FULLY FORMED ENAMEL MATRIX.

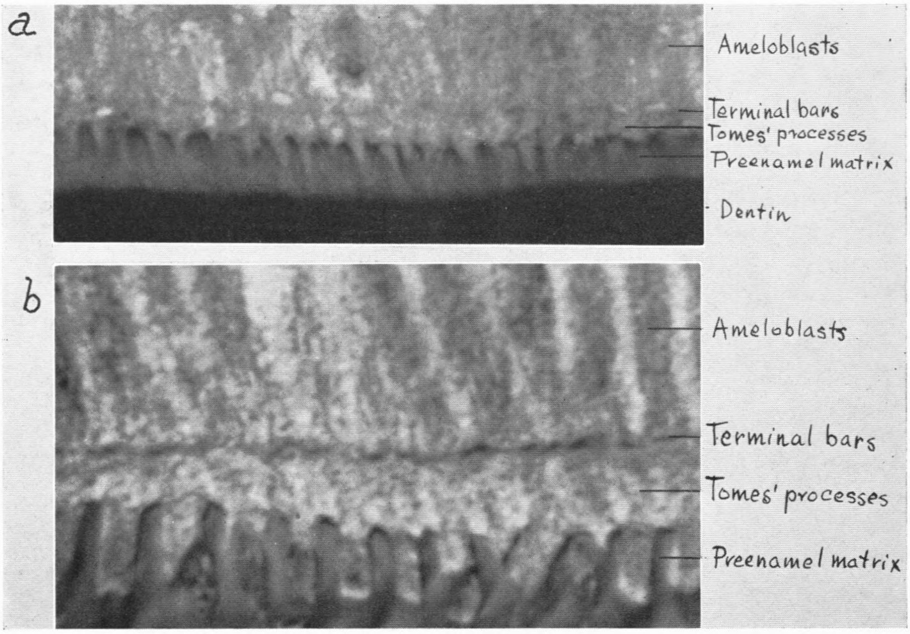

FIGURE 11a. RAT MOLAR; UNDECALCIFIED. SPECIMEN OF SAUNDERS, NUCKOLLS AND FRISBIE, SHOWING TERMINAL BAR APPARATUS, TOMES' PROCESSES, PRE-ENAMEL.

FIGURE 11b. RAT INCISOR. DECALCIFIED SECTION. SPECIMEN OF SAUNDERS, NUCKOLLS AND FRISBIE, SHOWING TERMINAL BAR APPARATUS, TOMES' PROCESSES, PRE-ENAMEL. NOTE THE IDENTICAL RELATIONS OF THE TERMINAL BARS, TOMES' PROCESSES AND PRE-ENAMEL IN THE UNDECALCIFIED AND DECALCIFIED SPECIMEN.

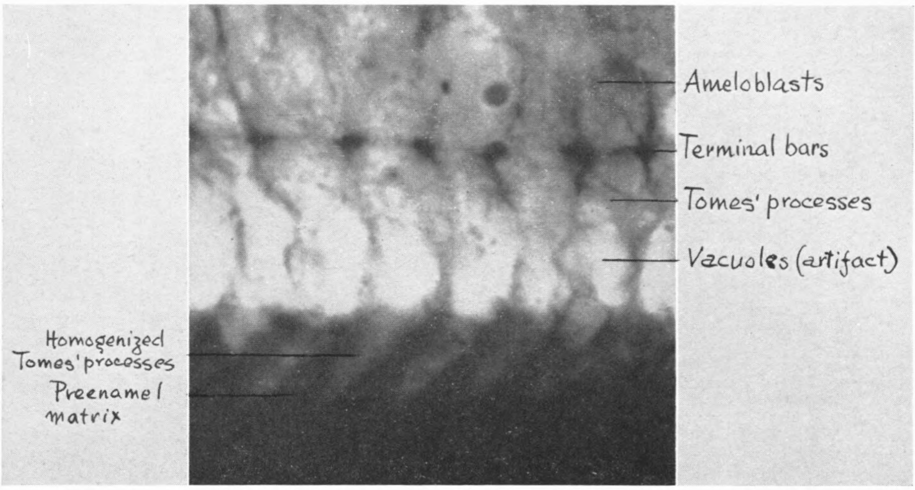

FIGURE 12. RAT INCISOR. H & E. TOMES' PROCESSES SHRUNK, ESPECIALLY AT THE ENAMEL END. LARGE REGULAR SPACES BETWEEN THE TOMES' PROCESSES SIMULATING VACUOLES.

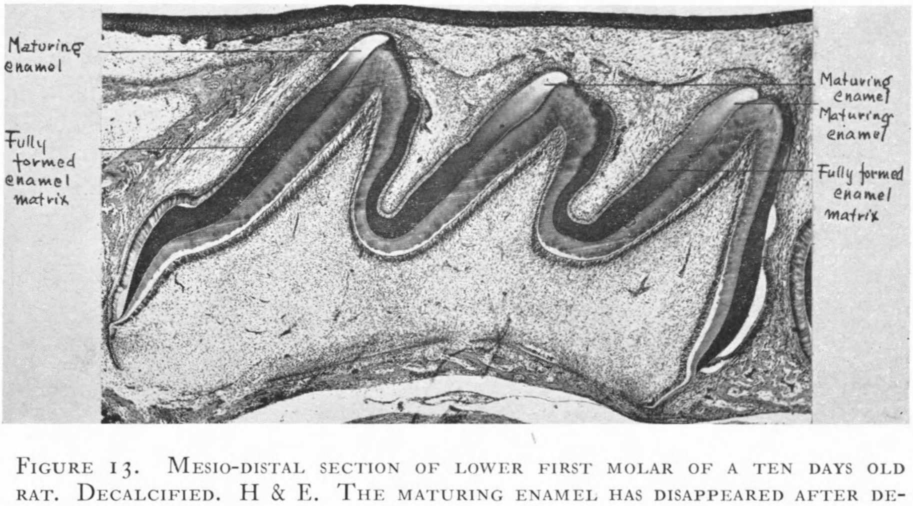

FIGURE 13. MESIO-DISTAL SECTION OF LOWER FIRST MOLAR OF A TEN DAYS OLD RAT. DECALCIFIED. H & E. THE MATURING ENAMEL HAS DISAPPEARED AFTER DECALCIFICATION. THE FULLY FORMED MATRIX IS ACID RESISTANT.

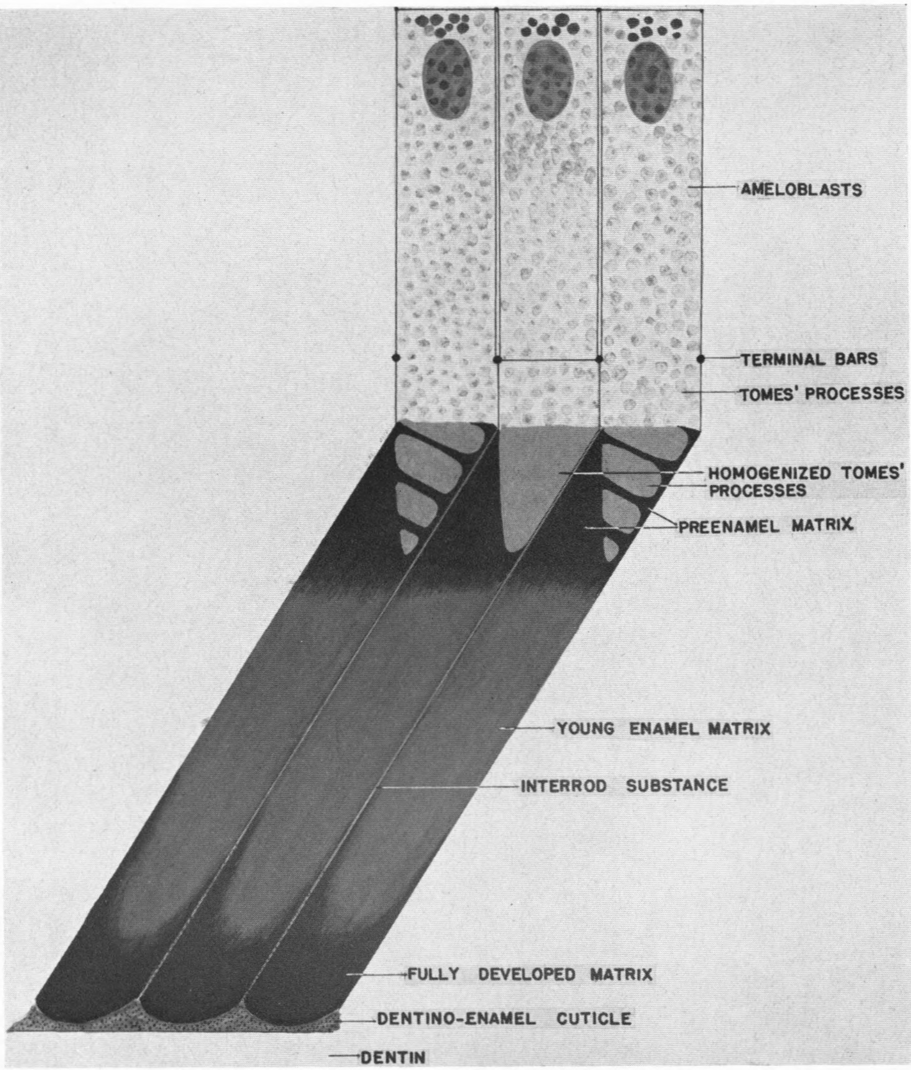

FIGURE 14. DIAGRAMMATIC ILLUSTRATION OF ENAMEL MATRIX FORMATION.

different stains, it appears more or less homogenous, *Figure* 7. This layer may be termed *young enamel matrix.*

Enamel matrix formation reaches its last stage when the young enamel matrix is about 16 to 30 microns thick. The enamel matrix turns slightly basophil, the outline of the rod and inter-rod substance is again clearly visible. In the fully developed matrix the inter-rod substance and the cross striation of the rods are argyrophil, *Figure* 10. This represents a second reversal of the reaction to silver in the formation of the enamel matrix.

Our decalcified material was compared with the undecalcified specimens of Saunders, Nuckolls and Frisbie, stained after von Kossa, and it was found that the pre-enamel matrix does not contain calcium salts. The calcification starts in the young enamel matrix.

The change of the acidophil reaction of the young matrix into the basophil reaction of the fully formed matrix seems to coincide with the progressive primary calcification of the matrix. According to chemical investigations[6] the fully formed matrix contains about 35 per cent mineral salts.

DISCUSSION

The dentino-enamel membrane was described by Saunders, Nuckolls and Frisbie as a product of specialized cells in the ameloblast layer which they termed kionoblasts. These were described as slender cells with narrow compact nuclei. The nucleus always stains red in Mallory-azan preparation. In later stages the cytoplasm changes from a basophil to an acidophil reaction. The dentinal extremity of these cells was claimed to be dichotomous and continuous with the dentino-enamel junction which is formed by the fusion of these processes with those of adjacent kionoblasts.

We were not able to find such supporting cells in well-fixed sections of the rat incisor. However, in molars of the rat and in teeth of dogs, pigs, and man, cells were observed which meet the description of the kionoblasts. The acidophil reaction of their pycnotic nucleus, and sometimes also their cytoplasm, can be explained only as a sign of degeneration. This point of view is borne out by the presence of cells showing an identical staining reaction in all other tissues of the same specimen, epithelial as well as mesodermal. Such cells were present in great numbers in areas which showed all signs of mechanical injury during preparation. We would submit that the peculiar reaction of some ameloblasts is due to supravital cell degeneration. Wherever we found such degenerated ameloblasts they seemed to be compressed by the adjacent cells. The dichotomous division at their basal end can be explained in the divergence of the cell membranes of the adjacent cells. Our observations on the formation of the dentino-enamel membrane support the interpretation of Held.[7] He claimed that this membrane develops by fusion of the mesodermal and epithelial basement membranes. Later, the epithelial membrane thickens due to fusion of the basal ends of the ameloblasts. It seems appropriate to call this layer dentino-enamel cuticle because it is chiefly the homogenous product of the epithelial cells. The fact that it develops at the basal end of these cells is due to the reversal of the functional polarity of the ameloblasts.

Saunders, Nuckolls and Frisbie deny the existence of a terminal bar apparatus claiming that these structures are artifacts produced by shrinking and curling up of the pre-enamel processes during decalcification. The presence of the terminal bar apparatus in well-fixed specimens, which do not show any sign of shrinkage and surface views of these structures, calls for revision of the interpretation of Saunders, Nuckolls and Frisbie. That the terminal bars are not an artifact was proved also in the undecalcified sections which Saunders, Nuckolls and Frisbie placed at our disposal, *Figure* 11. That these bars appear to be indistinct, and sometimes absent in the material of Saunders, Nuckolls and Frisbie, may be explained in that the terminal bars are not so well developed in the rat molars as in the incisors, and that the staining methods applied by Saunders, Nuckolls and Frisbie are unfavorable for the staining of these structures. Comparison of the undecalcified and decalcified specimens, which led Saunders, Nuckolls and Frisbie to their conclusion seems also to be misleading because decalcified sections of incisors were compared with undecalcified sections of molars.

The topographic relation between cell body, Tomes' process and pre-enamel matrix, as interpreted by Saunders, Nuckolls and Frisbie, was contrary to our findings because they considered the terminal bar apparatus as an artifact. *Figure* 11 shows that the pre-enamel matrix does not reach to the cell body the end of which is marked by the plane of the terminal bars. Between cell body and pre-enamel matrix the Tomes' processes can be seen, separated from each other by projections of the terminal bars. A comparison of *Figure* 11a, taken from an *undecalcified* rat molar, with *Figure* 11b, taken from a *decalcified* rat incisor, shows the identical arrangement of cell body, terminal bar apparatus, Tomes' processes, and pre-enamel matrix. The only difference is the greater size of all these elements in the incisor. The similarity of these two illustrations likewise proves that the pre-enamel matrix is not lost in decalcification, as claimed by Saunders, Nuckolls and Frisbie.

Saunders, Nuckolls and Frisbie described a terminal vacuole in the ameloblast as the progenitor of Tomes' process. No such vacuole could be seen in well-fixed specimens. The structure of the prismatic Tomes' processes is the same as that of the basal end of the ameloblast throughout enamel matrix formation, *Figures* 2, 5, 6, 7, 8. In specimens not so well fixed the Tomes' processes sometimes shrink quite considerably and the spaces between the shrunken processes may appear as vacuoles. In specimens where the terminal bar apparatus is visible and where the rods show a regular arrangement, these spaces can be recognized as artifacts, *Figure* 12.

The different stages of matrix formation were compared by Saunders, Nuckolls and Frisbie with the stages in the development of keratin. Preliminary observations with specific staining methods render this interpretation questionable. The changes by which the Tomes' process is transformed into a homogenized substance, the pre-enamel matrix, the young enamel matrix and, finally, the fully formed enamel matrix can be distinguished by staining reactions. This, however, does not seem to justify the chemical identification of the organic substances of the matrix.

von Kossa's method for determination of calcium salts was first applied by Saunders, Nuckolls and Frisbie in undecalcified sections of developing teeth. By this method, the authors revealed that an uncalcified phase in enamel formation exists, the pre-enamel. This finding of Saunders, Nuckolls and Frisbie was fully confirmed. In addition, we were able to show that the pre-enamel matrix is characterized by a definite staining reaction; it is argyrophobic, *Figure* 7. However, we were unable to confirm the authors' statement that the pre-enamel is acid soluble.

The interpretation of the terminal bar apparatus as an artifact, and the consequent failure to fix the boundaries between ameloblast and Tomes' process has led the authors to a concept which, in our opinion, is erroneous. Saunders, Nuckolls and Frisbie envisage the formation of the rods as a transformation of the ameloblasts. We believe that the rods arise by a transformation of the Tomes' processes at their dentinal ends, whereas their cellular ends are regenerated by secretion as long as enamel matrix formation continues.

The investigations of Saunders, Nuckolls and Frisbie cover the first phase of enamel development, i.e., the formation and calcification of enamel matrix. They demonstrated that this process occurs in two stages, formation of the organic matrix and its calcification. By application of the von Kossa method the authors showed that calcification of the matrix starts at the dentino-enamel junction and progresses toward the surface of the enamel. Calcification of the single rod starts at its periphery.

According to Weinmann, Wessinger and Reed,[9] the fully formed matrix contains only about 35 per cent mineral salts and 65 per cent water and organic material. The additional influx of mineral salts and the simultaneous disappearance of organic material and water occurs in a later stage of enamel development which may be termed "maturation" of the enamel. This process follows an entirely different pattern to that of the primary calcification of the matrix. Ac-

[9]Weinmann, J. P., Wessinger, G. D., and Reed, G.: Correlation of Chemical and Histological Investigations on Developing Enamel. *J. D. Res.*; *21*, 171; 1942.

cording to Diamond and Weinmann,[10] it starts at the incisal edge or the tips of cusps and proceeds in planes at a right angle to the long axis of the tooth. The chemical test for the maturation of the matrix is the change from an acid insoluble into an acid soluble stage. The process of maturation is not suited for investigation by von Kossa's method which is not quantitative and would require sections of undecalcified material. The hardness of mature enamel prevents the application of this technique. The maturation of the enamel in rat molars starts in the tip of the cusps of the first molar in animals ten to eleven days old, *Figure* 13.

SUMMARY AND CONCLUSIONS

Amelogenesis occurs in two distinct phases: enamel matrix formation and maturation. The regular arrangement of the structural elements of the rat incisor render it especially suitable for the investigation of amelogenesis. Therefore, the enamel matrix formation was studied mainly on decalcified sections of this tooth. All organic structures give, essentially, the same picture in both, undecalcified and decalcified preparations. The presence of calcium salts, however, can be shown only in undecalcified sections.

The formation of the enamel matrix is illustrated in the comprehensive diagram in *Figure* 14. Amelogenesis starts with the development of the *dentino-enamel cuticle,* a fusion of the basement membrane of the dental papilla and a cuticular product of the ameloblasts. When the cuticle has developed the ameloblasts produce the hexagonal, prismatic *Tomes' processes.* The boundary between cell bodies and Tomes' processes is marked by prominent *terminal bars.* The dentinal ends of the Tomes' processes are transformed into enamel rods whereas their cellular ends are continuously and simultaneously rebuilt by a secretory activity of the ameloblasts.

The first stage in the transformation of the Tomes' processes into the rods is a *homogenization* of their dentinal ends. The homogen-

[10]Diamond, M., and Weinmann, Joseph P.: The Enamel of the Human Teeth. *Columbia University Press,* New York, 1940.

ized material is changed immediately into *pre-enamel matrix.* This transformation occurs rhythmically and excentrically at the apical side of each rod. The rhythmical transformation causes the *segmentation of the rod* which persists as the cross striation of the mature enamel rods. The homogenized Tomes' processes are argyrophil; pre-enamel is argyrophobic. The pre-enamel matrix consists only of organic material; it is basophil and acid resistant. When the pre-enamel matrix is about 20 microns thick it undergoes a further change and starts to calcify. In this stage the *young enamel matrix* is somewhat acidophil. The change of the young enamel matrix into the *fully developed matrix* is characterized by a further influx of calcium salts. At the same time, the staining reaction changes again to slightly basophil.

The *inter-rod substance* is continuous with projections of the terminal bars between the Tomes' processes and is probably a product of the terminal bar apparatus.

The rods form an angle with the ameloblasts and Tomes' processes. Each rod is the product of one ameloblast.

THE DETERMINATION OF PARTICLE SIZES IN DENTIFRICE POWDERS[1]

MAURICE L. TAINTER, M.D., SIDNEY EPSTEIN, D.D.S., and ALEXANDER KLEIN, M.S.

From the Division of Physiological Sciences, College of Physicians and Surgeons—A School of Dentistry, San Francisco, and The Engineering Materials Laboratory, University of California Berkeley, California

In connection with studies now under way relative to factors controlling the abrasiveness of dentifrice materials, it has been found desirable to study particle size distribution in dentifrice powders to determine whether a correlation exists between such distribution and the amount of abrasion produced on teeth. While it is generally assumed that for particles of the same composition the coarsest particles are most abrasive, yet there is a paucity of published data on the magnitude of these effects or on the size for optimum abrasiveness.

The present study has been planned to help elucidate the fundamental factors involved in abrasion by powders. Elements of such a study which require particular analysis consist in the following:

1. Methods of characterizing the size of particles in the powders such that numerical values are subject to independent measurement by others.

2. Relationship between the degree of abrasion produced and the mean particle size, the median particle size (calculated in terms of cross sectional diameters), or the size of the particle of average volume.

3. The relation, if any, between the amount of abrasion and the surface areas of the powder.

Included in the investigation are a variety of powders used in

[1]Supported, in part, by grants from the American College of Dentists and the California State Dental Association. Second in a series of researches on Abrasiveness of Dentifrices.

dentifrices, in sufficient number, it is believed, to justify a correlation of their characteristics with the amounts of abrasion observed on teeth under controlled conditions.

This paper is restricted to the problem of establishing the distribution of sizes in a series of powders used in the abrasion studies. The results of the abrasion studies will be presented in detail in subsequent papers.

AVAILABLE METHODS FOR MEASUREMENT OF PARTICLE SIZES

The most direct method of measuring sub-sieve particle sizes is by observation under a miscroscope with magnification sufficient to permit ready measurement. This technic has been used frequently[2, 3, 4] and gives fairly reliable and reproduceable results. The degree of magnification can be greatly increased by projection of the microscopic field onto a screen or by photographic enlargement to the limits of the resolving power of the photographic emulsion.[3]

This method suffers from the inherent difficulty that only one plane of a particle is in focus and only two diameters are visible. By focusing up and down with the micrometer screw of the microscope it is possible to get some measure of the third dimension, but this is much less accurate than is that of the other two dimensions. Such a technique is sufficiently tedious to render this method of determining the third diameter impractical for ordinary purposes.

The microscopic method requires that powders be suspended in a mounting medium in such a way that the particles are not touching, in order that margins can be clearly demarcated. This is done by spreading a powder suspended in balsam on a glass slide. It is difficult to obtain complete dispersion and uniform distribution, due to a tendency for particles of larger diameter to be pushed to the edges of the slide. Consequently, the distribution in a series of microscopic fields may not be representative of the powder as a whole. There is also the possibility that mechanical force applied

[2]Perrott, G. St., and Kinney, S. P.: *J. Am. Ceramic Soc.*; *6*, 417; 1923.
[3]Haslam, G. S.: *Proc. Amer. Soc. Testing Materials*; *30*, 919; 1930.
[4]Dunn, E. J.: *Indust. Engin. Chem., Anal. Edition*; *2*, 59; 1930.

in distributing the powder over the surface of the slide may break down some of the larger particles and thereby reduce their frequency.

Dunn has discussed in detail the difficulties inherent in the microscopic method[5] and has emphasized particularly the necessity of defining the terms used to describe the particle size.[5] He suggests that for material containing particles of diameter less than eight microns it is necessary to count several thousand particles in order to obtain satisfactory results. The measurement of so large a number would require so much time as to be impracticable, except for special purposes. After several hundred particles have been measured, significant increases in accuracy require the accumulation of so much additional data as to render the procedure unduly difficult. It is probable that the best criterion of the number of particles needed is obtained by observing whether the frequencies plot reasonably close to a straight line of Hazen's log-probability paper. If such a line is obtained it is improbable that additional data would change its position significantly. However, if the plot shows that the distribution is irregular, additional data are needed. These considerations were well presented by Haslam in 1930.[3]

Sieves are not useful for measuring particle size distribution within the range of sizes represented by the powders under consideration. A number 200 sieve corresponds to 74-micron openings and the number 325 sieve to 44-micron openings. Thus the finest sieves ordinarily used have openings too large to retain particles below 40 microns, which is the range containing the sizes of interest in dentifrice materials. Even if finer sieves could be made with accurately graduated openings, the speed of passage of the powders through such would be very slow, and a separate sieve would be needed for each fraction desired.

A method for measurement of surface area is described by Emmett and DeWitt,[6] which depends upon the measurement of the

[5]Dunn, E. J., and Shaw, J.: *Proc. Am. Soc. Testing Materials; 33*, 692; 1933.

[6]Emmett, P. H., and DeWitt, T.: *J. Indust. Engin. Chem., Anal. Edition; 13*, 28; 1941.

films adsorbed upon the surface of the powder in question. Others have used adsorption of dyes or other materials in a similar way.[7] The fundamental objection to such processes is that the total surface area of a porous or granular powder may not be the same as the external surface which would be exposed or available for abrasive action in dentifrices. Adsorption methods therefore seem to be unsuitable for the purposes of this study.

Particle-size studies have been made by determining the apertures between particles when packed into a solid column, by measuring the rate of flow or pressure required for a gas or a liquid to pass through under certain predetermined conditions.[8, 9] The smaller the particles the closer is the packing and the smaller are the interstices. By this method a value can be obtained which reflects the cross sectional area of the spaces in a given powder, and subsequently the specific surface of the powder. However, no data are obtained relative to particle-size distribution. Application of the method seems highly empirical, particularly as regards the optimum rate of flow of the air or liquid through the powder, and as to the degree of packing. Therefore, it would seem to be of value primarily as a guide for control procedures on fairly uniform samples under standardized conditions, rather than for fundamental research.

The best established methods for determining particle-size distribution depend upon the application of Stoke's law, which relates the size and settling velocity of particles. Particles gravitate out of suspension at a rate dependent upon the size and density of the individual particles and upon the density and viscosity of the suspending medium. The largest particles fall most rapidly, and the density or concentration of the suspension at a given point steadily decreases, so that the size of the particles passing the given point in a given time can be calculated by means of this law.

Martin has recently given an excellent discussion of the determination of particle size in sub-sieve ranges through sedimentation

[7]Ewing, W. W.: *J. Am. Chem. Soc.; 61*, 1317; 1939.
[8]Carman, P. C.: *J. Soc. Chem. Ind.;* July, 1938 .
[9]Blaine, R. L.: *Bull. Am. Soc. Testing Materials; 108*, 17; 1941 (Jan.).

methods.[10] He reviews the literature on the gravitational, centrifugal and other types of such procedures, discussing the advantages and disadvantages of each. His consideration of the assumptions inherent in the use of Stoke's law is particularly valuable, inasmuch as this law is too frequently applied without its implicit assumptions being recognized or taken into account. He points out that reports of checks of cumulative sedimentation methods against microscopic analysis are sparce, and he suggests that this may be due to the difficulties of the comparison. These he believes arise from differences in the characteristics of the dispersion in the microscopic and the sedimentation methods, which modify the particle aggregates to an appreciable extent. He states that the sedimentation methods tend to over-estimate the heavy fractions, whereas the microscopic method, where diameter rather than weight is the crucial measurement, tends to over-estimate the proportion of fines. Consequently, considerable deviations may occur between results because of such systematic differences. Bishop has shown that on specially prepared glass spheres of sharply graded sizes very close correlation can be secured between the two methods.[11] However, ordinarily the particles of powders are not of such uniform diameter and depart widely from spherical shape, so that in general it is to be expected that agreement will be poorer than that found by Bishop.

Because of interference with sedimentation of ultra fine particles by Brownian movements, convection currents and vibration, the usual sedimentation methods are less reliable for particles smaller than one micron. However, this range can be increased by applying the centrifuge principle. In this way Svedberg and Nichols[12] have been able to extend the measurements down to 20 millimicrons with acceptable degrees of accuracy.

The principles of sedimentation are applied in a variety of ways.

[10]Martin, S. W.: 1941, March 4. Particle Size Symposium of the Am. Soc. Testing Materials, "The Determination of Subsieve Particle Size Distributions by Sedimentation Methods."

[11]Bishop, D. L.: *Bureau of Standards, J. of Research; 12*, 173; 1934.

[12]Svedberg, T., and Nichols, J. B.: *J. Am. Chem. Soc.; 45*, 2910; 1923.

In an early method described by Oden one scale pan of a balance is hung in a suspension of the powder in water or some other liquid. The progressive increases in weight on the scale pan measure the amount of powder which has sedimented at that time interval to the depth of the pan.[11, 13] However, since all the particles at the start are not in a single plane at an equal distance from the pan, and therefore do not have to fall equal distances, the increment in weight at any given instant represents the summation of the particles of all sizes which have had time to reach the pan level from their original starting point. It, therefore, is necessary to plot the changes in weight against time, and by projection of the tangents of the curve to the axes, to determine the quantities of the limiting particle sizes corresponding to each time interval,[13] or to calculate these mathematically.[11] A slight error in fixing graphically the slope of the tangents results in disproportionate errors in the quantities calculated for any given interval, and the mathematical method is fairly laborious. However, it has been shown[14] that there is a fundamental error in this method, since the rate of collection of the sediment on the pan does not represent accurately the sedimentation rate throughout the container. Sedimentation along the walls is greater than elsewhere in the solution. As a result, the weight on the scale pan may be only from 85 to 95 per cent of the amount expected from theoretical considerations. The causes for this error have been explored in some detail and theories to account for it have been proposed. Apparently the proponents of the "scale pan" method of measuring particle size distributions have not taken this phenomenon into account in the application of their method.

Another method of using sedimentation rates consists of measuring the decrease in turbidity of the suspension as the heavier particles separate out and drop below the field of a beam of light.[15] If the particles are not completely opaque, as is especially apt to be

[13]Calbeck, J. H., and Horner, H. R.: *Indust. Engin. Chem.*; *19*, 58; 1927.

[14]Shaw, C .F., and Winterer, E. V.: *Proc. and Papers, First International Congress Soil Science*; *1*, 1; 1927.

[15]Wagner, L. A.: *Proc. Am. Soc. Testing Materials*; *33*, 553; 1933 (part II).

the case with the finer ones, the light transmission observed will be too high, skewing the apparent distribution toward the larger particles.

The simplest method of using sedimentation, in theory, is to withdraw the upper layers of liquid from the suspension chamber at the end of given intervals of time, and after evaporating the liquid, to weigh the residue. The observed weight is that of the particles too fine to have sedimented out of the liquid collected in the time interval. By repetition of this procedure for different times the distribution of particle sizes in the powder may be obtained.[16] This method is tedious since a separate run is needed for each fraction, and the difficulty of getting sharp separations of liquid layers is such that the procedure is used only for special purposes.

An ingenious method of using the sedimentation velocity is to float out the powder in a stream of air rather than in liquid. By running air at a fixed rate through orifices of graded sizes the powder can be given different lengths of time to settle into collecting chambers distributed along the path of flow of the air stream. Special apparatus for this purpose is on the market, but is quite expensive. This method used alone does not give an absolute measure of the particle sizes but is useful for separating large quantities of powder, where the fractions do not have to be too sharp. Not all powders can be separated in this way since the particles may floculate or pack in the apertures, and it is difficult to control the velocity of the air. Therefore, close fractionation is not always possible to the limits required for many scientific purposes. However, as a practical method for separating large bulks of powders into rather broad groups of particle sizes, this is a rapid and useful technic.

A theoretically and actually simple application of Stoke's law is to measure the changes in density of the suspension with a hydrometer from time to time, and from these to calculate the weights of powder which must have sedimented to cause the changes observed.[16] As the larger particles fall below the center of buoyancy

[16]Cummings, D. E.: *Jour. Indust. Hyg.; 11*, 245; 1929.

of the hydrometer, they no longer affect the apparent specific gravity of the liquid, and the observed density is lowered by an amount related to the quantity of particles which have sedimented from the surface of the liquid to below this center of buoyancy. Therefore, by reading the density at successive intervals, it is possible to calculate the weight of particles that have sedimented a known distance in a given interval of time, and from Stoke's law to calculate the limiting particle diameter corresponding to each increment of weight.

A pronounced advantage of the hydrometer method is that it is substantially independent of all the properties of the material except those directly associated with fineness. No special equipment is required except the use of a sufficiently sensitive hydrometer, which after initial calibration remains unchanged. Since readings need be made only at infrequent intervals, the actual time required for determination is much less than that required with the microscope and many tests may be conducted simultaneously. Where surface area is the main value desired, the computations of the method can be decreased considerably by the use of a "surface scale hydrometer" developed by one of the authors.[17] This hydrometer is equipped with a special scale which gives direct readings in units of surface area. Depending on the degree of accuracy required, determinations can be made with as little as five readings at suitable time intervals.

It has been pointed out[18] that the limitations in the hydrometer method are limitations which are inherent in the use of Stoke's law. This law requires the assumption that the particles are sedimenting as if they were spheres. Therefore, what the calculations actually give are the diameters of spheres which would sediment with the same velocity as the particles under consideration. Inasmuch as most particles have non-spherical forms, and their rates of sedimen-

[17]Biddle, S. B., and Klein, A.: *Proc. Am. Soc. Testing Materials*; *36*, 310; 1936 (part II).

[18]Klein, A.: "An Improved Hydrometer Method for Use in Fineness Determinations." *Proc. Am. Soc. Testing Materials*; *41*, 52; 1941 (part II).

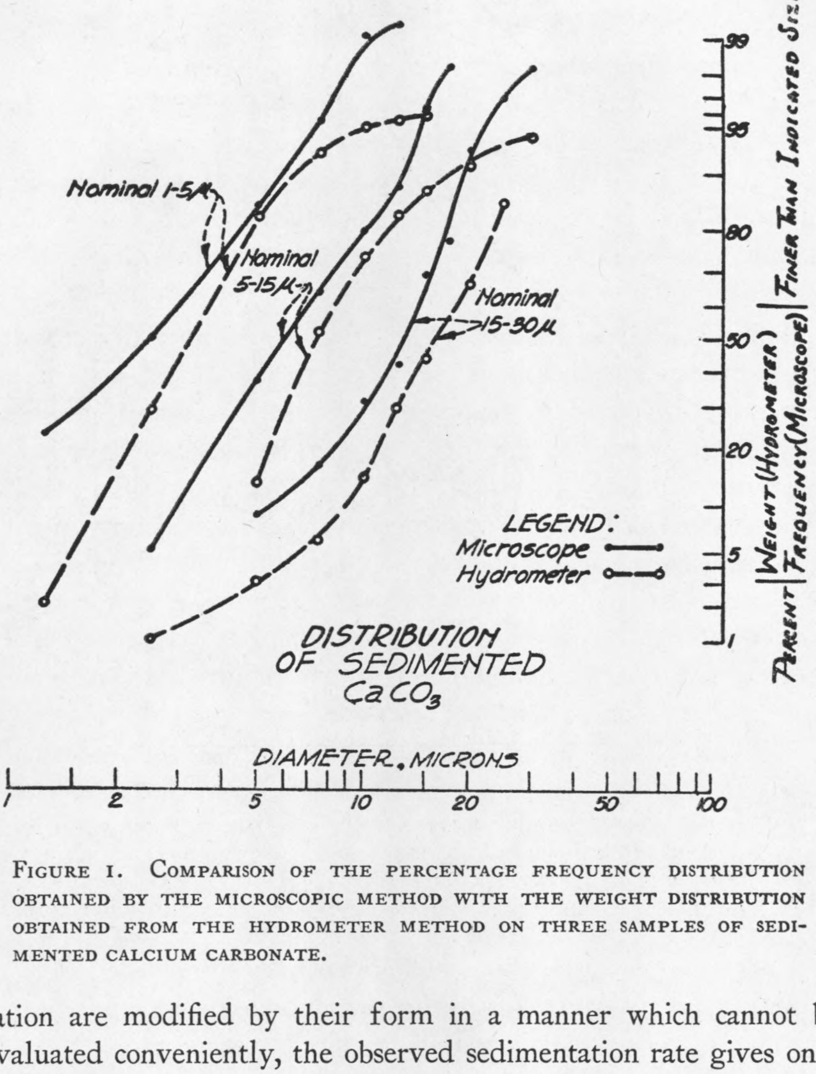

FIGURE 1. COMPARISON OF THE PERCENTAGE FREQUENCY DISTRIBUTION OBTAINED BY THE MICROSCOPIC METHOD WITH THE WEIGHT DISTRIBUTION OBTAINED FROM THE HYDROMETER METHOD ON THREE SAMPLES OF SEDIMENTED CALCIUM CARBONATE.

tation are modified by their form in a manner which cannot be evaluated conveniently, the observed sedimentation rate gives only an arbitrary relative measure instead of an absolute determination of particle size. However, for particles of similar composition and shape and for control work it gives reproduceable values which are useful for comparative studies. A powder which dissolves or forms a colloid in the suspending medium obviously is unsuitable for this type of study. Such difficulties can be minimized by the selection

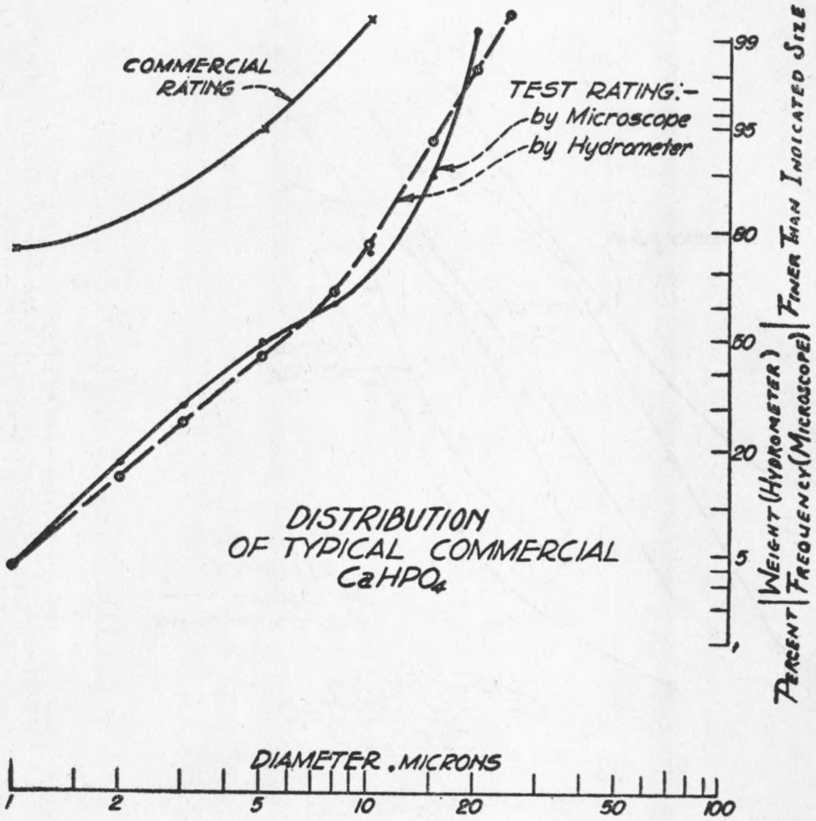

FIGURE 2. COMPARISON OF THE PERCENTAGE FREQUENCY DISTRIBUTION OBTAINED BY THE MICROSCOPIC METHOD, AND THE WEIGHT DISTRIBUTION OBTAINED FROM THE HYDROMETER METHOD, WITH THE MANUFACTURERS STATED DISTRIBUTION IN A COMMERCIAL SPECIMEN OF DICALCIUM PHOSPHATE.

of a non-reactive suspending medium such as kerosene or alcohol. Peptizing agents which lower the surface tension sufficiently that aggregation does not occur may be required in some cases.

Roller has recently undertaken extensive mathematical analyses of frequency distributions based on the assumption of a bimodal distribution of particle sizes, rather than the normal distribution observed in the present study.[19, 20] From his form of distribution

[19]Roller, P. S.: *J. Franklin Institute*; 223, 609; 1937.
[20]Roller, P. S.: *J. Physical Chem.*; 45, 241; 1941.

he is able to calculate various parameters describing the powders studied, which he feels are in good agreement with the values determined by the classical methods. He has pointed out that the normal distribution, which plots as a straight line on logarithmic-probability paper, is secured in powders that have been ground mechanically or reduced by physical or chemical means until they have reached an equilibrium condition. With the bimodal distributions discussed in his later publication, there may be some factor of incomplete reduction of his powders to the normal distribution sizes, as a result of some special treatment in their preparation, or the lack of complete equilibrium having been established.

METHODS USED

In the present study the surface-scale hydrometer[17] and the microscope[2] methods were used. From the distribution data for the various powders, established by both methods, were determined the range of sizes in each powder, the median and average diameters, the diameter of the particle of average volume, and the surface areas in square centimeters per gram and per cubic centimeter of powder. It was hoped that by using both methods there could be determined the characteristics and method which best correlated with the observed abrasive power. Since both methods give quantitative estimates of the proportion of particles in each size range, the same methods of computation were applied to all the data. The fractions were grouped in ranges having the limits 0 to 1.5, 2.5, 5, 7.5, 10, 12.5, 15, 20, 25, 30, 35, 40, 50, 60, 70 and 80 microns, and the absolute and relative frequency for each range observed and computed. These data were plotted on log-probability paper (*Figures* 1 and 2) to give the frequency distributions, which in turn were used to calculate the average particle sizes, specific surface, etc.

It has been observed that the size of particles in a normal powder conform closely to the normal frequency distribution, and that, when the cumulative precentages of particles smaller than given sizes are plotted against the logarithms of the diameters on Hazen's log-probability paper, a straight line is obtained. With the microscopic method, particles smaller than one micron are difficult to count or to measure accurately. Similarly, the frequency of large particles over 30 or 40 microns are difficult to measure in the hydrometer method since they sediment out so rapidly that the time intervals are too brief for accurate determinations. Therefore, the linear characteristic of the log-probability curve was used to extrapolate beyond the observed values so as to estimate the distribution in the ends of the ranges. While such an extrapolation is theoretically undesirable, it probably introduces no more error than is inherent in the microscopic technic from limitations of resolving power, incomplete dispersion and the necessity of judging the average diameter from measurements in only one plane, or in both methods from the lack of a spherical shape. Sampling variability also contributes to the relatively high standard errors of the frequencies in each class interval. Similar errors may exist in the hydrometer technic from aggregation of particles, temperature effects, inaccuracies in reading the hydrometer, as well as from the lesser effects of convection currents and disturbances in the suspension caused by insertion and withdrawal of the hydrometer.

In the application of both methods particle-size distribution was calculated to inherently practical limits. In the microscopic method particles smaller than one micron were counted but not measured, and it was assumed that these had an average diameter of 0.5 microns. For the larger particles the counts and calculations usually included 99 per cent of the particles, and it was assumed that those remaining were at the mid-point of the next class interval. These assumptions introduce uncertain quantities in the specific surface calculations, because the greater proportion of the surface occurs with finest sized particles. There is a corresponding uncertainty in the weight distribution curves resulting from the fact that a very few particles of large cross sectional diameter may have a bulk greater than hundreds of fine particles. Therefore, any systematic overestimation of the numbers of large particles results in deviations upwards of the weight distribution values, and errors in estimation of the proportions of the fines results in corresponding error in specific surface calculations.

The class intervals selected for purposes of calculations were the same for both methods in order that evaluation of the characteristics of the same powder will be subject to the same systematic errors at the ends of the frequency curve, and would therefore indicate the agreement possible between these two methods. While exact agreement in the frequency distribution of any given powder was not expected, yet the results tabulated hereafter demonstrate that the order of magnitude of the various characteristics was as close as could reasonably be expected in view of the inherent limitations. This indicated that both methods measured substantially the same quantity. As to which method gives values which best correlate with abrasion will be considered in subsequent publications, wherein the correlations can be presented at greater length.

The microscopic technic used in this investigation was, briefly, as follows: about one milligram of the powder was placed in the center of the slide and, after moistening with one drop of a 15 per cent solution of Canada balsam in xylol, was quickly mixed by means of a thin spatula and spread uniformly over the slide. Special precautions were taken to cover the largest possible area and to use small quantities in order that particles would not overlap. Using a measuring eyepiece, each particle was measured under 400 x magnification in two planes along the main axes, and the average of the two diameters recorded as the diameter of the particle. By means of a mechanical stage the slide was systematically moved across the field measuring each particle which came under the cross-lines of the measuring eyepiece. By sweeping the entire length and width of the slide in this way, percautions were taken to include the edges where particles of larger diameters might be more numerous. Approximately five hundred particles were measured on each powder, although this number was varied according to circumstances and the distribution in the powder examined.

The hydrometer method has been described in detail in connection with its application to characterization of cement and related materials.[17, 18] In essence, the technic was to determine the specific gravity of suspensions of the powders at the end of various sedimentation intervals. For each interval there was computed the limiting particle diameter which could still be in suspension at the center of buoyancy of the hydrometer, and the percentage by weight of the particles finer than the corresponding diameter. From these data there was constructed the particle size distribution curve using the formulæ set forth in the previous publications.[17, 18] The hydrometer used was one with high sensitivity especially designed and calibrated for this purpose.

In these hydrometer tests, water was the usual suspending medium. To 350 cc. of water was added 5 cc. of a 10 per cent solution of "TDA"[21] as a dispersing agent and 2 cc. of an 0.5 per cent uranin solution to increase the visibility of the meniscal junction with the hydrometer. Isopropyl alcohol was used as the suspending agent for magnesium carbonate, light and heavy magnesium oxide, since these form colloidal hydrates with water. Fourteen grams of powder was suspended in this solution to give a final concentration of 4 per cent. Tests were conducted at a constant temperature of 70° Fahrenheit. In all the determinations, a hydrometer was used having a special scale graduated in units of surface area, the description of which is published separately.[18]

The median diameter of the particles was read from the plotted curves at the 50 per cent frequency ordinate. The mean or average diameters were calculated from the frequencies for the various class intervals, taken at the midpoint of each fraction. The proportionate weight or volume distribution was calculated by using the cube of the mean diameter of each class interval and its bounding frequencies, from which was obtained the diameter of the particle of average weight. The surface area of a cubic centimeter of the powder (the specific surface) was calculated by dividing the midpoint of each class interval into the increment for that interval,

[21]Manufactured by Dewey and Almy Chemical Co., Cambridge, Mass.

and summating over the entire range of the distribution. This multiplied by 600 gave the surface area in cm^2 per cc. of powder. This value divided by the density of the powder gave the surface in square centimeters per gram of material. An alternative method is to use the formula:

$$S_v = \frac{\Sigma f \bar{d}^2}{\Sigma f \bar{d}^3} \times 60{,}000.$$

RESULTS

The data secured from the application of both methods to twenty-seven different powders are summarized in *Tables* 1, 2 and 3, *see pages 38-43*, and require little supplementary discussion. In each of these tables the frequencies set forth are those actually observed. From these were plotted the curves from which the extreme values were extrapolated, when necessary, and from which the frequencies in the class intervals used in the calculations were read.

The U.S.P. specimen of precipitated calcium carbonate was one used throughout our studies as the reference standard for abrasive power. In addition, two commercial chalks in 3 and 4 degrees of fineness respectively were studied. Other more uniform powders were made by sedimentation of chalk and dicalcium phosphate to obtain specimens consisting mainly of particles of 1 to 5, 5 to 15 and 15 to 30 microns diameter. *Figure* 1 indicates that while the greater part of each powder consisted of the sizes desired, there still were considerable amounts present in each outside the desired limits, so that the powders overlapped in their distribution. Still sharper separations can be made by repeated sedimentations if these are needed for special purposes.

The data of *Tables* 1, 2 and 3 show that good agreement between the methods was not always attained. The greater the deviation from the spherical form the greater may be the expected variance between the two methods. It is apparent from the data that the hydrometer revealed increased numbers in the smaller particle sizes. This results from the hydrometer measuring more accurately small particles which are not readily visualized by the microscope.

TABLE 1

Comparison of Results from Microscopic and Hydrometer Methods of Measuring

Type of Calcium Carbonate	Density	Method	Number Particles Counted	Percentage of Particles by Frequency or Weight Smaller than Indicated Particle Size, in Microns						
				1.25	2.5	5.0	7.5	10.0	12.5	15.0
		MF*		.0	40.1	73.5	87.5	97.9	100.0	.....
U. S. P. Standard of Reference....	2.72	MW	287	.0	1.8	11.3	34.1	74.4	91.3	100.0
		HW		29.5	65.8	85.4	91.5	94.7	96.8	97.2
		MF		28.2	62.6	86.1	93.1	97.9	99.0	99.8
"Snow Top," Regular, A. D. R.....	2.78	MW	915	1.2	2.5	12.8	34.2	55.2	76.0	89.9
		HW		11.5	48.8	75.9	89.5	96.1	97.0	98.0
		MF		.0	28.8	65.4	83.4	96.2	98.1	100.0
"Snow Top," Extra Heavy, A.D.R.	2.72	MW	788	.0	0.8	8.4	37.3	58.3	81.0	100.0
		HW		1.3	8.3	50.0	83.5	93.2	96.0	96.4
		MF		54.8	78.2	94.7	98.2	100.0	.....	.....
"Snow Top," Fine, A. D. R......	2.76	MW	547	0.8	4.4	21.2	67.0	100.0	.....	.....
		HW		41.8	69.3	94.8	97.2	99.0	.....	.....
		MF		40.3	58.1	79.1	84.7	92.0	94.5	96.7
"Sturge"—50 A. D. R............	2.82	MW	489	.0	0.3	2.1	8.2	12.9	22.0	29.8
		HW		2.0	24.4	55.0	71.9	80.7	86.2	90.9
		MF		37.8	64.9	90.9	98.8	100.0	.....	.....
"Sturge"—70 A. D. R............	2.78	MW	569	0.3	5.1	38.2	74.6	100.0	.....	.....
		HW		0.4	10.0	48.0	70.0	82.0	88.0	92.0
"Sturge"—100, A. D. R............	2.72	HW	...	1.2	8.5	57.0	73.5	80.0	83.0	86.0
		MF		.0	9.1	26.1	48.1	71.8	81.7	90.9
"Sturge"—130, A. D. R............	2.72	MW	482	.0	0.1	0.9	11.1	18.1	35.2	49.3
		HW		2.0	7.5	33.0	48.0	61.0	72.0	80.0
		MF		22.4	49.5	84.0	95.3	99.0	99.2	100.0
Sedimented, 1-5 microns..........	2.75	MW	487	0.5	2.3	21.0	51.0	77.8	91.3	100.0
		HW		2.0	28.4	82.0	92.2	84.6	95.1	95.7
		MF		.0	5.0	36.2	63.3	79.5	87.7	96.1
Sedimented, 5-15 microns........	2.75	MW	381	.....	.0	2.7	11.5	26.6	48.0	71.2
		HW		.....	.....	13.0	50.8	73.1	82.7	87.0
		MF		.....	.0	8.3	15.8	30.5	41.5	68.3
Sedimented, 15-30 microns........	2.75	MW	564	.....	.0	0.1	0.8	3.2	10.5	23.3
		HW		.....	1.0	3.0	6.0	13.9	29.4	43.6

*MF=microscopic frequency distribution; MW=microscopic weight distribution; HW=hydrometer weight distribution.

TABLE 1

Distribution of Particle Sizes for Various Samples of Precipitated Calcium Carbonate.

					Particle Diameter Microns			Specific Surface Square Cm.		Type o Calcium Carbonate
17.5	20.0	25	30	35	Median	Mean	Particle of Mean Volume	Per Gm.	Per c.c.	
					3.1	3.8				
							7.3	3020	8220	U. S. P. Standard of Reference
							3.4	14810	40280	
99.9	100.0				1.9	2.8				
96.5	100.0						7.7	2820	7830	"Snow Top," Regular, A. D. R.
99.0							3.8	9990	27770	
					3.8	4.6				
							8.5	2440	6650	"Snow Top," Extra Heavy, A.D.R.
							5.7	5640	15350	
					1.1	1.7				
							6.8	3180	8790	"Snow Top," Fine, A. D. R.
							2.2	19790	54620	
96.9	98.2	100.0			1.7	3.5				
32.7	44.6	61.5	100.0				15.8	1350	3800	"Sturge"—50 A. D. R.
92.2	93.1	94.9	96.2				7.8	5970	16840	
					1.7	2.2				
							4.8	4520	12560	"Sturge"—70 A. D. R.
96.0	98.0	99.5					6.7	4870	13540	
88.0	90.0	92.0					75.5	5070	13780	"Sturge"—100, A. D. R.
93.8	98.3	100.0			7.7	8.2				
66.4	80.9	100.0					13.2	1670	4550	"Sturge"—130, A. D. R.
84.0	87.0	91.0					11.1	4100	11140	
					2.6	3.0				
							6.3	3460	9520	Sedimented, 1-5 microns
							4.1	7600	20890	
98.2	100.0				6.1	13.3				
88.5	100.0						8.9	2450	6730	Sedimented, 5-15 microns
89.9	90.9	92.5	94.0				10.0	2970	8180	
77.1	92.4	96.8	98.2	100.0	13.1	13.0				
40.0	59.1	74.4	82.5	100.0			17.9	1220	3350	Sedimented, 15-30 microns
59.0	66.2	76.7	85.3				18.3	1570	4300	

TABLE 2

Comparison of Results from Microscopic and Hydrometer Methods of Measuring

Type of Dicalcium Phosphate	Density	Method	Number Particles Counted	Percentage of Particles by Frequency or Weight Smaller than Indicated Particle Size in Microns							
				1.25	2.5	5.0	7.5	10.0	12.5	15.0	17.5
"Victor," A. D. R....	2.39	MF*	227	6.6	24.7	48.5	56.8	74.4	78.0	89.0	90.0
		MW		.....	0.1	1.3	9.0	14.2	28.4	40.5	67.2
		HW		.....	.....	44.0	61.0	76.0	87.0	93.5	96.5
"Victor" Fine Air Separated through ¾-inch aperture...	2.39	MF	426	1.9	23.0	74.6	87.8	98.6	100.0	.....	.....
		MW		0.1	1.3	18.3	55.9	82.1	100.0	.....	....
		HW		11.5	28.0	56.0	74.0	86.0	93.6	95.0	96.0
"Victor" — Dust Air Separated........	2.39	MF	572	40.2	78.7	97.2	99.0	99.7	99.7	99.7	99.7
		MW		0.2	4.3	15.8	23.2	28.4	32.1	33.6	34.3
		HW		52.0	89.0	97.6	98.6	98.9	99.1	99.3	99.4
"Monsanto" Fine Air Separated, ⅝-inch aperture.........	2.39	MF	453	68.4	89.8	97.8	98.9	99.8	100.0	.....	.....
		MW		1.7	9.1	34.6	54.4	82.3	100.0	.....	.....
		HW		34.0	67.0	87.0	91.5	94.2	95.7	97.0	97.5
"Victor," Coarse, Air separated, ¾-inch aperture.........	2.39	MF	380	.....	.....	27.9	38.4	54.2	63.2	75.8	80.5
		MW		.....	.0	0.3	0.8	4.9	9.9	17.8	26.9
		HW		9.0	15.0	24.0	35.0	47.0	62.0	75.0	84.0
Sedimented 1-5 microns......	2.36	MF	492	36.6	62.8	84.8	90.4	97.6	99.2	100.0	.....
		MW		0.3	3.0	9.9	38.8	59.0	81.3	100.0	.....
		HW		11.0	33.0	63.8	73.7	84.6	91.2	95.3	99.3
Sedimented 5-15 microns.....	2.36	MF	515	0.0	24.9	49.1	57.7	68.0	76.5	83.9	88.2
		MW		.....	0.0	0.9	3.2	6.1	15.6	24.0	44.5
		HW		3.3	3.9	5.6	12.5	27.8	53.8	73.0	86.9
Sedimented 15-30 microns....	2.36	MF	338	4.7	12.4	18.3	22.5	29.0	34.9	47.9	55.6
		MW		.....	.....	0.0	0.4	0.7	3.8	6.2	18.0
		HW		.....	.....	2.1	3.8	8.5	18.0	29.5	47.0

*MF=microscopic frequency distribution; MW=microscopic weight distribution; HW=hydrometer weight distribution.

TABLE 2

Distribution of Particle Sizes for Various Samples of Dicalcium Phosphate.

						Particle Diameter Microns			Specific Surface Square Cm.		
20.0	25.0	30.0	35.0	40.0	45.0	Median	Mean	Particle of Mean Volume	Per Gram	Per c.c.	Type of Dicalcium Phosphate
99.1	100.0	...	...	...	...	5.4	7.1	...	...	...	
90.5	100.0	...	...	...	...	...	...	13.7	1830	4390	"Victor", A. D. R.
...	...	...	...	...	...	...	...	7.0	7570	18080	
...	...	...	...	...	...	3.6	4.1	...	...	...	"Victor" Fine Air
...	...	...	...	...	...	...	...	6.8	3700	8860	Separated through
96.2	96.5	96.8	...	...	...	...	...	6.1	10940	26140	¾-inch aperture
99.8	99.8	100.0	...	...	...	1.5	1.8	...	...	...	"Victor"—Dust Air
36.6	55.5	100.0	...	...	...	...	...	9.9	3240	6100	Separated
...	...	...	...	...	...	...	...	1.6	27530	65790	
...	...	...	...	...	...	0.8	1.3	...	...	...	"Monsanto" Fine Air
...	...	...	...	...	...	...	...	4.7	5300	12700	Separated, ⅝-inch
...	...	...	...	...	...	...	...	3.3	20470	48930	aperture
87.9	95.3	98.4	100.0	...	...	9.2	10.8	...	...	...	"Victor," Coarse, Air
37.6	63.4	83.1	100.0	...	...	...	...	19.4	1300	3100	separated, ¾-inch
90.0	96.9	99.0	...	...	...	...	...	10.8	7590	18140	aperture
...	...	...	...	...	...	1.8	2.8	...	...	...	Sedimented
...	...	...	...	...	...	...	...	7.8	3250	7720	1-5 microns
...	...	...	...	...	...	...	...	5.4	9740	23000	
96.1	98.8	99.2	100.0	...	...	5.4	8.0	...	...	...	Sedimented
61.6	79.3	84.1	100.0	...	...	...	...	16.9	1510	3560	5-15 microns
93.0	99.4	...	...	...	...	...	...	12.7	3780	8930	
75.7	88.8	96.4	98.2	99.4	100.0	15.6	14.8	...	...	...	
28.5	50.8	74.4	83.6	93.1	100.0	...	...	22.8	1110	2630	Sedimented
62.0	75.4	85.7	94.5	...	...	...	...	28.5	1820	4300	15-30 microns

TABLE 3

Comparison of Results from Microscopic and Hydrometer Methods

Description of Powder	Density	Method	No. Particles Counted	Percentage of Particles by Frequency or Weight Smaller than Indicated Particle Size in Microns								
				1.25	2.5	5.0	7.5	10.0	12.5	15.0	17.5	20.0
Silica "140 mesh"	2.65	MF+	235	....	.0	9.8	13.2	20.9	26.4	36.6	41.3	51.9
		MW		....	....	....	.0	0.1	0.5	0.8	1.8	2.7
		HW		3.0	4.2	8.0	11.9	16.2	21.6	25.7	28.5	31.0
Silica "240 mesh"	2.65	MF	198	....	.0	18.2	32.3	48.0	56.6	66.2	....	71.2
		MW		....	....	....	....	0.4	1.0	1.4	1.8	2.2
		HW		5.5	10.0	17.8	25.7	32.6	41.9	47.5	52.0	56.5
Silica "240 mesh" ground in ball mill..........	2.65	MF	293	....	19.1	38.6	45.4	52.6	59.0	70.3	78.5	87.7
		MW		....	.0	0.3	1.0	1.9	4.9	10.1	19.4	32.2
		HW		5.0	10.1	22.5	33.0	42.9	51.0	58.1	64.3	69.5
Fuller's Earth...	2.18	MF	242	....	.0	29.3	46.6	57.9	64.5	76.4	82.2	90.5
		MW		....	....	.0	1.0	2.1	4.3	7.8	13.0	19.4
		HW		....	....	....	3.5	9.5	21.0	37.5	51.0	57.0
Tricalcium Phosphate "Victor" A. D. R.......	2.68	MF	407	....	13.0	45.2	62.7	80.1	85.7	94.6	95.3	98.5
		MW		....	0.2	2.2	7.0	19.8	34.0	51.0	64.4	74.0
		HW		....	16.7	33.5	51.9	68.7	80.0	87.0	91.5	93.6
Magnesium Carbonate U. S. P.	2.16	MF	234	....	....	26.5	35.9	51.3	60.3	74.4	79.1	90.2
		MW		....	....	0.2	2.1	4.7	10.8	20.6	34.3	50.3
		HW*		39.0	67.0	89.5	99.9	100.0	....	....	....	....
Magnesium Oxide Light...	2.38	MF	192	....	20.3	49.0	62.0	75.0	80.7	89.6	92.2	95.3
		MW		....	.0	1.2	3.6	10.5	21.2	32.2	41.0	55.5
		HW*		51.0	61.0	75.5	85.0	91.5	94.5	98.8	99.8	100.0
Magnesium Oxide Heavy.	3.65	MF	314	....	.0	29.9	45.9	62.7	67.8	77.4	79.0	87.9
		MW		....	.0	0.3	0.9	2.4	3.2	6.4	10.0	14.1
		HW*		7.0	13.5	21.5	27.0	32.0	35.0	38.0	40.0	42.5

+ MF=microscopic frequency distribution; MW=microscopic weight distribution; HW=hydrometer weight distribution. * Hydrometer test made in isopropyl alcohol.

TABLE 3

of Measuring Distribution of Particle Sizes for Various Powders.

25.0	30.0	40.0	50.0	60.0	70.0	80.0	Over 80.0	Particle Diameter Microns: Median	Particle Diameter Microns: Mean	Particle Diameter Microns: Particle of Mean Volume	Specific Surface Square Cm.: Per Gn.	Specific Surface Square Cm.: Per c. c.	Description of Powder
66.8	77.0	84.3	91.9	95.3	96.2	97.0	100.0	19.9	23.4	....	....	....	
6.8	11.6	18.4	32.0	44.8	50.4	58.1	100.0	....	....	51.4	440	1170	Silica "140 mesh"
40.5	48.8	62.0	....	....	....	....	....	....	....	35.5	2640	6990	
81.3	83.8	86.4	90.9	93.9	96.5	100.0	....	10.5	18.0	....	....	....	
5.5	7.0	10.3	22.2	36.6	57.2	100.0	....	....	....	53.1	430	1130	Silica "240 mesh"
65.0	72.0	....	....	....	....	....	....	....	....	21.1	3360	8900	
94.9	95.6	99.7	100.0	....	....	....	....	9.1	10.7	....	....	....	Silica "240 mesh"
51.6	55.0	93.5	100.0	....	....	....	....	....	....	22.5	1010	2660	ground in ball
78.2	85.3	....	....	....	....	....	....	....	....	15.3	4730	12540	mill
94.6	96.3	97.9	98.8	99.6	100.0	....	....	8.8	11.0	....	....	....	
27.3	32.8	43.0	55.7	78.8	93.3	100.0	....	....	....	30.9	900	1970	Fuller's Earth
66.0	75.0	86.0	....	....	....	....	....	....	....	22.5	1610	3520	
99.3	100.0	....	....	....	....	....	....	5.6	6.9	....	....	....	Tricalcium Phos-
84.0	100.0	....	....	....	....	....	....	....	....	13.1	1720	4600	phate "Victor"
97.0	99.9	....	....	....	....	....	....	....	....	8.4	7710	20650	A. D. R.
97.4	99.6	100.0	....	....	....	....	....	9.8	10.6	....	....	....	Magnesium Car-
79.1	95.2	100.0	....	....	....	....	....	....	....	17.9	1550	3350	bonate U. S. P.
....	....	....	....	....	....	....	....	....	....	2.2	28660	61910	
99.5	100.0	....	....	....	....	....	....	5.2	7.3	....	....	....	Magnesium
92.0	100.0	....	....	....	....	....	....	....	....	16.4	1540	3650	Oxide Light
....	....	....	....	....	....	....	....	....	....	3.3	27870	66340	
92.0	95.5	97.8	99.0	99.4	100.0	....	....	8.0	11.3	....	....	....	Magnesium
20.5	30.5	44.1	58.3	71.6	86.0	100.0	....	....	....	32.4	510	1850	Oxide Heavy
46.5	50.0	55.0	....	62.0	....	67.0	100.0	....	....	136.0	3490	12750	

The median diameter value is less affected by the uncertainties at the ends of the distribution than are the mean diameter or the diameter of the particle of mean volume. This last characteristic is markedly changed by even a few particles of the large sizes, since the volume contained by these is proportional to the cubes of their diameters, and may skew the mean far from the median. On the other hand, the surface area values were always smaller for the microscopic than for the hydrometer method, indicating that a significant fraction of the fine particles were probably missed in the miscroscopic technic. Which of these various characteristics of the powders is most closely related to the abrasive power remains to be presented in another publication.

With the hydrometer method, the weight distribution of the powder is given by the readings. From this may be obtained values for the diameter of the particle of mean volume and the surface areas. Since these same characteristics, among others, are also obtainable from the microscopic method, it is possible to compare the agreement between the two methods for these and to ascertain with which one the more close agreement is obtained. Therefore, the percentage deviations from the means of each pair of readings in the tables were calculated. The average of these deviations of the volume figures was 32 per cent of the means, and 54 per cent for the surface area values. It is to be seen that considerably closer agreement was obtained between the two methods for the diameter of the particle of mean volume than for the surface area characteristics. If other things were equal, the volume figure might therefore be the one of choice for correlation with abrasive power, since it could be obtained by either method.

An opportunity for discrepancies between the two methods was introduced for some of the powders when sedimentation was used to separate out special fractions of the calcium carbonate and dicalcium phosphate. These sedimented powders were used for the hydrometer test without drying after the separation, whereas for the microscopic measurement the powders had to be dried to constant weight at 70° C. In drying, the powders caked slightly so that they were broken up and passed through a 100-mesh sieve to eliminate the gross lumps. In spite of these procedures, which could have caused alteration of size of the particles, the agreement between the two methods, illustrated in the data of *Tables* 1 and 2 is as good as for the other powders. Hence, suspension in water and drying at 70° C. do not significantly affect the observed particle sizes for these two materials.

The most discordant results are those of the three magnesium products, the carbonate and light and heavy oxide. For such materials it is impossible to use water in the hydrometer method since they form colloidal aggregates. They were therefore sedimented from isopropyl alcohol without difficulty. However, agreement between the two methods remained poor, inasmuch as the dry powders formed aggregates of smaller particles which could not be differentiated adequately under the microscope.

A number of the calcium carbonates and calcium phosphates studied are described in Accepted Dental Remedies, and their particle size or weight distributions there set forth.[22] In general it was found that the claims made for the fineness of these powders did not even remotely agree with our observations. A typical example, in which the discrepancy is no greater than that observed in the others, is given in the graph in *Figure* 2. This powder is stated to have 75.6 per cent of the particles below 1 micron in diameter. The observed value by both the microscopic and hydrometer methods was actually 4 per cent. Particles smaller than 5 microns were claimed to comprise 94.5 per cent of the total, but we observed only 48.5 per cent in the microscopic frequency, or 1.3 per cent in the microscopic weight distribution and 44 per cent in the hydrometer measurements. Such wide differences between the observed and the claimed sizes of the particles indicate either that the manufacturers do not adequately control this characteristic in these products, or that the methods of particle size estimation are completely unreliable. Since

[22]Council on Dental Therapeutics, Am. Dental Assoc.; *A.D.R.*; 7th Edition, p. 917.

our microscopic method was practically that of Perrott and Kinney, as stated to be used by the manufacturer, and since the same discrepancies were present in the powders from other commercial sources where different methods of measurement were used, it seems probable that the difficulty is either in failure to manufacture powders of the sizes desired or that the samples tested were not generally representative of the product. If these size distributions are of any significance in the use of the powders, it would seem imperative that effective control methods be developed and enforced, or the allegations of sizes deleted from the A.D.R. until reasonable agreement with the claims can be assured.

CONCLUSIONS

1. Determinations of the particle size distributions of twenty-seven powders used in dentifrices have been made, comparing the microscopic method with the Klein surface hydrometer technic. From these distributions were calculated the median and mean diameters, the diameters of the particles of mean volume, and the surface areas per cc. and per gm. of each powder.

2. The microscopic method gives lower proportions for the finer particles with resulting higher mean diameters and lesser surface area figures, while the hydrometer reveals higher proportions of the fines with resulting lower mean volumes and greater surface areas. These discrepancies are, in part at least, due to the inherent limitations of the two methods, the microscope permitting measurement of only two of the three diameters and being unable to effectively resolve the finest particles, and the hydrometer measuring not the true size of the particles but rather the diameters of spheres which would sediment at the same rate as the particles in the powder.

3. A survey of other available methods for estimating particle size distributions reveals that these, while they may be advantageous for special purposes, are not more generally useful or applicable than the two methods compared here. The methods used by us do not require any special apparatus not readily available in any laboratory, although the hydrometer method may be simplified by the

use of the special Klein hydrometer. Because of the small amount of time required for each reading, the hydrometer method is particularly useful where a number of powders are to be studied simultaneously.

4. In a subsequent report the correlation between the various characteristics of these powders and their abrasive power on teeth will be presented to determine which method and characteristic will be most useful in predicting abrasive power of powders used in dentifrices.

PROBLEMS IN PROSTHETIC DENTISTRY

WALTER J. PRYOR, D.D.S.
Cleveland, Ohio

It is generally agreed that thorough preparatory and professional-school training provide a background which enables the student to develop his native talents more quickly and to a fuller degree than would be the case if such training had not been received. As a consequence educational standards in the professional schools have been raised gradually to the present high level. However, we will probably always have with us the unprepared or the partially prepared individual who edges his way into the practice of the healing arts. Although the medical profession is more beset by a myriad of the unlicensed, and of those licensed to limited practice, the dental profession is also obliged to give attention to this problem in continually changing forms. The prosthetic field is the one in which most of the dental malpractice occurs, because much of the work is performed in the absence of the patient. Paradoxically, prosthetics is one of the most exacting branches of dentistry. It is probably not stating it too strongly to say that in no branch of dentistry is it more difficult to produce results satisfactory both to the dentist and the patient.

The dental profession itself is largely to blame for prosthetic malpractice because many dentists delegate too much of their work to the dental laboratory in lieu of developing in themselves the necessary skills. A certain percentage in the profession—owing to their deficiency—fall so far behind, and lean so heavily on the dental technician that the technician develops a contempt for the dentist's ability and feels that he could do the work better himself. Neither of these should attempt this work, if the patient is to receive the proper type of service—the deficient dentist, because he has failed to build adequate mechanical skill on the foundation of his basic training; the technician, because, even if he is a *good* mechanic, lacks the basic training provided in the professional school. Very often the technician who oversteps into the practice of dentistry was not a success in the laboratory field.

An astonishing sidelight at the recent Senate and House Health Committee hearing in Washington, on the bill to outlaw the mail-order denture racket, was the testimony of a lawyer who owned one of the laboratories. Although he knew nothing whatever about the construction of dentures until a year ago, he testified at length with the air of an expert. He admitted that his interest was entirely mercenary. Interesting parts of his presentation were testimonal letters of several apparently satisfied patients. Since the work in the mouth is done by the patient himself, in the mail-order denture racket, these letters—unless patient psychology is taken into consideration—are incredible to a dentist who very often is put to the limit of his ability to secure even a fair result. A possible explanation involves two phases in human psychology: (1) the patient has been sold on what is represented to him as a big bargain and, not being notably intelligent, goes to great lengths to defend his bargain; (2) he regards the denture as being, in important degree, his own handicraft and is the type to defend his own masterpiece to the limit against all comers. In this connection the writer has frequently observed patients of the type who damaged and in some cases ruined the fit of a denture by filing or cutting it to relieve soreness. Invariably, such person insisted that he helped the situation and did no harm to the denture by the "home doctoring," even though at the time, he was applying to have the denture refitted. It is to be hoped that the bill to outlaw the mail-order denture racket will not be lost under the pressure of attention to war problems, and that it will soon be enacted into law.

The denture field is also continually being intruded upon by commercial teachers of so-called post-graduate courses. In some cases these men are not even licensed dentists, and again the profession is to blame for supporting their racket. Often men in high office have unknowingly been used to promote their game. A few years ago a president and a president-elect of the A.D.A. used their influence to secure a place on the program of the full-denture section for a man unknown to the section's officers. Part of a technique was shown and immediately post-graduate courses were offered and advertised by the individual for a substantial fee. There was nothing in the technique which could not have been shown without commercializing it. Before the recently postponed meeting of the A.D.A. the president of a state dental society endeavored to secure a place on the program of the full-denture section for a dental friend. Not being a prosthetic man, he did not realize that the dentist would present the work of a technician unqualified to appear on the program. This technician is backed by a commercial house interested in the sale of a material. He lacks knowledge of the problem involved, and is not qualified by experience or license to operate on patients, but with an abundance of ego and commercial "push" he is actually being paid by dentists for courses in mouth technic. These cases are cited to illustrate that those in charge of programs of dental meetings should know what they are doing when they select essayists and be wary of those who request places on programs, or have others do so for them.

Another problem from the very beginning of the profession has been the activity of commercial houses in the prosthetic field. At the start it took the form of process patents which plagued dentistry for years. At present, efforts are being made to restrict the sale of certain materials to dentists except at prices much higher than those charged manufacturers. A concern now sponsoring the teaching of technical procedures in the mouth by a technician presents this history: A firm was manufacturing railway equipment and had not even a remote connection with the dental field until a dental technician interested them in the idea of producing an alloy to be used in prosthetic work in place of gold, and with large profits in prospect. An alloy already on the dental market was copied closely, neither originality nor pioneering being involved. After making a start involving considerable expense in advertising, etc., the large profits were not in evidence. A "go-getter" sales manager was then hired to put it over. Having no sense of professional ethics, he sees nothing wrong with this activity so long as dentists fall for it and it increases the sale of the product.

Another small firm in the dental field, with no experience whatever in denture-base material, watched closely the meetings of the American Chemical Society to select a plastic that might be used as a denture base. When the plastic methyl-methacrylate appeared several firms immediately began experimenting with it carefully, as most of the former plastics foisted on the profession proved boomerangs to responsible firms when the materials failed. This firm beat the others to the market by sending free samples to prosthetic men and quickly getting approval, as the acrylic plastic was found to possess great native merit. A price was set on the product but it was so high that many of the bootlegger type of dealer were attracted by the prospective large profits, even at a greatly reduced selling price. This type of dealer procured the moulding powder, through connections of one kind or another, from plastic moulders, notwithstanding the fact that plastic moulders were forced to sign an agreement forbidding them reselling to the dental profession or dental trade. Recently two large chemical firms were indicted in federal suits involving charges of restraint of trade, as a result of their efforts to require a health-service profession to pay many times the price charged commercial moulders for this same product. Out of all of this confusion flies the goose which was expected to lay the golden egg. Had a fair price been placed on the plastic in the beginning, as the dealers were advised by a few prosthetic men, this situation would not have developed.

These are but a few of the problems that beset dentistry. Some of them are within our own ranks and some are without, but in either case, control or correction lies within our own domain and we should act. Most of it will fall upon the shoulders of the prosthetists since that branch is so thoroughly dependent on the manufacturer. But in a conflict between ethics and profit, ethics should prevail. The alert is sounded—be on guard.

"IT IS UP TO US"

WENDELL D. POSTLE, D.D.S.
Columbus, Ohio

A great deal of consideration has been given to the problem of who should study dentistry. Most of us will agree as to the type of individual we would like to see choose dentistry as a career, but unfortunately many dental schools, because of the small number making application, have been forced to accept students who are not particularly qualified. We are not so fortunate as medicine, since the pool they have to draw from is much larger, hence they can be more selective. Most medical schools accept very few students below a B average, while in dentistry we accept students with a C average.

Dentistry does not seem to be so appealing to young people, for which there may be several reasons. First, medicine being a broad field made up of its many specialties is more attractive than dentistry which confines students to a rather narrow subject, as it is a specialty within itself. Second, dentistry has not enjoyed the same type of publicity, such as being glamorized over the radio and in the movies. In fact, in most instances, since dentistry is so closely related to medicine and is considered by some as one of its specialties, it is included in the general term of medicine and too often unintentionally omitted altogether. So, in considering a vocation, many times dentistry is left out because it is included in the general classification of medicine and for this reason many students do not even consider it in planning their life work. Third, the fact that many students have associated dentistry with unpleasant experiences in the dental office adds to the lack of interest.

Dental schools are constantly criticized for the type of students they are accepting. This is unjust criticism for all dental schools would be only too glad to improve the caliber of their student body if they had the opportunity that is afforded the medical schools. But we need not be in the least discouraged, for the quality of dental students has gradually improved over a period of years and will continue to do so. However, there are some definite things we can do to help this along. It is not a problem for the dental schools alone, but a responsibility of the dental profession to encourage the right kind of young men in the study of dentistry. There are many ways in which this can be done. Probably the most effective is for individual dentists in the various communities throughout the country to take on the obligation and interest young men to follow in their footsteps. A very successful minister in my community once remarked to me that he felt he was unsuccessful in his work if he did not interest at least one boy a year to take up the study of the ministry. I might say that he has done this very thing and he tells me that nothing in his life's work has given him more pleasure than watching the development of these young men whom he has interested in following in his footsteps.

Just think what would happen if every dentist would interest some good young boy in the study of dentistry. Our schools would be flooded with applications and I am sure the quality of the students selected would immediately rise. In the past three years we have been appealing to the dentists in Ohio to do this very thing and already we are beginning to see the results. We have two dental schools in this state and from 125 to 150 new students a year is all that we could possibly handle between us. There are thirty-eight accredited colleges in Ohio offering pre-dental work and we have found that in most of these schools the personnel men, those who were advising students, were entirely unfamiliar with dental college requirements. In many cases boys who were headed for dentistry were wrongly advised, making it necessary for them to continue in the Arts College another year in order to qualify. It seems almost unbelievable that in a state where we have so many colleges, and over 4000 dentists, we do not have at least 150 young men of the highest caliber apply for dentistry every year.

I think that we, as dentists must realize that the future of our profession depends entirely upon the men who are entering the field and that we, as individuals, should accept some of that responsibility and encourage young men to become dentists. We have entirely too many pessimists in our profession. Young men are constantly being discouraged from entering this field. Young people are interested in getting into a vocation which will make them economically secure. Dentistry offers this opportunity. There is an abundance of work to be done with a limited number of people to do it. A dentist has a fine opportunity to render a real service to his fellow men and at the same time gain a good livelihood for himself. Many dentists have made the remark, in talking to young people, "If you want to make money, don't go into dentistry." I think this is entirely the wrong pyschology for statistics show that dentists, as a group, fare well. They live on a comparatively high standard, and are respected, reliable citizens of their communities. It is possible for every dentist, during his earning period, to make himself secure for his old age. What more could anyone ask?

If the dentists and the dental schools will cooperate on this important problem, we would be surprised at the results obtained. *"It is up to us."*

THE WAR AND DENTISTRY

GEO. W. WILSON, B.S., D.D.S.
Milwaukee, Wis.

As the war progresses, and the conflict between the philosophy of democracy, freedom, and liberty, and that of aggression, dictatorship, cruelty, and slavery comes to tighter grips, it becomes obvious that there can be no end to the conflict until freedom and righteousness have been restored to a war-torn and weary world. War is destructive of everything, both good and evil. It destroys the lives of men, women and children which medical science has tried so effectively to preserve through the centuries. It levels to rubbish the social, economic, moral, and religious systems which men have established to help human beings accomplish the purpose of existence. It is also destructive of selfishness, greed, false ambitions, and decaying systems. All these are leveled before the onslaught of war.

As we settle deeper into this conflict, its effects are progressively being felt by dentistry as it has, and will continue to have, upon all other professions. Dentistry is not to escape the destructive effects of war, nor, we hope on the other hand, shall we fail to reap the beneficial effects, intangible and uncertain as we may now believe them to be. Good is the object of the human will. The wills of good leaders of our cause will prevail.

This then is a critical period in the history of dentistry. The scientific and statutory status of dentistry, as an autonomous profession, is in danger because of the evil influence of war. Its very existence as an independent health service profession, and freedom to grow in usefulness and appreciation in the public good is insecure and will continue to be so in the future.

We live in an era of regimentation made necessary by the demands of a world-wide war. This war can come to a successful termination for our cause only through the process of regimentation by our government of all our resources, both man and material. One of the resources of the nation and the one in which we are involved to the greatest extent is health service. Dentists are health servants. They are being regimented as citizens and professional people. The profession of dentistry is being regimented in order to serve best not only the needs of the civilian population, but even more important at the moment, our military forces. Our expanding army will need the entire product of the graduating classes of American dental schools for many years to come. The flower of the profession is going into the armed forces of the country to be educated and to serve as dental officers and assistants to medical men in the medical corps. Older men and those unfit for military service are to be left to take care of the civilian population. Some of them are being dislocated through their entry into the military forces and the U. S. Public Health Service.

The dental schools of the country are accelerating their undergraduate curriculum to produce more trained dental officers for the military service and yet maintain high standards. The morale of dental student bodies is being effected by uncertainty and confusion. A future normal, free, private, professional life of service seems obscure to them. Faculties of dental schools are being depleted, some seriously, by the demands of military service. Their places must be taken by less experienced men from the dental profession. Many selective service boards do not look with sympathy upon the deferment of part-time teachers in dental schools because of their belief that any dentist can be a teacher.

These situations will have a serious effect upon the quality and effectiveness of instruction in dental schools. Students who are heading for military service upon graduation are not inclined to be as interested in learning how to place a good gold restoration or a suitable fixed bridge to restore function, because they know that is not going to be the type of service they will perform in the Army or Navy. Their youthful minds cannot see beyond the horizon of war to the realization that most of them, at least, will one day pursue civilian practice of some type.

There is another even more grave doubt and feeling of uncertainty in the minds of dental students. They wonder if their post-war professional career will be a private practice as we have it today, or group practice, or practice for a salary paid by the state, or under a compulsory health insurance plan. Will their custom of receiving a fixed adequate salary while in military service distract them from the desire for a private practice, thus making civilian practice for a salary desirable? Will regimentation continue to be a major influence in our new democracy? Certain it is, we have established social and political ways and systems which will never be scrapped in a post-war world.

The quality of service which has been rendered the public by the private practitioner for the past quarter century will suffer seriously under the influence of a socialized system. Those who favor more health service believe a lower quality is better than none. The influence of those thousands of the flower of our profession which will be released after military service under the direction of the medical corps, must be given consideration in our speculation on the effects of this war upon dentistry. These young men will have forgotten how to perform operations required to serve the civilian population adequately. They have been graduated from dental schools as safe beginners to practice but, having entered military service immediately after graduation, will not have benefited by the experience of a private practice. They will not be ready to assume the responsibilities of a civilian practice, or to deliver a quality of service any more adequate than those provided our armed forces.

If the present high status of American dental education and dentistry is to continue, and not become a war casualty, there are several things which must be done to preserve it. We must recognize the fact that a new world is in the making for sure this time, that regimentation is now an established system in this country, and that in all probability it will prevail in some form in post-war rehabilitation. We must understand that dental students are being subsidized and regimentated by the federal government, and that dentistry is by its very nature susceptible to socialization. We know that the physical examination of American youth has revealed a serious need for dental care, and that when our soldiers leave the military service their dental condition will perhaps be worse. Social planners will press for more health service for the people of this country. There is certain to be esablished a government-designed and controlled system of delivering health service to all its people. It will be, in all probability, a compulsory health insurance system. What part will we be prepared to play in any new plan?

If some group plan is in the offing, we must not resist like an ostrich with its head in the sand, and attempt to thwart the inevitable. We must be realists, motivated by practical idealism, ready to make sacrifices and give unselfish assistance to the government in any post-war project which we believe to be of the most benefit to the people. This above all must motivate our aims and purposes. We must oppose any plan which does not offer that critical characteristic.

Lastly, we must begin now to safeguard and protect the status of dentistry, dental education, and the quality of practice by contemplating post-war short graduate courses through schools and societies, to salvage the flower of our profession when they return to civilian life and the practice of dentistry. They are being deprived of the opportunities which those who completed the dental curriculum during peace-time enjoyed. They must be guided back to the road of civilian practice, with all its aspects, from the detour made necessary by military service. This will be a delicate job for dental schools and organized dentistry.

A BRIEF HISTORY

OF THE

William J. Gies Endowment Fund Committee for the Journal of Dental Research

C. FRED GaNUN, D.D.S.
Secretary, New York

In 1936 the *Journal of Dental Research* had been serving the dental profession with distinction for seventeen years. More than a thousand research articles had been published in its pages. Its influence was instrumental in obtaining recognition for dentistry as a scientific body by the American Association for the Advancement of Science.

With its unique position of usefulness to dentistry it might be expected that, unlike most research journals, it would be self-supporting. And yet, there had not been a single year since it began publication in 1919, in which there had not been an average deficit of not less than $2,000. The amount necessary to meet this annual debt had been raised each year by its founder, Dr. Gies, and it's not a poor guess largely contributed by him personally.

There were men in the profession who fully appreciate this situation, and with a desire to manifest this appreciation to some degree, developed this plan and presented it to the profession in an effort to place the *Journal* on a firm financial foundation. With this in mind, Dr. Arthur H. Merritt called a meeting in his office on May 15, 1936, at which time the William J. Gies Endowment Fund Committee for the Journal of Dental Research was formed with the following membership:

Theodor Blum
Frank C. Cole
S. Ellsworth Davenport
William B. Dunning
Joseph D. Eby
C. Fred GaNun
Gordon M. GaNun
Henry W. Gillett
Herman J. Kauffer
Joseph Kauffmann
Frederick C. Kemple
Alfred Kohn
Frederick C. McKay
Arthur H. Merritt

Albert L. Midgley
Bissell B. Palmer
Richard B. Pomeroy
Theodor Rosebury
J. A. Salzmann
Martin C. Tracy
Leuman M. Waugh
C. Raymond Wells
G. H. Whitson
Maurice William

Dr. Arthur H. Merritt was asked to act as Chairman, Dr. Leuman M. Waugh as Treasurer, and Dr. C. Fred GaNun as Secretary, for the Committee.

The Committee's primary purpose was to raise an endowment fund of not less than $50,000 for the *Journal of Dental Research.* To achieve this purpose the Committee had three objectives:

First: An increase in the circulation of the *Journal* to make it as far as possible self-supporting.

Second: Support from advertising.

Third: The creation of an endowment fund by which recurring deficits could be met and the usefulness of the *Journal* increased. It endeavored to accomplish this by (a) establishing different classes of subscribers for the two-fold purpose of increasing circulation and adding to the Endowment Fund; (b) soliciting legitimate advertising, and (c) encouraging direct contributions to the Endowment Fund.

To further these objectives, the Committee sent to individual members and organizations in the profession a brochure containing two subscription forms: (a) for Annual ($4), Sustaining ($10), Endowment ($25), and Life ($100) subscriptions, and (b) for Goodwill Contributors ($250), Donor ($250-$500), Patron ($500 to $1,000) and Benefactor ($1,000 up), intended for individuals and organizations contributing directly to the Endowment Fund.

Several meetings of the Committee were held from the time of its organization on May 15, 1936, through February 5, 1937. At that time it was proposed to establish a nationwide organization to carry out the objectives that this Committee had initiated. Thus every member of the dental profession was given an opportunity to participate in the establishment of the Endowment Fund for the

Journal of Dental Research. By this participation he gave encouragement to the research worker by giving him a worthy journal in which to publish his findings; he expressed his own idealism; and he justified the faith and sacrifices of the founder of the *Journal*.

In 1938 when Dr. Merritt became president-elect of the American Dental Association, Dr. John E. Gurley of San Francisco, took over the chairmanship of the Committee and continued to carry on until 1941 when Dr. Merritt again resumed the chairmanship.

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE[1]

PROCEEDINGS OF THE SUBSECTION ON DENTISTRY, EIGHTH ANNUAL MEETING (postponed), NEW YORK, N. Y., DEC. 28, 1942

PAUL C. KITCHIN, M.Sc., D.D.S., *Secretary of the Subsection*

The committee in charge of Subsection activities for the past year consisted of Dr. A. H. Merritt, Dr. W. J. Gies and Dr. Paul C. Kitchin. Although preparations for a program for the New York meeting were started early, it soon became evident that more than the usual difficulties were going to be encountered. It had been planned (originally) to devote a major share of time to a symposium on "Dental Aspects of the Focal Infection Theory." This had to be abandoned because practically all the persons invited to present various aspects of the subject were too busy with work, directly or indirectly connected with the war, to assume further obligations. By this time the members of the committee were becoming convinced that the New York meeting should not be held. Other dental groups were cancelling meetings in order to relieve the burden of necessary wartime travel. Inquiries made of the A.A.A.S. as to whether the New York meeting would be held were answered by the statement that we should proceed as though it would take place as scheduled.

The Subsection Committee, while favoring cancellation of the A.A.A.S. meetings, did not wish to act independently of the parent group in this matter, and efforts to arrange a program were again put forth. The help of the New York, Boston and Philadelphia sections of the International Association for Dental Research were solicited through their respective secretaries and a group of miscellaneous original papers were secured, largely from the members of the New York section. This cooperation, particularly that of

[1]For previous reports of the Subsection, *See J. Am. Col. Den.*, *5*, 73; 1938, March-June. *Ibid.*, Footnote No. 1; also, *6*, 56 and 184; March-June, 1939; *7*, 74; 1940; March-June; *8*, 44; 1941, March; *9*, 229; 1942, June.

Dr. Neuwirth of the New York section, was very much appreciated and proved a great help to the Subsection Committee in a difficult situation.

The committee had also secured a paper of general interest for presentation at the noon luncheon meeting by Dr. R. C. Osburn of the Zoology Department of Ohio State University on "Biology and the War." In addition to this, Dr. Osburn was also on the program for a research paper, an abstract of which is presented among those published herewith.

On November 27, when all arrangements for the Subsection program were complete, the A.A.A.S. meeting was officially postponed with no definite plans for holding it later. This was done at the request of the Office of Defense Transportation.

Thus the abstracts included in this report are those of papers which would have been presented at the New York meeting on December 28, 1942, had that meeting not been cancelled by the A.A.A.S.

The 1943-44 meeting, if held, will be in Cleveland. Therefore, the Subsection Committee, through its secretary, submitted a ballot containing the names of all the Cleveland Subsection members who were also fellows of the A.A.A.S., to all members of the Subsection. The result of this vote was the submission to the Council of the A.A.A.S. for its approval the name of Dr. T. J. Hill for Subsection Chairman and Dr. B. Holly Broadbent as a member of the Subsection Committee for the Cleveland meeting scheduled for December 27, 1943-January 1, 1944.

This past year was the final one of the term for which the Secretary of the Dental Subsection was elected. Therefore nominees for the office were solicited by mail from the entire Subsection membership and those of the persons nominated who were willing to serve if elected were balloted on by mail. As a result of having received the largest number of votes by this process the name of Dr. Paul C. Kitchin was submitted to the Council of the A.A.A.S. for its approval as Secretary of the Dental Subsection for the two-year period beginning with 1943.

During the past year, the A.A.A.S. issued its first bound volume on a dental subject. This was A.A.A.S. Publication 19, "Fluorine and Dental Health." It contains various symposium papers presented at the Dallas, Texas, meeting of the Dental Subsection in December, 1941. It is for sale and can be secured from the office of the A.A.A.S., Smithsonian Institution Building, Washington, D .C.

During the past year the following persons have become *members* of the Dental Subsection:

Francis A. Arnold, Jr., Div. of Infectious Diseases,
National Institute of Health, Bethesda, Md. Nd43
Alfred J. Asgis, 7 East 42nd St., New York, N. Y. NdQK43
Guy P. Bannister, 2362 Tudor Dr., Cleveland Heights,
Cleveland, Ohio Nd43
Carl O. Boucher, 317 Beggs Bldg., Columbus, Ohio NdH43
John W. Dobson, 30 Shirley St., Halifax, N. S., Canada Nd43
William E. Durbeck, 823 Medical Arts Bldg., San Antonio, Texas . . Nd43
Alton K. Fisher, U.S.N.R., care A. A. Barker, Route 1,
Newport, Rhode Island NdH43
John T. Flynn, Harwood Bldg., Scarsdale, N. Y. Nd43
Morris Freeman, 3806 Bailey Ave., New York, N. Y. NdF43
Bernard Gottlieb, 1420 Hall St., Dallas, Texas Nd43
G. A. Grubb, 2919 Garfield St., Lincoln, Nebraska NdB43
William Howard Hake, 1401 E. Alabama St., Houston, Texas Nd42
Chester J. Henschel, 1235 Grand Concourse, New York, N. Y. . . NdBC43
Maxwell J. Lentz, 655 Main Ave., Passaic, N. J. Nd43
Roland Lynn, 905 Medical Arts Bldg., Dallas, Texas NdG43
Harry Maeth, Mosinee, Wisconsin Nd43
Herbert I. Margolis, 311 Commonwealth Ave., Boston, Mass. . . . NdHF42
F. D. Ostrander, University of Michigan School of Dentistry,
Ann Arbor, Michigan Nd43
John Lewis Preston, P. O. Box 300, Wichita Falls, Texas Nd43
Louis H. Renfrow, Jefferson Apts., 16th and M St., N. W.
Washington, D. C. Nd43
Frank A. Richison, U. S. Naval Hospital, Philadelphia, Penn. Nd43
Leon Segat, 3106 LaGrange St., Toledo, Ohio Nd43
Edwin M. Short, Div. of Infectious Diseases, National Institute
of Health, Bethesda, Md. Nd43
M. Russell Stein, 157 West 57th St., New York, N. Y. Nd43
Lyon P. Strean, 4928 Grosvenor Ave., Montreal, Quebec, Canada Nd43
C. H. Swanson, Columbus, Montana . . . . NdI 43

A. Porter S. Sweet, D.C., U.S.N.R., 9101 Sudbury Rd.,
Silver Spring, Md. NdH43
Donald A. Wallace, 212 E. Superior St., Chicago, Ill. NdCF43
Jacob M. Wisan, 891 Wyoming Ave., Elizabeth, N. J. Nd43
Daniel E. Ziskin, 630 West 168th St., New York, N. Y. Nd43

According to the current membership cards received from the office of the Secretary of the A.A.A.S., twenty-nine members of the Dental Subsection have not renewed their membership for 1943.

The following members of the Dental Subsection have been elected by the Council of the A.A.A.S. to *Fellowship* in that organization during the past year:

Harvey J. Burkhart, P. O. Box 879, Rochester, N. Y.
Thomas J. Cook, 4645 N. Bay Road, Miami, Florida
William H. Crawford, 1121 W. Michigan St., Indianapolis, Indiana
William B. Dunning, 140 East 80th St., New York, N. Y.
Bion R. East, 600 West 168th St., New York, N. Y.
Kenneth A. Easlick, University of Michigan School of Dentistry, Ann Arbor, Michigan
John J. Fitz-Gibbon, 56 Suffolk St., Holyoke, Mass.
John E. Gurley, 350 Post Street, San Francisco, Calif.
Harold W. Krogh, 1835 Eye St., N. W., Washington, D. C.
E. G. Meisel, 121 University Place, Oakland, Pittsburgh, Penn.
Albert L. Midgley, 1108 Union Trust Building, Providence, Rhode Island
Balint Orban, 180 N. Michigan Ave., Chicago, Ill.
J. Ben Robinson, 42 S. Greene St., Baltimore, Md.
C. E. Rudolf, University of Minnesota School of Dentistry, Minneapolis, Minn.
Carl A. Schlack, U. S. Naval Dental School, Washington, D. C.

The following are abstracts of papers to have been presented at the New York meeting, had it been held:

Interpretation of Salivary Magnesium Levels in Caries

FRANCES KRASNOW, Ph.D.
Guggenheim Dental Clinic, New York City

Recent evaluation of figures for 131 cases ranging in age from four to thirty-six years has corroborated for the third time the elevated values of magnesium in saliva of subjects suffering from caries. The general average when compared with caries-free, non-systemic cases shows significant odds

against randomness. Systemic involvement associated with a carious condition accentuated the abnormality in concentration. It may be that in the organism, magnesium replaces calcium to a greater or lesser degree. Where magnesium is being laid down rapidly, especially due to high intake from meats, fish, cereal products with calcium availability low and under acidic conditions, the latter will go into solution to keep the ion concentration of the circulating fluid at an optimum as long as possible. Magnesium, on the other hand, obtained in super-abundance will be constantly at a high level in all tissues and also in the saliva. Regulation of physiologic needs tends to bring about a balance, the values approaching the norm. In time, under controlled conditions, alleviation in decay is produced. Magnesium determination then may serve as an objective aid.

Tooth Condition, a Factor in the Absorption of Isotopes

CHARLES F. BODECKER, D.D.S.
Oral Histololgy School of Dental and Oral Surgery,
Columbia University, New York

Calcified dental tissues absorb experimentally introduced isotopes to a varying degree, dependent largely on the following conditions:

1. Type and age of animal.
2. Eruption age of the tooth.
3. Degree of attrition.
4. Secondary dentin.
5. Degree of protective metamorphosis.
6. Degree of vitality of the dental pulp.

It is generally realized that the first five conditions affect the permeability of teeth, but the absence of the pulp has not been considered in this connection.

Wasserman, Blayney, Groetzinger and DeWitt in their experiments observed radio-active phosphorus in the dentin and a lesser amount in the enamel, irrespective of the vitality of the teeth. Evidence is presented that the removal of the pulp temporarily increases the permeability of a tooth to an abnormal degree so that experimental dyes can penetrate the cementum from the exterior, saturate the dentin and thus reach the enamel. If radio-active phosphorus has the same reaction, its presence in pulpless teeth is explained.

Observations on pulpless teeth, therefore, should not be interpreted as signifying that the pulp is non-essential in the distribution of the substances which are required for the post-formative maturation of the teeth.

The Innervation of Dentin

JULIAN AMBROSE, D.D.S.
Pathology Laboratory of Sydenham Hospital, New York City

Past studies of the innervation of the dentin have been inconclusive. In re-examining this problem the author attempted an approach involving the unilateral severing of the sympathetic and central nervous system nerves to the mandibles of kittens, the study of sections of adult human teeth, and the sectioning of the jaws of human foetuses. Haematoxylin and eosin, Mallory's and van Gieson's stains were employed as checks upon the customary gold and silver impregnations.

The author found that certain fibers, resembling nerves, accompanied the odontoblastic fibers within the tubuli of adult and foetal teeth having no nerve supply, that these fibers were demonstrable with all stains, and that they were not nerves.

A hypothesis is offered as to the identity of these fibers. Through the study of foetal tissues it was found that these fibers are formed by the odontoblasts as odontoblastic fibers, lose their connection with these cells, atrophy, and remain in the tubules alongside of the odontoblastic fibers, in this shriveled state having the morphological characteristics of nerve fibers.

The author concludes, therefore, that the most probable agent for the transmission of sensation through the dentin is the odontoblastic fiber.

Further Observations of Dental Lymph in the Dentin

WILLIAM LEFKOWITZ, D.D.S.
School of Dental and Oral Surgery, Columbia University, New York City

The rate of flow of dental lymph from odontoblast to the terminus of Tomes' fibril has been measured in the teeth of dogs. A dye, inserted into the pulp, reached its maximum diffusion in thirty-eight minutes. The entire body of the dentin was stained except the apical third of the root. A marked difference in the intensity of the stain was observed between the area of the cut tubules and the remainder of the dentin which exhibited minute particles in the tubules.

Examination of transverse sections of dentinal tubules in predentin demonstrated that the dye diffused outward through Tomes' fibrils. This was also observed in isolated Tomes' fibrils.

Afferent and efferent flow of dental lymph may be observed in young human specimen in which the dye was placed in a stain pocket at the incisal area of the dentin. The dye was transported to the pulp and redistributed throughout the crown in the same manner as that found after insertion of the dye into the pulp.

The presence of cells in the dentin, previously reported, caused by the suction produced by forceps in extraction was observed in the dentin over the incisal horn of the pulp. No forceps were used in dissecting the specimen.

Heat Impact of Revolving Instruments on Vital Dentin Tubules

CHESTER J. HENSCHEL, D.D.S., *Sydenham Hospital New York; Clinical Collaborators:* LEON LIEBER, D.M.D., MORRIS GUDWIN, D.M.D., *Sydenham Hospital;* JACK R. KOPLEY, D.D.S., *Hebrew Orphan Home, New York*

Thermal abuse from revolving dental instruments falls into: A. general tooth temperature rise; B. intolerable temperature rise at the cut surface of vital dentin tubules. Many authorities attribute much operative pain to frictional heat, a theory confirmed by the practice of "Thermal Control" by our graduate group. Earlier work on this subject indicated that a rise of more than *25° F.* must accompany the *gentlest* use of the *smallest* bur. This contradicted otherwise accepted research which showed *neglible* thermal shock from *light pressure* and *small* burs.

New experiments from a different point of view (type B) measured the total caloric generation of revolving instruments. The heat impact on dentin tubules was calculated from the caloric recording considering the weight, specific gravity, and specific heat of the substance involved. The thermal impact on cut dentin surface ranges from a *60° F.* rise during *gentle operating* to a possible rise of 1000° F. in abuse.

It is concluded that dry field operative dentistry is contra-indicated where revolving instruments are used and pain control is believed important. Workable "Thermal Control" apparatus has been perfected, permitting dental engine preparation free from heat trauma, and no more painful, but faster, than hand instrumentation.

Preliminary Report on Flow Tests of Methyl Methacrylates

ARTHUR B. GABEL, M.A., D.D.S.; E. HOWELL SMITH, D.D.S.
School of Dentistry, University of Pennsylvania, Philadelphia

Numerous reports on the behavior of methyl methacyrylates seemed to indicate that excessive flow more than any other property might contraindicate the use of these resins in operative dentistry and crown and bridge prosthesis.

Tests showed a considerable variation even among supposedly identical specimens prepared by the same technician.

A tendency to elastic recovery was noted in practically all specimens amounting to as much as 50 per cent and frequently taking place within ten minutes, no further recovery being noted in as much as forty-four days.

The wide variations in performance indicate a possible explanation of the differences in results obtained by practitioners.

The tendency to elastic recovery cast doubt on the efficacy of the flow test alone as a measure of the material's fitness for dental use.

The coefficient of restitution of different materials of known value is being measured to see if there is any relationship between this property and performance.

Inheritance of Tooth Form and Number in a Cross Between the Goldfish and the Carp

RAYMOND C. OSBURN, Ph.D.
Department of Zoology and Entomology, Ohio State University, Columbus

The Goldfish (Carassius auratus) and Carp (Cyprinus carpio) breed together in the shallow waters of western Lake Erie, producing numerous natural hybrids. The hybrid between these two genera is easily distinguished by a number of external characters, as well as by the differences in form and number of the pharyngeal teeth.

The carp has a dental formula of 1, 1, 3 — 3, 1, 1, the first tooth in the main row bunodont, the others all low, broad and cross-grooved, resembling in miniature those of the elephant. The goldfish has only the main row (formula 4 — 4), the first tooth bunodont, the others all transversely compressed, without cross-ridges and all taller than those of the carp.

The hybrid has the total number of teeth of both parents (formula 1, 1, 4 — 4, 1, 1), so the number in the main row is like the goldfish (4), the number of rows the same as in the carp (3), the first of the main row is bunodont while the others are all tall and compressed but less so than in the goldfish, and all have the simple crown pattern of the goldfish.

The Health Hazard of Decaying Teeth in Children

JOHN OPPIE McCALL, D.D.S., and GEORGE H. CHAPMAN
New York City

A joint study was undertaken by the Guggenheim Dental Clinic and the Clinical Research Laboratory of New York to determine certain phases of dental infection not heretofore reported. The study, which is still incomplete, is reported in two parts, the clinical and the bacteriological.

I. Clinical Aspects

JOHN OPPIE McCALL, D.D.S.
Director, The Murry and Leonie Guggenheim Dental Clinic
422 E. 72nd Street, New York City

The purpose of the study was to determine not merely the presence of infection in decaying or carious teeth but to find out whether or not there were bacteria of marked potential pathogenicity in these teeth and if so their numbers and their proportions to the non-pathogens. This has importance for two reasons. If carious teeth of children not suffering from frank focal infection disease harbor any considerable number of probably highly pathogenic bacteria, they constitute a serious health hazard. If this hazard exists with any uniformity in the mouths of children, the importance of a preventive and protective dental program for this age group is clearly proven.

The magnitude of the problem is indicated by the findings at the Clinic that 98 to 99 per cent of children in the group served develop dental caries early in their school life.

The teeth studied were those extracted for children attending the Clinic which were considered unsaveable by the placing of routine fillings; they included vital as well as non-vital teeth, with and without X-ray abnormality. Infection was found uniformly where vital pulps were involved by caries, as well as in the non-vital cases. In the former case, however, apical cultures were usually negative even when periapical alteration was disclosed by the X-ray.

II. Bacteriologic Aspects

GEORGE H. CHAPMAN
Director, Clinical Research Laboratory, 604 Fifth Avenue, New York City

The total number and proportion of streptococcal variants that were resistant to 1:125,000 hexylresorcinol for two hours were calculated for crown and root sections of extracted teeth. Although there was general agreement between clinical classification and bacteriologic findings individual teeth sometimes showed marked discrepancies. However, when the tooth sections were classified according to the amount and intensity of necrotic or discolored material there was close agreement with bacteriologic findings. Teeth with much necrotic material showed large numbers and proportions of resistant (toxigenic) streptococci and frequently contained colon bacilli and N. catarrhalis, etc., while apparently normal teeth showed mostly small numbers of nonresistant streptococci. Many roentgen positive teeth showed much necrotic coronal material but little evidence of apical infection. This suggested that the source of apical soft tissue damage might have been the necrotic pulp rather than the mild apical infection. Such carious teeth often contained more resistant (toxigenic) streptococci than are found in other parts of the body. Hence, a carious teeth may be a major health hazard.

Anthropological Studies in Dental Caries

MEYER KLATSKY, D.D.S.
401 Broadway, New York, N. Y.
JACK S. KLATELL, B.S., D.D.S.
Sea View Hospital, Staten Island, N. Y.

The object of this study was to investigate the comparative incidence of dental caries among various peoples, ancient and modern, primitive and civilized. Four thousand skulls and their 37,000 teeth were examined at the anthropological section of the American Museum of Natural History, New York. These skulls were collected from all parts of the globe, and represent different racial, national and territorial groups and all ages. The collections are arranged geographically. The major part of forty-six of these geographical groups was examined. The number of teeth in each group was counted, and each tooth was carefully checked for caries. Of the forty-six geographical groups, the following six showed no caries: Eskimo, British Columbia, Chatham Island, Hawaii, Siberia, and Patagonia. All the other groups showed various degrees of caries, ranging from 0.3 per cent in the New Guinea group to 34 per cent in the Yugo-Slav group. Ancient and primitive peoples showed a low incidence of caries, the percentage rising in the modern and civilized groups. These groups with a lower caries index possessed well developed jaw bones, with full bony ridges and prominences for the attachment of the masticatory musculature. Their teeth were worn and flattened by attrition. These are both evidences of complete masticatory function. And there seems to be an inverse relation between masticatory function and the incidence of dental caries.

Periodontal Disease as a Possible Focus of Infection

SAMUEL CHARLES MILLER, D.D.S.
New York University College of Dentistry
LOUIS R. BURMAN, Ph.G., B.S., A.M.· D.D.S.
New York University College of Dentistry

Although bacteria play an insignificant role in the etiology of periodontal disease, the bacterial contamination may be a potent creator of local and distant disturbances. The danger to health and life possible through focal infection or through extension of periodontal inflammation into contiguous and underlying tissues must be considered of much greater importance than periapical areas because: a. Periodontal disease involves a much larger zone than a periapical abcess, considering the total surface area of the walls of all of the pockets. b. Absorption from the gingival sulcus is more rapid, since the blood and lymph supply to the gingivae is much greater than to a periapical area in bone. c. Resistance to bacterial growth is lower in the gingival sulcus than anywhere else in the oral cavity.

Infection from the periodontal tissues may spread as follows:

1. Through the blood stream.
2. Through the lymph channel.
3. By direct extension within the tissues.
4. By ingestion and aspiration into the gastrointestinal and pulmonary tracts.

Pericoronal infection, both acute and chronic, must be given serious thought because of the danger to life and the more frequent possibility of systemic disturbances caused by such areas. Examples of fatal sequellae of acute pericoronitis are given, as well as instances of the relief of focal infection disease by eradication of these foci. The bacterial considerations are discussed and the manner in which secondary foci are induced is amply presented. The mechanism of chewing in forcing infection into the tissues and the danger of extraction of teeth with periodontal involvement is given consideration. Tests for periodontal foci and the methods of combating such reactions are discussed.

Statistical evidence from the New York University Periodontia clinic and case samples are provided.

Combination of Blood Sedimentation Tests with Short Wave Irradiation as an Effective Laboratory Aid for Diagnosis of Active Oral Foci

JAMES L. ZEMSKY, D.D.S.
Bronx Hospital, New York City

Blood sedimentation tests have been occasionally employed in dentistry for the purpose of determining presence of dental foci of infection. By this method it is possible to show definitely that the patient has infection in his body, but it does not indicate where that focus is. For this reason the scope of application of this procedure is rather limited in the practice of dentistry and consequently of little practical value.

Short wave irradiation is used as a provocative agent, serving as a diagnostic aid in medicine and presence of foci of infection is discovered.

However, the same difficulty is encountered here as in case of the sedimentation tests; it fails to isolate or localize the focus of infection, and therefore this method of diagnosis of oral foci of infection is of questionable importance in connection with dental practice.

At this time, when there exists such a great divergence of opinion of the importance of dental foci in their relation to systemic disease, the lack of adequate diagnostic means is deplorable. This seemingly hopeless situation can be corrected by the employment of a combined method of investigation, i. e., using short wave irradiation for the purpose of activating a *certain definite focus*, and then observing the effect produced by resorting to the sedimentation test. A positive reaction is indicative of the presence of an active focus, while a negative result proves that the area irradiated is not an active focus. The evidence offered by a number of case reports appears to be strongly convincing.

Vitamin A and Estrogen Interrelationship. Effect on the Gingivae of Monkeys of Large Doses of Vitamin A: The Ameliorating Effect of the Estrogenic Hormone

A Preliminary Report by

DANIEL E. ZISKIN, D.D.S., and
SOLOMON N. ROSENSTEIN, B.S., D.D.S.

School of Dental and Oral Surgery, Columbia University, New York

Pre-experimental gingival biopsy on a sub-adult macacus rhesus female monkey was followed by daily intramuscular injections of 10,000 I.U. of Vitamin A for one month. Another gingival biopsy was taken followed by daily intramuscular injections for one month of combined solution of 10,000 I.U. of Vitamin A and 1,000 rat units of estrogenic hormone. Final biopsies were then taken. Findings after administration of Vitamin A indicated tissue degeneration characterized by: a keratin layer, thinner than the normal and of inferior quality, with easy separation of the keratin layers; increased edema in the epithelium and corium; fewer basal cells, with increase in number of mitotic figures; presence of many fibreblasts in the corium with few fibrocytes. Following combined administration of Vitamin A and estrogenic hormone, the findings showed amelioration of the high Vitamin A effect and generalized hyperplasia resulting in a thicker keratin layer, increased basal cell production, and greater number of mature connective tissue cells. There was improvement in the quality of the keratin and a reduction of intercellular edema. These changes are characteristic of long-term estrogenic hormone therapy.

Chronic Desquamative Gingivitis

DANIEL E. ZISKIN, D.D.S., and
EDWARD V. ZEGARELLI, A.B., D.D.S.
School of Dental and Oral Surgery, Columbia University, New York

A clinical and histo-pathological report of chronic desquamative gingivitis in nine females and two males, ages twenty-two to fifty-five. Lesions were found on the alveolar, palatal and edentulous gingivae, presenting raw, beefy red and glistening surfaces with tendency to easy bleeding. In some, the surface epithelium was absent, in others it could be easily stripped off, while in still others, vesicular blebs were present which would rupture, leaving raw surfaces. Etiology is unknown. Hypothyroidism appeared concomitantly in several cases suggesting a relationship. Complaints are intermittent burning sensations and pain. Duration was one to eight years. Preliminary work-up consisted of X-rays, study models, gingival biopsy, medical and dental histories and physical examination. Treatment was as follows: sex hormones, according to sex, were applied topically in the form of an ointment. Testosterone propionate in males and Progynon-DH in females. Three or four applications of thirty minutes to one hour each were given weekly for two to three months supplemented by some treatments which consisted of "buttering" the hormone on the gums. Following this treatment period, frequency of applications was reduced. Treatment periods were about two years. Observations, in a few, extended over a period of six years. No other forms of treatment were permitted. All cases benefited. Some cases were relieved completely of all symptoms with regeneration of new epithelial surfaces, seen clinically and microscopically. With cessation of treatment there is a tendency for the desquamation to recur so that intermittent periods of treatment must be maintained.

Mouth Conditions Observed in Rats Fed Toxic Amounts of Zinc Carbonate

DANIEL E. ZISKIN, D.D.S., PAUL GROSS, M.D., GEORGE STEIN,, M.D., D.D.S., and ELEANOR M. KAPP, A.B., M.Sc.
Columbia University, New York City

The heads of a series of rats which were fed a synthetic diet containing 0.8 per cent zinc as zinc carbonate were examined and compared with litter controls. Pantothenic acid was fed in suboptimal levels in both groups. Symptoms resembling a vitamin deficiency developed in animals fed the zinc carbonate but not in the controls. This consisted of a reduction of growth (as measured by weight), alopecia, caked whiskers, and spectacled eye condition. The prominent findings in the mouth were ulcers on the tongue and cheeks and a whitish film, consisting mostly of bacteria, on the lower incisors. The ulcers had sharp margins and were covered with a yellowish grey slough. The microscopic picture was characterized by faintly staining cells filled with a fine granular cytoplasm. Inflammatory exudate and hyperemia were absent in the regions surrounding the ulcers. Almost all animals fed the zinc diets showed these changes. Of three who did not, two died early in the experiment. Independent experiments by one of us (P. G.) showed that the zinic, in toxic doses, precipitates the deficiency syndrome by interfering with the function of the pantothenic acid—inositol mechanism.

EDITORIALS

To Win or Not to Win

We are in a war. And we must win. But there is another phase of this war and we must win that, too. This is the peace. In order to win the war all our physical strength of whatsoever nature must be thrown into the effort—that might not seem great but we know that it is and we know we are going to stay with it until we do win. But the other side of the situation, the peace, may be the harder. One sometimes wonders if we are laying our plans properly to win the peace. We don't need ships and guns to win the peace but we need ideas, ideals, and vision. When we look at what is being done at the present time, namely, the allocation of everything to develop our physical force, including the elimination of so much of the cultural and spiritual side of life, one cannot but develop fear of losing the other side or of losing the peace.

There is great danger in allowing the military to gain full control—we must not lose sight of the fact that our peace must be built solidly, which means that we must have full understanding of our arts and sciences, cultural, and further, that we must have complete knowledge of the spiritual side of life. We cannot win the war simply by crushing the other side. Although this must be done, yet after that is done we must work to build up educationally and spiritually so that the world will really have something to point toward.

In the *American Scholar*, Vol. 12, No. 2, Spring, 1943, there is an editorial by Nason which should be read by every educator and everyone interested in the solution of the problem ahead of us.

In this same issue there are also two articles, one by Wilkie and one by Dean Gauss of Princeton,—one has been referred to as a challenge and the other as a charter. These should be taken seriously.

It is said that a medical, dental, engineering and physics student will be allowed to complete his course, though at the same time it is these same students who will be taken over by the military.

While we must train, of course, for military purposes we should also recognize that a little more time spent in training for civilian purposes will mean more in the long run. Unfortunately, specialists see but one thing,—that is their job. The old saying that a specialist is one who sees more and more about less and less is true, so in this case. Therefore, in these times we shouldn't let the military run away with us. We must recognize the big job ahead to be done. God is in his Heaven, and while all is not well with the world, yet He has men prepared in the spiritual, in the educational and in the military fields to handle matters that have to be handled. Let us be careful that we take all of this into consideration.

A Little Matter of Percentages

It would be difficult to find a flaw in the inspiring article, "Dentistry Takes the Initiative," on page 400 of the December, 1942, issue of this Journal except that, as it seems to us, the author, Dr. Albert L. Midgley, rather overemphasizes the public's concern over the findings of the draft boards. In this connection he says: "The dental deficiencies revealed by the draft boards of the two World Wars have created astonishment and dismay in the public mind". . . . Now if this statement is correct then all we can say is that the section of the public with which we come in contact is most successful in concealing its emotions. Furthermore, apart from comments emanating from the profession, social workers and other interested sources, we have failed to notice any real, tangible evidence of such public interest reflected in the public press, which would certainly be the case if this interest had reached any sizable proportions.

As to the "dental deficiencies revealed by draft boards," we do not believe that these are always as black as they are painted. For example, the *New York Journal of Dentistry* for January, 1943, published an editorial from which we quote: "The Dental Corps of the United States Army increased from a mere 231 men in 1941 to almost 10,000 in 1942. This is the answer to the findings of the Selective Service that 20.9 per cent of selectees had to be rejected because of dental defects." In response to an inquiry as to the source of his information the editor's answer was to the effect that he had seen these figures quoted in a number of publications.

That this protest may not be regarded as just another instance where "everyone is out of step but Jimmie," we present authentic data to show that, in the above case at least, the report of rejections for dental defects is grossly exaggerated. Here are the facts from *Medical Statistics Bulletin*, No. 1, issued by Selective Service Headquarters and dated November 10, 1941. We quote:

"Summary reports from local boards and a sample analysis of reports of examinations by Selective Service Boards and army induction stations indicate that about 50 per cent of the approximately two million registrants who have been examined have been found to be unqualified for general military service. Of the approximately one million registrants who were not qualified for general military service, 900,000 were so classified because of physical and mental defects and 100,000 because of lack of educational qualifications.

"Based on the major defect or principal cause of rejection, dental defects account for an estimated 188,000 or 20.9 per cent of the 900,000 registrants not qualified for general military service."

From this authoritative report it will be seen that, of the two million *selectees* examined, 188,000 or a trifle less than 10 per cent were rejected because of dental defects. Nor is it too much to assume that rejections for purely dental defects were even less than that. As every practitioner knows, dental defects often run concurrently with mental and many physical defects, and it is not only possible but quite probable that many of those rejected, ostensibly because of dental defects, would have been rejected anyway, even had their dental equipment been satisfactory.—*C. F. H.*

Professional Spirit

What is this thing that binds professional men together; that urges them to conduct themselves in a disciplined manner? It is the *professional spirit*. And how does the professional spirit manifest itself? Elting E. Morison, in his "Admiral Sims and the Modern American Navy" made this impressive statement:[1]

" 'And I,' William Schwenk Gillbert's Lord Chancellor assured the peers, 'embody the law.' It was an arrogant and incorrect assumption shared by

[1]Admiral Sims and the Modern American Navy: By Elting E. Morison; page 463 (Houghton Mifflin Company, Boston, 1942).

many of his predecessors. No man can embody any profession. Though it may be possible, as Oliver Wendell Holmes asserted, to live greatly in the law as elsewhere, still it is only possible to live there as a lawyer. Personalities, however great, however free, must, in a profession, find themselves bound to the accepted standards, restricted within the limits of special knowledge. What religion was to the schoolman a profession is to its practitioner. Both give direction to the mind, both provide controls for the emotions, both minister to the spirit, and both hold the searching energies of the devotee within the iron grasp of doctrine. In its highest manifestations the professional spirit makes the good man better than he is and holds the best men in heroic bondage."

Thus we see that the professional spirit has its limitations as well as its accomplishments. Yet there is no substitute for the professional spirit. No "ersatz" makeshift that appears to harmonize with new social concepts will do, unless the proposed changes are on a higher plane than the present. The professional spirit has been hundreds of years in developing and will not be downed in a day, a month, a year, a decade, or a lifetime—*G. C. P.*

Fluorine and Dental Health

Much has been written within recent months concerning Fluorine and Dental Health. In fact, a considerable amount has been collected and put in book form by the American Association for the Advancement of Science, being headed by H. T. Dean and Paul C. Kitchin, Publication Committee.

No single subject in dentistry requires so universal attention from dentists as does caries, or decay of the teeth. Much research is being carried on relative to this condition, none the least of which is the possible relationship of fluorine. It would be well for the members of the profession to advise themselves generally on this important subject. This book, informational in character and published by an association having no material object other than the advancement of knowledge should demand wide reading. The office of the association is in the Smithsonian Institution, Washington, D. C., through which office much information is available to members of our profession at reasonable expense.

"You've Got to Go by What They Do"

I like to call on dentists. Every now and then one will take me into his operating room, introduce me to his patient and show me the work which he is doing. If there is no patient, we go into the laboratory and see some of the cases he is carrying through. Without exception this man is a skillful operator and is proud of his work, and justly so, but he isn't complacent or self-satisfied. He wants to know what you're doing—what criticisms or suggestions you may have to offer. He never boasts about his practice—that is self-evident from the condition of his office, from the good taste of its appointments, its general orderliness and cleanness, and from the host of case histories and models that bulge the files and cabinets. He is the backbone of American dentistry. He is the fellow who makes me proud that I too am a dentist.—*G. C. P.*

Rear Admiral in the Navy

Dentistry is coming rapidly into its own. For some time we have had proper recognition in the Army, but now, with the appointment of Alexander Gordon Lyle as Rear Admiral in the Navy, D. C., we are given that recognition which is our just due. We must see to it that dentistry as a profession really merits all of these duties which are coming to us.

CORRESPONDENCE AND COMMENT

Was John Harris "the Founder of American Dental Education?" (continued)[1]

I. ARE THE CLAIMS RELATIVE TO JOHN HARRIS AND BAINBRIDGE, OHIO, IN PRIORITY OF DENTAL EDUCATION, DUBIOUS?

EDWARD C. MILLS, D.D.S.
Columbus, Ohio

On pages 333-36 of the issue of this Journal for September, 1942, reference is made to Dr. J. Ben Robinson's examination of the claims of Bainbridge, Ohio, to priority in dental education, published in the *Den. Items Int.* (Feb. 1941). A rebuttal of this attempt to refute all evidence establishing claims for Bainbridge was published in the issue of the same publication for June, 1941. To these two issues, together with those for March, 1932, and July, 1941, of the *J. Am. Den. Assoc.*, we would respectfully refer those who have more than a casual interest in this controversy, out of which the truth must eventually develop. Quoting Dr. Robinson in these articles:

> "John Harris lived during the trying period from 1839 to 1849 when dentistry was experiencing the gigantic task of establishing firmly its literature, its system of institutional education and its permanent organization; this was his opportunity to exercise those unusual qualities of leadership and that well-defined professional instinct claimed by his friends. *But through this trying period he demonstrated no initiative and made no effort in support of these fundamental movements.*"

This comment seems grossly unwarranted in the face of the facts recorded in contemporaneous literature, written by men who had no motive other than that of contributing something to the history of their profession, and especially since the veracity of their statements has remained unchallenged for almost a century. We cite the following: Dr. James Taylor, editor of the *Dental Register*, published the obituary of John Harris, as it appeared in the *American*

[1]The original allusion to this subject was published on pages 333-36 of the issue of this *Journal* for September, 1942.

Journal of Dental Science (Vol. 9, pp. 383-85, 1848-49), in the *Dental Register* (Vol. 3, pp. 49-52, 1849-50), with this comment:

"In giving space to the following obituary notice of Dr. John Harris, we feel compelled from a sense of justice to the memory of one we knew so well, to add a few remarks. We first knew Dr. Harris in 1825, shortly after his location in Bainbridge, at which time we entered his office as a student of medicine, and from a long and intimate acquaintance with the medical profession, we must say that we know of none better calculated to advance a student in his studies. The success of his practice in medicine was the result of his thorough knowledge of his profession, and we have always thought had he devoted himself exclusively to the practice of medicine and general surgery, that he would have soon enjoyed an enviable reputation. His attention was, however, turned more especially to the specialty of Dentistry, and our profession might date much of its present advancement to his unwearied zeal."

In a letter dated September 8, 1849 (*Ohio State Den. Soc. Bul.*, Vol. I, No. 3), Dr. Harris' brother, Chapin A., who studied medicine with him at Madison, and dentistry at Bainbridge, referred to him in terms of affection, saying: "In his death science has lost a friend."

As per Dr. Harris' announcement in the *Ohio State Journal and Columbus Gazette* (Oct. 14, 1830), he had "been a practitioner for more than ten years and devoted more than half his time to the theory and practice of dentistry." Here is evidence that he began practice of dentistry as early as 1820, while in Madison, Ohio.

He conducted his school of medical instruction in Bainbridge, between the years 1825 and 1830, having among his students Chapin A. Harris[2] and James Taylor,[3] destined to become the founders of the first two dental colleges in the world; also others who attained prominence in the dental profession.

Dr. Harris removed to Chillicothe in May, 1830. He was living there in 1833; his daughter, Amanda, died there in October of that year.

[2]New light on dental history: L. Parmly Brown, *Den. Cos.*, *62*, 936-958; 1920.

[3]Dental education in Ohio, 1838-58: Edward C. Mills, *Quarterly of Ohio State Archaeological and Historical Society*, *51*, 294-312; 1942.

While practicing in Georgetown, Ky., in 1841, Dr. Cyrenius O. Cone (b. 1820, d. 1858) was associated with him for one year (1845), when he (Cone) returned to Baltimore. Cone was the author of Dr. Harris' obituary in the *American Journal of Dental Science* (Apr. 1850, page 210) and the *Dental Register of the West* (1849-50, pp. 49-52) and, having been associated with Dr. Harris in Georgetown, was no doubt familiar with his activities. Quoting from the obituary:

"He (Dr. Harris) made an effort in 1836 to obtain a charter for a dental college in Kentucky . . . and although this effort to secure legislative privileges for educating the dentist was unsuccessful, still it is worthy of remembrance as being the *first effort* in this country to establish an institution of this kind, with means for teaching, and powers for graduating for practice, the dental student."

"In the year 1835-36 he prepared a series of articles which were published in the *Kentucky Commonwealth*, explanatory of the dentist's professional requirements."

"During the winter of 1835-36, in compliance with a request of the Faculty and Students of the Medical Department of the Transylvania University, Dr. Harris delivered a course of dental lectures before the medical class of that institution. These lectures, probably, are marked as the first successful effort at a systematic course of teaching dental surgery in the west, if not in the United States."

Dr. Taylor must have been familiar with these facts as related by Dr. Cone, as he republished the obituary without any changes. However, it is quite obvious that the exact year of the effort to secure a charter for a dental college was not definitely recollected by Dr. Cone, as shown by the following (quoting from Dr. L. Parmly Brown):

"I have had a search made at Frankfort, the capital of Kentucky, the only result being the discovery of four official records of 'A Bill to Incorporate the College of Dental Surgeons of Kentucky' without mention of the applicants for the charter. (Journal of the Senate for the session of the Legislature of 1838-1839.) This Bill was introduced January 17, 1839; reported January 25; ordered engrossed January 31; and, with others, had a third reading February 1, when it was 'Resolved that the said bills do pass, and that the titles thereof be as aforesaid' (pp. 149, 191, 217, 232). As there is no further record relating to the bill for the dental college, the obituary appears to be correct in stating that the effort to obtain the charter was unsuccessful. . . . There can be no reasonable doubt but that John Harris was one of the applicants for the Kentucky charter, which seems to give him his chief claim to a place in the history of dentistry." (*J. Am. Den. Assoc.*, *19*, 1412; 1932.)

A letter from Dr. R. L. Sprau, of Louisville, Ky., under date of January 5, 1943, who was formerly Secretary of the Kentucky Board of Dental Examiners, states:

"Possibly the first mention of dentistry in the Kentucky Legislature occurred February 10, 1836. On this date there was introduced in the Senate, a Bill: 'To regulate the practice of Dental Surgery in the State of Kentucky.' The 1835-36 Senate Journal (page 294) gives the following: 'On motion of Mr. (Aaron K.) Wooley, leave was given to bring in the following bills, viz.: ". . . and a bill to regulate the practice of Dental Surgery in Kentucky." . . . and the Committee of Courts of Justice was directed to prepare and bring in the latter (Dental Surgery) bill.'

"A close review of both the Senate and House Journals between February 10, 1836 (page 294), when the bill was introduced, and February 26, 1836 page 403) when the committee was discharged, shows no record of the bill. On this date, February 26, 1836, the following action is recorded: 'On the motion of Mr. Guthrie, the Committee of Courts of Justice were discharged from further consideration of all the business referred to them, except . . . (two bills are mentioned, neither of which was the dental bill).'"

Dr. Sprau stated that it is not mentioned who is responsible for introducing the bill, but we do know that Dr. Harris was living in Frankfort at the time. No doubt the confusion of dates may be accounted for in mistaking the date to "regulate the practice of dentistry (1836)" with the "bill 'to secure a charter for a dental college' (1839)."

It may be of interest to note that the Transylvania School of Dental Surgery was chartered by Act of the Kentucky Legislature, March 7, 1850. (Laws of Ky. 1849-50, p. 648, Chap. 531.) This was the third dental college in the world.

"During the trying period from 1839-1849" Dr. Harris became a charter member of the American Society of Dental Surgeons, and was one of twelve members selected to prepare essays on special subjects "for the benefit of the profession." The subject assigned to Dr. Harris, "On the Utility of Filing Teeth," was published in the *American Journal of Dental Science* (Vol. 5, pp. 42-48, 1844-45). The article was used in its entirety in the second and in several succeeding editions of "Harris' (Chapin A.) Principles and Practice of Dental Surgery."

While practicing at Annapolis, Md., in 1845, a letter by Dr. John Harris on the subject, "Is the Negro Subject to Hare-lip?," was published in the *American Journal of Dental Science* (Vol. 6, p. 58, 1845-46); also "Removal of a Drill-head from the Cavity of a Tooth by Means of a Magnet," *Ibid.* (Vol. 6, pp. 87-88, 1845-46).

At the Sixth Annual Meeting of the American Society of Dental Surgeons, August 5, 1845, Dr. Harris, with many others, went on record as disapproving the use of amalgam. At this meeting he read a paper, the subject of which had previously been assigned to him, viz.: "Toothache." This was published in the *American Journal of Dental Science* (Vol. 6, pp. 100-110, 1845-46). In this paper he advocated the removal of teeth where devitalization was necessary, saying in part:

> "The proper treatment, therefore, is—in the majority of cases—the removal of the diseased organ . . . and so many dentists substitute their treatment, which at least is inefficient and subjects the unfortunate sufferer to a train of evils far greater than toothache. . . . Cures have been speedily and permanently effected by the removal of diseased teeth, even where they have not been productive of pain or suspected as the cause of mischief. Many cases have fallen under my own observation."

A paper on "Observations on the Evils Resulting from Premature Application of Artificial Teeth on Plate, with Clasps, Obturators, Palates, etc.," by John Harris, M.D., late of Georgetown, Ky., was published in the *American Journal of Dental Science* (Vol. 6, pp. 282-291, 1845-46). In this article appeared a copy of a letter under date of July 28, 1845, from Annapolis, Md., at the solicitation of his brother, Chapin A. Harris, giving a description of an artificial nose and palate made by him (John Harris) for a young lady in

Scott County, Ky., in 1841. A description of this case was used by Chapin A. Harris in his edition of Fox's Natural History and Diseases of the Human Teeth, in 1846.

Dr. Harris died at Hertford, N. C., on July 26, 1849, to which place he had made itinerant trips while living at Frederick, Md. Even though a stranger, the Masonic Lodge gave him a Masonic funeral and wore a badge of mourning for thirty days as a tribute of respect to him. This was indeed a high honor.

The following are a few early references to the Drs. Harris and others at Bainbridge:

Dr. J. Taft, in an obituary of Dr. Edward Taylor: "Born near Bainbridge, Ross County, Ohio, which place might properly be called the starting point of the following pioneers of the profession in the Mississippi Valley; Drs. John, James, and Chapin A. Harris; Dr. Jones, formerly of Dayton, Ohio; Dr. Wampler of Illinois; Dr. Church of Baltimore; Drs. Joseph, James, and Irwin Taylor." (*Dental Register*, Vol. 22, p. 91, Feb. 1868.)

Dr. George Watt, in a biographical sketch of James Taylor: ". . . and this quiet country locality might well be called the birthplace of American Dentistry . . . a free exchange of opinions showed that Drs. Chapin Harris and James Taylor held identical opinions as to the necessity of a thorough professional education for the dentist." (*Ohio Journal of Dental Science*, Vol. 7, pp. 5-6, 1887.)

Dr. George Watt, in a biographical sketch of Chapin A. Harris: "Drs. Harris and Taylor at their meeting in Bainbridge discussed fully the demands of the dental organs and the necessity for thoroughly educated specialists, who should give their entire professional attention to these organs or their collaterals: . . . Had these two men not met, it is doubtful if the world would yet have seen a dental college." (*Ohio Journal of Dental Science*, Vol. 7, p. 250, 1887.)

John Harris' announcement of "Medical Instruction," in the *Supporter and Gazette* (Chillicothe, Ohio, Nov. 1, 1827); of "Surgical Instruments" in the same paper on February 21, 1828.

Unclaimed letters at the postoffice in Bainbridge, Ohio, advertised in the *Ohioan and Chillicothe Advertiser* (July 7, 1829-Oct. 13, 1829).

It has been offered as evidence that John Harris did not lecture on dentistry at the Transylvania University Medical School, session of 1835-36, "because his name appears among the list of medical students for that term." Having had practical experience as a dentist since 1820 (some sixteen years) he was fully qualified to lecture on dentistry, as stated by Dr. Cone in his obituary of Dr. Harris. He was enrolled among the students as "John Harris, M.D., Chillicothe, Ohio." The fact that he enrolled as a student, after practicing medicine previous to 1819, and medicine and dentistry as late as 1829-30, having been a member of the Tenth Medical Society in 1828 and 1829—cannot but increase our respect and admiration for the man in taking a "refresher course" to keep abreast of medical progress, a very popular custom in recent years. In evidence of his activity and the diversity of his qualifications as a practitioner, we quote from an announcement published seven years prior to his matriculation at the Transylvania Medical University, in the *Scioto Gazette* (Chillicothe, Ohio, June 3, 1829) which appeared until September 8 of the same year:

"Dr. John Harris has just returned from the south . . . is furnished with an extensive assortment of medicine, including most of the rare articles not often kept by physicians in country towns, also a special supply of dental and surgical instruments, including a stomach pump for removing poisons, etc., from the stomach, instruments for performing all the various operations consequent on diseases of the eye; trephining, amputating, etc. Dr. Harris has performed a number of operations of a dental character . . . and from the success attending them, we confidently believe he will be able to set artificial teeth and treat all diseases of the teeth and gums in a manner not to be surpassed in the western country. Surgical operations will be performed on indigent persons gratuitously, if brought to town. His residence and shop is on the west end of Main Street, Bainbridge."

The latter portion of this announcement indicates his charitable disposition to those in need, and designates the property bought in recent years by the Ohio State Dental Society, which has been dedicated as a "Shrine to Dentistry."

This résumé of at least a part of the activities of Dr. John Harris certainly discloses to an unprejudiced mind that Dr. Harris did demonstrate a considerable *influence* on his colleagues, and did show undeniable *initiative* during the so-called "trying period—1839-1849."

"For thus such reverence is lent
To well-established precedent."

II. WAS JOHN HARRIS AT TRANSYLVANIA UNIVERSITY DURING 1836?

B. W. WEINBERGER, D.D.S.
New York City

The issue of this JOURNAL for September, 1942, on pages 334-36, directs notice to the fact that Dr. J. Ben Robinson claims I have intentionally withheld information and that "this is a typical illustration of how far Weinberger can be trusted to deal with the truth." My reading of Mrs. Norton's letter to Dr. Eskin fails to convey the interpretation that Dr. Robinson has placed upon it and the conclusions reached thereby as stated on page 336: "Weinberger, according to Mrs. Norton's statement, had explored this source of information. Did he fail to explore the source thoroughly, as he insists should be done in the interest of accuracy; or, having explored the source thoroughly, did he withhold vital information which, if known, would have been fatal to his 'pet theory?' In either case his unreliability as a writer of dental history is clearly exposed." I will confine my remarks to Dr. Robinson's endeavor to undermine my historical writings.

In "The Foundations of Professional Dentistry," Dr. Robinson stated in a footnote on pages 1011-12:

"Claims have been made that John Harris was a preceptor to many prominent dentists of this period; his supporters have gone to the extent of claiming that he operated a dental school in Bainbridge, Ohio. A careful study of the evidence leads to the conclusion that the school merely offered instruction in premedical courses for those who were planning later to enter medical college. There is no evidence that any interest was taken, or instruction offered, in dentistry. Little is known of Harris' dental students. James Taylor studied medicine at Bainbridge and later in conjunction with John Harris took up the study and practice of dentistry. It is also claimed that John Harris lectured on dentistry at Transylvania University, School of Medicine, in 1835-36. The Registrar of Transylvania University reports that John Harris was enrolled there in 1835-36 as an undergraduate medical student. It is hardly possible that the University would arrange a course of lectures and invite a member of its student body to assume the responsibility of instructing in it. There is nothing in dental history to show that John Harris exercised any influence on the progress of either the science or the art of dentistry."

Exception was taken to the whole statement. Dr. John Harris' position in dentistry has been considered by Drs. E. C. Mills, L. P. Anthony, Harry Bear, Arthur H. Merritt, F. C. Waite, and others. My own opinion is recorded in the *Journal of the American Dental Association*, July, 1941, pages 1181-88, and I will not answer these at this time.

The fact that John Harris was a student there had not previously been known, and there was no supporting evidence of this in our literature at the time the statement was printed in 1940. It was therefore Dr. Robinson who presented the "new evidence" theretofore unknown to those interested in John Harris, and not I, as he endeavors to infer in italic on page 334. The information as to John M. Harris was not "new evidence" that might add to John Harris' position in dentistry but, as will be explained later, an attempt to correct an apparent confusion of individuals.

From the comment on pages 334-36 one is not made aware of the fact that the printed portion was but the closing argument of an attempted reply by Dr. Robinson in the March, 1942, number of the *Bulletin of the History of Medicine*, pages 356-67, to an article of mine in the same issue. I had had an understanding with the editor that the courtesy be accorded to Dr. Robinson to reply, if he so desired. Instead of answering the errors enumerated, Dr. Robinson devoted the space to a personal abuse and a revolting tirade of insinuations, ending with what he presumed would be a fitting climax, the part quoted on pages 334-36.

The letter of Mrs. Norton to Dr. Eskin has been purposely misinterpreted in order to arrive at the deductions made and in an endeavor to place me in an embarrassing position, but does it? Mrs. Norton's letter now bears the date of August 11, 1941, which was lacking in the original publication of the reply, and should be carefully reread, for one finds the following clearly stated: "In 1929 I had an extended correspondence with Dr. B. W. Weinberger about Dr. John Harris, dentist. . . . *It did not occur to me then, I believe, to look for Dr. Harris' name in the matriculation lists of students*" (italic not in original). There his name appears *John*

Harris, M.D., 1835-36, Chillicothe, Ohio." Mrs. Norton clearly and definitely states that the correspondence took place in 1929, and at that time, she believed, it did not occur to her to examine the matriculation lists. Not having had further correspondence with her from 1929 until 1942, how then did I possess this information that Dr. Robinson now emphasizes I withheld? It might be of interest to find out the exact date that Mrs. Norton located the matriculation book and to whom she conveyed that information. From Dr. Robinson's statement on page 335 we learn that he himself was not aware of it until the "following astonishing reply" was received. Not until his answer was received and in print was I therefore acquainted with the fact that such a list existed, a fact that can be ascertained from her.

In March of 1942 I again communicated with Mrs. Norton and she kindly furnished me with a photographic copy from the "manuscript matriculation book." I was also informed by her that the University did not have the printed "Catalogue" of 1836, and therefore could not answer certain questions that were important in this case and which I will relate later. I found further discrepancies when I compared the manuscript list and the printed catalogue. I do not know if the "manuscript matriculation list" is the original or a copy made at a later date, for all the information, names, places of residence and preceptors appear in the same handwriting, although it was customary in those days for each student to sign such lists in person. Whether that was the procedure at Transylvania University can be ascertained. It therefore becomes necessary for one to decide first, which of the two is the more dependable: the unpublished, written record in one handwriting; or the published catalogue, printed by the University in January, 1836—one of them is in error. The latter has been my source of information and I must assume that, being a University publication, it is correct, accurate and authentic. This "Catalogue of the Officers and Students of Transylvania University," 1835-1836, contains only the name of one John Harris, a student with a middle initial "M" and whose preceptor was Charles J. Walker, page 6. He, however, was a resident of Richmond, Ky.; therefore I reported the fact, and in the *Journal of the American Dental Association,* July, 1941, page 1187, remarked "can he (John M. Harris) and John Harris of Bainbridge, be the same individual, or is it a case of mistaken identity?" This has been reported on page 334. This was not "new evidence" as anyone can readily see. The matriculation list now shows I was in error, but am I incorrect? Let us turn to page 12 of the "Catalogue" and under the listed Ohio students there is to be found the following name: T. Harris, M.D., Chillicothe, minus the name of a preceptor. Here is one of the discrepancies previously mentioned. Was the "T" a misprint for "J" and is he the same John Harris listed in the matriculation list? I will not try to solve this problem, for it would only complicate the issue further.

I personally am delighted to have the information, for it definitely establishes the fact that John Harris was at Transylvania University during the year 1836, and thus strengthens both Drs. C. O. Cone's and James Taylor's statements of John Harris' association with that University.

Dr. Robinson's appraisement of John Harris' activities in dentistry, as found in the footnote on pages 1011-12, is remarkably at variance with two other opinions in the same volume of the Proceedings, and for that reason I here record both: Dr. Harry Bear, on page 899, in speaking of "Dental Education: Milestones of Progress" states:

"According to an announcement in the *Supporter and Gazette,* Chillicothe, Ohio, November 1, 1827, Dr. John Harris, of Bainbridge, Ohio, gave a course of lectures to prospective students of medicine and dentistry. Among his students were Chapin A. Harris and James Taylor, founders, respectively, of the first two dental schools in the world—the Baltimore College of Dental Surgery and the Ohio College of Dental Surgery(3). The efforts of the leaders in the profession were partially rewarded in 1839 and 1840 by the events which are the occasion for the present centennial celebration."

Dr. L. Pierce Anthony, "The Influence of Organization on the

Development of Dentistry in the United States," page 872, writes of John Harris' influence:

"Practically coincident with, but in no way, to our knowledge, related to this more or less abortive effort at organization in the east, there was developing a dental relationship to medicine in the middle west that was destined to become epoch-making and profession making. In the little town of Bainbridge, Ohio, there was evolving the thought that dentistry was of sufficient importance to be practiced and taught separately from medicine. John Harris, a highly reputable physician of Bainbridge, had given considerable attention to dentistry in association with his medical practice and became so impressed with the possibilities of dental practice that he essayed to instruct a group of medical men in the art of dentistry. After several efforts in this direction, and with continuing success, he sent forth a number of medical men equipped and qualified to practice dentistry on the same professional basis as medicine of that day was being practiced, and among the group, so taught, was the brother of John Harris—Chapin A. Harris—who later removed to Baltimore and began to practice dentistry."

NOTES

Dental Rank in the Navy

The Senate and the House of Representatives passed, and the President signed, the bill authorizing the rank of Rear Admiral in the Dental Corps of the Navy.[1] No member of the Corps has as yet (February 16, 1943) been selected. This will await action by a selection board. Only one member of the Dental Corps can be selected for the permanent rank of Rear Admiral, but as many more can be given the temporary rank as the selection board deems necessary for executive purposes. The Legislative Committee of the American Dental Association and its capable chairman, Sterling V. Mead, deserve great credit for presenting this bill effectively to, and in guiding it through consideration by, Congress. The Committee had two great odds to combat: the hostile attitude of the Navy Department in its recommendation against enactment of the bill; and the diverting conditions of the closing days of the session

[1]The last previous allusion to this subject, in this *Journal*, was presented on pages 461-63 of the issue for December, 1942.

of Congress. Chairman Mead, after being buffeted about by the House Naval Affairs Committee, was able by his persistence and tact, on the ground of the public desirability of the cause he represented, to overcome the hostility of the Navy Department and all other adverse conditions. In the Navy, rank is all important; hence the full significance of the bill's import is apparent when dentistry is placed on a basis equal to that of other staff corps.—[*C. Ed.* (1)].[2]

"Smile of Beauty" and "Pink Toothbrush" No Longer Toothpaste Slogans

The Federal Trade Commission not only "wiped off" the "smile of beauty" but threw out the "pink toothbrush" in a complaint against the Bristol-Meyers Co., makers of Ipana Toothpaste, and the related advertising agencies. An interesting discussion of this action and its possible sequelae, in the issue of the *New Republic* for January 11, 1943 (page 38), is quoted below:

Ipana and the FTC: Readers of the illustrated magazines and listeners to the radio are familiar with the many virtues of Ipana and Massage. Remember the sad story of the nightingale who had youth, charm, personality—*everything*—until she smiled? "It takes a Pretty Smile to Sell a Song—And yours, My Pet, is on the Blink," the band-leader said. "You can't star with my band until you can flash a smile that travels right from the stand into the customers' hearts." But was she downhearted? She *was* not. She went home and used Ipana and Massage, and now she sees her name in lights and Ipana Toothpaste in her beauty cabinet forever and then some.

Or the Big Brother who told his sister off one day? "Live and Learn, Beautiful," he said. "You've had this coming to you. 'Pink toothbrush' isn't one of those things Fate just hands out to starry-eyed Oomph girls! Usually it's your own fault. Go and see the dentist . . . and do what he tells you to! Don't risk that pretty smile of yours, Sis. And if he suggests 'the healthful stimulation of Ipana Toothpaste and massage'—obey, little girl, obey!" (P.S. That's *exactly* what the dentists *did* suggest.—Ed.)

Well, the Federal Trade Commission has gone and spoiled it all. It has issued a complaint against Bristol-Meyers Company for its Ipana advertising

[2]The terminal numerals in parenthesis are inserted for purposes of identification in the records of this *Journal.*—[Ed.]

copy, and has also cited the two advertising agencies which handle the Ipana business. The complaint charges that the respondents have "misrepresented the properties of Ipana toothpaste in a number of respects." According to the FTC, Ipana will not produce a beautiful smile, increase the popularity of the user, remove tobacco stains, whiten teeth not naturally white or prevent, or cure, so-called "pink toothbrush."

What, we wonder, will the Nightingale do now?

The foregoing treatment of the Commission's action is certainly not what a newspaper would publish. A great many advertisers would effectively boycott any newspaper that did so. Our "free press" is *not free* when advertisements are involved, differing in this respect from the professional press as professional ethics differ from commercial customs. Today as always the professional press must be constantly on the offensive against all influences that are indifferent or hostile to the public welfare. A constant fight, in the literal sense of the word, must be maintained to keep the public interest paramount in all professional affairs.—[*C. Ed.* (2)].

Another Verdict

In each of the last few issues of this Journal there have been condemnations of the transactions by which the *Journal of Dental Research* was degraded by its Publication Committee to the status of an assistant to the producers of Teel in promoting sales of that product—despite the decision of the A.D.A. Council on Dental Therapeutics that Teel is an unacceptable dentifrice. The following related quotations from despatches to newspapers should be added to the published record:

(I) "*Special to The New York Times:* Boston, June 8—A Federal grand jury, after a six-month investigation, returned a fifty-two-page indictment today against the Procter & Gamble Company and ten individuals, charging them with fraudulent use of the mails and conspiracy in a scheme to defraud Lever Brothers Company, Cambridge soap manufacturers. Those named as defendants are Procter & Gamble Company, the Procter & Gamble Distributing Company, the Procter & Gamble Manufacturing Company, D. Paul Smelser, Raymond J. Lamping, Cleo W. Knappenberger, all of Cincinnati and all employees of Procter & Gamble Company. Others indicted include Thomas L. Mulvaney of Cincinnati, Anthony Mersicand of Boston and five former employees of Lever Brothers Company. They [include] . . . Frank J. Elms of Boston. . . .

"The indictment alleges that from February, 1937, to and including January 26, 1942, a scheme to obtain information, samples, soap products, production figures and confidential data from the files of Lever Brothers Company was formulated by the various parties to the indictment and in the forwarding of this information to Cincinnati the mails were used. One defendant, an employee of Lever Brothers Company, the indictment alleges, received a sum of about $2,700 for this information. Some of this money was distributed in small amounts to associates at Lever Brothers Company. The money is alleged to have come from the Procter & Gamble Distributing Company" . . .—*New York Times*, June 9, 1942.

(II) "*Boston, Feb. 5 (AP.)*.—The Procter & Gamble Company was acquitted by a directed verdict today of charges of using the mails to defraud in an alleged conspiracy to obtain trade secrets of a rival firm, but *three of the company's employees*, who pleaded guilty, were fined. . . . In directing the acquittal verdict against the Procter & Gamble Company, Federal Judge George C. Sweeney said that *while there plainly was a violation of business ethics, he felt that there was absence of proof that officers of the company acquiesced in the unlawful acts of employees* (italic not in original).

"*Dr. D. Paul Smelser, head of the marketing research department of Procter & Gamble, was fined $5,000 and Cleo W. Knappenberger, assistant to Smelser, was fined $1,000 for using the mails to defraud and conspiracy to obtain trade secrets of a rival firm.* . . . Raymond J. Lamping . . ., a salesman for Procter & Gamble, was fined $500 and Frank J. Elms . . ., received a suspended sentence of six months in jail and was placed on probation for one year. Thomas L. Mulvaney . . . and Antonio Mersicand . . . were acquitted (italic not in original).

"Assistant United States Attorney Joseph M. Hargedon told the court that he agreed the evidence was short in respect to Mulvaney and Mersicand but *he did not agree that there was insufficient evidence to hold the corporate defendants*. The judge said he was imposing milder sentences than the Government prosecutor asked for but more than the defense had asked. . . . Judge Sweeney further said that he *believed that Smelser was the principal who had conceived and directed the scheme*" (italic not in original).—*New York Sun*, February 5, 1943.—[*C. Ed.* (3)].

BOOK ANNOUNCEMENTS

Enameloid Acrylics in Dentistry (1942): Maurice N. Stern, D.D.S., Associate Visiting Oral Surgeon at Queen's General Hospital, New York City: Published by the Credo Publishing Company, Forest Hills, Long Island. Price $4.00. This book of 140 pages carries 140 illustrations. The text is concentrated and may prove of interest to dentists interested in acrylics.

An Evaluation of Dental Health Literature (1942): This little book of sixty pages, bound in paper, is arranged by Vern D. Irwin, D.D.S., M.P.H., Director, and Netta W. Wilson, M.A., Educational Assistant, Division of Dental Health, Minneapolis Department of Health, with a foreword by Frank C. Cady, D.D.S., M.P.H., Senior Dental Surgeon, U. S. Public Health Service, and published by the Bruce Publishing Company, Minneapolis. It carries with it an approval of the American Association of Public Health Dentists. It is a composite statement of dental health providing a definition and a story of the evolution of dental health education. The larger part or contents of the book is devoted to a recitation and criticism of "Inaccuracies in Dental Health Literature." On the whole, it contains much of benefit to the profession, from the standpoint of dental health. The price is not listed.

OUR ADVERTISEMENTS

A policy intended to safeguard professional interests and to encourage the worthiest industrial endeavor

The basis and conditions of our policy relating to advertisements are set forth below (*J. Am. Col. Den.*, 2, 199; 1935):

I. Advancement of the material aspects of civilization is largely dependent upon the expanding production and distribution of commodities, and their correlation with individual needs and desires. Successful practice of modern dentistry, on a broad scale, would be impossible without an abundance of the useful products of dental industries. Leading dental manufacturers and dealers have been providing invaluable merchandise for the dental practitioner. The business of supplying dental commodities has been effectually organized and, as an auxiliary to oral health-service, is more than sufficient to tax the greatest ingenuity and all the attention and integrity of each dental producer and distributor.

The American College of Dentists aims, in the public interest, to strengthen all wholesome relations and activities that facilitate the development of dentistry and advance the welfare of the dental profession. The College commends all worthy endeavors to promote useful dental industries, *and regards honorable business in dental merchandise as a respected assistant of the dental profession.* Our Board of Editors has formulated "minimum requirements" for the acceptance of commercial advertisements of useful dental commodities (*J. Am. Col. Den.*, 2, 173; 1935). These "minimum requirements" are intended, by rigorous selection on a high level of business integrity and achievement, to create *an accredited list of Class-A dental products and services,* and include these specifications: Advertisements may state nothing that, by any reasonable interpretation, might mislead, deceive, or defraud the reader. Extravagant or inappropriate phraseology, disparagement, unfairness, triviality, and vulgarity must be excluded. Advertisements relating to drugs or cosmetics, foods, dental materials, education, finance—to any phase of interest or activity—will be accepted for only such commodities or services as merit the commendation, approval or acceptance of the National Bureau of Standards, American Dental Association, American Medical Association, Council on Dental Therapeutics, Dental Educational Council, Better Business Bureau, and other official bodies in their respective fields of authoritative pronouncement.

The welfare of the consumer is our paramount consideration. In accordance with the recommendation of the American Association of Dental Editors, the placement of advertisements will be restricted to the advertising section.

II. An advertisement, to be accepted or repeated, not only must conform with the said "minimum requirements," but also *must meet the special test applied through a questionnaire* that will be repeatedly exchanged confidentially with numerous referees in all parts of the United States, and which contains the following inquiries:

Questionnaire for referees on acceptance of advertisements.—(1) Has ________ (person, company, service, etc.) always been honorable and fair in (his, their) dealing with you personally? (2) If not, indicate confidentially your experience to the contrary. (3) Has ________ (commodity, service, etc.) always been, in your use of it, what its advertisers claim for it? (4) If not, indicate claims that were unwarranted when made. (5) Would the accompanying (copy of a proposed) advertisement of ________ (commodity, service, etc.) be warranted, in your judgment, as a recognition and encouragement of useful dental commercialism? (6) If your answer to Question 5 is Yes, will you agree to test, *critically*, the above-named commodity (service, etc.) and to respond at intervals to our further inquiries as to whether all the claims published currently in its behalf, in advertisements *in the Journal of the American College of Dentists or elsewhere*, are justified?

III. The advertisers whose claims are published on the succeeding pages stand high in commercial character and on the recognized merits of their products (services, etc.). They are not among those who seek advantage from misrepresentation, and need no assistance from a prejudiced or insincere journalistic policy. They are above the temptation to try to control or influence any aspect of the conduct of this *Journal*, which in all its phases is completely independent, and fully representative of the professional ideals and the professional obligations of the American College of Dentists. We commend each advertiser in this issue to the patronage of all ethical dentists.

AMERICAN COLLEGE OF DENTISTS

STANDING COMMITTEES (1942-1943)

Ad-Interim—The President, President-elect, and Secretary.

Certification of Specialists—E. W. Swinehart, *chairman;* Max Ernst, W. E. Flesher, H. C. Fixott, H. E. Kelsey, D. F. Lynch, J. O. McCall.

Education—W. C. Fleming, *chairman;* C. W. Freeman, Harry Lyons, J. T. O'Rourke, G. D. Timmons.

Endowment—Arthur H. Merritt, *chairman;* H. J. Burkhart, O. J. Chase, W. J. Gies, E. W. Morris, J. E. Psayla, C. Ray Sturm.

History—W. N. Hodgkin, *chairman;* H. L. Banzhaf, E. E. Haverstick, A. W. Lufkin, J. Ben Robinson.

Hospital Dental Service—W. Harry Archer, Jr., *chairman;* R. W. Bunting, E. A. Charbonnel, L. H. Meisburger, Howard C. Miller.

Journalism—Wm. R. Davis, *chairman;* J. M. Donovan, Walter Hyde, B. E. Lischer, E. B. Spalding.

Necrology—J. V. Conzett, *chairman;* A. L. Martin, P. V. McParland, R. H. Volland, M. L. Ward.

Nominating—A. W. Bryan, *chairman;* G. M. Damon, H. E. Friesell, H. O. Lineberger, R. C. Willett.

Oral Surgery—L. M. FitzGerald, *chairman;* M. W. Carr, H. L. Cartee, William Macfarlane, Wm. Shearer.

Preventive Service—Edgar W. Swanson, *chairman;* Hermann Becks, M. M. Bettman, L. A. Cadarette, C. S. Foster.

Prosthetic Service—Walter H. Wright, *chairman;* Louis Brach, C. A. Nelson, C. G. Porter, Jack Werner.

Relations—L. E. Kurth, *chairman;* E. D. Douglass, T. E. Purcell, Nathan Sinai, L. T. Walsh.

Research—A. L. Midgley, *chairman;* L. E. Blauch, P. J. Brekhus, J. E. Gurley, P. J. Hanzlik, P. C. Kitchin, A. B. Luckhardt, L. R. Main, L. M. S. Miner, L. W. Morrey, Irvine McQuarrie, Fr. A. M. Schwitalla.

Socio-Economics—Geo. W. Wilson, *chairman;* E. H. Bruening, W. H. Mork, B. B. Palmer, K. C. Pruden, M. W. Prince, C. E. Rudolph, Maurice William.

Announcements

Next Meeting, Board of Regents: Cincinnati, Oct. 14 and 15, 1943.
Next Convocation to be announced.

Fellowships and awards in dental research. The American College of Dentists, at its annual meeting in 1937 [*J. Am. Col. Den.*, *4*, 100; Sep. and 256, Dec., 1937] inaugurated plans to promote research in dentistry. These plans include grants of funds (The William John Gies Fellowships) to applicants, in support of projected investigations; and also the formal recognition, through annual awards (The William John Gies Awards), of distinguished achievement in dental research. A standing committee of the International Association for Dental Research will actively cooperate with the College in the furtherance of these plans. Applications for grants in aid of projected researches, and requests for information, may be sent to the Chairman of the Committee on Dental Research of the American College of Dentists, Dr. Albert L. Midgley, 1108 Union Trust Bldg., Providence, R. I. [See "The Gies Dental Research Fellowships and Awards for Achievement in Research," *J. Am. Col. Den.*, *5*, 115; 1938, Sep.]

JOURNAL OF THE AMERICAN COLLEGE OF DENTISTS

Issued quarterly. Subscription price: $2.00 per volume. Presents the proceedings of the American College of Dentists and such additional papers and comment from responsible sources as may be useful for the promotion of oral health-service and the advancement of the dental profession. Address: Journal of the American College of Dentists, 350 Post St., San Francisco.

THE RECORDER PRESS
SAN FRANCISCO, U. S. A.