Alumni Bulletin

INDIANA UNIVERSITY
SCHOOL OF DENTISTRY

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Contents

Alumni Bulletin

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A free and non-profit bulletin issued quarterly by Indiana University School of Dentistry for the purpose of keeping its Alumni informed of the activities and progress of the school.

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Officers of the School of Dentistry Alumni Association for 1946-47 are:

John W. Geller—President
Harry Healey—Secretary

● *The Chemistry of Tooth Tissues*

TOOTH decay is such a prevalent disease that it affects 95 per cent of the individuals in this country. While it is true that many adults live apparently healthy lives without natural teeth, there is always the generalized infection and severe illness. Then, too, replacement of tooth tissues that have been lost and destroyed by tooth decay with fillings, bridges, and plates is an expensive and time-consuming procedure.

The belief that refined carbohydrates, such as sugar, exert a harmful effect on teeth has been taught by the dental profession and accepted by the public for many years. This idea has persisted in spite of the fact that, biochemically, very little is actually known about the oral cavity or what happens to the various types of ingested carbohydrates in the mixed saliva which bathes the teeth. Actually, the causes of tooth decay are still a long way beyond our understanding. For that matter, we have just begun to do intelligent research.

We do know that tooth decay is a surface phenomenon and that during the early phases before the cavity is formed, there is a change in the tooth surface equilibrium. Bacteria grow on practically all tooth surfaces constantly and harmlessly. However, in certain protected regions, apparently the physiochemical equilibrium becomes disturbed sometimes so that these organisms cease to be harmless and tooth surface destruction takes place.

To bring about the formation of a cavity, some change in the enamel surface must occur. As yet, we know too little about the morphology of the surface and its physiochemical properties. There are two ways, of course, in which a surface may become changed. It may be the result of either mechanical abrasion or molecular exchange. Both of these conditions prevail upon the teeth. On the one hand, one may find shallow cavities formed at the necks of some teeth. These cavities have smooth polished surfaces and for a long time were thought to be due to an erosion by an acid secreted by the adjacent soft tissue. It has now been shown that these cavities are caused by abrasions brought about primarily by improper use of the tooth brush plus perhaps an abrasive dentifrice. On the other hand, there can be no doubt that the other more common lesion—that is, tooth decay—starts as a disturbance or early molecular surface change. Before either process can be studied, it is of course necessary that more is learned about the normal conditions of normal tooth surfaces. This is true both from a morphological and a physiochemical standpoint.

Enamel—Microscopic Appearance

The enamel of the tooth is a very hard structure covering that part which extends above the gum tissue. This is known as the tooth crown. The enamel covering varies from a thickness of about 2 mm. on the biting edge to the thinness of a razor-blade at the neck of the tooth. This enamel is composed of microscopic rods about 0.005 mm. in diameter, and the length of each rod extends throughout the thickness of the enamel covering. The rods are so closely cemented to each other along their sides that it is impossible to separate them. Their general direction is radial, but they describe many curves and crisscrosses throughout their length. This enamel is the hardest tissue of the body, and as a covering of the tooth it is the part which usually comes in contact with the saliva, mouth debris, and myriads of bacteria in the saliva.

The enamel is so hard and brittle that it would fracture even under ordinary biting stresses unless it were supported by the elastic bone-like dentin which, as one can readily see in Figure 1, forms the

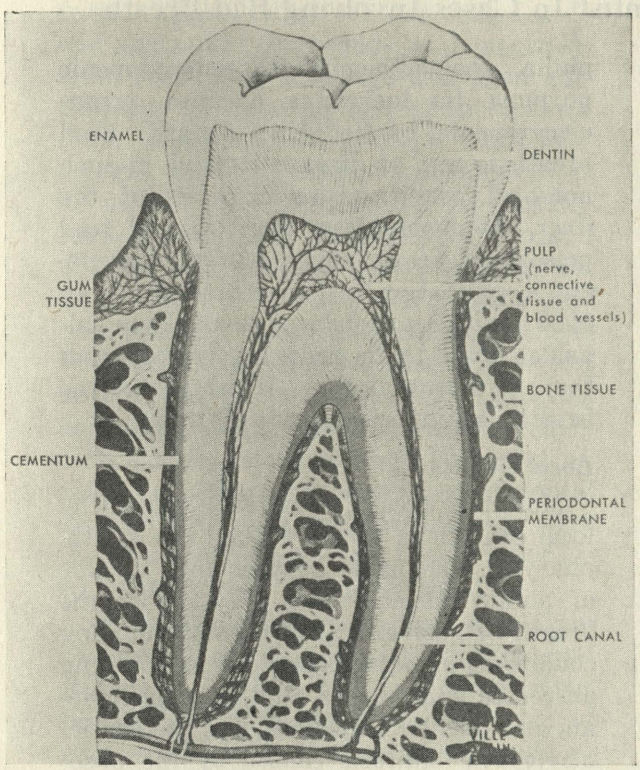

FIGURE 1.—TOOTH AND SUPPORTING STRUCTURES

bulk of the tooth, crown, and root. This dentin, although hard like bone, is not so hard nor nearly so brittle as the enamel which is supports. The rest of the tooth is composed of a cavity containing blood vessels, nerves, and other soft tissues. This is called the pulp. The soft tissue pulp and its blood circulation keep the dentin relatively moist, and therefore relatively elastic. There are minute channels leading from the pulp through the dentin, which provide an exchange of fluids between the dentin and the tooth pulp. However, the circulation and channels do not extend into the enamel, so that while there is a slow diffusion of fluid from the saliva into the enamel and from the dentin to the enamel, it has been shown that this permeability is of low order (*1*).

When the tooth is formed, there is an organic keratin covering, or cuticle, over the enamel surface. There is also an organic protein matrix composed of keratin throughout the enamel. Keratin is a substance very similar to that material which makes up the hair and fingernails. The enamel chemically contains approximately 96 parts of inorganic calciferous material, 1.7 of organic keratin matrix, and 2.3 parts of water. This organic matrix of the enamel is so minute in amount and is so intimately bound up with the calcified material that any decalcification of the tissue brings about immediate dissolution.

After the tooth erupts into the mouth, some of the organic surface material is rubbed off during mastication. On the enamel surfaces which actually come together during chewing, one probably finds little or no such organic material; however, on almost every other surface of the enamel, there is at all times a luxuriant, mat-like growth of filamentous bacteria. The surfaces which are kept clean by the contact of teeth during mastication very seldom show tooth decay. The greater surfaces of the enamel which are exposed to the excursion of food do appear under normal conditions bright and polished. A microscopic examination of these surfaces, however, shows the presence of many bacteria. These bacteria apparently thrive without damage to the enamel. However, in certain protected areas, such as the pits and fissures and the surfaces in between teeth, one will find all too frequently areas in which the by-products of bacterial growth are presumably decalcifying tooth surfaces. It is on these protected surfaces that chemical change of the enamel itself is gradually brought about and cavities eventually develop. It is the chemical composition of this enamel surface that must be studied so that the changes associated with the decalcification of tooth decay may be understood.

The Chemistry Of Enamel

In order to further the knowledge of dental caries, chemists and dentists have for many years been attempting to determine the chemical constitution of enamel and dentin. As yet, the molecular construction is not definitely known. Research, by X-ray diffraction in particular (*2*), has shown a marked similarity between certain naturally occurring apatites and tooth substances. This work, and the chemical studies which determined the Ca:

(Continued on page 12)

● The Responsibility Of The Dentist In Cases Involving Bad Breath

HALITOSIS or "bad breath" is a symptom that unmasks a multitude of ills, all of which present a definite and positive responsibility to every practitioner of dentistry. The social stigma and psychological injury that go inseparably with bad breath make it important that the dentist understands the causes of and treatment for conditions of offensive breath so that he can be certain that his own breath is entirely acceptable at all times, and so that he can prevent correctible oral conditions from causing halitosis in his patients. The healthy mouth should be free from odor and the alert and informed dentist is the one who recognizes the significance of halitosis in the diagnosis of disease. While it is certainly true that non-oral conditions frequently cause bad breath, the dentist's responsibility to his patient is not fulfilled as long as the patient has a breath odor, and it is the dentist's duty to see that the source is discovered and proper treatment instituted.

Systemic Causes.

The breath consists of air taken in and expelled by the expansion and contraction of the thorax. "Bad breath", then, is caused by some condition, temporary or permanent, that causes odors from the lungs, air passages, or mouth to be expelled with expired air. In this regard it is especially important to remember that the stomach is not an organ of respiration, and, except when the cardiac sphincter is released, as in belching, the stomach is never directly responsible for the odor of the breath.[1] The lungs, on the other hand, are organs for the elimination of toxic products absorbed from the gastro-intestinal tract or other diseased parts of the body.[2] The breath, then, may be contaminated by odors picked up by the blood stream from various pathological conditions in the body. Diabetes millitus, for example, is readily identified by the fruity (acetone) odor of the breath, and a fetid odor in the breath may be caused by the various blood dyscrasias manifest as hemophilia, polycythemia, thrombocytopenic purpura, the luekemias, anemias, agranulocytopenia, or Hodgkin's disease. Foul breath is also of diagnostic value in such non-oral conditions as cirrhosis of the liver, duodenal ulcer, mercury and lead poisonings, scarlet fever, scurvy, typhoid, and constipation.[3] The dentist is in an ideal position to render a particularly valuable service to his patients by recognizing the aforementioned abnormalities in the breath as signs of systemic disorders.

Local Causes

Most bad breath, however, is caused by local conditions in and around the mouth, pharynx, and nasal pasages that become of public concern when they render the breath offensive.[4] Such breath-offending conditions as oesophageal carcinoma, lung abscesses and tumors, diptheria, pneumonia and tonsilar infections, and the particularly vile halitosis caused by the naso-pharyngeal disease called ozena,[5] while frequently of diagnostic interest to dentists, are specifically treated by medical specialists in rhinology and laryngology. Odors arising from the disease of the soft structures of the oral cavity are usually due to supperative processes which in all cases are productive of foul odors. The fetor in Vincent's infection is usually very pronounced and may constitute the outstanding symptom. Markedly foul odors are diagnostic of the decomposition and ulceration of tissue in syphilis or malignancy. Stomatitis, gingivitis, or a tongue coated with a thick greenish brown fur is accompanied by offensive breath. A temporary halitosis is caused by an infected blood clot following tooth extraction or any surgical interference in the mouth.[6] These conditions are definitely within the scope of the dentist, and he must be thoroughly familiar with their causes, diagnosis, pathogenesis, and treatment.

Ninety per cent of all cases of odors arising from purely dental conditions originate from prolonged stagnation and bacterial fermentation of food debris about the teeth. A sickly foul odor is produced

from carbohydrates, odorous fatty acids and ammonical compounds, and especially from the highly offensive hydrogen sulfide and penetrating mercaptan formed from albumen and protein. Artificial bridges, dentures, orthodontic appliances or other prosthetic fixtures are readily covered with sticky mucoid deposits which undergo fermentation. Vulcanite plates absorb offensive odors which cause "denture breath". Untreated caries, with or without pulpal gangrene, may cause bad breath, and the indol-forming organisms associated with periodontitis cause a characteristically repulsive odor.[7] Sulser, *et. al.* using the osmoscope found the periodontal disease, gingivitis, and dental decay were the principle causes of bad breath associated with the local oral pathology.[8]

Of general interest are the odors from the use of some foods, condiments, and stimulants. The highly characteristic breath odors associated with the use of tobacco and with the use of alcoholic or yeast beverages certainly require no description here. In unclean mouths the stale odor of tobacco caused by nicotine, pyridine, and ammonia in the smoke may remain aroung the teeth for as long as fifteen hours, and is especially strong and persistent in the breaths of "those who inhale". Alcoholic odors come from the action of the lungs in the removal of the alcohol from the blood, and will last as long as the blood alcohol level is high. The odor of beer may be elaborated both from the lungs and from the collection of fermentable yeast products around the teeth and prosthetic dental appliances. "Onion breath" is caused principally by adherence of essential onion oils in a film on the tooth surface, gingival crevices, or roughened areas in the mouth. Garlic, the strongest of all condiments with regard to persistent residual odor in the breath, may be noticed for as long as 70 hours after ingestion. Garlic odors, and the odor of onions when taken in massive amounts, come from a removal of the odors from the blood by the lungs.[9] Before final elimination, the garlic odor assumes a musty character not unlike that found in the breath of the habitual user of opium or the opiates. The dentist must exercise moderation and forethought in the use of foods and stimulants which affect the breath if he is to protect his breath and, thereby, his practice.

Treatment

The dentist must be familiar with the causes of bad breath, as shown above, if he is to answer intelligently the problems of breath odors in his own patients and those referred to him by the advertising of the tooth paste manufacturers. Since halitosis is always a symptom and never a disease, the definite treatment of halitosis is the treatment of its cause. While the value of mouth washes and flavored dentifrices as agents for correcting bad breath has been grossly over-exaggerated in the advertising of some commercial products, Sulser,*et. al.*, with the use of the osmoscope as a means of measuring breath odor intensity, have obtained evidence to indicate the usefulness of some of these agents in relieving such temporary forms of halitosis as "early morning breath" and that associated with excessive speaking or singing.[10] These odors are not caused by truly pathologic states, however, and this type of treatment is fundamentally empirical, rather than rational, since is consists primarily of substituting a favorable odor for an objectionable one. Since oral malhygiene is the principal etiologic factor in bad breath, the thorough treatment of oral pathology, with particular emphasis on removing caries and periodontal pockets, is frequently ample treatment for halitosis. If, however, the condition of bad breath persists after healthy mouth hygiene has been attained, the dentist's responsibility is not completed. He should make another careful study of the oral cavity and, still failing to find the cause of halitosis, he should refer the patient to, and work with, a competent medical practitioner in search of a systemic cause. This is the type of service that a patient and his physician have a right to expect from the responsible dentist, and will do much toward establishing the dentist as the medical specialist of the mouth.

(Bert W. Gilbert, B.S., '48)

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Alumni Notes

from the Dean's Office

Something new has been added in the Dean's Office—a "Guest Book"—so please don't fail to drop in and add your autograph to the growing list of "outstanding men in dentistry". The following persons have been in and signed our book since January 1, 1947. (We are ashamed to admit that we quite often forget to have alumni sign because this is so new and we are so absent-minded). Paul T. Worster, '44, R. R. 4, Connersville, Indiana; Robert K. Fields, '46, 1032 138th Place, East Chicago, Indiana; Robert L. Anderson, '45, 315 W. Second Street, Seymour, Indiana; Hugh Davis, '14, 7512 Greenwood Avenue, Chicago, Illinois; H. C. Lumpp, '22, Medical Arts, Mattoon, Illinois; G. F. Henricks, '34, R. R. 4, Lafayette, Indiana; E. H. Porter, '40, 209 Johnson Building, Muncie, Indiana.

First Lieutenant Marlin R. Inman, '45, reports that he has been in the army since the latter part of September and is now leaving the States for over-seas duty. He did get to attend the Chicago Dental Meeting and no doubt saw many of you there. Among other things, he recommended a student for our 1947 class, and while we are simply overwhelmed with applications, it is always a pleasure to have the recommendation of our alumni because that shows they are interested in their Alma Mater. Thanks, Dr. Inman, and hope you will write us from "across the sea" and let us know what you are doing.

Lieutenant (jg) M. E. Boone, '45, is stationed at Parris Island, Box 62, South Carolina. He has the wife and Skipper (the "boss" of the Boone family) with him and they are enjoying life as best they can but he says, "Oh, how I long for my Indiana Home." Dr. Boone says he has been following the school rather closely in the dental magazines and the Indiana Alumni Bulletin. Remember, he can't read about you unless you come in or write in and tell us what you are doing. Write again, Dr. Boone, and help keep us supplied for this column.

Congratulations are due to Dr. Angel P. Garcia, who has opened an office for Oral and Maxillo-Facial Surgery in Puerto Rico. This came as a surprise and we do wish him well in his practice. He states, "I hope that I do not get into a rut around here and that soon I can return to the States for some more work." We trust Dr. Garcia will not forget his "hope" and we shall probably take time out someday to write him and remind him of it.

Lieutenant (jg) Paul S. Yingling is in the navy and writes from the U.S. Navy Dispensary, Navy Department, Arlington Annex, Washington, D.C. He didn't give us much news so hope he will write again and tell us what is going on in Washington. We are sorry to hear that his mother is quite ill and we are sure you all join us in wishing her a speedy recovery.

Item from Indianapolis News, January 11, "Kokomo, Indiana—Dr. Norman Simpson, 75, a practicing dentist in Kokomo nearly fifty years, died Friday. He had been ill several months. A Howard county native, he attended Valparaiso University and taught school several years. He was graduated from Indiana State Dental College in 1897."

We hope you all noticed in last month's bulletin that "Ma" Sanford was looking at our *now complete* file of class pictures. We are indebted to alumni, who responded to our SOS, and to Mr. Scott, our photographer, who in one instance had to take the pictures out of the year book and photograph them and reproduce them in a group. We are quite happy that our roster is complete and believe all the alumni will rejoice with us.

Mrs. Cleona Harvey, Recorder

Notice

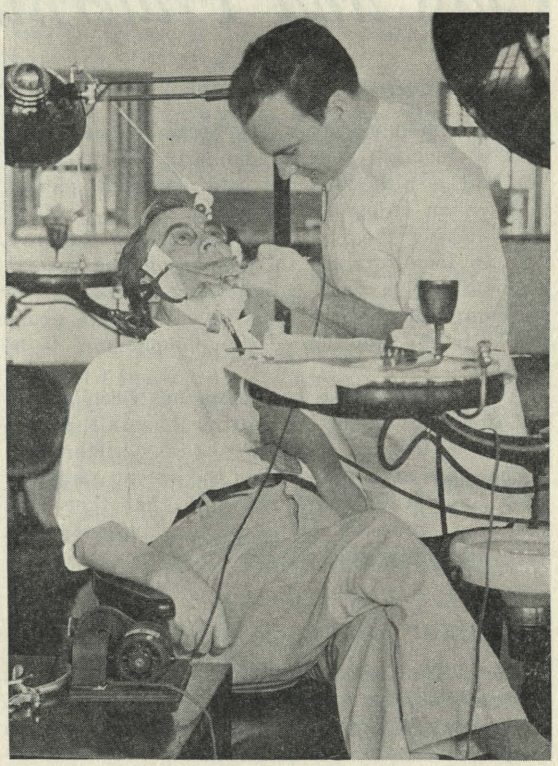
We again want to appeal to the Alumni Association members for collections of disassociated teeth. We need "buckets" of teeth for our dental anatomy class. Also, don't hesitate to send in malformed teeth, which are needed for study in oral pathology.

Odd-Dentities

by

ruhamah hannah

we are all much gratified by dr. herbert waldhier's speedy recovery. after a major operation, he is able to come out now and then to see how things are getting along and expects to be back at work sometime before july . . . there is much activity in the clinic besides the usual. we are getting a new public address system, which is going to be very nice when finished, but right now, in the embryonic stage, is just so many wires stretched along the floor, waiting to be stuffed down inside the walls. then, there are two telephone men putting in extension phones on the east wall of the clinic, just outside the prosthetics department, for the students to take their incoming calls . . . dr. wilbur stamper, children's clinic, is among the indisposed. . . dr. e. h. porter, '40, was in the other day, as was dr. george f. henricks, '34. dr. porter is practicing in muncie, and dr. henricks is at lafayette . . . the assisting staff have been invited to attend the weekly seminars held every monday at 1:00 . . . dr. frank c. hughes, prosthetics, was in washington, d.c., for a week in march, appearing on the program of the district of columbia post graduate course . . . plans are under way for remodeling the building this summer. the basement is going to be excavated and that space down there utilized. also an elevator will be installed . . . i received a letter from bill hohe, '45, who is still in the navy but expects to be out in june . . . a letter to the bulletin from dr. john buhler, formerly on the staff here, now at temple university, was gratefully received. he complimented us on the new make-up of the bulletin and announced, not for bulletin publication, that he is a proud papa for the second time. he also said that he reads my column. that makes two of us who read it. . . a letter also from dr. f. k. etter, who is now at san francisco with fellow navy man, r. p. nickels. . . and thats' all for this time.



Graphic proof that Dr. J. L. Wilson, exponent of gold foil and the rubber dam, practices what he preaches. Dr. Ally N. Burks officiates.

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● "Man Against Pain"

Have you seen Howard Raper's new book "Man Against Pain"? This book is winning for dentistry the recognition and respectful credit for the discovery of surgical anaesthesia. Those of you who remember Dr. Raper as a teacher at Indiana need not be told that the book is accurate, concise, and carefully written. The book is designed for the lay public but every dentist would profit from a careful reading. If you haven't a copy of this book, you should treat yourself to this best seller in the field of popular medical books.

Class and Fraternity Notes

● *Sophomore Class*

The Sophomore Class has begun its new term with a class party at the home of Walter Dean. We had a nice turn out and everyone seemed to have an enjoyable afternoon.

By having the first semester out of the way, we can look forward to completing the second. The outlook is very enlightening because after its completion, clinic time is within our grasp and it is the ambition of every sophomore to be there.

A spohomore base ball team has been organzed for the on-coming spring baseball season and it is looking forward to many victories.

The class as a whole finds the second semester very interesting and I am sure that they find that the study of dentistry is a science of a very distinguishable nature.

Gene Sheppard

● *Junior Class*

The advent of spring finds the junior class limbering up for a strenuous season of softball. Ably coached and managed by Bob Avery, the team will take on all challengers.

Whenever the proud fathers of the class, and there are many, happen to be congregated in the same place at the same time, the conversation always turns to their offspring; they never tire of the subject. One more class member, Jerry Schindel, has joined their ranks; it's a boy for him.

One of our more ambitious boys is talking about doing research on the theory of heteroplastic implantation. Most of us are rather dubious about the theory, but we're willing to be convinced.

Dr. Hughes was gone for a week in March, but he thoughtfully provided for our class period during his absence—a test.

All of us who saw the I. U. All-Stars playing in the city independent tournament thought they made a very good showing.

We hope that the faculty will have a softball team again this year. (See paragraph 1.)

Betty Graves

● *Senior Class*

Hudson Kelley and Richard Johns represented Indiana University at the Cleveland Dental Society's Children Day meeting. Kelley gave a paper and demonstration on space maintainers and Johns presented a paper on amalgam. There has been a rising interest among the senior class in orthodontia and pedodontia. Bite planes, space maintainers, and partial dentures have been made by the majority of the class in children's clinic this year.

The dental school basketball team reached the semi-finals in the city tournament. Chuck "Machine Gun" Radcliffe paced the team all season. Bill Kunkel, Danny Laskin and Marty Walton all played fine basketball and contributed much to the team's success.

Woody Walker, beaver deluxe, has been observed playing it casual lately, dropping from 100 to 50 counts per week. Jack Singer is high point man in the class with 1100 counts. Jim Compton is still putting out a full upper and lower each week. Looking around the lab, you will see House cases set up. Crown and bridge is a very busy clinic these days. Those crown and bridge requirements are rapidly being completed.

Edward Flynn

● *Xi Psi Phi Report*

We opened the second semester with the celebration of Founder's Day. February 8th, 1889, was the day that the five great men of Xi Psi Phi laid plans for the fraternity at the University of Michigan. The chapter held a stag party on Founder's Day and several of the alumni were present.

March 22nd was the date of the Alumni Banquet at the Claypool Hotel. Several of the actives attended this affair.

Now that the semester is nearly half over, we are again going to have to buckle down for the "mid-term hurdles". They'll be around the second week in April.

April 19th is Younger Brother's Day. This is the day that the actives are to be entertained by the alumni. We hope that they don't forget their obligation, for I know we'll remember.

Later in the semester the senior banquet will be held in honor of our five graduating seniors. The seniors are: Robert McKay, John W. Pentecost, Arthur Stine, Albert Kazwell, and William Temple. Arrangements are being made for this occasion, but the date has not yet been set. The banquet will be followed by a dance.

Max C. Burke

● *Delta Sigma Delta*

Xi chapter will entertain the members of our district at the conclave April 25-27. Delegates will come from Illinois, Marquette, Washington, St. Louis, Louisville and Northwestern Dental Schools. A banquet and the spring dance will be arranged for the weekend.

Highland Country Club will be the scene of the annual golf tournament, banquet and initiation into the supreme chapter when the Indiana Auxilliary members entertain the graduating seniors Sunday, May 18.

The Ray Anderson, '44, and Victor DeFrank, '44, families are proud of their February children. Ray has a daughter, Lynne, and Vic has "Li'l Vic". Jim and Mary Ann Compton, '47, tell us its a girl at their house.

Drogi, the house mascot, is equally proud of a son and daughter born in different litters a few days apart. The puppies Noria and "Cedric" are three months old and lots of fun to watch play. Another of our animals, a cat, was seen yawning and it was found he had a maxilliary cuspid. Etiology unknown.

Art Gustavson, USN, '44, is stationed near Jacksonville and is enjoying Florida and has a new wife.

Lt. Carmelo "Toad" Todaro, '46, as reported in a recent visit, has fallen heir to one of the most interesting assignments in the post-war army dental program. It seems the Ascension Island nestled in the Atlantic off the western coast of Africa (thanks to the Atlas) is the position of one of the dental outposts. "Toad" has been assigned to make a two week survey on the island of the dental needs of some 500 men and to perform the emergency treatment necessary. The beauty of the thing is that his itinerary will include stops in West Palm Beach, Porto Rico, Dutch Guiana, and Natal, Brazil.

Lt. Henry Kezlarian, USN, has been seeing the world on a "good will" tour with Admiral Conolly. He tells us he shipped on the USS Spokane, flagship for the Atlantic Fleet, which put in at London, Scotland, Norway, Denmark, Germany, Lisbon, North Africa, Gibraltar and the Carribean theater for one week each. He had the privilege of visiting the dental schools in all these places as well.

We are happy to see Herby Waldhier, Zi Psi Phi, '45, feeling well again.

Norman R. A. Alley

● *Alpha Omega Fraternity*

Alpha Gamma Chapter has been keeping it's program busy with regular monthly clinic meetings and plans to complete the year's activity with two exceptionally fine programs. On April 21st the Chapter will sponsor an Indianapolis appearance of Frater Sam Stulberg, D.D.S., M.S., of Detroit, who will present a discussion on "A Practical Approach to Dentistry for Children" during the school's seminar period. That evening a dinner in Dr. Stulberg's honor will be held in the Washington Hotel. Two members of the I. U. Department of Pedodontics, Dr. Drexel Boyd and Dr. Ralph MacDonald, and Dean M. K. Hine will be guests of the fraternity at this meeting.

The 1947 Senior Farewell Banquet and Ball will be held on Saturday, May 17th, preceding the annual meeting of the Indiana State Dental Society. Dr. J. Frank Hall, Dean Hine, and a national officer from the fraternity will be special guests. Alumni fraters intending to be present for the state meeting are urged to contact Bert W. Gilbert at the school as soon as possible regarding this event.

Our monthly dinner meetings have included clinics by Dr. William E. Barb on "Mucostatics", on "Partial Denture Construction" by Dr. Charles J. Ringle, research head of the Williams Gold Company, and Dr. Ert J. Rogers on "Die Making". These have been primarily joint meetings with the members of the Indianapolis Alumni Club and were all very interesting and enjoyable.

Through the courtesy of Frater Sam Binder of West New York, New Jersey, the Chapter obtained films showing activity at the National Atomic Convention in Detroit. Alpha Gamma representatives, Bert Gilbert, William Winer, and Phil Goodman, '46, appeared in the films. Some Indiana fraters of previous years were recognized. The chapter wishes to acknowledge the many kind letters and cards sent us by alumni, and we welcome more. We hope to see many of you at the Senior Farewell in May.

Irwin L. Burack

● *Psi Omega Fraternity*

In February a meeting of the Indiana State Alumni and the active chapter was held at the house. The attendance was very encouraging and the group discussed the plans of the fraternity for the coming year. The proceedings were under the direction of Dr. William B. Currie, the president of the Indiana State Alumni Association.

A few notes on alumni are presented so that you may follow the activities of former graduates. Dr. Harlan B. Shupert has been separated from the service and is now practicing in New Castle, Indiana. Dr. Lester H. Mosson has joined the regular navy. Dr. Henry Swenson has returned to the faculty after serving in the U. S. Navy. Dr. Roy Kixmiller is now in Evansville, Indiana. Dr. Harry C. Steinsberger is now taking a refresher course after seeing service in five major campaigns in Europe. Also recently discharged from the service is Dr. Wayne F. Kirchoff. He may be reached at Freelandville, Indiana. Dr. Edgar K. De Jean, who recently visited the school, has been separated from the U.S. Army. Formerly of the army, Dr. R. J. Ping is in Terre Haute, Indiana, at 679 Ohio Street.

Several new men are now located in Indianapolis. Dr. Robert Bodkin is at the Hume-Mansur Building. During the war Dr. Bodkin served with the navy. Dr. John Yates is practicing at the Bankers' Trust Building. Also in Indianapolis is Dr. William Jefferis, who is located at 62nd Street and College. Dr. Richard Howard set up his office here in town. Dr. Howard has joined the faculty as an instructor in pedodontia.

A Valentine Dance was held at the house during February. Many members of the alumni,

(Continued on page 12)

faculty and student body attended the affair. Our thanks go to Robert Moss for his excellent photography during the evening.

At the end of March the Annual Easter Dance provided the social activity for the school. The evening provided an enjoyable time for the large gathering that attended. The party was enlivened by the singing of familiar tunes with Dr. Adams at the piano. The preparations and arrangements were handled very well by Miles Shepard and Cal Christensen.

The National Meeting of the fraternity, scheduled for the spring at The Windmere East & West Hotel at Chicago, has been postponed to October.

W. F. Castle

● The Chemistry of

(Continued from page 5)

P ratio in enamel to be 2:15, seems to indicate that the main molecular constituent of enamel is a complex salt, mainly $Ca_3(PO_4)_2.Ca(OH)_2$. The compound is called hydroxy-apatite. This calcium compound can be found in nature as can various other metallic hydroxy-apatites. Some $CaCo_3$ is apparently also present in enamel and is usually found as the compound $Ca_3(PO_4).CaCo_3$. Various other unexpected elements are present in small quantities, such as 0.05 per cent Cl, 0.02 per cent Pb, and 0.02 per cent Fe.

Although the inorganic chemical composition of enamel is similar to organic material in dentin, there is a much greater amount of organic material in dentin. This results in a marked difference in hardness between the two tissues. Figure 2 shows Knoop indentations on a polished surface of enamel and dentin at the dentino-enamel junction. These indentations are made by means of a diamond point under constant load. The length of the indentations are indicative of the corresponding hardness for the enamel and dentin; the longer the indentation, the softer the material. As shown in this picture, the indentation in the dentin is much longer than the one made in the enamel even though the load was the same. Knoop hardness readings for enamel are usually from 170 to 200. Corresponding hardness readings for dentin vary from 35 to 55. Hardness will of course vary for individual teeth and for different areas in the same tooth.

Dental caries is dependent, to a large extent, upon the solubility of the enamel. The more insoluble the enamel, the more resistant it is to the action of acids which are liberated by the bacteria. Active decay with cavity formation is undoubtedly preceded by the slow dissolving of the enamel surface. For this reason, it is of fundamental importance to study the mechanism governing the solubility. The relationship of the solubility of enamel and the pH of the surrounding medium may be described in terms of the solubility product (*3*).

Since $Ca_3(PO_4)_2$ is apparently the main unit

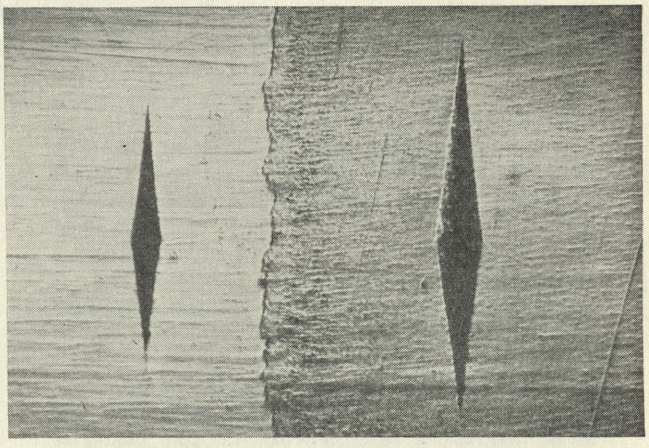

FIGURE 2. — KNOOP HARDNESS INDENTATIONS MADE ON A POLISHED SURFACE OF ENAMEL AND DENTIN AT THE DENTO-ENAMEL JUNCTION. THE SMALLER INDENTATION IN THE ENAMEL AT THE LEFT INDICATES GREATER HARDNESS.

of the complex apatite salts which make up the composition of enamel, the solubility may be approximately in terms of this compound. According to the well-known solubility product principle, the following relationship holds true when calcium phosphate is in equilibrium with its solution:

$$[Ca{+}{+}]^3 \times [PO_4^{\equiv}]^2 = K_{sp}$$

If the product of $[Ca^{3}{+}{+}]^3 \times [PO_4^{\equiv}]^2$ is momentarily increased over the value of K_{sp}, prescription of $Ca_3(PO_4)_2$ will result; but if the product is reduced below K_{sp}, solution of the $Ca_3(PO_4)_2$ will proceed until the product is again increased to K_{sp}. It thus follows that the solubility of enamel is to a large degree dependent upon the concentration of $Ca{+}{+}$ and $PO_4^{\equiv}$ in the surrounding medium. In this connection, the work of Karshan and Rosebury (4) is interesting. They determined the concentration of calcium and phosphate which was necessary to prevent the solubility of enamel at various pH levels in buffered solutions of lactic and succinic acids. For example, at a pH of 7.0, less than 1 mg. of phosphate per 100 cc. was required to inhibit the solution of the enamel, yet 200 mg. were required at a pH of 4.0. Thus,as the pH is lowered, additional calcium or phosphate is needed in the surrounding medium in order to inhibit solubility. When sufficient concentration of the two are present in the surrounding medium of the tooth, the pH can be quite low without danger of dissolving the enamel.

This rate of solution of the enamel will be governed not only by the pH, the $Ca{+}{+}$ and $PO_4^{\equiv}$ concentrations, but also by the type of acid present (*5*). We have found that tooth crowns which were stored in solutions of orange juice, lemon juice, coca-cola, and many other similar products lose as high as 20 per cent of their original weight after 20 days immersion. Fortunately, such materials do not remain in contact with the teeth for that long a period of

time, yet it does show the effect that low pH can have upon the enamel.

The content of Ca^{++} and $PO_4^{\equiv}$ in the saliva is probably always great enough to prevent solution of the enamel within the range of pH that does occur in saliva. It is a highly buffered medium, with a pH ranging from 6.8 to 7.2 (*6*), and thus aids greatly in neutralizing acids taken into the mouth and those formed in the oral cavity. This may explain why tooth decay usually takes place in the more protected parts of the enamel which are not so thoroughly bathed with saliva.

In the past many different methods have been presented for the control of tooth decay, including use of certain vitamins, bone meal, diet, etc. The most recent theory, and apparently the most promising, is the incorporation in the developing enamel of ingested fluorides present in the drinking water or the topical application of fluorine to the formed tooth surface. Epidemiologic and clinical studies have brought out the fact that fluorides inhibit tooth decay up to about 40 per cent of the average of samples studied. The definite mechanism by which fluorine does inhibit decay is not too well understood. Apparently the fluorine does actually substitute into the space lattice of the hydroxyapatite, replacing the OH group and thus forming calcium fluoro-apatite. This replacement produces a more insoluble enamel.

Recent research has shown that the heavy metal fluorides, such as lead and uranium, reduced the solubility of enamel to a much greater extent than the alkali metal fluorides which were previously used. In these cases, some of the Ca in the apatite is believed to be replaced by the heavy metal, forming for example, a lead fluoro-apatite, $Pb_3(PO_4)_2.Ca(F)_2$. Further X-ray diffraction and spectrograph studies are needed to substantiate this.

Using the Knoop indenter for hardness, we have found further evidence of the inhibiting action of fluorine compounds. Table 1 shows the loss in enamel hardness following treatment (*a*) with a buffered acetic acid of pH 4, (*b*) with a buffered acetic acid of pH 4 plus the fluorine compound indicated. It is quite evident from these data that the enamel is protected by this replacement reaction since the loss in hardness from the original is much less in the fluorinated acetic acid.

TABLE 1

Loss in Hardness of Enamel When Immersed in Fluorinated and Unfluorinated Acetic Acid Solution

Five groups of 12 teeth each were polished, hardness determined; each group was placed first in acetic acid, and then after determining hardness again, in acetic acid containing one of five different fluorides, with results as follow.

Buffered acetic acid at pH 4.0. *Per cent change in hardness*	*Buffered acetic acid plus fluoride at pH* 4.0. *Per cent change in hardness*	*Fluoride added*
—23.3	—8.1	1. NaF
—37.2	—2.5	2. PbF2
—15.0	—3.7	3. CuF2
—27.6	+6.8	4. ZnF2
—43.8	+3.1	5. SnF2

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(*By Ralph W. Phillips and Grant Van Huysen*)

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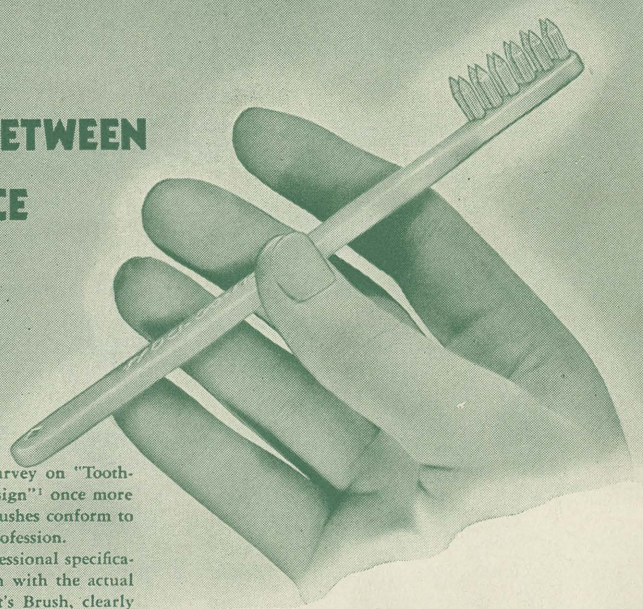

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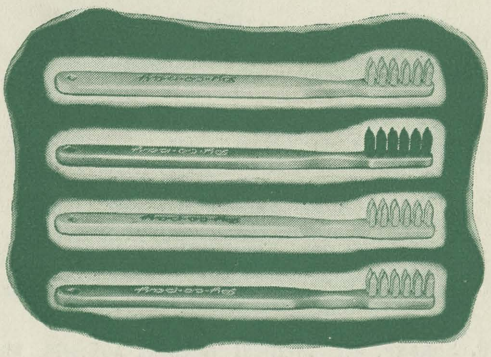
Tuft Length	½ inch	7/16 inch
Over all Length	6½ inch	6½ inch
Handle Length	5 inch	5¼ inch
Handle Shape	Straight	Straight



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