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Dr. Howe and the Forsyth Infirmary

ROLLO WALTER BROWN

HARVARD UNIVERSITY PRESS • CAMBRIDGE • 1952

The Making of an Institution

ONE day when James Bennett Forsyth had called Dr. Ervin A. Johnson, of the Tufts College Dental School, to his room in the hotel to give him dental attention that he required, he asked in the course of the hour: "If you had a sum of money to leave, what would you do with it?"

Dr. Johnson knew precisely what he would do. If he had money to leave, he would put it into a dental clinic or infirmary for children. The trouble with dentistry was that most dental attention came too late in the patient's life. And then, of course, far too much of it never came at all.

The problem in the first decade of the century is today next to unbelievable. Vast areas of the United States had no dentist at all. Teeth went their way until the toothache was beyond endurance, and then the nearest family doctor yanked them out — while the patient writhed and screamed in agony. In many a rural community the test of a man's self-command was whether he could have a tooth pulled without grunting. Sometimes the doctor who was reputed to be "good at it" would drive through the snow or mud in his buckboard for six or eight miles and take out teeth for three or four patients who assembled at one house. It was not unusual for him to take out six or eight or ten for one patient — and with no anesthetic. And in communities lucky enough to have a dentist, he often had had such brief training, possessed such inadequate equip-

ment, and made such imperfect use of what he had that there was a tradition in favor of keeping away from any dentist just as long as possible. Even in the cities that were well provided with dentists, something of this attitude — perhaps accentuated by the fact that the dentist was almost sure to cause pain — worked against him, no matter how conscientious and skillful he might be. As for small children, they could get along without dentists!

Dr. Johnson had been thinking about the matter, and he presented the case so vividly that James Bennett Forsyth was impressed. All his life the inventive work that he had done in the new field of rubber revealed a clear imagination. Here, in a field where he was a stranger, he could see that there might be an idea of importance. He was ready to have details.

On one occasion he called in his brother Thomas to hear what Dr. Johnson had to say, and the three spent an hour and a half together. The brothers were interested.

Early in the discussions, Dr. Edward W. Branigan, Professor of Clinical Dentistry in the Tufts Dental School, was called in consultation. He had long dreamed of a dental clinic for children, and had worked for years in an effort to establish one. But he had never been able to secure even a modest sum of money for such an enterprise. At one time he had tried to secure a gift or a loan from Andrew Carnegie — a mere \$60,000 — but was unsuccessful. He was very much discouraged.

It is easy enough to imagine, then, how completely overcome Dr. Johnson and Dr. Branigan were after James Bennett Forsyth's death (June 11, 1909) to be told by Thomas Forsyth that there would be two million dollars with which to begin work on a dental institution for children. "So go to work."

Soon a board of trustees was brought into existence, and through a special act of the Massachusetts legislature the Forsyth Dental Infirmary for Children was incorporated, in 1910. The incorporators were Thomas A. Forsyth, Frederick W. Hamilton, Edward W. Branigan, Harold Williams, John

F. Dowsley, Sumner Robinson, Ervin A. Johnson, Chester B. Humphrey, and Timothy Leary.

The two surviving Forsyth brothers — that is, Thomas and John — purchased a tract of land fronting the Fenway not far from Huntington Avenue, and held a competition for the design of the proposed building. Edward T. P. Graham was the architect whose design was unanimously accepted. The building was to be commodious, with over-all dimensions of about 170 by 80 or 85 feet; it was to be dignified in appearance, built of stone or marble — marble was finally chosen; and the interior was to provide not only the best in dental equipment but the most inviting environment that children could have from the moment they entered the building until they left it. When, for instance, a competition was held for the design of the tiles to be used in the children's room, some of the subjects submitted by the competing artists were: Dorchester Giant, Rip Van Winkle, Hiawatha, Jason and the Golden Fleece, the Blue Bird, the Pied Piper, Briar Rose. The building was to be "dedicated to the children."

The tentative plans were set forth in a handsome booklet, prepared by Dr. Timothy Leary for the Trustees, which was sent to dentists and dental schools throughout the country. The institution was to engage in a pioneer enterprise, and the founders and the trustees wished to have all possible suggestions that might save them from wasted effort in false starts, reveal to them whatever might be of value in the work that others had done, and confirm them in whatever was sound in their own tentative plans.

What they proposed to do seemed so reasonable, so genuinely philanthropic, that they felt sure of much praise for the basic idea and many suggestions for the improvement of details. And there was, in truth, wide approval of the general conception. Sometimes, to be sure, it was only a more or less perfunctory approval. Sometimes the approval was hitched up to a favorite theory held by the sender. One distinguished dentist, for instance, had a strong belief that bottle-fed babies required more orthodontic attention than breast-fed babies,

and hoped that this belief would receive attention. Sometimes the approval revealed only the highest professional concern, and the most disinterested consideration. The faculty of the College of Dentistry of the University of California, for instance, wrote a thoughtful letter of approval, and wondered quite logically whether it might not be advisable to provide for the publication of the research that was sure to be carried on in such an institution.

But the incorporators had not considered all the objections that could be marshaled against their high enterprise. They seemingly had been so completely and generously engrossed in what they were doing that they were more or less forgetful of the threat that a fresh, virile idea inevitably offers to the ideas and prejudices already established in men's minds. And early in the twentieth century this fresh idea of theirs was at once so startling and so reasonable that it was acutely disturbing to the solidly orthodox and the well established.

These were able to bring a vast array of objections to the plan. It was contended, for example, that the incorporators provided for one big pretentious infirmary, when the needs called for a half-dozen small clinics in the highly congested parts of the city. And even if one central infirmary were to be built, it ought not to be placed on the Fenway. Here it seemed too much in the atmosphere of the Museum of Fine Arts and other institutions little related to the teeth of underprivileged children. The streetcar fare would be prohibitive, even if the children were to "pay" only five cents for each appointment at the Infirmary — much later, a dime. The children would not feel at home in such a magnificent place, and would avoid it. And if there were to be research laboratories, they ought to be somewhere else, removed from the too great accessibility of the clinics.

Some of the objections were expressed with a warmth that occasionally approached venom. This kind of objection centered so closely in Boston that, forty years later, one cannot help wondering whether there were not a definitely organized conspiracy against the new venture. It is not possible to know

was no money for a dentist. Forty years later it requires all the testimony of school nurses of that earlier day, of teachers, and of aging men and women with good memories, to make believable the suffering that children endured from defective teeth and the time lost either in absence from school or in suffering in the schoolroom so that complete attention to studies was impossible.

It is much less difficult to imagine how these children responded to the idea of having no more toothache of this kind. And all of the relief was to come by going to a great and beautiful place such as they had never seen. To many of them the experience was to be such an adventure that they almost forgot about their teeth.

From the nurses they learned not only what to expect but how to conduct themselves. They were instructed, for example, in such a matter as riding in open streetcars — then still much in use, and full of invitation to take chances. So impressive was the instruction and so sharp were the eyes of the escorting nurses that after many years the chief nurse of the school system was able to report that there had been not one transportation casualty.

When the children arrived at the Infirmary, they entered a waiting room on the semibasement floor. For many of them, this room in itself brought an important experience, for it had been arranged with thought for avoiding as much of the tedium of waiting as possible. There were comfortable chairs and seats, and books and pictures; there was the interesting frieze in colored tiles of Rip Van Winkle, the Golden Fleece, the Pied Piper, and the Dorchester Giant that the prizes had been offered for; and for a time there was an aquarium — until it proved to be more of a problem than a diversion. The entire room was of tile, so that it could be flushed from floor to ceiling and kept in the most perfect sanitary condition.

After all the details of registering, paying the required nickel and the like had been carried through, half-dozens were escorted by attendants in white to a smaller waiting room upstairs, and then when operators signaled that chairs were

*Forsyth Infirmary*

THE FORSYTH DENTAL INFIRMARY FOR CHILDREN

*Forsyth Infirmary*

MAIN OPERATING ROOM

were impressed by this family life, but all their circle of friends, especially the young. She was conservative in her outlook, and it seemed somewhat strange that this man who was to be known for his unorthodoxies should find in her life precisely the kind of haven that he required. Perhaps every way-breaker has some fortress of this kind — or of some kind — as Cézanne once confessed. In any event, Dr. Howe needed one, and possessed it.

As for his dentistry, he soon had to take in another dentist to help with the growing practice. He busied himself, of course, with cements and fillings and crowns and dentures. But the relation of teeth and dentists to the total health of a human being steadily pressed in upon his consciousness.

"I formed the habit of scrutinizing the teeth and oral tissues of each of my patients as I worked. It seemed to me that a world of difference could be observed — differences in the tooth substance, in the type of decay, in the saliva, in the tone of the tissues. I began to reflect on the general constitution and make-up, on the temperament, of my patients. Here's a big stalwart fellow, steady as a rock, slow of movements and speech. Next comes a school teacher from New York, slight of frame, delicate, and nervous as a witch. Would you expect to find identical physiological processes in these two people? Or would the oral expression of these processes be the same? I sensed that a multitude of complexities lay behind these differences."

One day a man brought his niece of eight or nine years and wanted gold fillings put in some teeth because he understood that gold constituted the very finest work. Dr. Howe filled the teeth. "But all the time I was so engaged, doubts were rising in my mind as to the suitability of my operative act. Here, I thought, is a structure not fully formed. Are all the teeth of this child alike? Or is there a difference — what and why? I realized that the root ends of the permanent teeth were wide open and the tooth itself not much more than a shell undergoing the processes of growth and development. Were they fit subjects for the hardy treatment necessitated by the inser-

tion of gold? Was I performing the very best service for this patient? I believed I was not."

Patients were coming in every day who kept in his mind this relation of dental practices and general health. An experienced physician appeared one morning with one of his patients who had many carious teeth and was in poor health. He said he wanted those teeth taken out and her mouth "cleaned up," for he was of the opinion that the carious teeth were the cause of her run-down condition. Dr. Howe removed the teeth, but he grew more and more troubled about the patient. He could not help believing that it was her run-down general condition that accounted for the extensive decay and not the decay that accounted for her weakened condition. "Dr. Wedgewood told me to pull her teeth, but I shouldn't have done it. Something else was the matter with her." Her case was one of the many that early convinced him that the state of the teeth was more often the expression of the trouble than the cause of it.

He received his greatest early awakening, however, from the case of a young friend who was a medical student. "His teeth were as white and as free from caries as could be when he contracted a severe case of typhoid fever. He came home from medical school and nearly passed out. Convalescence was long and slow and marked by several disturbing episodes. Some time later his teeth troubled him and he came to me. I found several teeth crushed through. Although I removed the broken particles of enamel and broken-down tooth substance and tried to put in small pellets of cotton saturated with eugenol and morphine and other obtundents, these only gave him the greatest pain. He could not bear the slightest touch. The only substance offering any relief was compound tincture of benzoin flowed into the cavities of the broken-down teeth. Here was nothing other than an internal softening, a very great softening of the dentine with crumbling of outer surfaces of the teeth, all due to physiological conditions. As recovery progressed, adventitious dentine formed and the teeth became hard again. These teeth were under my amazed observation for many months, and difficult as it may be for anyone

notes — fortunately not lost — in which he more or less defined the limits of what he first set out to do. "The present theories of dental caries," he observed, "are incomplete and the attempt to apply them ineffective. The work upon which they were formulated is far from modern — our clinical methods are at best but restorative and palliative. Carefully prepared statistics, some of which were gathered under the direction of this department, show that tooth decay is almost universal. It is distinctly an accompaniment of civilization. The need of thorough scientific study of this problem is obvious." This was in 1917.

He noted further: "After a preliminary study of the general mycology of the mouth in cases of much tooth decay and in cases that are free from it, we have made a more refined study of the microorganisms intimately associated with the process. This has included a study of the mouth protozoa, study of distinctive types of bacteria, of bacteria from the deep layers of decay, of certain bacteria in pure cultures, of bacterial counts."

After jottings about the details of method, he went on to note: "We have made an extensive and practical examination of the antiseptic value of various filling materials. These have been analyzed and the action upon the flora in the teeth themselves determined. The introduction of materials of antiseptic properties into filling materials is a new step — and of importance to the profession." A World War had that spring come to us, and some of his investigations, such as the efficacy of mouth washes, were carried on for the benefit of the armed services.

It is possible to follow out his early program somewhat specifically. When he assumed his duties — that is, enjoyed the possibilities — in research, the amoebic theory of pyorrhea was still fervently discussed. He felt that he now had what he called his golden opportunity to become informed about the microbic life residual in the mouth, "for about this little was then known." Here was a great clinic from which one could draw material, at least as it pertained to the mouths

of the young, and "here was a technician admirably qualified to pursue the very paths along which I had already taken some steps."

Did the mouths of the children of the Infirmary contain endamoebae? If so, in what pursuits were these organisms engaged? Could they be regarded as the cause of pyorrhea? These were some of the questions that claimed him.

The Infirmary afforded immediate assistance. "We went through the clinic taking a sample of material from under the edge of the gum in the mouths of a hundred unselected children. Examined the specimens fresh, and in a warm physiological salt solution at a magnification used in the study of blood cells. We found endamoebae present in a very large percentage of the samples taken from varying oral conditions, but especially in those taken from stagnant congested areas under the gums. Yet we found no condition akin to pyorrhea among these children. Therefore we concluded that the presence of oral endamoebae in the mouth did not provide a standard by which to detect pyorrhea alveolaris. Just as common as blades of grass, and just as harmless!

"These organisms were found not to have penetrated the tissues. Therefore we considered them not parasitic but harmless and engaged in the autodisinfection of the mouth. To see if the endamoebae could be made to attack tissue, we established artificial pockets in the mouths of guinea pigs and after partial healing filled them with salt solution containing endamoebae. The organisms in no instance interfered with the healing nor did they give any indication of destructive action on the tissues, but promptly encysted and disappeared.

"Miss Hatch with great skill stained and photographed endamoebae at a higher magnification — that is, higher than mentioned above. She prepared many specimens which were subsequently used at lectures and exhibits." In fact, one dental colleague who visited the laboratories was so excited over the slides that he carried them off to use in an exhibit, and forgot to return them.

Since emetin had been hailed as the cure for pyorrhea,

Dr. Howe and Miss Hatch searched for persons who had been subjected to the emetin treatment. They found that these persons remained "flagrant sources of endamoebae. It was evident that if complete destruction of these organisms had at any time taken place, it must have been only temporary." A girl who worked in the Infirmary had taken the emetin treatment, yet was such a prolific source of endamoebae that whenever an interested or skeptical visitor came to the laboratories, Dr. Howe hurried Miss Hatch away for a culture from the mouth of this girl. "The crux of the whole matter lay in the fact that the projectors of this theory had not distinguished between the endamoeba histolytica and the endamoeba buccalis."

By the time only slight beginnings had been made in the laboratories, professional visitors were arriving to see what might be expected — for it must constantly be borne in mind that as recently as thirty-five years ago the field of dental research had not been widely explored. Mr. Thomas Forsyth himself became more and more interested. His satisfaction had been great from the first among the swarms of children, but here was something in the laboratories filled with deep mystery — and perhaps with deep significance. He was fascinated.

Once at the Hotel Touraine after dinner, Dr. Howe assured Mr. Forsyth that he had done a fine thing philanthropically, but that now he must choose between making a good orphan asylum out of the institution or a scientific center that would lead the world — "for very little is known about the cause of the conditions that we are studying."

Mr. Forsyth asked: "How would you go about this?"

"If you would allow me to have three more trained assistants — one a bacteriologist, one a chemist, and one a person to prepare tissue for examination — and hold Miss Hatch, whom Dr. Leary has trained, as a bacteriologist and general assistant, and pay them enough to enable them from time to time to visit other laboratories to see what is going on or to further their training as needed, we would then have a team

of workers such as no other dental institution has, and with this great clinic as a source of study we could beat the world."

Mr. Forsyth had a question: "How much would it cost?"

"I don't know."

"Well, go ahead anyway."

And a greater intimacy sprang up between the men. It was to have unexpected results a number of years later, but immediately it produced a warmer atmosphere for research. Dr. Howe could now feel his way ahead in whatever direction the observable facts and his imagination might lead.

What he did in the field of pyorrhea and the "microbic life residual in the mouth" was the culmination of years of study, and must not be regarded as inconsequential. But when he could have all the facilities of the Infirmary at his disposal, he seems rather quickly to have come to believe that the approach to the fundamental problems of dentistry must be something other than a bacterial approach. At least the possibility of some other approach must be accepted. He would have to work on.

While he was pushing forward where progress was slow, a problem in dental practice that he had grappled with resulted in what was to become known over the world as "Howe's Silver Reduction Method" or "Silver Nitrate Precipitation by the Howe Technique." "While we worked in the laboratory," he wrote in his notes, "on the possible relation of bacteria to caries, it was appalling to discover the ravages of the carious process in the six-year molars of the children. These teeth were so broken down that they were hopelessly beyond repair, and their extraction was going on at a great rate — a proceeding always dreaded even by the operator. Many patients were sent to our institution from outside practitioners and from other clinics simply because the average dentist disliked to assume the responsibility of extracting these teeth. A troublesome operation all round. Moreover, extraction of this particular tooth was likely to have a disastrous effect on the further growth and development of the jaw."

Here was one more instance of the fortunate collaboration provided by the pioneering institution and the earnestly pio-

neering man. He said: "I tried to think of some method by which decay could be arrested, teeth beyond the ordinary means of repair retained, and extraction, especially of the six-year molars, stopped. I thought a great deal about this; carried it home with me; thought of it in my dreams."

One night he recalled a patient of his whose "wise old dentist had years before shown discretionary understanding of a method occasionally used by practitioners of the period. Instead of excavating her two front teeth for filling, he had skillfully touched with nitrate of silver two tiny cavities between her teeth. This practice was common enough in posterior teeth showing indications of superficial caries, but was seldom used in anterior areas on account of its blackening effect. Although many years had passed, this silver deposit in this woman's teeth had never weakened, but had stood firm in its work of effectually stopping the carious action. I had seen many similar cases, but for some reason this one never left me."

He had to think this over. "Of course the silver had gone through a reducing process. Could not this be hurried along? I had had experience with AgNO_3 in a number of laboratory tests. I had used a chemical test in my studies on saliva, Tollen's test for aldehydes. I had also used silver reduction in Cajal's method for the staining of nerves and other tissues in order to bring out their finer anatomy." He thought perhaps fate had been in his favor in this instance, as well as in others.

"When morning came I looked up the chemistry of metallic silver reduction, as in the making of looking-glass and in photography, and found that silver nitrate put into solution with ammonia added made a nonexplosive mixture from which reduction was readily effected." He had earlier made tests, but with a compound that proved to be explosive.

"I asked my chemical associate, Miss Keniston, to prepare AgNO_3 in different percentages in solution and to add ammonia in different strengths. We chose a saturated solution of AgNO_3 to which we added ammonia until the black precipitate of silver oxide nearly cleared up. Filtered, this solution

gave a heavy deposit of silver on the addition of a reducing agent. Many substances could act as reducing agents, but we chose one-part-to-four solution of formalin."

He tried this solution on some extracted teeth, and then split them open to note the degree of penetration. In pulpless teeth and in teeth with dead pulps the solution had penetrated through the root canals in their entirety and into the affected dentine as well.

"The first case we treated in the clinic with the silver-reduction method was that of a young girl who came to the Infirmary with a very sore and much 'elongated' left upper first molar. Some society girls who were philanthropically inclined had promised this child an auto trip to a seashore resort along with other children and she was most anxious to go. The usual treatment for such a case is to vent the tooth—that is, to make a small opening into the pulp chamber to let out the gas formed by the death of the pulp. Relief quite promptly ensues but this becomes only the beginning of a long series of treatments, the outcome of which is dubious.

"In this case, Dr. Burke under my direction introduced into the cavity the silver solution which he had prepared allowing a few moments for it to be taken up by diffusion into the disorganized tooth structure and also into the pulpal tissues. The solution very gradually disappeared. Again he applied the solution and did this several times until the absorbing tissues seemed satisfied. He then applied the formaldehyde solution as a reducing agent. When it was evident that precipitation of the metallic silver had occurred, he absorbed the remaining fluid as well as he could and inserted a filling of zinc oxide and eugenol. We asked the patient continually how the tooth felt. She said, 'Better. Much better.' I told the child if she had any further discomfort to come back at once. I assured her that in any event we would make it possible for her to go to the seashore on the next day.

"We did not see this girl for several days. When she did come in, the tooth had got over its soreness and was entirely comfortable. I told Dr. Burke to use the rubber dam and to

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isolate the tooth, paint it and the adjacent rubber dam thoroughly with iodine, and to open into the pulp chamber while I brought up our bacteriologist. When he opened the pulp chamber he found a stiff dry mass of silver albuminate which we cultured and found to be absolutely sterile. I told him to apply the silver once more and to reduce it; then to clean out the pulp chamber as well as he could, avoiding forcing any of the treated tissue through the root end; then again to apply and reduce the silver, to flow into the pulp chamber a solution of gutta percha in eucalyptus oil, to place zinc oxide and eugenol in the bottom of the cavity, to allow this to harden somewhat and dry it as well as possible, then to trim and line the cavity with cement, finally filling it with amalgam. I saw this child occasionally for several years. There was never any indication of further trouble.

"After this we treated with the impregnation method a thousand teeth that would have had pulp exposures had they been excavated in the usual fashion. Our records showed only five or six failures. These I attributed to the state of the pulp, determined, according to my belief, by the physical condition of the child."

When he had tried out the effectiveness of this method "in every conceivable way," he published an article, with formula and techniques of treatment, in *Dental Cosmos* (September 1917). He made a jotting about the preparation of this article that revealed how he was ever a live-minded human being in a world that was interesting. "I recall sitting by my study window thinking how sweet and delicious was the warm early summer air that I breathed, and in the quiet of that morning how clear and defined were my thoughts on the subject matter."

There was a demand for the article that the editors of the journal said had never been equaled. Immediately he was invited everywhere to give lectures and clinics on the use of this treatment, and these personal appearances served only to add to the interest that the article in *Dental Cosmos* had created.

The method was adopted widely if not universally by the Army dental service after we had entered the First World War. Dr. Howe was called upon to give very explicit directions to dental officers for applying the material in root canals, and he traveled away from Boston to lecture and observe operative procedure. Once when he went to a large cantonment in Iowa he found operators so fearful of not reaching the apical end of the root that they were forcing the material through mechanically. This disturbed him, for he had insistently said never to pass a broach up a canal for any distance. "I have repeatedly shown, and others also, by treating extracted teeth and then making them transparent, that the pulp canal is not a straight tube but has many bifurcations and divisions, sometimes opening directly through the side of the root. The mechanical attempts to reach the end of a tooth root often leave many of the branches of the root canals untreated. This material applied as directed reaches all branches and as for the sealing process accompanying the silver reduction method it is perfection itself. The affected tissues are not only rendered sterile but with every avenue filled with silver with microscopic precision, the tooth is sealed in a way not attained by any other method. Should there be an abscess or area of disintegration of the outlying bone above the tooth it would be no harm if a little of the silver did pass through the root."

He originated a method of his own to show just what the root canals were really like. "I treated teeth in the laboratory with the silver solution and precipitated the silver. Then I decalcified the teeth in 10-percent hydrochloric acid. When the teeth became pliable I rinsed them in water and put them into strong acetic acid where they soon became transparent. To render them more clearly so, I next placed them without washing into xylol. It was immediately seen that in many teeth the canals were *anything but straight tubes*. They had branchings and bifurcations that were highly interesting, and in the roots of temporary teeth undergoing absorption a fine vascular lacework was to be found. After rendering the teeth trans-

parent I embedded them in a transparent jelly and carried a few specimens about with me to show to various audiences.

"Our work appeared to throw an interesting light on the process of root absorption that was well worth continued study. The usually accepted theory was that the permanent teeth pushing down over the deciduous teeth caused the roots of the latter to be absorbed. Our studies indicated that a vascular change took place about or within — I think *within* — the roots at the time of their absorption. This observation would explain the fact that in an occasional case x-ray examination disclosed no permanent teeth above the deciduous, yet the roots of the latter had mysteriously disappeared. We had some beautiful specimens showing a cobweb of tubules where the silver had penetrated. But we did not always find this." He hoped others would attempt to repeat this work, and he offered precautionary instructions.

He was called upon to contribute other papers on the subject. And through the years there has been a long list of papers by other dentists and investigators. He was urged also to enter into some commercial arrangement for distributing the solution, but always he refused. "It is simple enough for anyone to prepare, and I do not want to commercialize my science." He was not unhappy, however, when a commercial distributor reported that sales went on and on. His great concern was that the dentists who used his method should do their work with utmost care and utmost thoroughness. Everything depended on that.

His mind all the while was running ahead to the possible relation of nutrition and caries. Yet in this development of a silver method, which sometimes seems to be thought of as much less important than other pioneering that he did, he revealed something basically significant. Much later, one of his young colleagues in dentistry personally expressed the belief that "this departure from mechanical repair of decayed teeth may become a milestone in the development of dentistry, its first attempt to treat dental decay as a lesion rather than by amputation and partial or total prosthetic replace-

ment. This fundamentally new approach has not made its full impact upon dentistry. But recent medical accomplishments through the study of biochemical lesions suggest fruitful possibilities in fundamental research on the lesions preceding clinically visible caries, possibilities of breaking into the unknown chain of events leading to caries, and eventually enabling us, at the proper time and place, to apply the proper inhibitory measures. The future drugs may develop to be very different from silver nitrate, but the principle is likely to remain the same, and represents one of Dr. Howe's prime contributions to the clinical approach to dental decay."

He himself in these first years at the Infirmary professed only to feel that he was a little on the way to clearer seeing ahead.

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IN these early years in the laboratory Dr. Howe gave more and more attention to matters directly associated in the professional mind with caries. It was but logical for him to do so, since here he was, in an institution where as many as eighteen hundred children with defective teeth came for treatment in one week. It was not possible for him to forget caries.

He began with the accepted theory of Miller. He believed that Miller originally might have sought for a specific bacterium as the causative agent in caries, and not finding it, had fallen back on Pasteur's theories of fermentation, since in 1890, the date of the publication of Miller's *Microörganisms of the Human Mouth*, Pasteur's ideas had but rather recently become accepted in the medical profession. Miller had proposed that sugars and starches which lodged in the fissures and crevices of the teeth fermented there with the production of lactic acid which ate its way into the tooth and caused a carious cavity. "He thought the acid dissolved the inorganic substances of the tooth, while he had no explanation for what became of the organic residue except to intimate that this was probably taken care of by other bacteria." Dr. Howe had the greatest respect for Miller. But he more than once declared that the careful reading of Miller's work led him to wonder whether Miller himself did not have doubts as to the entire validity of his theory.

Dr. Howe decided to repeat Miller's experiments. He secured quantities of teeth with which to work. These he

immersed in a mixture of bread and abundant saliva collected in flasks from the children of the clinic — flasks attached to the saliva ejectors. For a period of from three to six months he had the teeth submerged in this fermenting mixture, which he kept acid by replacing the bread from time to time. When at the end of the period the teeth were taken out and closely examined it was found that decalcification had slowly taken place in some areas. But this, he and his associates believed, was different from caries — the caries occurring in the mouth. He and Miss Hatch published a paper on their study in *The Journal of Medical Research* in 1917.

Soon, however, he had begun to feel surer than ever that other considerations than the immediate environment of the mouth entered into the cause of caries. "I began to think that we had hold of the tail of a great deal bigger dog than we had realized." Much later he said: "I never have felt that we had done anything more than take an introductory excursion into the biological field. There was no finality about this work, but only an opening of new doors for further investigation. Our studies did establish the fact that the cultivation of oral bacteria had as a rule been too restricted; that the media and the mode of cultivation were the important things; that morphological changes in the appearance of these microörganisms needed to be thought of in attempting to establish their identity."

He confessed that the cultivation of these microörganisms under widely varying conditions opened a new field, brought about a complete change in his ideas, and introduced new principles into his thoughts. He also revealed something of the man he was "in the general." "It is a safe rule never to accept the too obvious without searching proof. Training for research is like preparing oneself to go on a polar expedition beyond the farthest footsteps of man, or into the heart of a tangled forest with which man is entirely unacquainted, or for exploration into the depths of the sea. For all these entries into the unknown, man must prepare himself unstintingly. He must use his imagination, even though he may be wrong.

would show distinct signs of lameness. Cure followed correction of the deficiency state with equal regularity.

"We had not been at work long before a destructive process of the teeth occurred which in some respects appeared like caries. We showed the teeth to various people who thought these lesions were true caries. The teeth of guinea pigs have persistent pulps and are in constant process of growth, wearing down under stress of mastication to their ordinary length. They grow their entire length in a month. We decided to begin studies on monkeys, whose teeth are similar to ours, to see if we could produce decay in these animals.

"So we bought a dozen monkeys, and as time went on, many more. They were macacus rhesus — from India — and young animals. Their arrival created considerable excitement. I had had forty cages prepared, good large roomy ones, each with a trapeze for exercise. We managed to transfer them from the box in which they came to their new and commodious abode."

He had spent much time in trying to produce caries in rats, mice, and guinea pigs by feeding them the microorganisms he had found in his studies of the mouth, along with plenty of sugars and starches, and now he had opportunity to make the tests with monkeys. He and his associates prepared the stickiest, starchiest sugary confection that they were able to devise, and fed it to eight monkeys for a period of eight or nine months. The teeth of the monkeys were more or less completely covered all the time by the sticky mess. But at the end of the period when the teeth were cleaned, there was not anywhere a suggestion of caries — just as there had been none when he had experimented with the other animals.

Soon he was giving his chief thought to effects he could secure through nutrition. "I fed many diets to my monkeys, composed so as to be deficient in mineral elements — in vitamins so far as these were understood — at different protein, fat, carbohydrate levels, and with or without roughage. I obtained a most heterogeneous lot of extensive pathology, such as joint trouble, nervous troubles, edema, eye disturb-

ance, tooth and bone changes, ulcers in digestive tract, heart changes, kidney degenerative changes, and what not."

To these studies he gave the most thorough attention. And always he had the devoted assistance of Miss Hatch. Their animal house was much spoken of as one of the finest early ones in America. She kept a daily record of every animal. Eventually she had given every one a name, according to some dominant characteristic. In her observations, she took into consideration all the quirks of temperament that she found. For her records she made observations hour by hour, day after day as long as was necessary, and often stayed up all night when something significant in the deterioration that followed deficiency feeding was to be seen, or when the process of recovery after the deficiency had been supplied was dramatic.

It must be remembered that this was thirty or thirty-five years ago. Research in medicine had begun to have place in institutions all over the country after the revolution touched off by the Flexner report, but in the field of dentistry relatively little research had been done. What Dr. Howe was doing therefore brought him much attention from the medical world, and sooner or later many distinguished visitors.

One morning — he reported the incident himself — when he went to the Infirmary, he found a stir of excitement in the vicinity of his laboratories. There were two visitors from England. He was introduced to one of them — Sir W. Arbuthnot Lane, of London. Then he was led away to meet the other. As he came up to a knot of men, all very much on their dignity, one of them was explaining how he had removed the tonsils of patients they had just seen, as a means of removing "causative factors of infected heart valves."

"Ah, yes," a man with very British accent answered, "but what kind of infection?"

It was Sir James Mackenzie, who was then in full fame as a heart specialist in England. When Dr. Howe was introduced he said, "Dr. Mackenzie, I do not agree with those men. I think the infection of these valves" — it had been mentioned as "viridans infection" — "is a secondary matter, for nearly

all the animals that I have on deficient diets show these heart complications." And at once the two men had a great common interest.

Sir Arbuthnot Lane was at that time very seriously working on preventive medicine, and the effects of continuous deficiency diets on health. What Dr. Howe was revealing about intestinal disturbances caused by deficiency feeding — one of the many by-products of his pursuit of caries — interested Lane because here, he believed, was support for his theory that there was an undeniable relation between inadequate nutrition and cancer. Dr. Howe had long been on record as believing that dental caries and certain attendant ailments resulted largely from "civilization" and all its artificialities in nutrition, and since Sir Arbuthnot Lane had become convinced through studies in many places that cancer likewise was an accompaniment of "civilization," he had to know more about what Dr. Howe had done and was proposing to do. The two visitors came to Forsyth for a second day. They stayed longer, in order to examine in detail the tissues of the animals that Dr. Howe and his assistants had worked on. And when they had returned home one of them wrote back to America — if it is now permissible to mention the fact — that he was more impressed by Forsyth than by anything else in America.

Dr. Howe received all visitors cordially and in humility. In one way or another he continued to say that he did not expect to find any single, direct cause-and-effect relation that would explain the carious process. "They're going to find that it's a state of affairs, not one specific thing. It is civilization moving in on the human race where many effects play their part in the distortion of nature's efforts to institute perfection of structure in the tooth-forming process. Everything I have experienced leads me to believe that caries is of metabolic origin and directly attributable to our departure from a mode of natural life into what we are pleased to term civilization."

He was always encouraged when men of discernment came

along and caught the significance of his somewhat lonely efforts, and often revealed some of the enthusiasm of a boy — a boy given to understatement. But he had relied upon his own penetrant observation and his own thinking until he was quite able to go along in his own way whether visitors brought moral support or not. In a small notebook of purely personal jottings, he had written: "I believe we were the first to show nutritional effects on the teeth — at least in this country. I mean to be able to produce these effects at will, and to restore the ability of the pulp to function again normally."

He continued to receive attention in the medical world. Once when there was to be a meeting in Boston to present views on arthritis, he was asked as a dentist to take a minor part in the discussion, since the theory prevailed that hidden centers of bacteria in the mouth might well be the cause of arthritis. One gathers the impression from the fragmentary details of the program as it was arranged that the medical men expected him either to support the prevailing view or to give them an opportunity to disregard him completely.

When all the other speakers had presented their beliefs and Dr. Howe was asked to participate, he explained that the conditions in pyorrhea thought by some to be caused by amoebae were akin to such conditions as he had just heard described in the joints. But he and his associates had found that the amoebae of the mouth were not the cause of pyorrhea. They had been able, however, "to produce with regularity and within a very short time pronounced joint disturbance in animals by a lack of what is now known as Vitamin C." He did not leave the impression that he had discovered the cause of arthritis. Undoubtedly, he said, many factors were involved. But here was one factor in the causation of bone and cartilage changes comparable to some existing arthritic changes. And he exhibited slides "demonstrating arthritic changes in the joints of animals as a consequence of various dietary deficiencies."

Several of the participants in this meeting stayed over to visit the Forsyth laboratories. They saw animals that had died as a result of protracted deficiency diets — and yet, Dr. Howe

reminded them, diets very little different from those in daily use by many people. The visitors were confronted by "the spurs and abnormal deposition of bone salts in the tissues which were in some cases ankylosed." Although many of the visitors came to the Infirmary strongly prejudiced against what he had told them they might see, he believed that some of them found in his work what he called a new lead to certain arthritic conditions.

He did not try to prove too much. In truth, he only helped them to see for themselves with a new clarity. He showed them how he had found that most patients with manifest enlargement of the joints existing over a long period of time have similar enlargement at the root-ends of the teeth. He found that in spite of the fact that the teeth often were loose they were removed with some difficulty because of these enlargements. "Sections of such specimens show that calcification has proceeded to construct these enlargements in onionlike layers. Deflection of the circulatory channels entering the tooth seems to have occurred in many instances. I mention this merely to show that many of the influences involved in constitutional changes are reflected in the dental structures."

He was accustomed to say that research work was a simple matter: you tabulated facts and made deductions; or you took an existing theory and put it to the test to determine its truth or its falsity; or you let your imagination run free in open fields to see if you could come upon some inkling of reality not yet recognized. In this busy period of the first few years at Forsyth he had engaged in all of these activities, but his long experience and his mental constitution led him more and more to the last of the three, where he could let his imagination move out from what he had already discovered into uncharted areas.

Especially did his research on the possible relation of diet and the teeth lead him more and more to live in the area of research that seemed to him to belong in common to dentistry and medicine. Dental health is general health — general health that has the right factors entering into it. Dentistry, therefore, must not remain isolated in a neat world of its own. It was an

extension of medicine, a special field in medicine, and the dentist should have a groundwork of good medical training, just as the specialist in the eye and the ear has. In truth, Dr. Howe had come to believe, through his years of observation, that the healthy development of the teeth and oral cavity and the face bears a more or less unobserved relation to the whole development of the child, including his mental development. He was critical of his own profession. He thought that the great emphasis on repair work in the training of dentists, and their complete occupation with such matters in their practice, deprived them of the progressive new understandings that the situation required. But he was also critical of the medical profession, in that physicians in turn looked upon the dentist's world as one that physicians need have no acquaintance with. So there was on both sides unacquaintance with what should have been common ground.

In these early years of his research, then, in addition to establishing the groundwork of all his later research, notably that in nutrition, Dr. Howe had come into full possession of the great dominant idea of his life: there must be a more inclusive conception of what dentistry is. Dentistry must be one of the fundamental constructive forces in the pursuit of general health; general health must serve the cause of dentistry. His expanding pursuit of caries had made him surer than ever that all health is one health, just as all life is one life.

Forsyth Dental Infirmary for Children, for the mere existence of such an institution at that time was not always known, and was certain to be insufficiently known. He told them about his silver-solution method, and held clinics in which he demonstrated exactly — not approximately, but exactly — how the process should be carried through. He told them about the experiments in feeding that he and his young colleagues at Forsyth were carrying on, and how clearly he had come to see that Miller's theory of caries was inadequate. He went into detail to show how deficiency diets could produce all the pathology he had discovered, and how at least something could be done through completer diets to improve fundamental conditions, especially the prenatal life of the child. He urged mothers to nurse their babies and not to wean them too early, since pasteurized milk was a poor substitute for the diet provided by the mother — under the right emotional conditions. He confessed that more and more he was concerned with the relation of complete general health and the full health — that is, full resistant health — of the teeth.

He waged, too, an unceasing and lonely and very characteristic battle against the theory of focal infection that in those years was causing the wholesale extraction of teeth. He contended that the infection was only secondary, and insisted that the dentist could save most teeth if he gave thought to them and to the patient's nutrition. The wave of the focal-infection theory was so high and so completely respectable that physicians and dentists often jumped to hasty conclusions and caused patients to lose an entire mouth of teeth that were perfectly serviceable. One woman came all the way from New York to Boston to ask Dr. Howe whether it was really necessary for her to lose all her teeth. He assured her that it was not, and she went back to New York a very happy woman. The theory was carried to such lengths that physicians without any examination deserving the name prescribed according to the vogue of the hour. There is at least one case on record of a man troubled with a great weariness whenever he was long on his feet who went to a physician who was committed strongly

to the belief that the teeth caused a high percentage of men's ills, and told him of this inclination to weariness. "That means your teeth. You must have them out at once."

"But," the patient protested, "I wear a plate above and below."

"Then it's your tonsils."

"They are out, too."

From another physician the bewildered patient heard — rightly — that he was suffering from a fallen arch; this was soon restored to a normal condition, and all the evidence of focal infection vanished.

There were countless instances that were just as absurd as this one. But the theory swept the country like an epidemic. The "distinguished" dental authorities, and many "distinguished" men in medicine, spoke before national and state and city meetings in favor of cleaning out all foci from which infection spread to every part of the body. One speaker of national repute at a large meeting in Boston set forth a list of some of the diseases that had come to be accepted as of tooth origin. They were: St. Vitus's dance, fallen arches, rheumatism, heart disease, kidney trouble, iritis, wryneck, high blood pressure, — these in addition to numerous lesser matters such as general lassitude, neuralgia, headache, eyestrain, insomnia, until more than a half-hundred ailments were charged to infected teeth.

Like other mass movements, this one sought to crush out all opposition. Dr. Howe, nevertheless, offered such resistance as he could. And in these first half-dozen years or so at the Infirmary his repute was growing so steadily that many societies were willing to let him have his say. He insisted that the theory was insufficient to explain everything that happened. He contended that it was at least extraordinary that "something like seventy-five different diseases" should travel about from suspected microorganisms in the mouth to elected spots in different parts of the body. It was too simple just to speak casually about "elective localization" — of that he felt sure.

He could be thorough in viewing the matter historically, and he could be reasonable and simple and direct in consider-

independent foci. So many, in short, that to attempt to eliminate them by the knife is to eliminate life.

"It has been reported that clinical results support this theory. I have made an effort to find out the truth of this. I can only say that I have never yet seen a single case in which any such effect was to be seen. I have been in practice nearly thirty years. I have been in close association with large clinics and hospitals, and many others connected with both have reported that they have not been able to see that the elimination of dental areas of disturbance have brought about any such effects as have been ascribed, so far as they could see. In the large clinic at the Forsyth I have never been able to detect anything that would support this theory, based upon the streptococcus viridans. In reply to a statement that I had found no arthritis deformans here, Dr. Rosenow replies that children do not have this trouble. I am not so sure of that, but they do have granulomas and blind dental abscesses by the thousand, and if these are the cause of arthritis why do they not have it? Cases of rickets and of rheumatic hearts exist here, but I have never been able to see any evidence whatever that an abscessed tooth could be considered the cause of these rheumatic conditions. I have examined the urine of two hundred cases. No difference exists between that of children that have had blind abscesses and those that are free from them. There are occasionally children that are mentally deficient, but the idea that the teeth cause insanity is preposterous.

"We are now going through an era of destructive dentistry. I believe in constructive dentistry. If an eye had a condition that was considered infective, would you extract it? An infected tooth can be cured, irritation can be overcome. Roots can be successfully treated. The amateur radiographist has proved to be a questionable asset to dentistry. You cannot tell infection by the x-ray; you cannot tell pus by the x-ray; you can distinguish light and dark only.

"The teeth are necessary factors in nutrition. Once lost, they can never be replaced. The first act of digestion gone, the rest must be carried out under stress by the digestive tract. Every

intelligent effort should be made to save the teeth. Clear up all diseased areas, of course. It may be that in certain rare cases a very extensive infection about the teeth, one such as no modern dentist would ever allow to occur in his private practice, would have a general effect upon a person who was physically below par, but such an oral condition would not be the cause of his being below par, but a sequence of it. If we consider dental diseases, such as pyorrhea, and some of the effects ascribed to it, from a nutritional and functional standpoint, we shall be nearer the real cause of our troubles, rather than if we consider these solely from an infectious point of view."

In this battle the entire weight of all his addresses and papers never ceased to be in favor of saving as many teeth as possible, and then finding the diet best suited to sustaining health, which would include the health of the teeth.

Long afterward, when the teeth of patients were not extracted in quite the same wholesale fashion, and when there was an ever-increasing demand upon Dr. Howe for reports on his research, he sometimes smiled and remarked that his many public appearances had been useful in one respect at least: they had required him to find out what he had been doing, and make summaries. What he always had to say to his audiences, however, which was almost more important than any specific revelation of research done, was that the dental profession did not know enough. Nor did he pretend to think that he himself knew enough. Nobody knew enough. Nobody had yet really scratched the surface. And not enough dentists were trying to do any scratching. He jollied them. He gave them amazing caricatures of dentists as they sometimes were. He called upon them to awake and occupy themselves with the unknown that was everywhere close about them.

"The American Indian makes his way through the forest. The moss on the trees shows him the direction of the prevailing winds. Birds in roused flight give him warning, for he senses the nature of their disturbance. From a footprint he knows the tribe. The terrain through which he travels has a thousand

meanings for him. The air he breathes, the sounds, the odors, all speak to him.

"The stomatologist has before him an infinite variety of physiological signs. To only a few does he give heed. He looks for a bacterial thing when in reality it's a cellular thing. He looks in the mouth and hunts for a cavity. The character of the soft tissues, the teeth, the fluids that bathe them, the oral flora carry to him all too few significant meanings. He thinks of little but the form and the finish of his restorative act. He fails to notice from the stroke of his burr the nature of the destructive process, for there are different types of decay. He pays but slight heed to the character of the disintegrated tooth substance that he removes. He fails to read the signs of his terrain with which he sorely needs to be conversant."

When he was invited to give an address before his fellow alumni of the Philadelphia Dental College (April 19, 1922) he chose as his subject "The Need of Further Research in Dentistry." He hoped he would be pardoned if he referred frequently to his own work, for it was always in his mind, and all that he would say about it would "only show how defective and incomplete it all is."

But despite his modesty, he revealed to his audience how inclusive his inquiries had become. After he had made a specially complete summary of all that he had attempted in research, he said: "These, Fellow Alumni, are some of the things that call for further study. The need for further research in dentistry is clear. Theory after theory has arisen only to be disproved. What is needed is to put theories to the actual test. We must preserve the open mind and observe the facts. It does not do to have preconceived ideas in research work. It is only those who possess a very limited knowledge of the human organism that have very decided opinions about pathological states. Only upon facts can a safe procedure for practice be constructed."

He had in the total of his qualities an impelling, almost warlike energy, a stern self-discipline, a great hopefulness, a poised wit, and a robust good will, proportioned in such an unusual way that when he talked about what he had done, he did not

humiliate those who had done less, but stimulated them to profound resolves to do more. Whether he had ever read what George Herbert Palmer once said about "The Glory of the Imperfect," or what William James said about the "healthy-minded buoyancy in most of us" that would make us welcome a universe not yet complete, he shared their belief. He believed in working toward the greater perfection about which one could always dream. When he spoke — naturally, energetically, and from the depths of a great sincerity — those who heard him caught some glimpse of the expanding world that he saw. Even those who disagreed with him — sometimes violently — had to admit that the expanding world might be there. They could not fail to see that at least he belonged with the great imaginatives of every field. It was only that a great imaginative in the field of dentistry was startling. This he knew better than anyone else, but he was quite content so long as his colleagues were moved to consider the broader foundation for dentistry about which he was ever impelled to think and talk.

The Growth of Relations with Harvard

IN this period when Dr. Howe was busy with many developing ideas, he came into official relation with the Harvard Dental School and the Harvard Medical School. It was a very important relation. It was also a perfect instance of the development of an important relation out of what seems to be a fortunate chance happening.

While Dr. Howe had his office as a practicing dentist on Newbury Street in Boston, he had contrived a laboratory in the cramped basement of the building. Later he moved to 10 Exeter Street in order to have next to his office more ample research facilities. Here he was quite proud of his laboratory, and believed it to be as well equipped as anyone might reasonably expect in connection with a private office. He could now give all the time he had — and more — to what he liked to call investigative activities. In truth, the laboratory claimed so much of him that his Scotch-Irish office girl was thoroughly disquieted. "Don't you dare mention 'research' to me!" she was accustomed to say to him chidingly. "If you'd only tend to your practice, you could sweep the town."

To anyone who revealed the slightest interest, he was ready to exhibit his laboratory and to confess that his greatest aim in work had little to do with sweeping the town. "As it was, my practice had nearly swept me off my feet, for I had indigestion from indiscriminate lunches, and was consuming sodium bicarbonate in quantity as an antidote. Finally I had to quit practicing and go yachting for a time to rest and cool off."

In that period he had as a patient a man who was a near neighbor of Dean Bradford of the Harvard Medical School. Dr. Howe took interest in what he saw in this man's mouth — as in every mouth — and was continually carrying into his laboratory something to examine in detail. This patient fell into the habit of walking into the laboratory himself, just to look about — and to discover, if possible, what the matters were that interested Dr. Howe so profoundly. He seemed to be an unusually discerning person. Certainly he moved about in a spirit of great curiosity.

One day after Dr. Howe had become chief of research at Forsyth, but was still carrying on part-time practice, this patient came in to say that they were to go together to Dean Bradford's house. It was this pleasant engagement that turned out to be what Dr. Howe regarded as one of the significant experiences of his entire life. For he and Dean Bradford talked about the relation of dentistry and medicine, and they shared the belief that the two professions were little acquainted with each other, and too divergent in what they were attempting to do. They agreed that medicine spurned dentistry, and that dentistry saw no connection "between filling a hole and disease." It seems that Dean Bradford had been thinking much about Dr. Howe. He had a proposal to make. Would Dr. Howe be ready to have a conference with President A. Lawrence Lowell in University Hall and go over this matter with him?

This proposal of Dean Bradford's came soon after the president of Tufts College had invited Dr. Howe to a professorship in the Tufts Dental School. Inasmuch as he now felt sure that President Lowell must also have some appointment in mind, he was once more called upon to make an important decision. He confided in Thomas Forsyth, since already he was a part of Mr. Forsyth's institution. Mr. Forsyth heard him sympathetically, and was eager to have him accept the post at Harvard — if the invitation should come. He thought it would be much to the credit of the Infirmary if Harvard should honor it in this way. And to support his assurances to Dr. Howe, Mr. Forsyth sent word to President Lowell that he would be glad

5. Food requirements of infants, children, adults, pregnant mothers, with reference to the teeth;
6. Tables of height and weight relation;
7. Effects of various diets upon the teeth of experimental animals.

It is always well to know just what a waybreaker in any field must encounter in his explorations. It is well to bear in mind that he would not be a waybreaker were it not for the fact that the environment in which he works is in one way or another antipathetic or indifferent. The dean of the Harvard Dental School at that time seemed in truth not to be sympathetic in his attitude. Dr. Howe thought he understood why President Lowell had wished to dictate that original letter to Dean Smith. He thought he could see that research in the Dental School was tolerated rather than encouraged. He had never regarded his silver-solution treatment as the most important contribution he had made to dentistry, but he did feel that it had importance, and that in principle it was a right approach to dental problems. It had quickly gone pretty much all over the world, and continued to be widely employed. Yet he complained that it was "prohibited" to the Harvard students of dentistry.

Strange rumors filled the atmosphere. One of these was that this outsider wanted to make over the Harvard Dental School into a new kind of school of medicine. He was — as many had argued years before about the Infirmary — looking at dentistry as if he were a medical man.

Whoever set these rumors afloat went a little beyond the truth — the truth at that time. But Dr. Howe did see that there were problems in dental education, and he could not easily refrain from thinking about them. Later, when these claimed more of his thought, he set down in one of his personal notebooks a paragraph on the subject: "Were I to run a school — connected with Harvard — I should first try to procure money enough to make the school independent for a time of the tuition of the students. I should then make a careful selection of aspir-

ing and prospective students, looking for real aptitude. I would not take the mediocre candidate. Then I should select a committee capable of choosing outstanding men." It was only logical that such matters should claim some of his thought. He was constantly brought face to face with all sorts of specific problems that raised questions of general import. But his new approach to dentistry called for basic research, and in the 1920's this research had his chief attention.

Somebody set adrift another interesting rumor: Harvard was trying to steal the Forsyth Infirmary in order to have the advantage of its magnificent building and its substantial funds. It was declared that Harvard's appointment of Dr. Howe to the Dental School staff was only the first move in the conspiracy. This rumor seems to have had a hearing because of the new recognition of the need that all agencies of health — medical schools, hospitals, children's health centers, and the like — should be closely associated. Since there was this increasing tendency of groups with common interests to work together, to make the greatest possible use of all available facilities, and since many persons, some of them connected with Forsyth, thought some working arrangement should be made with Harvard, it was not too difficult to wonder whether Harvard were not in fact trying to gain control of the Infirmary and its funds. Even Thomas Forsyth was annoyed, although he knew that legally the Infirmary was always to be an independent institution.

Dr. Howe came to the defense of Harvard, and he sought to assure Mr. Forsyth, in a long letter. "Harvard," he said in this letter, "has never 'stolen' any institution yet, nor could it blight its reputation by such an act. It is affiliated with many institutions which still remain as they were donated. The Peter Bent Brigham Hospital; the Robert Brigham Hospital; The Children's Hospital; The Cancer Hospital, etc., etc., have received great benefits from Harvard and they are still the institutions which they were intended to be. They have not lost their identity in any degree. Whatever measure of control has passed into Harvard's hands has only been a safeguard against

questions. He hoped, too, that they would form discussion groups, and have their own arguments over what the lecturers had said. And they must form the habit of concentrated reading — not hasty skimming, but thoughtful, inquiring, perhaps sometimes even slightly skeptical reading — to make certain that they not only understood but felt the value of what the writer was saying. Especially must they learn how to read the professional journals. They must know something about the journal itself, about the writer and his reputation for making thorough observation, and especially about his caution in drawing definite conclusions. "As a rule, I think that definite statements made with great assurance indicate a rather shallow insight into problems, especially regarding biological matters."

On one occasion he used an example of how work should be done. "Quite recently Dr. Mendel of Yale read a paper before the New England branch of the American Chemical Society to which he gave the title of 'The Challenge of Nutrition to the Chemist.' In this article he showed the many and long gaps in knowledge on this subject. Some of these were perhaps beyond chemistry's ability to explain in the present state of this science.

"This was the attitude of a man thoroughly trained for his work — a man eminent in his field (who has carried out countless experiments) and of many years' experience. All through his many writings one sees him draw definite conclusions only rarely and these are expressed as the best we know at the moment — always with awareness that further study may throw some light on the subject which will necessitate a revision of the expressed idea. He is wise, cautious, and sees far into the future — such a man is safe to follow. In all science the road of progress is not straight nor the ground always solid. Advance is usually made as through a marsh or bog where the step is made from tussock to tussock, and each step is taken only after thorough testing of the ground to see that it will support the adventurer. He may laboriously pursue his way only to find that he has reached an impassable

place and so must retrace his steps and start out again in another direction. Scientific advance does not know discouragement, nor ease and comfort. It requires a never-flagging persistence spurred on by an enthusiasm which excludes all else."

He hoped that their experience at Forsyth would "induce habits of broad reading, discriminating thought, and diagnostic acumen." But more than all else, he hoped they would see the yet unimagined significance of the new conception of dentistry that he was always busy with. "We hope to inspire you to look over the wall imposed by technical procedures into the broad field of biology. We believe that we shall have a sounder approach to prevention if we study not the tooth cavity alone but the patient himself, searching for those signs of a more fundamental disability which permits such a destructive process as caries to become active.

"The reason for this is that dentistry after an experience of more than fifty years has by limiting its practice to filling and cleaning teeth failed to reduce the incidence of caries appreciably. Authentic estimates show that caries today exists to an extent of from 96 to 98 percent among school children. When we turn to scientific evidence we find that no one has as yet succeeded in producing caries in experimental animals according to the theory on which practice has been so long based. Yet as I will show you later on, caries has occurred among animals according to a different principle. However, it is not my purpose at the moment to do more than point out to you that we have problems on our hands that require broad study. As something concrete I might suggest that it would be profitable to study the oral conditions of the patient from two standpoints: one as to periods when caries is actively progressive, the other as to those periods when it is inactive — particularly the latter."

He wanted the interns to be more than just good dentists. They must never cease trying to take the over-all view of things. He urged them to use libraries and buy books in order "to talk intelligently with the physician." He counseled them

matter? And a decade later he was publishing a series of papers from the Harvard School of Dental Medicine which were so arresting to him that eventually he was wondering whether for life he was not to be known as "the enamel man."

Thus it came to pass that before Dr. Howe had long been Director there was an atmosphere of intentness, of eagerness, of great confidence throughout the institution. There must be a solid scientific foundation for whatever was done. And it was expected that much would be done.

There was orthodontia, for instance. Orthodontia had been in a confused state. Why not have the proponents of the different views present their cases for the benefit of everybody concerned, so that the institution might move toward the most intelligent procedures possible?

Dr. Howe hoped to have — he meant to have — a more inclusive, more significant use of the clinic. It would scarcely be possible to imagine a richer field for research than the clinic afforded, with all the thousands of children bringing their problems in teeth, in environment, in prenatal history, in diet, in outlook. He was sure that more of the cases in the clinic should be made case studies, that records should be used more extensively in the laboratories. Perhaps the Infirmary should be a trifle less wholesale in the number of young patients admitted, and more attentive to studies growing out of those that did come. They still were to come by the thousands each year, but the thorough studies increased.

In a score of ways it had soon become evident enough to everyone that the Infirmary had a new Director.

CHAPTER XI

Widening Recognition

IT cannot be made too clear that the coming together of Dr. Howe and the Forsyth Infirmary in the second decade of the twentieth century was good fortune of an extraordinary kind. It was not just that each provided the collaboration that the other required; it was that this collaboration came opportunely. For this was a period when many diverse activities — such, for example, as the inquiry into medical education by Abraham Flexner — and many specific discoveries made the atmosphere of the whole world of health increasingly favorable to improvement. One of Dr. Howe's associates believed that in dentistry alone there were three developments that helped to make the atmosphere dynamic: the coming of the dental x-ray, the availability of Novocain, and the perfecting of the casting process. These not only changed the whole complexion of operative dentistry, but inevitably made the profession aware that other important and encompassing developments might be just ahead.

Dr. Howe himself felt that, despite all antipathy, the world was becoming a more favorable world. Men might not be ready to accept all of his beliefs about the relation of dentistry and medicine, but they were turning more and more to him for counsel on every sort of matter closely or remotely related to what he was thinking about — or not related at all. The questions that came to him covered the past; they anticipated the future; they induced thought; they sometimes induced merriment. The director of an animal farm wrote to ask about

the possibility of false teeth for a horse — and Dr. Howe had to reply that here was something a little out of his field. One morning some time after telephone service reached across the Atlantic, just as he was finishing his breakfast he had a call from Scotland — Glasgow or Edinburgh — about the relation of oatmeal and teeth. Did he think there was anything in oatmeal that caused teeth to suffer deterioration? What necessitated the haste of such a long-distance call remained a mystery. It may have been that the champions of oatmeal were disturbed by something that the Mellanbys in England had been saying about oatmeal and decalcification. That seemed a reasonable conjecture.

Appeals for counsel grew more numerous through the years. In the late 1920's they had come to express a recognition of his importance to his time. He was never concerned with the political manipulations engaged in by those active in an organization, his characteristic remark after he had been in a meeting for a time was, "Come on, let's get out of here." Yet in 1927-28 the American Dental Association made him its president-elect by a kind of unprecedented vote. He was astonished, but he was pleased that the honor was an unsolicited expression of appreciation.

According to the procedure of the Association, he as president-elect would assume office as president at the annual meeting of 1929. This meeting was to be held in the nation's capital, and that fact added greatly to all the other reasons which dentists had thought of for being present.

The members of the Washington committee on arrangements worked for months in overtime fashion, and were thorough in getting the news to everyone who belonged to the dental profession. There was full emphasis on the Capitol, the Library of Congress, the Washington Monument, the White House, the Lincoln Memorial, Mount Vernon, the Bureau of Standards, the Corcoran Art Gallery, the National Museum, and other places of public interest. The program, with specimen Washington attractions, was first sent out by the American Dental Association, and then repeated in one

form or another, with many of the same accompanying illustrations of things to be seen in Washington, in less inclusive professional journals over the country and in the bulletins of regional dental societies, until it was difficult to believe that there was anybody interested in teeth anywhere in the country who had not heard of the meeting at least several times. President Hoover was scheduled to appear and welcome the visitors, but found it necessary to have Vice-President Curtis represent him, although he himself was happy to greet the officers of the Association at the White House.

There was, then, an unusual atmosphere of expectancy when the dentists reached Washington and were ready to attend the first general meeting in the ballroom of the Mayflower Hotel on the morning of Tuesday, October 8. After the customary music and welcomings, they were to hear their new president, Dr. Howe.

He startled them the least bit in his first sentence: "I ask your indulgence in departing somewhat from the customary form of presidential address." Promptly he declared that while the pride of the profession had formerly been in manipulative skill, it had now come to be in keeping "abreast of the developments of science."

He startled them further by speaking — very tactfully — with great respect concerning the work of Miller, whose theory of caries, it was well enough known to his audience, he did not accept. Miller, he declared, more than anyone else deserved credit for bringing to dentistry the methods of science. "He entered into a comprehensive study of the mouth, and a review of his work shows a familiarity with the oral flora which is astonishing, considering the primitive state of bacterial cultivation then extant . . . While recent research casts doubt on the validity of some of his conclusions, his performance, considering the disadvantages of his day, was remarkable."

Thus he opened the way to what he wished to say about the newer approach to dentistry. "The physiologist, anthropologist, pathologist, bacteriologist, dietitian, have all added

their quota of investigation, and what appeared to be dissociated and unique phenomena are rapidly being welded into a coördinate whole. Modern biologic study has been most fruitful. No longer do we regard vital forces as negligible, or the teeth as inert masses of carbonate and phosphate of lime to be acted on solely by external factors. We believe they are subject to internal changes hitherto unsuspected, and we feel that the principles which apply to other calcified structures are applicable here."

In keeping with his natural custom, he stimulated his audience while he was in the process of being critical. Or did he criticize them while he was in the process of stimulating them?

"Through the progressiveness of some of our men, the whole field of our research has been critically examined by scientists of note, and the attempt will be made to direct our future efforts along lines that will measure up to the requirements of modern research standards. Too often, theoretical speculation has carried us far beyond what was warranted by experimental facts, and what were assumed to be interesting discoveries have proved to be fetishes of the hour. The great body of clinicians whose only contact with the research laboratories is through the dental magazines and occasional lectures can have no certain method of determining the precise value to dentistry of the scientific data which are gradually accumulating; nor can they always be expected to distinguish between the scientific and the pseudoscientific. It is for this reason that we feel that all our theories should be scrutinized by men of the highest standing, for thus a solid and substantial basis for real progress will be provided.

"The profession, rightly, does not accept too readily ingenious speculations, but more and more demands demonstrable proofs. Individually and collectively, we are becoming scientifically minded. Our research indicates that we have a full program ahead, going into the province of medicine and public health, especially as it relates to children. We must call attention to the fact that not all diseases are crises, but that

some are the manifest culmination of degeneracy changes which, while leaving their impress on the teeth, are in reality of more fundamental significance."

In closing he said: "We are pioneering. We have no traditions to bind us; we dare to think so long as we can prove our results. As never before, our profession is in the straight line of progress. We have opened a door. We do not know where it leads, except that, in general, it is in the right direction. 'Nature does not reveal all her secrets at once,' said Seneca. 'We imagine that we are initiated into her mysteries; we are, as yet, but hanging around her outer courts.'"

His listeners had for years been reading what he had published, and they had heard him when he addressed their regional associations. But now they heard him as the head of their national organization, and he had for them a new importance. They had known something of his point of view, and many of them were partisans for or against it. Yet it had a different sound when he stood before them and sketched it in a few paragraphs. They knew that he had lodged with them a conception that they could not immediately forget. They would have to think it over, argue about it, resist it, admit its reasonableness, and then think about it some more — which was precisely what he most wished to have them do.

Something else that in his long life they never ceased to talk about was his forthright honesty and unpretentiousness as a presiding officer. Was he well versed in parliamentary law? Could he keep all the conflicting elements in the Association neatly balanced? Could he give an external harmony to a situation that had in it the elements of warfare that are always developing in any vast organization?

Well, he was not much troubled about such matters. He wanted to plunge in and transact all necessary business with dispatch. At other meetings of the Association he had learned something of what to expect. That man, for instance, who was always rising to object to something, to protest that something else must be done, to use up time in a long speech — what was to be done with him? It was very simple. Dr.

of 1930, the year in which the conference was to be held. At that time (January 17-18) a meeting of the Committee on Medical Care for Children, Section on Medical Service, met in New York to go over the preliminary plans for the committee's part in the Conference, and at this meeting Dr. Howe, as chairman of the subcommittee on Dentistry and Oral Hygiene, presented a proposed program. This tentative program — still in existence — immediately revealed his deep concern with a view that would include dentistry in relation to medicine, and the teeth in relation to the general health and disease of the child. Once more the background of experience in Forsyth enabled him to speak with unusual authority. He proposed considering how much knowledge a medical student should have of teeth and their relation to health; collecting and studying the records of the prevalence of dental disturbances; correlating dental disturbances and general body conditions; determining the period in the life of the child when preventive measures may be made most effective; considering the status of the dental hygienist; collecting statistics concerning the number and the distribution of dental practitioners, oral hygienists, dental hospitals and dispensaries, hospitals with oral-hygiene and dental service, health centers with dental service.

There was discussion. He thought preventive measures still undeveloped; he believed many reports on dental defects were misleading; he believed childhood was the period when most effective preventive measures could be taken. He stated "the examination of children passing through the Forsyth Dental Infirmary showed that dental disease was often associated with a distinct low-grade general degeneration process." He felt that "dental disease should be classified as a degenerative disease."

Before the Conference itself was held — November 19-22, 1930 — Dr. Howe was busy with investigative work for his committee on Dentistry and Oral Hygiene. When the report of the committee was in final form the first paragraph indicated the ground to be covered.

"In keeping with the policy outlined by the Section on Medical Care for children, an effort was made to determine the existing conditions of the mouths and teeth of the children within our jurisdiction, including a study of (1) dental caries, (2) dentofacial deformities, (3) mouth infections and their sequelae, and (4) the effect of systemic diseases on the tissues of the mouth."

The report dealt in detail with all these matters, especially with caries — age incidence, seasonal incidence, urban and rural incidence, racial incidence, and the like — but there were two clear intimations of the direction that Dr. Howe's thought was taking all the while: (1) the major dentofacial deformities, from laboratory evidence at Forsyth, were of nutritional origin; and (2) too little attention had been given to the very important prenatal life of the child in relation to teeth, and to the likewise very important nursery and kindergarten period when the child very probably would see little or nothing of a dentist, but only the physician — who usually did not know much about teeth and seemed to give little thought to pathologic changes that affect teeth.

Should there not be a change in point of view? Since the Conference was considering the child in a democracy, ought there not to be a shift away from the treatment of disease when it comes, to a philosophy of the promotion of health in which professional effort would have the support of the public, the basis of democracy?

And after the Conference itself was over and Dr. Howe's work on four or five committees had been done, he engaged in perhaps even more important work on a follow-up committee that in the end contributed some substantial volumes on *Growth and Development of the Child*. Here he had opportunity to record once again for a professional or semi-professional audience much that he had come to believe about teeth in their relation to the whole body and about the relation of dentistry to the whole of medicine and public health. In this period, too, he undertook to state his "idea" simply enough to be understood by a radio audience — the great

unconcentrated audience that must receive its impression solely through the ear. The manuscript of one of these broadcasts — "Preventing Diseases of the Teeth and Gums" (1930) — has been preserved, and is interesting as a specimen of Dr. Howe's nontechnical presentation of a subject of this kind.

While he was still busy with all the diversified activities that President Hoover's Conference added to what he had been doing before, he was repeatedly and insistently invited to come to Paris to take part in the program of the eighth meeting of the *Fédération Dentaire Internationale*. The invitations to read papers, to discuss other papers, and to hold clinics seemed so important to the Board of Trustees at Forsyth that they voted to send him over. When the time came, he had brought together so much material that he declared he was equipped to carry on a dental convention singlehanded.

For a week and more (July 30–August 8, 1931) he found himself much in demand, and busier, he was sure, than if he had stayed at home. Before the American Dental Society of Europe, which was holding its meeting in the same period, he spoke on "Nutritional Aspects of Dental Disease"; before the *Fédération Dentaire Internationale* he spoke on "The Bacteriological Etiology of Dental Caries," discussed a paper that dealt with children of afterschool age, spoke on "Silver Reduction in the Treatment of Nonpenetrating and Penetrating Caries," conducted a clinic, or "pedagogical demonstration," on the treatment of dead teeth and teeth with exposed pulps, and held an exhibition showing the effects of mineral and vitamin deficiencies on the teeth of animals.

When he went to the room where he was to conduct the clinic on the preparation and use of his silver-reduction method, he found a larger audience than he could possibly deal with directly; so he spent a half-hour in giving instructions to five or six men, and they then served as centers of explanation. He had not imagined such tremendous interest. "They kept piling in," he reported, "and asking, 'Would you mind repeating what you've just said?'"

He exhibited numerous specimens of teeth "which had been

treated with the silver-reduction process and made transparent by the method I had devised showing particularly the multiple branchings in root canals, especially in the apical region. In another part of the building prepared for exhibits I presented photographs of the pathological results on bone and teeth of the various vitamin deficiencies which Dr. Wolbach and I had studied." He covered some of these deficiency studies also in his paper before the American Dental Society of Europe, and made a remark about the reception of this paper that today has significance as history: "The pathological examination of tissue affected by vitamin deficiencies was new [1931] and therefore of unusual interest." He did not mean that it was altogether new to him or to numbers of his colleagues. But it takes time for any idea to penetrate the world that is busy with something else, and these dentists had been busy. They were sure, however, now that they were hearing him, that they were having fresh contact with unfolding reality.

He and his wife found Paris much more fascinating than he had found it when he attended the meeting there on the eve of the First World War. One experience provided him with a glow of warmth as long as he lived. He went out to the Pasteur Institute as a member of a small group and had the great pleasure of meeting Dr. Roux and having what he himself called "a most interesting conference" with him. Already Dr. Roux was in his late seventies, and a Roux legend was well established — the humbleness of his quarters when he was called upon to become head of the Institute, his habitual use of the tram and motorbus before he was prevailed upon to use the Institute's automobile, and the long-continuing tubercular cough that kept him awake at night. Dr. Howe was still an imaginative country boy — as he always would be — and as he stood face to face with this stooped but clear-eyed ancient who had worked with Pasteur and who was known the world around for his discoveries in diphtheria, he knew that he was having one of the rare experiences of his life. It was something that belonged with the day when Sir James Mackenzie and Sir

Arbuthnot Lane walked into Forsyth and found out what he was doing.

When the Howes came over to England on their homeward way, Sir Arthur Keith came down to London to extend greetings. He hoped also to procure Dr. Howe's skulls of experimental monkeys for the museum of the Royal College. The meeting was a pleasant one, though Dr. Howe feared that he did not carry his part of the conversation. He showed Sir Arthur the skulls, but thought, as he said later, that if they were good enough for Sir Arthur to want, they were good enough for Forsyth to keep. So he did not leave them in England.

On shipboard he had quiet for thinking things over, and he could not escape the fact, he somewhat shyly admitted long after, that things had not been going so badly.

CHAPTER XII

Dr. Howe and the Harvard Changeover

IN the period following the trip to France and England in 1931, Dr. Howe was confronted by another of those questions that he enjoyed talking about. It was this: Was he to become so completely engrossed in administration and educational aims and practices that he would be obliged to abandon his own research work altogether?

Sooner or later this question always poses itself to the man occupied with research if it is found that he also possesses an aptitude for the work of an administrative office. It was this question that President Lowell had in mind when he remarked to the visitor who was viewing the half-finished Mallinckrodt Chemical Laboratories that here was enough equipment to develop fifty Pasteurs, but that he did not expect to have them, since professors with plenty of equipment were sure to be swallowed up in administrative details.

Some of Dr. Howe's friends who were interested chiefly in his research became violent in their denunciation of what they could see taking place before their eyes. The fascinating concerns of educational policy were baiting him away from the laboratory. These concerns, they feared, would bring him out exactly nowhere, compared with where he would be able to go in research.

Somewhere along the way, however, he came to see beyond what they were seeing. If research was to have effect, there would have to be a place where the importance of research could be made evident to students of dentistry.



"You may recall," he said in speaking of the matter, "that one of the reasons why I entered on a dental career was that I was told dentistry was soon to become a part of medicine. This was many years ago, and I have continually watched for significant trends in educational programs which lead in that direction. It was not, however, until I became connected with the study of children's dentistry at Forsyth that the reasons for the close affiliation seemed to become so essential. Here at the beginning of life does the character of the teeth begin to take form." He dwelt again, as he was always doing, on the fact that "much of the responsibility for dental conditions lies in the hands of the physician. This he does not realize. The medical curriculum should fit him to take over."

Soon there was a new president at Harvard, and Dr. Howe was pleased, for he felt that President Conant would be in sympathy with basic research in dentistry. When President Conant wished to form an inclusive Harvard committee on research, Dr. Howe gladly accepted membership. The function of such a committee, President Conant pointed out in his Report to the Board of Overseers, 1933-34, was to participate in an extensive program of coöperative research. "It is evident to anyone who is familiar with modern experimental science that many important problems can be solved only by the efforts of a team of specialists. It also seems clear that the solitary worker immersed in his own ever-narrowing specialty is losing his importance. Whether or not an investigator be actively engaged in coöperating with one or more of his colleagues, he should be aware of much that is happening outside his own department and direct his own course accordingly. Unless I am much mistaken we shall require more professors in the future whose point of view is broad enough to embrace several of those fields which are now sharply differentiated. In teaching as well as in research there are rich opportunities for those who will venture into the uncertain areas which connect one specialty with another."

The program of the committee at least made provision for continuing and elaborating the research that Wolbach and

Howe had carried on. As to the ultimate effect of the appointment of the committee, Dr. Howe was ready to wait and see. He had favored such a committee before it was formed, and he believed, as he put it, that it was one of the many ripples in the sea of education that would mount in size until they resulted in a storm.

He had, in truth, gone so far ahead in his thinking that he could now be content only when he saw at least one school somewhere trying in its program to bridge the gap between dentistry and medicine and to make dentistry more solidly preventive. He never failed to explain that he was in favor of the most perfect reparative work that could be achieved. But he felt that if nothing more than reparative work were done, dentistry was losing the battle. And he wanted to see the battle won.

In the meantime, there were opportunities for him to make his point of view known to more men in both dentistry and medicine. At the Harvard Tercentenary, for instance, he was invited to present two papers, one before a medical group and one before a dental group. He confessed that he "felt some trepidation" about appearing before the medical group, since, after all, he was a dentist, and since he was to speak at the opening session of the Medical School (Tercentenary) meeting, and thought the audience might be large and distinguished. And it was both.

But Dr. George R. Minot as chairman started him off with an introduction which he confessed made him feel very much alive. Dr. Minot said: "A new day has dawned for dentistry — a day of organized research, and one of great importance to human welfare because the prevention of dental disorders is the prime object. Dental problems should be studied in relation to man as a whole, and thus concern all branches of medicine. There is no better example of this than the effect of diet on teeth and their adjacent structures. Dr. Howe, in 1914, was the first person in America to carry out experimental observations concerning this subject. He has indicated that subclinical scurvy can be responsible not only for defective dentition but

also for most types of malformation of the bony structures of the mouth. In 1924, Dr. Robert W. Lovett, as a member of the Board of Trustees of the Forsyth Dental Infirmary, appreciated that Dr. Howe's interests would be advanced by a pathologist, which led to Dr. Wolbach's and Dr. Howe's successful endeavors to characterize vitamin deficiencies pathologically.

"Dental caries is rare in primitive people and is to be associated with so-called 'civilization.' The incidence of caries in children may be reduced by regulation of the diet, as Dr. Howe, among others, has demonstrated. Oliver Wendell Holmes would certainly be pleased that as one of the real founders of dental education at Harvard he had helped pave the way for the recognition that the development of dentistry and medicine must go hand in hand and be increasingly closely associated. 'The Relation of Avitaminosis to Oral Pathology' is a significant topic. The Thomas Alexander Forsyth Professor of Dental Science, Dr. Howe, will speak to us on that subject."

Dr. Howe gave a brief, clear statement of just what the situation was at the time, and demonstrated with a series of lantern slides showing effects of dietary deficiency. But he did not fail to make clear what was uppermost in his mind at the time: "It is the hope of present-day research workers that medical men will work to build good dental conditions by advising proper nutrition in prenatal and early postnatal periods, in so far as this is understood, and that dentists will regard dental pathology not as an isolated situation, but as the result of general physiologic conditions. Only with the coöperation of the medical profession can dentists hope to eliminate such oral pathology as is apparently due to vitamin and mineral deficiency."

The next day he read a paper before the dental group on "Nutrition and Oral Health." In one of his notebooks he confessed that he said very much the same thing as he had said at the Medical Symposium the day before. This was not too literally true, for he went more into detail before the dentists. Yet he did make the same point — that there must be a closer coöperation between physicians and dentists. Perhaps he played

them off against each other ever so little. He reminded the physicians that their coöperation was essential to the dentists; and then before the dentists he concluded his address with the gentle reminder: "It is urged that the dentist inform himself on nutritional subjects. The medical profession has begun to realize that it has its part to play in seeing to it that strong resistant teeth and normal arches are formed through nutritional regulation so far as this is possible."

In this Tercentenary season Dr. Howe found himself among interesting men from many places, and he seemed the least bit surprised that they knew about him and treated him as if he too were interesting. One of the men with whom he had the fortune of a long talk was Sir Frederick Gowland Hopkins. Through their work in vitamins they had known each other since the days when the vitamins were referred to as "accessory food factors," or otherwise lumped loosely enough together to be scientifically safe if someone should discover a basis for being more specific. When the two talked they had to go into the subject of purified diets and what factors they lacked — or might lack — in the rearing of their experimental animals. Dr. Howe had often enough been aware that he worked pretty much alone, and the Tercentenary season of association with distinguished scholars from so many parts of the world filled him with a great modest content and a great new eagerness.

Just in this period, too, on the long train journey from New Orleans to Boston he spent several hours with Dr. Howard M. Marjerison, then Dean of the Tufts College Dental School. They had never known each other well, and now they found how much they belonged together, for Dr. Marjerison, too, was alive with the conviction that there must be a new era in dentistry. He later published a paper in *The Journal of Dental Education* (October 1938) in which he considered eloquently whether dentistry was to be regarded as a profession or a trade.

"My thesis therefore is this: that before dentistry can frame a sound educational program, before it can clarify its position in the field of education, it must first clearly define its educa-

tional philosophy. Our educational philosophy is the creative force which shapes and directs our educational policy. It is the source from which we derive our major premises. Whether we accept dentistry as a vocational system or a university discipline is basic to our whole educational development. We cannot compromise on the issue much longer. We must choose one or the other of these incompatible philosophies. If we accept dentistry as a vocational system, in which technical training receives the major emphasis, then dentistry has no place in the university family; it should be relegated to the position of a trade school. If, however, we accept dentistry as a university discipline, in which the major emphasis is placed on the study of dentistry as a problem in human biology, we at once assume new obligations and responsibilities which call for a complete revision of our educational setup."

Dr. Marjerison went on to say that if men of high capacities and enthusiasm for biological science were to be attracted to the dental field, dentistry must not have educational standards inferior to other fields of professional study. Science must be made primary in dentistry, as in medicine.

"It will be no easy task," he declared, "to change the status of dental education from that of a vocational school to that of a university discipline. Many experiments will have to be made. No one at present can see the picture as a whole, nor can he tell the shortest and least expensive route to the accomplishment of this end. Nevertheless, I see no other course to pursue but that dental education should be just as scientific, just as severe and testing, as the education which is demanded for any other branch of medicine."

Dr. Howe knew he had found a staunch ally — and right at hand. But only a little later, Dr. Marjerison was invited to the deanship of the College of Dentistry of the University of Illinois, and accepted.

In the meantime (1937) Dr. Howe had received notice from the Harvard Corporation that he had been appointed a member of the University Committee on Research in Dental Medicine. He never felt too sure of just how much could be accomplished

through committees, but he was glad to see that, as he habitually put it, the door was opening a little more.

Other evidences that dental education as it was carried on must in some way be supplemented were beginning to appear. *The Rockefeller Foundation Review* for 1938 declared: "Although America leads the world in dentistry, it is a leadership based more upon ingenuity of a mechanical sort than upon the amount or character of research done on the anatomy, pathology, or physiology of the oral cavity. Almost no dentists are trained in such a way that they can do research of a quality comparable to the research in medical schools on medical and surgical problems. Until our dental schools are brought more closely into line with our medical schools much of the mechanical brilliance of American dentists will remain that and nothing more, and the essential curative and preventive measures will go unstudied."

Dr. Howe commented at some length on the paragraph: "I was in entire agreement with this report because at this Infirmary I was taking each year as interns top students from the various colleges in the country and Canada, and so far as I could see these men had comparatively little biological understanding yet they were skilled in the reparative work for adults. Perhaps this would be of not much moment if they confined their professional services to the adult. When, however, the majority of these students thought that the adult method was applicable to the best dental interests of the child they were in error. The dental services rendered to children must embrace an understanding of biological principles, and mechanics must be subordinated to therapy. The student must remember that the little organ called the pulp presides over the calcification of the tooth. The root ends in the permanent teeth of the child are wide open. The body of the tooth itself has not reached its ultimate size. Growth and development of calcified tissues are going on continuously and are not complete until somewhere about the twentieth year. These processes reach back into the earliest periods in life. The dental student needs to know much about these processes as they occur in the intrauterine life, in