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Dominion Dental Journal

Vol. X. TORONTO, MAY, 1898. No. 5.

Our Portraits.

DR. C. N. JOHNSON, Chicago, was born at Brock, Ont., and educated at Port Perry High School. He passed his examination for the L.D.S. in 1881; practised about two years in Collingwood, went to Chicago and graduated as D.D.S. in 1885. Dr. Johnson, both personally and professionally, always finds a warm corner in the hearts of the Canadian profession. Though occupying a very important professional position in the Chicago College of Dentistry, and enjoying a large and select practice in his adopted city, his pen and presence have always been ready to show that he has not forgotten his Canadian connection. As a practical operator he is recognized as one of exceptional merit, and as a full and fluent writer, his fine literary attainments have enabled him to add a great deal of solid value to the literature of the profession, as well as to *belles-lettres*. We are glad to observe, by a press despatch, that Dr. Johnson has volunteered for one of the Chicago Canadian-American regiments which have offered their services during the war, and that he has been elected as one of the Executive Committee.

G. V. BLACK, M.D., D.D.S., Sc.D., Chicago, is in his sixty-first year, and is one of the many living proofs that a man of science who has accustomed himself to industrious research, is in the prime of his mental life, when the younger members of the profession regard him as having one foot in the grave. The Doctor practised dentistry near Jacksonville, Ill., before the war, and served in the army as a full private in the rear rank. He practised a short time in St. Louis before he went to Jacksonville in 1891. On the reorganization of the Dental School of the North-Western University in 1891 Dr. Black was placed on the teaching staff, and is now Dean. It would need a volume to recount the story of his indefatigable labors in the science of the profession. His published works are the most eloquent testimony.

Proceedings of Dental Societies.

ONTARIO DENTAL SOCIETY.

The tenth annual session of the Ontario Dental Society was opened March 3rd, at 10.30 a.m. Dr. J. A. Marshall, President, in the chair. In the absence of the Secretary, Dr. W. Cecil Trotter, B.A., was elected secretary *pro tem.*

The election of officers was then proceed with and resulted as follows: President, Dr. G. S. Martin, Toronto Junction; Vice-President, Dr. J. M. Brimacombe, Bowmanville; Secretary, Dr. W. Cecil Trotter, B.A., Toronto; Treasurer, Dr. C. E. Klotz, St. Catharines. Representatives on Executive—District No. 1, R. E. Sparks, Kingston; No. 2, D. C. Smith, Stouffville; No. 3, Dr. W. E. Willmott, Toronto; No. 4, Dr. F. Kilmer, St. Catharines; No. 5, Dr. Beemer, Simcoe; No. 6, Dr. W. A. Brownlee, Mount Forest; No. 7, Dr. Eidb, Stratford.

It was moved by Drs. W. E. Willmott and J. F. Ross that the Secretary be instructed to paste a copy of the Code of Ethics in the membership roll-book, and for this year that all those who sign the code and pay the annual fee be entitled to membership in the Society. (Carried.)

On motion of Drs. W. E. Willmott and W. Cecil Trotter, it was resolved to have printed membership tickets in the form of a receipt for the annual fee, and that admission to the session at which Dr. Black addressed the meeting be by ticket, except to the members of the Senior Class of the College.

Owing to the lamentable death of the Treasurer, Dr. C. P. Lennox, since the last meeting, and his report not yet having been placed in the Society's hands, the order of business, "Reading Treasurer's Report," had to be dispensed with.

The Executive recommended a change in the order of subjects on the programme, owing to the fact that Prof. Ramsey Wright could not be present at the evening session as advertised.

The afternoon session was called to order by Dr. J. A. Marshall, who introduced the newly elected President, Dr. G. S. Martin, who, in a few words, thanked the Society for the honor done him. Dr. J. A. Marshall then delivered his retiring address.

The Chairman then introduced Prof. Ramsey Wright, of Toronto University, who delivered an address on "The Evolution of Teeth," the lecture being illustrated by lantern slides under the direction

of Prof J. J. McKenzie, of Toronto University and the Dental College.

Prof. Wright showed by his very excellent slides how the evolution might be traced from a very rudimentary state, where the teeth are in layers or strata. In the case of the shark, when one stratum of teeth is worn off the next lower takes their place. This arrangement corresponds with the temporary and permanent teeth in man. From the lantern slides showing the teeth of the cat, the dog, the bear, etc., it was very clearly and convincingly shown that nature tends to develop the useful and get rid of the less useful in this as in all other fields of her operation.

The presentation of an address on "The Clinical History and Pathology of Alveolar Abscess," by Dr. J. B. Willmott, was one of the most interesting and practical portions of the programme. Dr. Willmott demonstrated by means of a fine series of lantern slides the different types of abscess, and the different stages in their development, also the dangers attendant on their presence in the alveolars.

Dr. Willmott was followed by Dr. D. C. Smith, of Stouffville, in a paper on "Treatment of Alveolar Abscess," and a discussion was introduced by Dr. J. F. Adams. The point that chiefly bothered Dr. Adams was how to relieve at once the severe pain suffered by the patient who comes to the office perhaps at two or three o'clock a.m. and wants tooth saved.

Dr. C. N. Johnson, Chicago, said the best way to avoid trouble of that kind was to have office down town and live five or six miles away from it.

Dr. G. V. Black, of Chicago, being invited to answer Dr. Adams' question, gave his method of relieving severe pain from abscess. He would take a strong knife and with a quick stroke would cut right down through alveolus to the seat of abscess. The relief is instant and the remedy not as severe as one might think.

Dr. C. E. Klotz described his method of getting down a curved or contracted root by means of a barbed Donaldson bristle, used with a sawing motion.

Dr. C. N. Johnson being asked to describe his method of amputating root, did so by means of a diagram on blackboard. He enlarges fistulous opening by means of a tent of cotton so as to get access, then cuts off apex of root with drill in engine.

At the evening session Dr. M. G. McElhinney, of Ottawa, read a thoughtful paper entitled, "In the Matter of Advertising."

The discussion was opened by Dr. J. E. Wilkinson, Toronto, who advocated educating the public as the best means of off-setting the advertising quack.

Dr. Harold Clark, Toronto, wished action to be taken by the Society to publish a pamphlet to be distributed by the Society without having any dentist's name attached. It was decided to defer action for the present, it being stated that the Toronto Dental had such a pamphlet under consideration.

Dr. W. A. Sangster, of Port Perry, next read his paper, "Preservation of Pulps." (See paper.)

In the discussion that followed, the well-worn question of pulp capping was handled in an interesting and instructive way.

Dr. John F. Ross thought the question might be most profitably considered by asking two questions.

1. Under what conditions is pulp preservation advisable?

2. What method will best preserve the pulp?

Granted that the conditions are such that there is a reasonable hope of success, his method is to obtain absolute dryness if possible, using, after applying the dam-absolute, alcohol with the warm-air blast. Dr. Black's 1, 2, 3 mixture is a favorite dressing. Use oxide of zinc, or Weston's capping in a thick, putty-like paste.

Dr. Beacock asked if the oxide of zinc was not a menace to pulps from the presence of arsenic.

Dr. C. N. Johnson did not consider that there was much danger in the arsenic to be found in oxide. Take into consideration the age of the patient. If the tooth is not properly calcified, by all means try to save pulp alive. In anterior teeth save pulp if possible, because of darkening so frequently caused by devitalizing. Save any pulp if you can soothe pain. Tell patient it is a temporary expedient. Let us be merciful to our patients and save them all the pain possible. One point he would emphasize. All decay should be cut away, as it is poisonous to the pulp. The demonstrations made by Dr. Williams show that the effects of caries extend a long way in advance of the visible line of decay.

Dr. Sparks, of Kingston, objected to Dr. Johnson's idea of covering pulps that he expected would die. Better devitalize at once and save the patient and yourself trouble. Your reputation will suffer from failure, even if explained to patient.

Dr. Baird, Uxbridge, found that the presence of malaria in his district prevented saving pulps that might be saved in Toronto. Found better success with farmers than with towns people.

Dr. J. B. Willmott called the attention of the Society to the action of the National Dental Association in placing the Province of Ontario with the Eastern States in the recent arrangement and amalgamation with the Southern Association. This was mainly due to the influence of Dr. Thomas Fillebrown, of Boston, President

of the National Association, and this Society should acknowledge the courtesy done the profession in Ontario and accept the arrangement officially. On motion, the courtesy of the National Association was unanimously accepted.

On motion of Drs. Klotz and R. J. Husband, a committee, consisting of Drs. H. T. Wood, J. B. Willmott and R. G. McLaughlin, was appointed to prepare a letter of condolence to be forwarded to the family of our late lamented Treasurer, Dr. Chas. P. Lennox, of Toronto.

At the annual meeting of the Ontario Dental Society held during the month of March in the city of Toronto, the following resolutions were unanimously adopted:

"That the members of this Society have heard with feelings of profound sorrow of the death of C. P. Lennox, L.D.S., an honored member and officer of this Society.

"His untiring interest in its work for many years, and his zealous discharge of the duties devolving upon him as an officer, have won for him the esteem and respect of his fellow-members.

"For more than thirty years engaged in the practice of dentistry in the Province of Ontario he was looked upon as one of the pioneers in the profession in this country, and as one who had borne a part in the early development of the profession so near to his heart.

"To his bereaved family we extend our heartfelt sympathy, and trust that the weight of their grief may be made lighter by the power of God's lovingkindness, and that they may be enabled to look beyond the narrow sea of death and perceive the perfection of that Divine purpose that doeth all things well.

"That a copy of these resolutions be sent to the family of the late C. P. Lennox, and to the DOMINION DENTAL JOURNAL."

Friday, March 4, 1898.

ANNIVERSARY SESSION.

"Dentistry and Dentists in Ontario before 1868." Paper read by Dr. H. T. Wood, M.D.S., Toronto.

"Development of Dentistry from 1868 to 1898," was read by Dr. J. A. Marshall, Belleville.

"Our Responsibility for the Future of Dentistry in Ontario," was read by Dr. R. J. Husband, L.D.S., D.D.S., Hamilton.

Dr. JOHNSTON then read a paper.

The PRESIDENT—There are some letters here from some of the old members which Dr. Marshall will read.

Dr. MARSHALL read communications from old members.

AFTERNOON SESSION.

Meeting opened at two o'clock.

The PRESIDENT—Dr. J. B. Willmott will address you in a few words.

Dr. WILLMOTT said:

Mr. President and Gentlemen of the Ontario Dental Society, —I have asked permission of the President to be allowed to introduce to this Society Prof. Black of the city of Chicago. (Applause.) To all those who are familiar with the "American System of Dentistry," Dr. Black's name is a household word to all those who have been keeping track in any way of the literature of the profession in the last twenty years. The work which Dr. Black has done for the profession is not so well known as his name. I sometimes tell my class that knowledge is divided into two sections. Those who have eyes and see not; those who have eyes and use them; those who have ears and hear not, and those who have ears and use them, the first section immensely outnumbering the second. In other words, that we have in the community a very few observing people. A very small percentage of the entire community have anything of the faculty developed, which might be spoken of correctly as the observing faculty. A few have this faculty by nature, and they develop it by exercise until they have become of inestimable value to their fellows. Dr. Black emphatically belongs to this last class. A man who has eyes and has used them all his life; who has never come across a phenomenon in which he was not moved by an irresistible impulse to enquire into and determine its origin and cause, and, as a consequence, he has become known to the scientific as an original investigator. His work has not been confined by any means to this question of amalgam, in which he has made its physical properties a study for a good many years, but in the realms of bacteriology, histology and physiology Dr. Black's name is quite as well known as it is on the question of amalgams. I esteem it a very great pleasure that the members of the Dental Society are permitted to attend a meeting in which Dr. Black is going to give us the result of his observations and experiments with reference to amalgams. Dr. Black met the members of the Toronto Dental Society on Wednesday evening and we filled thirty steel tubes, and these have been under constant

measurement and observation since. They were filled about half-past ten on Wednesday night and they are not turning out satisfactorily. I am afraid some of us, who plumed ourselves that we were making thoroughly satisfactory amalgam filling, will have to get ashamed of ourselves and do better. The result of these fillings show beyond a doubt that amalgam filling does not preserve the teeth. I confess to a feeling of deep humiliation as I sat in the meeting this morning, when we were holding the thirtieth anniversary of the date of the incorporation of the Royal College of Dental Surgeons, when dentistry in Ontario became a profession by the strong arm of the law. I was not happy by any means. In the first place, I had invited all the members of the senior and junior classes, about 130 men, to be present this morning, and we had about twenty of them wanting to learn something. In the second place, the members of the Society had gone to a great deal of trouble and expense to make this thirtieth anniversary a memorial day, and we had the grand total of thirty members of the Society present. It is not creditable to the members of the Society; it is not creditable to the dentists of the city. We had four admirable papers as we don't generally have an opportunity to listen to, and I regret exceedingly that the members of our own classes, and I regret equally as much that the members of the profession, whom I see now in considerable numbers, did not see fit to attend a meeting that was intended to be an important epoch meeting in the history of dentistry in this country. It affords me great pleasure to introduce to you Dr. Black, of Chicago.

Dr. G. V. BLACK, Dean of the Dental Department of the North Western University, Chicago, said:

Mr. President and Gentlemen,—In presenting to you this old subject of amalgam in its new features I am undertaking a task that is extremely difficult. I recognize that here, as I have recognized it elsewhere, I am introducing to you physical measurements of the movements of amalgam that will be difficult for you to comprehend, difficult for anyone. The manner of arriving at these results is perhaps somewhat difficult to understand, and I wish that you have the best opportunity that I can give you of understanding these plans of work; and of understanding what I say in regard to them. I recognize that it is exceedingly difficult for me to convey in words descriptions of these processes and of these movements that amalgams perform during the setting that would be clear to your minds. Now, I should like for Dr. W. E. Willmott, who has been with us in every mersurement, I believe, and has kept the records of these measurements, has observed the movements recorded by the micrometer and the movements as seen by the microscope, been with us through it all, I would like

for him to give us first his impressions of this work—of course it has all been new to him—and whatever else he may wish to say to you about it. Then, I should like for you, as many as may wish of the members of this Society, to go to the histological laboratory and look at the fillings under the microscope. There you can see the amount of shrinkage as revealed by the microscope. See for yourselves what it means, and make out in your mind, if you can, what I shall mean when I tell you that this amalgam has shrunk ten points, or eight points, or seven points. See for yourself, for these things can be seen by anyone. We make them directly tangible to the senses. By this observation I think you will be much better enabled to understand what I mean when I say that this or that filling has shrunk so much.

Dr. WILLMOTT:

Mr. President and Gentlemen,—Since the meeting of the Toronto Dental Society on Wednesday evening at half-past seven, I have been working every spare moment night and day at these measurements, and I have not had time since Dr. Black asked me to give my impressions of the measurements to compare the records one with another. What I have seen, though, impresses me very forcibly with the fact that we cannot depend on amalgam. What has impressed me more than anything else, apart from the amalgam, is the wonderful accuracy with which Dr. Black makes a measurement to forty-thousandths of an inch, leave it for half an hour and then test it and it is exactly the same as it was. As far as I have had time to look at the records it seems to me it makes very little difference as to manipulation, but it is in the preparation of the cutting and the annealing. It will not be proper for me to make any comparison of the records. Dr. Black has already made that, and will give you that far more accurately than I can if I had studied the record for a week. Just one point about the shrinkage. It may seem to you but a very small shrinkage. Compare the distance between the amalgam and the edge of the tube under the microscope. Compare the distance with the size of the micro-organisms that we understand are present. We can get three hundred or four hundred of them side by side in that space.

Dr. BLACK—Now, Dr. Noyes and Dr. Willmott have arranged a number of specimens in such a way that you can pass in single file and examine all of them without crowding. Make it a point to do that and view the specimens and return in the same way and we will be able to see them quickly and have no confusion, and particularly note the amount of shrinkage or the amount of separation of the amalgam from the walls of the tubes. (Members of Society

pass out in single file and view specimens. After all had viewed them,)

The PRESIDENT—Dr. Black will now address the meeting.

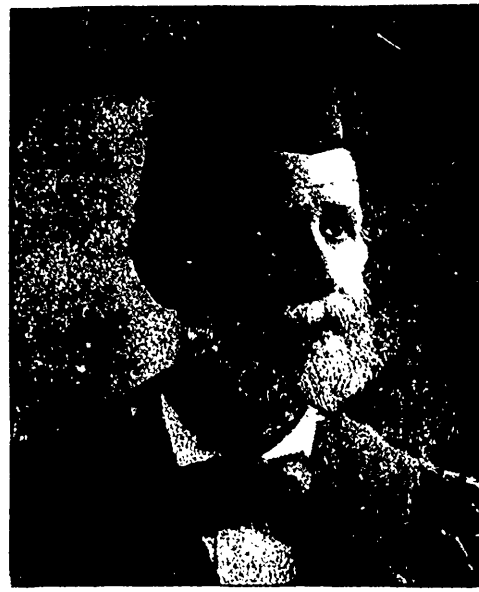
Dr. BLACK (who was received with applause), said:

Mr. President and Gentlemen,—After seeing the exhibits I think you will be better able to understand what I mean when I speak of shrinkages of amalgam. The arrangements were not such that you could well see the results of expansion, but certainly you could understand from the observations you made through the microscopes that an amalgam that will shrink until you can see between the amalgam and the margin of the cavity, which in this case is a steel tube, is not a suitable material for filling teeth. There have been thirty-five fillings made, nearly all of alloys you are using in your practice. Twenty-five of these have the margins open so that they are readily seen by microscopic observation. There are eight fillings that are sufficiently good so that the opening cannot readily be seen by the microscope. There are two fillings, the margins of which are badly broken by expansion. This leaves but eight fillings out of the thirty-five which we could regard as reasonably good if they had been put in teeth. Now, gentlemen, this may seem to you to be a very bad report of amalgam as a filling material. I have made such an exhibition as this in the Illinois State Dental Society, in the New York State Dental Society, and Dr. Noyes has very recently made a similar exhibit in the Odontographic Society of Chicago. I will say to you that this is just about as good a showing as has been made in any of these, so that the showing here is not worse, nor is it particularly better, than the showings that have been made elsewhere.

Now, a word or two as to the manner of making these measurements. You understand that it is with the binocular microscope that we get the best views of shrinkage and expansions; indeed, with expansions, we can do almost nothing with the monocular microscope, but shrinkages we can see moderately well with the monocular microscope, that is, we can see the parting of the amalgam from the edge of the cavity or tube, but we cannot see the sinking of the amalgam below the surface as we can with the binocular microscope, in which we are able to get a stereopticon view, if I may so speak, that is, we are able to see depth as well as lateral shrinkage, and follow the sinking of the amalgam into the tube. This is the instrument (micrometer) with which the measurements are made. It works readily to a ten-thousandth of an inch and even to a forty-thousandth of an inch if we wish to be careful and work in the fourths of a point, that is, one-fourth of one ten-thousandth of an inch. The markings on the dial are one ten-thousandth of an inch. We readily divide them into fourths and

work to ¼ of one ten-thousandth of an inch. The instrument proves itself to be quite accurate, doing that work very readily.

After a long search and careful examination of material in which to place fillings with the view of getting one that is unchangeable, we found tempered steel to be the best. Many seem to fear the changes of temperature, causing expansion and shrinkage of the steel, would falsify our measurements. Of this I will say that the arrangement of the instrument is such as to eliminate such changes. For instance, this is a setting block, while here are the tubes.



DR. G. V. BLACK, M.D., D.D.S., Sc.D.,
CHICAGO, ILL.

Some of you didn't perhaps see the tubes before they were filled and I will pass a few of them so that you may see them. (Passes few tubes around. Steel tubes about an inch in diameter and half an inch long.) The tube in the measurements made is caught by its face and the measurements are taken from the face of the tube, so that differences in temperature that cause expansion of the tube will make no difference, because it is caught by its face. Then the only element of shrinkage and expansion that could possibly affect our measurements in any way would be the difference that there might be in the shrinkage and expansion of the amalgam from temperature and the shrinkage and expansion of the steel. That

difference is not eliminated, and by careful trial I find that I cannot find it with this instrument. For instance, an amalgam that has stood until it has become stationary, if measured at a temperature of 32 degrees and then measured again at the temperature of the human body, or 98° F., will not show shrinkage or expansion on account of thermal change with this instrument, so that we regard thermal changes as being eliminated entirely from our measurements. These tubes have a groove cut around the bottom of the walls of the tube, for this reason: We find that a smooth

DR. C. N. JOHNSON,
CHICAGO, ILL.

tube with parallel walls, if filled with amalgam that will shrink will allow the amalgam filling to drop out, and it is necessary that we make a cut in the wall to keep the filling in the tube. Notwithstanding that, several of the fillings we have made here have become shaky in the tube. They cannot fall out, but they will shake about so that we cannot continue the measurement with this instrument; but we can follow it with the microscope.

Now, the report of the fillings made here, as many report of fillings are made, will be a jumbled mass of which you can get neither head nor tail as to whys and wherefors. We have made fillings of amalgam and measured them. Generally we have not

known the age of the cut; we have not accurately known the formula. If we are going to make out what a given amalgam will do we cannot do it in that way. One of these is the Fellowship alloy, which Dr. Crouse handed us a few days ago to test. We didn't do it until we came here. I made a filling of it. He told me he had annealed that alloy more than usual in order to make the working properties better, and he wished a test made of it. It shrank 1½ points. It is just possible, with a good light, with the binocular microscope, to see that there is the least breaking of the margin. The Frost White expanded 1¼ points, which we generally regard as not very bad. I give these just haphazard as they come. Tube V shows a shrinkage of 9¾ points. The alloy was fine cut. Tube AE, supposed to be the same alloy, shows a shrinkage of ¼ point and an expansion of ¾, an excellent filling. Tube CM packed dry on the bottom and wet on the top shows a shrinkage of 1 point and an after expansion of 2½ points. This was fine cut. Another tube, CF, shows an expansion of 2½ points. These two were made, I believe, out of the same bottle of alloy, but were made with different manipulation as a test. In one the amalgam was packed very dry in the bottom and very wet at the top; in the other, I believe, packed as usual. There is no difference in result. Now, all four of these fillings are supposed to be made from the same alloy, and one has shrunk badly, the others have not. Now, here is one that I have brought with me on purpose for an illustration of the changes that occur in alloys. And mind you, gentlemen, the point that I wish to make, and that I wish you to understand before I am through, is this: That you may have an alloy that will make a perfect filling to-day and an imperfect filling next week and a still more imperfect filling in six months from now, and it may sit in your drawer tightly corked in the bottle the whole time, except you take some out to make a filling. That is, it does not remain one thing two days together; that it is continually changing until a certain change has been brought about, and that certain change I wish to illustrate with this alloy. The alloy was made by the S. S. White Manufacturing Co. and sent to me in ingot. I cut from that ingot two and a half years ago and set the bottle away in my drawer corked, and marked the remaining ingot. It was with that bottle that the first filling was made. It was followed with the microscope until it had shrunk 6½ points and was then found to be loose and shaking in the tube. The next filling was made by Dr. Reade who filed from that ingot from which the first was made. He filed enough for two fillings. Then after mixing it and sifting it he divided it in half. One half he placed in a small glass flask and placed that flask in boiling water for fifteen minutes, thus annealing the alloy. The shrinkage in that tube as shown by the micrometer was 8 points. It did not

become shaky, but in viewing the two with the microscope you will find them twin sisters. The shrinkage in the two is just about as near alike as you could possibly make it. The next filling was made of the fresh cut alloy without annealing. The result was a contraction of ½ point and an expansion of ½ point, practically a perfect filling. Now, I know these to be all from the same alloy and no manner of change in the process of packing will make any considerable difference in the result. Notice now that time has made the same change in the alloy as the annealing.

It is hardly worth while to go over these alloys. I will give you some idea of them perhaps just by reporting a few. There is the Eureka alloy; one filling shows an expansion of 1½ points, and one of 1¾ points. There are some few incongruities creeping out. Here is one—Silver, 48; tin, 48; gold, 2½; platinum, 1½. Dr. Price made a filling expansion, 1½ point. That was remarkable. The alloy being reported to have been annealed, and well knowing that such a formula could not produce this result, Dr. Noyes reannealed the alloy by placing it in a flask, and put it in boiling water for fifteen minutes, and then made a filling, and it had an expansion of 1 point. It had been annealed before, but there is a mistake in that formula, and anyone who undertakes to follow that will find that it will deceive him. I have experimented with these formulæ right through this line, and they have never given this result. Mistakes are common among men who are making alloys. It does not pertain to one, but it pertains to many who are making alloys. Then here is another alloy, supposed to be the same formula, and made by the same man: Five fillings—shrinkage, 4¾, 7, 2½, 4¾, 1½ points. I will say, however, that the report of the last filling cannot be regarded as correct, for the reason that the amalgam has a strong dual movement. The filling was made and measured late at night, and it was not re-measured again until ten o'clock the next day, and the second movement had begun. The microscope shows the shrinkage of this last one to have been considerably more.

This, perhaps, will be enough. We have every grade of shrinkage, from a little expansion to a very considerable shrinkage, so that it is not necessary that we run over these. You have seen them in the microscope; but if I can get you to understand why it is, or the conditions under which these alloys shrink, and the necessity for other means of preparing alloys for our use, I will have accomplished what I came here to do. I make these reports simply to show you that the alloys we are using are totally unreliable; and, so far as the present showing is concerned, that is what I expected.

The question is, Why do alloys change, and how can we remedy this defect? Why do they change? Suppose we find a formula

that makes an alloy that neither shrinks nor expands as we test it. At the next test, a month later, we find that it has changed, it does not produce the same result, and we are unable to make it do so by any kind of manipulation. Now, why? You all know very well when you have rolled your gold plate that it becomes hard and stiff. The physical property of the gold has been changed by the force, by the violence, used in rolling it out, or in hammering it, if you use a hammer. You change its physical properties again by annealing. Take your steel instruments as your plugger point, put it in the flame of your annealing lamp; you draw the temper. You change the physical properties of the metal, and it becomes soft, and its serrations batter down when you attempt to use it. A similar thing occurs in alloys. An alloy is cast. Then it is cut, either by a file or a cutting machine. The violence of tearing off those little pieces of metal, whether by the file or cutting machine, hardens that metal as though it had been hammered. This alloy is a metal that melts at a comparatively low temperature; it is annealed, or changed in its physical property, at a comparatively low temperature. It becomes annealed very slowly at the temperature of our rooms. At the temperature of boiling water it becomes annealed quickly, and is softened. It is brought to the normal condition of the alloy at normal temperatures. Why, I don't know, but the results of many experiments show that in this change from the hard state in which we find it immediately after cutting, to the soft state, as it is when annealed, *there is also a change in the relation of the metal* to mercury. We may take, for instance, the formula 65 of silver and 35 of tin. We use the fresh cut alloy. It will require about 52 per cent. of mercury to make a mass which will, when well kneaded, give good prints of the skin markings of the finger. It will set very quickly and will expand about one point. If, however, we anneal it for fifteen minutes, or put it in a corked bottle, and set it away for a year and a half at ordinary room temperature, we may make a good mass with 30 per cent. of mercury. One that will take the prints of the skin markings of the finger readily the same as the other, and it will shrink about ten points in setting. It will be soft, very soft, and set slowly, while the other will set quickly. Now, as this annealing will occur very slowly, taking a year and a half for it to occur at room temperature, we have this change going on from day to day as the alloy remains in our office. Consequently, the alloy is not alike in its working properties, nor in its results one day with another; it is continually changing. From this you will understand, I think, why, even with the same alloy, the same formula, in such a test as we have been making here, we get such different results. It is simply that we get that which has been cut different lengths of time. With these facts before you, you will understand

that we could not do otherwise than get various results from the same alloy. It is these various results that we are getting from the same alloy that we want to avoid in the use of the material in filling teeth. It is these various results that we have not been able to avoid in the past. We may make a perfectly good filling of this alloy, one that we will be proud of years after, yet other fillings will come back made from the same bottle of alloy, that we will look at and feel ashamed; made seemingly under the same conditions, with the same material, with the same care. A gentleman said to me not long ago, "It does seem that those men who slop in their amalgam fillings in any way are doing almost as well as I can do with all my care, and I am discouraged."

Now, as to the shrinkage. What is it we want to do in filling teeth? We want, first, absolutely to exclude moisture; second, we want absolutely to exclude micro-organisms. We want to exclude both. We have made our measurements to the ten-thousandth of an inch. Microscopists use the micron for their measurements. There are two and a half (roughly stated) microns in one ten-thousandth of an inch. The micro-organisms that we habitually find in the mouth average about six-tenths micron in breadth. A whole army can march in through the cracks, you see, beside these fillings. A whole army of those micro-organisms can march in. Now, our object is to exclude these. A less break than any we can see with the microscope by reflected light will admit micro-organisms. Indeed, with these lenses, you cannot see one of these individual micro-organisms. You will have to take a lens of greater power to recognize one of them.

Now, how are we going to prevent these changes? We do it in this way. We find a formula for an alloy which, upon careful trial, careful test, will make an amalgam that, when fully annealed, will neither shrink nor expand. Mind you the conditions. Find a formula for an alloy which, when fully annealed after cutting, will make an amalgam that will neither shrink nor expand. This must be found by careful test with suitable instruments in each individual case. If the alloy is annealed to the point of softness normal to it at normal temperature, we may expect it to be as permanent as any other metal, and the results of our investigation show that it is permanent. One of the alloys here, the Frost White, has been cut six months. I am not absolutely certain that I made the test of that particular alloy, but I suppose I did, as I was making tests for the man who made it at that time. It has not changed since. Two years ago, in April, I put up the first annealed alloys. I put them up in bottles after annealing, and have left them stand until the present time, making fillings occasionally. I made tests just a short time ago from these. They have not changed now in nearly two years. They make just as good a filling, and work just the

same as they did then. Now, this length of time of experiment is all I have to give you. I have not five years, and I cannot say what five years hence will add to present knowledge, but I have every reason to believe that they will be permanent.

Now, can this be done in the ordinary course of manufacture? Most certainly it can. Men can work so closely that their alloy should not expand nor contract more than one point across a central line, within a half point of absolute perfection. It is perfectly possible that this can be done. How? First, by accuracy in casting the alloy; second, care in cutting; third, accuracy in annealing; and this process cannot be done haphazard. Accuracy in annealing, and last, and most important, if possible, accuracy in the test of each batch before it goes on the market. To do this we will have to have the instruments by which these tests can be reliably made, and we will have to have acquired sufficient skill in their use. Now, can any part of this be done by the ordinary methods? By the ordinary methods there will be great difficulty in casting the ingot of alloy. It has been done heretofore in the open fire, and more or less metals are oxidized in the fire in melting for this cast. When we put a thousand grains into our crucible to melt, we don't get a thousand grains of metal in our result. Something has been lost by oxidation. If we cast in this way we will have to allow for that oxidation, for a difference of one-half of one per cent. will come out in the results when we come to test with these instruments. *Our formula must be accurate.* We can have a good many of them. We are not confined to any one formula. We can have a whole lot of different alloys, differently constituted, *but we must be accurate.* Recently, I have had an electric crucible made, heated by electricity. The crucible is closed, and while melting, a stream of illuminating gas passed through the crucible, which you all know is a deoxidizing agent, and with that I can pour my metal and have the same number of grains in my ingot that I put in my crucible—(applause)—and with that instrument, as it will undoubtedly be perfected and adapted to large quantities in the near future, we can make an ingot very exactly. When we can do this there will be little difficulty in doing the rest. But let me tell you this: I see that a number of men are putting out amalgams which they speak of as annealed. You should remember that they cannot know whether these amalgams are right or wrong unless they have proper instruments to make the test before these amalgams are put on the market. They cannot know anything about it. It must come down to this, gentlemen, that you must require of your manufacturer, or your dealer, that these tests be made and be made accurately. Then, we can have amalgam that will neither shrink nor expand.

Now, will we have perfection in filling when this is done? Perfection in filling with amalgam! No. The amalgam may be one that will neither shrink nor expand, but we will not then have perfection in filling with amalgam because there are very few of us who can make perfect amalgam fillings even then. There are very few fillings that have been made here, though they have been very good, very excellent, the best I have ever had of this kind, yet there have been very few, my own included in the number, that were perfect, that showed perfect margins to begin with. Amalgam is a very difficult material to manipulate perfectly. When I first said this publicly, Dr. Crouse thought he could make an amalgam filling that was perfect. He went to work and tried and soon found he could not do it, and said so. Another thing. Many of our amalgams are too soft to be really valuable in filling teeth. You suppose that this amalgam is a hard, brittle substance, because when you strike it with a hammer it flies like glass. So it does. It is hard and brittle in one sense, but there is another sense in which amalgam is very soft. I hold in my hand a little tube in which I have two blocks of amalgam. They were both just alike yesterday. They were made in the same die and were just alike, but I put one of them under a pressure of 60 lbs. and let it remain under that pressure for a time. Now, I will pass that bottle among you. You will see it has not broken, it has simply flattened out. The amalgam flows. Here is the instrument in which these blocks are made (exhibiting). Now, you see that it falls to pieces on taking out a pin, and when the pin is in place it is ready to make fillings. You see there are several cavities of one size; we file them, take out the pin and remove the fillings. Now, I will put into this dynometer a block of amalgam. First let me explain the instrument (exhibiting). Here in this piece of the instrument I have a micrometer. Between these two points I can put in a substance and make a measurement of it in thousandths of an inch. In this part of the instrument I have a dynometer in which I can put stress upon that piece as placed anywhere from 1 to 400 lbs., and in this other instrument up to 600 lbs. Or I can put on the pressure and let it rest. In these instruments we may test the strength of different amalgams, and we find they have a wide range in strength. Now, I will put in a block of 40 of silver and 60 of tin, one of the soft alloys. Now, I want you to notice this. You see I have two needles here. I have put them exactly together. If that block of amalgam shortens, the black needle will move and the other remain to mark its place. Now, I will put stress on that and you watch the needle. I will run the stress up to 60 lbs.; there I will let it stand. You will notice that this needle is crawling, it is moving, the amalgam is flowing under that stress. I will set it up here and you will notice the needles part more and more. You will notice

that that needle will very slowly keep moving and that the stress is diminishing, as shown by this other needle. Now, while you are noticing that flow I will try the crushing of these. Just two or three blocks of certain amalgams that are different from each other to show you something of the difference in strength of different amalgams. This we regard as a soft amalgam (puts one block in micrometer). Now as I begin running up the stress you will notice those needles of the micrometer parting. There, it is broken at 200 lbs. I have another of the same. These blocks were made with as much care as I was capable of, and they ought to break at a pretty definite figure. (Another block put in of same material and breaks at 205.) Now, I will take another amalgam, one made from an alloy of 69 of silver, 27 of tin, 3 of copper and 1 of nickel. This will illustrate to you the influence of nickel in alloys. (Puts in micrometer and breaks at 80 lbs.) Now, I will take another alloy that is very nearly of the same formula, that is about 68 of silver, 26 of tin, 4 of copper and 1 of zinc. You see practically the zinc replaces the nickel in the alloy, and I want you to notice carefully the parting of the needles in this case. (Breaks at 350 lbs.) We will try another block of that. (Makes another trial of same substance, which breaks at 390 lbs.) The difference in the flow is very remarkable in these alloys. In the tests of that alloy that I have made there has been regularly an expansion of the batch from which these blocks were made of ½ point. (Tries another block of same. Breaks at 465 lbs.) I generally expect blocks made from that alloy to break at about 400 lbs. Some of them have broken at a little less than that, and I want to say that if any of you undertake to make these blocks for the first time, and get them to break within 50 lbs. of each other, you will do very well. These blocks are 8-100th of an inch square. When I first began making blocks for tests I found that I could not make blocks out of the same mix of amalgam that would break anywhere near each other, and I was disgusted with myself, but after careful study and by using care in the handling of the mass and in the packing of it I got better results. Well, that is enough to show you that there are great variation in the strength of amalgam and also that there is great variation in the individual blocks made of the same mix. We can make a block that will bear a stress of 400 lbs., or out of the same mix with amalgam apparently perfectly packed, we may make a block that will break at 100 lbs. or 150 lbs., depending on the manipulation. But I cannot go into manipulation now. We will notice these instruments again. (Refers to dynometer in which an alloy was under pressure.) You see the amount of flow. You see that the pressure we applied at 60 lbs. has been reduced by the shortening of the block to 50 lbs., but the shortening of the block continues. Now, gentlemen, gold don't do

that. I will put a block of gold in the other instrument and try to explain to you the difference. This is a block made by Dr. Johnson. It has been in my micrometer once before about three years ago and the block was longer than now. I will put 150 lbs. on it. All the flow it will make has been made. It will stand right there. It was under that pressure for two hours before. You will see that the needle now does not move, and we may set it up here till the middle of next week and it will not move. Now, this is the difference between amalgam and gold as to sustaining stress. If I put on more stress I will move the needle, but it will move immediately and then will stand. Amalgam will keep crawling even though we diminish the pressure. Now, right at this point, and to enforce the importance of it, I gave this instrument (instrument for testing strength of the bite with the teeth) to the young men here yesterday and asked them to bring me a record of what they could crush with their teeth. This is a knathodynometer for measuring the force with which we may bite, the pressure that we exert with our teeth, and I also have another instrument for measuring the force required for the mastication of the different articles of food. I didn't bring that with me. I want to read you some of the figures that the young men brought me here in this school yesterday. On the incisors, 65, 75, 90, 100, 95. On the molars, 205, 220, 185, 95, 185, 210, 110, 200, 180, 195. This instrument registers 270 lbs. and the next fellow shut it up. (Laughter.) In an exhibition, a day before I left Chicago, before my class, one of the members of my class bit down 260 lbs. with his incisor teeth. Now, gentlemen, this illustrates to you what it is we have to provide for in filling teeth. It shows you this, that we must have the strongest amalgam that we can make to endure the stress. You see how they flow, how they move with stress, and unless we have anchored them well, and have the very strongest amalgam that we can make they will move so as to leak, even if the amalgam does not shrink. Now, I have perhaps taken up as much of your time as I should. I want to hear from others, and afterward I will be glad to answer any questions that I can.

Dr. J. B. WILLMOTT—One point that you made yesterday morning I should like to have you make for the Society. That is the range where contraction commences and expansion commences in tin and silver alloys.

Dr. BLACK—The range at which contraction ceases and expansion begins. If we take the unmodified silver tin alloys—and when I say unmodified silver tin alloys I mean an alloy in which there is nothing but silver and tin—and begin at 40 of silver and 60 of tin we will first get a shrinkage and afterward an expansion, a dual movement, as is seen in many of the alloys we have tested here. As we increase the amount of silver up to about 60 per cent. that

dual movement ceases. The contraction ceases, if we use fresh cut—and that "if" must always be put in in speaking of alloys—and when I say fresh cut I mean within one hour after the cutting, not longer. We must be exact. At that point, 60 of silver and 40 of tin, we get no shrinkage. With 65 of silver and 35 of tin there will be a slight expansion, that expansion will increase with the proportion of silver until we have reached about 74 of silver. At that point we will get a large expansion, but an expansion that may be removed by annealing. An annealed alloy of about that constitution will neither shrink nor expand. Adding more silver we will be unable to remove the expansion entirely. By annealing we will remove it in large degree, but it will still expand some. Therefore, in the unmodified silver-tin alloys we are confined closely to our formula. Heating it in the open fire some will want a little more silver and some less, depending on how much oxidization we get. But when we come to use the electric crucible I think we will have no reason to do that. If we add other metals, then we have the conditions changed immediately. For instance, copper increases the expansion very materially. Lead diminishes it a little. For instance, taking 65 of silver and 35 of tin on such a basis for trial we found that the gross expansion was 1 point, then adding gold we got 4 points expansion; adding platinum it was 1 point expansion again; adding copper we got 23 points expansion; adding zinc we got 68 points expansion; adding cadmium we got 100 points expansion; adding bismuth we got no expansion. These additions were 6 per cent. in each case. Adding aluminum, 5 per cent., we get 445 points expansion. With aluminum, 1 per cent., we get 166 points expansion. Dr. Noyes will show you a tube filled with aluminum alloy (tube shown). Now, you will see with these modifications by different metals we can obtain a large range of formulæ and yet have alloys that will neither shrink nor expand when fully annealed. We are not confined to any one alone by any means.

Q. When you add copper, that will permit a larger per cent. of silver, as I understand?

Dr. BLACK—You mean a larger per cent. of tin?

Dr. J. B. WILLMOTT—Yes.

Dr. BLACK—It modifies it also in making it very much harder. Copper increases the strength of the alloy. Also zinc makes the amalgam stronger. I found that nickel did not do as I thought it ought. Nickel simply ruins it. It has no strength at all. One per cent. of nickel simply ruins an alloy.

Q. What effect has gold?

Dr. BLACK—It makes it work a little bit softer, that is about the only effect it has.

Q. Less shrinkage?

Dr. BLACK—Not particularly.

Q. Does it make much difference in the order in which these are melted?

Dr. BLACK—It don't make any difference. Gold has not any considerable influence, either on shrinkage or expansion; very little influence, indeed, except that it makes the working property a little bit softer.

Dr. JOHNSON—I should like to ask your opinion of an amalgam that works beautifully and handsomely in the hands of an operator as to its effectiveness in the mouth and as regards its permanency.

Dr. BLACK—I think that question is an important one, and I might spend a long time talking about the matter of working property, but I don't intend to spend but a few minutes. An amalgam made from filings of coin, as most of you know who may have tried that, is a very harsh, gritty and granular stuff. We have run that down by adding tin until we arrived at a beautiful, soft working property, and we find the alloys shrink, but that is not all. It is found absolutely impossible to make a filling that has perfect margins with those soft amalgams. You put an amalgam of that kind into one of these tubes or into a cavity and try to finish it perfectly at this side and you find it has opened at the other side. It is soft and springy, and when you try to bring it up again it springs away at another point, and will keep doing this. This is what it will do, as seen by the microscope, in the tube; and it will do the same thing in the teeth. In order to have an amalgam that you can work with reasonable perfection in filling teeth it must be stiff when made up; one that when you put your instrument on it and compress it you find that it is immediately hard and stiff and will therefore stay in place. Fortunately it so happens that the amalgams made with large proportions of silver will do this. Particularly the amalgams made with a small addition of copper do this to a remarkable degree, so that while your amalgam works soft to begin with, you will find, after working with reasonable rapidity, about the time your filling is finished it will be so hard and stiff that you will not be forcing it this way and that. You can put pressure on one side and force it up to the margin and find you have not moved the other side. Now your amalgams must get into that condition before you will be able to make a perfect filling, and it will not have that very soft, velvety feel that the amalgams that we have been using lately have. I find it impossible for me to make a good filling with those soft amalgams even if they don't shrink. I don't think anyone else ever can make good fillings of them. In order to make good fillings we must so temper the working property of our amalgams that we can have

them stiff at the time we finish our filling. We can make this annealed amalgam so that it will work soft or hard as we please, but after we have annealed and produced the condition of non-expansion we can make the working property very soft if we choose. If we have control of shrinkage and expansion we can control the working property. We can make amalgams containing seventy-four parts of silver work very soft and be a long time in setting, but it would defeat us to do that. We must have our amalgam work stiff, gentlemen, or we cannot make good fillings. (Applause.)

The PRESIDENT—I would like at this juncture to introduce to you a gentleman that has come with Dr. Black from Chicago, in a certain sense as his assistant—Dr. Noyes of the Northwestern University of Chicago, the Dental Department, and I take great pleasure in extending to Dr. Noyes the courtesy of the floor and have him say something to us.

Dr. NOYES—I thank you very sincerely for this courtesy, which I appreciate very much indeed, and am very glad to have a chance to say just a word in regard to these amalgams, which I think may be of interest to you. Very shortly before we left Chicago we had in that city the tenth anniversary of the Odontographic Society for the Clinic of which I was asked to give an exhibition of some of the amalgams on the market, and I think perhaps you would be interested in hearing the report to that Clinic. Before I do I want to say just one word in regard to this little instrument, although the Doctor is present. In the preparation of that Clinic there were forty-five fillings made, and each one of these fillings was measured from five to fifteen times. A great many of them produced a movement which was accomplished in about two days. The work of the preparation of these fillings was stretched over ten days, and on each day, two or three times a day, all the fillings that had been made were measured. I wish to say that that instrument acted in a way which seemed to me to be truly remarkable, although I have had some experience with physical instruments for measurement. We found that after the filling had completed its movement it could be measured ten times, one time by myself, the next by Dr. Black, and so on indifferently, Dr. Black or myself making the measurements, and record exactly the same reading.

Dr. NOYES then read from report to the Odontographic Society, entitled, "A Series of Tests of Amalgams as to Shrinkage and Expansion."

The first point which Dr. Black developed was the annealing property of alloys, briefly stated as follows: The cutting of the alloy changes the action of the filings towards mercury so that they require more mercury to amalgamate them and in setting the

changes are brought about more rapidly. Heat returns the filings to their normal condition so that they require less mercury to amalgamate them, the setting is less rapid, and the shrinkage-expansion property is changed. If when fresh cut the amalgam did not change its bulk in setting; after annealing or tempering (as Dr. Black calls the effect of heat on the filings) the amalgam will shrink; if when fresh cut the amalgam expanded greatly, after annealing it will not expand so much or may even shrink. This change may be accomplished at the temperature of boiling water (220 F.) but it goes on slowly at the ordinary temperatures so that in a year or two the same change in the action of the amalgam will be brought about. This is beautifully illustrated in the four fillings reported near the end of the table Nos. 39, 40, 41, 42. When once fully annealed the alloy does not change at ordinary temperatures.

Dr. Black showed that silver-tin amalgams present peculiarities in shrinkage and expansion with various proportions of silver and tin. In alloys of 45% silver, 55% tin, there is a strong double movement; that is, in setting they first shrink, then expand. If the filings are fresh cut, the shrinkage is small, the expansion great; if the filings are old or have been annealed, the shrinkage is great, the expansion small. In alloys of 65% silver, 35% tin, the double movement is small. Fresh cut they expand but slightly; annealed, they shrink about 9 or 10 points. Alloys containing more than 73 or 74% of silver expand very much when fresh cut; annealing reduces the expansion, but they cannot be made to shrink.

Dr. Black showed that the addition of a small per cent. of certain metals to a silver-tin amalgam will make it expand in spite of annealing, and, unlike the expansion of the silver-tin amalgams, it is not completed in a day or so, but will continue to do so for weeks or months. Both aluminum and zinc act in this way; refer to tube X No. 29 in the table, which contains 5% of zinc and had made an expansion of 7 points in ten days and was still expanding when the filling was removed on the 25th inst.

If you will notice the four fillings of Dr. Black's 65-35 at the end of the table, you will see that one ingot was cast in July of 1896, half of the ingot was filed and the stub kept. From this stub filings were cut and a filling made fresh (tube I), which expanded 3¼ points; from the filings that had been simply kept in a bottle since 1896, a filling was made (tube J) which shows a shrinkage of 9 points. A new ingot of the same proportions was cast and half of it filed; the filings were divided into two portions; from the first a filling was made fresh (tube Z), which expanded 2¼ points; from the second point a filling was made after the filings had been exposed to the temperature of boiling water for seventeen minutes (tube O); this filling shows a shrinkage of 9¼ points, so

that the aged and annealed filings gave the same results within one forty-thousandth of an inch.

That annealing is permanent in its effect is shown by the last filling in the table which was made by Dr. Black from filings cut and annealed a year and a half ago. The filling made from the filings immediately after annealing gave the same result as the one reported here.

Thus far we have been showing what can be expected of an alloy for a dental amalgam. How do the alloys on the market show in the table? Look at all the alloys manufactured by the regular dealers: Pearl, Fox & Gerheart, S. S. White's Alba, Chicago Dental Manufacturing Co., etc., etc. They all shrink, the shrinkage increasing as they are kept until the limit of shrinkage for that alloy is reached. The only alloys that do not show a shrinkage are: first, the few that are annealed and tested before they are put on the market, namely, "The Fellowship," Dr. Kester's "Frost White" and his "Specially Tempered," and Dr. W. E. Harper's; second, the alloys which contain aluminum or zinc; these expand, but the movement is too long continued and is liable to be accompanied on the second or third day by a pause in the expansion and a slight contraction which opens the margins.

Shrinkage or expansion is a property of the alloy and cannot be controlled by any method of manipulation, it may be modified more or less (usually less) by manipulation but it cannot be prevented.

As evidence on this point, please note the fillings which are marked with a star in the table. Tubes D and AL of Goldsmith Bro.'s alloy were filled by Dr. H. Alfred Gunther (tube AL) and myself (tube D), using very different manipulation, mine being made by the method adopted uniformly for all the test fillings, he using a special method with the idea of controlling the shrinkage. You will notice that their extreme movement was within 1 point of the same. His shrinking 7 points and coming back 2; mine shrinking 8 points with no return movement. Again, tubes AA and B, of Fletcher's alloy. Tube AA was packed by Dr. J. D. Patterson, using the Fletcher method, tube B in the regular way. You will notice that their movement is within one forty-thousandth of an inch of the same.

These are the points from that investigation. I think there is nothing more I can say either about that or about this. (Applause.)

The PRESIDENT—I will now call upon Dr. Harold Clark to open the discussion on this question.

Dr. CLARK:

Mr. President and Gentlemen,—I regret that our programme-maker had not selected someone of more years of experience in

the handling of amalgam to have opened the discussion, or replied to Dr. Black's paper. As for discussing of the paper that I cannot and will not do. I felt as Dr. Black was giving his talk, that here and there I had some questions to ask. He has shown that he is not only a great scientific investigator, but that he is in a very high sense a teacher, because as each question raised itself I jotted it down. I felt that that was one of the questions I must ask. I did not wait long before every question was very carefully and fully answered, and I simply had to strike it off. I have looked forward to Dr. Black's paper with a good deal of interest. Like all of you, no doubt, I have, even in the few years I have practised, been confronted with the difficulty that has been nothing short of a mystery. I have tried conscientiously to put in amalgam fillings that were as nearly perfect as possible. I have been careful to select what I thought was the best alloy. I have availed myself of every article in journals on the subject, and still I would find some fillings which seemed to be perfect, and yet others made from the same alloy, and as far as I knew under similar conditions, were very imperfect. We owe a good deal, of course, to Dr. Black for his many investigations, and many things he found out and told us regarding alloy. It seems that Dr. Black has got the clue to the mystery, if he has not yet even solved it, by which we may have an alloy that will make as perfect a filling as we can get out of amalgam. I have no doubt some have already the question in their mind, Can he tell us now what that alloy is; if it is manufactured, where can we get it. I cannot help referring to one or two points of the lecture that to me seemed almost marvellous, and that was the manipulation seemed to produce no difference in the result. And the other point is the effect of ageing. Did not I understand you to say, Doctor, that once annealed the property remains the same? It does not change after you anneal?

Dr. BLACK—Yes, Sir.

Dr. CLARK—There has been nothing said about the color-keeping properties. I don't know whether we are to learn something about that or not. There is another question I want to ask about the flow. Does the formula that most nearly produces the ideal flow, less or more, than other alloys that are otherwise not so desirable?

Dr. BLACK—The flow is most in the alloy that has most tin, less in the alloy that has most silver up to 75%. It increases again after that. I will refer to this instrument again (refers to dynometer in which gold block has been placed under 150 lbs. pressure). This gold block has been under that pressure of 150 lbs. and the needles have not moved, and I may say that they would not move at all in a week. The gold will sustain the stress per-

manently. A block of tin will flow from under a pressure of 15 lbs. The more silver put in it the less flow. Copper diminishes the flow. These are important points, particularly when we get patients, as well as students who will bite down 270 lbs.

Dr. CLARK—Have you anything to say upon the color keeping properties of amalgam?

Dr. BLACK—I have not made special investigations of that, but I have noted this fact prominently, and that is, mercury is the whitest of the metals that we put in alloys, and the more mercury required by the alloy the whiter the amalgam. Alloys containing zinc are whiter than the alloys not containing zinc. I would like to hear Dr. Johnson's views on this question of a perfect amalgam.

Dr. JOHNSON, Chicago—Dr. Clark raised the question and wished Dr. Black to answer it. What particular amalgam would uniformly give you the best results? I simply want to tell you that if he gave you that formula you would not use it. That may seem like a plain statement, but I make it based on the experience that we have had in Chicago. What is the condition in Chicago to-day? The men who are selling the most amalgam are the men who sell these soft amalgams, that go just like this amalgam under a pressure of 60 lbs. Why? Simply because it is hard work to insert a good amalgam. You can take this soft amalgam and slap it into the cavity, and it will not set too soon. You can probably read the newspaper and gossip with your neighbor while it is setting, and I tell you the majority of the dental profession are looking for soft snaps. Now, that is why men use these amalgams, and until they are forced to use better by virtue of keeping records of their own work, and studying their failures, they will not do so. I have been using in recent months this amalgam that has stood up under this enormous pressure of 400 lbs., but it is difficult to manipulate. We are not talking about gold to-day, but there is one thing about gold, and that is, it is uniform in its results; you take a piece of gold and put it against the walls of the cavity and condense it and it stays. Take the ordinary amalgam and put it into that cavity and condense it against one margin, and you pull it from the other. The more I see of this amalgam question the more I hate amalgam. We see the records of amalgam filling where it has been in for a great many years, but we don't see a record of the failures. I do hope this, that when an amalgam does come out with the endorsement of such a man as Dr. Black, that you will have the courage of your convictions, and use it even if it is harder work.

Dr. WILLMOTT—I don't propose to discuss this matter except one aspect of it. It is the relation of the percentages of the silver and tin to stability in an amalgam filling. It might be of interest to the members of the Society for me to read a few formulas that we

have been in the habit of using extensively. (Reads from book number of different formulas.) I have been studying the reports of these experiments for some years, and I have come to the conclusion that amalgam as we use it, is a thoroughly unreliable filling material. One thing that has been quite clear to-day will be the putting on the market of an alloy that has been already annealed, so that whatever it is at one time, we may expect it at another. It will always have the same characteristic. We are just at the mercy of the manufacturers in this respect just now, and until some manufacturer makes an alloy that will always be the same, we are at their mercy. We had an illustration of this the other night before the Clinic. One of the members of the Toronto Dental Society said that he made some fillings some years ago, at least some time ago, and he saw them occasionally, and they were beautiful fillings, and they kept beautiful, and he thought this was a very fine alloy, so he brought a sample of it and made a filling before the Clinic, and before it was over he was talking about crawling all around that filling in the tube, it had shrank to such an extent. Now, the probability is that he got it fresh cut, and now it has got annealed by age, and it is not worth anything at all. One thing, we will have to go on using the present amalgams until we have something better made. There is one question I want to ask, and it is this: Whether the partial success of amalgams as we have been using them, is or is not due to the antiseptic property it exercises, especially if it contains copper?

Dr. BLACK—Well, I don't know that I can answer that question satisfactory to myself. I venture this. If the amalgam filling is perfect, no matter how much the amalgam blackens, the walls of your cavity will remain clear and bright to the margin of the filling, as much so as if the filling had been made with gold. If the margins are imperfect it will be discolored. If we take a silver pin and thrust it through the flesh, as in surgery we often do, we will find all of that outside blackened after a few days, but if we remove it we will find that that portion of the silver which is in contact with the living tissue is bright, has not lost its color. Just so with the amalgam filling. I hope that some of these days we will see our amalgam filling standing, perhaps black, with the margins of the cavity of the teeth perfectly bright up to the margin. We see it in our gold fillings. Now, if there is any antiseptic imparted to this material it is not sufficient to prevent decay. That is certain, because we do see decay progressing right alongside amalgam.

Dr. CLARK—I want to know if there is any amalgam that we can purchase now that will give good results, and who makes it?

Dr. BLACK—I can tell you what I know about that. I have myself nothing to do with the manufacture and sale of alloys. I

hold aloof entirely from that. A dentist, in Chicago, I know, has been studying this subject, and has been making alloys more or less for sometime, and he has tried to make these alloys. Unfortunately, he has not properly equipped instruments yet, and is depending on somebody else for examination of the alloys. The Dental Protective Supply Company has been making a great effort in this direction, have been studying this subject closely and experimenting. Their instruments are not as perfect as I could wish. A number of specimens that I have examined for them, I have found very close, generally within one half of one point. I don't know of anyone else who has undertaken to provide themselves with instruments except the Dental Protective Supply Company. I have agreed to give a course of instruction, especially for amalgam makers this next summer. How many will avail themselves of that course, I don't know. If they will undertake that, I think they will learn to make alloys, if they send men who have already some experience in the handling of physical instruments. A man totally ignorant of physical instruments cannot learn to use them in six weeks or six months.

Dr. CÆSAR—I would like to ask Dr. Black if he were to take an ingot of the best alloy that he knows, and filed from that sufficient to make several fillings, and at same setting insert them in the mouths of different patients, if he can always depend upon the same result. I would also like to hear Dr. Johnson's views on that point.

Dr. BLACK—Do I think that fillings made with the same amalgam, practically upon the same day, for several different patients, will be equally satisfactory? Yes, if each of the patients is fifty years old, and the evidences are prominent that decay has practically ceased in all the cavities of each mouth. But if a young girl comes in to me with decay rapidly advancing, and I attempt to compare her teeth with those others, it will be an entirely different case. We cannot compare results in that way, and expect that they will be equally satisfactory as results. The conditions are not the same. Fillings of the same alloy in different mouths will not be equally satisfactory, and even with gold, with the best of our efforts, we will not get equally satisfactory results with different people. No, the results are very different. With gold less so. You see, gentlemen, that the gold under that pressure (referring to the gold block under pressure) remains the same. The gold does not condense under that pressure, but stands firm; but the amalgam is flowing completely away. Gold is the king of filling material.

Dr. JOHNSON—There is just a feature of that question that I don't think Dr. Black quite grasped. Dr. Cæsar, in asking this question, referred to a similar class of patients, as I understand,

and he wanted to know whether the amalgam would behave the same in the same class of patients. You may have noticed that we may take one patient, and put in a filling; and we may take another patient of the same age, and, as near as we can judge, with the same tendency to decay; we may use the same alloy with the same care, and in six months we see those two cases, and they are vastly different in their results. Now, there is just one feature of that I want to speak on, and a point we too often overlook, a thing that Dr. Black just touched upon, and that is the difference of mastication in those mouths. There are patients who will crush these amalgam fillings so as to batter them out of shape, unless we have an amalgam filling that will stand up under pressure. We may put in a filling of amalgam in one patient and it will stand all right, and there are other patients who will simply crush that out of the cavity with mastication without any trouble at all. We have to take into consideration the question of the resistance against stress of mastication. I agree with Dr. Black, that we do get more uniform results with gold, and I want you to consider that gold is the best filling we have.

Dr. CAPON—In speaking of gold, is there any virtue in putting a layer of tin in the cavity, and then a filling with gold? It is a thing that I have been using more or less.

Dr. JOHNSON—As to the advisability of placing tin at the cervical margin in these large cavities in molars, I have not any experience with tin alone. I have with a combination of tin and gold, and I am of the opinion that the main virtue that we get from that combination is the facility for the adaptation to that margin. We simply make upon that cervical wall a cushion upon which we can condense our gold without injuring the enamel under that condensation, and I want to say there are some places where it is a most excellent method.

Dr. WILLMOTT—In reference to the question which Dr. Cæsar has just asked, I have a very profound conviction that the difference in the service of an amalgam filling, or a gold filling in one mouth and another mouth depends very largely on the hygienic conditions of our patients. Here we have a whole culture bed of micro-organisms absolutely in contact with our filling, and how can we reasonably expect that that filling is going to escape? If we could see that the teeth of every person was in a hygienic condition, I don't think there would be the difference that exists in the various mouths to-day. Then, some patients take very much better care of their teeth than others. Some take the particles of food between the teeth away by cleansing them, and others do not. I think that the operator is not responsible altogether for the success or failure of his operations; that the conditions which are forced upon us in the mouth have a good deal to do with failures,

and the conditions which are under the control of the patient and not under the control of the operator have a good deal to do with the success. If we could get perfectly hygienic care for mouths our success would be very much better.

Dr. NOYES—In regard to these different amalgam fillings, I would like to suggest that if the different patients are steel tubes the results will be identically the same. If they are ordinary folks they won't. If they are steel tubes, you have eliminated all the varying conditions.

Dr. CÆSAR—But remember that our patients are not steel tubes, unfortunately. I don't expect that one patient is going to keep his mouth perfectly cleansed and sweet and nice, and the other patient is going to have a hatchery in his mouth by any means. I am supposing, as Dr. Johnson comprehended the question, that the fillings are put in about the same day and under the same circumstances. Will that amalgam act the same provided that we have physically the same class of patients in each case, and they keep their mouths in similar conditions?

Dr. NOYES—The difference in the action of these same fillings in the different mouths is not due to the amalgam, but it is due to different environments, differences which are ordinarily not taken into account. If you eliminate all of these possible differences you must get down to the steel tube.

The PRESIDENT—I am afraid we cannot spend any longer time on this question unless there is some specially important question that has to be asked. I will ask Dr. Black to close the discussion.

Dr. BLACK—In closing this discussion, I want to express my gratitude and my thanks to the members of the Society for the assistance they have afforded me in making these demonstrations, and for the uniform courtesy with which I have been met here. For all of this I thank you.

Dr. MARSHALL—In view of the fact that Dr. Black has gone to so much trouble in giving us this excellent talk, I think it would be a very nice thing for us to extend to him a vote of thanks. It affords me very much pleasure, therefore, to move a vote of thanks to Dr. Black.

The PRESIDENT—It has been moved and seconded that this meeting tender Dr. Black a vote of thanks for his instructing us on the question of amalgam. (Carried.)

It was moved and seconded that the place of meeting for the Ontario Dental Society for next year be left to the Executive.

Question Drawer.

Edited by DR. R. E. SPARKS, M.D., D.D.S., L.D.S., Kingston, Ont.

Q.—35. In cases of bridge work, where the bite is close and the dummy broad for occlusion, the gum becomes congested, filling up the place left for cleansing. This is particularly noticeable where a dummy is placed between two natural teeth. Can this be prevented? or is there any advantage in leaving a cleansing space where such is likely to occur?

A.—1. I should certainly leave a cleansing space. It need not be large, but sufficient to allow the mouth wash to reach every part in rinsing the mouth. Turgescence of the gum is less likely to follow if such precaution is taken. Such a dummy should if possible be carried by two strong piers to prevent any pressure upon the gum in mastication. I would also curtail the surface for occlusion.

A. A. SMITH, Cornwall.

2. Yes—By keeping the dummy away from the gum, or the tip of the porcelain may touch without exerting pressure enough to prevent the free passage of air or fluids.

J. E. OVERHOLT, Hamilton.

3. Yes—There seems to be a tendency for the gums to grow over the facings, but space should be left and astringent mouth washes used.

J. G. ROBERTS, Brampton.

4. Make the gold crown to fit very close over the natural tooth, burnishing the edges under the gums, making the cusps (if a bicuspid or molar) broad and in such a way that the food will not wedge between the teeth. W. B.

5. In bridge work, where the bite is close the dummy should never be wide, as it would surely interfere with cleanliness. Better not insert a bridge than cause any insanitary or abnormal conditions of the surroundings.

The only obvious method for the no space theory would be a removable bridge. If the object of the bridge be simply mastication a prism shaped gold bar would take up much less space than if dummies were attached, and will serve admirably for occlusion in cases of short bite.

OBSERVATION.

Q.—36. What is the best method of bleaching a tooth discolored after the use of arsenic? Is the discoloration likely to return? If so, why?

A.—1. Treatment by means of Cataphoresis is by all odds the most successful and easily accomplished method to bleach teeth regardless of the cause of discoloration. A fairly strong solution of pyrozone, Sodium peroxide or the old stand-by alum, chloride of lime and acetic acid, if administered by this means, will produce the most satisfactory results. The apical foramen must be stopped and the canal filled nearly to the cervix before treatment, then carry the bleaching operation too far, line the cavity with cement, suitable for the desired shade, and finally fill. From observation we are inclined to an opinion of our own in respect to the darkening of the tooth after the operation. The enamel gets thoroughly dried during the treatment and turns light in color, then in getting moist by the surrounding conditions when the dam is removed, it goes back a little, so to speak. Who has not observed the change that takes place during a long operation where the rubber dam is used? Almost any tooth protected from moisture for a couple of hours will assume a very much lighter shade, but, in the course of a short time after the dam is removed the light shade will change back again. D. D. S.

B.—2. Hydrogen Peroxide and Chloride of Aluminum. If discoloration returns it is because the action of the bleaching agent has not been continued long enough, or the tooth has not been bleached sufficiently high up into the root, or the use of metallic, instead of bone or hard rubber instruments, imperfect root filling etc. J. E. OVERHOLT.

Q.—37. How may we diagnose an abscess in the bifurcation of the roots of a molar.

A.—1. Oftentimes extremely difficult; but, in some cases, a close examination will reveal an inflamed and even ulcerated margin of the gum opposite the bifurcation, either on the lingual or buccal surface. This point of gum tissue will respond to the actual condition of the abscess, as it is, in fact, the fistula of the abscess. If $H_2 O_2$ be injected into it you will find immediate effervescence in quantity marked enough to prove the presence of pus.
A. A. SMITH

A.—2. application of ice or jet of cold water on tooth crown, if abscess has not extended far enough to destroy vitality of pulp.
J. E. OVERHOLT.

3. I don't think it possible (in all cases) to locate the exact position of an abscess in molars. W. B.

QUESTIONS.

Q.—46. In Dr. Black's experiments with amalgam fillings at the recent meeting of the O. D. S., at Toronto, it was found that out of thirty-five fillings inserted in cavities in steel dies, only seven were perfect enough to have preserved teeth in the mouth. Many of the imperfect fillings were made from alloys which have been in use in the dental profession for a great many years.

How may we account for the preservation of teeth which we know have been preserved by fillings made of these imperfect alloys?

Reviews.

Descriptive Anatomy of the Human Teeth. Fourth edition. By G. V. BLACK, M.D., D.D.S., Sc.D. Philadelphia: S. S. White, Dental Mfg. Co. 1897. $2.50, net.

Coincident with the portrait of Dr. Black, which we publish in this issue, we are very glad that the publishers of Dr. Black's valuable work on the anatomy of the teeth have given us a timely opportunity to repeat, and to emphasize the special value of this treatise to every student and practitioner. The author does not write from any *cacoethes scribendi*, but from the depths of his experience as a practitioner and a teacher. Most of us from our earliest career realized the barrenness of teaching in relation to the anatomy of the teeth, in the systematization of our terminology. It made it almost as difficult to convey as to comprehend, even clinically. If Dr. Black had done nothing else for us than to systematize our nomenclature, he would deserve our gratitude, but the reader of this work will appreciate it all the more when he knows that in the special departments, and to a large extent in the special methods of investigation, he has been distinguished for his extreme care and an utter absence of the melo-dramatic dogmatism which has made some of our "scientific authorities" a screaming farce. The changes in the present from the first edition are enough to make the former obsolete. The glossary is alone worth the money and ought to be strictly taught and adhered to. A small volume devoted exclusively in the same terse way to the entire nomenclature of dentistry would be a boon. We look upon this work as the basis and ground-work of all sound and scientific dental teaching. It is a work as necessary to the practitioner as to the student. It is in itself a post-graduate course of the greatest value.

Sajous's Annual and Analytical Cyclopædia of Practical Medicine. Philadelphia: The F. A. Davis Company, publishers. Cloth, $5.00; half Russia, $6.00.

For years there has been a constant and increasing chasm between the generally-accepted facts in medicine and surgery and that which is more or less subject to debate. There was once a happy time, years ago, when the average doctor learned his trade and practiced it in peace and quiet thereafter. But those days have gone, never to return. The Americans—perniciously active, according to our European friends, in their methods of turning to account any scientific discovery—have left no stones unturned in attempts to realize practical advantage from every discovery in medicine and surgery, no matter from what source it might originate. A great relief was afforded by *Sajous's Annual* in classifying the periodical literature, especially to those who have taken each consecutive issue; but there is nothing so good that it cannot be improved upon; and thus, after many years of careful consideration, the editor has worked out what is believed to be the solution of the whole problem. Dr. Sajous—whose experience, all will admit, has been sufficient to constitute him a person qualified to judge—believes it is absolutely feasible to combine the features of a text-book and of a work like *Sajous's Annual* in one system. His idea has been submitted to many eminent medical writers and has, in every instance, received their unqualified approval. Likewise a large number of busy, general practitioners, who not only feel the financial tax for medical works quite severely, but find that the possession of a large reference library only entails a corresponding amount of labor in using it, look upon Dr. Sajous's plan with particular favor. The new publication has the alphabetical arrangement, and comprises a concise statement of the generally accepted methods in vogue, in one style of type, while in a different type, on the same page, can be found the opinions of well-known authorities bearing upon whatever may be debatable regarding the subject in hand. This alphabetical arrangement will consider all the practical subjects of medicine and surgery and the clinical application of therapeutics. It will appear at the approximate rate of one volume each six months, the whole alphabet being thus covered in three years, and during this time a monthly supplement (*The Monthly Cyclopædia*), alphabetical from A to Z, will be brought out; so that a doctor can have a complete synopsis of the latest journal literature to reinforce his system of reference Subscriptions are taken for the entire series only, at $5.00 per volume, in cloth. This secures a large six-volume reference system with thirty-six monthly supplements during that period. The volumes will be beautifully illustrated, each volume will be handsomely bound in two colors of cloth. The half-

Russia binding will be furnished at $6.00 per volume, if desired. It will thus be seen that the aim of Dr. Sajous and his editorial staff is designed to accomplish two things: 1st. To give a satisfactory statement of what may be safely relied upon as the best general method of treatment in any given case. 2nd. To combine with this a means of practically utilizing the discussion by the leading medical authorities of the world, which may in any degree modify present establish methods.

Appleton's Popular Science Monthly for May, 1898. New York: D. Appleton & Co. 50c. a number; $5.00 a year.

The unique position which France holds in relation to "The Question of Wheat" is pointed out by Worthington C. Ford, chief of the Bureau of Statistics at Washington, in his second article, which heads the table of contents in *Appleton's Popular Science Monthly for May*. The "West Indian bridge between North and South America" is the title of an instructive geological study by J. W. Spencer, in which the probability is shown of such a land connection having existed between these continents in recent geological times. The article is given added value by a number of illustrations. "Witchcraft in Bavaria," by Prof. E. P. Evans, is full of interesting history, and among other things gives some rather startling information regarding the crude and ridiculous theological doctrines still taught in some of the German universities. The advances made in kite-flying during 1897, and the meteorological data obtained by the use of kites, are described by George J. Varney, in an illustrated article entitled "Kite-flying in 1897." "The Theory and Practice of the Income Tax" is the subject of Mr. Wells' eighteenth chapter. He takes the ground that it is impossible to enforce such a tax equitably. An extremely interesting and unique paper, entitled "A Study of Snow Crystals," is contributed by W. A. Bentley and G. H. Perkins. It gives an account of the various forms assumed by snow crystals, and shows that certain kinds of storms are almost invariably characterized by certain sorts of crystals. The most interesting feature of the article, however, is a series of photographs of the actual crystals, taken with the aid of a microscope. Prof. H. Carrington Bolton has an interesting study entitled "A Relic of Astrology." It gives the history of the naked figure of a man, surrounded by the signs of the zodiac, which has been the sign manual of the patent-medicine almanac from time immemorial. "A Study of Children's Ideals," by Estelle M. Darrah, will be found of interest and value by all persons having to do with the education of the young. "Man's Dependence on the Earth," by M. L. Gallouédec, is an interesting essay on the relations between man and his environ-

ment. A curious psychological study, entitled "Earliest Recollections," is contributed by Victor and Catherine Henri. The sketch is of Russell H. Chittenden, of the Sheffield Scientific School of Yale University, and is accompanied by an extremely good frontispiece portrait. Under the head of correspondence are two interesting communications; one entitled "A Fasting Frog," and the other giving an amusing account of the "Eating of the Heart of Louis XIV.," by Dean Buckland. "An Educational Heretic" and "Realization of a Prophecy of Mr. Spencer" are the titles in the Editor's table.

Cataphoresis, or Electric Medicamental Diffusion, as applied in Medicine, Surgery and Dentistry. By WM. JNO. MORTON, M.D., New York: American Technical Book Co., 45 Vesey St. 1898. 267 pages; 76 Illustrations. $5.00.

Enthusiasts in fads and facts are always intolerant to those who are not of their way of thinking, and when they happen to hit upon a fad and a fact of real value there are no epithets too damnatory to apply to those who were distrustful. Dr. Morton is an enthusiast of the first degree. This enthusiasm, however, is not based upon his own amazement at the immensity of his own brain, but upon deep and modest devotion and experimental research. If he is not fitted to give us an authoritative work on Cataphoresis Medication, we do not know who is. The contents are divided into the following chapters: I., Historical; II., Physics and Physiology; III., Apparatus and Outfit; IV., Applications in Medicine and General Surgery; V., Special application to Dental Surgery; VI., Application in Microscopical Work. To some readers the work will be of intense interest, to others of intense mystery. The question and technique in electrical action still remains to many busy men an unexplored region, and yet a fascinating one of most modern interest. At present the value of the cataphoresis is not fully accepted by conservative thinkers and practitioners. Yet it may happen, as it has frequently happened in science, that more ignorant men may stumble into the heaven of truth by virtue of their boldness. Failures, which have been many, and difficulties, which are always delightful stimuli, are no sound argument against the possibilities of this method; neither is occasional success sound argument for belief in its infallibility. Imperfect insulation of a county from the gum tissue; the use of the wrong electrode; too high a voltage on thin dentine over exposed pulps will have their victims; but it is too late to condemn cataphoresis on that account; yet it seems too soon to give it unstinted praise. The work is well worth the money. It will need, as it will merit, deep study We ask for it a good sale in Canada.