INQUIRY TOOTHBRUSH.

Section of the H. C. F. D. I. August 5th 1926 Geneva..

The Inquiry re toothbrushes has shown that upon this subject many colleagues still hold opinions wich are quite out of date.

The H. C. consider it therefore their urgent duty to put forward standardized methods for the rational construction and use of the toothbrush. The arrangement of this work has been delegated to Mr. A. E. Rowlett, Leicester.

Thesis adopted by Unanimity by the session of the H. C. F. D. I. August the 5th 1926 Geneva.

The tooth-brush is and remains the prophylactic weapon „par excellence" according to the actual state of our knowledge. The evil the tooth-brush is suspected of, is imputable rather to its irrational use or the use of badly constructed brushes. Therefore we must try first of all, to unite and make popular the rational principles of construction and use of the tooth-brush.

i.e. I. Construction and consistence
II. How to be used
III. Sterilisation and causes of reinfection
IV. Necessity of dentifrices and if so, what kind.

Moreover it results from the investigations that it would be very important and consequently desirable to determine on a scientific basis, the part (be it only a very small one) imputable to the tooth-brush with regard to causing or aggravating perio-dontoclasic phenomena (wedgeshaped defects included).

In consequence whereof, the H. C. F. D. I. appeals to the scientific experts to realize this aim.

Secretary H. C., F. D. I.

ORIGINAL CONTRIBUTIONS

I.

TOOTHBRUSH.

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Of all the means which have been devised to prevent dental disease, the toothbrush is the one most commonly used.

But since the toothbrush is not a natural product, such as a properly chosen diet of hard and detergent foods may claim to be, and since the act of brushing is likewise artificial, it is necessary to enquire both what is the best type of toothbrush to use, and what is the most efficient manner of using it.

Let us first consider why a toothbrush came into being; the toothbrush was invented because teeth decayed and gums became unhealthy, and it was the desire to prevent this disease of the oral tissues that has established the habit of brushing the teeth.

As a prophylactic measure the toothbrush occupies a very important place in dentistry, and it is a powerful agent for preserving the dental tissues when properly used, but when improperly used it can do irreparable damage.

An enquiry circulated among both the dentists and the manufacturers of toothbrushes has shown a great diversity of opinion, and since it is impossible in the short space at our disposal even to summarise all the answers received, we shall content ourselves in putting down the agreed principles which should guide us in the construction of the toothbrush and its use, and from these deduce a few practical applications.

First let us take the *Toothbrush:* —

1. It must be simple in construction and easy to keep clean. A complicated brush which has, as some of the brushes we received, screws and interchangeable heads, will soon become septic, must of necessity be expensive, and is quite unfit for universal use.

2. It should not be too large. Many brushes are so large that in many mouths it is quite impossible to reach the buccal surfaces of the posterior molar teeth, and it is better for a toothbrush to be too small rather than too large.

3. The bristles, preferably bleached, should be fairly stiff, but tough rather than hard. It seems the general opinion that

they should be disposed in small separated tufts, rather than closely set, and many dentists favour a tuft at the end of the brush.

4. *The handle.* The material most commonly employed is bone or celluloid. It should be perforated at the end to enable the toothbrush to be suspended upon a nail, and is with advantage set at an obtuse angle with the head of the brush.

It will be understood that these recommendations are only for a standard brush, and modifications will naturally suggest themselves, e.g. it may be desirable to have soft bristles in tender mouths, or a special brush with a single tuft of longer bristles may be found more practical for the lingual surfaces of the teeth.

In deciding upon a brush it must always be remembered that it has a dual purpose; the brushing of the teeth and the massage of the gums, i.e. the prevention not only of caries but of gingivitis, which is the invisible precursor of pyorrhoea.

Our next consideration is the best method of applying the brush, with a brief mention of dentifrices.

The prime importance of brushing the gums as well as the teeth is not generally realised, yet it is a fact that not only gingivitis can be in large measure prevented, but also vertical and interproximal caries, by conserving the health of the gums.

In brushing the gums the brush should be applied to the surface of the gums with the bristles pointing vertically downwards for the lower jaw, and vertically upwards for the upper jaw. The brush should then be firmly rotated so that the bristles may sweep along the surface of the gums and the buccal surfaces of the teeth towards the occlusal surfaces. This motion will not only massage the gums at the gingival margin, but will also sweep out any foreign matter from the interproximal spaces.

It is also the most efficient manner of keeping in health

that triangular piece of gum which should fill the interproximal space between the teeth.

The gums should be brushed both lingually and buccally, and for the buccal surfaces the brush with a single tuft may be conveniently used, especially if the teeth are rather long.

Brushing of the whole of the palate and the dorsum of the tongue has been recommended, but is not a usual procedure. A solution of common salt, Na Cl. (one teaspoonful to a glass of cold water) should be used for brushing the gums. Sodium chloride is a constituent of the blood, and if by osmosis some of this salt enters the blood stream no harm can result.

The teeth themselves should be brushed on all their surfaces, occlusal, lingual and buccal, and for this in many mouths a dentrifice consisting of some impalpable powder, e.g. precipitated chalk, is necessary. Powdered soap and an antiseptic may be added if desired.

There is no advantage in a paste over a powder, except that a paste is possibly more convenient.

If possible teeth should be brushed after every meal and last thing at night, and if it is impossible to brush the teeth after a meal, a quill toothpick should be used and the mouth rinsed with water.

After use the toothbrush should be carefully washed and dried, and suspended upon a nail in the sunshine if possible, and it is wise to keep more than one toothbrush in use so that a dry brush may always be at hand.

The following dimensions may be considered as being suitable for an ordinary toothbrush: —

Handle of Toothbrush	4½ inches.
Head „ „	2 „
Length of Bristles	⅜ „

ALFRED E. ROWLETT.

THE TOOTHBRUSH IN RELATION TO OCCLUSAL FISSURES [1])

616.314 083 × *7*

(with 5 Photomicrographs)

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„Clean teeth do not decay" is the cry that has kept patients, dentists, bacteriologists, chemists and tooth brush makers earnestly endeavoring to find some means of maintaining this cleanliness. Both dentists and patients however, frequently become discouraged, in finding that a tooth which they had kept apparently scrupulously clean, had, in spite of e very precaution become carious.

There are two reasons for this, firstly, some teeth can not be kept clean, and secondly, a marked susceptibility to dental caries. Only the former will be considered in this paper, as the susceptibility to dental caries is far too extensive a field of research to be treated on this occasion.

Let us therefore analyse the question; Is it possible to keep a tooth clean? It all depends upon what we understand under cleanliness. If we mean that to be clean, a tooth must be free from bacteria, then it is impossible. But if we modify our conception of cleanliness and apply it only to a tooth free from

[1]) The author hopes that some members of the F. D. I. in each of the various countries will take up the study of fissures and if they are convinced of the correctness of Hyatt's contentions, do all to stimulate the practice of the early treatment of occlusal fissures before decay has penetrated to the dentine.

food debris and bacterial placques, then indeed it is possible. One condition, however, affects our ability to keep a tooth clean and that is, that it must be perfect; it must be normally formed with perfectly calcified enamel having no faults. Such a tooth or even such a complete set of teeth may be kept „physiologically clean" [1]) by a determined effort on the part of the patient, and dental caries will not appear, unless a considerable susceptibility to this disease is present.

The exciting cause of dental caries appears to be the mucigen placque under which lactic acid forms by the decomposition of carbohydrate food particles. This acid soon decalcifies the enamel and the initial lesion of dental caries results. It is undoubtedly possible to prevent the formation and adhesion of such placques upon all smooth, accessible areas. Deep grooves and fissures, however, which are commonly found on the occlusal surfaces of molars and bicuspids, form the exception and this explains the prevalence of dental caries in these areas.

Occlusal fissures are found in the areas of molars and bicuspids where the enamel has not calcified perfectly. The dental practitioner has repeatedly noted that such areas are most prone to dental caries, so prone in fact, that 98 % of first molars become carious at these points. T. P. Hyatt [2]) has caused considerable discussion in the United States by the publication of his statistics which show that there are more carious cavities on the occlusal surfaces of molars and bicuspids than the sum of all of the other four surfaces of the teeth. He advanced the proposal of treating these fissures, before dental caries sets in and named this procedure „Prophylactic Odontotomy." This brought a storm of protest upon his head. The author was at first not in favor of this method of placing fillings before decay set in, but considered the subject worthy of thorough study. [4]) Many ground sections of molars and bicuspids were microscopically examined which showed a considerable amount of tooth distruction with no external

sign of this process which the clinician could diagnose with his probe. Taking the fact into consideration that even slight carious cavities may cause changes in the pulp through irritation, the author believes that Hyatt is right in his contention and that the dental practitioner can save innumerable teeth by placing S m a l l fillings in deep grooves and fissures before caries has penetrated to the dentine. This subject will be discussed in a series of articles by the author in the Items of Interest of this year.

The object of this paper is to show the absurdity of expecting the patient to deep grooves, and occlused *fissures* (not normal grooves) free from placques by any method at his disposal.

The four means the conscientious patient has for the care of the teeth are:

1. Mouth wash; 2. Tooth paste and powder; 3. Floss silk; 4. Tooth brush.

In their effect, they may be classed as follows:

1. Mouth wash = mainly chemical action;
2. Tooth paste and powders = chemical and mechanical action;
3. Floss silk =purely mechanical action.
4. Tooth brush = purely mechanical action.

These four agents for the care of the teeth are not equally effective or of equal importance. The mechanical removal of food debris and bacterial placques from the teeth is of prime importance in the prevention of dental caries to which the chemical sterilization of the mouth is secondary, if not even harmful. [1])

The tooth brush and floss silk are, in consequence, the more valuable means of keeping the teeth clean. The author however, does not, by any means wish to minimize the advantage of the tooth pastes, powders and washes in the toilet of the mouth, he only wishes to emphasize the importance of the mechanical removal of the food debris and placques. No

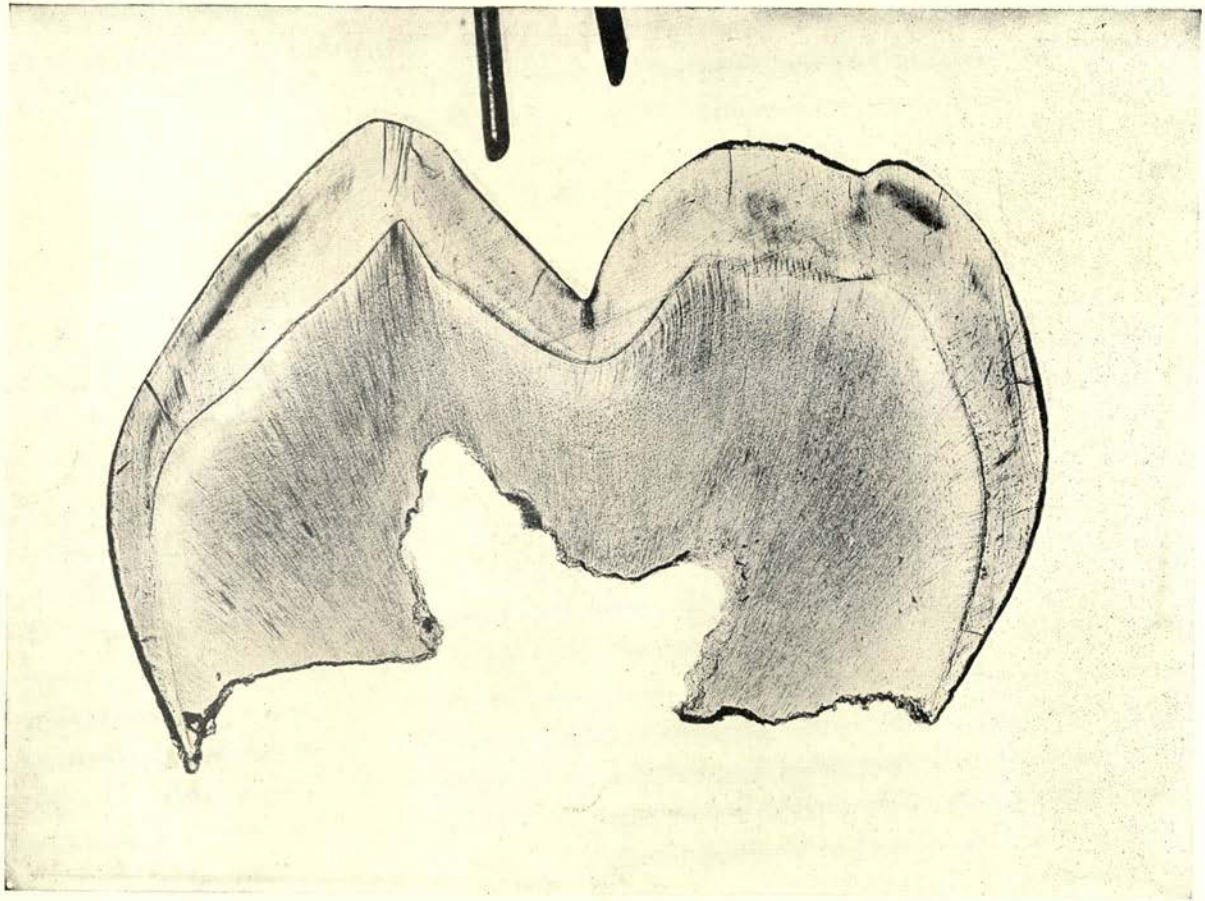

Fig. 1. Chas. F. Boedecker. The Toothbrush in relation to Occlusal Fissures.

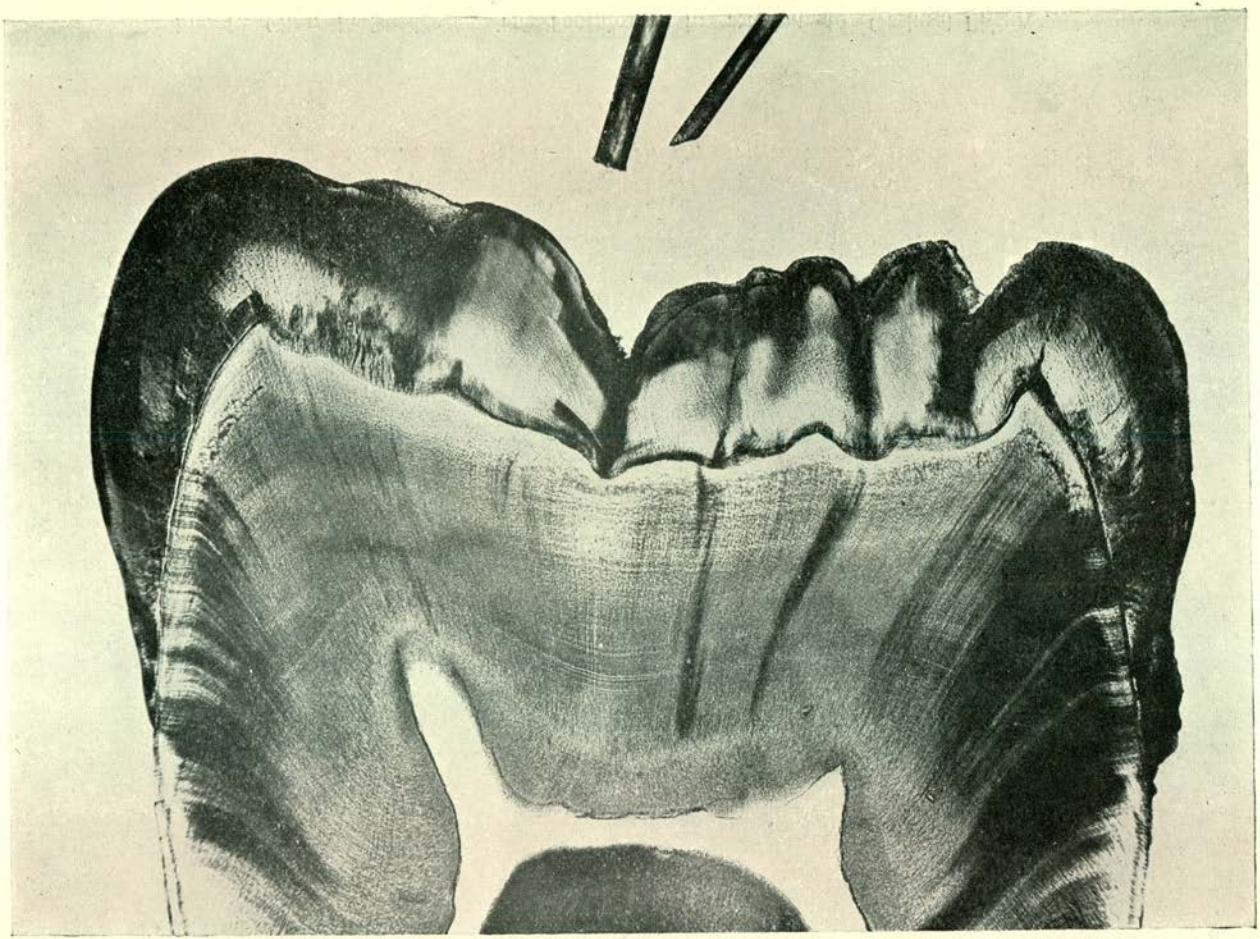

Fig. 2. Chas. F. Boedecker. The Toothbrush in relation with Occlusal Fissures.

amount of sterilization and neutralization of the acid of decay in the oral cavity will prevent dental caries. The public, as a result of the claims of various manufactures, have been led to believe that the pastes or powders alone will do this and that the principal office of the tooth brush is to distribute the agent on and around the teeth. This is not true. The real purpose of the pastes should be to so affect the mucigen placques that they may more readily be removed by a thorough and energetic use of the tooth brush.

But now we come to the important factor: Can all surfaces of the teeth be kept free from placques by the means of the tooth brush and floss silk? They can, as before mentioned, if the tooth is perfectly developed. But so few molars, and particularly the six year molars, are perfectly developed. The majority have faults in the enamel on their occlusal surfaces and as will be proven, these faults or fissures absolutely preclude the possibility of keeping these areas clean. It is for this reason that particularly the first molars are readily attacked by dental caries and often become so badly decayed as to often make their removal imperative. Fissures are so frequent in the occlusal surfaces of molars that they may well be regarded as a common occurence, yes, even a normal condition.

Let us now turn to the question whether real fissures Can be kept clean by use of the tooth brush. T. C. Hyath gave me the valuable suggestion to compare the tooth brush bristle with a fissure as I had done with the dental probe. [3])

Figure 1 shows a ground section of a deciduous molar with a fine (17 micron) and coarse tooth brush bristle (23 micron). The groove in the occlusal surface of this tooth is normal, being quite shallow and bounded by surfaces that meet almost at right angles. The slight fissure at the base of the groove does not penetrate deeply into the tissue and is separated from the dento-enamel junction by a considerable thickness of perfectly calcified enamel. We note that even the coarser of the two bristles, shown in the photomicrograph, would penetrate

the groove and thus the patient could readily keep such a tooth perfectly clean by means of the tooth brush. Such a groove, even in a permanent tooth need not be operatively treated, as the danger of its becoming carious is slight. These grooves are however comparatively rare in the permanent molars.

Figure 2 depicts a ground section of a molar with shallow grooves in comparison with a fine (17 micron) and a coarse (23 micron) tooth brush bristle. We note that the depth of the groove is minimal so that the bristles could readily reach the bottom and thus keep them free from bacterial placques. Such a favorable condition is easily recognized by the dentist and no filling need be placed in these shallow grooves.

Figure 3 shows another ground section of a molar in which the conditions are not so favorable. In this tooth the groove is not only deep and exceedingly narrow, but its walls are almost parallel. It would be impossible to remove the bacterial placques from this area with even the finest (17 micron) bristles of the tooth brush, while the coarse (34 micron) ones may even be considered injurious. These would tend to pack the food debris even tighter into grooves of this type. Such a condition however, may be readily recognized by the dentist by means of the explorer and should be operatively treated as soon as possible. The occurence of dental caries is certain in this type of groove as soon as the general resistance of the patient is lowered by some systemic ailment and therefore the sooner such areas are protected by S m a l l fillings, the better it is for the tooth.

Figure 4 shows a type of groove in a molar that is exceedingly treacherous on account of the inability of the dentist to recognize the existing conditions. The operator might probe such a tooth with the utmost care and not be able to detect any place where the instrument would catch. Our finest explorer is about equal in diameter to the fine tooth brush bristle (18 micron) shown in the photomicrograph. We can therefore readily understand that the dentist could not discover

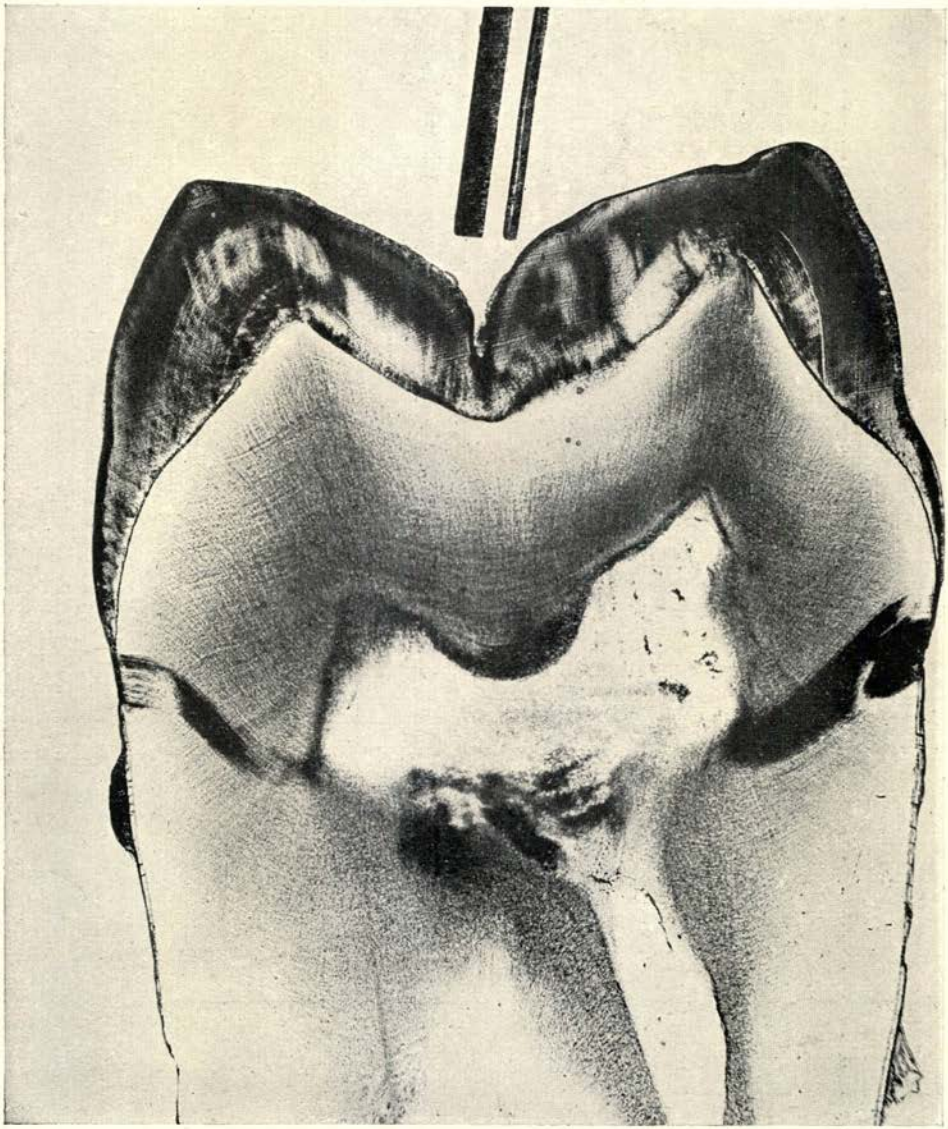

Fig. 3. Chas. F. Boedecker. The Toothbrush in relation to Occlusal Fissures.

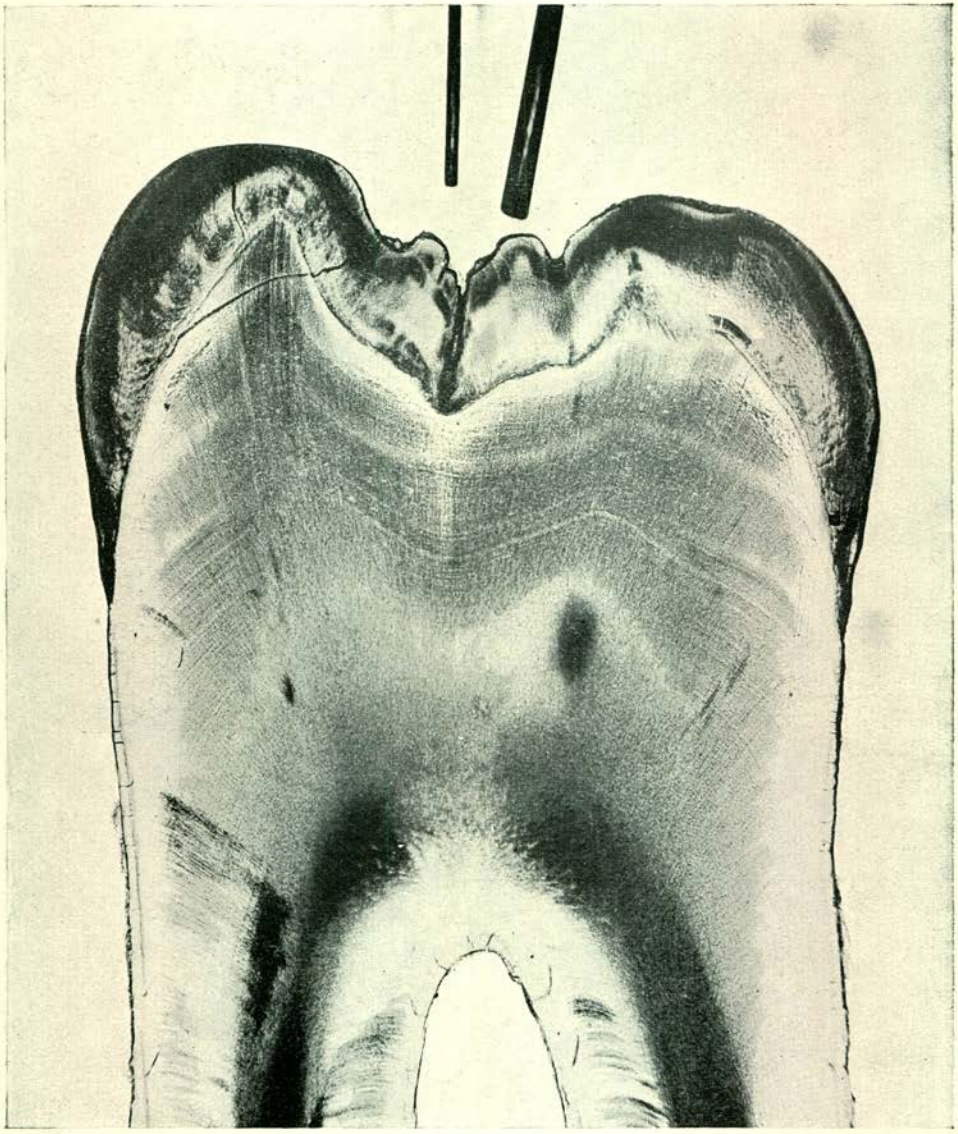

Fig. 4. Chas. F. Boedecker. The Toothbrush in relation to Occlusal Fissures.

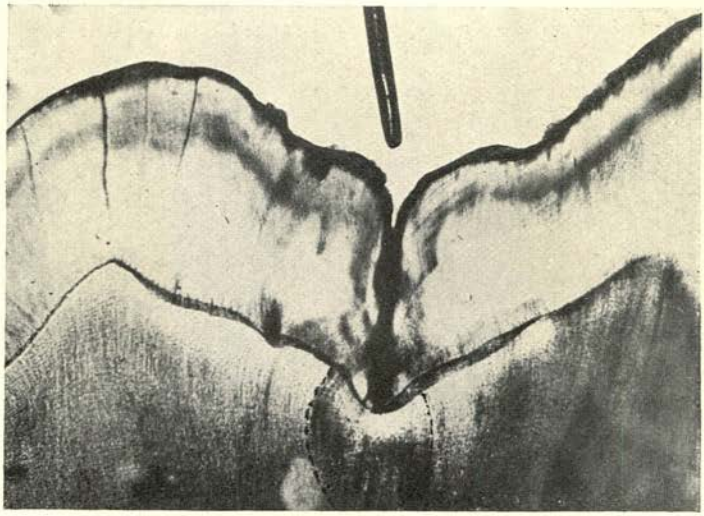

Fig. 5. Chas. F. Boedecker. The Toothbrush in relation to Occlusal Fissures.

the minute crevice leading into the depths of the enamel. A section through the tooth, however, proves that, even though externally the groove appears to be almost self-cleansing, a minute crevice extends halfway to the dento-enamel junction. This is seen as a delicate white line marked (X) and may be considered as a typical fissure, i.e. the absolute failure of the lobes of the enamel to coalesce. The section is evidently taken from a tooth of a young individual for the signs of abrasion are slight. The carious process, therefore, has not had time to reach the dentine.

Figure 5 shows another treacherous fissure in which dental caries has penetrated beyond the dento-enamel junction and caused considerable reaction in the dentine. Here again the relative size of the bristles in comparison to an occlusal fissure, shows the absurdity of expecting the patient to keep such areas clean by means of the tooth brush.

CONCLUSIONS.

1. Histo-pathological examinations of ground sections of molars show that the occurrence of occlusal fissures or faults in the enamel are exceedingly common, so common in fact, that we may even regard them as normal in our present day, poorly calcified, caries-susceptible teeth.
2. The size of the tooth brush bristles in relation to deep, narrow grooves and fissures is so gross that it is impossible for the patient to keep these free from food debris and bacterial placques.
3. Dental caries is, therefore, sure to result in these vulnerable areas, if the patient becomes susceptible to this disease.
4. More than 98 % of the people are susceptible, in a varying degree, to dental caries.
5. Dental caries is most active in the teeth of the young.
6. The tooth most commonly attacked by caries and frequently ravaged beyond repair is the first permanent molar, erupting at a time when susceptibility to caries is greatest.
7. Prosthodontists, orthodontists and in fact the entire dental profession regard the first permanent molars as the most important of the entire set.

Therefore, as over 98 % of the first permanent molars do become carious, *be it resolved* to place small fillings in the grooves of these teeth, irrespective of whether they are carious or non-carious, as soon as practicable after their eruption.

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A SHORT SUMMARY OF MY EXPERIMENTAL WORK

616.314 083

by

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My work may be divided into three divisons dealing with:

1. The structure of teeth in relation to caries,
2. The conditions which affect the structure of teeth,
3. The part played by diet in preventing the onset and spread of caries in erupted teeth.

In order to deal satisfactorily with the first point, *the structure of teeth in relation to caries,* it must be possible to produce caries at will in experimental animals. This has not yet been accomplished, so that it has become necessary meanwhile to use indirect methods.

I have examined a large number of teeth and have found that, in general, those which are badly formed are very much more carious than those which are well formed. The following table shows the result of the examination of children's deciduous teeth.

Type of Tooth.	Number Examined	GOOD STRUCTURE		DEFECTIVE STRUCTURE	
		No. Caries	Caries	No. Caries	Caries
I	100	58	11	1	30
C	70	5	0	25	40
M	466	2	11	2	451
Total	636	65	22	28	521

Previously dental authorities have stated that only about 3 % of children's deciduous teeth are defective in structure, whereas I have proved on examining them microscopically that at least 80 % are badly formed, as will be seen from the foregoing table.

In dealing with the second point, namely, *the conditions which affect the structure of the teeth,* it was found that the main factor affecting calcification is a vitamin known as the calcifying vitamin, which has a very similar distribution to the growth vitamin A.

A typical basal diet for the experimental animals is as follows:

Cereal, 80—200 gms.
Lean Meat, 10—30 gms.
Separated Milk, 150—250 s. gms.
Fat, 10 gms.
Orange Juice (for antiscorbutic vitamin)
Yeast (for anti-beri beri vitamin).
Sodium Chloride, 1—4 gms.

When the fat in the diet is cod liver oil or some other fat containing the calcifying vitamin in abundance, perfect teeth are formed. When, on the other hand, the fat is deficient in the calcifying vitamin, defective teeth are the result. Other factors, such as the type of salts, the amount and variety of cereals, rate of growth, exposure of the animal or food to ultraviolet radiations, all play a part when the calcifying vitamin is deficient; but, within limits, if there is sufficient of the calcifying vitamin present in the diet, these other factors do not seem to be of much importance.

Evidence was obtained on the last point, i.e. *the part played by diet in preventing the onset and spread of caries in erupt-*

ed teeth, to show that the spread of caries in such teeth was delayed by a diet, which, in puppies, produced good teeth. The following table shows the effect of diet on caries in children:

Diet	Main dietetic difference.	Average new carious points per child in about 8 months.
A	Abundant calcifying vitamin and calcium. No oatmeal.	1.4
B	Less vitamin and calcium. Oatmeal.	5.1
C	Intermediate between A and B.	2.9

The main facts brought out by this work are that the production of either good or bad teeth can be brought about in puppies by very small variations in a diet, variations which, until recently, would have been considered negligible; also that even after eruption, the resistance to noxious influences can be affected by the same variations in the diet. If these results hold for man, as they almost certainly do, we now have at our disposal means for ensuring that, by correct feeding of infants and children, perfectly formed teeth can be produced, and that, by the same principles of diet and hygiene, the resistance of fully erupted teeth to caries can be enhanced.

ON THE PLEOMORPHISM OF THE FUSIFORM BACILLUS

576.8

by

THEO. B. v. BEUST,

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During the past forty years organisms of the fusiform type have attracted the attention of investigators. Their occurrence in purulent processes involving the tissues of the mouth, throat, maxillary sinuses, lungs and other parts has been pointed out by W. D. Miller, Cornil, Babes, Vincent, Plaut, Veillon, Bernheim, Ellermann and many others.

A study of the earlier literature exhibits a notable inconstancy in the data concerning their morphology. It was not until after their pleomorphism became known that rigid morphological peculiarities ceased to be ascribed to them. They have been described as occurring in curved, straight, spiral, blunt, pointed, long, short, slender and thick forms. Notwithstanding these discrepancies a smear of infectious materia in which they occur, if properly stained, presents a picture so characteristic that, once studied, it is not again easily forgotten.

The object of this contribution is to present further evidences of their pleomorphism. While engaged in the study of the organisms composing the materia alba in 1906 (1) my attention was attracted to a falcate organism exhibiting a pleomorphism in a biological sense to which I applied the

1) This work is supported, in part, by a Grant from the Research Commission of the American Dental Association.

Fig. 6. Th. B. v. Beust. On the Pleomorphism of the Fusiform Bacillus.

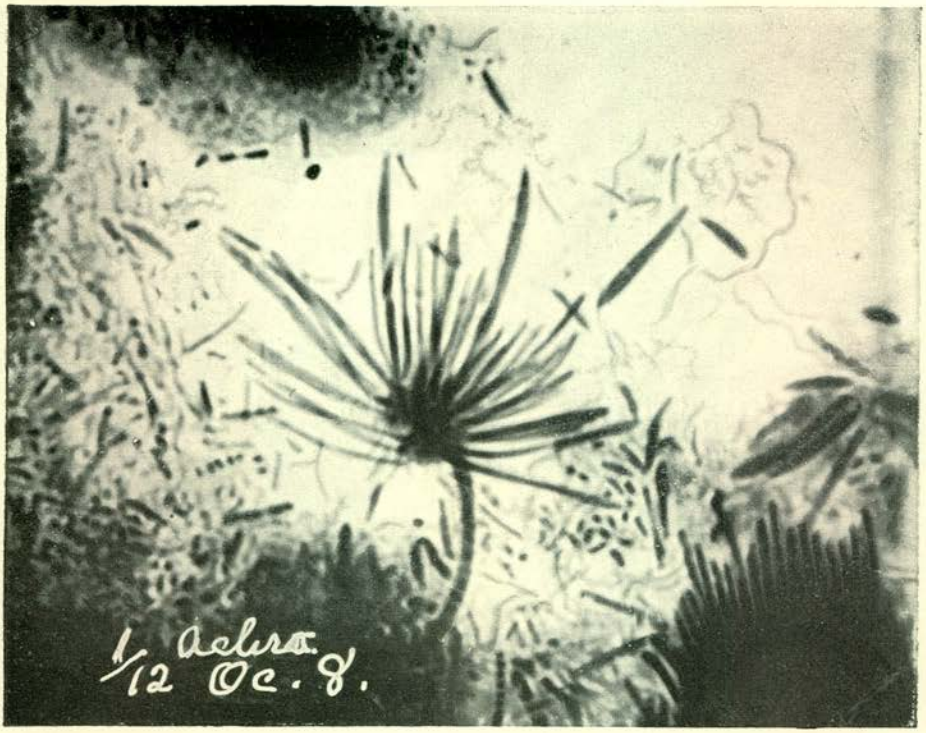

Fig. 7. Th. B. v. Beust. On the Pleomorphism of the Fusiform Bacillus.

name Leptothrix falciformis. This form was further commented in 1908 (2), 1909 (3) and 1910 (4).

Recently an investigation was again undertaken, the results of which are herewith presented. Reference to the accompanying micrographs, together with their descriptions, will make it evident that the falcate forms described by me must be identical with the fusiform bacillus of early and contemporary observers. The specimens shown in the illustrations demonstrate the similarity of the conidea with the fusiform bacilli of Vincent's and pyorrhoeal infections. They furthermore show that the fusiformed bacilli of Vincent's stomatitis are in no way differentiable from the fusiform organism of pyorrhoea.

The organism fructifies after the manner of Leptothrix racemosa Vincentini (5). While an actual differentiation of this form, with its falcate conidea, from the Leptothrix racemosa, with its blunt spores, is thus far impossible, its habitus as well as its pathogenesis appears to characterize it as a distinct organism.

In 1913 Tunicliff (6) succeeded in culturing a fusiform bacillus which was said to include in its life cycle a spiral form. Such a variation in the organism here described has not yet been adduced from the smears.

Contrary to accepted belief the fusiform bacillus of the mouth is peritrichally ciliated. This may be inferred by reference to Fig. 12 and unmistakably demonstrated in preparations.

For further information concerning the morphology, classification and methods of detection of these organisms, the reader is referred to the Dental Cosmos (2).

This contribution fulfills in part the prophecy of Vincentini who claimed that many of the microbial forms of the mouth are derived from a common parent.

DESCRIPTION OF ILLUSTRATIONS.

Fig.'s 6, 7 and 8. Specimens of fragments of Leptothrix falciformis 1/12 Hom. Immersion, Oc. 8.

9. Specimen showing peripheral conidea. 2 mm. Apochromat, Co. 8.

10. A smear from a field taken from a case of Vincent's angina. 2 mm. Apochromat, Oc. 8.

11 and 12. Two fields from the same smear, taken from a case diagnosed clinically as a Vincent's infection. 2 mm. Apochromat, Oc. 8.

13, 14, 15, 16. Smears taken from pyorrhoea cases. 2 mm. Apochromat, Oc. 8.

17. Fusiform bacilli. 2 mm. Apochromat, Oc 15.

Camera extension for all micrographs was approximately 1 Meter.

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Fig. 8. On the Pleomorphism of the Fusiform Bacillus.

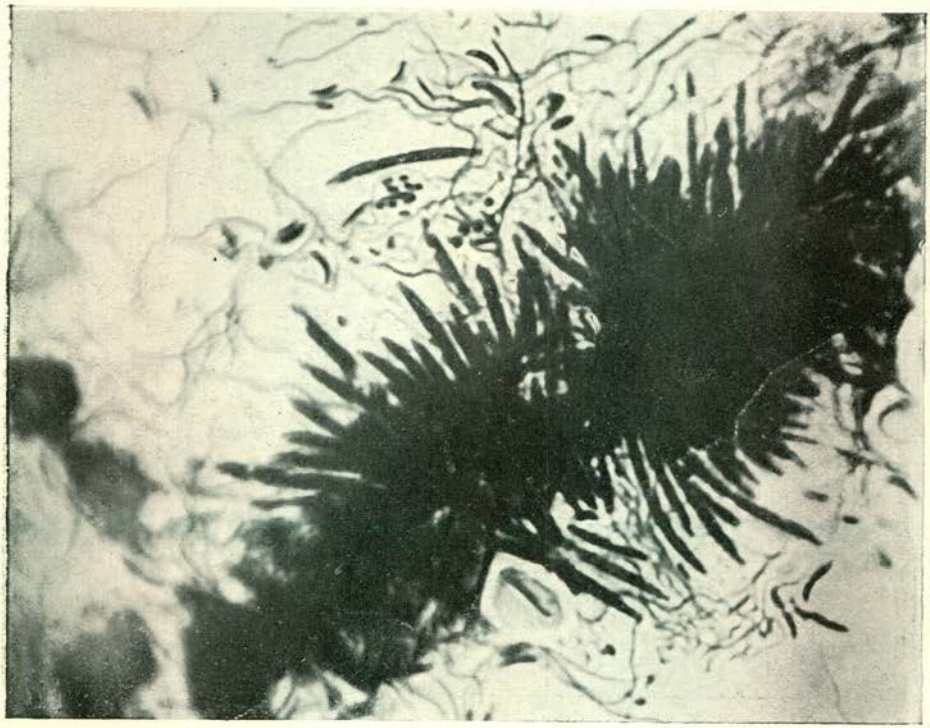

Fig. 9. Th. B. v. Beust. On the Pleomorphism of the Fusiform Bacillus.

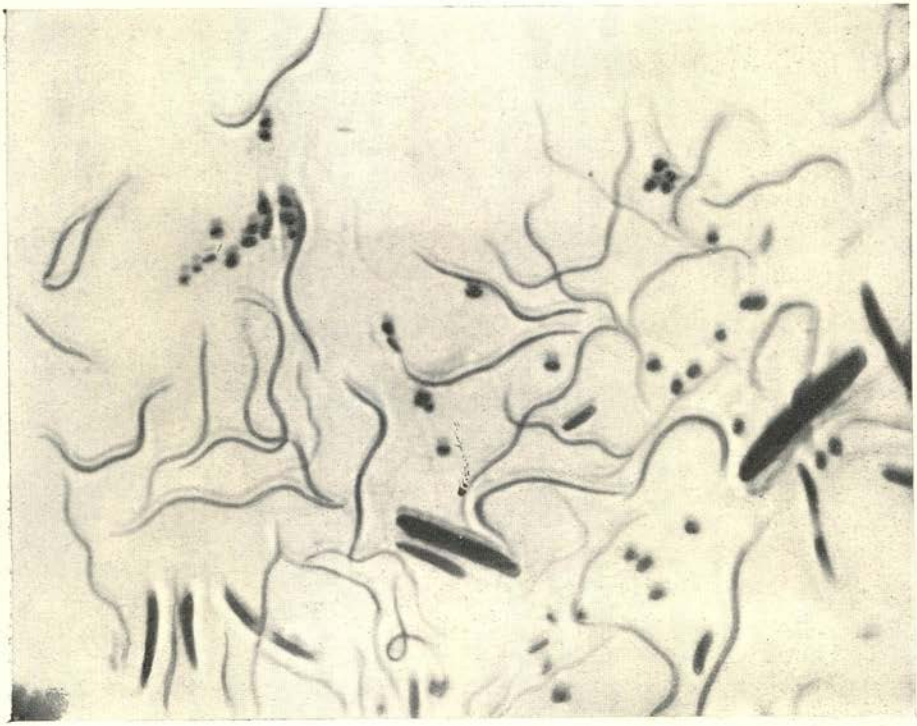

Fig. 10. Th. B. v. Beust. On the Pleomorphism of the Fusiform Bacillus.

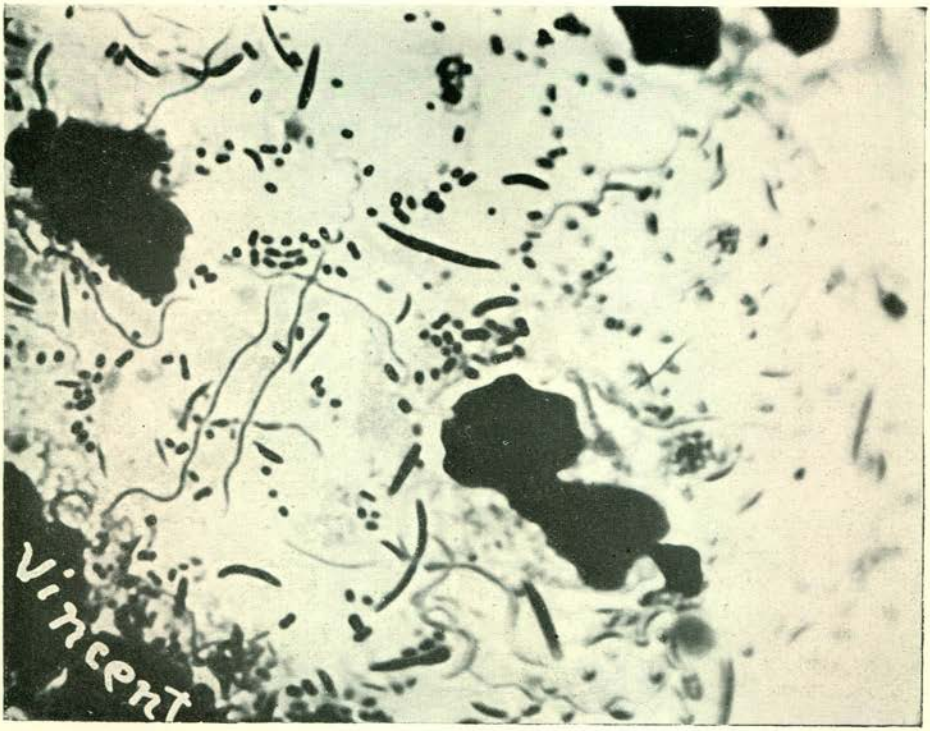

Fig. 11. On the Pleomorphism of the Fusiform Bacillus.

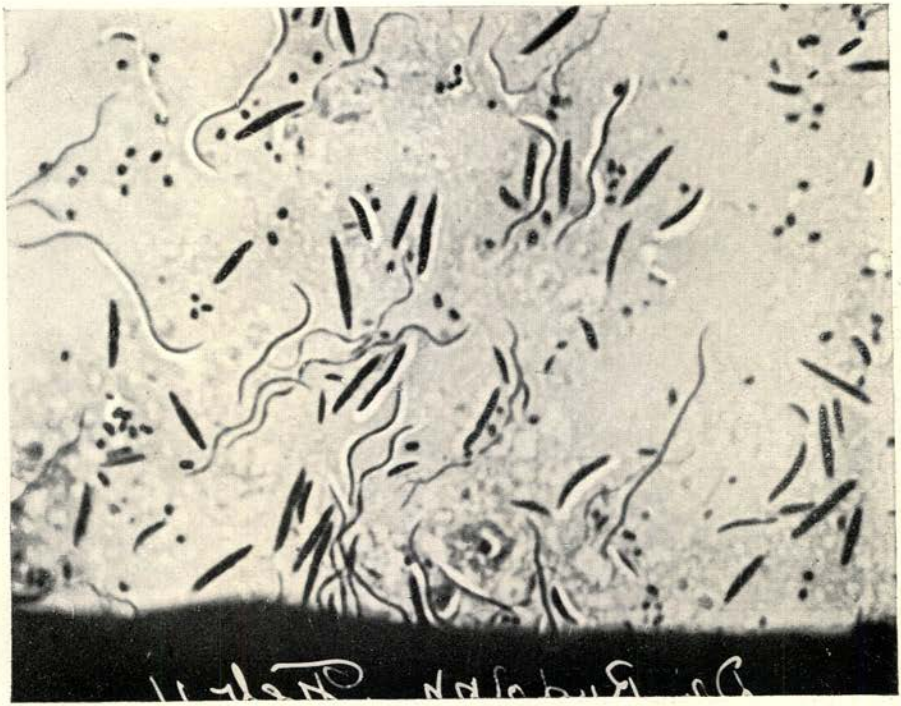

Fig. 12. Th. B. v. Beust. On the Pleomorphism of the Fusiform Bacillus.

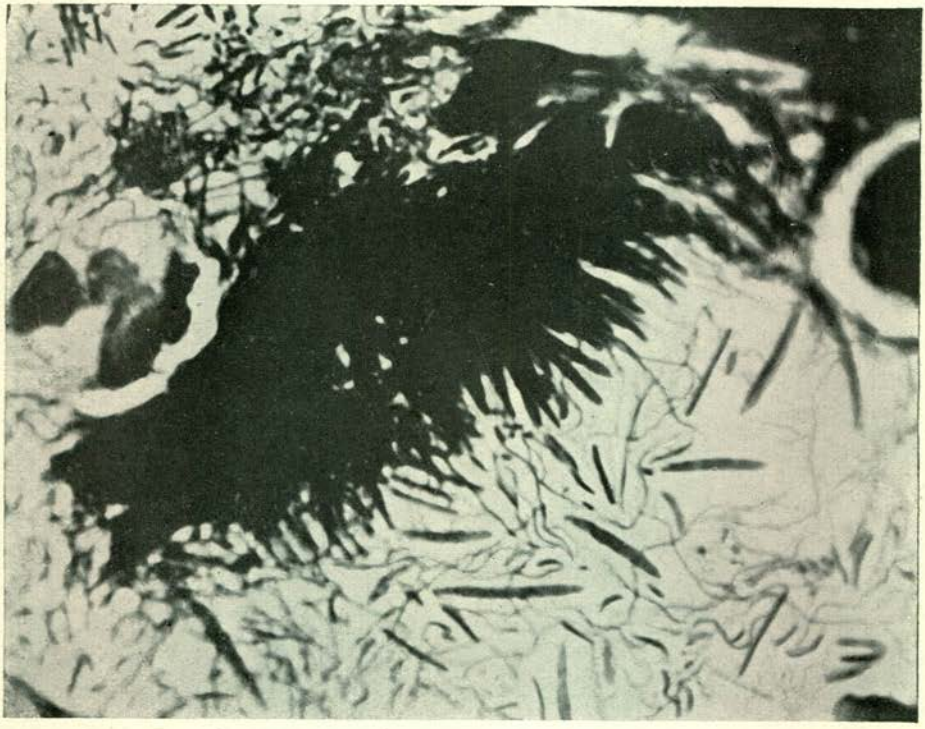

Fig. 13. Th. B. v. Beust. On the Pleomorphism of the Fusiform Bacillus.

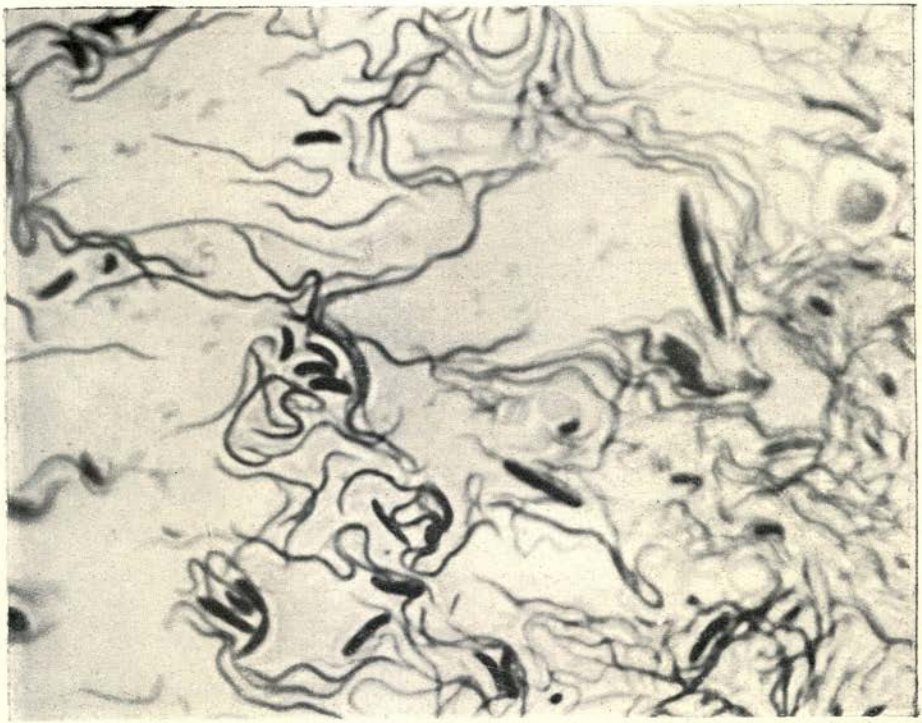

Fig. 14. Th. B. v. Beust. On the Pleomorphism of the Fusiform Bacillus.

Fig. 15. Th. B. v. Beust. On the Pleomorphism of the Fusiform Bacillus.

Fig. 16. Th. B. v. Beust. On the Pleomorphism of the Fusiform Bacillus.

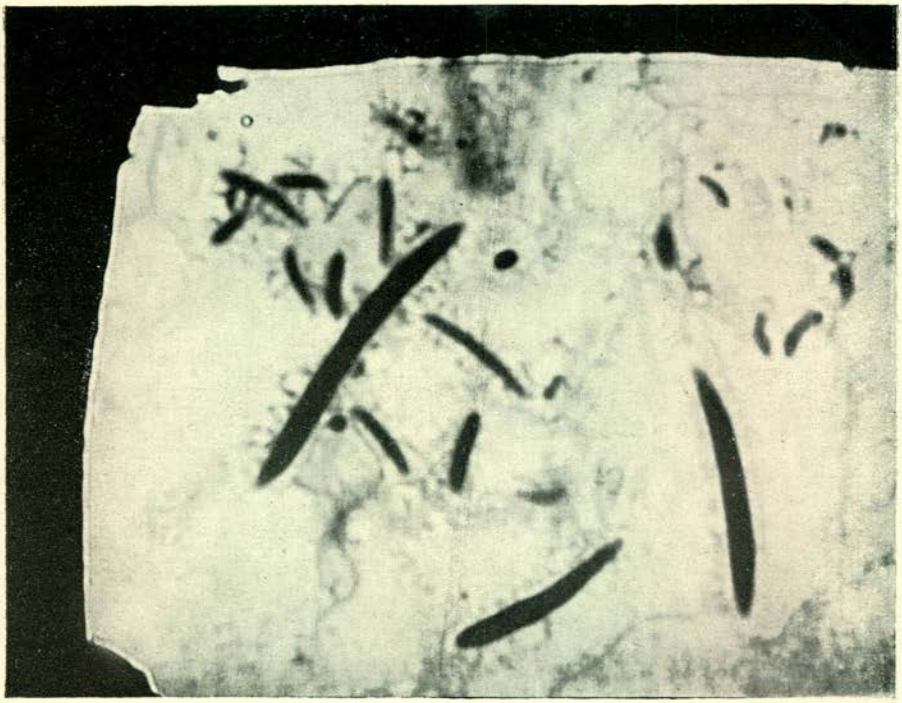

Fig. 17. Th. B. v. Beust. On the Pleomorphism of the Fusiform Bacillus.