

## NED. TANDHEELKUNDIG GENOOTSCHAP

HONDERD EN TWEE EN TWINTIGSTE VERGADERING TE  
UTRECHT IN HET TANDHEELKUNDIG INSTITUUT  
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### *Discussie voordracht Mrs. Mellanby*

Prof. Grijns: Mr. Chairman, Ladies and Gentlemen. I ought to begin by apologising for my speaking English, in case I should use wrong words and expressions or if I should badly pronounce my words. For a foreigner it is a queer thing that the English permit themselves the luxury of having a language understood everywhere but for us, who are accustomed only to read English it is difficult to express our thoughts in speech correctly.

As to the talk Mrs. Mellanby gave us today I think we have to discriminate between two things: the experiments on dogs and the experiments on children, I think that we may certainly take it for granted that the same dietetic factors which are controlling rickets are also controlling the structure of the teeth. I think there would be no objection to the conclusion that there is a very definite relation between the structure of the teeth and the diet the individual had during his youth. As to the other part of the lecture I am also convinced that there is a relation between the structure of children's teeth and the chance they have to get caries. However it is not so easy to bring those two things in connection one with another because as I understood the efforts to make dogs' teeth carious have failed yet. This is always a great difficulty. When we are not able to transmit a disease to animals the experiment becomes very difficult and we are forced to take to observation. In observing we are not able to eliminate factors we don't want or to interpolate factors of which we would study the consequences so that the number of observations wanted is much higher than the number of experiments which would be sufficient to reach the same end.

It would be very interesting to make observations on caries in countries where rickets is very scarce. I think that those dental surgeons who practised in the Indies where rickets is very uncommon could give valuable information in this respect. If caries and rickets go the same way we might expect that caries in the tropics would also be very scarce in comparison with other countries. I stayed in the tropics during a long time but, having other work to do, I had no opportunity to make any observations in this direction, but perhaps the dental surgeons could tell us something about the coincidence of rickets and caries.

As to the experiments with puppies you might allow me a remark not by way of opposition, but which nevertheless might be worthy of your attention.

In feeding puppies with oatmeal and other puppies with wheat, the puppies fed with wheat had better teeth. In hearing that oatmeal gave a worse diet than wheat I thought this might be caused by the quantity of phosphor which is relatively much higher in oatmeal than in wheat. In raising cattle it is necessary, when oatmeal is given as a diet, to add some calcium carbonate in order to have a good result. You also told us that adding calcium carbonate to the oatmeal was better than adding calcium phosphate. That would be very nice had not rice contained very little calcium and relatively much phosphor whereas rice gives a good diet. That reminds us that there is another and a very important difference between the different feeding materials, and that is the difference between the albumens. The albumens contained in the various cereals are by no means the same. The investigations of the Lister Institute and in America those of Osborne, Mendell and Mac Collum have shown that the albumens of oatmeal and of wheat are incomplete albumens and that the albumens of rice are more complete. So rice is better in that respect and without denying the importance of calcium and phosphor we must be aware of the important part played by the albumines. A good diet should contain not only the necessary quantities of vitamins and of albumens but also several other indispensable things and, one of these necessities lacking or being insufficient in quantity, that factor becomes the controlling one for the result of the nutrition. So in every case we must control every one of those components and it is not sufficient to control the vitamins and the salts only. It is possible that the differences between oatmeal, wheat and rice are diffe-

rences of the phosphor or the calcium contained therein, but it is also possible that the difference is caused by the variation of albumens.

Concluding I want to assure you that I followed your lecture with the greatest interest and I want to congratulate you upon the very fine results you have attained.

Dr. D. E. D a C o s t a: Mr. Chairman, Ladies and Gentlemen. Please consider my discussion of this paper only from the viewpoint a practicing dentist may take.

Repairing teeth which will keep on decaying is not very satisfactory. The prevention of dental caries, difficult as the problem may be, is the only solution which will give entire satisfaction. Whoever tries to find an answer to this problem deserves our gratitude.

I think our profession is much indebted to you, Mrs. Mellanby and I wish to thank you most heartily for all you have done in this connection. Your wonderful research work has proved undoubtedly that a properly regulated diet will grow better teeth than anything else.

Granting that we are proceeding in the right direction there are still many questions which want elucidation. Miller's theory on caries is a theory still. Let me just mention the osmotic pressure theory on caries. Do you consider the results of dr. G. V. Black's investigations on the physical and chemical construction of the teeth out of date? Professor Gryns mentioned that rickets is less widely spread in the tropics than here. Now the investigations of Mr. G. Friel and the late R. Mummery show that the teeth of the Kaffirs, before adapting the food introduced by the civilised, were practically free from caries. After introduction of the civilised foods Friel's investigation shows that caries had increased about 800 % and that notwithstanding the fact that many of the Kaffirs examined had been brought up on native food in early life. Is it probable that the Kaffir's diet in its original composition would be better regulated than after partaking of the food of the civilised?

The investigation of dr. Leon Williams has shown that the same defects seen in the teeth of the civilised were also present in the teeth of the anthropoid apes notwithstanding their complete freedom from caries. How can we fit the diet theory in these cases?

The teeth of praehistoric man compared to those of the civilised show that marked changes have taken place. The teeth of civilised man have smaller crowns and smaller development of the enamel cusps,

consequently smaller crevices. The development of the cingulum, so much greater in prehistoric man, together with a corresponding deep lingual pit on the incisor would indicate that these teeth were more liable to stagnation of food and thus more predisposed to caries. Which is not the case.

I cannot free myself from the supposition that a revolutionnary evolution is taking place in the human denture.

Mr. Ch. F. L. Nord: Mr. Chairman! I should like to ask two questions.

In the first part of her paper Mrs. Mellanby referred to the influence on the structure of the teeth in the onset and the development of caries and she divided the teeth into well structured and badly structured teeth. It would be interesting to hear something about the percentages. I didn't quite understand *when* the moment came which makes Mrs. Mellanby consider a tooth as one of defective structure. Perhaps she could tell us that and inform us how the percentage was established. The director of a Children's Hospital told some time ago that he formerly gave to the children calcium phosphates but that nowadays he gives them pure phosphor in cod liver oil and calcium, so that the phosphates are formed in the body. He gets far better results now. I should like to know what Mrs. Mellanby thinks about that.

Mr. H. Van der Molen: Mr. Charman. Some time ago I had an opportunity to see two children, twins, treated by Dr. Heybroek, our guest. One of them was treated with ultraviolet rays at the age of 2½ months, before there were any signs of rickets. The other child was treated with ultraviolet rays at the age of 5 months, when it showed craniotabes and other signs of rickets.

When I saw these two children, they were 3½ years old. Their dentures showed much resemblance, except as to caries. In the denture of the first child, that is the child which had been treated prophylactically, there were only two signs of caries, but those were very small areas of arrested caries. The other child had about 7 cavities and I could not see that there were signs of arrested caries. So it is possible that the treatment of these twins with ultraviolet rays has influenced upon caries of the teeth.

Mrs. Mellanby: May I first congratulate you, Mr. President, and other speakers, not only on the way in which you have understood and other speakers, not only on the way in which you have understood the language my ignorance has forced me to use, but also on the amazing ability with which you have spoken in the English language. There was certainly no need for any of you to apologize for your lack of powers of expression, and I am sure that any English people listening to this discussion would have been both surprised and delighted at your command of the language.

In answering the first speaker, Professor Grijns, I should like to say that, owing to my not having grasped the pronunciation of his name, I had not recognized in this gentleman that pioneer worker whom I know of so well in print. It is an honour to know that he is present here to day and moreover, that he opened the discussion. I agree with most of Professor Grijns' remarks. It is quite true that my work can be divided into two parts, the first dealing with puppies, and the second with children. It is also true that I am trying in various ways to connect up these two parts. In the first part, the main results show how well calcified or badly calcified teeth can be produced. The second part deals with the relation between the structure of teeth and caries in children, and also the effect of diet on the resistance of erupted teeth to noxious influences. I should like here to say that efforts are being made to produce well calcified teeth in children by getting friends to treat children on the lines which have been shown in puppies to produce perfect teeth from the point of view of structure. Unfortunately, we have no children of our own. Had we had any, of course we feel sure that they would have grown up with perfect and non-caries teeth!!

The first child to be given a 'good' diet on the basis of our work was the son of my valuable assistant, Mr. G. Payne, without whose help much of this work could not have been done. Mr. Payne was for many years — about fifteen I think — laboratory assistant at the Royal Dental Hospital in London. He came to me 6½ years ago imbued with all the ideas held by the best English dentists; in other words, he thought oral hygiene the all-important factor in dental caries. After he had been with me about a year, I found that he was getting very interested in the experimental results, and was actually making his wife, who was pregnant at the time, take cod liver oil,

which he saw always produce perfect teeth when added to the diet of puppies. Since weaning the child has been fed, as far as the father could ensure, on a diet calculated from the animal results, to produce well calcified teeth. The child is now just over five years old. The teeth are beautifully white and shiny and well spaced and show no signs of caries as yet. My husband has a bet with a lady doctor — he is to get £ 1 if the child reaches six years of age without showing any signs of decay and is to give £ 5 if decay sets in before that age. We are already wondering how we shall spend the £ 1! I am of course looking forward to the time when I have procured ground sections of all the deciduous teeth of this child. Many other children are being brought up on similar lines, and so far have perfect non-carious teeth.

The close connection between rickets and poorly formed teeth is undoubted, and it would be most interesting to know something of the condition of the teeth in those countries where little rickets is to be seen.

I am trying in other ways to connect up the work on animals and on children; for instance, there are the investigations referred to in the lecture on the spread of caries in children and also the attempts to produce caries in animals — but of course I agree with Professor Grijns that until we succeed in producing at will experimental caries in puppies or other suitable animals, it is going to be difficult to study the problem of caries satisfactorily. Animals are liable — especially under domestication — to get caries, and I am hoping now that I have the opportunity of keeping dogs over longer periods, to have less difficulty in producing caries in these animals.

It is quite possible, as Professor Grijns suggested, that the high phosphorus content of oatmeal may be in some way responsible for the extraordinary effects this food produces on the teeth when the calcifying vitamin is deficient. As he himself suggests, however, the experimental results obtained with rice seem to preclude the possibility that the effect is due to the relatively low amount of calcium as compared with the phosphorus. The distribution of calcium and phosphorus can be seen in the following.

TABLE 5.

	Per cent. Calcium.	Per cent. Phosphorus.	Ratio Ca/P	
			Ca.	P.
Oatmeal . . . . .	0.069	0.392	1	5.7
Rice. . . . .	0.009	0.096	1	10.7
White flour . . . .	0.020	0.092	1	4.6
Whole meal flour	0.031	0.238	1	7.7
Barley. . . . .	0.020	0.181	1	9.0
Rye flour . . . . .	0.018	0.289	1	16.1
Wheat germ . . . .	0.071	1.050	1	14.8

It does not appear from these figures that either the absolute or the relative amounts of calcium and phosphorus can explain the effect of cereals on dental calcification.

The question of the part played by the *type* of proteins (albumens) in the diet has been considered to some extent and it seems possible from the experiments on puppies that these substances may play a part, but only a subsidiary part. The importance of the type of protein when the calcifying vitamin is deficient is being more fully worked out at the present time. The calcifying vitamin holds such a dominant position that, when present in abundance, it does not appear to matter within limits what quantity or quality of protein, fats, carbohydrates and salts are present in the diet, well calcified teeth are produced. When this vitamin is deficient then many other factors, such as the amount and balance of calcium and phosphorus, amount of sunlight, amount of carbohydrate, etc., are all of importance.

Dr. Da Costa referred to Miller's theory as to the origin of caries. I am a great admirer of the work of Miller, but I am convinced that he himself, were he alive to-day, would have admitted that much of his work was incomplete, and I think too, that he would have been interested in the work I am doing. I feel justified in thinking this, among other reasons because of the keen interest and encouragement that great and careful worker Dr. J. Howard Mummery, a friend of Miller's,

has taken in the results both of my experimental and other investigations. Dr. Mummery has almost from the beginning given me his help in many ways — by discussion, by criticism and even by correcting some of my papers before publication.

Dr. Da Costa also mentioned the osmotic pressure theory. I do not find Eckermann's papers always easy to understand, yet I shall not be surprised if later on there is found to be just a grain of truth in his work. I, myself, believe that both external and internal factors play their parts in caries. The work of Dr. G. V. Black, referred to by Dr. Da Costa, was, if I remember correctly, rather a side issue in a piece of work being carried out in connection with fillings and not primarily with regard to the part played by hard and soft teeth in caries. I think that Black would be astonished if he were alive to-day and realized how often his remarks had been quoted and requoted in defence of the statement that structure plays no part in the liability of teeth to be attacked by caries. I referred to this question in a communication given before the Royal Society of Medicine in 1923. (Proceedings of the Royal Society of Medicine 1923, Vol. XVI (Sec. Odont.) pp. 74—82). Pickerill of New Zealand does not agree with Black on the point at issue.

Dr. Da Costa asked whether I thought it probable that the Kaffir's natural diet would be better regulated than that eaten under civilised conditions, under which their teeth became very carious, having previously been almost free from this trouble. I think this is very likely to be the case with the Kaffirs just as it is with the Icelanders. Foods eaten by civilised communities, especially by the poor, comprise much cereal and little of those substances containing the calcifying vitamin, which are generally expensive.

Referring to Dr. Leon Williams' statements, I have not myself examined many teeth of anthropoid apes, but I doubt very much if they are found to be defective in the sense that I have shown a large percentage of children's teeth to be defective, and yet to be free from caries. It was, of course, interesting for me to hear from Dr. Da Costa that the teeth of prehistoric man had larger crevices than those of civilised man, so that from this point of view they should have had more and not less caries.



In answer to Mr. Nord, I should like to say that in most cases, it was quite easy to decide whether a tooth was well or badly formed, for in the very great majority of cases they were so clearly badly calcified. There were very few real border-line cases, and these, as a rule, were put into the 'well formed' group. I may say that I have divided up the teeth into many more groups than given in the table. I was naturally not surprised to hear that the director of the Children's Hospital obtained much better results with phosphorus in cod liver oil than with calcium phosphate alone. In the first case he was of course adding the calcifying vitamin as well as phosphorus.

The next speaker, Mr. Van der Molen, found that ultra-violet radiations used as a prophylactic and in arresting caries was effective in two cases. I think ultra-violet rays will be shown to play a part in prophylaxis and in the arrest of caries when the diet taken at the time is under the circumstances deficient in the calcifying vitamin.

I have tried to answer your questions, and will now close by thanking you very much for listening to me so patiently.

**The Chairman:** Ladies and Gentlemen. I may take for granted that the gentlemen who took part in the discussion are satisfied by Mrs. Mellanby's answer. I think it is time now to go for a small luncheon but before doing so I may observe that there is among the gentlemen present one whom we cannot permit to go out of this room before he has said a few words. So I call upon Professor Mellanby to be so kind as to close this meeting.

**Professor Mellanby:** Mr. Chairman, Ladies and Gentlemen: It has been a very great pleasure for me to come to this meeting and to have the privilege of being a member of this distinguished audience. I should like to take this opportunity of thanking you for inviting my wife to deliver this lecture to-day and for giving her such an excellent welcome.

I think it is very cruel to ask me to speak now because, as we say in England, "Comparisons are odious." I do not like to be put too much in the shade by my own wife!

Of course in our work we have been able to carry on harmoniously. She is interested in the problems of the teeth and I am interested in other problems. I do not know anything about teeth and I want to make quite clear to you that this is her own work. She has attacked the problem in her own way with extraordinary energy, and, I am glad to think, with some success.

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