An Address

ON

ORAL SEPSIS IN RELATION TO GENERAL DISEASE.

DELIVERED BEFORE

THE ULSTER BRANCH OF THE BRITISH MEDICAL ASSOCIATION,
BY THE PRESIDENT,

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For the customary presidential address I have selected a subject which has of late occupied a great deal of the attention of medical men, and may, perhaps, seem also worn out. It is a consideration of the part which is played by oral sepsis as a cause of general disease. The widespread interest which this problem has of late evoked, and the natural eagerness to discover a tangible and removable cause for disease, has given rise in many cases to a want of moderation in considering this subject from an etiological point of view. Making due allowance, however, for excessive zeal on the part of many of the observers, there is, I believe, sufficient ground for regarding the question of the septic mouth as one worthy of close attention and careful study. It seems to me that there is very good reason for giving special attention to the condition of the mouth when the following points are taken into consideration:

There is hardly any portion of the surface of the body which is normally free from the presence of septic micro-organisms. It is, however, in the alimentary canal that the bacteria flourish in greatest abundance. In the fetus and newborn child the alimentary tract is sterile, but does not remain so for many hours after birth. It is promptly invaded via the mouth by micro-organisms delivered from the mother's nipple, fingers, clothing, etc., and in a short time it has been shown to contain many bacteria. Their presence is quite consistent with health, provided the skin or mucous membrane is healthy, for microbes coming into contact with the protected surface are usually unable to exercise any injurious influence. It is, however, probable that healthy mucous membranes may be penetrated by bacteria, but in most cases in small numbers. In such circumstances the invading microbes are overcome by the resisting forces of the tissues, and are destroyed as they advance. In the course of their destruction they deliver their endotoxins into the surrounding tissues without causing such a severe lesion as suppuration, but merely causing injury to the structures affected. This is the condition spoken of by Adami as subinfection, and is believed by him to be the real cause of the various results usually attributed to alimentary intoxication.

It has, however, been shown, as stated by Adami in his address published at the beginning of last year, that cultures of bacteria can constantly be obtained from the lymph nodes of the respiratory and alimentary tracts, and also from the liver and kidneys of healthy animals. As a result of this constantly recurring mild intoxication and infection the defensive mechanism of the individual is unceasingly trained and developed during his lifetime; an immunizing power is thus gradually built up, until, in the tissues of the animal inhabitants of our planet, a power of defence is established by which they can successfully resist the ever-present germs. Slight damage to the surfaces, external and internal, admits larger doses of the poisons, and the defensive mechanism is thus in most cases developed to a degree whereby serious infections are successfully repulsed.

As an additional defence against the injurious effects of these and other poisons upon the organs and tissues of the body, we have an important support in the liver. The portal circulation delivers a large proportion of the materials absorbed from the alimentary canal to this organ, where they undergo changes, and where toxic ingredients are rendered less harmful to the tissues. It is the absence of this safety valve from the area of mouth absorption which, in the opinion of Hunter and others, makes oral sepsis especially active as a cause of disease. There are, however, other defensive structures—for

example, the thyroid gland and the lymph nodes—which render good service in the general defence.

It will, therefore, be understood that it is possible for a person to remain apparently in good health while he is absorbing steadily, and perhaps copiously, the poisons manufactured by bacteria in the alimentary tract or elsewhere in the body. It is, however, to be expected that such long-continued exposure to the effects of toxins will have a deleterious influence upon the tissues, and it is believed by most observers that this chronic poisoning gives rise in the course of time to serious damage of tissues and viscera, either in the vicinity of the seat of the poisoning, or at a distance from it.

It is this remote injury and the effects of long-continued poisoning which have given rise to so much discussion and difference of opinion. The more direct and local effects of poisoning need not detain us, as they are so obvious and well known to us all. I propose to consider the more distant result, of septic absorption, and further to narrow the subject to sepsis of the cavity of the mouth and its causal relations to internal medicine.

In the first place, we must realize that the number, variety, and even virulence of the germs present is not the only or even the chief factor in local poisoning. Thus the normal colon and rectum contain more bacteria than the normal mouth; none the less the mouth is more poisonous than the bowel. It has been shown that many varieties of pathogenic micro-organisms are to be found constantly in the mouths of apparently healthy persons. In the stomach the presence of hydrochloric acid inhibits to a large extent the growth of bacteria, though at times the absence of acid secretion may permit the microbes to exist and multiply in the stomach. In the small intestine the conditions are more favourable for the cultivation of bacteria than in the stomach, but not so encouraging for them as in the mouth or, still more so, as in the large bowel. In the colon and rectum huge multitudes of bacteria are present, and of these the *Bacillus coli* is by far the most numerous. A large proportion of the microbes in these regions are fortunately dead. The mere enumeration of the bacteria does not, as has just been stated, give one a correct idea of the relative importance of the different regions of the alimentary tract as a focus of disease. The chief point to be determined is, Where do the microbes most actively exert their toxic influence? This must be wherever they can most readily gain admission to the neighbouring tissues. It is only when the surface is broken, and, indeed, not usually even then, that serious results follow. The condition of the surface is, therefore, the chief indication of an infective focus.

If one examines carefully a large number of mouths, and takes note of even slight departures from a healthy state of the mucous membrane, one must, I think, come to the conclusion that almost all the adult mouths in this country, and probably in other civilized countries, are in an unhealthy condition. No doubt among the more enlightened classes there are many who do their best, by cleanliness and frequent visits to their dentists, to keep their mouth in a healthy condition. Even in this class, however, an extraordinary amount of neglect is present. Various figures have been published, showing the prevalence of mouth sepsis; thus, V. P. Blair states that 95 per cent. of the adult population have dental caries, and in a series of cases examined in the Royal Victoria Hospital the unhealthy mouths were 94 per cent. of all those reported on.

We have no instance of such a prevalent inflammatory process in any other portion of the body; certainly not on the skin surfaces, and there has been no evidence produced from *post-mortem* examinations, nor from the results of surgical operations, of anything approaching this state of affairs in any of the internal regions. Even in the bacteria-infested region of the large bowel there is no reason to believe that an unhealthy state of the surface is the habitual condition, such as one finds in the mouth. In the small intestine and the stomach we have also reason to believe that lesions of the mucous lining are much less prevalent than in the mouth.

The reason for the excessive frequency of mouth lesions can be stated at once: it is the presence of teeth. If we were fortunate enough to remain in the edentulous condition in which we are born we should suffer much less from those lesions which render the normal oral sepsis

dangerous. At times, no doubt, there may be seen ulcers or injuries of the surface of the mouth which cannot be attributed, directly or indirectly, to teeth. These are of comparatively rare occurrence and may be due to injury, infection, or new growths. The tonsils also are a very frequent source of trouble, and even when the gums and teeth are perfectly healthy the tonsils may be the seat of bacterial activity. It is, however, very common to find the fauces or the naso-pharyngeal region inflamed as the result, in all probability, of the direct conveyance of infection from the gums.

Giving full and due weight to all the mouth lesions arising without obvious dependence on the state of the teeth, we must still recognize that the teeth—or foreign bodies introduced into the mouth as substitutes for teeth—are in most instances the starting point of oral sepsis.

It is at the junction of the gum with the dental periosteum that inflammation very often occurs. The accumulation of bacteria in this situation is facilitated by the constriction of the neck of the tooth, which provides a resting-place for food and microbes; here, also, insoluble salts in the form of tartar are deposited. If not removed at frequent intervals, these foreign substances form a culture medium for the bacteria, which on the one hand act injuriously on the teeth by producing acids from the food (especially from the carbohydrates), and, on the other, attack the adjacent soft tissues at the junction of the gum with the periodontal membrane, or dental periosteum. This is the condition known as marginal gingivitis, and may be recognized by the presence of a red line at the edge of the gum, with swelling of the portions of gum tissue intervening between the teeth, and in later stages by the exudation of pus from the margin of the gums. As the inflammatory process advances, the microbial action extends deeper in the periodontal membrane, forming pockets surrounding the affected teeth, from which pus may easily be squeezed, and the walls of which are practically ulcerated surfaces. This is the condition now generally known as pyorrhoea alveolaris. These ulcers readily admit bacteria and their toxins into the adjoining tissues. It is surprising what a large extent of ulcerated surface may be furnished by pyorrhoea. A simple arithmetical calculation will show that an area of two to five square inches of ulcers may be present in a mouth which is seriously diseased in this manner. The inflammation may extend more deeply, an alveolar abscess being formed, and often involves the bone, causing enlargement of the alveolus, and eventual destruction of the dental process or projecting bony ridge which forms the walls of the alveoli and intervening bony septa.

The teeth themselves, when caries has opened a pathway through the hard enamel and dentine, become a channel for the conveyance of sepsis to the tissues. In the dead pulp of a tooth many varieties of bacteria have been found. These and their toxic products easily gain admission to the body by the lymphatics and blood vessels which pass through the aperture at the apex of a root.

There is only one other class of damage to the mouth to which I have to refer, and it is also associated with dental defects—namely, the injurious effects of reparative dentistry, such as plates, bridges, crowns, and imperfect stoppings. In most cases the objectionable results presented by artificial dentures are due to neglect or ignorance on the part of the patient, who omits the very necessary attention to the mouth which alone can prevent injury being sustained from the presence of septic foreign bodies. In some cases, however, the dentist is at fault, not so much, perhaps, in his workmanship, which must often excite our admiration, as in the principles which guide him. An extraordinary high degree of manipulative skill is required to produce unobjectionable crowns and bridge work. The mere retention in the mouth of a pulpless tooth or root, which forms the foundation on which an admirable superstructure may be built, is unscientific, and often causes serious septic trouble.

One of the most obvious results of pyorrhoea is the passage of bacteria and toxins directly into the stomach. This is by some observers considered the chief direction in which the evil influence of pyorrhoea is exerted. The reduction of acidity of the stomach contents during the periods of inaction of digestion gives an opportunity to the bacteria to exercise their function with impunity in the stomach and bowels. This in most cases does not

amount to much in the way of damage, but under certain conditions may have serious consequences. It is desirable, therefore, to pay special attention to the state of the mouth at bedtime. Absorption of toxins from diseased gums directly into the surrounding tissues is the more obvious route, the ulcerated surfaces forming an ever-open door, which during the whole twenty-four hours of the day freely admits the enemy.

While the advocates of oral sepsis as the main factor in disease have no hesitation in attributing all sorts of remote disorders to a septic state of the mouth, they have not, so far, made a very convincing case, in my opinion, for the more extreme views. The chief points relied upon are, first, the beneficial results which in some cases ensue upon the surgical cleansing of the mouth; and, secondly, the extreme prevalence of septic mouths. It must, however, be observed that a diagnosis based on the results of treatment contains fallacies. There are so many factors involved in the treatment of all diseased conditions that one is entitled to demand very clear and indisputable evidence before accepting the result of a certain treatment as proof of the nature of the disease. As regards the widespread existence of the condition, it is to be expected that the individual may have acquired a sufficient degree of resisting power or immunity to the action of the disease germs, and, in spite of their presence in great abundance, he may lead a fairly healthy life. We all know how very prevalent a foul condition of the mouth is among all classes of the community, and particularly among the working classes. In this connexion I would like to draw your attention to the results of a careful examination of the mouths of the patients in the medical wards of the Royal Victoria Hospital for a short period. This has been done for me in a most thorough and complete manner by my house-physician, Dr. Hall. Though the number of cases is small and insufficient to enable one to form a very definite opinion on the question of oral sepsis, there is, I think, some light to be obtained by a short examination of the results of this investigation.

Condition of the Mouth in 155 Cases in the Medical Wards of the Royal Victoria Hospital, Belfast.

Disease.	Number of Cases.	Age.			Sex.		Condition of Mouth.				Total Number of Teeth present.	Percentage of Carious Teeth.
		20 and under.	21 to 35.	Over 35.	Males.	Females.	Clean.	Fair.	Bad.	Very Bad.		
Chronic gastritis...	19	—	6	13	5	14	—	2	7	10	247	48
Gastric and duodenal ulcer	10	3	6	1	—	10	1	6	3	—	191	21
Acute tonsillitis ...	3	1	1	1	1	2	—	1	—	2	52	36
Rheumatoid arthritis and chronic rheumatism	7	—	2	5	4	3	—	2	1	4	105	78
Acute rheumatism ...	16	8	5	3	3	13	3	3	6	4	341	23
Heart disease ...	25	11	8	6	12	13	2	6	12	5	509	28
Arterio-sclerosis ...	3	—	—	3	2	1	—	—	2	1	40	37
Chlorosis and secondary anaemia	8	2	5	1	2	6	—	—	5	3	130	42
Pernicious anaemia ...	4	—	—	4	1	3	—	—	3	1	32	39
Exophthalmic goitre ...	3	—	1	2	—	3	—	—	2	1	20	80
Tuberculosis of lung and pleura	6	1	1	4	1	5	—	2	1	3	94	36
Chronic bronchitis ...	4	—	2	2	2	2	—	—	3	1	52	25
Asthma ...	3	—	—	3	3	—	—	1	2	—	40	25
Sundry cases ...	44	9	17	18	26	18	3	13	14	14	801	26

In the first place, we find, in 155 medical cases taken without selection, that there are only 9 in which the condition of the mouth can be looked on as normal. I do not, of course, mean that these nine mouths were aseptic, but there was no obvious injury to the lining of the mouth or to the teeth. This is probably a fairly liberal estimate of the proportion of healthy mouths in the adult hospital cases in industrial communities, and it amounts to almost 6 per cent. of the cases examined. If this can be accepted as anything like the average condition, we have to

recognize the existence of over 90 per cent. of unhealthy mouths in the community. The almost universal occurrence of the condition is relied on, as I have just said, as an argument in favour of the activity of mouth sepsis as a cause of general disease. It can, however, be argued on the other side that the frequency of its occurrence makes it hopeless to estimate its influence in such a variety of diseases as are often attributed to it. That it had an influence there can be no doubt, but when one examines the claims of some of the more extreme champions of oral sepsis one is left unconvinced. For example, it is not only maintained by some observers that rheumatoid arthritis is caused by poisoning from the mouth, but it has been recently stated¹ that 70 per cent. of the cases of rheumatoid arthritis are due to pyorrhoea alveolaris. We all know that sepsis is an important factor in various forms of arthritis, but I do not think we have sufficient grounds for believing that so large a proportion is due to this particular mode of infection. There are only 7 cases of this description in the table which you have before you, and though the number is too small to bear much weight, they corroborate the connexion between mouth sepsis and the chronic arthritic conditions. The condition of the teeth in these 7 cases was very unsatisfactory, there being 78 per cent. of them carious. The proportion of carious teeth is not a very reliable guide as to the degree of oral sepsis, but at least it indicates in this group an extensive lesion. No doubt there are many cases recorded in which improvement and even cure of rheumatoid arthritis has followed the cure of oral sepsis, but in my experience the removal of carious teeth, and the cure of pyorrhoea has not been followed by any material benefit in cases of chronic rheumatoid arthritis. This, of course, may be explained by the fact that the poisoning has been going on in most cases for many years, and that the structural damage to the joints has proceeded so far that the removal of the chief focus of infection cannot be expected to relieve the established arthritis. When we examine the diseases of the blood, we are, I think, equally unable to agree with the view that oral sepsis is the chief cause of serious forms of anaemia. In the twelve cases of anaemia in this table, the condition of the mouth is undoubtedly bad in every instance. Here, again, I think the results of treatment of the mouth have rarely been sufficiently brilliant to justify one in accepting the oral sepsis etiology. It is, perhaps, in the cases of chronic gastritis and general debility, associated with oral sepsis, that thorough treatment of the mouth produces the best effects. I suppose every one present has been struck with the prevalence of septic mouths in cases of this description. Of the nineteen cases of chronic gastritis in this list there were seventeen with a very bad condition of the mouth, and the percentage of carious teeth was very high. This is in marked contrast to the ulcers of the stomach and duodenum; the majority of patients in this group had mouths to which but little exception could be taken. This may, no doubt, be partly due to the fact that the disease was often in younger persons, who have usually less septic mouths than their elders, but still it does not bear out the view expressed by many, that gastric ulcer is commonly the result of oral sepsis.

Another condition to which attention has been drawn of recent years as commonly resulting from alimentary toxæmia is exophthalmic goitre. The mouth may doubtless be a source of infection in this condition and in the few cases recorded in this list it very distinctly appears to be so. The work of Major McCarrison in this region has proved that septic absorption from the bowel has a profound influence upon the thyroid gland. It is probable that this organ, like the liver, is largely occupied in neutralizing the effect of absorbed toxins, and as a result of prolonged excessive work of this description it may become hypertrophied and over-active, or, on the other hand, cystic and degenerated. The influence of chronic poisoning upon the arteries has been well established; among the poisons which produce hardening and degeneration of the arterial coats, those derived from the mouth may very well play an important part. The few cases of arterio-sclerosis mentioned in this list were examples of severe oral sepsis. The connexion between tuberculosis and mouth sepsis is not very obvious. No doubt tubercle bacilli have been frequently found in carious teeth, and in the pockets of pyorrhoea. In this position they would

naturally be a source of danger, and, together with the numerous other organisms present, might be expected to produce their usual results. It is, perhaps, in the influence which a septic mouth exercises on the organs of digestion that the ill effects of oral sepsis in cases of tuberculosis is manifest. The cases recorded by Dr. Wingfield² are interesting, and confirm this view of the question. In all of the 41 cases of phthisis which he tabulates there was pyorrhoea, which he treated in every case by wholesale extraction of the teeth. His results were satisfactory enough, but not brilliant. He is, I think, more to be congratulated on his success in radical dentistry than on any exceptionally favourable effects on the diseased lungs.

There were 16 cases of acute rheumatism, and of these 10 had a bad condition of the mouth. This is contrary to what one would expect in a series of young adults, and it is possible that the septic state of the mouth may in some of the cases have been a factor in the production of the disease. The 25 heart cases may be considered in conjunction with acute rheumatism. As the majority were young adults, the proportion of serious oral sepsis (17 out of 25) is a rather high one. Here again one cannot ignore a possible causal relationship.

Of chronic bronchitis and asthma there is nothing to say; the cases were too few, and did not lend any strong support to the oral sepsis theory of the cause of these diseases.

In this list there is only one case of cancer; it is among the 44 sundry cases; it was carcinoma of the oesophagus, and the mouth was in a very septic state. The relation of cancer to oral sepsis is not well established, but the subject is ably discussed by Mr. Steadman in a paper read before the Royal Society of Medicine.³ The figures he adduces in support of his opinion that oral sepsis is a very common cause of cancer are certainly suggestive, though by no means convincing. He examined the mouths of 192 persons suffering from cancer, and he found that the proportion of highly septic mouths was very much greater in these cancerous cases than in a large number of non-cancerous individuals whom he examined as a control. An objection may be adduced in the fact that the age in cancerous subjects is somewhat advanced, and it is, of course, in elderly people that dental caries, tartar, and pyorrhoea are most frequently found.

Among the 14 sundry cases were examples of organic disease of the central nervous system, of neuritis, of muscular rheumatism, and of functional nervous diseases. These do not call for special comment, as the degree of oral sepsis did not depart materially from the general run of cases, with the exception of the neurasthenics, of whom there were 3, whose mouths were exceptionally clean.

There was one case of mercurial stomatitis whose teeth were much decayed. He had sixteen sound teeth and seven carious; there was severe pyorrhoea, and much general inflammation of the gums. This is in accordance with the usual experience that persons with unhealthy mouths are more liable to become salivated by mercury than those whose mouths are in good condition.

The remaining cases included Addison's disease, chronic Bright's disease, syphilis and gonorrhoeal arthritis, but there is nothing in their condition worth referring to.

I have not attempted to deal with the relationship of oral sepsis to any disease outside those strictly within the purview of the physician. It is well known that in ophthalmic practice many eye affections are attributed to sepsis of the mouth. Mr. W. Lang states that of 215 cases of inflammation of the eyeball 139 were due to oral sepsis. Dermatologists, urologists, rhinologists, gynaecologists, and general surgeons have in many instances been known to assign the causation of diseases in their respective departments to poisoning from the mouth.

To make even a cursory review of the voluminous literature which has grown up around this subject during the past few years would occupy more time than I am justified in claiming from you to-day. I may, however, direct your attention to an article by Mr. J. G. Turner,⁴ which presents a very complete and admirable review of oral sepsis, considered from the standpoint of the dental surgeon. As examples of the sharp differences of opinion, one may point to the recent animated correspondence in the *Lancet*. The ball was set rolling by Sir James Goodhart, who threw down his glove to the oral sepsists in a vigorous letter to that journal on

July 25th, calling forth a display of divergent opinions. There have been many interesting articles in medical publications on the subject; dentists, physicians, and bacteriologists have all taken a share. Among the more interesting were a paper read by Dr. Horder at the Odontological Section of the Royal Society of Medicine last spring, and a prolonged debate in the same society a year previously, in which a numerous company of practitioners of every conceivable speciality took part. The subject of this debate was the wide one of alimentary toxæmia, but oral sepsis received ample attention. Every medical journal in this country and abroad has been occasionally occupied with the subject, and no small number of books dealing with mouth sepsis have been published within recent years. After consulting a number of these writings, the impression left on my mind is that a gentle spirit of moderation is becoming evident. There are still the stalwarts of blood and iron, who hale their victims straightway to the tormentor, being convinced that oral sepsis is the source of most human disorders, and that a clearance, root and crown, is the only remedy. This is a most attractive theory. It would be a great satisfaction to all concerned if we had the cause of so many of our ills under our very noses, in a most accessible position where it could be attacked with every hope of complete victory. Unfortunately there is not, to my mind, enough evidence to convict the mouth of being the *causa causans* of so many diseases. In the phraseology of the Scottish law courts, the guilt of the accused is "not proven," but he remains under grave suspicion.

In conclusion, I will only say a few words as to the treatment we should advise. Caries of the teeth must not be allowed to remain unrepaired. In the earlier stages of gingival inflammation careful attention to the state of the gums and the application of suitable antiseptics works wonders. Later, when deeper pockets have formed, thorough drainage of the little abscesses and ulcers and frequent cleansing of the septic surfaces may result in a cure. This is denied by some, who state that when once a definite pocket has formed there is nothing for it but to remove the tooth. So long as there is a source of poisoning, they say, which is difficult to remove by mild measures, and which in the meantime is producing arthritis and other maladies, we must have no mercy on the tooth. This is not a sound practice. Before resorting to the sacrifice of a tooth one must make a persevering attempt by local treatment, vaccines, change of air, tonics, etc., to effect a cure.

In the advanced stages of pyorrhoea alveolaris, where there is not merely destruction of the dental periosteum, but where the bone is seriously diseased, there is no hope of any treatment which does not include extraction of the teeth which are involved. Scrupulous care should be given to the thorough cleansing of all artificial teeth and other fittings and foreign bodies in the mouth.

Prevention is, of course, what we should attend to. If one desired to epitomize the prophylaxis, it might be put in four words—active mastication, efficient cleansing. Finally, to summarize in some measure the subjects we have been discussing, I shall submit for your consideration the following conclusions:

Oral Sepsis

1. Is sometimes tolerated by the patient for many years with little apparent injury.
2. Is always a possible source of danger.
3. May give rise to (a) disease in the vicinity of the mouth; (b) disease in situations which come directly in contact with the unhealthy secretions of the mouth, such as the stomach and the intestines; (c) disease in distant parts of the body not in direct communication with the morbid secretion; (d) a state of ill health and lowered vitality without obvious involvement of any organ. It may thus be said to aid and abet disease arising from some other source.
4. Is commonly the result of imperfectly cleansed teeth.
5. Does not necessarily involve the extraction of teeth.

REFERENCES.

- ¹ Dr. D. D. BROWN, BRITISH MEDICAL JOURNAL, October 17th, 1914. ² *Lancet*, July 18th, 1914. ³ *Proceedings of the Royal Society of Medicine*, March, 1914. ⁴ J. G. TURNER, BRITISH MEDICAL JOURNAL, 1914, vol. i, pp. 1244 and 1301.

ON THE TREATMENT OF DIABETES MELLITUS WITH CASEIN AND CREAM.

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RECENTLY I have employed the following method of dietetic treatment in certain cases of diabetes mellitus with more prompt and satisfactory results than I have obtained by any other treatment. The method is worth trying in most cases of diabetes if ordinary diabetic diet does not check the glycosuria. But in some of the most severe forms with marked acidosis, as will be mentioned later, I should not advise it.

In this treatment casein and cream are given in small quantities every two hours. The patient is kept at rest in bed, or on the sofa, and every two hours, from 8 a.m. to 10 p.m., receives a glass of artificial milk prepared from casein, cream, and water. One tablespoonful of casein is well mixed in a tumbler with one tablespoonful of cream until a paste is formed; then hot water (or cold if preferred) is added gradually until the tumbler is full, the mixture being well stirred with a teaspoon whilst the water is being added. A white fluid is thus prepared which has the appearance of milk. It contains milk albumin and fat, but only a very small percentage of milk sugar derived from the cream. The fluid may be sweetened with saccharine or saxon if desired, or a pinch of salt may be added, or it may be flavoured with nutmeg, according to the patient's taste. Most patients prefer the fluid warm. Usually the patient takes this artificial milk quite well, and likes the taste; some take it well, but do not find the taste quite satisfactory; but a few patients complain that it causes nausea, and in such cases it should be at once discontinued. The fluid may be taken well when it is hot, but may cause nausea when lukewarm or cold. When it produces nausea, or is distasteful even when the fluid is warm, another preparation of casein should be tried; or, in place of casein, biogene should be employed, but double quantity of the latter should be used—that is, two tablespoonfuls of biogene with two of cream to the tumblerful of water. I have employed usually a cheap casein preparation, sold at 1s. a pound, but a more expensive casein, dietetic casein (A), is more palatable to some patients. Recently I have chiefly employed biogene (which is a casein preparation) though it is more expensive (3s. a pound). It may be obtained from Mr. Bonthron, 50, Glasshouse Street, London, W. Most patients like the taste of biogene much better than casein.

The diet of casein and cream, as just described, is sufficient to satisfy some patients at least for several days; but many, of course, feel very hungry, and in a few cases the casein treatment causes the patient to feel very exhausted.

When the patient feels very weak or exhausted on the casein treatment alone, he may be allowed, in addition to the casein and cream, a cup of tea and beef-tea twice a day; if he still feels very weak on this diet, two eggs (buttered) may be allowed daily, and after a few days one casein pudding may be added. The casein pudding is prepared as follows:

- One tablespoonful of casein.
- One egg well beaten up.
- A small pinch of salt.
- One teaspoonful of baking powder.

Mix well together, adding the baking powder just at the last. Then bake in the oven like a custard for thirty minutes. The addition of a little water may be necessary if the egg is a small one. This forms a cheap and palatable pudding.

Usually the treatment with the casein and cream causes a little loss of weight; but for a week or two if the patient rests in bed or on the sofa all day, the loss is only a few pounds, and it is desirable to keep the diet down to the minimum amount; but it is important not to allow the patient to become exhausted by the treatment.

In milder cases of diabetes and in many cases of medium severity the urine becomes quite free from sugar in two or three days or in a few days, even when an ordinary very rigid diabetic diet has failed to check the glycosuria. In many cases the casein treatment can be continued for two or three weeks, or a little longer, without much loss of