

of arriving at a definite conclusion as to the nature of an obscure glandular swelling is certainly entitled to the most careful consideration.

In the severer forms of the disease the possibilities of a serum diagnosis are much greater. It has already been shown that during the early stages of the illness the agglutinative properties of the blood are but freely developed and that unless a careful technique be adopted for its demonstration the reaction is liable to be missed altogether. After the second week of illness, however, and particularly in those cases where the bubo undergoes resolution, the chances of obtaining the bacillus by puncture of the gland diminish rapidly during convalescence. This fact is well illustrated by the last three cases in Table IV., in which attempts to cultivate the organism by this method at the end of the first, second, and third weeks of illness respectively completely failed, though numerous degenerated bacillary forms were seen in smear preparations. Indeed, in the case of Mrs. M. (Table III.) culture tubes inoculated on the eighth day of illness with fluid obtained from puncture of the bubo proved sterile, though two days previously an actively growing pure culture had been obtained. On the other hand, the agglutinative power of the serum, insignificant at the commencement of the illness, progressively increases up to the sixth or seventh week of the disease, by which time a comparatively high degree of potency has been attained, especially in the severer forms of the disease which recover. Thereafter it begins to decline, but, as already shown, may be present in well-marked cases four or five months after the primary illness. It is therefore during and subsequently to the stage of convalescence, when the possibility of a bacteriological diagnosis is more or less remote, that the diagnostic value of the reaction becomes most apparent. In all cases, moreover, associated with the presence of glandular enlargements of dubious nature, the occurrence of which from time to time during the progress of an epidemic of plague may present a diagnostic problem of perplexing character, the application of this reaction cannot fail to prove of signal service.

Glasgow.

## SUGAR-FREE MILK AS A FOOD FOR DIABETICS.

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THE difficulty often presents itself in practice of providing a patient suffering from diabetes with a diet which, while wholly free from carbohydrate, can yet be taken without repugnance for a prolonged period of time. The essential point of such a diet is that its nutritive constituents must consist only of proteid and fat. As far as possible most of the energy which it yields must be derived from fat, for there are certain risks and disadvantages incidental to an excessive consumption of proteid. But, unfortunately, it is often difficult to persuade a diabetic to eat enough fat. Bacon he can usually manage and a certain amount of fat meat and fish, and perhaps even some salad oil, but the necessary exclusion from the diet of bread and potatoes renders it difficult to administer even moderately large quantities of that most easily digested of fats—butter. A little can be got down on some variety of starchless bread or in the form of sauce with fish or mixed with green vegetables, but in many cases the most that can be managed in these ways does not exceed three or four ounces daily.

Now, in milk we have fat and proteid in a form in which they may be easily taken and are readily digested, while the special form of proteid present in milk (casein) has the additional advantage that it is not capable, as most proteids are, of yielding sugar in the body. Unfortunately, however, milk itself contains a carbohydrate in considerable amount (4 per cent.), and though it may be true that in some cases milk-sugar is better borne than most other forms of carbohydrate, yet it must be remembered that, as experiment has shown, lactose is not directly assimilated in diabetes. Experience shows, too, I think, that in the majority of such patients the addition of milk to an otherwise strict diet increases the amount of sugar in the urine and coincidentally with that aggravates the thirst and the other symptoms which are due to the presence of an excess of

sugar in the blood. It is not surprising, therefore, that attempts have from time to time been made to get rid of the sugar in milk whilst retaining its other ingredients. In standard works on diabetes a description of several such sugar-free milks will be found, but hitherto they have not found very general acceptance, partly, perhaps, because they are troublesome to make at home and it has not as yet been possible to buy them ready-made. I have described elsewhere<sup>1</sup> a sugar-free milk prepared for me by Mr. Morris, chief dispenser to the London Hospital, which has now been brought to a very high degree of perfection and which can be obtained for use at home in a sterilised form.<sup>2</sup> This milk contains all the original casein and salts along with a certain additional proportion of fat. It is practically sugar-free and can hardly be distinguished from a rather rich specimen of ordinary milk. It can be readily administered either plain or with some effervescing water or it can be added to tea, coffee, or cocoa. It has also the advantage that it can be made into boiled or even baked custards with eggs, thus rendering it possible to add a nourishing and harmless "sweet" course to the diabetic patient's dinner. Assuming that it contains about 3 per cent. of proteid and 5 per cent. of fat and that three pints are taken in one form or another in the course of a day, the total energy yielded will be about 990 calories or almost one-third of the total amount required, while the amount of fat which the patient gets is equivalent to fully three ounces of butter. I have had this form of milk in constant use in hospital practice for more than a year and have found it of the greatest service. It is specially useful in those cases in which it is desirable to observe as strict a diet as possible, but even in those instances in which it is decided that a limited amount of carbohydrate can be taken with advantage it will be found best to substitute sugar-free milk for ordinary milk and to give the allowable quantity of carbohydrate in the form of potatoes and bread. This plan is not only more satisfactory to the patient, but it has also the advantage of enabling one to administer larger quantities of butter. The scheme of a strict diet which includes the use of this milk would be something as follows:—

*Breakfast.*—Bacon; eggs scrambled with butter; fish and butter sauce or some form of cold meat; toasted protene bread with plenty of butter; and café-au-lait made with sugar-free milk and sweetened with saccharin if desired.

*Dinner.*—Soup (without vegetables or other carbohydrate containing matter); fish (preferably one of the fatter sorts); meat with green vegetables and melted butter; custard of eggs and sugar-free milk; and cheese with protene bread and watercress. Beverage: whisky-and-water or any dry natural wine.

*Supper.*—A cup of well-made beef-tea; eggs in some form—e.g., as an omelette with as much butter as possible; fish or cold meat; and cheese with protene bread-and-butter and a salad with plenty of salad oil. Beverage: a glass of sugar-free milk.

The rest of the milk, sufficient to make the total daily allowance up to three pints, should be taken as a beverage between the chief meals.

The above diet is, of course, merely an outline which can be modified to suit the taste of individual patients, but it will be found to answer very well in practice and is practically free from carbohydrates. I have recently had a patient on it who was passing on an ordinary diet more than 300 grammes of sugar per day and who on the above diet had an excretion of only about 25 grammes and gained weight rapidly. The attainment of this result was greatly facilitated by the use of sugar-free milk, and my object in writing this short article is to try to make the merits of the latter more widely known among the profession.

London Hospital.

## THE VALUE OF ANTITOXIN IN THE PREVENTION OF DIPHTHERIA.

By A. E. PORTER, M.D., D.P.H. CANTAB.

IN the belief that the prophylactic administration of anti-toxin is not so largely used in this country to prevent the extension of diphtheria among inmates of infected houses and institutions as its success seems to warrant, I hope that the following account of cases in which it has been employed and which have come under my notice as assistant to the medical officer of health of the County of Essex and of the

<sup>1</sup> Food and the Principles of Dietetics. London: Edward Arnold. Second edition, 1901, p. 474.

<sup>2</sup> Prepared by Messrs. Clay, Paget, and Co., 23, Ebury-street, S.W.

combined rural districts of Chelmsford and Maldon may be of interest not only to medical officers of health, but also to those members of the profession who are engaged in general practice.

During the past 12 months diphtheria of a virulent type has been extremely prevalent throughout the greater part of Essex, and the Chelmsford and Maldon rural districts have suffered severely in this respect. With a view of attempting to check the epidemic the councils of the two districts have lately agreed to pay to medical practitioners a small sum for each prophylactic injection of antitoxin given with the sanction of the medical officer of health on the occurrence of a case of diphtheria in a household. Up to the present this practice has been adopted in 24 families, with the gratifying result that, with one possible exception, not a single person so injected has subsequently developed diphtheria, notwithstanding the fact that two-thirds of the cases were treated at home. In eight instances the injection was refused, and amongst these there were three subsequent cases of diphtheria. One of the houses (No 3) was a home for orphan children; all the remainder, with two exceptions, belonged to members of the labouring classes; many of them contained but two sleeping-rooms, and these frequently communicated with one another. Wherever there was any doubt as to the nature of the case a bacteriological examination was made to confirm the diagnosis. Of the 136 persons thus protected 60 were adults of 20 years of age and upwards. The remainder were children chiefly at about the school age, and swabs from the throats of many gave almost pure cultures of the diphtheria bacillus on blood serum.

The following is a tabular list of the families to whom prophylactic injections were administered :—

TABLE I.

Family.	Number of cases notified before injection was given.	Number of members in family to whom prophylactic injections were given.	Number of persons thus injected who subsequently developed diphtheria.	Number of persons to whom no injection was given.	Persons not injected who subsequently developed diphtheria.	Remarks.
No. 1 ...	1	4	0	2	2	Not removed to hospital.
" 2 ...	1	6	0	2	1	" "
" 3 ...	2	17	0	2	0	" "
" 4 ...	1	2	0	1	0	" "
" 5 ...	4	1	0	—	—	" "
" 6 ...	2	8	0	—	—	" "
" 7 ...	1	7	0	—	—	Removed to hospital.
" 8 ...	1	7	0	—	—	" "
" 9 ...	1	8	0	—	—	" "
" 10 ...	2	6	0	—	—	One case (only) removed to hospital.
" 11 ...	3	6	0	—	—	Removed to hospital.
" 12 ...	1	9	0	—	—	Not removed to hospital.
" 13 ...	1	4	0	—	—	" "
" 14 ...	1	5	0	—	—	Removed to hospital.
" 15 ...	1	2	0	—	—	" "
" 16 ...	1	6	0	—	—	Not removed to hospital.
" 17 ...	1	8	0	1	0	Removed to hospital.
" 18 ...	1	7	0	—	—	Not removed to hospital.
" 19 ...	1	3	1 (?)	—	—	" "
" 20 ...	1	3	0	—	—	" "
" 21 ...	1	3	0	—	—	" "
" 22 ...	1	4	0	—	—	" "
" 23 ...	1	5	0	—	—	" "
" 24 ...	1	5	0	—	—	" "
Total	—	136	1 (?)	8	3	—

In No. 19 the mother of a child suffering from diphtheria received a prophylactic injection and in a few days suffered from sore-throat. As she was nursing the case, which was a severe one and terminated fatally in a few days, it is

probable that she too caught the infection. The attack was, however, so mild that she was scarcely prevented from attending to her household duties, and she escaped notification. There was, therefore, only one failure, and that a doubtful one, out of 136 cases in which prophylactic injections were given.

For purposes of comparison I have drawn up a second table showing the number of secondary cases occurring in another series of 24 families, taken consecutively from our notification records before the prophylactic injections came into force. The number of individuals in the families is approximately the same, as is also the proportion of adults, of whom there were 53. It will be seen that in one-third of the houses secondary cases occurred and that one-sixth of the inmates contracted the infection in the absence of the prophylactic injections, in spite of the fact that a larger number of the primary cases were promptly removed to the hospital. This series of families has in no way been specially selected, and the proportion of houses in which secondary cases have occurred has practically obtained throughout the present epidemic.

TABLE II.

Family.	Number of primary cases.	Number of persons in family excluding primary cases.	Number of secondary cases.	Remarks.
No. 1 ...	1	2	0	Not removed to hospital.
" 2 ...	1	6	0	" "
" 3 ...	1	2	0	Removed to hospital.
" 4 ...	1	4	3	" "
" 5 ...	1	7	0	Not removed to hospital.
" 6 ...	1	6	3	" "
" 7 ...	1	5	0	Removed to hospital.
" 8 ...	1	3	0	" "
" 9 ...	2	8	2	" "
" 10 ...	1	3	0	" "
" 11 ...	1	8	4	Not removed to hospital.
" 12 ...	1	3	0	" "
" 13 ...	1	6	0	" "
" 14 ...	1	7	0	" "
" 15 ...	1	4	0	" "
" 16 ...	1	5	1	Removed to hospital.
" 17 ...	1	5	1	Not removed to hospital.
" 18 ...	1	7	1	Removed to hospital.
" 19 ...	1	5	0	Not removed to hospital.
" 20 ...	1	4	0	Removed to hospital.
" 21 ...	1	4	0	" "
" 22 ...	1	9	6	" "
" 23 ...	1	7	0	Not removed to hospital.
" 24 ...	1	5	0	" "
Totals...	—	125	21	—

No doubt similar instances of the efficacy of this mode of prevention could be indefinitely multiplied. A striking example is mentioned by Mr. J. Damer Priest, medical officer of health of the Waltham Holy Cross Urban District Council, in his annual report for 1900. Three cases of diphtheria occurred at short intervals in a convalescent home for children situated in his district. The remaining 35 children were injected and there were no further cases.

In America this method of treatment is adopted on a large scale. In the city of New York, between Jan. 1st, 1895, and Jan. 1st, 1900, no less than 6806 persons who had been exposed to infection were given prophylactic doses by the officers of the Board of Health; of these 19, or less than 0.3 per cent., afterwards contracted diphtheria, and only one of them, who was suffering from a simultaneous attack of scarlet fever, died.

The success which attended the methods adopted in arresting the recent outbreak of diphtheria in the borough of Cambridge is still fresh in our memory, and the report by the medical officer of health (Dr. Bushell Anningson) is well worthy of study by all those who are interested in preventive medicine. Unfortunately, it cannot be claimed

that an injection of antitoxin will prevent an attack of diphtheria with absolute certainty, but it will undoubtedly do so in a large proportion of instances, and, if diphtheria should occur, the attack will in all probability be a mild one. As to what constitutes an efficient dose authorities differ. By some 300 units are considered sufficient, whilst others inject 800 to 1000 units. Our practice in the Ohelmsford and Maldon rural districts has been to give 500 units, and so far with satisfactory results. Such a dose can usually be obtained in a bulk of about 20 minims and a hypodermic syringe may therefore be used for the purpose. With 500 units it is rare to experience any serious after-effects if the injection be made in the loin or between the scapulæ. With larger doses the rash and the joint pains occasionally associated with the use of antitoxin are sometimes met with, their occurrence being due to the particular batch of serum used and possibly to individual idiosyncrasy. As a rule there is a slight rise of temperature and occasionally a feeling of malaise and nausea within 24 hours of the operation, often followed by some irritation round the seat of injection. The first three symptoms quickly pass off, the last may persist for a few days. If, however, the serum be injected into the arm sequelæ are frequent and consist chiefly of inflammation and œdema, together with stiffness of the joints and intense irritation.

It is important to bear in mind that where antitoxin is used as a prophylactic in persons who are actually harbouring the diphtheria bacillus, although the clinical symptoms may be averted, the throats are none the less infective—at all events the bacilli may, in my experience, remain for weeks. Hence such persons are still liable to become foci of infection and should be prevented from spreading the disease until sufficient time has elapsed to eliminate the danger or until they are shown by bacteriological methods to be free from infection.

As a result of my experience detailed above I believe that we possess in antitoxin a valuable means of preventing the onset of diphtheria in persons who have been exposed to infection, and that it is of especial benefit where it is impossible properly to isolate a primary case, or when the infection is introduced into an institution in which a number of susceptible individuals are congregated.

Chelmsford.

## THE ROENTGEN RAYS IN SOUTH AFRICA.

By J. HALL-EDWARDS, L.R.C.P. EDIN.,

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AN experience of 14 months as x-ray expert to the Imperial Yeomanry Hospitals at Deelfontein and Pretoria has amply proved the immense usefulness of Roentgen's discovery as applied to military surgery. On starting from England I had already formed some idea as to the extent to which my speciality might be of service, but my wildest anticipations were exceeded and my preconceived notions born of ignorance, and backed up by the officials at the War Office, have proved to be incorrect and absolutely unsatisfactory. On information received from certain pseudo-reliable sources I was convinced that so few bullets found their billets in the tissues of the wounded that an x-ray outfit would prove an incumbrance instead of a help, and although I had some hopes that my ideas might prove incorrect I entered upon my task with fear and trembling. These fears were magnified when on reaching Cape Town we were informed that Cronje had been captured and Ladysmith relieved and that the war could not last more than a few weeks. This last statement, like those received at home, was far from true, and whilst it was given in good faith, it was the child of ignorance, born in the cradle manufactured by our Intelligence Department.

I well remember remarking to an officer (on the Government landing-stage at Cape Town), who had been my companion since leaving England and who was wishing me adieu and success, "that if I could take back with me five negatives showing the presence of bullets, I should consider my visit to South Africa more than justified." It would be exceedingly difficult even to guess the percentage of retained bullets in all gunshot wounds, but there can be no

doubt that it is far higher than is generally imagined, although taking into consideration the number of wounds received it must be very small. My own figures cannot, of course, be taken as any guide, inasmuch as I only radiographed cases specially sent to me for the purpose, a large majority of the cases admitted to the hospital not being of sufficient interest to warrant the taking of a radiograph. In several of these bullets which could be localised by palpation were removed without the aid of the x rays and they therefore take no part in my calculations. In all, 193 cases of gunshot or shell wounds were submitted to me and in 65 of these there were found and localised, either a whole bullet, portions of a bullet, or fragments of shell. This is, of course, an exceptionally large percentage which can only be accounted for by the assumption that many cases in which the presence of a bullet was suspected were sent to us for the purpose of having them localised. It is absolutely impossible to form any idea of the percentage of retained bullets in wounds received; neither can I satisfy myself as to the range at which most bullets are retained. Bullets which are nearly spent have, of course, the greatest chance of remaining in the tissues, but the ranges given in my notes are so various that many other circumstances must combine to diminish the penetrative power, even at distances where under ordinary conditions they would pass through the body. In previous articles on this subject I have pointed to some of these and a careful perusal of the accompanying table may suggest others.

*List of Cases of Injury, with Bullets, Portions of Bullets, and Fragments of Shell, Radiographed at the Imperial Yeomanry Hospitals at Deelfontein and Pretoria, between March 19th, 1900, and March 31st, 1901.*

Parts injured.	Number of cases radiographed.	Number of cases in which foreign bodies were localised.	Parts injured.	Number of cases radiographed.	Number of cases in which foreign bodies were localised.
Eye... ..	3	1	Spine ... ..	1	1
Head ... ..	11	1	Back ... ..	5	3
Neck ... ..	2	1	Pelvis ... ..	6	4
Chest ... ..	18	7	Thigh and } hip ... .. }	30	18
Shoulder ...	10	1	Knee ... ..	8	3
Arm ... ..	13	4	Leg ... ..	16	8
Elbow ... ..	14	2	Ankle ... ..		0
Forearm ...	10	1	Foot ... ..	18	2
Wrist ... ..	3	0			
Hand ... ..	19	8			
Abdomen ...	2	0	Total... ..	193	65

The list here given is not a long one, but is must be remembered that in most of these cases the presence of a foreign body was suspected. Many other cases were examined in order to ascertain the amount of injury sustained by bone during the passage of bullets through it, and in addition to several medical cases over 50 accidental fractures were radiographed. Again, during the greater part of our stay in the Karroo we were to all intents and purposes a base hospital, and all the cases had filtered through other hospitals before coming to us. It was only during the last two months that we received any wounded straight from the field, and curiously enough none of these came into my hands.

The list is exceedingly interesting in showing that by far the larger majority of bullets retained in the tissues are found between the ankle and abdomen, whilst the upper extremities are comparatively free, with the exception of the hand. Here only in one instance was a whole bullet retained, the remainder being in the main splinters from bullets which had struck stones in front of the fighting line, and as in most cases the men were lying down the hands and heads were chiefly exposed. Where the head was struck the result was in a very large majority of instances fatal, although a good number of these escaped, as is shown by my figures. In nearly every instance where a bullet was retained in the hip or thigh the whole of the missile was found. In more than three-fourths of the cases in which foreign bodies were localised they were removed by the operating surgeons and in no single instance was the