The anaemia was severe, as shown by the extreme pallor of all the organs and by the blood counts. Haemoglobinuria was common. The most striking post-mortem feature, apart from the general bloodlessness, was the fatty, mottled liver. This organ appeared to be enlarged; but when its weight was charted against body weight it was found that the organs obtained both from intact and from splenectomized rats fell within normal limits. In cases exhibiting haemoglobinuria the bladder was distended with dark-coloured urine and the kidneys were large and very dark. The bone marrow showed no macroscopic change.

The blood showed the typical picture of a macrocytic anaemia. The red cell count fell in certain cases from 10 to 1.35 million, and the haemoglobin from 13.2 to 4.9 grams per cent. This fall was associated with a marked degree of anisocytosis; the average diameter of the red cells was increased from 5.9μ to 8.2μ . As the anaemia progressed large numbers of normoblasts appeared in the blood stream. But the finding that clinched the diagnosis of Bartonella anaemia was the presence of the characteristic rod-like bodies in the red cells (Fig. 1).

SPLENECTOMY EXPERIMENTS.

In order to confirm the diagnosis arrived at in the previous experiments, and to show that all the stock and experimental animals were infected with Bartonella, and in addition to test various lines of treatment, a series of representative animals were splenectomized. Sixty-six animals were operated on by Colonel McCarrison. Of these one died of haemorrhage from the pancreas in the first twelve hours; the others survived the operation well. Post-operatively all the animals were fed on the stock diet with the addition of unlimited whole milk; 25 had no further treatment, 17 were treated with liver extract, 12 with fresh spleen, and 11 with vitamin A concentrate (radiostoleum). With a few exceptions all the animals developed the anaemia; liver, spleen, and vitamin A extract afforded no protection against the "infection" in splenectomized rats.

The clinical, pathological, and post-mortem appearances were identical in the splenectomized rats and in those developing the anaemia as a result of faulty feeding, save that the former had no spleens and their blood picture showed an enormous polymorphonuclear neutrophil leucocytosis and a much heavier incidence of red cells "infected" with Bartonella. The leucocytosis is probably a direct result of the splenectomy as it occurs immediately after the operation; but the reason for the number of "infected" red cells being so much greater, although the anaemia is no more severe, is not clear.

INOCULATION AND CULTURAL EXPERIMENTS.

With the exception of the above-mentioned experiments with pregnant animals fed on a Hindu diet all attempts to produce anaemia by the inoculation of infected blood into intact animals were unsuccessful. We were also unable to confirm Ford's² work with young rats. All attempts to culture the "organism" failed.

DISCUSSION.

The interest of these experiments lies in the fact that it has been possible by dietetic means alone to produce a severe Bartonella anaemia in intact animals, the anaemia being of the same order as that occurring after splenectomy in infected rats. The diets used have one common fault—a relative deficiency in vitamins A and C. There were many other experimental animals in close contact with those which developed the disease, but although all were infected, as shown by the splenectomy experiments, only those fed on diets with this dual deficiency developed the anaemia. It seems safe to conclude, therefore, that the factor that renders intact rats liable to this anaemia is a dietary one. The present series of experiments is not sufficiently conclusive to determine the exact nature of the deficiency; the results suggest that either a relative deficiency of vitamins A and C or of some other closely associated dietetic factor, perhaps a specific anti-anaemia one as found in liver, is most likely to be responsible. The presence of the characteristic "organism" in the red cells clinches the diagnosis of Bartonella anaemia.

It is suggested that the deficiency, whatever be its exact nature, may have some effect on the reticulo-endothelial system comparable to that of vitamin A deficiency on epithelial structures; and that it is by virtue of this action that the natural resistance of the intact rat is overcome, even as it is overcome in infected stock by removing a large bulk of this tissue—that is, the spleen. In view of the importance of the reticulo-endothelial system in the defence of the body against infections, particularly protozoal ones, the experiments reported here may not be without significance in connexion with the incidence of these diseases in India, where a large section of the population exists on diets having the faults described above.

SUMMARY.

1. A severe anaemia has been produced in rats by feeding them on diets low in vitamins A and C.
2. The anaemia was more frequent and more severe in females than in males.
3. Blood examination revealed the presence of *Bartonella muris* in the red cells of the anaemic rats.
4. Splenectomy experiments showed that all the Coonoor rats were infected with Bartonella.
5. Liver, spleen, and vitamin A concentrate failed to protect the rats from this anaemia after splenectomy.

We wish to thank Colonel McCarrison for placing the material from his earlier experiments at our disposal, and for his generous help in this work.

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TREATMENT OF ANAL FISSURE AND SPASM BY DIATHERMY.

BY

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THE use of high-frequency currents in the treatment of haemorrhoids and fissures and other painful and ulcerative conditions of the anus was first advocated and practised by Professor Doumer of Lille in 1897. Doumer introduced into the anus a conical metal electrode attached to the Oudin resonator of the original high-frequency apparatus. A detailed report of eight cases treated by Doumer's method was published by Seeuwen¹ in 1906.

The advent of the modern diathermy apparatus rendered possible a greater and more sustained production of local heat, and Bensaude and Meyer,² by employing this current, were able to improve upon Doumer's original technique. They published a report of 114 cases so treated with markedly beneficial results. They made use of a modification of Doumer's electrode in their more chronic cases, but in the very acute ones they did not attempt to penetrate the anal canal even with a fine electrode, confining themselves initially to a saline pad pressed against the orifice of the canal. The indifferent electrode was a pad placed upon the lumbar region. Finally J. H. Marchand³ reviewed these various methods in the *Journal Médical Français* in 1929.

Our own experience of the treatment of certain ano-rectal cases by diathermy leaves no room for doubt that it is a curative agent of considerable value. Cumberbatch has drawn attention to the efficiency of this form of treatment, but it is remarkable that it has been so little employed in this country. The types of cases most suitable for its employment may be roughly subdivided under two headings—acute and chronic.

Acute Cases.

These include: (1) simple anal fissure and other ulcerations of the ano-rectal mucous membrane; (2) inflammatory and ulcerative conditions of the anus associated with haemorrhoids; (3) cases following operations on haemorrhoids and other operations in this area, in which the mucous membrane has not healed. Such cases are always attended with a considerable degree of spasm of the sphincter ani. The spasm cuts off the blood supply to the underlying mucous membrane, and the resultant tissue

anaemia prevents healing from taking place. The pain caused by the unhealed mucous membrane sets up a reflex spasm of the sphincter, and a vicious circle is thus produced.

Chronic Cases.

The late results of all these conditions are not uncommonly seen. Fissures and ulcers have healed over by scar tissue, resulting in fibrous bands and contractions. The lumen of the canal is partially occluded, rendering defaecation painful and difficult. Constipation is induced, and the attempt to pass a normal stool produces a fresh tear. In such cases one frequently finds on rectal examination areas of old scarring and contracture in one segment and a recent tear in another, attended with persistent spasm of the sphincter. If the fibrosis exceeds the ulceration the stools are malformed. The attention of the patient is often concentrated upon these disabilities, and a definite state of hypochondriasis may be set up. If the ulceration exceeds the fibrosis, pain and spasm predominate.

Technique.

The patient lies on his side in the Sims position. We use as the indifferent electrode the metal abdominal belt described by Cumberbatch⁴ and Robinson in the treatment of cervicitis. All towels and instruments should be sterilized, and complete asepsis observed.

Electrodes used in acute cases. | Electrodes used in chronic cases.

In very acute cases it may be found necessary to begin the first treatment by applying a pad to the anal orifice, as recommended by Bensaude and Meyer, with the object of reducing the spasm, but we have never met a case in which it has not been possible to insert a fine electrode before the completion of the treatment. All electrodes should be warmed to a temperature of thermal indifference with the skin, and well lubricated with sterile vaseline before insertion. The very greatest care should be exercised in introducing the electrode. We begin with a metal rod of 3 mm. diameter and of uniform bore. The sphincter closes tightly upon it. The current is turned on and very gradually increased until a sensation of warmth is appreciated by the patient, but it should never exceed 300 milliamperes with this electrode, because in very acute cases the patient is sometimes unable to distinguish the sensation of heat from that of pain. (Normally this transition takes place at about 115° F.) In a few minutes the spasm begins to relax, and the patient often volunteers the remark that the instrument appears to be falling out. The electrode should be held *in situ* for ten minutes. During this period a painful reflex spasm of the anus may occur from time to time, but this will gradually decrease and finally disappear. It will now be possible to move the electrode up and down quite freely without producing further spasm. It is then removed very carefully, and another of slightly wider bore inserted and retained for a further ten minutes. Treatment in the early stages should be continued daily or even twice daily. At each treatment the initial electrode should be of slightly smaller bore than that selected at the end of the previous treatment. In this way it is usually found possible to increase on each successive application, until

full dilatation is obtained. The relaxation of the sphincter induced by the diathermy current remains for a considerable time after treatment, and defaecation is rendered less painful. Regeneration of the mucous membrane is promoted over the ulcerated surface by the increase in blood supply, and the passive dilatation of the canal prevents the occurrence of fibrosis.

In chronic cases in which stenosis of the canal has taken place as the result of fibrous contraction, and which are often the late result of operations for the removal of haemorrhoids or of old ulceration in this area, active ulceration is not usually present, although attempts to pass a stool of normal consistency may produce recurrent tears in the adjacent mucous membrane. The patient is driven to the use of every kind of purgative, the passage of a stool of normal size and consistency in some cases being mechanically impossible.

In these cases it is usually found possible to insert a fine blunt electrode without difficulty. The method we adopted was suggested to us by Dr. A. F. Hurst, who had previously treated cases with success. It consists in the use of a much more intensive application of diathermy, with the object of rendering the whole area flaccid and malleable. The anal canal is then dilated manually. Recourse is had to the conical electrode of Doumer. These we had made of varying gradients according to the type of case to be treated, the position of the stricture, and the degree of dilatation required. In no case should the electrode exceed four inches in total length, in order to ensure that its tip should not impinge upon the roof of the pelvi-rectal flexure. It is graduated at intervals of 1/2 cm. in order to check the progress made at successive treatments. The electrode is pushed forward until slight pain or discomfort is experienced, and is left in this position for a few minutes, and then further inserted. This process is repeated at each operation. The amperemeter is not a good guide as to current, because the surface contact varies in individual cases, and this increases as further dilatation is obtained. More than 1,400 milliamperes can be given. At the end of each treatment, which lasts from twenty to thirty minutes, the forefinger is inserted, and later both forefingers, and the canal is gently but firmly stretched. It will be found that a much greater degree of dilatation can be produced after diathermy than is possible without such application, and the tendency to spasm is very considerably reduced. The dilatation produced has in most cases been permanent, and there has been no recurrence of fibrosis.

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PROTEIN THERAPY IN INSANITY.

BY

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DURING a recent outbreak of dysentery it was observed that the blood of patients who eventually died of the disease showed the highest estimation in agglutinative properties. Although these patients had a considerable amount of specific antibody, it would appear that for some unknown reason they were unable to utilize it against the infection. Since complement is considered necessary in a reaction of this nature, it might be reasonably assumed that the amount present had been insufficient, or at least not in proper proportion to the amount of antibody and antigen.

It has been demonstrated in our laboratory that in order to produce complete fixation of specific antigen and antibody in known quantity, the amount of complement required had to be, within limits, in proportion to the amount of antigen and antibody. The complete fixation did not take place if the quantity of complement was too great or too small. Whether this applies to reactions in