CASE X. Intrahepatic Abscess: Operated on in Japan: Recurrence: Pyaemic Organisms in Blood at Time of Second Operation; Died of Haemorrhage from Abscess Cavity.—E. R., aged 28, European male. In China got fever in March, 1902; went to Japan. A liver abscess pointed in epigastrium, where it was opened and drained. The wound healed over, and he came to England via America. Went to watering-place in the North of England, where he was treated for malaria. He was seen at Coventry by Dr. M. M. Moore, who diagnosed hepatic abscess. On October 20th I operated in the usual way—trocar and cannula and siphon drainage. The pus flowed from cannula with enormous force, and from 1 to 2 pints escaped at the time of operation. Drainage not quite satisfactory. On October 27th and again on November 11th the channel was enlarged until three fingers could be introduced into the wound. The patient never did well. Staphylococci were found in the blood, but no malarial parasites. The patient died suddenly of haemorrhage from the walls of the abscess cavity.

Most probably the haemorrhage was due to pyaemia, although there was some evidence in the history of the case that it might have resulted from cirrhosis. This case proves the futility of opening a liver abscess in front. If a hepatic abscess is pointing in the epigastrium it is of great extent, and can be, and ought to be, reached from the neighbourhood of the angles of the ribs. Should the abscess have been opened in the epigastrium it should also, as soon as possible, be drained from further back and the front wound allowed to close.

INSTANCES OF PUS BEING FOUND IN AND AROUND THE LIVER NOT CONNECTED WITH HEPATIC ABSCESS.

(a) *A Case of Suppurative Pylephlebitis in which Pus was Found by a Needle Passed into the Liver Substance.*—J. D., aged 67, European, male, had been in Crimean war (1854), where he had an attack of dysentery. Never lived abroad afterwards; no recurrence of dysentery, and in good health for forty-five years. In 1902 had influenza, from which he gradually passed into a pyaemic state. Sir Lauder Brunton diagnosed that the cause was attributable to some lesion in the liver, and at his suggestion I searched the liver for pus. At the sixth stab pus was found with the syringe, but on inserting the trocar and cannula no pus escaped. The pus that was removed was grumous, muco-purulent-looking material of a character which I had never before seen removed from the liver, and I ventured to state that the pus was not from a liver abscess. The patient collapsed and died, and at the necropsy the following conditions were found: A small perforation of the rectum on the posterior wall, $\frac{6}{16}$ in. above the anus; outside this in the perirectal tissue on the posterior wall was a mass of fibrous tissue evidently of very old standing. In this tissue pus was diffused, and the veins which led from thence to the inferior mesenteric vein were full of pus. The trunk of the portal vein and its tributaries and every branch of the portal vein in the liver were quite full of pus.

I had, therefore, aspirated one of the branches of the portal vein in my search, and the peculiarities of the pus—non-hepatic abscess pus, yet from the substance of the liver—was accounted for. The history was now made plain: Dysentery, 1854; dysenteric perforation of rectum; a barrier of fibrous tissue prevented faecal extravasation; influenza had reduced resistant power of the barrier tissue, with faecal infiltration, suppuration locally, pylephlebitis, and pyaemia. The question arises, How long had the portal vein been completely occupied by pus? The pyaemic state, with local signs and symptoms of pylephlebitis, had lasted over three weeks, so it may be conjectured that a man can live for three weeks with the portal circulation in abeyance.

(b) *Pus in the Dome of the Liver due to Appendicitis.*—A male Indian patient was admitted into the Seamen's Hospital in state of collapse. He died shortly afterwards, and *post mortem* the appendix was found lying parallel with the ascending colon, and almost touching the liver. Suppurative appendicitis was found to be the cause of death, and a large quantity of pus had found its way between the liver and diaphragm.

Had this case been submitted to hepatic exploration by the aspirating syringe, pus would have found no doubt; and been unless care had been taken in the examination of the pus extracted the surgeon might have been content to establish drainage over the liver, and thereby have missed the real origin of the trouble. Both the cases related (a and b) show the importance of ascertaining if it is really liver pus that is coming away in the aspirating syringe or during subsequent drainage. It is not sufficient to get pus, it is necessary to be known whether that pus is of hepatic or of extrahepatic origin. If the abscess is suprahepatic in origin the pus will be sterile when first drawn off; if the abscess is intrahepatic there will be cocci present in the pus, a history of fairly recent dysentery, and the pus will look and smell like liver pus. If the pus is of extrahepatic origin there will be a history of some extrahepatic lesion, or of pyaemia, and in addition the appearance of the pus, its odour, and the bacteria present will serve to differentiate its origin.

[Four other cases of hepatic abscess were referred to.]

(To be continued.)

SCIENTIFIC GRANTS COMMITTEE

OF THE

British Medical Association.

REPORT LXXVII.

THE PATHOLOGY OF ACUTE RHEUMATISM AND ALLIED CONDITIONS.*

PROGRESS REPORT ON CHEMICAL PATHOLOGY.

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In a previous note¹ published by one of us in association with Dr. R. M. Beaton, we were able to confirm the original observation of Triboulet that a particular micro-organism is constantly associated with acute rheumatism. To this organism we venture to apply the distinctive term "*micrococcus rheumaticus*"² on the ground that although we were unable by ordinary methods and on ordinary culture media to distinguish it from the other members of the streptococcus group, yet certain points of difference had been ascertained quite definitely, strongly suggestive of the specific nature of the micro-organism concerned. These differences consisted in:

1. The colour change produced in a blood-agar culture similar to the change originally noted by Eyre and Washbourn with the pneumococcus, and by Eyre with the bacillus influenzae, but not observed with ordinary streptococci.

2. The differential reaction obtained in Marmorek's test,³ namely, the power of growing in filtered cultures of an ordinary streptococcus.

3. The faculty of growing best in highly alkaline media (as noted previously by Wassermann⁴).

4. The rapid production of considerable quantities of acid.

These differences are quite as definite as those by which, for example, the bacillus enteritidis has been distinguished from its nearest allies, and were considered to suffice for a provisional separation of the rheumatic organism from the ordinary pyrogenetic streptococci.

Moreover, the organism has in several hands produced all the stigmata of acute rheumatism in rabbits, except chorea and the cutaneous erythematata. And the infection runs in animals a course quite different from that usually associated with streptococcus septicaemia.

The attempt which has been made to decide the question whether this organism is an ordinary streptococcus by showing once again that the latter can occasion endocardial lesions hardly affects the question, since it has long been known that many different organisms may produce endocarditis.

We are not, however, here concerned with the results of animal experiment, nor with the production of rheumatic lesions. The present communication is directed to a further stage of the investigation dealing with the chemical pathology of rheumatism and with the chemistry of the micrococcus.

In the first place we may mention incidentally the observation that the micrococcus has a haemolytic action upon red¹ blood corpuscles greater and more rapid than that of any other streptococcus which we have yet examined—a fact of interest in relation to the very rapid and considerable anaemia of rheumatic fever.

As regards the pyrexia, also, of rheumatic fever, we have succeeded in isolating an albumose from cultures of the organism grown in albuminous fluids free from albumoses, which on injection into animals (guinea-pigs and rabbits), rapidly produces marked pyrexia, and leads to an increase of temperature of three or more degrees of Fahrenheit, reaching on one occasion 105° F.

Our main results, however, deal at present with the production of acid by the micrococcus, and the isolation of this acid from rheumatic subjects. The point particularly to be

* A part of the expenses of this work were defrayed out of grants received by Dr. Walker from the Scientific Grants Committee of the Royal Society and from the British Medical Association.

emphasized at the moment is that the rheumatic micrococcus produces relatively large quantities of formic acid, and that the same acid is obtainable from the urine of rheumatic patients. On these points we are able to formulate the following provisional statements:

1. The micrococcus rheumaticus produces formic acid in very considerable quantity, and also at least one other acid of the fatty acid series.

2. The acid (formic) is present not only in the filtered cultures of the organism, but it can also be extracted from the bodies of the micro-organisms themselves. The washed micrococci contain, in addition to formic acid, at least one of the higher fatty acids.

3. Ordinary streptococci, such as a streptococcus isolated from a case of erysipelas, only give rise to a small quantity of formic acid, so far as our experiments at present go. This observation may constitute a means of differentiation between the rheumatic micro-organism and other members of the streptococcus group.

4. Formic acid and probably another fatty acid are present in the urine during the course of acute rheumatism in appreciable amounts. From normal urine formic acid is either altogether absent or occurs in traces only.⁵

5. Under the salicylic acid treatment of rheumatic fever formic acid is, so far as we have been able to investigate, reduced in quantity in the urine of the patient.

6. Formic acid is obtainable from the tissues of an animal (rabbit) suffering from acute arthritis due to the inoculation of the micro-organism.

The cultures which we have employed in these experiments are cultures grown in highly-alkaline (—10 Eyre) broth for about six days, by which time the reaction has usually become neutral to litmus. And from a litre of such culture fluid, after filtration, we are able to obtain an amount of acid corresponding closely to the total change produced by the organism in the reaction of the media. Of this acid formic acid constitutes about one-half, the remainder being chiefly acetic or propionic, probably the former. A litre of culture yields about $\frac{1}{2}$ gram of formic acid.

The method which, after many trials, we at present find to be the most convenient for the separation of the acids, which we had previously found to belong to the fatty acid series, is by evaporation of the filtered culture (or urine) in an alkaline condition to about a quarter or one-fifth of their original bulk, subsequently acidifying with sulphuric acid and subjecting the acid fluid to steam distillation.

With regard to the origin of formic acid, we believe it to be formed by the micro-organism by the oxidation of sarcolactic acid into formic and acetic acids according to the equation—

Such a decomposition is readily admissible. From ordinary culture broth or *Fleischwasser* alone traces of formic acid are obtainable by means of steam distillation with dilute sulphuric acid. This we believe can only originate by a hydrolytic decomposition of the sarcolactic acid in meat extract, similar to the decomposition known⁶ to occur in heating lactic acid with dilute sulphuric acid in sealed tubes at 130° C. according to the equation—

And we have found experimentally that the same change occurs, though only slowly, in the steam distillation of a weak solution of lactic acid with dilute sulphuric acid.

From culture fluids containing preformed formic acid the acid distills over rapidly at first, but later on comes off more slowly and maintains a fairly constant yield. The later portions we attribute to the above decomposition, since they are comparable in amount with the results obtained from our controls. Thus in one case the acidity of successive litres of the distillate from a rheumatic culture corresponded to 12.2, 2.15, 1.3, and 1 c.cm. of normal soda, while the control gave constantly an acidity corresponding to about 1 c.cm. of normal soda per litre of distillate.

From the bodies of the rheumatic micrococci themselves, after repeated washing to remove adherent traces of the culture fluids, we have obtained appreciable amounts of formic acid. It follows that the processes concerned in its production proceed within the body of the micro-organisms themselves. Traces of formic acid are also obtainable from ordinary streptococci.

In most cases the formic acid found in our experiments has been separated as a sodium salt, and has been subsequently identified by the usual chemical tests. It may also be separated as an insoluble iron salt.

The connexion of formic acid with the activity of the rheumatic micrococcus is of considerable interest in relation to the evidence of country folk-lore, since it is currently alleged that persons who keep bees, and are thus frequently subjected to the action of formic acid, are peculiarly insusceptible to rheumatism.

We are at present endeavouring to perfect our methods, and propose to enter on a full investigation of rheumatic affections and the allied conditions along these lines, comparing them with the ordinary septicaemias. There are already indications that the beneficial action of salicylates in rheumatism may find a simple chemical explanation.

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¹ BRITISH MEDICAL JOURNAL, January 31st, 1903. ² *Practitioner*, February, 1903. ³ *Annales de l'Institut Pasteur*, 1902. ⁴ *Berl. klin. Woch.*, 1899, No. 29, p. 638. ⁵ Von Jaksch, *Zeit. für physiol. Chem.*, 1886, x, 536. ⁶ Erleu-meyer, *Zeit. für Chemie*, 1868, iv, 343.

REVIEWS.

TSETSE FLIES AND TRYPANOSOMIASIS.

As soon as the dissemination of malaria was proved to be connected with mosquitos, the Trustees of the British Museum with commendable promptitude brought out Mr. F. V. Theobald's *Monograph on the Culicidae*, and now that the subject of trypanosomiasis has begun to loom large on the medical horizon, the same body has authorized the publication of a *Monograph of the Tsetse Flies*,¹ by Mr. E. E. Austen, the Dipterologist to the Museum. The monograph is well illustrated, and contains seven coloured plates of exceptional excellence by Mr. Terzi. It may be divided for the sake of convenience in two parts, the first consisting of the bionomics of tsetse flies, a historical survey, the systematic position of the genus, the systematic description of the genus and its species, and a chapter on the anatomy of the mouth parts, by Dr. H. J. Hansen, of Copenhagen, the second dealing with the bibliography, which is unusually large, and a series of very interesting and instructive appendices. To the majority of people, especially to those who have read the many books on sport and exploration in Africa, the name tsetse is familiar, but beyond this very few know what the fly is like, or any adequate idea of the damages it has caused and still causes amongst horses and cattle in Africa. The book will afford most interesting information to biologists, scientists, doctors, Government officials, and laymen, especially to those who are interested in the colonization and future development of the large tracts of pastoral Central Africa. The historical survey contained in Chapter II is of great interest, as it contains the earliest records of the pioneers of African exploration and sport, and shows how they were hampered by this pest. It is wonderful how closely all the descriptions of the tsetse fly agree with each other, and the few divergences of opinion that exist may be accounted for by the fact that the tsetse embraces at least seven different species. The chapter on the external anatomy and the description of the different species is the best that has ever appeared on those insects; and with such a clear description the identification of those different species—a most important point—should be within the reach of all. The bibliography of the subject takes up a large part of the book, and is very fully entered into, extracts from each book or paper being given, so that one can follow with ease the different accounts of the many people who have written on this subject. The interesting appendices at the end of the book prove that there is not such a close connexion between the tsetse fly and the buffalo as has generally been supposed. After reading through the monograph carefully, the impression left is that the whole question of the tsetse fly and the spread of disease by it is still in its infancy. It seems more or less certain that *Glossina morsitans* and probably *Glossina pallidipes* are responsible for the transmission of the trypanosoma Brucei from animal to animal, but it has yet to be shown what part, if any, the other species play in the spread of trypanosoma diseases. The identification by Mr. Austen of the tsetse fly from Entebbe, Uganda, as *Glossina palpalis* is of exceptional interest. Mr. Jackson first noted its presence there, and pointed out that there was no big game, whilst cattle, sheep, and other domestic animals lived and thrived there. On the other hand, however, the trypanosomes discovered by

¹ A *Monograph of the Tsetse Flies (Genus Glossina, Westwood)*. Based on the collection in the British Museum. By Ernest Edward Austen: with a chapter on mouth parts by H. J. Hansen, Phil. Doc. London: British Museum (Natural History). 1903. (Roy. 8vo, pp. 330, 9 plates. 15s.)