dependent on special aptitude, a wider interest in the need for, and the means of proving its propositions will be necessary. It is possible that the increasing knowledge of experimental methods may bring this about and stimulate a renewed vigour in purely clinical work. In the second place, as successful clinical observation demands a certain special aptitude, and the unrelenting contemplation of a very large and rich material such as we find at its highest in, for example, a Hughlings Jackson, it should be the source and reservoir of that flow of ideas which alone can maintain the fertility of the whole field of medical science.

To the experimenter immersed in his research, and to the clinician struggling with the load of experience and the needs of his patients, it may seem impractical to concern ourselves with the theory of medical knowledge. On the other hand, it is perhaps the lack of rational doctrine and a general interest in the problems of method that has made medicine the scene of so much disunited and contradictory effort, and helped to put it down from its historical position as the mother and the nurse of science.

INFECTION BY ANAEROBIC STREPTOCOCCI IN PUERPERAL FEVER.

BY

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THERE are many cases of puerperal fever in which we are unable to make a precise bacteriological diagnosis. Blood cultures give no growth and cultures made from the cervix uteri give a mixed growth of several bacterial types. If haemolytic streptococcal colonies occur in any number it is usual to assume that an infection by that organism is responsible for the patient's fever—and probably that assumption is more often right than wrong. When haemolytic streptococci are absent we are left in doubt as to the nature of the infection, and without a laborious, and possibly unfruitful, examination of the patient's blood for evidence of an antibody response to one or other of the uterine microbes, we can get no further. All these cases—and they constitute a considerable proportion of the total puerperal infections—have to be written down as *infections of uncertain origin*.

HISTORICAL.

The suggestion that anaerobic streptococci may play an important part in puerperal infections is not a new one, although it has received hardly any attention in this country. In 1899 Menge and Krönig recovered these organisms from the peritoneum in cases of suppurative peritonitis, and claimed that they ought to be regarded as definitely pathogenic for man. Krönig (1895) had previously demonstrated that similar streptococci were often present in the vagina of pregnant women. They were first cultivated from the blood in puerperal fever in 1910 by H. Schottmüller, whose papers make an important contribution to our knowledge of the clinical aspects of this disease. He applied the name *Streptococcus putridus* (later *putrificus*) to this organism on account of the fetid gas produced by it in cultures when blood was present. Veillon had (1893), however, previously named it *Micrococcus foetidus*. In Schottmüller's series of 50 cases he obtained a pure culture of *Streptococcus putridus* from the blood in 5, and in one case a mixed culture of *putridus* and *haemolyticus*. In the same series of 50 cases a pure culture of haemolytic streptococci was obtained from only two cases. Uterine cultures showed these two types to be present in an equal number of cases—namely, fifteen.

The further experience of twenty years has served to strengthen Schottmüller's belief that these anaerobic streptococci are at least as important as the haemolytic variety in the causation of puerperal post-partum infections. An analysis of his findings in 231 fatal cases published in 1923 showed that the haemolytic streptococcus was obtained in pure culture from the blood of 42 patients,

and *Streptococcus putridus* from 41. In 11 other cases blood culture gave a mixed growth of anaerobic streptococci with other species. Peritonitis occurred in 89 of the patients, haemolytic streptococci being obtained in pure culture from the pus twenty-eight times, *Streptococcus putridus* thirty-one times. *Streptococcus putridus* grew in mixed culture from the pus of 7 other cases. The clinical conditions most frequently associated with infections by *Streptococcus putridus* were subacute and chronic thrombophlebitis affecting the parametrial venous plexuses, and salpingitis. Abscess formation was a common sequel.

Reviewing the whole subject of puerperal infection in 1928 Schottmüller states that the haemolytic streptococci account for scarcely one-third of all his fatal cases. He still recognizes only a single type (*putridus*) of anaerobic streptococci. His view as to the importance of the anaerobic types is not shared by all his German colleagues, but recently Sommer, in an analysis of 261 cases of generalized infection occurring in Berlin (186 of them post abortum and 58 post partum), has brought some support to it. Sommer's observations led him to conclude that staphylococcus is by far the most common cause of the generalized infections following abortion (71 cases out of 186) and that haemolytic streptococci and *Streptococcus putridus* (in that order) are responsible for most of the post-partum septicaemias.

Schwarz and Dieckmann (1927) have also reported an investigation carried out by them in Washington. Combined aerobic and anaerobic blood cultures were made in a series of 68 puerperal fever cases occurring during a period of two years. In 11 cases a pure growth of strictly anaerobic streptococci was obtained, and in 6 cases a growth of "aerobic organisms" (types not specified). Ten patients died, of whom five had a generalized infection by anaerobic streptococci. In 35 cases cultures from the uterus gave a growth of these cocci.

Schwarz and Dieckmann do not suggest that they encountered an epidemic of infection due to these anaerobic streptococci, and their conclusions are in general agreement with those of Schottmüller. They did not attempt the differentiation of the strains isolated from their cases, but (unlike Schottmüller) they did not regard them as a homogeneous group all conforming to the *putridus* type. They call particular attention to one type which was cultivated in nine blood cultures (? from nine different patients)—a small Gram-negative coccobacillus which produced black discoloration of blood agar. It is not quite clear whether they included this organism among their anaerobic streptococci.

Two facts, then, stand out from the investigations of the past—namely, (1) that in Germany and in America strictly anaerobic streptococci have been isolated from the blood of a number of cases of puerperal fever, particularly those of the thrombo-phlebitic type; and (2) that similar organisms are frequently present (estimates vary between 5 and 20 per cent.) in the vagina during pregnancy (Krönig, Natwig, and others).

Beyond these facts we have learned very little. The description of strains by Veillon (1893), Krönig (1895), Natwig (1905), Schottmüller, Lewkowicz (1901), Sternberg (1900), Graf and Witneben (1907), and particularly the laborious investigation of Prévot (1924), seem to show that there is a large group of these anaerobic streptococci, and that their final differentiation is likely to prove a matter of considerable difficulty. Prévot has suggested a preliminary differentiation into three main classes: (a) those which produce fetid and other gases in culture; (b) those which do not—mostly very small cocci; (c) those which are only "anaerobes of predilection"—that is, they can be educated, more or less, to aerobic growth. This differentiation Prévot found to be justified by serological tests. A few of the strains examined by him were pathogenic for laboratory animals and a few produced a feeble exotoxin. No specific treatment of the infections by these organisms has yet been forthcoming.

AUTHOR'S OWN EXPERIENCE.

During the years 1923-28 I made bacteriological investigations of a large number of cases (about 240) of severe, and moderately severe, puerperal fever. From 55 to 65

per cent. of them *Streptococcus pyogenes* was cultivated, either from the blood or the uterus, or, in many of the fatal cases, from both. Anaerobic streptococci were not isolated from the blood of any case, and the presence of these microbes in cultures made from the uterine discharge was not specially noted.

During the same period cases were met with from time to time which puzzled me very much. In spite of frequent rigors and high fever blood cultures were always negative, and cultures from the cervix uteri (usually only aerobic) gave a scanty mixed growth. (Schottmüller's work was not familiar to me at this time.) When these cases came to necropsy cultures from the spleen were usually sterile.

In the autumn of 1928 a patient of this type came under my notice at Queen Charlotte's Hospital. During several weeks of irregular fever, with almost daily rigors, I failed to cultivate anything from the blood, but finally, by more strictly anaerobic technique, succeeded on two occasions in isolating a gas-forming streptococcus, which refused to grow aerobically after repeated subculture. The patient ultimately developed a large abscess containing very foul pus from which this streptococcus was cultivated, together with diphtheroid bacilli (facultative anaerobes).

Having learned something of the characters and cultural requirements of this anaerobic streptococcus from my experience of this case I determined to investigate future cases of puerperal fever more carefully, with a view to detecting these infections if they should occur. Anaerobic plate cultures (blood agar) were therefore made from the cervix uteri of every case, and my routine procedure for blood cultures was modified in such a way (vide infra) as to favour the growth of strictly anaerobic as well as aerobic organisms.

It is not proposed to report at any length in this paper upon the cultures made from the uterus. Many of them have given an almost pure growth of haemolytic streptococci on both the aerobic and anaerobic plates. Many others have given no growth, or only a very sparse growth of diphtheroid bacilli, on the aerobic plate, but a profuse growth of indifferent streptococci—sometimes of more than one type—on the anaerobic plate. How many of the latter were strict anaerobes, or only "anaerobes of predilection," has not been determined; nor is it known how many of them are to be regarded as saprophytes multiplying in the blood clot, etc., of the placental site, and how many represent a true infection of the uterine tissues. Until there is more information on these matters little is gained by making a careful census of the cases yielding an abundant culture of haemolytic streptococci and of anaerobic types respectively. For the present it may suffice to state that both classes are frequently met with in puerperal fever.

The evidence furnished by blood cultures, on the other hand, is generally accepted as indicating true infection, even if the microbes—as is often the case—are simply thrown off into the circulation from a local focus of sepsis.

In the accompanying table I have summarized the combined aerobic and anaerobic blood cultures made on 76 cases of puerperal fever between October, 1928, and June 1st, 1930. The great majority of these cases were post-partum infections.

Blood Culture Results in 76 Puerperal Fever Cases.

	Number of cases positive.	Positive on more than one occasion.	Deaths.
Pure culture of <i>S. pyogenes</i> (haemolyticus)	12*	4	6*
Pure culture of anaerobic streptococci ...	9	4	3
Mixed culture—two types of anaerobic streptococci or anaerobic streptococci with other organisms...	8	6	4
Pure culture of staphylococcus ...	1	1	1
Pure culture of <i>B. coli</i> ...	3	0	2
Pure culture of <i>B. proteus</i> ...	1		1

There was a negative result in 44 cases.

* Includes one case in which the blood culture was actually negative, but in which the post-mortem examination showed that invasion of the blood stream had probably taken place during life.

It will be seen that anaerobic streptococci were recovered from the blood in no fewer than 17 cases, either in pure or in mixed culture.* The high proportion of mixed cultures is remarkable. Anaerobic streptococci were also grown in pure culture from the pleural effusion of one more patient whose blood, examined rather late in the disease, proved sterile. In no case did the blood culture give a mixed growth of haemolytic and anaerobic streptococci. Two patients whose blood gave a pure growth of anaerobic streptococci gave a few colonies of haemolytic streptococci along with anaerobic types, in cultures from the cervix uteri.

Some Particulars of the 17 Cases of Generalized Infection due to Anaerobic Streptococci.

Etiological.—Thirteen of the cases occurred at Queen Charlotte's Hospital (12 of them between March, 1929, and June, 1930) and 4 were met with in other London hospitals. There has been nothing to suggest epidemic infection among the Queen Charlotte's Hospital series of cases. In 10 of the 13 cases occurring there some intra-uterine manipulation had been carried out—for example, in 6 cases manual removal of the placenta, in 3 cases manual rotation or the replacement of a prolapsed arm, and in one case plugging of the uterus on account of placenta praevia.

Clinical Features.—In no case was the infection fulminating. In the most rapidly fatal case the patient died in eleven days with broncho-pneumonia; the average course, whether to death or convalescence, was six to seven weeks, and one patient is still in hospital after twenty-seven weeks' illness. The clinical manifestations varied considerably, but on a broad view they might be summarized as follows: the patients are much less ill and the fever less severe and less sustained than is the case in generalized infections by haemolytic streptococci; rigors are of frequent occurrence, but the general condition is good, and the pulse rate often low, in the intervals; there is usually no pain, and little can be made out by physical examination, except perhaps a slight tenderness on deep palpation over the brim of the pelvis—a sign which can often be related at necropsy to a septic thrombus in the ovarian veins. Anaemia is a striking and progressive feature in the prolonged cases; diarrhoea is not common except when supuration has occurred in the retroperitoneal tissues of the floor of the pelvis. In 9 of the cases pus has formed in this or some other situation. One developed general peritonitis, probably as the direct result of the bursting of an abscess. She recovered after drainage of the peritoneum. Cultures from the peritoneal pus and from the patient's blood a few hours before the laparotomy gave mixed growths of anaerobic streptococci (apparently identical types) and of an unidentified slender Gram-negative bacillus (facultative anaerobe). It may be noted that 5 of the 9 cases which and in 3 of them a septic thrombus was found post mortem.

The mortality rate for the series of 18 cases was 39 per cent. (7 deaths).

Post-mortem Examinations.—Necropsies were carried out on 6 cases. The findings were, briefly, as follows:

Mrs. R.—Septic thrombus in right ovarian vein which had ruptured and was communicating with a large abscess behind the caecum. Splenic infarcts. Pus in right pleura. Terminal endocarditis.

Mrs. G.—Septic thrombus in left ovarian vein, extending to renal and inferior cava. Abscesses in cave of Retzius and behind left ovary. Foci of suppuration in wall of uterus. Infarcts in kidney and lung.

Mrs. S.—Septic thrombus in left ovarian and renal veins. Abscess around left ovary and in uterine wall. Small ulcers in colon and rectum.

Mrs. H.—Retroperitoneal tissues of pelvis honeycombed with foci of suppuration. Pus in both ovaries. Lung infarcts. No septic thrombus found.

Mrs. B.—Septic thrombus in right ovarian vein and inferior vena cava. Thrombus (? septic) also in common femoral vein. Abscess of lung. No infarction of other organs.

Mrs. C.—Sloughing ulcer of endometrium. Abscesses in pouch of Douglas and uterine wall. Infarcts in spleen and lung. Effusion in left pleura.

* One more case—of blood stream infection by anaerobic streptococci (pure culture)—has been met with since this paper was sent in.

Methods Employed for the Cultivation of Anaerobic Streptococci from the Blood.

Schottmüller advocates the addition of 20 c.cm. of the patient's blood to 75 or 100 c.cm. of melted glucose agar (at 45° C.). He incubates this large volume of medium in long tubes, 30 by 5 cm. In order to detect the colonies of anaerobic streptococci (which do not cause any haemolysis or other colour change) it is necessary to dislodge these large cylinders from the glass after incubation and throw them out into a dish, where they are cut up into many slices of 2 to 3 cm. thickness for separate examination.

This procedure appeared to me to be open to several objections: it is laborious; the process of searching for colonies affords too much opportunity for contamination; the splitting of the medium by gas bubbles leads to difficulty in obtaining pure cultures; and the method does not lend itself to application at the bedside.

For these reasons I have not employed Schottmüller's "agar cylinder" method, but have relied chiefly upon fluid media, using only 3 or 4 c.cm. of the patient's blood. The routine procedure for blood culture which I now employ is as follows:

1. One c.cm. of the blood is introduced into a tube of glucose broth (Douglas's digested heart muscle broth with 1 per cent. glucose), to which approximately 0.3 c.cm. of sterile trypsin (Fairchild's "injection trypsin") has been added in order to counteract the several antibacterial factors—leucocytes, opsonin, etc.—of the blood (vide Douglas and Colebrook, 1916). (It is important to ensure that the trypsin is thoroughly mixed with the broth.) This culture is incubated aerobically and provides good conditions for the growth of any aerobes or facultative anaerobes which may be present in the blood.

2. One c.cm. of blood is introduced into the same broth, but prepared in such a way as to favour the growth of strict anaerobes—that is, the broth is thoroughly boiled and quickly cooled before the trypsin is added (vide R. Dubos, 1928, *re* the presence of a reducing factor in freshly boiled broth) and is then covered with melted vaseline. When required for use the vaseline seal is freed from the glass by gentle local heat and the tube sloped. After addition of the patient's blood and thorough mixing with the broth the tube is again warmed at the top of the fluid in order to reset the vaseline seal.

3. One c.cm. of blood is implanted into a tube of minced meat broth medium, such as that described by Lepper and Martin (1929), under liquid paraffin.

4. In order to determine roughly the number of microbes present in the circulating blood 1 c.cm. of blood is mixed with about 25 c.cm. of melted agar at 45° to 47° C. in a Petri dish and incubated, when the agar has set, in an anaerobic jar (McIntosh and Fildes). When the patient is at a distance from the laboratory and it is inconvenient to provide melted agar at the bedside the procedure is modified by mixing the blood with an anticoagulant—for example, 1.25 c.cm. of 5 per cent. sodium chloride solution, or of 0.5 per cent. sodium citrate solution—and incorporating the whole in the melted agar on returning to the laboratory.

The boiled glucose broth *plus* trypsin (No. 3 *supra*) has proved in my hands much the best medium for the cultivation of anaerobic streptococci from the blood. The same broth, unboiled and incubated aerobically, has usually failed to grow the anaerobes; it grows the haemolytic streptococci as well as the anaerobic media; and is better than these for the cultivation of staphylococci and *B. coli*. In the plate culture (No. 4 *supra*) I have only once detected colonies of anaerobic streptococci in the blood, and that with difficulty. It is very useful, however, for the rapid detection of haemolytic streptococci in the blood, and ought to be retained in any blood culture procedures for that purpose.

The question may be asked, How does the above technique of blood culture differ from that employed by me prior to October, 1928, when I failed to cultivate anaerobic streptococci from puerperal infections? It differs chiefly in that cultures Nos. 2 and 3 provide conditions more suited to the growth of strict anaerobes. Prior to 1928 the glucose broth of culture No. 2 was not freshly boiled before the addition of trypsin, and it was not covered with a vaseline seal. Meat medium (culture No. 3) was

not employed. These differences appear to me to be of sufficient importance to account for my failure to isolate the anaerobic streptococci from the blood prior to 1928.

It should be added that the primary growth in blood cultures is usually slow—two to seven days; and also so scanty that it is scarcely perceptible by the naked eye. Moreover, subcultures on blood agar are not always successful at first.

Characters of the Strains of Anaerobic Streptococci which have been Isolated.

The investigation of my strains is at present very incomplete, and a full account of it will therefore be held over for publication later. Certain general impressions may, however, be given.

Pure cultures have been obtained of 19 strains derived from the blood of puerperal fever patients, and a few strains derived from uterine cultures. They appear to form a heterogeneous group.

Morphology.—Stained specimens of most of the strains show round cocci similar in size to those of the haemolytic type, but two or three strains show much smaller cocci, resembling Prévot's *Streptococcus micros* or *S. intermedius*. They are Gram-positive, but some of them less strongly so than the more familiar streptococcal types. Chains have usually been very short in the majority of the strains, but this character varies somewhat with the cultural conditions. Several strains show considerable pleomorphism, one of them so extreme that Dr. Mair, to whom I submitted it, was in favour of calling it a leptothrix. Other colleagues agree with me that it exhibits in certain phases perfectly definite streptococcal formation. I have therefore retained it among the anaerobic streptococci for the time being.

Intolerance of Oxygen.—Here again the strains show great differences. Two of them may be classed as "anaerobes of predilection"—that is, they have at times given some growth in the presence of air. Most of them, after repeated subculture, will not grow at all aerobically, but it should be said that no attempt has been made so far to educate them by passage in atmospheres of slowly increasing oxygen tension. In shake cultures (serum agar) the zone free from growth at the top has varied from 0.5 cm. to 5 cm.

Gas Formation.—Ten of my strains, like Schottmüller's *S. putridus*, produce fetid gas in medium containing blood; others produce gas in media free from blood; others, again, have not been observed to form any gas.

Colony Characters.—The majority of the strains, when acclimatized to growth on the surface of blood agar (McIntosh and Fildes jar), produce similar discrete round colonies, transparent at the edge and semitransparent at the slightly raised centre. There is no haemolysis or other discoloration of the medium. The colony substance has little coherence. Colonies in shake cultures are lenticular, but I have not observed the budding lenticular types figured by Prévot.

Growth in Fluid Media.—Glucose broth (boiled) *plus* serum under vaseline has given very poor growth of most of the strains. A minority give rise to turbidity. Moderate degrees of acidity are reached (pH between 5.2 and 6.4).

Growth in Human Serum.—Of seven strains so far tested only one was found to grow in normal human serum. If this is confirmed by further testing it will indicate a fundamental distinction between these streptococci and the familiar aerobic types.

Viability in Normal Human Blood.—Four strains were mixed with defibrinated blood under vaseline and incubated for two hours on a rotary drum in order to prevent the corpuscles from settling. With three of the strains the implanted cocci (at the rate of 20,000 to 70,000 per c.cm.) were reduced by 85 to 95 per cent. during the two hours' incubation. With the fourth strain the reduction was somewhat less. After twenty-four hours' incubation none of the blood samples contained living cocci.

Sensitiveness to Organic Arsenicals.—Of two strains tested neither was comparable to the haemolytic streptococci in their sensitiveness to neosalvarsan.

DISCUSSION.

In common with many other writers on this subject I have in the past supported the contention that haemolytic streptococci (*S. pyogenes*) are responsible for nearly all the severe and fatal cases of puerperal fever, and that attention should therefore be concentrated chiefly upon these infections. The data now presented—taken in conjunction with the findings of Schottmüller, Sommer, and Schwarz and Dieckmann—carry the obvious suggestion

that that contention requires to be modified, and that a somewhat different conclusion would have been reached if strictly anaerobic technique had been habitually employed in the investigation of puerperal infections.

The experience of Queen Charlotte's Hospital probably represents a fairly average sample of the septic infections occurring in other large maternity hospitals where a relatively high proportion of complicated labours is dealt with. For a period of nearly two years every septic case (with the exception of one rapidly fatal case of peritonitis which occurred while I was abroad) has been investigated by one or more cultivations from the uterus or the blood, or both, and also from the urine when necessary. There has been no (apparent) epidemic spread of infections during that period.

The records may be summarized as follows:

Women delivered (October 1st, 1928, to June 1st, 1930): 3,674.

Septicaemias giving a pure culture of haemolytic streptococci from the blood during life: 6, with 3 deaths.

Septicaemias giving a culture of anaerobic streptococci from the blood during life: 13, with 5 deaths.

(The cases of localized sepsis due to haemolytic and anaerobic streptococci respectively may be left out of consideration for the reason given above.)

These results show that, during the period of observation, two-thirds of the septicaemic infections have been due to anaerobic streptococci (or to these cocci in association with other microbes) and only one-third to *S. pyogenes*.

In seeking for an explanation of such results, which are apparently in conflict with previous experience of puerperal fever in this country, one is driven to consider four possibilities, namely:

(a) That epidemic spread of these infections by anaerobic streptococci occurred in the hospital.

(b) That the occurrence of 13 cases of septicaemic infection by these organisms was merely an extraordinary coincidence.

(c) That the etiological agents concerned in puerperal fever vary widely from time to time and from place to place.

(d) That these cases of infection are in reality not uncommon in this country, but have usually been overlooked by the bacteriologists (including myself) who have investigated puerperal fever.

With regard to (a), as stated above, there has been nothing to suggest epidemic spread of these infections in the hospital, although one cannot deny that one or two of the cases may have arisen in this way. The fact that there has been no epidemic of infections due to haemolytic streptococci for several years, although the provision for isolating infected cases leaves very much to be desired, is in itself a fairly reliable indication that the hospital's anti-septic procedure is on the whole satisfactory, and does not favour epidemic spread. In this connexion it is also noteworthy that 5 cases of anaerobic streptococcal infection have been met with among a comparatively small series of cases investigated in three other hospitals during the same period. Further, the fact that no fewer than 8 of the 12 cases had had some intrauterine manipulations is somewhat suggestive of an autogenous origin of the infection.

With regard to (b) it need only be pointed out that even if we discount 50 per cent. of the 13 septicaemic cases as having been possibly due to the operations of chance we are still left with 6 cases—that is, as many as in the haemolytic streptococcal group.

There may well be some truth in the suggestion (c) that the nature of the bacterial infections occurring after childbirth may vary from time to time, just like the infections of the respiratory tract. Available data lend some support to this conception. Some records—for example, those of the Aberdeen maternal deaths inquiry (Kinloch, Smith, and Stephen, 1928)—seem to show that *S. pyogenes* can be recovered from almost every fatal case of puerperal fever. For some years that was also my own experience. On the other hand, Stacey (1930) has recently reported that only 3 out of 12 cases of sepsis, when death followed unsuccessful attempts to deliver by forceps, were infected by haemolytic streptococci. There is need for further data on this point.

The fourth possibility—that our bacteriological investigations have often been at fault—probably accounts in

large measure for the failure to recognize these infections by anaerobic streptococci. Personally, I am satisfied that with the technique I employed prior to October, 1928, many of the blood infections reported in this paper would have been overlooked, and the less severe cases, giving apparently negative blood cultures, would have excited no special comment.

In conclusion, it may be pointed out that if it is established by further investigation that puerperal infection by these anaerobic streptococci is of common occurrence in this country, much that has been written with regard to the epidemiology of puerperal fever, unsupported by bacteriological data, will cease to have any value. The epidemiological problem will at the same time resolve itself into two main divisions—namely, that concerned with the haemolytic streptococci, which are believed to be seldom present in the genital tract before labour, and that concerned with the anaerobic streptococci, which are apparently present in a considerable number of pregnant women.

SUMMARY.

1. Anaerobic streptococci have been isolated from the blood of 17 puerperal fever patients since October, 1928; and from the pleural effusion of one other case whose blood was sterile at the time of culture. In 8 of the 17 cases the blood culture gave a mixed growth—of two types of anaerobic streptococci or of anaerobic streptococci with other species.

2. The incidence of these 17 cases has not been such as to suggest a contagious origin of the infection. Ten of them had required intrauterine manipulations during labour.

3. Seven of the patients died (mortality 39 per cent.). Septic thrombo-phlebitis was found post mortem in 4 cases and infarction in 2 others. Suppuration occurred during life, or was found post mortem, in 9 cases, anaerobic streptococci being always recovered from the pus.

4. Thirteen of the 17 cases of generalized infection by anaerobic streptococci have occurred at Queen Charlotte's Hospital. During the same period there have been only 6 cases of septicaemia (possibly 7) due to haemolytic streptococci at this hospital (3 fatal).

5. The nineteen strains of anaerobic streptococci isolated from the blood of patients appear to form a heterogeneous group. Some of them conform to the *S. putridus* type described by Schottmüller, while others do not.

6. The technique of blood culture which has proved suitable for the isolation of the anaerobic streptococci is described.

7. The view is expressed that puerperal infection by anaerobic streptococci probably occurs much more frequently in this country than has been recognized; and that failure to detect the generalized infections has resulted from the use of unsuitable blood culture methods.

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