THE BACTERIOLOGY OF THE BLOOD IN EARLY LIFE *

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Medical literature is full of reports of the bacteriologic examinations of the blood in adults, and much valuable information has been obtained therefrom. Various infections have been studied in this way: typhoid, pneumonia, endocarditis, erysipelas, osteomyelitis, and many of the obscure febrile cases so frequently seen in our hospital wards. But while much work of this nature has been done among adults, we find comparatively few reports on this subject among infants and children. In scarlet fever alone have bacteriologic examinations of the blood been made to any extent.

Study of this infection by Jochmann,¹ Baginsky, Slavyk,² Hektoen³ and others, has shown the presence of a streptococcus, apparently identical in its characteristics with the streptococcus erysipelatis. Thus, Jochmann, studying 161 cases of scarlet fever, found the streptococcus twenty-five times. All of these patients died, and Jochmann, from analysis of his own cases and those of other authors, comes to the conclusion that the presence of this organism in the blood in scarlet fever gives an almost fatal prognosis. Curiously enough, however, neither Jochmann nor Slavyk found the streptococcus in the foudroyant cases, also invariably fatal.

Aside from these studies on scarlet fever, reports on other infections in children are meager. Rotch and Low⁴ report a series of thirty-six cases comprising a variety of infections, the greatest number of any single infection being typhoid (eight). They point out the scientific and practical value of taking blood cultures and urge a more widespread use of this method of investigation.

Delestre⁵ examined the blood in forty cases, the patients ranging in age from a few days up to 4 years, all suffering from infections likely to prove fatal. Thirty-two of the forty died; eight recovered. Among the eight recoveries there was but one infant showing an organism in the blood, and this organism was the influenza bacillus. In the fatal cases, the blood obtained either during life or immediately after death, showed

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1. Jochmann: *Deutsch. Arch. f. klin. Med.* 1903, lxxviii, 209. *Ztschr. f. klin. Med.* 1904, liv, 408.

2. Slavyk: *Jahrb. f. Kinderh.*, liii, No. 5.

3. Hektoen: *Jour. A. M. A.*, 1903, xl, 685.

4. Rotch and Low: *Jour. Am. Med. Assn.*, 1907, xlviii, 185.

5. Delestre: *Ann. d. gynéc. et obst.*, 1901, lv, 51.

organisms in twenty-two, in order of frequency as follows: streptococcus, staphylococcus, pneumococcus and colon bacillus.

Delestre also examined the blood from twenty-one premature infants; of these nineteen died, and fifteen of the fatal cases showed organisms in the blood, the order of frequency being as follows: streptococcus, colon bacillus, staphylococcus and pneumococcus. The author attributes this susceptibility of the newly-born to bacteremia, to the extensive absorbing surface in the lungs and intestines, and regards these tracts as the main points of entry of the bacteria, though the umbilicus, of course, is another vulnerable point. He gives few details in his cases, not stating either the clinical or anatomic diagnosis. The blood taken during life was obtained by an incision into the skin, and he believes his technic was so nearly aseptic that there was no danger of contamination.

Otten⁶ reports a series of 250 cases of lobar pneumonia in children up to 15 years of age, with blood-cultures in seventy. He found the pneumococcus in nine of these seventy cases, 13 per cent.; of these nine, four patients recovered; five died.

The paucity of studies on this important subject in children is undoubtedly due to the difficulty of obtaining sufficient blood for examination from this class of patients. The veins of children are so small that it is extremely difficult to get into them. We have ourselves experienced this difficulty, and, besides the cases reported below, have made numerous but unsuccessful attempts to obtain the blood from other patients, chiefly infants and young children. Others apparently have had the same experience. Indeed, one author, studying a large series of infections of otitic origin among adults, "throws up the sponge" at the outset and says that no attempt is made to study children on account of the difficulty of carrying out the technic. But considering the frequency of obscure febrile infections among infants and children, it would seem that in such patients especially, systematic bacteriologic blood-examinations might be of great value; furthermore, in view of the future possibilities of antivaccine and antiserum treatment, accurate knowledge of disease is more than ever desirable; hence any method of investigation which promises to give us this accurate knowledge should be thoroughly tested, and, if prolific of results, systematically employed. It seems worth while, therefore, to report the following cases, even though small in number:

TECHNIC

Most of the cases have been studied at the Children's Memorial Hospital, a few each at the Cook County and Presbyterian hospitals, and to the attending physicians at these institutions we are much indebted for the material used.

6. Otten: *Jahrb. f. Kinderh.*, 1909, lxi, 568.

The blood has been obtained by the usual method, from the median basilic vein just above the elbow. In two cases of suspected typhoid it was obtained from the lobe of the ear, as recommended by Peabody. Various kinds of syringes have been used, but the Luer glass-syringe has been the most satisfactory. The blood thus obtained has been mixed immediately at the bedside with various media: in most of the cases two tubes of bouillon, two of agar and agar plate have been inoculated. In five of the typhoid cases, ox-bile has been used as the medium, with positive results in all. A case of suspected typhoid in which bile medium was used was negative, but proved later to be a case of tuberculous meningitis.

In using the ox-bile as a medium, the following technic was observed:

Test tubes containing fresh ox-gall sterilized in the autoclave were used. The blood obtained from the vein, or from the lobe of the ear in some cases, was introduced directly into the test-tube of bile. This was then put in the incubator from fifteen to eighteen hours, at the end of which time a few loopfuls were transferred to a tube of coagulated blood-serum: after three to five hours of incubation microscopic examination of the water of condensation showed, in the positive cases, the presence of motile bacilli. The presence of such motile bacilli is now accepted as evidence of a typhoid or a paratyphoid organism.

We have made sixty-nine examinations on sixty-four infants and children during life, and have studied sixteen cases post mortem. It is with the former group of cases that we are chiefly concerned. This is composed of the following infections:

Disease	No of Cases	Results
Typhoid	20	11 Positive
Pneumonia—		
Lobar	15	3 Positive
Lobular	3	1 Positive
Rheumatism	5	5 Negative
Meningitis—		
Meningococcus	5	2 Positive
Staphylococcus	1	1 Negative
Tuberculous	1	1 Negative
Chorea	2	2 Negative
Pyelitis	2	2 Negative
Nephritis	1	1 Negative
Erysipelas	1	1 Negative
Appendicitis, General peritonitis and lobar pneumonia	1	1 Negative
Leukemia	1	1 Positive
General septicemia	1	1 Positive

In addition to the above one case each of scorbutus, miliary tuberculosis, arthritis deformans, toxic erythema and of tuberculous adenitis, gave negative results. Thus, of the sixty-nine examinations made on these sixty-four children, we have obtained nineteen positive results. These will now be analyzed according to individual infections.

TYPHOID

It is in this infection perhaps that the greatest amount of blood-culture work has been done among adults, with interesting and important results. During the first week of the disease, 95 to 100 per cent. of the patients will show the presence of typhoid bacilli in the circulating blood: with the progress of the disease, this number diminishes so that in the second or third week they are found much less frequently (40 per cent.). As the Widal reaction pursues exactly the reverse course, absent at first, present later, the blood culture test becomes an extremely important method in the early diagnosis of typhoid, at least among adults.

How is it among children? Our own cases are of course too few to warrant conclusions. We can state only that eleven of the twenty cases gave positive results, and that these positive results were obtained as early as the sixth and as late as the twenty-second day (Table 1). The negative results were obtained in the first case on the tenth, thirteenth and twentieth days, in the second case during the seventh week (relapse), and in the third and fourth cases on the eighth day.

Combining Rotch's series, our own and a few scattering reports in literature, we find thirty-one cases of typhoid fever, in twenty, or 66 per cent. of which, bacilli were found in the circulating blood. We find, furthermore, that they were found as early as four days before the onset of symptoms and as late as the twenty-second day. The former case was that of a 12-year-old child whose sister was already ill with typhoid (Conradi).⁷

These results were obtained with all kinds of media and at all periods of the disease. It is probable that with the more widespread use of Conradi's ox-bile medium and more frequent examinations early in the disease, this proportion of positive results will be considerably increased. Only when large numbers of cases have been examined, and at different periods of the disease, can we draw final conclusions as to the importance of this particular laboratory investigation. If the results of the future correspond with the results already obtained in large numbers of adults, this method will become even more valuable among children on account of the more irregular, atypical nature of the disease in early life. We urge a constant, widespread use of the method, that our knowledge in this direction may be increased as rapidly as possible.

PNEUMONIA

The pneumococcus is a frequent invader of the blood in adults, not only in pneumonia, but also in pneumococcic infections with the pathologic seat of the disease in other localities, e. g., the endocardium and pericardium, the joints, the meninges, the tonsils, etc. As in typhoid the literature is voluminous as to adults, meager as to children.

7. Conradi: *Deutsch. med. Wehnschr.*, 1906, xxxii, 58.

Otten studied 250 cases of pneumonia in children up to 15 years of age. He made blood-cultures on seventy of these patients, finding the pneumococcus in nine, or 13 per cent. Of these nine children four recovered, five died.

Spitta⁸ describes a case of lobar pneumonia in a 17 months' infant, with a general pneumococcic infection, resulting in an arthritis and empyema; pneumococci were found in the blood during the sixth week of illness and one week before death. Autopsy confirmed the ante-mortem examinations.

We have taken cultures in fifteen cases of lobar pneumonia and three of lobular pneumonia. Four of the cases in the former group were positive, one in the latter, the organism found being the pneumococcus in every instance.

Thus in the eighty-five cases comprising our own and Otten's series, thirteen, or 15 per cent., showed pneumococci in the circulating blood, a striking difference from its frequency among similar infections in adults. This failure to discover the organism more frequently in the blood in children is due to one of the two causes. Either the technic employed in the cases already studied is faulty, or the organism does not invade the blood frequently. The technic employed is apparently important, great discrepancies existing among the authors who have studied this question in adults. Thus Lenhartz, Schottmüller, Grimm and Jochmann find pneumococci in the blood in only one-fourth to two-thirds of their cases, whereas Procharska and Weins find them in practically *all* of their cases. The former group of observers worked with solid media—blood-agar; the latter with fluid media—blood bouillon.

To this difference in culture media, Otten attributes the varying results obtained by these workers, maintaining that the pneumococcus grows better on fluid media, and that consequently those who use such media will get a comparatively high percentage of positive results. He himself in his work on children used fluid media, yet got positive results in only 13 per cent. of his cases. Consequently, if his reasoning be correct, the pneumococcus is not a frequent invader of the blood in the lobar pneumonia of children. However, here again the cases available for study are too few to warrant final conclusions, either as to the frequency of its appearance or as to its prognostic value when present. Future investigations must determine these points.

THE RHEUMATIC AFFECTIONS

In this group we have included cases of endocarditis, arthritis, tonsillitis and chorea, these manifestations occurring either singly or in combination with each other (Table 1).

8. Spitta: Brit. Med. Jour., 1902, ii, 1579.

TABLE 1.—BACTERIOLOGY OF BLOOD ANTE-MORTEM

Case, Sex and Age	Clinical Diagnosis	Day of Disease	Number of Cultures	Medium	Result	Remarks
1—M.—4 years.	Typhoid	?	1	Agar plate; two bouillon.	Negative..	Three Widal's incomplete; persistent leukopenia; recovery. Recovery; Widal positive tenth day.
2—M.—7 years.	Typhoid	10-13-20th day.	3	Bile	All negative.	Recovery; Widal positive.
3—M.—12 years.	Typhoid	14th day.	1	Bile	Positive..	Recovery; Widal negative fourth day; culture taken second day of measles.
4—F.—11 years.	Typhoid	6th day.	1	Bile	Positive..	Recovery; Widal negative fourth day; culture taken second day of measles.
5—M.—42 months.	Typhoid	7th day?	1	Bile	Positive..	Entered hospital for genu valgum; blood from ear third day of measles rash; Widal negative twenty-first day.
6—F.—5 years.	Typhoid	22d day.	1	Bile	Positive..	Recovery; Widal negative twenty-first day.
7—F.—10 years.	Typhoid	?	1	Bile	Positive..	Recovery; severe case; hemorrhages.
8—F.—11 years.	Typhoid	10th day.	1	Bile	Positive..	Recovery; severe case; hemorrhages.
9—M.—6 years.	Typhoid	7th week.	1	..	Negative..	Negative during relapse; recovery; Widal positive eighth day.
10—F.—8 years.	Typhoid	14-18th day.	2	..	Both positive.	Recovery; Widal positive fifteenth day.
11—M.—5 years.	Typhoid	6th day.	1	..	Positive..	Recovery; Widal positive fifth day.
12—M.—12 years.	Typhoid	8th day.	1	..	Negative..	Recovery; Widal positive eighth day; serum reaction to "paracolom" B. and "paratyphoid" B. negative.
13—M.—11 years.	Typhoid	3d week.	1	..	Positive..	Widal negative fifteenth and seventeenth days.
14—M.—4 years.	Typhoid	13th day.	1	..	Negative..	Widal positive eighth day.
15—M.—42 months.	Typhoid	8th day.	1	..	Negative..	Widal positive; recovery.
16—M.—6 years.	Typhoid	7-12th day.	2	..	Positive..	Widal positive; recovery.
17—F.—8 years.	Typhoid	9th day.	1	..	Positive..	Widal positive; recovery.
18—F.—8 years.	Typhoid	6th day.	1	..	Positive..	Widal positive; recovery.
19—M.—10 years.	Typhoid	10th day.	1	..	Negative..	Widal positive; recovery.
20—F.—10 years.	Typhoid	15th day.	1	..	Negative..	Widal positive; death.
21—M.—18 months.	Pneumonia	?	1	..	Negative..	Second day of a high temperature probably a relapse; outcome unknown; child removed from hospital against advice.
22—M.—30 months.	Pneumonia	?	1	..	Negative..	Recovery.
23—M.—7 years.	Pneumonia	15th day.	1	..	Negative..	Lysis on fifteenth to sixteenth day; recovery.
24—M.—9 years.	Pneumonia	10th day?	1	..	Negative..	Appendicitis; general peritonitis; pneumonia; death.
25—F.—2 years.	Pneumonia	8th day.	1	..	Positive..	Rachitis; temperature normal ninth day; convalescence tedious; recovery in two months.
26—M.—3 years.	Pneumonia	8th day.	1	..	Negative..	Crisis on ninth day; recovery.
27—M.—2 years.	Pneumonia	4th day.	1	..	Negative..	Cretin; death four hours after culture.
28—M.—5 years.	Lobar pneumonia	5th day.	1	..	Positive..	Brother and sister on same day; pneumococci in sputum of each.
29—F.—7 years.	Lobar pneumonia	4th day.	1	..	Positive..	Recovery.
30—M.—9 years.	Lobar pneumonia	9th day.	1	..	Positive..	Recovery.
31—M.—18 months.	Lobar pneumonia	4th day.	1	..	Positive..	Recovery.
32—F.—6 years.	Lobar pneumonia	7th day.	1	..	Positive..	Recovery.
33—F.—9 years.	Lobar pneumonia	4th day.	1	..	Negative..	Recovery.
34—M.—11 years.	Lobar pneumonia	4th day.	1	..	Negative..	Recovery.
35—F.—12 years.	Lobar pneumonia	9th day.	1	..	Negative..	Chronic endocarditis; recovery from pneumonia.
36—M.—1 year.	Lobar pneumonia.	10th day.	1	..	Negative..	Recovery.

37—F.—16 months.	Lobular pneumonia.	2d week. ?	1	.....	Negative..	Pneumococci in blood.
38—M.—20 months.	Lobular pneumonia.	Weeks.	1	.....	Positive..	Death.
39—F.—54 months.	Empyema	? 17 ?	1	.....	Negative..	Streptococci in blood and in pus from abscess; removed from hospital.
40—F.—11 years.	Pulmonary abscess.	? 3d-11th day.	1	Blood agar; bouillon.	Positive..	Acute exacerbation; culture taken two months before death, May 1.
41—M.—4 years.	Chronic endocarditis.	? 3d-11th day.	2	.....	Negative..	During intercurrent tonsillitis (streptococcus).
42—F.—6 years.	Chronic endocarditis.	? 3d-11th day.	1	.....	Negative..	Culture second day of a three days' temperature; no evident cause; recovery from this.
43—M.—11 years.	Chronic endocarditis.	Months.	1	Agar bouillon....	Negative..	Antecedent history of rheumatism; entered C. M. H. 3-19-10; temperature 98-103 from 3-27-10 to 4-7-10; culture taken 4-1-10; temperature 99-102 that day.
44—F.—11 years.	Chorea; chronic endocarditis.	7th week.	1	Agar bouillon....	Negative..	No elevation of temperature; recovery.
45—M.—10 years.	Chorea; chronic endocarditis.	19th day.	1	.....	Negative..	Antecedent rheumatism; culture taken after three-four days' temperature without evident cause, when it became normal, then Chronic (?) endocarditis and arthritis; improvement, then measles, acute tonsillitis (streptococcus and staphylococcus), general septicemia; death, cultures during acute arthritis, etc.
46—F.—66 months.	Rheumatic fever.	9-16th day.	2	.....	Negative..	Meningococcus in spinal fluid; death one month later.
47—M.—3 years.	Meningitis	5th day.	1	.....	Negative..	Meningococcus in spinal fluid; death eleventh day.
48—M.—10 years.	Meningitis	? 7th day.	1	.....	Positive..	Meningococcus in spinal fluid; death fifty-first day.
49—M.—66 months.	Meningitis	5th day.	1	.....	Negative..	Meningococcus in spinal fluid; recovery.
50—M.—9 years.	Meningitis	5th day.	1	Bouillon; agar plate.	Positive..	Meningococcus in spinal fluid; recovery.
51—F.—6 years.	Meningitis	48th day.	1	.....	Negative..	Meningococcus in spinal fluid; death four weeks later.
52—F.—22 months.	Meningitis	12th day.	1	.....	Negative..	Staphylococcus in spinal fluid; recovery.
53—F.—10 years.	Meningitis	10th day.	1	Bile	Negative..	Suspected typhoid; Widal negative; von Pirquet positive tenth day; spl. fl. that of tuberculous meningitis; death.
54—F.—20 months.	Pyelitis	Weeks.	.....	.....	Negative..	Rachitis, chronic endocarditis, otitis media two days before culture; pneumonia six weeks later; death.
55—F.—18 months.	Pyelitis	8th day.	1	.....	Negative..	Recovery.
56—F.—8 years.	Erysipelas	5th day.	.....	.....	Negative..	Recovery.
57—F.—12 years.	Acute nephritis..	4th day.	1	Agar bouillon....	Negative..	Entered C. M. H. with typhoid symptoms; Widal negative fourth day; leukocytes 18,000; culture April 8, 1910; endocardial murmur April 11 and pericardial friction-rub April 12.
58—F.—10 years.	Scorbutus	25th day.	1	.....	Negative..	Acute arthritis fifth day of fever; chorea.
59—M.—30 months.	Miliary Tb?	8th day.	1	.....	Negative..	Recovery.
60—F.—5 years.	Arthritis deformans.	? 5th day.	1	.....	Negative..	Positive Wassermann but no characteristic signs of syphilis; left hospital unimproved.
61—F.—3 years.	Toxic erythema..	5th day.	1	.....	Negative..	Positive Wassermann; improving.
62—F.—15 months.	Tuberculous adenitis (cervical)	? 5th day.	1	.....	Negative..	Recovery; rachitis.
63—M.—4 years.	Leukemia (lymphocytic)	Weeks.	1	.....	? Positive..	.....
				.....	Positive..	Streptococci in blood one week before death.

Post-mortem examinations in cases of endocarditis have shown a varied bacteriology, streptococci, staphylococci, pneumococci, gonococci, pyocyaneus and influenza bacillus, all having been found in the heart's blood and on the valves of the heart in such patients. During life, in cases of septic endocarditis in adults, bacteria have often been found in the blood (Billings). We know practically nothing of this aspect of the subject in children, however. Our own group comprises seven cases; all had chronic endocarditis; in five of the cases, the cultures were taken during a febrile stage, due either to a tonsillitis, an arthritis, or to an unknown cause, possibly an acute exacerbation of the chronic endocarditis. There were two cases of chorea, and in both of these the temperature was normal when the cultures were taken. Cultures were negative in all seven of the cases.

MENINGITIS

It was formerly thought that in epidemic meningitis the meningococcus rarely invaded the blood, but recent investigations with improved technic show its presence in the blood in about 25 per cent. of the cases. We have examined four cases, with two positive results. In the tuberculous case the patient was examined on the tenth day of the disease as a suspected typhoid.

OTHER DISEASES

One case each of pyelitis, erysipelas and acute nephritis gave negative blood-cultures. Catheterized specimens of urine from the cases of pyelitis and nephritis showed a streptococcus in the former and nothing in the latter. One case of acute lymphocytic leukemia showed the streptococcus in the blood one week before death.

POST MORTEM

Much more work has been done on the bacteriology of the blood on children post mortem than ante mortem. After death the blood often shows the presence of organisms in great variety. We have reports on the bacteriology of the heart's blood in seventeen cases, of which thirteen showed positive results. These cases comprised the usual run of hospital patients: intestinal, pulmonary, bronchial, otitic, etc. (Table 2). Three cases of special interest were, one each of hemorrhagic disease of the newly born, erysipelas and status lymphaticus. The hemorrhagic disease showed in the heart's blood the *Staphylococcus aureus*, the bacillus coli, the streptococcus and an unidentified diplococcus midway between the pneumococcus and the streptococcus.

Of the four cases with a sterile heart's blood, three were as follows: A pyelo-nephritis due to the *B. pyocyaneus*, an otitis with a general septicemia, but with entirely negative post-mortem results, and a meningo-

TABLE 2.—BACTERIOLOGY OF BLOOD POST-MORTEM

Case, Sex and Age	Clinical Diagnosis	Anatomical Diagnosis	Blood—		Hours After Death	Remarks
			Ante-Mortem	Post-Mortem		
1—M.—12 days.	Urem. disease of newborn.	Septic thrombosis of umbilical vessels; numerous hemorrhages; meningitis pneumoniam.	No examination.	Staphylococcus aureus coli; few streptococcus.	5	All organisms in cerebrospinal and peritoneal fluids; staphylococcus and <i>B. coli</i> only in pericardial fluid.
2—F.—8 months.	Ileocolitis	Ileocolitis; bronchopneumonia.	No examination.	Streptococcus	3	Streptococcus in pericardial pleura, peritoneal and splenic fluid; staphylococcus aureus in bile, splenic and pericardial fluids.
3—M.—Infant.	Rachitis	Enterocolitis; rachitic osteochondritis.	No examination.	Smears: Gram-positive coccus and a gram-negative bacillus. Cultures: Staphylococcus aureus and colon bacillus.	8	.....
4—M.—4 months.	Malnutrition ..	Ileocolitis; bronchopneumonia.	No examination.	Three organisms resembling in all respects streptococcus pyogenes, staphylococcus aureus and diplococcus lancicollatus.	6	Some organisms from pus of lung.
5—F.—4 months.	Gastro-enteritis..	Gastro-enteritis; otitis media; bronchitis; meningitis.	No examination.	Negative	36	Cultures from cerebrospinal fluid showed the colon bacillus.
6—M.—3 months.	Bronchopneumonia.	Bronchopneumonia; bronchiolitis; cerebrospinal meningitis; patent ductus arteriosus.	No examination.	Staphylococcus aureus; streptococcus pyogenes.	28	Cultures from cerebrospinal fluid showed: diplococcus lancicollatus, staphylococcus aureus, streptococcus pyogenes, <i>B. fecalis</i> alk.
7—M.—6 months.	Enterocolitis*...	Enterocolitis	No examination.	Staphylococcus albus	30	.....
8—F.—11 years.	Endocarditis....	.....	Negative.	Negative	16	Bouillon only used post-mortem.
9—F.—3 years.	Otitis; general septicemia.	Nothing abnormal found.	No examination.	Negative	16	.....
10—M.—14 months.	Pyelonephritis...	Pyelonephritis; bronchopneumonia; cloudy swelling of myocardium, liver and kidney.	No examination.	Negative	18	<i>B. pyocyaneus</i> in pelvis of left kidney; also <i>B. coli</i> ; staphylococcus albus from mesenteric gland; staphylococcus aureus from right ureter; staphylococcus citreus and micrococcus tetragenus from pericardium.
11—F.—5 months.	Enterocolitis....	Enterocolitis	No examination.	Staphylococcus albus	50	No meningitis.
12—F.—18 months.	Meningitis	Status lymphaticus.	No examination.	A diplococcus midway between the pneumococcus and the streptococcus pyogenes; colon bacillus; streptococcus.	1	Colon bacillus on trachea. (Case 56, Table 1.)
13—F.—20 months.	Rachitis; pyelitis; endocarditis; laryngitis; lobar pneumonia	Rachitis; acute nephritis; vegetative endocarditis; laryngitis; lobar pneumonia.	Negative.	Contamination ? .....	..	.....
14—M.—3 months.	Enterocolitis ...	.....	No examination.	Streptococcus .....	..	.....
15—M.—3 months.	Erysipelas ...	Pulmonary tuberculosis.	No examination.	Streptococcus	15	.....
16—F.—6 months.	Meningitis (meningococcus).	Purulent meningitis.	No examination.	Negative	..	Meningococci in spinal fluid, ante-mortem.
17—M.—.....	Infant atrophy..	Lobular pneumonia; patent foramen ovale.	No examination.	Negative	24	.....

* Case 26, Table 1.

coccic meningitis. The fourth case was an endocarditis in which the ante-mortem blood was also sterile (Case 26, Table 2).

The organisms recovered post mortem were as follows: the staphylococcus six times, aureus five times, albus one time, the streptococcus eight times, bacillus coli three times, the *Diplococcus lanceolatus* one time, and the unidentified diplococcus already mentioned.

We are much indebted to Prof. E. R. LeCount of the Pathological Department of Rush Medical College, under whose supervision most of the post-mortem work in our cases was done.

SUMMARY

The main points in this paper may be briefly summarized as follows:

Blood-cultures in adults during life, in large numbers of cases, have yielded information of scientific interest and diagnostic value.

Little work in this direction has been done in the infections of early life. There is need of more of this work among infants and children.

It is reasonable to suppose that blood-cultures in early life may be of even more value than in adult life, on account of the greater frequency of obscure infections during the former period.

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