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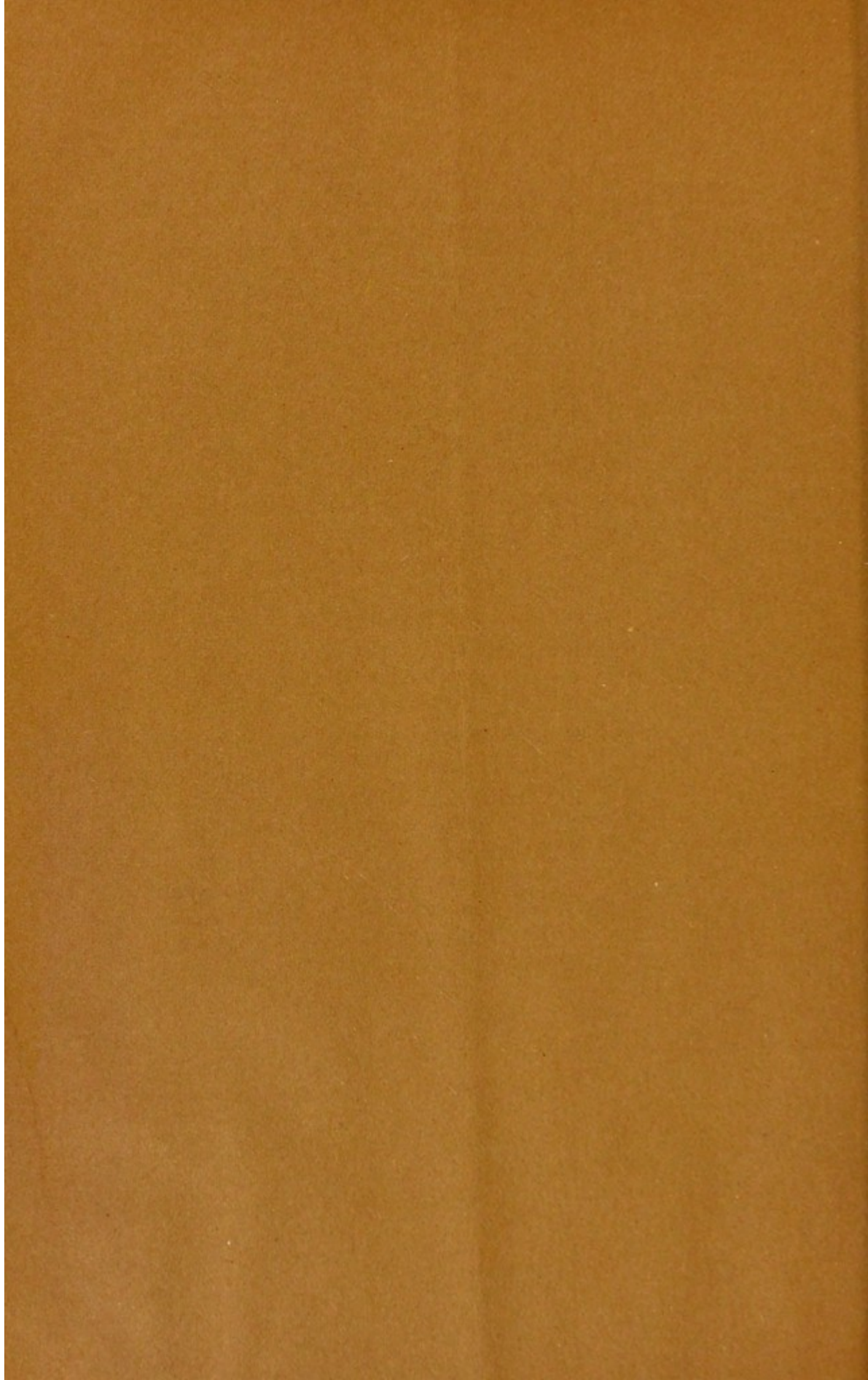
*With the compliments
of E. W. Cushing.*

Relations of Certain Bacteria to Puerperal
Inflammations.

By E. W. CUSHING, M. D.

Read before the American Academy of Medicine at the Annual Meeting,
October, 1885.

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RELATIONS OF CERTAIN BACTERIA TO PUERPERAL INFLAMMATIONS.*

BY E. W. CUSHING, M. D.

IT is with no little hesitation that I venture to offer here the results of some observations which I made last Summer at Vienna, on the relations of bacteria to puerperal, septic processes. It is very probable that the work has been better and more thoroughly done and more fully reported by others, but I trust that the results of personal investigations, even if very limited, may be more acceptable here than elaborate abstracts of the work of others. Nevertheless, I must preface my observations by a short description of the bacteria which, thanks to the labors of Ogston, Rosenbach and Passett, are called septic, in distinction from numerous other varieties which are either harmless to man, or if they cause disease yet do not induce suppuration, pyæmia nor septicæmia.

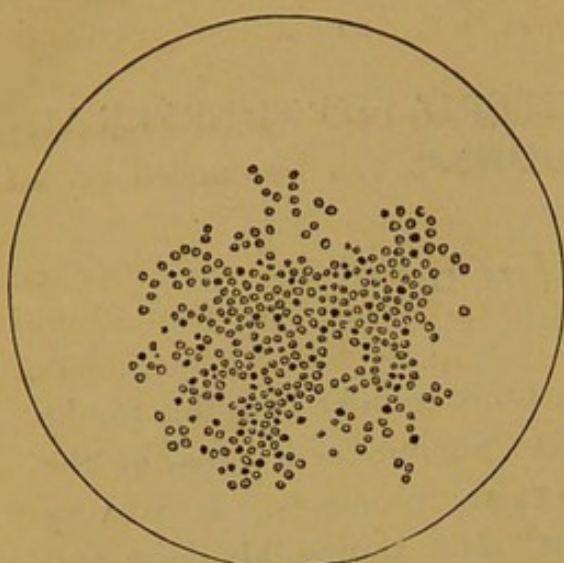
Of course, it has long been assumed by the disciples of Lister that infection of wounds is caused by germs, and on this base the whole fabric of antiseptic surgery has been built. But it is only recently that the strict rules and methods of Koch have been applied to proving the theory of Lister to be true by demonstration.

I have not space here to say much concerning the nature and habits of these organisms. They are well described in the works of the above authors, and I subjoin a plate from Passett's recent work, showing the figures of germs as found in acute abscesses in man. That they must be considered as the causes of the suppuration has been shown by a most careful series of experiments on the lines laid down by Koch, and by following his methods.

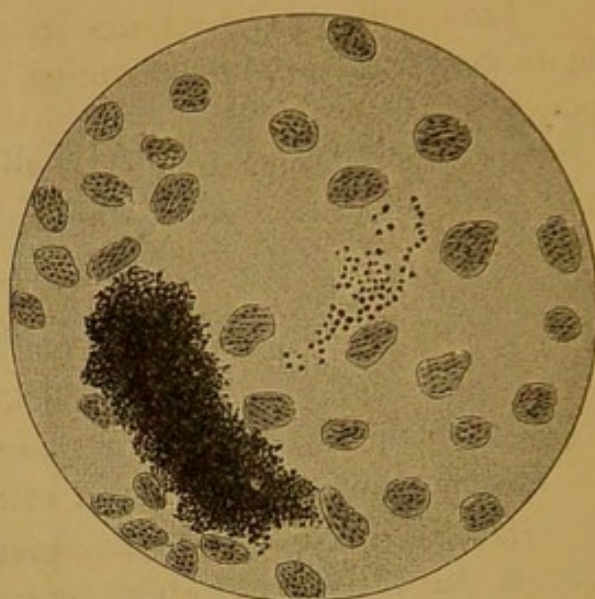
They are usually present either singly or together in acute suppurations.

They can be bred in pure cultures for successive generations, using always a quantity so infinitesimal to sow each successive culture that it is certain that none of the original virus remains in the cultures.

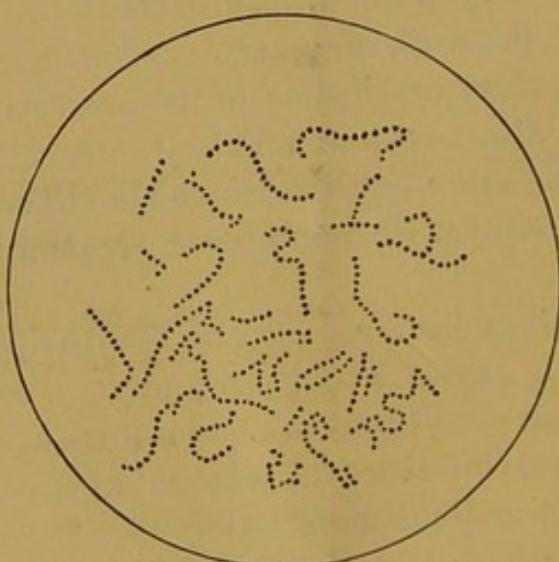
* Read before the American Academy of Medicine at its annual Meeting in New York; Oct., 1885.



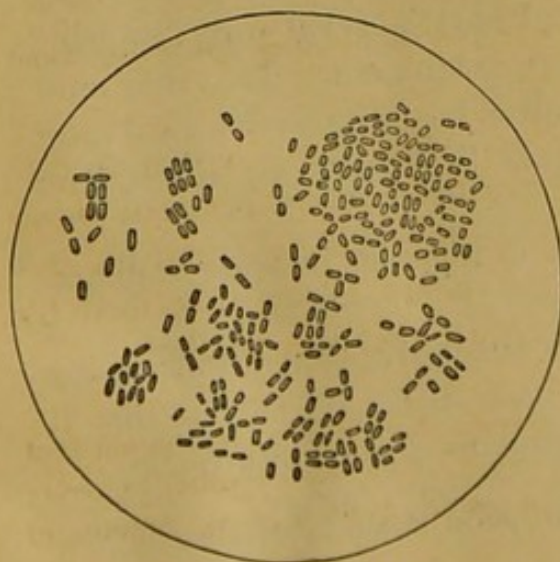
Passett, *Fig. a*, 1,600 x.



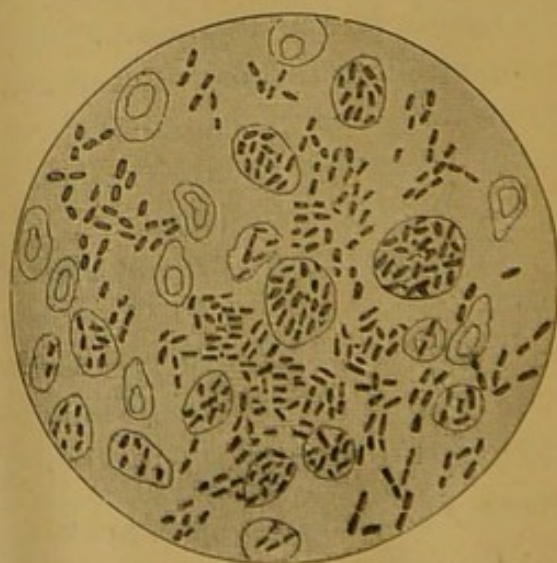
Passett, *Fig. b*, 1,600 x.



Passett, *Fig. c*, 1,600 x.



Passett, *Fig. d*, 1,600 x



Passett, *Fig. e*, 1,600 x

From cultures many times removed from the original, inoculations in animals will produce the original disease, viz., acute abscess, or blood-poisoning, or both.

In animals dying of disease thus induced, the original organisms and no others are found, and so the process can be carried on ad infinitum.

Without entering on the question of the relative importance of the work of different authors, or detracting from the great merit of Rosenbach in his original work in this matter, I quote the classifications of Passett with his plate.

Streptococcus.

Staphylococcus pyogenes aureus.

“ “ albus.

“ “ citreus.

“ cereus albus.

“ “ flavus.

Bacillus pyogenes foetidus. *

NOTE TO EXPLAIN PASSETT'S FIGURES.

Passett, *Fig. a.*—Staph. pyog. aureus, on cover glass, seen in water; from Agar-plate 48 hours old.

“ *Fig. b.*—Section of rabbit kidney. The rabbit died two and one-half days after infection of Staph. pyog. aureus in jugular vein, staph. seen interstitially and in tubules.

“ *Fig. c.*—Streptococci of pus from gelatine culture, seen on cover-glass in Canada balsam.

“ *Fig. d.*—Bacill. pyog. foetidus from gelatine culture.

“ *Fig. e.*—Bac. pyog. foet. in section through lung of guinea pig, which died twelve hours after injection of a gelatine culture of the b. p. foet. into its jugular vein.

In all these figures the artist has doubled the original dimensions, thus giving about 1,600 diameters instead of 790 in Passett's plate.

As for the streptococcus, or chain germ, suffice it to say that no differences in form or manner of growing can be detected between those found in abscesses and those described by Fehleisen as found in, and bred from cases of erysipelas. Also the chain germs described by Löffler as found in some cases of diphtheria are precisely similar.

* Messrs. J. W. Queen & Co., 924 Chestnut Street, Philadelphia, inform me that they have for sale microscopic preparations of the above, and of various other bacteria; also, sterilized nutrient gelatine, and agar-agar, in test-tubes, for making cultures of bacteria.

They are all alike under the microscope, act alike with staining reagents, grow alike in gelatine, and have similar effects on animals when inoculated, while no one dares to try inoculations on man for fear of fatal results.

The staphylococci, or cluster-of-grapes germs, are all alike when stained under the microscope, but can be divided as above by breeding them in gelatine, etc., on flat plates, so that each kind has a chance to grow and develop its color apart from the others. The last two kinds do not set up suppuration in animals but are found in human pus, according to Passett, who kindly showed me his preparations in Munich.

The small round germs, or cocci, of which the chains in one form or the clusters in the other forms are composed, are about $\cdot 58$ of a micrometre in diameter. Perhaps it will be easier to comprehend if I say that when magnified 800 times they look about as large as a period point of this print.

The bacilli pyogenes foetidi, or foul-smelling rods, are about the same in width and two to three times as long. They are found in foul abscesses, and when bred in gelatine impart to it the bad smell, no matter through how many generations the cultures are carried. All of these multiply by fission or splitting in two, each part soon becoming as large and perfect as the parent. Allowing that under appropriate conditions each divides hourly, we have the well-known problem of geometrical progression, so that if at the end of three hours there are eight, at the end of twenty-four hours there will be sixteen and one-half millions, more or less, and in a week a number requiring over fifty figures to express it. As each one either excretes a poisonous material, comparable for activity and deadliness to snake virus, or forms it from the substances on which it lives, it is no wonder that if they fairly get into the fluids of the body and the general circulation, the mortality is terrible.

As a rule, they do not make the gelatine fluid in cultures, they grow at ordinary temperatures, and are not necessarily derived from previous suppurations.

The last point is of immense importance, as no one can tell when he may get them on his fingers or instruments.

It might be assumed as they grow so readily in all sorts of media and at all ordinary temperatures, and are extremely tenacious of life when dried, that they would be found independent of previous suppuration and Passett has shown this by actual search.

In regard to their tenacity of life, Rosenbach states that old cultures of staphylococci, quite dry and black, on being moistened, were as

active as ever, and as capable of setting up infection. There is reason for supposing that when once dry, these low germs can exist indefinitely with their evil powers latent but not destroyed. I said above that these organisms, or some of them, are usually found in abscesses. Practically, it might be said that they are always there, and they can be bred with ease and certainty from all *acute* suppurative processes.

Still it is not claimed that suppuration cannot occur without their presence, for it has been shown that croton oil, even when most thoroughly sterilized, will produce suppuration. The method of showing this is to introduce under the skin of rabbits fine glass tubes hermetically sealed, containing croton oil. This is done with full antiseptic precautions, and when everything has healed, the tube is broken subcutaneously and an abscess ensues. But the matter contained in the abscess has no germs in it, neither will it set up abscesses nor blood poisoning if inoculated into other animals.

With this very imperfect sketch, I will leave the subject of septic bacteria in general, to describe certain imperfect observations which I have attempted, in order to ascertain whether the puerperal inflammations are caused by the same agencies as other suppurations and blood poisonings, or are distinct and *sui generis*.

The question is of importance because such affections have been classified as a distinct disease, viz., "puerperal fever," supposed to be epidemic in the air, like smallpox for instance, and to prevail in certain places and at certain seasons owing to some mysterious epidemic influence.

During nearly three months of this year (1885), I endeavored to be present at the autopsies of all women who died in the General Hospital at Vienna, of puerperal diseases, or after gynecological operations; and in septic cases, whenever practicable, I took advantage of the courtesy and guidance of Prof. Kundrat, and of his accomplished assistants, Drs. Paltauf and Kolisko, to examine the fluids and organs for bacteria. I wish to express my gratitude to these gentlemen, and may here call attention to the many advantages for pursuing practical work in bacteriology in the Pathological Institute in Vienna. By the energy of Prof. Kundrat, the accommodations have been recently much enlarged, and a room specially fitted up for bacteriology, where Dr. Paltauf, who speaks English, gives regular courses to physicians, besides which at least three other courses are given elsewhere in Vienna.

The great advantage of an immense choice of fresh material, learned instruction in pathology, and skilful guidance in the technique

of bacteriology, all under one roof, is difficult to find elsewhere. Verily:

“Es giebt nur eine Kaiserstadt
Es giebt nur ein Wien,”

so far as concerns opportunity to employ all one's time profitably in the study of all, or various, branches of medicine. I do not wish, however, to detract from the great merits of Berlin as a place where each department of medicine is carried to the highest degree of perfection possible, particularly the subjects of bacteriology, antiseptic surgery and gynecology.

The advantages of Vienna, however, as a place for study, lie in the concentration of material, the arrangement of the courses, and the excellence of the teachers, and most of our countrymen studying abroad find that these advantages are sufficient to cause them to spend the greater part of their time there.

I approached the subject of puerperal fever, so-called, somewhat influenced or prejudiced by the opinions on that subject so ably set forth by Prof. Barker in his classical work, but was soon convinced that all the cases which I could examine, post-mortem, supported the view which I believe is usually held and taught in Germany and Austria, viz., that puerperal fever is the result of an invasion and multiplication of bacteria, arising from infection of the uterus or abraded vagina.

Under this view, what is called septicæmia would be considered merely as a symptom of the rapid entrance into the circulation of poisonous products of bacteria.

As this paper is rather intended as a means of inducing a discussion of the subject, than as an attempt to dogmatize or strictly to prove anything, I shall first mention a few facts which seem to have some bearing on the question, and then I will briefly describe a very few cases, or autopsies, and show some microscopic specimens of bacteria as found in the secretions, or fluids, examined.

Of course, even assuming that puerperal fever is caused by bacteria, very little light is shed on the practical question of how it is “caught,” unless the mode of infection can also be discovered.

For it is perfectly conceivable that bacteria, or their spores, may be blown about as dust, and thus come in by an open window, and perhaps be inhaled, or be wafted into the vagina, and so fill for the scientific mind the place of the time honored idea expressed by “catching cold.”

Now so many cases occur where direct infection cannot be shown, that this idea of infection by atmospheric germs has taken a strong hold on the profession and public, and is, of course, at the root of Listerism, spray, etc. It is too wide a question to discuss now whether there is much basis for this belief. It is certainly a comfortable doctrine, and it would shake the profession to its foundations if it were ever assumed by the doctors, and taught to the public, that for every unlucky case of puerperal fever and pyæmia some one were to blame for criminal carelessness; that in all such cases a diabolical coccus had hidden under a finger-nail or on a sponge or syringe and had directly poisoned the patient.

And yet, from my very imperfect observations of the natural history of the bacteria, found after death, in such cases, I should always regard the theory of direct infection more probable than that of dry septic dust in the atmosphere, that is in the general out-door atmosphere, and a contrast of the habits of the hospital assistants and students at Berlin and at Vienna merely strengthens this view.

For, as I will shortly explain, it seems to me a sheer impossibility that the Vienna lying-in and gynecologic wards could be as free as they are from septic diseases, if the germs thereof could readily be carried about in the air at large.

In Berlin, the most extraordinary precautions are observed to prevent the introduction of any septic germs carried on the hands, or even in the hair or clothing of those present at births or laparotomies, and, besides injunction as to cleanliness of hands, person, linen, etc., a most absolute promise is required of all proposing to be present as above, that they shall not go to any autopsies or pathological institute, nor visit septic cases.

The spray is used very thoroughly at operations, and everything is done which could be suggested by the belief or knowledge that septic bacteria or their germs are abundant in the air and easily portable in the dry state.

If this were really and practically the case, however, it would hardly be possible or conceivable that the great Vienna hospital should be and remain practically free from puerperal fever, and that the frequent laparotomies should show such good results as far as sepsis is concerned, for not only are the students present in the lying-in wards to be seen every forenoon at the autopsies, but the responsible assistants who perform the obstetric operations make it a rule to be present at the section of any case dying in their wards.

And this is not all, for the chief assistant of each division gives every afternoon a practical course of obstetric operations on the cadaver, and with no protection, except a rubber cot on each forefinger, drags badly-corned babies through the pelvis of a very stale cadaver, or demonstrates the ghastly realities of craniotomy and decapitation.

In an hour he may have to perform version on the living woman. Why does he not infect her? Practically he does not, of that there is little doubt, for the septic cases in the hospital do not originate there, but are sent in already in fever, to be delivered, after having been worked over outside, sometimes for several days, by mid-wives and doctors.

By the courtesy of Dr. Pritzl, First Assistant of the Clinic, I was enabled to watch pretty closely for cases of infection caused by assistants or students, and to observe the conscientious prophylaxis of the assistants. Although as a system, it is theoretically very dangerous, yet practically no ill results seemed to arise.

The assistants take a bath and change their clothes after their operative course on the cadaver, for the rest safety is sought and found in *thoroughly cleaning and disinfecting the hands and wrists before making any and every vaginal examination*, using soap, water, sublimate or permanganate of potash, and nail brush, again and again, with what to scoffers seems damnable iteration.

Laparotomies are done without spray, by Prof. Braun, with the same assistants who have charge of the labors as well as of operative courses on the cadaver, and in presence of a class of 100 or more, fresh from all sorts of wards, or from the pathological institute, seated in an amphitheatre, but not touching the patient or instruments. Yet there is very little sepsis. Of the last fourteen laparotomies of the course, done in the first two weeks of July last, all recovered but one, who sank, without fever, after the removal of a huge sarcoma of the ovary. Of course, every conceivable precaution is used to disinfect the skin of the abdomen, and the hands, sponges and instruments of the operators, but there seems to be no fear of dry germs in the atmosphere, and no reason to think that infection actually occurs in this way.

In a case which I shall shortly describe, where sepsis and death followed the removal of a fibroid polyp of the uterus, I believe it probable that the infection came from some of the numerous students who made digital examination just before the operation commenced.

The fact that such immunity from septic infection exists, where assistants and special students are continually handling the cadaver,

implies that thorough cleansing and disinfecting of the hands is a sufficient precaution and, perhaps moreover, since such disinfection would sometimes by accident be incomplete, that the bacteria found in ordinary cadavera (for, of course, those dying of septic maladies are not used for instruction) are not usually sufficient to set up puerperal or septic processes; and, I think it probable that this may also be true, although, of course, it would be unjustifiable to attempt directly to prove it; for I found, as far as my observations went, that in puerperal cases there was regularly present one or the other of the above kinds of micrococci, each very definite and breeding true in gelatine, viz., the streptococci or the staphylococci described by Rosenbach and Passett as the active agents in the infectious diseases of wounds, or the bacillus pyogenes foetidus.

The process seemed to be an inoculation of the uterus or abraded vagina (or the fluids or parts of placenta retained) with one or the other of the above varieties of micrococci; then emigration in purulent infection of the tissues adjacent, with formation of abscesses, in cases where the system tried to free itself from the invasion; later, or in some cases primarily, the micrococci were taken up by the veins, forming colonies in the softened thrombi, and thence were carried to the lungs, or joints, or other seats of pyæmic, or so-called metastatic, abscesses.

When infection takes place, it arises either from wounds or rents in the genital tract, or by absorption from surfaces not wounded but laid bare by the process of parturition.

In the former case, the infection is apt to be rapid, to run quickly over the pelvic areolar tissues, and end fatally with great rapidity.

“Where there are no wounds, the process may be also rapid, and here on examination hardened veins may be felt in one of the broad ligaments. In a few hours these are surrounded by hard exudations, which soon soften down, and with an overwhelming general blood poisoning, the patient dies pyæmic. Generally, however, the process instead of spreading by the veins, goes on by a creeping infiltration of the parametric areolar tissue with symptoms of more or less rapid septicæmia, according to the acuteness of the infection, the resistance of the organism and the treatment. The lymph glands offer some resistance, but it is insufficient, and the infection spreads, destroying everything in its course; usually nothing resists it, muscles, fascia, vessels, and glands are infiltrated and softened, and at any time the micrococci may pass into an eroded vein and terminate the process fatally, or by a

slower spread the phlegmon may increase until it reaches the peritonæum; or, happily, the mass becomes circumscribed by thick abscess walls, and begins to point towards the vagina, bladder, rectum, or abdominal walls; in this way it may be evacuated spontaneously, or reached by the knife, or troicar, and drainage tube of the watchful practitioner."

Virchow has given a most thorough description of the anatomical processes here considered. (V.'s Archiv, 23 Bd., 1862, 3 and 4 Heft, S. 415.)

Also Freund, in his new and monumental work, "Gynækologische Klinik," S. 238, describes the course of the disease as above, and insists on the distinction between the condition of the sheaf of vessels in the broad ligament in septic and in ordinary phlegmons.

In the first, *Plate A*, they are infiltrated, separated and their sheaf is broken up and destroyed, while in ordinary phlegmons the latter is preserved, although compressed or deformed, *Plate B*.

I subjoin two figures taken from Freund's work, to which I shall again refer.

(SEE PLATES A, B.)

Of course, it is *conceivable* that the infection in such cases is quite accidental, occurring from the micrococci floating in the air as dust, and in fact the researches of Passett show that the staphylococcus can be dried and yet preserve its life and power of development, and, moreover, that it exists independent of the human body; as, for example, in kitchen-sink water and in stale butcher's meat, and there is little doubt that wounds may be infected by this organism, either directly from the air or by its being deposited from the air on dressings or instruments, particularly in hospital wards where there have been cases of sepsis prevailing. But the more frequent organism in puerperal infections is the streptococcus, which does not appear to be as commonly met with apart from diseased persons, and their surroundings, and it seems very improbable that either of these varieties can get into the uterus except by direct importation, while no one now considers infection by inhalation as worth discussing. The fact is now established, at any rate, that, when hands and instruments are kept surgically clean, and no direct infection is allowed to occur, puerperal fever is abolished in properly-conducted hospitals, as far as concerns women who come into them before labor commences. As far as I could learn in Vienna and Munich, no cases, or almost none occur, except in women who are sent in already infected and in the

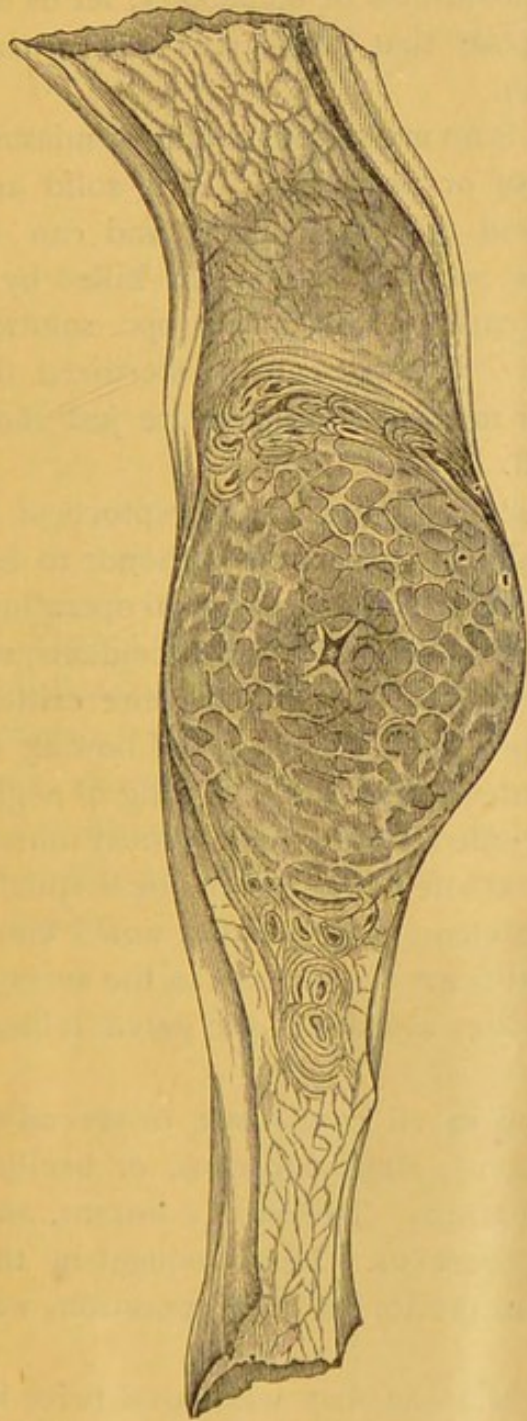


PLATE A.

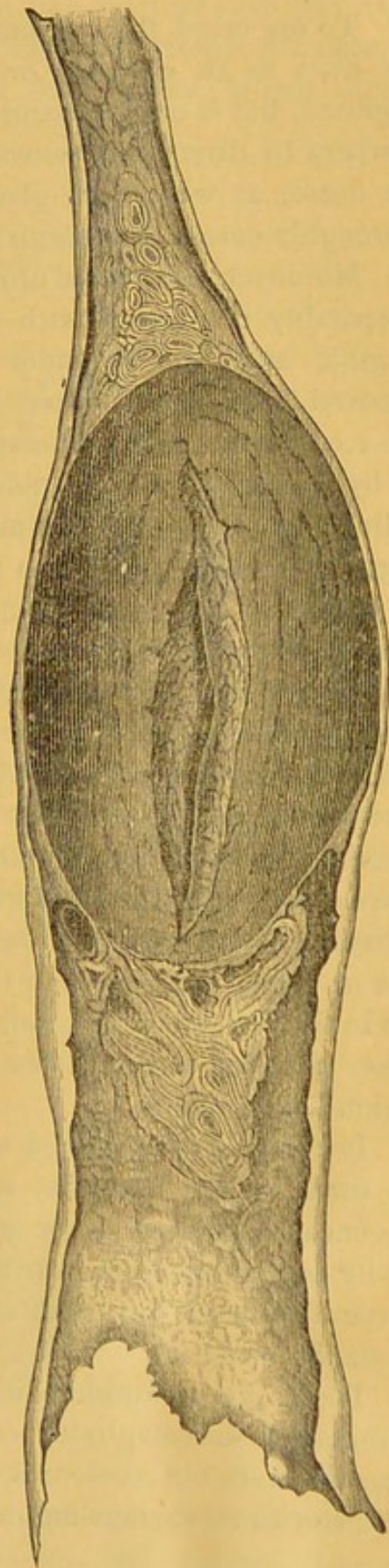


PLATE B.

throes of difficult labor. Yet the windows are open ; there is puerperal fever, so-called, always in the city ; there is free coming and going in the wards.

To my mind the inference is irresistible that puerperal fever does not exist as an endemic or epidemic disease in the sense formerly supposed, but is only a name for the symptoms of an infection of the puerpera by direct carelessness or uncleanness of somebody, let us say the nurse, as we would gladly suppose that physicians are *always* thoroughly careful and surgically clean.

Moreover, the source of infection is no mysterious aroma or miasma, inseparably connected with the nurse or physician. It is solid and tangible and usually under or around the finger nails, and can be removed by soap and water, by baths and nail brushes, or killed by a 1 to 1,000 solution of sublimate, or by carbolic acid in two ppc. solution or by permanganate of potash, etc. Clothes can be sterilized by baking them in an oven for an hour or more at a temperature just short of 300° F., where they begin to scorch.

The day is at hand when the presence of chains of streptococci in a puerperal woman will be considered a disgrace and dishonor to her accoucheur, and this standard is already attained in surgical operations in the best hospitals. I do not say that at present all such accidents, so-called, can be avoided, but I am sure that there will be a more critical spirit in the public as well as in the profession ; less talk of bowing to the visitations of an inscrutable Providence and more reviling of negligent doctors, and I trust more care in selecting properly-trained nurses. Deliveries at home ought to be at least as safe as those in public hospitals. Five or even three years ago they were incomparably safer, now I know that in the *best* public hospitals, the results are better than in the average home, provided not only death but lighter cases of septic pelvic inflammation are included.

In the bodies examined were found in all cases, one or several of the three septic bacteria, streptococcus, staphylococcus, or bacillus pyogenes foetidus, alone or in combination. The most constant, and usually occurring alone, was the streptococcus. Less frequent in the puerperal process, but more common in peritonitis after operation, was the staphylococcus.

The *B. pyog. foetidus* did not occur alone, but was found twice in combination with staphylococci in cases of which I will speak more fully. The cases were not numerous enough, nor do I have sufficiently accurate histories to warrant me in drawing any conclusions as to compara-

tive frequency ; but they seemed fair average cases, and I will briefly report what I found, my intention being rather to show the specimens, as average samples of what usually occurs, than to enter into any argument to prove that bacteria, and nothing else, are always the cause of septic processes, a fact which personally I believe, but which cannot be demonstrated in a forty-minute paper.

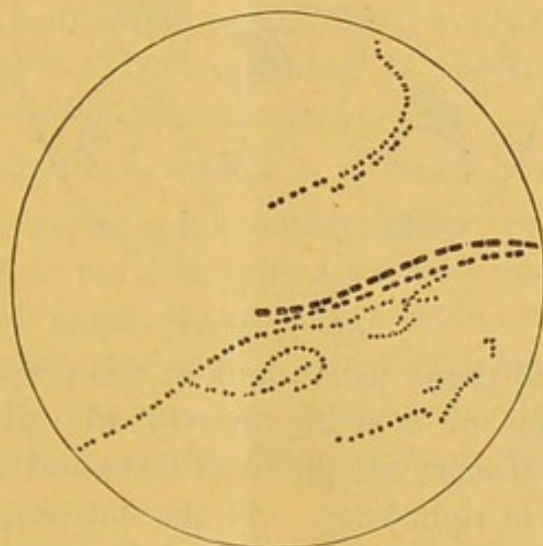


Fig. 1. 800 x.

First I show, *Fig. 1*, for purposes of comparison, streptococci of erysipelas from a culture in meat-water-peptone gelatine. You will see micrococci always in pairs, forming chains or resembling strings of beads. Some chains, however, are much larger than the others, and the links form short rods, each rod being just about to divide into two members. The difference in the size of the different cocci is quite noticeable.

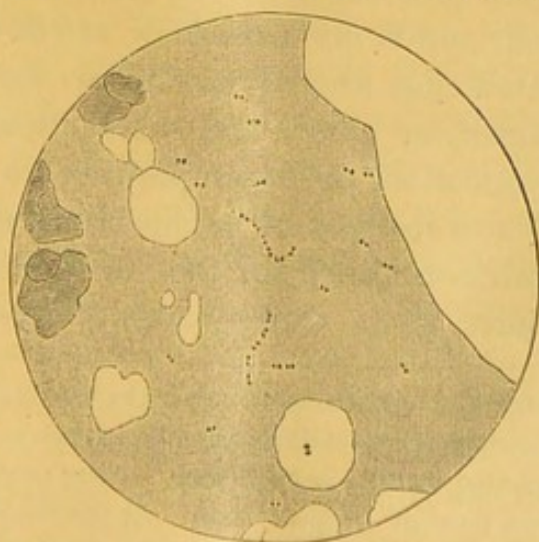
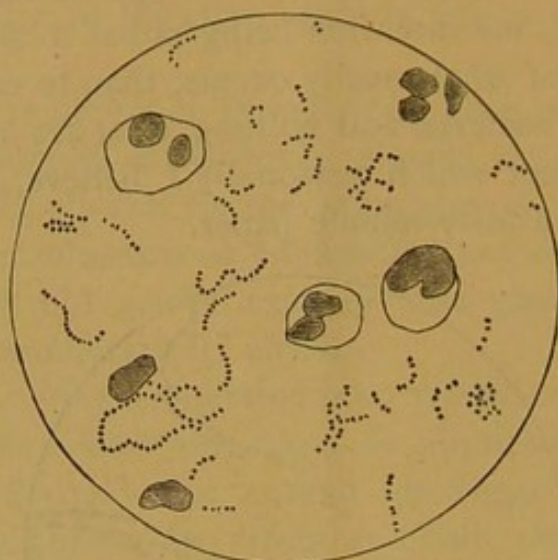


Fig. 2. 800 x.

I next show, *Fig. 2*, similar chains from a phlegmon of the arm, in a case of paralytic dementia, where the infection had resulted from a scratch, setting up a diffuse cellular inflammation.

*Fig. 3, 800 x.*

Having observed these, please look at this preparation of pus, *Fig. 3*, from the knee-joint of a young woman, who died some two weeks after delivery, with obscure symptoms of fever and stiffness in the neck, with moderate pain in right knee. At the autopsy, the uterus was not apparently diseased, nor was there any pelvic abscess, but the right sterno clavicular articulation and the right knee-joint were full of creamy pus, which looked laudable, but was filled with chains of streptococci.*

I will here state that every care was used in taking the specimens examined; the skin was well washed, also the knife used, and the pus was aspirated into capillary tubes, which had been sterilized and sealed beforehand. The examination of the pus, or blood, was made at once, so that there is no doubt that whatever you see came from the interior of the bodies examined, and is not a result of accident or carelessness.

This case represents a class where infection has occurred usually from the hand of the physician, or nurse, and where death results without noticeable pelvic inflammation, or decomposition in the uterus. The resemblance of the chains to those of erysipelas is very interesting in view of the fact, so well established, of the infection of many puerperæ by physicians who have taken care of cases of erysipelas. This fact,

* Dr. Biggs, of the Carnegie Laboratory, New York, kindly furnishes the following description. "In a case of low septicæmia following confinement, a suppuration of the right knee-joint developed about two weeks after delivery. After death, the pus in the joint was found to contain a pure form of streptococcus. At the temperature of the human body, this germ grows extremely slowly upon agar-agar, forming a very delicate, transparent, and easily perceptible layer upon the surface of the agar. It also grows very slowly in gelatine, and only reaches a very moderate development when the growth ceases; it induces slight liquefaction of the gelatine." Dr. Biggs had no opportunity to make experiments with it on animals.

so well described by O. W. Holmes many years ago, in his work, entitled "Puerperal Fever a Private Pestilence," and so often noticed since, was well illustrated by Dr. H. O. Marcy, who last summer reported five consecutive cases of puerperal fever seen by him in consultation, where the physician who attended them all consecutively had first had charge of a case of facial erysipelas. The last of these cases developed cutaneous erysipelas around the buttocks, and from the fluid in the blebs which were developed Dr. Marcy reports that he cultivated chains of streptococci. Or to go back to the first authorities, let us remember the aphorism of Hippocrates,

**Ἦν γυναικὶ κυούσῃ ἐρυσίπελας ἐν τῇ ὑστέρῃ γένη θανατῶδες*

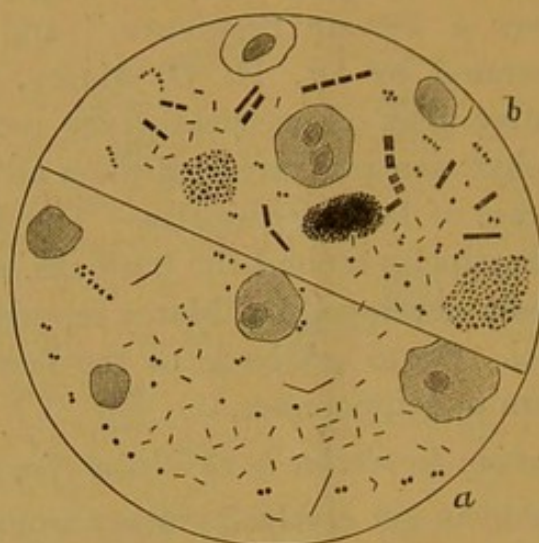
"If a pregnant woman get erysipelas in her womb it is fatal."

It is interesting to note, in connection with the suppuration in the knee-joint above mentioned, that Löffler,* in his experiments with pure cultures of streptococci, repeatedly found that, after injecting them into the veins of the ear in rabbits, abscesses formed in the joints of the hind legs of the animals, which, being opened, were found to contain streptococci.

The next case to which I shall call your attention came into the hospital feverish, and was delivered, and as the pyrexia continued, she was sent to one of the medical clinics, after a few days, to avoid danger to the other lying-in women. The lochia became extremely offensive, the fever and chills continued, the skin grew yellow, and she died in about a fortnight, with all the symptoms of pyæmia, or we will say blood-poisoning.

At the autopsy, the uterus was found to contain a piece of placenta, perhaps one and one-half inches square, with a great deal of horribly offensive putrid fluid. There was pus in the uterine and iliac veins, abscesses in the parametrium, and in other parts, especially the lungs. I show specimens, *Fig. 4*, from the iliac vein, *a*, and from the blood pressed from a cut in the lung, *b*. You will see a very few micrococci in chains, and many of the thick bacteria of decomposition, besides the bacillus pyogenes foetidus of Passett; these last probably accounting for the terrible odor. Staphylococci are also present in large numbers, forming the characteristic evidence of infection, appearing in clusters like bunches of grapes, staphyloi, or in larger masses like spawn of frogs or fish. They also occur alone, or in pairs, and when pairing or dividing, resemble short bacilli. As for the chains present here and in the next case, they are

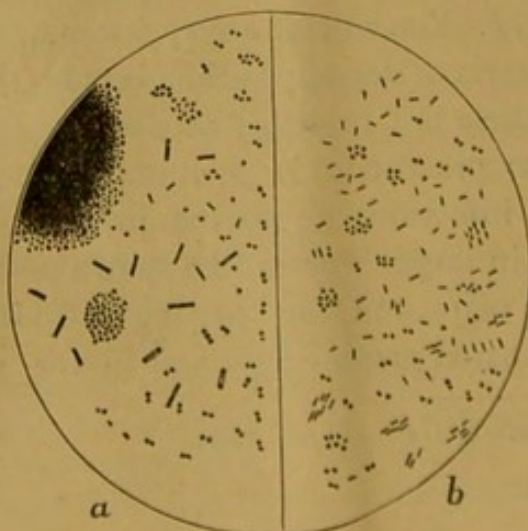
* Mitth. d. Kais. deutsch. Ges. Amtes, 1884.

*Fig. 4, 800 x.*

so few in number, and show so little evidence of arrangement in pairs that I think they should be considered rather as a casual or accidental arrangement of the staphylococci, than as streptococci proper.

The last case to which I shall refer is that of a woman who had a myoma of the uterus as large as an infant's head, growing on a pedicle about one and one-half inches thick. This was removed by the vagina, by Carl Braun, and the pedicle severed by the galvanocautic wire.

Just before the operation, while under chloroform, digital examination was made by a large number of students present, and although they all washed their hands previously, yet some of them probably did not do it thoroughly. After the operation, the uterus was well doused with bichloride, and the stump powdered with iodoform, yet it was insufficient. Some micrococci had been inoculated, where the disinfectant could not follow them, and in a few days the patient died septic. The autopsy showed pus infiltrated in the stump, and from there the infection had spread, causing abscesses in the pelvis, etc.

*Fig. 5, 800 x.*

I show you a specimen of pus taken from the stump, *Fig. 5, a*, at some one-half an inch from the cut surface; it is filled with masses of micrococci, evidently staphylococci and there are *bacilli pyogenes fœtidi* in abundance, also bacilli of putrefaction, the saprophytes of Rosenbach.

I show also from this case, *b*, a preparation from a second culture, in meat-water-peptone gelatine, which shows the same organisms, the *b. p. fœtidi*, which grow most rapidly, being now the most abundant.

Here is also for comparison a preparation from pus, from a case of acute infectious osteomyelitis of the tibia, or necrosis, as we used to call it, showing the staphylococci, and also one, *Fig. 6*, from a second culture of the same.

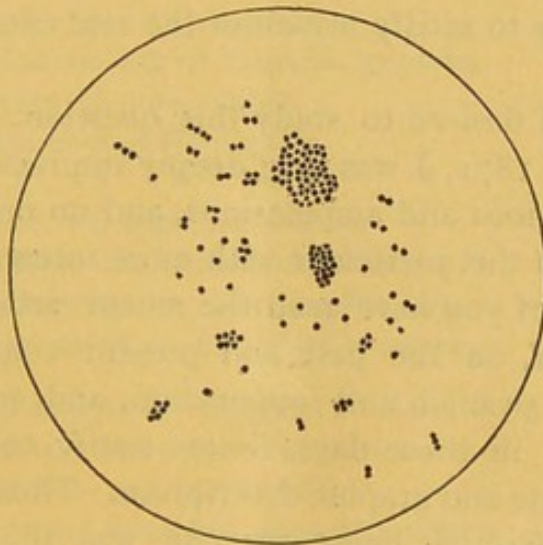


Fig. 6, 800 x.

Likewise here, *Fig. 7 and 8*, is a very thin section of a kidney, a so-called surgical kidney, showing the plugging of the tubules with

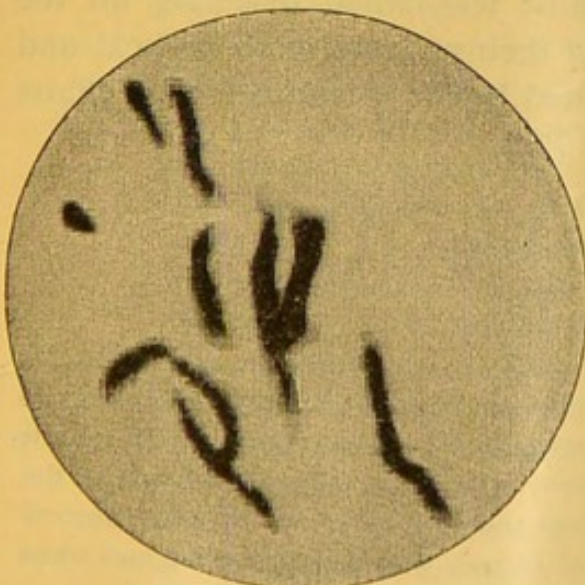


Fig. 7, 100 x.

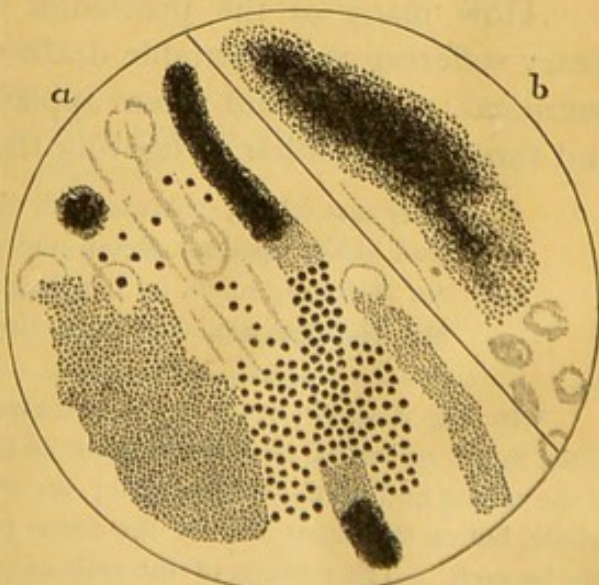


Fig. 8a, 300 x.

Fig. 8b, 800 x.

masses of the staphylococci, and the heaping together of white cells, which is Nature's mode of fencing out the intruders by the formation of an abscess.* Although this specimen did not come from a puerpera, yet it is just as valuable, for the same condition is not infrequent in puerperal septic inflammations, and it demonstrates perfectly how these bacteria are carried about by the circulation, how they are deposited, forming so-called metastatic abscesses, and how the system tries to repel and eject the invaders.

I hope that I have not taken up too much of your time in describing these investigations. They were not made for publication, and hence the general nature and imperfectness of the above descriptions. I was working merely to satisfy myself of the real cause of pyæmia and septicæmia.

For years I had desired to study this question, for, as interne of Bellevue Hospital in 1871, I was very deeply impressed by the terrible mortality after operations and amputations, and no one has followed the progress of science in this particular with more interest than I.

I suppose most of you have read the recent article of Dr. Stephen Smith, in the *Record*, on the past and present condition of Bellevue Hospital in regard to pyæmia and suppuration, and, as one who followed that revered teacher in those days, I can testify to the vivid picture recalled by his accurate and graphic description. Those were the "good" old times when the faithful house surgeon was thought to have done well if he had no maggots in the wounds in his wards in August, and when the whole staff would poke their fingers into a compound fracture before putting it up, and carefully wash their hands *afterwards*.

How many of the profession must feel, when reflecting on the weary suffering and miserable death of their patients, both surgical and puerperal, as Faust did when applauded by the peasants for his efforts and those of his father in fighting the Pest.

Hier sass ich oft gedankenvoll allein
Und quälte mich mit Beten und mit Fasten.
An Hoffnung reich, im Glauben fest,
Mit Thränen, Seufzen, Händeringen,

* In *Fig. 8, a*, the artist has represented the nuclei of the leucocytes on each side of the figure rather too small; the nuclei of the epithelial cells are shown in the middle of the tubule and on either side of it; the staphylococci form plugs at each end of the tubule, but on the inner ends of the dense plugs and on their edges the staphylococci can be seen. The outlines of the cells cannot be seen with the Abbe-condenser when the diaphragm is removed in order to see the cocci.

Dacht ich das Ende jener Pest
Vom Herrn des Himmels zu erzwingen,
Der Menge Beifall tönt mir nun wie Hohn,
O könntest du in meinem Innern lesen,
Wie wenig Vater und Sohn
Solch eines Ruhmes werth gewesen !
Mein Vater war ein dunkler Ehrenmann,
Der über die Natur und ihre heilige Kreise,
In Redlichkeit jedoch auf seiner Weise
Mit grillenhafter Mühe sann * * *
Hier war die Arznei, die Patienten starben,
Und Niemand fragte : wer genas ?
So haben wir * * *
Weit schlimmer als die Pest gelobt.
Ich habe selbst das Gift an Tausende gegeben,
Sie welkten hin ich muss erleben
Dass man den frechen Mörder lobt.

* * * * *
Ach, glücklich, wer noch hoffen kann,
Aus diesem Meer des Irrthums aufzutauchen !
Was man nicht weiss das eben brauchte man,
Und was man weis kann man nicht brauchen.

Here, lost in thought, I've lingered oft alone,
When foolish fasts and prayers my life tormented.
Here, rich in hope and firm in faith,
With fears, wrung hands and sighs, I've striven,
The end of that far spreading death
Entreating from the Lord of Heaven !
Now like contempt the crowd's applauses seem ;
Couldst thou but read, within my inmost spirit,
How little now I deem
That sire or son such praises merit !
My father's was a sombre brooding brain,
Which through the holy spheres of Nature groped and wandered,
And honestly, in his own fashion, pondered
With labor whimsical and pain :

* * * Death the patient's woes soon ended,
And none demanded : who got well ?
Thus we * * * worse than the pestilence have passed.
Thousands were done to death by poison of my giving ;
And I must hear, by all the living !
The shameless murderers praised at last.

* * * * *
O happy he, who still renews
The hope, from error's deeps to rise forever !
That which one does not know, one needs to use
And what one knows, one uses never.

But it was the dawn of the new day. Lister was beginning his teachings, and he found willing listeners in Bellevue, until now suppuration is abolished *there* and abdominal section is performed weekly or oftener with less than seven per cent. of mortality, including all cases. Now all these questions are clearing up; antiseptic surgery is almost a fixed science; but much of the old mystery and confusion still clings to the puerperal processes. Not every one is willing to allow the analogy between operations and deliveries, and to consider every puerperal fever as an infected wound.

If my imperfect observations have made the analogy more striking in your minds, I shall be more than satisfied, but before closing I will make a very few more remarks concerning treatment, and treatment is naturally divided into prophylactic and remedial. There is no need to emphasize the superiority of the first, especially in such a grave disorder, and I presume that all are agreed that the strict rules of surgical antisepsis should be extended to mid-wifery. I have already outlined to-night the precautions on the part of the accoucher as to perfect cleanliness, which the patient has a right to expect; but to make the patient aseptic, the precautions must be taken before labor and during delivery. We must not depend on perfunctory injections, given by ill-trained nurses, after labor; on the contrary, they are unnecessary and ill-advised in cases of normal labor.

I will quote a few lines from a letter which I wrote from Berlin last spring, published in the *Boston Medical and Surgical Journal* of May 14, 1885, as to the prophylactic treatment in Berlin, which may be taken as a type of that in German and Austrian hospitals:

"After a bath and scrubbing of the body, and especially of the genitals, with soap and water, the vagina is well and thoroughly douched with a solution of corrosive sublimate in water 1:5000, and the external parts and ostium vaginæ are washed with a solution of the same, 1:1000; whenever during labor there are repeated digital examinations, the vaginal douche 1:5000 is used again.

"Toward the end the vulva is well anointed with corrosive sublimate in glycerine 1:1000. After delivery of the placenta, ergot is given, and the vagina is well washed out with the 1:5000 solution. If there has been any operation, the uterus is also washed out with the same solution. Then the vulva is washed and douched with the 1:1000 solution.

"After that there is no more vaginal douche and no need of it. External cleanliness and daily washing of the vulva with 1:1000 sublimate solution suffices.

“The most scrupulous care, however, is taken to prevent infection by the doctors or nurses during delivery. Everywhere in the wards, and in the lying-in rooms, are abundant facilities for hand washing, which is not a simple form, but a real scrubbing of hands and arms up to the elbow.

“This is done most thoroughly before and after examinations per vaginam, and in deliveries the hand is always put into the 1:1000 sublimate solution before making an examination. It is then not dried, but oiled while wet and so introduced.

“*Finis coronat opus.*”

In order that this opinion may not seem to rest too much on my own way of thinking, I will again quote from Freund, whose great work is the latest authority on the subject.

“But since the successes of lying-in institutions have clearly shown that the above affections (septic parametritides), which represent the chief contingent of the diseases grouped together as puerperal fever, can be so far prevented that a healthy puerpera does not get sick, and one casually brought in already sick after labor does not become a fire-brand to infect the many puerperæ lying in the hospital, it is well that every one to whom such an institution is entrusted should declare the principles on which he administers his responsible office, and should emphasize those controlling influences which seem to him to be the most important.

“Taking for granted the conscientious performance of the general antiseptic precautionary measures, which at present have long become part of the code of medical propriety and professional honor, I consider the chief factors of prophylaxis to be: a delivery as gentle as possible, avoiding lesions; a strictly surgical treatment of any injuries that may have occurred (careful suture); the so-called expectant management of the period of labor following the birth of a child, leaving, under normal conditions, the expulsion of the placenta to the forces of Nature; *the leaving undisturbed the internal genital apparatus of the healthy puerpera*; finally the local treatment of local, carefully diagnosed, affections of the genitals during the puerperal period.”

If, nevertheless, we have to treat a case where it appears that infection has taken place, where fever, chill, or foul lochia show the inception of trouble, here surely something more is due from the physician than to order the nurse to give a vaginal douche of slightly carbolized water.

Time is precious, a very few hours may be enough to find his patient fatally infected. He must satisfy himself by a careful examination of the condition of the parts, whether there are any secundines in the uterus, or any rents or wounds to absorb septic matter.

He must himself wash out the uterus and not merely the vagina, as often as is necessary, with simple water, or better, with two per cent. carbolized water, or 1:1000 sublimate solution. In bad cases this may have to be done very often. Wiley reports cases where even once

in two hours was not sufficient, but the patient was saved by very frequent disinfective douches.

Iodoform is also of great value in pencils in the uterus, in gauze in the vagina, or in powder on abrasions or wounds.

In short, the accoucheur must work as promptly, conscientiously and energetically as would a surgeon who found a case of compound fracture doing badly, and feel as little disposed as would a surgeon in such a case to leave to a nurse what he ought to do himself.

Time forbids any attempt to enter here into the relative merits of different antiseptics, or the question whether simple water is not enough. Each method has its partisans, and each likes the treatment that suits his ideas or pleases his vanity.

Trahit sua quemque voluptas.

I can only insist that the matter is to be decided on strictly surgical principles, such as would govern the treatment of any "pus cavity" or infected wound difficult of access and situated near vital parts.

Thus we see that if every fatal case is an infection, not every infection need be fatal. It is not only a question of seed but also of soil and of conditions, or as Hippocrates said in an aphorism, that in every case there are three factors, the disease, the patient, and the physician. If bacteria could always fatally infect, the human race would long have ceased to exist. But here, as in the case of other infections, the human organism fights against the lower forms, and is often victorious, *provided the continued source of infection is early enough removed* by cleansing the cavity of the uterus, and provided the system is supported and the constitution is not overwhelmed by an irresistible infection, or weakened by previous disease, or by hunger, grief, or shame. Under favorable circumstances, the invading bacteria are caught and fought by the wander-cells; they are fenced off in closed abscesses, and kept prisoners until they die or are evacuated.

Symptoms of sepsis are, therefore, not a signal for blank despair, but are a call to conflict, a summons to attack the *materia peccans* in front and rear, generally and locally, especially locally; and in nothing is the *prompt* and judicious interference of the physician more satisfactory than in these cases.

When a puerpera gets a chill and has fever, we must not think, "oh, dear; she has puerperal fever; she will die." We must think, as the surgeon does when his patient shows similar symptoms, "aha, there is pus collecting somewhere; I must find it, I must wash it out, I must drain it."

168 Newbury Street, Boston, October 29, 1885.