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BY

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The bacteriology of the genital tract in various normal conditions:

In the New-Born Child, in almost all cases, no germs are found in the vagina. Very soon, however, they enter, favoured by baths, washing, the application of oils, etc. Stroganoff states that a breech delivery of a female child favours their premature entry. Within the first two weeks gelatine-liquefying germs are rarely found.

In Girls and Women various bacilli and cocci may be found in the vagina, as well as sarcinæ, yeast fungus, etc. One of these germs is very common and is called Döderlein's vaginal bacillus. The pathogenic organisms flourish best when the vaginal secretion is alkaline; in acid conditions they are weakened in vitality or killed. As a rule no germs are found in the uterus or tubes. Menge has carried out an interesting series of experiments regarding the bactericidal properties of the vaginal secretion in a large number of non-pregnant women. He introduced into the vagina a number of pathogenic organisms, viz.: bacillus pyocyaneus, staphylococcus pyogenes and streptococcus. In all cases he found that within 70 hours they had been destroyed or their virulence greatly diminished.

He also carried out the following experiments. The vagina was carefully sterilised in the case of 70 women on whom abdominal section was to be performed. About 16 days after the operation the vaginal secretion was carefully removed and alkaline agar plates innoculated. In 62 cases the plates remained absolutely sterile. It was different, however, with specimens taken from the vulva for 66 of these gave rise to growths on the agar, only 4 being sterile. Of the 8 cases in which the vaginal secretion gave rise to growths, the germs were not pathogenic.

In 12 cases acid agar plates were also employed, cultures being obtained in 6 cases (mostly consisting of bacilli); while in the same cases only 3 cultures were obtained on alkaline plates. (These few experiments are not, however, of particular value, for pathogenic germs without exception develop in alkaline media and not in acid media.)

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In another series of experiments, 12 in number, he used grape-sugar agar and obtained cultures 11 times, thus demonstrating the frequency of non-pathogenic anaërobic germs in the vagina.

Döderlein has advanced the view that the micro-organism which he has called the " vaginal bacillus," of anaërobic growth, produces an acid secretion, which is the cause of the normal vaginal reaction and prejudicial to pathogenic organisms.

Menge, however, believes that the vaginal secretion, whether alkaline or acid is bactericidal to these organisms and he believes that the acid secretion of Döderlein's bacillus plays an unimportant part in the purification of the vagina. Of more importance is acidity due to other causes (found in the new-born child when no germs are present). But a considerable role is played by phagocytes and leucocytes which enter the vagina. The chief agents are, however, the anaërobic germs and their growth-products. In proof of these statements, Menge made the following experiments. He removed the acid secretion from the vagina in sterilised holders and innoculated it with staphylococci. The latter were soon destroyed. If the secretion were previously sterilised with steam the staphylococci lived for a considerable time or were not killed at all.

If the secretion were made weakly alkaline, the cocci lived longer than in the acid solution. If the alkalised secretion were sterilised by steam before hand, the germs flourished vigorously.

Menge believes that the tissue fluids possess this bactericidal action, and that this is found in the new-born child, whose vagina is free of germs. The absence of oxygen is also an important factor.

In the order of their importance the factors destructive to pathogenic microbes in the vaginal secretion may be arranged as follows according to this investigator :

1. The antagonism between the normal vaginal bacilli and the pathogenic organisms.
2. The products of the vaginal bacilli.
3. The acidity of the secretion.
4. The secretion of the vaginal wall.
5. Leucocytes ; phagocytes.
6. The absence of free oxygen in the vagina.

It is important to note that the vaginal secretion may vary greatly in its effects on pathogenic organisms. In some cases it may quickly destroy them ; in others it may only weaken them or destroy their virulence, as Winter has shown. Their virulence may be retained, if the nature of the secretion be altered, *e. g.*, by dilution, by secretions

from inflammatory areas, *e. g.*, gonorrhœa in the cervix, or by the addition of solid organic debris.

Secretions poured into the vagina from inflammatory conditions in the uterus weaken the power of the vaginal secretion. In 10 cases in which there was gonorrhœal inflammation in the uterus, the vaginal secretion contained numerous streptococci. If the vagina in these cases were completely disinfected with strong antiseptics *e. g.*, carbolic acid, lysol, corrosive sublimate, and then left for some hours, the streptococci again appeared in the vaginal discharge in 3 to 6 hours. On the other hand, if at the same time the interior of the uterus were thoroughly disinfected with a 50 per cent. chloride of zinc solution, the cocci in the vaginal secretion thereafter disappeared.

As regards the normal uterine canal Menge finds that organisms do not dwell in it, though the secretion be alkaline. The cervical mucosa, according to him exercises a protective influence. He innoculated the cervical canal with streptococci and staphylococci in 15 cases and within 12 hours found the cervical mucus sterile.

The normal tube is always sterile. Menge examined 83 specimens and obtained a culture only from one, in which there was an infective endometritis associated with a carcinoma of the cervix.

As regards the influence of Menstruation.—Jacobs and others state that the vaginal organisms are increased during the period of the flow owing to the diminution in the acidity of the normal vaginal secretion as a result of the entrance of the blood. Stroganoff examined the cervix during the menstrual flow and found that in many cases it contained germs, though none that would liquefy gelatine. It is probable that some germs are washed out by the menstrual blood, and that the vaginal secretion loses some of its strength by the dilution which occurs.

In Pregnancy, the vaginal secretion is believed to be very germicidal to pathogenic organisms. Stroganoff found plenty of ordinary vaginal bacilli, but rarely germs that would liquefy gelatine. Krönig performed a number of experiments on pregnant women, introducing various organisms into the vagina. He found that the streptococcus was killed before the staphylococcus, and showed that douching of the vagina with antiseptic solutions reduced or destroyed its germicidal power, and that the use of plain water slightly diminished it. He thinks, therefore, that prophylactic syringing before confinement can do no good and may be a source of harm.

Stroganoff also found various microbes in the vaginal secretion, but none of them would liquefy gelatine by their growth.

In the Puerperium, the use of antiseptic solutions in the vagina

after labour is being discarded by many authorities, save where digital examination has been carried out, where labour is abnormal, or where operations have been performed ; and in cases where the patient may be depressed in health from various causes, *e.g.*, nephritis, heart disease, syphilis, anæmia, etc.

If, however, there be any inflammatory condition in the cervix, vagina or vulva (especially if of a possible gonorrhœal origin) there is a very strong indication in favour of employing vigorous antiseptic douches.

In Abortions, the vaginal reaction varies according to the amount of blood and debris found in the vagina. The germs also vary greatly in number and nature from time to time ; the pathogenic organisms are more apt to be found in the vagina and cervix in connection with abortions than in other conditions, probably chiefly due to the frequent digital manipulations that are carried out or to the carelessness of women in having themselves attended to.

In Old Age, Stroganoff finds various microbes in the vagina, mostly rod-shaped, and smaller, on the whole, than those found during the period of sexual life.

The vaginal secretion is only faintly acid ; in the neighbourhood of the cervix it is neutral or alkaline.

In the cervix living germs were found in about 50 per cent. of cases, though very rarely were any of them able to liquefy gelatine in their growth.

The Bacteriology of the Urethra.—Various germs may be sometimes found in the urethra in health. Gawronsky's experiments may be quoted. He made cultivations from the urethral secretion in 62 cases. In 15 of these bacteria were found, in 8 staphylococcus pyogenes albus, in 2 the bacterium coli commune. Amongst the negative cases were 10 where the women had peri- or parametritis, 6 prolapsus uteri, 3 pregnancy.

The Bacteriology of the Intestines.—Various forms of micro-organisms are found in the bowel. It is not necessary to specify these ; the germ which is of chief importance as an infective agency is the bacterium coli commune.

Relation of Micro-organisms to Pelvic Diseases.—At the present time the tendency is to attribute the great majority of inflammations which occur in the peritoneum, cellular tissue and viscera of the pelvis to the action of micro-organisms. The inflammatory processes are simply, to state the modern view, the series of phenomena caused by nature's resistance to the noxious influence of the infecting organisms. These processes are, therefore, not evil in themselves, but are bene-

ficent and purposeful. The most important germs which act as infecting agents are :

Streptococcus pyogenes (most frequent source of trouble).
Staphylococcus pyogenes aureus.
Bacterium coli commune.
The following are less often a source of trouble :
Staphylococcus pyogenes albus.
Staphylococcus pyogenes citreus.
Staphylococcus epidermidis albus.
Bacillus pyocyaneus.
Diplococcus pneumoniæ.
Tubercle bacillus.

These germs may gain entrance by the vagina, rectum, bladder, intestines, or may be carried from some distant part by the circulation.

The conditions which favour their entrance are a favourable soil, *e. g.*, a raw surface, a tissue of impaired vitality, a general condition of bad health in which the power of resistance of the tissues is reduced, dying organic matter such as blood-clot, remains of placenta or membranes.

In some cases the micro-organism *e. g.*, the gonococcus is capable of attacking the tissues and of setting up specific reaction when the individuals are in a state of perfect health. The most common source of entrance for the various germs is, undoubtedly, the vagina. They may spread into the uterus and tubes and may infect the peritoneum and ovaries ; this may take place either by an extension of infective activity along the mucous membrane or by advance as a result of germ-development in a favourable medium lying within the genital canal. They may enter a raw, injured or diseased surface and then spread to cellular tissue, peritoneum, tubes or ovaries, or even to more distant parts by means of blood-vessels and lymphatics.

The exact relationship between germ-action and various other factors which have long been regarded as causal in the production of pelvic inflammation has not yet been definitely established.

Thus menstruation has always been considered important especially in relation to the development of inflammation in the uterus, a chill or some extra exertion being considered as playing a leading role in precipitating the inflammatory processes.

Now-a-days, we are rather inclined to regard menstruation as a factor in altering the nature of the vaginal secretion, rendering it, by the addition of alkaline blood, more suitable for the growth of pathogenic germs which might enter the vagina, and making it more easy for them to spread into the upper genital tract and attack the tissues.

It is possible, also, that such influences as chill and fatigue, by diminishing the resisting power of the tissues, render them more susceptible to the action of germs.

Excessive coitus, especially at menstruation, is said to lead to inflammatory changes, especially in the uterus. There is, however, no proof that the mere physical excitement can induce these. Most likely it requires to be combined with microbial activity; the irritation of the tissues caused by the excessive movements in some measure depressing the vitality of the tissues and thus favouring infection by germs which might be present. When it occurs at the menstrual period there is also to be considered the altered nature of the vaginal secretion favouring the development of micro-organismal growth.

In some of these cases, in which the inflammation is supposed to be due to coitus, gonorrhœa is the infecting agent; either an acute gonorrhœa existing in the man or a latent gonorrhœa in the man or woman. In the former of these the virulent germ attacks the woman directly, its infectivity being unaffected by the action of coitus; in the latter the latent condition is stirred into a renewal of activity as a result of the irritation and excitement of the excessive coitus.

The Influence of Labour has long been regarded as most important among the factors causing pelvic inflammations. In the puerperium many conditions favourable to the development of micro-organisms are present. The vitality of the tissues in general is impaired as a result of the fatigue of the pregnancy and labour; the uterus is weakened by its great exertion in delivery, the condition of its circulation is greatly altered owing to the contraction and retraction of its musculature, and its tissues are below their normal standard of strength owing to the puerperal retrogressive changes which take place in them; the inner surface affords a large absorbing area; the placental site presents a number of opened blood-sinuses in which blood-clots are formed; blood-clot often lies in the uterine cavity and portions of the placenta and membranes may be left in it; the cervix, vagina and perineum are more or less bruised and very frequently lacerated.

That the bruising and laceration *per se* can start an inflammation is very doubtful and, by many, is not at all believed. Were it not for the irritation of germs or their products, wounds would heal by direct union or by granulation, without the accompaniment of inflammatory processes.

Certain other conditions in the puerperium are believed by many to lead to inflammation, viz., too early rising, walking or working. It

is very doubtful, however, if these influences can bring about metritis in the uterus directly. They act undoubtedly mainly by impairing the vitality of the tissues and thus favouring infection by germs. It is very noticeable that these conditions are, in many instances followed by no disturbance whatever. Among the labouring classes may be found a large number of women who systematically rise early after child-birth and go to work, in whom no inflammatory changes, whatever, follow.

Injuries resulting from operative measures may also lead to conditions which favour microbial infection, *e. g.*, bruises, tears, cuts; the irritation of a pessary may also act in the same manner.

The influence of all diseases which weaken the system is one which acts as a predisposing cause. It is believed by several that in certain states, *e. g.*, rheumatism, malaria, scrofula, constitutional syphilis, there is a special tendency to inflammatory changes in the pelvis, but their mode of action or their relationship to microbial action is not known. They would certainly act in one way viz., by depressing tissue vitality.

Regarding the modes of action of the various forms of streptococcus and staphylococcus, their various life-histories and the changes brought about by them in the body nothing need be said here, since these matters are fully discussed in works on bacteriology and surgery.

Different tissues are affected, different reactions brought about and different results produced. These differences depend upon the mode of entrance of the germs, their virulence, the nature of the soil on which they grow, the power of resistance of the tissues.

Special reference must, however, be made to the part played by certain specific organisms.

Gonococcus.—Since Nœggerath published his first paper in 1872, on the relation of gonorrhœa to pelvic disease, an immense amount of attention has been directed to this subject. In Great Britain, Sinclair, and in Germany, Sänger have been among the most prominent of those who believe in the profound importance of this relationship. Gonorrhœa may affect the pelvic soft parts in different conditions.

Acute Gonorrhœal Infection.—All agree that the vagina may be readily attacked by the gonococcus in childhood. There is some difference of opinion as to the areas which it may attack in the adult. For many years Bumm's views have been most widely held. He stated in 1880, that this organism could not develop in the stratified squamous epithelium of the vagina, being limited in its attacks to the urethral and cervical mucosa. This statement was based upon a number of experiments of the following nature. Active gonococci were placed in contact with the vaginal walls for 12 hours, no vagini-

tis being set up. He also excised a portion of the wall in a bad case of gonorrhœa and failed to find gonococci in it. He believed that the swelling and tenderness of the vagina, so often found in acute gonorrhœa, were due to the irritation of the discharge flowing down from the cervix.

Schwarz, Touton, Dinkler and others have strongly opposed Bumm's views and, more recently, he has modified them, stating that occasionally in the adult a true gonorrhœal vaginitis may occur in acute cases though not in chronic cases, *e. g.*, when the mucosa is in a delicate condition or thinned as in old age. Sänger holds that the vaginal walls can be affected only in children, in young girls, in old women and in the pregnant, states in which the epithelium is particularly imperfectly developed, delicate or altered in vitality.

Mandl has also carefully investigated this subject. He excised portions of the vaginal wall in three cases (aged 21, 21 and 24 respectively) of acute gonorrhœa and examined them with great care. In some parts the epithelium was very thin in its inner layers, here and there, the papillæ being quite exposed. The surface was injected and swollen and had a red, raw appearance. In many parts the epithelium, as well as the subjacent connective tissue was infiltrated with pus-cells. Gonococci were found on the surface and in the entire thickness of the epithelium, many being within the pus-cells. In several places they were detected in the sub-epithelial connective-tissue, being most deeply placed where the epithelium was thinnest.

In one of these cases the uterus was absent so that the influence of a cervical discharge on the vaginal walls was out of the question.

Döderlein has also recently described an undoubted case of gonorrhœal vaginitis after extirpation of the uterus and appendages.

Mandl believes, therefore, that there can be no doubt as to the development of a specific gonorrhœal vaginitis, though there are undoubtedly variations in the resistant power of the vaginal walls and in the degree to which they may be infected. Thickness, toughness and softness of the epithelium, the size of the interstitial spaces are important factors in determining the nature of the resistance.

In examining sections of the vaginal wall, it is important to note the period of duration of the disease. In old cases, the degenerated cocci may easily fail to take on the stains and may so be overlooked.

Very common sites of infection are the openings of the ducts of the glands of Bartholin and the small recesses about the urethral orifice. In most cases of acute infection the disease is set up in the cervix and vulvo-vaginal parts at the same time. Sometimes, the former may be at first affected; sometimes, the infection may attack the

lower structures and spread upwards, or sometimes the cervical mucosa may remain unaffected.

In some cases acute infection may spread along the uterus and tubes to the peritoneum. It may also affect, in some cases, the bladder, ureters and kidneys. It may spread to the Bartholinian glands.

Latent or Chronic Gonorrhœa in the Female.—After the signs and symptoms of an acute infection have passed away the virus may still remain in the various parts above noted, viz., the crypts about the outer part of the urethra, the ducts of the Bartholinian glands and the mucosa of the cervix. In this condition infection may spread and inflammatory reaction be set up in the whole urinary tract, the whole genital tract, and in the peritoneum of the pelvis.

It is necessary to inquire into the cause of infection in these cases. Is the gonococcus the chief factor ? Is there a *mixed infection* of gonococcus and other pathogenic germs, *e.g.*, streptococcus, or is the infection due to the latter germ entirely, they having been started into activity and having been able to spread by the favouring influence which the products of the gonococcus exert ?

These questions cannot be answered with accuracy. By many it has been believed that the gonococcus is capable of carrying infection directly to all the above-mentioned parts, both in acute and chronic conditions.

Now, the tendency is to limit the range of its activity. There are, however, many varying opinions. One fact seems to have been definitely established, viz,, that the products of the gonococcus can so alter the secretion in the vagina (rendering it neutral or alkaline) as to render it favourable to the growth and activity of streptococci and other pathogenic organisms.

Regarding the spread of an inflammation from the urethra to the bladder and, it may be, to the ureter and kidney, it is now believed by many that the gonococcus is not the infecting cause, but streptococci, which have developed under the favouring influence of the gonococcus growing in the urethra.

With regard to the occurrence of inflammation in the Bartholinian glands, some believe that the gonococcus may be directly responsible, while others hold that it is the other cocci to which I have referred. I think that while the infection is due to streptococcus in most cases, it may also arise from the gonococcus entirely. The gland is lined with a single layer of cylindrical epithelium—the site most favoured by the gonococcus, and the organism itself may be found in the gland in some inflammatory conditions. It is, however, very difficult to eliminate the influence of the pathogenic germs, as they can, in these cases, so easily gain access to the gland.

As regards the uterus, there seems little doubt that inflammation may be set up in it by the action of the gonococcus, though as to the frequency with which this occurs, and as to the conditions under which it is most likely to take place, accurate knowledge does not exist. In many cases of uterine inflammation, which clinically might be attributable to the influence of the gonococcus, the germ cannot be found at all. No doubt, in some of these cases the infecting agent is some other organism, *e.g.*, streptococcus.

It must be stated here, however, that Bumm, Gottschalk and Immerwehr have recently reported that in a considerable number of cases of uterine inflammation they could not find any germs in the secretions from the uterus. Menge also reports that examinations of scrapings of the uterine mucosa in 73 cases of endometritis revealed micro-organisms, including the gonococcus and tubercle bacillus only in a proportion of instances. These statements do not, in any way, prove that the infecting agency was not in these cases of microbial nature. We do not yet know how they act in keeping up chronic irritation, nor how numerous they need be to affect a considerable area. It may be that in chronic conditions a few foci in the tissues may serve to diffuse an irritating influence sufficient to continue the altered activity of the tissues. If this be true, it is easy to understand why the microbes might but rarely be found in the secretion obtained from the uterine cavity and why, indeed, they might only occasionally be found in curetted parts of the mucosa.

In some cases the infection of the uterus may be directly due to the action of the gonococcus along with the streptococcus or other of the pathogenic organisms.

It is important to note that the uterine cavity may become the seat of marked microbial development, if it contain detritus from a new growth, from retained membranes or placenta, or if the mucosa be injured.

As regards the Fallopian tubes, there is ample proof for believing that the gonococcus may infect it and lead to inflammatory changes. A. Martin believes that the infection may travel not only directly through the lumen of the genital tract, but also through the lymph channels and connective tissue spaces in the parametrium.

Here, as lower down in the genital canal, inflammatory changes may result from mixed infection, the gonococcus and streptococcus being both active, or the latter being the chief cause developing in the lumen under the favouring influence of the products of the gonococcus.

It is interesting to note the results of Menge's examinations of

diseased tubes. In 30 cases of hydrosalpinx and 3 of hæmato-salpinx no cultures could be obtained. In 122 specimens of purulent salpingitis he obtained the following results :

In 75 cases the tubes were sterile.

In 28 cases gonococci were present.

In 9 cases tubercle bacilli were present.

In 3 cases streptococci were present.

In 1 case staphylococci were present.

In 1 case bacterium coli commune were present,

In 1 case saphrophytes were present.

In 1 case anærobic bacteria were present.

In 3 cases various bacteria were present (in one case with streptococci.)

He found that 10 cases of pyosalpinx were absolutely sterile, thus differing very decidedly from Boisleux and Witte, who state than an abundance of germs were found in such cases.

There can indeed be no doubt that in the great majority of cases the contents of a pyosalpinx are absolutely sterile.

Kiefer states that generally pus collections in the tubes become sterile in 6 to 12 months, the cocci being probably killed by their own toxins. It is important to note, as Olshausin points out, that with the onset of fresh infection or exacerbations new cocci may be introduced and the infectivity of the pus increased.

In regard to the pelvic peritoneum, Sänger believes that the gonococcus is only capable of setting up localised pelvic inflammation, *e.g.*, periovaritis, perisalpingitis. He thinks that it cannot initiate a wide peritonitis, which he believes due to a mixed infection, the active agent being streptococcus or some other organism. The gonococcus does not appear to survive long in the peritoneal cavity.

Winter is also of this opinion and states that general acute peritonitis is never caused by the gonococcus. Kiefer also observed 11 cases, in which fresh gonorrhœal pus escaped into the peritoneal cavity without any reaction taking place, whereas virulent pus containing streptococci, or staphylococci always caused a reaction.

Several observers have pointed out the frequency of localised pelvio-peritonitis after removal of pus-tubes. This may be due to foci present before operation in the peritoneum or cellular tissue, to oozing from the uterus through the interstitial portion of the tube, or to fresh infection with bacterium coli.

As regards pelvic cellulitis, it is believed that the gonococcus may be the infecting agent sometimes, but that in the majority of cases one of the other organisms is the cause.

The same may be stated in regard to the ovary.

Menge found in 8 cases of ovarial abscess that the gonococcus was present in 3, the tubercle bacillus in 2, and streptococci in 1 ; the other three cases being sterile. Kiefer found the *bacterium coli* in several cases.

Sänger has laid great stress upon the marked liability of pregnant and puerperal women to contract acute gonorrhœal infection and, also, on the tendency towards the development, in these conditions, of an acute exacerbation of what was once previously a slight inflammatory process. Thus, a latent condition may develop into an acute outbreak in pregnancy or the puerperium without the inciting influence of any fresh infection.

Sänger also points out that in the puerperium a special variety of acute inflammation of the tubes and ovaries of a pure gonorrhœal nature, may be due simply to a recrudescence of an old gonorrhœal trouble, without any freshly acquired infection.

It must, however, be remembered that similar phenomena may be produced by the action of septic organisms which find a favourable condition for development where gonorrhœa, recent or latent, has altered the state of the secretion in the genital canal. Possibly, therefore, some of the cases referred to by Sänger are of this nature.

Latent Gonorrhœa in the Male.—The particular work carried out by Nœgerath was to point out the importance of latent gonorrhœa in the male as a prominent factor in the production of various forms of inflammation in the female pelvis, *e.g.*, endometritis, salpingitis, ovaritis, and localised peritonitis. He pointed out what is now generally recognised, that the male urethra may remain the source of an infective power long after all apparent signs and symptoms of acute gonorrhœa have passed away. This power resides in a discharge produced by the remains of the original gonorrhœal infection, and is probably limited to the crypts of the mucous membrane. The excitement of marriage, of alcoholic indulgence, or of over-fatigue may stimulate these areas of latency into renewed activity and, as a result, the woman after coitus may be infected in the various ways already described by me. The manner in which the infection is brought about is not clearly known. In many of these discharges from the male urethra no gonococci can be found. Very probably, in such instances, the discharge may act by modifying the vaginal or uterine secretions so as to afford a suitable medium for streptococci or other infective germs, which may spread upwards and lead to the various disturbances which I have described. Very often a perfectly healthy woman may be infected as a result of this latent gonorrhœal condi-

tion in the male, the most distressing pelvic troubles developing soon afterwards.

Gonorrhœal infection of the mucosa of the rectum may follow immediately upon an infecting coitus, or it may afterwards follow as a result of the entrance into the bowel of gonococci from the vulvar discharges. Rarely it may follow rupture of a Bartholinian abscess into the rectum. The inflammation may be followed by an ulcerated condition.

Bacterium Coli Commune.—This organism, first described by Escherich in 1885, is believed to be the most frequent infecting microbe which may extend from the intestinal tract into neighbouring parts. It is of great importance in relation to general peritonitis, as has been shown by Treves and others, but it also plays some part in local pelvic inflammatory affections. According to the researches of Vignal and others, this organism is found in the whole alimentary tract. Normally, it is believed to number about 95 per cent. of all the organisms in the bowel (Treves).

According to Tavel and Lanz there are many varieties of this organism, and also corresponding differences in its virulence. According to the experiments by LeSage and Macaigne a culture outside the body is harmless and will not set up peritonitis when placed in the peritoneal cavity of animals, because under normal conditions the germ is not virulent.

It may, however, become virulent under various conditions, *e.g.*, in weakened, diseased or injured states of the wall of the gut, such as obstruction, strangulation, congestion, diarrhœa, compression, bad constipation, etc.

If in such a condition of virulence, a culture of the germ be made, it has a distinct influence when placed in the peritoneal cavity of animals, varying according to the degree of toxicity. Thus it may only lead to slight constitutional disturbance with diarrhœa; a localised purulent peritonitis may be set up; or in some cases acute septicæmia may lead to death before any local signs of peritonitis are developed.

P. Ziegler has pointed out that normally the bacterium shows no tendency to pass through the bowel wall; if however, the vitality of the wall be impaired, in addition to becoming virulent, it at once begins to penetrate the wall and may extend into surrounding tissues for a considerable distance.

When the bacterium reaches the peritoneum it may set up an inflammatory reaction varying in extent according to its virulence (as well as other conditions).

Paul Ziegler has shown that its activity is increased there, if fluids,

especially blood, be present in the peritoneum. It is also accentuated, as Laruelle has pointed out, if the intestinal secretion be present, even though the latter be artificially sterilised. This germ is generally the cause of peritonitis in hernial sacs, in obstruction and strangulation, in appendicitis cases and other intestinal conditions.

Freshly filtered fluid from the normal bowel introduced into the peritoneum generally sets up peritonitis. The cause is the bacterium coli. According to Barbacci the peritoneal endothelium is damaged by this fluid, thus favouring an infection by the germs; and I have already pointed out that the activity of the microbe is increased by the presence of the intestinal fluid in the peritoneal cavity. If the fluid be in any quantity it has a depressing influence on the system on account of the absorption of the toxins in it.

The bad effect of fæces when introduced into the peritoneal cavity is due to the presence of microbes, especially the bacterium coli, in it. If sterilised fæces be introduced no bad result follows.

It is likely that a considerable proportion of local pelvic infections in women are due to this bacterium and it is possible that in nulliparous women the frequency of retro-uterine inflammation is related, not to infection from the uterus in the great majority of cases, but from the rectum.

The overstretching of the rectum from constipation, so common in women, the continual soaking of the wall in this state with toxic matters in the bowel-contents, the occasional occurrence of cracks and ulcers in the rectal wall are all factors which favour the passage of the bacterium coli into the utero-sacral ligaments, surrounding cellular tissue and peritoneum and even the uterus.

Tubercle Bacillus.—Tuberculosis in the genital tract may be set up in a variety of ways.

1. It may be primary, *i. e.*, the bacilli may enter from the outside by way of the vagina, being introduced by dirty instruments, by examining fingers, by sleeping with a tubercular person, by coitus with a man suffering from genito-urinary tuberculosis. In such cases, the vagina and cervix may be first affected, the disease spreading afterwards along the uterine and tubal mucosa; or the upper genital tract may sometimes be first attacked, according to Whitridge Williams, the bacilli entering a denuded surface on the vaginal wall and being carried up by the lymphatics.

2. The genital organs may become affected by the direct spread from neighbouring tuberculous areas, *e. g.*, tuberculosis of bladder or bowel; ulcers may perforate or abscesses burst leading to fistulous communications.

W. Williams states that one of the most frequent sources of genital tuberculosis is tubercular peritonitis. Weigert has shown that in this disease the bacilli which become free in the peritoneal cavity tend to sink into the pelvis setting up infection ; they are there in the best position to be swept towards and into the tubes and they may undoubtedly be carried into the tubes setting up disease without infecting the pouch of Douglas at all.

3. The bacilli may be introduced directly into the vagina when the patient has tuberculosis in some other region, *e. g.*, urinary tract, intestines, lungs, the infection spreading from the discharges.

Hegar has pointed out that genital tuberculosis is rare in childhood and after the climacteric.

Infection by men suffering from genito-urinary tuberculosis is of considerable interest. Derville reports five cases in which the husbands of women with genital tuberculosis had tubercular epididymitis. Fernet reports four cases in which men with pulmonary tuberculosis infected their wives, but we do not yet know whether the semen in such cases may contain tubercle bacilli. Landouzy and Martin mixed the semen of a guinea-pig which had died of tuberculosis with salt solution and injected the mixture into the peritoneal cavity of 15 guinea-pigs; five died of tuberculosis. Curt Jani found very few bacilli in apparently healthy testicles and prostates of several persons with tubercular phthisis. Gärtner in reference to Jani's description states that in tubercular patients, before death occurs, the bacilli may spread to various parts of the body and hence in this stage may often be found in the blood.

Spano injected semen from a tubercular man into the abdominal cavity of eight guinea-pigs and produced tuberculosis in six cases. In two other cases by injecting it into the vagina, genital tuberculosis was caused.

Mafucci injected large doses of bacilli into the jugular vein of a dog and found them afterwards in the semen of the animal.

Rohlff, however, introduced semen from a tubercular man into the anterior chamber of the eyes of goats and rabbits with a needle puncture and got no result ; but the amounts injected were very slight and goats are not very susceptible to tuberculosis.

Westermeyer introduced testicular tissue from a tuberculin pateart into the peritoneal cavity of rabbits without setting up tuberculosis, but he was not able to distinguish tubercle bacilli in microscopic examination of the testicles. In a case of acute miliary tuberculosis in which bacilli were found in the testicle, injections of portions of it into the peritoneal cavity caused tuberculosis in the rabbit.

Walter examined several testicles in cases of phthisis and found no tubercle bacilli in them. Gärtner believes that they are very scanty in the semen in such cases. He injected tubercle bacilli in the trachea and lungs of male guinea-pigs, setting up infection, and after three or four days obtained semen from their testicles. In 32 cases, he found tubercle bacilli only in five, and the semen in these few instances, when introduced into the peritoneum of other animals, set up only a mild form of tuberculosis.

In another set of cases he set up tuberculosis in the testicle by local injection and found that in 50 per cent. of the animals into which he introduced the semen from these cases, severe tuberculosis was set up. Gärtner, therefore, believes that genital tuberculosis in the male is a very much more serious danger for the female than distant tuberculosis.

The various parts of the genital tract, including the ovaries, may be affected, though the vulva and vagina are very rarely attacked. Sometimes a mixed gonorrhœal and tubercular infection may take place. Pyosalpinx may develop in tubercular salpingitis (? due to a combined septic infection).

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