Researches into Sterility of Cows in South Africa.

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In this report are presented:—

(a) The Diseases of the Fallopian Tubes in Cows, and

(b) The Etiological significance of Contagious Vaginitis to Sterility in Cattle.

Further contributions on the subject will appear in subsequent reports.

PART A.

DISEASE OF THE FALLOPIAN TUBES IN COWS.

PATHOLOGICAL changes in the Fallopian tubes are found in a very large percentage of cows which suffer from incurable sterility. It is doubtful whether salpingitis occurs with less frequency than pathological changes in the ovary. Williams (1) states that 15·3 per cent. of cases examined for genital disease showed pathological changes in the Fallopian tubes. The study of the genital affections of cattle in South Africa has indicated the important position which salpingitis takes amongst the pathological conditions which interfere with reproduction. Tubal pathology is no less common here than it is in the United States.

Tubal infections do not occur independently. They are due to secondary invasion from some existing pathological lesion in the genital tract or in the peritoneum. When a history of affected cows is available there is evidence of a puerperal metritis, a cervicitis or both, following on placental retention, difficult parturition or parturition injuries. In herds where contagious abortion is known to exist salpingitis very frequently follows the metritis of abortion. Nielsen (9) believes that the adhesions found inside and outside the fimbriated extremity of the tubes are the result of parametritic extension, rather than from extension from the tube itself. The frequency with which parametritis is found associated with pavilionitis supports this view. However, there is little doubt that the majority of tubal affections ascend from the uterine extremity of the tube.

Tubercular salpingitis is quite frequent when tubercular lesions occur in the peritoneum, probably in this case infection of the tube occurs from the ovarian extremity. In other cases infection occurs from the cornual extremity as a result of extension from the uterus. Salpingitis is very commonly met with in herds amongst which

contagious abortion and infectious vaginitis are intense and wide spread, and in which desirable hygienic conditions are not maintained. It is a rule in South Africa to treat cows which abort by uterine irrigation, strong disinfectants being used. In this country contagious vaginitis was looked upon by many as the most fertile cause of sterility amongst cattle and as such it received the therapeutic attention of dairymen. It was treated in the most drastic manner with strong irritant disinfectant, with little aseptic precautions, with the result that it was quite a usual occurrence to find treated herds suffering from an acute vaginitis and cervicitis as a result of the drastic measures adopted to overcome the disease. It would appear that contagious abortion or infectious vaginitis were not the direct cause of salpingitis, but that the invasion of the salpinx was the result of infection due to secondary organisms conveyed during treatment. It is not difficult to imagine the ease with which the tubes can be invaded in a paretic uterus filled with disinfectant and fluid, which is introduced into the uterus through a not too clean irrigating apparatus. It is not contented that irrational treatment of uterine affections is the only cause of salpingitis. It is observed in cows that have never been treated, but unsuitable treatment of infectious vaginitis, metritis and retained afterbirth renders the possibility of tubal infection far more likely.

In the United States salpingitis would seem to be a common occurrence in heifers [Williams (1)]. This does not appear to be the case in this country. Only one case has been observed. The subject was an eighteen months old Friesland heifer, which had never been served. When 15 months old, the heifer began to show enlargement of the mammary gland, which became so enlarged that she had to be milked. Clinical examination revealed a non-pregnant uterus somewhat enlarged and flaccid, with cystic ovaritis, hydrosalpinx and cystic pavilionitis. With this one exception pathological changes in the tubes have been found in cows which have been bred. Williams (1) has observed salpingitis in herds in which the disease could be traced to the bull without the incidence of an intervening pregnancy.

The bacteriological flora of the Fallopian tubes is at present being investigated at this Institute, but the study has not yet proceeded sufficiently for publication. In America the organisms most frequently found are a Streptococcus of the viridans group, Staphylococcus albus and aureus, an organism resembling *B. abortus*, [Gilman (3)] and *B. pyogenes* [Beaver Boyd, Fitch (4)], Streptococci, Staphylococci, *B. Coli*, *B. vitulinum* and Bang's Bacillus have been described in the normal tube by Find (5). Brandt (6) found Staphylococci, and *M. tetrangenus* in the Fallopian tubes of normal cows and bacilli in addition in pathological tubes. Hundsberger (11) found Staphylococci, Diplococci, *Micrococcus tetragenus*, *B. coli* and short rods in pregnant animals as well as non-pregnant animals. He therefore concludes that the presence of these organisms does not necessarily cause sterility

The diagnosis of tubal disease is of much economic importance in as much as clinically recognisable changes, bilateral in nature are incurable. Examination of the tubes throughout their length requires considerable practice. Richter (12) says that under normal conditions rectal palpation of the tubes is very difficult and often

impossible. He maintains that if one finds an easily palpable tube at a rectal examination the diagnosis salpingitis is justifiable. However, to one experienced by frequent clinical examination, and with the possibility of making post-mortem examination to confirm his intra-vitam findings, tubal palpation becomes easy unless the tubes are surrounded by fibrous adhesions in the meso-salpinx. Williams (1) gives a technique for examining the tubes in detail. Palpation is begun at the fimbriated extremity and continued towards the ostium uterinum. It is readily admitted that the method gives a possibility of accurate diagnosis of changes in the tubes in most cases, but there are some cases in which the broad ligaments are elongated and the uterus somewhat enlarged as a result of many pregnancies, where it has been found more convenient and expeditious to examine the tubes from the corunal extremity. The ovary is first sought per rectum; it is then placed in the fingers of the other hand introduced into the vagina. The uterine cornua is then traced to its apex. The fixing of the ovary renders this manipulation extremely easy. From the apex of the horn the tube is traced to the ampulla with the thumb, first and second fingers and the examination completed by palpating the fimbriated extremity.

Careful palpation of the tube and its fimbriated extremity reveals minute pathological changes. Isolated cystic enlargements 3 to 4 mm. in diameter can be detected, adhesions on the inner and outer surfaces of the ovarian pocket can usually be felt. There are cases, however, where one finds micropathological changes in the absence of palpable macroscopic change. In those cases the tube is somewhat enlarged either locally or diffusely, but the finest tactile sense cannot detect the change at a clinical examination. In these cases a tentative diagnosis can usually be made by concurrent symptoms. Williams (2) has pointed out that tubal disease is very frequently associated with cystic degeneration of the corpus luteum as a result of infection of the ovarian crater after ovulation. This cystic degeneration of the corpus luteum of the last interovulation period prevents normal physiological atrophy of the corpus luteum. This results in cessation of oestrum or irregularity of the interovulation periods, which are usually abnormally long. After some time oestrum will again occur, that is when the lutein tissue in the wall of the cyst has become so atrophied by the internal pressure of the slowly developing cyst that it no longer inhibits oestrum. The opposite ovary then ovulates and the corpus luteum resulting is also retained and undergoes cystic degeneration in its turn, to follow the same path as its predecessor in the other ovary. It is not an unusual thing to see a large cyst with a trace of lutein tissue in its walls in one ovary and a corpus luteum with a developing central cyst in the opposite ovary. One sometimes finds three corpus luteum cysts in the ovaries, two in one and one in the other. The luteum tissue in their walls clearly indicates the age of the corpora lutea. The oldest one, or that of the third last interovulation period has a thin complete or interrupted band of yellow tissue, that of the second last interovulation period has somewhat thicker band of lutein tissue, while the corpus luteum of the present interovulation period may show a central developing cyst or it may be normal in appearance. If the case can be followed carefully it may be possible to detect these changes in the ovaries. It is fairly

safe to diagnose salpingitis in the absence of palpable lesions in the tubes if there is a history of placental retention, metritis or cervicitis followed by cessation or irregularity of oestrum with long interovulation periods. Failure of the corpus luteum to undergo the normal physiological atrophy after the 11th or 12th day of the interovulation period must be looked upon with suspicion in the absence of palpable pathological lesions in the genital tract or ovaries of sterile cows. Abeyance or irregularity of oestrum with long interovulation periods is also observed in cases of functional sterility due to obesity produced by unsuitable diet and insufficient exercise, but careful investigation of the ration fed and the environments under which cattle are kept will help to exclude functional sterility. The history of the animals in these cases is of the utmost importance.

Symptoms.

In the early stages of the disease palpation does not as a rule lead to definite diagnosis of salpingitis, since the tubes are not much enlarged. Usually the first symptom which can be diagnosed at a clinical examination is the presence of adhesions in the funnel shaped extremity or adhesions between the free border of the fimbriated extremity and the ovary. In very acute inflammation the three coats of the tube may be involved, infection extending from the mucosa to the serous coat. Then one may find adhesions between the border of the mesosalpinx and the neighbouring organs (Fig 20, right salpinx). As the disease becomes chronic palpation reveals enlargement of the tube. At first the enlargement is local (Fig. 18) and is frequently confined to the ovarian extremity. Enlargement may, however, occur at any point in the tube. The enlargements may be so arranged that the tube feels like a row of beads (Figs. 16 and 20). There may be only one or there may be several dilations along the course of the tube. In other cases the tube is diffusely enlarged from the uterine cornua to the fimbriated extremity (Fig. 19). The tube becomes elongated and tortuous. Towards the ampulla it not infrequently forms several coils in the mesosalpinx which appear as a fairly large cyst with an irregular surface. On palpation per rectum the dilated tube, whether the dilation be local or diffuse is firm to the feel, but compressible on pressure, fluctuation cannot be detected. The dilations vary in size from a single cystic enlargement, a few m.m. in diameter to a diffuse enlargement along the whole length up to 1 to $1\frac{1}{2}$ c.m. in diameter. In advanced cases of salpingitis the pavilion is always involved. The first palpable symptom of invasion of the pavilion is the presence of adhesions in the funnel or around the attachment of the free extremity with the ovary. As the disease advances the adhesions become more extensive until the pavilion becomes entirely closed, either by adhesions within the funnel itself or by adhesion of the free border to the ovary. In the latter case the ovary is frequently encapsuled by the pavilion of the tube so that it becomes difficult to palpate (Fig. 22, left ovary). The ovary can as a rule be easily felt, but definite diagnosis as to its condition is difficult owing to the encapsulation within the pavilion and fibrous adhesions to neighbouring organs. Sometimes the ovary is not encapsuled, the free border of the pavilion is just attached to it. When the pavilion forms a closed sac it always becomes filled with exudate which on accumulation forms a cyst (Figs. 17, 21, 22). The cystic enlargement may vary in size from 2 to 10 c.m. in diameter. The cyst of pavilionitis is characteristic and is not

easily confused with a cystic ovary. It is a soft cyst, the contents not entirely filling up the capsule, which is thin walled and tough. The swelling is quite independent of the ovary, not a part of it.

On post-mortem examination the enlarged tube of hydrosalpinx is as a rule thin walled, whitish in colour. On opening it contains an opaque, greyish fluid with some flocculi, or the liquid contents may be quite clear. On close examination of its cross section it is possible in some cases to observe the enlarged and elongated mucous folds occluding the tube and forming septa between the cystic dilations. The contents of the cystic pavilion are also greyish opaque liquid with some flocculi, or the liquid may be clear. In two cases the contents of the pavilion were markedly blood stained and contained brown pigment, apparently the result of haemorrhages from the wall of a Graafian follicle which had opened into the pavilion. (Haematosalpinx). (Figs. 21, 22.) There was no trace of tubal pregnancy,

In acute cases of salpingitis where occlusion of the lumen of the tube occurs early as a result of swelling of the mucous folds, accumulations of pus occur. Local abscesses in the tube have not been observed. It has always been uniformly distended with pus. Sometimes the swelling is slight and the walls appear thickened. In other cases, however, where the wall is much distended it is thin walled and may even show fluctuation. In pyosalpinx the pavilion may also be involved. Pus accumulated in the closed extremity forms a soft abscess which is encapsuled in the thin walled but tough membrane of the fimbriated extremity. There would not appear to be much tendency for the abscess to rupture. It is extremely difficult to make an intra-vitam diagnosis between hydrosalpinx and pyosalpinx at a clinical examination. Adhesions between the border of the mesosalpinx and the neighbouring structures would appear to be more commonly met with in pyo than in hydrosalpinx. In the latter condition, however, tense adhesions are sometimes met with (Fig. 24). A case in which a mixed pyo and hydrosalpinx co-existed has been seen. The condition was bilateral. The pavilion and about a third of the ovarian extremity of the tubes contained pus, while the cornual extremity was distended with an opaque watery fluid (Fig. 23). The description described by Williams (1) resulting in necrosis of the ovary has not been seen. Diseases of the Fallopian tubes are in the great majority of cases bilateral. In one case only has unilateral hydrosalpinx been observed. It produced an incurable sterility in a valuable ten year old Friesland cow.

Salpingitis is very frequently associated with pathological conditions in the ovary. The most common lesion is that of retained and cystic corpus luteum [Williams (2)]. Wester (18) also mentions the concurrence of pathological changes, including lutein cysts in the ovary with salpingitis. Retention of the corpus luteum causes oestral abeyance, or irregular oestrum with long interovulation periods. The cyst as it grows larger causes atrophy of the lutein capsule until the lutein tissue present no longer inhibits oestrum, which then results from the ripening of the Graafian follicle in the opposite ovary, or sometimes in the same ovary. The resulting corpus luteum also undergoes cystic degeneration, so that cystic corpora lutea may be found in both ovaries. It is not unusual to find one ovary small, inactive and indurated, showing no evidence

of developing Graafian follicles. (Figs. 17, 23.) That such an ovary has functioned normally is evident from the presence of corpora albicantia and immature Graafian follicles on microscopic examination. It is not easy to say when cystic degeneration of the retained corpus luteum begins and how long it takes for degeneration of the gland to be so complete as not to inhibit oestrum. No doubt both periods are very irregular. Corpora lutea have been found microscopically showing marked or commencing cystic development at the end of the third week after oestrum, and cows have been under observation which have shown interovulation periods varying from two to eight months. It is not claimed that the cessation of normal oestrum may not be due to other causes, but since the cows suffered from salpingitis with retained corpora lutea it is not unlikely that the retained and cystic corpus luteum was culpable. Another ovarian lesion which is found associated with salpingitis is the cystic degeneration which is apparently developed from the unruptured Graafian follicle and which is sometimes associated with nymphomania. (Fig. 19.)

There is not much doubt that the ovarian pathology is dependent on infection of the ovary from the diseased extremity of the tube at the time of ovulation.

Tubercular salpingitis is also a common occurrence in bovines. It is likely that the infection in this case most frequently descends down the tube from the peritoneum. Infection from the uterus, through the blood or lymph stream or from the peritoneal surface of the tube would appear to be of rare occurrence [Frei (8).] Gilman (3) maintains that the source of infection is as a rule haematogenic, though he accepts the possibility of spread from the vagina, ovaries, uterus and peritoneum. It appears that the fimbriated extremity of the tube is in the majority of cases the site of tubercular lesions prior to the invasion of the lumen. [Fischer, Hansen, Johne, Reick, Eber, Meyfarth (10), and Frei (8).] Williams (2) states that even in cases of severe uterine tuberculosis the oviducts are sometimes free. This can be confirmed as a result of microscopic and histological examination of a case of tubercular metritis which has been destroyed here.

On palpation the tube is irregularly enlarged, firm and nodular. In cases of long duration the whole length of the tube is involved in the dilatation, or it may be confined to the abdominal extremity. The cases observed were all apparently of long standing so that the whole tube and the uterus were invaded with tubercular lesions. There was a local tubercular peritonitis on the uterus, uterine horns, mesosalpinx and meso-ovarium. The surface of the ovary also showed tubercular lesions. The fimbriated extremity of the tube showed adhesions to the ovary but it was not cystic. The tubercular invasion of the tubes was in the cases observed bilateral.

On section the lumen of the tube is occluded with yellowish brittle caseous contents. When the contents are scraped off the lining appears yellowish and granular with numerous reddish spots.

Microscopic Examination.

In the case of catarrhal salpingitis the mucosa is the seat of initial changes. It becomes swollen as a result of accumulation of

serous infiltrate, and round cell infiltration. There is a dilatation of the capillary vessels. The mucous folds become swollen, sometimes filling up the lumen of the tube. An exudate is thrown out into the lumen which contains desquamated epithelial cells. There is a loss of cilia and fairly well marked epithelial desquamation, so that the mucous folds may be partly stripped of their epithelial covering. Williams (2) states that the epithelial desquamation begins on the apices of the mucous folds and gradually descend into the intervillus spaces. The folds when stripped of epithelium coalesce by the deve-lopment of fibroblastic tissue so that the lumen of the tube presents a cyst-like appearance, the vesicles being lined by epithelium. (Figs. 2, 3, 4, 5. The coalescence of the folds or the swelling of the mucosa in the early stages causes occlusion of the lumen so that the exudate accumulates within the tube. In very acute cases the muscular coat may also show round cell infiltration and a slight serous exudate. Hyaline degeneration of the blood vessels sometimes occurs. Hyaline degeneration with calcification of the tunica media of the vessels has been seen in the apex of the uterine horn but calcification has not been seen in the tube. (Fig. 15.)

When occlusion of the uterine extremity of the tube is complete the exudate accumulates within the lumen and is passed out into the fimbriated extremity which also becomes involved in an inflammatory process [Williams (1)]. The result is the production of fibrous adhesions across the fimbriated extremity and between the free border of the tube and the ovary or neighbouring structures. Thus the tube also becomes occluded at its upper extremity.

As the inflammation subsides and the tube has been fortunate enough to avoid occlusion it is possible that complete regeneration of the desquamated epithelium occurs and it returns to normal. There is little doubt that this does occur in many cases where a slight catarrhal salpingitis only was present. It is difficult to imagine a metritis with atony of the uterine wall in which the uterine extremity of the tube is not also involved. Still, with rational treatment most of these cases recover and again become regular breeders.

When the tube is closed at its proximal and distal extremity the contents accumulate, resulting in a hydrosalpinx or a pyosalpinx. On microscopic examination, the pathological changes which take place in the tube from the acute catarrhal inflammation to the well-estab-lished hydrosalpinx can be traced. The histological changes during the acute or initial stages have been described up to the establishment of occlusion. In the early stages of hydrosalpinx when the acute inflammatory phenomena have subsided, a cross section of the tube shows the presence of closed vesicles due to coalescence of the mucous folds (Figs. 2, 3, 4, 5, 6, 7). In places the normal pseudostratified epithelium can be recognised, mostly devoid of cilia. In other places the vesicles are lined by flattened epithelium, apparently the result of pressure. All these vesicles with flattened epithelium contain fluid. Other vesicles are seen, the walls of which are pushed together so that they become adherent (Fig. 6), forming secondary vesicles. The epi-thelium can be seen undergoing desquamation and atrophy as the result of pressure so that the membrana propria of neighbouring folds coalesce. There are distinct changes in the connective tissue of the tunica propria. In places there is active multiplication of tissue as

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shown by the presence of foci of round cell infiltration. Fibroblastic tissue and newly formed connective tissue are also evident. (Figs. 5, 6, 7.) The membrana propria is in cases markedly thickened with these newly formed tissue elements. In well established hydrosalpinx it appears that coalescence of neighbouring mucous folds and the formation of secondary cystlike vesicles are the result of the change in the tunica propria pressing upon the epithelium causing atrophy, thereby allowing the newly formed tissue in the folds to coalesce. In some sections scattered through the epithelium there are occasional eosinophyles.

As the lesions become older and the intra-tubal pressure increases from accumulation of fluid the vesicles become larger and the epithelial lining throughout is flattened or cubical. Occasionally vesicles are met with in which attempts at epithelial regeneration are evident. The epithelium is stratified throughout, or shows local stratification, being raised into villus-like projections of epithelial cells. (Figs. 10, 11.) Here and there the epithelial cells are vacuolated and their surface covered with exudate. (Figs. 8, 9.) It is difficult to say whether the vacuole formation in the epithelial cells is associated with secretion or whether it is due to regressive change. The mucosa shows well marked oedema apparently due to diffusion from the vesicular contents. (Figs. 8, 9.) The muscular layers as a rule in those cases of marked tubal distention show a very marked atrophy. (Figs. 1, 2.)

Sometimes the mucous folds coalesce towards the centre of the lumen forming fibrous radiating septa. From these smaller septa are thrown out so that the neighbouring larger septa anastomose. (Figs. 3, 4.) These histological changes in the mucosa of the tube appear to resemble closely what has been described in the human female by Scridde and Schoenholz (19) as epitheliofibrose. The authors attribute the condition to congenital deformity. In the few cases described here it is most probable that the original lesion was inflammatory. Both tubes were involved in the histological change, so that conception was impossible. However, the animals had previous to the last parturition been normal breeders.

In the case of pyosalpinx the wall is as a rule thickened while the peritoneal covering is the seat of fibrous adhesions. The mucosa is infiltrated with round cells and neutrophyles. The epithelial layer has disappeared. The lumen is filled with pus. Here and there one occasionally sees cyst-like formation from coalescence of the folds, but in old standing cases these disappear.

In tubercular salpingitis as already stated the invasion of the tube would appear to begin most frequently from the ovarian extremity, the fimbriated extremity being the first part to show tubercular lesions. The tubercle bacilli enter through the epithelium covering the mucous folds. The propria becomes the seat of tubercles, with epitheloid cells and giant cell formation, surrounded by a zone of round cells, which gradually extend. Fischer (13), Richter (12), describe round cell infiltration of the mucosa and epithelial desquamation, which has been referred to by Frei (8) as probably an earlier stage.

Gilman (3) also describes profuse leucocytic infiltration and some epitheloid cells.

The folds become swollen and the epithelium rapidly disappears.

The apices of the folds appear to be first involved as they do in the case of catarrhal inflammation so that one can recognise the advance of tubercular lesions towards the periphery. Ulcers are also recognised. The lumen of the tube is filled with exudate containing granular debris. With the advance of tubercle formation and swelling of the mucous folds the lumen of the tube becomes entirely occluded as a result of coalescence of the swollen folds and the tube becomes very much increased in size. Towards the muscular wall in the deeper portion of the mucosa, cyst-like cavities lined with epithelium can still be recognised (Fig. 13), but these, too, gradually disappear from pressure of the growing tubercles. (Fig. 14.) When the tube is very much enlarged, there is well marked atrophy of the tunica muscularis.

One recognises in old cases, caseous degeneration and calcified areas in cross section. (Fig. 14.)

The tunica muscularis may also show the presence of tubercles so that it may be almost entirely destroyed. The tunica serosa in old standing cases shows an increase in formation of connective tissue. There is peri-salpingitis present.

Prognosis.

The prognosis of bilateral salpingitis which can be recognised by rectal palpation appears to be hopeless. The pathological lesions which such tubes reveal at a post-mortem and histological examination are incurable. It is possible that many cases of slight catarrhal inflammation which are concurrent with or a sequel to metritis, recover spontaneously. The possibility of frequent tubal infections associated with metritis cannot be questioned. Especially is this the case in a paretic uterus during the puerperal period. Still, when suitably treated the majority of these cases recover and again become regular breeders.

Treatment.

With our present knowledge, preventive measures only are likely to be of any use in the treatment of the condition. Therapeutic measures adopted have not been satisfactory. It is known that salpingitis is secondary to affections of the cervix and the uterus, such as are associated with metritis, contagious abortion, placental retention, parturition injuries, and irrational measures employed to overcome infectious vaginitis.

Williams (2) points out the prevalence of tubal diseases in heifers and suggests that it is probably referable to unsuitable hygiene during calfhood, the infection remaining dormant until sexual maturity has been reached.

Williams further points out that an infection which may produce salpingitis may be carried by the bull and introduced during coitus; that such an infection may not prevent conception, but may cause salpingitis during pregnancy.

It therefore becomes evident that breeding cattle and their offspring should be kept under ideal hygienic conditions if a high fertility record is to be maintained. Further, cows should be watched carefully for anything pathological during the

puerperal period. Such pathological lesions should receive immediate attention. Sex hygiene should be advocated. Cows showing any suspicion of genital infection should not be allowed to copulate until the nature of the lesion has been diagnosed. How often does one find a cow with a muco-purulent or purulent discharge from the womb being served by the stud bull, who thereby runs the risk of spreading the infection. It is notorious that in this country the prevalence of sterility in cows is proportional to the degree of hygiene maintained in the byre and calf-sheds and to the efficiency of the methods adopted in overcoming diseases of the genital tract.

Treatment of tubal disease must be expectant. If it does exist concurrently with cervicitis and metritis, these conditions must be treated with modern methods. The danger of irrigating a paretic uterus has long been recognised. Modern methods have shown that treatment with pessaries of iodoform and bismuth subnitrate, or iodoform and boric acid [Williams (2)], charcoal sticks, [Hoffman (14)], carbo medicinalis, [Klein (16)] and patargol sticks are more compatible with recovery and subsequent fertility than uterine irrigation. Chronic uterine lesions can be treated with saline injections or saline and Lugol's iodine in solution, rivanol solution, etc. Should a small quantity remain in the uterus it is not likely to pass into the tube, especially when the wall of the uterus has more or less regained tone. If diseases of the tubes should be suspected it would be unwise to express corpora lutea just because the interovulation period was abnormally extended. Thereby ovarian infection is rendered more likely. When uterine infections subside and the normal physiological relations of animals have been restored the corpus luteum, unless already cystic will, probably, undergo normal atrophy. In the absence of palpable pathological lesions in the tubes expression of a retained or cystic corpus luteum can be tried. It has been pointed out that salpingitis is usually bilateral, but Williams (2) has seen unilateral infections which were capable of diagnosis by rectal palpation and recommends treatment by unilateral ovaro-salpingectomy.

The literature on the treatment of salpingitis in human medicine indicates that there is a vast field for research in unspecific-specific therapy as indicated by Opperman (15). Among the non-specific preparations used in human medicine are the following: Milk, aolan, cascosan, novoprotin, omnadin, yatren-casein, yatren-vaccine, which are administered intracutaneously, intramuscularly, or intravenously. In veterinary practice this method of therapy although tried in a limited number of cases by Opperman and his students, requires further investigation before its use can be recommended as of universal value in the treatment of salpingitis.

Within recent years Stoss and Mai (17) showed that it is possible to force air from the uterus through the tubes. A manometer showed that the necessary pressure was 160 mm. of mercury. The pressure gradually sank in the case of normal tubes, but it remained constant when the Fallopian tubes were occluded in salpingitis.

Stoss states that it appears possible in cases of salpingitis catarrhalis to open the tube to admit the passage of spermatozoa in the lower animals as has already been demonstrated in human gynaecology.

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EXPLANATION OF PHOTOGRAPHS.

1. Cross-section of fallopian tube of a cow showing salpingitis. There is a marked dilatation with long non-brached villi and atrophy of the muscular wall, with slight oedema. × 45.
2. Cross-section of the fallopian tube of a cow showing salpingitis. There is a marked dilatation and cyst-like formation due to coalescence of the villi. × 17.
3. Cross-section of the fallopian tube of a cow with salpingitis. The apices of the villi have coalesced in the centre of the tube, thus forming a number of loculi lined with cubical or flattened epithelium. There is a marked fibrosis at the point of junction of the villi. × 8.
4. Cross-section of the fallopian tube of a cow showing a similar condition to that described in No. 3. × 38.
5. Section of fallopian tube showing fibrosis and cellular infiltration of the villi and cystic formation towards the muscularis. The epithelium of the cysts may be seen to be partly cylindrical and partly flattened. × 28.
6. Similar condition to that described in No. 5. × 75.
7. Another portion of the fallopian tube shown in No. 6. × 75.
8. Section of the wall of the fallopian tube of a cow showing salpingitis. Note oedema and atrophy of the muscular coat and the nature of the epithelium. × 20.
9. Same as No. 7. × 40.
10. Section of the fallopian tube of a cow showing stratified epithelium. × 28.
11. Similar to No. 10. × 65.

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12. Section of the wall of the fallopian tube of a cow showing salpingitis. There is desquamation of epithelium, sub-epithelial round cell infiltration and slight fibrosis of the mucous folds, and marked oedema of the sub-mucous tissues. × 45.
13. Tubercular salpingitis. × 75.
14. Tubercular salpingitis showing calcification of a tuberculous nodule. On the right bottom corner the remains of intervillus crypts can be recognised. × 33.
15. Section towards the apex of the uterine borri; calcification of the capillary wall.
16. Genital organs of cow (1213). There is salpingitis, endometritis chronica catarrhalis. Cyst of the right ovary with a thin band of lutein tissue in wall. Central small cystic degeneration of the left ovary. Hypertrophy of the cervical folds.
17. Genital organs of cow (1685). There is salpingitis with a large cystic pavilion on the left side, and a retained central corpus luteum on the right side. The left ovary shows a small cyst adenoma.
18. Genital organs of cow (1683). There is salpingitis with a large cystic pavilion on the left side. There is local accumulation of cysts on the right side. The serous surface shows perimetritis.
19. Genital organs of the cow (1870). There is endometritis chronica catarrhalis—note left horn without cotyledons, cervix duplex, hydrosalpinx and cystic pavilionitis. The right ovary contains an embedded corpus luteum and some small cysts. The left ovary is entirely cystic.
20. Genital organs of cow (1659). There is endometritis chronica and polypus-like formation of the cervix, and salpingitis. The left ovary shows a large cyst with lutein tissue in its wall. The right ovary shows an eleven day old corpus luteum and some normal follicles. Adhesions are seen between the right ovary and the broad ligament.
21. Genital tract of cow (1686). There is salpingitis and cystic pavilionitis. The contents of the cystic pavilion on the right side are blood stained (haematosalpinx). The left ovary shows a cyst with an area of lutein tissue in the wall and a corpus luteum with a small central cavity. The right ovary is entirely cystic. It also shows an area of fibrous filaments attached to its surface.
22. Genital organs of cow (1871). There is endometritis chronica catarrhalis—note absence of cotyledons in the uterine mucosa—fibrosis of the cervix, and salpingitis. The pavilion of the right fallopian tube contains blood-stained fluid (haematosalpinx). The left ovary contains a corpus luteum and some developing follicles. The right ovary shows a few very small follicles.
23. Genital organs of cow (2074). There is a mixed pyo- and hydrosalpinx. The left ovary shows a cystic corpus luteum with a thick lutein tissue capsule.
24. Genital organs of a cow (2023). There is endometritis chronica catarrhalis, bilateral salpingitis and pavilionitis. The right ovary show a large cyst with a trace of lutein tissue in its walls.