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Canadian Army Medical Corps

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This Bulletin is issued to every unit of the Canadian Army Medical Corps. It will be passed for reading, and will be initialled by all officers. After return it will be kept on file by the officer commanding for further reference.

SPUR-LIKE FORMATIONS OF BONE FOLLOWING AMPUTATION.

By J. D. MORGAN, B.A. Cantab., M.D., C.M. McGill,
Major, C.A.M.C.

THE X-ray picture of a healthy amputation stump should show the bone rounded off and clean, surrounded by a fairly uniform shadow of the soft parts. Some atrophy of the end of the bone may have occurred, or some small amount of periosteal thickening be present. Not a little to my surprise, in the routine X-ray examination of amputation stumps following upon war wounds, instead of this moderate button-like extremity to the shaft there has been seen, in the majority of cases, a shadow projecting from one or other (usually the internal or posterior) border of the bone shaft near its extremity. In one case this represents but a small spicule; in another, a large thick spur; in a third, the the impression given has been of the presence of a "wing" of bone. As a rule these project in an upward direction. They are frequently the source of considerable pain and discomfort, and are responsible for the persistence of a discharging sinus. Their presence, consequently, often necessitates a reamputation. Occasionally they recur following this operation. I have attempted to determine in what proportion of amputation cases these spurs are found, and also their relative frequency in the different bones involved, but at present it is impossible to arrive at any accurate conclusions. This must therefore be left till a later date.



FIG. 1.

Necrosis of end of stump of humerus with the formation of a bone slough.

That these spur-like formations do, on occasions, occur on amputation stumps has been known for a long time. This can, of course, be gathered from what has appeared, from time to time, in the surgical literature. It is astonishing, however, how little is to be found bearing directly on this subject. Many text-books do not mention it, while a few refer to it only in the vaguest manner. For example, no direct reference to "spurs" can be found in the text-books of such authorities as the following: Treves and Hutchinson[1], Rose and Carless[2], Spencer and Gask[3], Waring[4], Cheyne and Burghard[5], or Warren[6]. They refer merely to a possible mushroom-like formation at the end of the bone, or to the occurrence of necrosis (fig. 1), and ascribe these results to the presence in greater or less degree of one, or both, of two conditions, namely, sepsis, and injury of the periosteum about the end of the bone-stump. On the other hand, Binnie[7] gives as one of the causes militating against the efficient weight-bearing capacity of a stump, "irregularity of the end of the bone, either from faulty division of the bone or from irregular callus formation." Farabeuf[8] remarks that it is not unusual to find some irregularity around the end of the bone-stump which may give it a resemblance to a much used walking-stick. These irregularities are periosteal in origin. The deep scar-tissue may become adherent to them, and occasionally also the skin. Under the influence of continued

irritation to the periosteum (e.g., sepsis) there may result not merely a simple roughening, but a variable number of bony spurs, some of them pointed, and of sufficient length even to perforate the soft parts of the stump and the skin. Kocher[9], referring to the cause of pain in stumps, says: "Tenderness is due much more to excessive growth of the periosteum (perhaps, also, of the marrow, Bunge), which leads ultimately to the formation of exostoses."

This dearth of pre-war literature, and apparent lack of experience of this condition on the part of many surgeons, might, at first, appear somewhat astonishing, considering the frequency with which we see cases of this nature at the present time. In the course of one year's work at the Granville Canadian Special Hospital at Ramsgate and No. 15 Canadian General Hospital at Taplow I have come across some 250 examples. On more mature consideration it becomes evident that it is only the changed conditions occasioned by the War that have brought the subject of "spur-formation" so forcibly before us.

In this regard the following points must be considered:—

(1) We have never before had such a series of amputation stumps for observation. (2) Never before have stumps been so systematically X-rayed as during the present War. (3) Owing to the tremendous demand for medical officers occasioned by the War, many amputations have had to be done by men who have lacked experience. (4) The almost universally septic condition of the wounds. (5) The long distances which many of the patients have to travel after operation before arriving at a base hospital, during which journey great difficulties are experienced in the renewal of the dressings, even if, indeed, it is possible to do this at all. On account of these last four points it is hardly fair to compare pre-war amputations with those done as the result of war wounds.

Most observers, e.g., Binnie[14], Hirsch and Bunge[12], Maclaure[11], Kocher[9], and Farabeuf[8] consider that these spurs are the result of bone formation caused by irritation of the periosteum, particularly by long-continued sepsis.

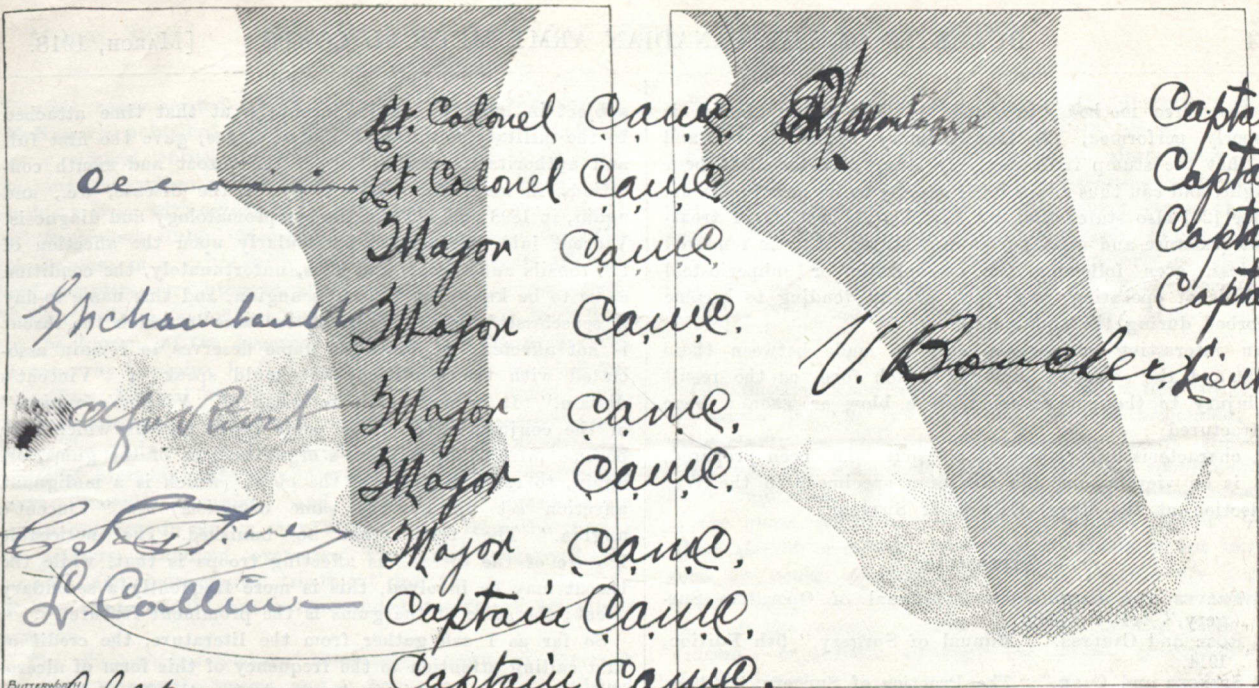
Kocher[9] attributes undue tenderness in a stump, in most cases, to excessive growth of bone from the periosteum. Farabeuf[8] says that spurs may attain such size as to perforate the soft tissues and skin. One need only look through a series of X-ray pictures of amputation stumps to appreciate these statements. (See figs. 2 to 7.) The figures, with one exception, are from cases of amputation through the femur, and have been selected as characteristic of the different forms.

Looking through a series of skiagrams of amputation stumps, it is remarkable how much more frequently these spurs develop on the inner side of the bone than elsewhere. While this applies to almost any bone, it is particularly noticeable in the case of the femur. Referring to amputation through this bone, Hofstätter[13] suggests as an explanation the presence of the *linea aspera*, from which the periosteum cannot be so thoroughly removed as from the smooth surface of the rest of the bone-shaft. The presence of these spurs is one of the principal causes necessitating the reamputation of a stump. These operations have been very frequent during the past three years.

It is obviously a matter of great practical importance, therefore, to prevent the formation of these spurs in the first place. Can this be done?

Bier[10], by his osteoplastic-flap method, first attempted to produce a weight-bearing stump free from spurs. The difficulties in the technique of this operation resulted in the introduction of a modified form, viz., the sub-periosteal method advocated by Cheyne and Burghard[5], Rose and Carless[2], Waring[3], Poncet[15], Monod and Vauverts[16], Laurent[17], and others.

In Treves and Hutchinson's "Manual of Operative Surgery" we read: "The value of the periosteal flap has not yet been clearly demonstrated in all cases . . ." Again, Hirsch and Bunge[12] have shown that the removal of the periosteum (and, according to Bunge, of the marrow) from the last few centimetres of the end of the bone tends to the production of a good, clean stump. Views such as these culminated in the aperiosteal method of amputation. Warren[6], Jacobson[18], Hofstätter[13], and Bunge[19], among others, have stated their preference for this method. Steiger's observations show that satisfactory results can be obtained by any



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FIG. 3.

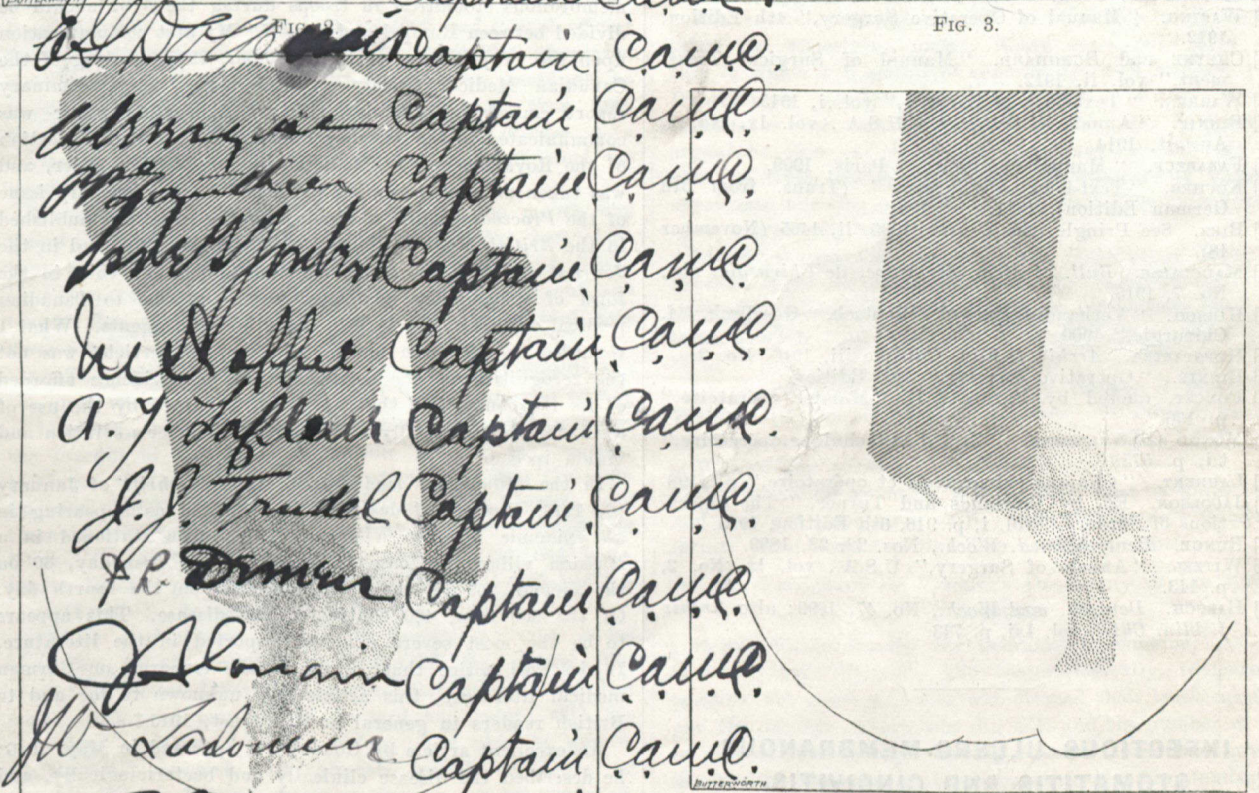


FIG. 4
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FIG. 5.

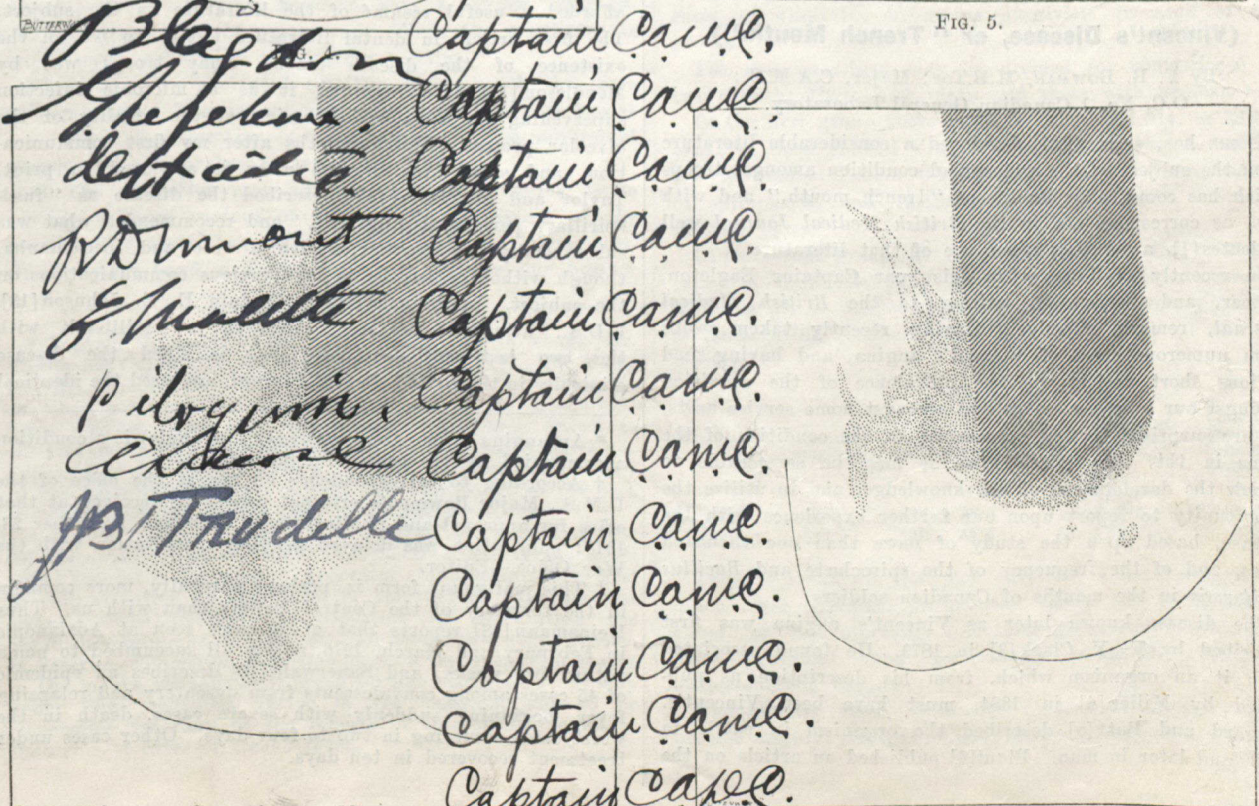


FIG. 6
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FIG. 7.

of the three methods, provided (1) that the operation is properly performed, (2) that primary union occurs; and (3) that the stump is at an early stage accustomed to bear weight, and can thus adapt itself rapidly to its new functions. Witzel [20] also states that by Hirsch's [21] method of treatment (exercise and massage) painful stumps may be rendered painless, even following the osteoplastic or subperiosteal methods of operating, any spurs present tending to become absorbed during the treatment.

An interesting comparison may be made between these spurs and the so-called exostoses which form as the result of injury to the periosteum from a blow or when a bone is fractured.

A characteristic specimen of a "spur" has been prepared, and is on view among the Canadian specimens in the War Collection at the Royal College of Surgeons.

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INFECTIOUS ULCERO-MEMBRANOUS STOMATITIS AND GINGIVITIS.

(Vincent's Disease, or "Trench Mouth.")

By F. B. BOWMAN, M.B.Tor; Major, C.A.M.C.;
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THERE has, since 1915, developed a considerable literature upon the subject of the widespread condition amongst troops which has come to be known as "trench mouth," and with this, as correspondence in the *British Medical Journal* well indicates [1], a striking ignorance of that literature.

So recently as January in this year Captains Eagleton, Mercer, and Hudson [2], writing to the *British Medical Journal*, remark naïvely, "Having recently taken swabs from numerous cases of Vincent's angina, and having read various short articles on the prevalence of the condition amongst our overseas troops and amongst home service units, we are surprised to find no mention of the condition of the gums in this infection." Thus it may be serviceable to review the development of our knowledge, and to utilize the opportunity to report upon our further experience with the disease, based upon the study of more than one thousand cases, and of the frequency of the spirochæte and *Bacillus fusiformis* in the mouths of Canadian soldiers.

The disease known later as Vincent's angina was first described by F. Y. Clark [3] in 1879. He found associated with it an organism which, from his description, as published by Miller [4] in 1884, must have been Vincent's. Lingard and Batt [5] described the organism in cattle in 1883, and later in man. Plaut [6] published an article on the

subject in 1894. In 1896 Vincent [7], at that time attached to the military hospital at Val de Grâce, gave the first full and authoritative description of the throat and mouth conditions in man, the bacteriology of the disease, &c., and again, in 1898 and 1905, of the symptomatology and diagnosis. Vincent laid stress more particularly upon the affection of the tonsils and throat, and thus, unfortunately, the condition came to be known as Vincent's angina, and this name to-day is senselessly* applied by many to cases in which the throat is not affected. If Vincent's name deserves to remain associated with the condition, we should speak of "Vincent's disease." It is as sensible to speak of "Vincent's angina" of the conjunctiva or glans penis (both regions which may become infected by Vincent's organisms) as of the gums, or, again, to refer to noma of the cheek (which is a malignant affection set up by the same organism) as "Vincent's angina." The term must be banished. The noticeable feature of the disease as affecting troops is that, while the throat may be involved, this is more frequently a secondary event; the state of the gums is the prominent feature.

So far as I can gather from the literature, the credit of first calling attention to the frequency of this form of ulceromembranous stomatitis in troops during the War should be divided between Rumpel and myself. My first communication upon the subject was at the December, 1915, meeting of the Canadian Medical Society at Shorncliffe.† A preliminary report embodying the data of my Shorncliffe paper was communicated to the January meeting of the Medical Section of the Royal Society of Medicine by Sir William Osler, and was taken as read, becoming published in the February issue of the *Proceedings*. [8] A synopsis of the work was published in the *British Medical Journal* of March 11, 1916, and in the *Journal of the Royal Army Medical Corps*; and this in the form of a pamphlet was later made an issue to Canadian medical officers of the D.M.S. Canadian contingents. What I regarded as the main feature of these two articles was not the recognition of the condition, but the evidence afforded of its frequency, and the rapid results gained by the use of a mixture of practically equal parts of Fowler's solution and vinum ipecac.

In the *Münchener medizinische Wochenschrift* of January 16, 1916, Rumpel [9] described the disease as appearing in an epidemic form in a group of 900 men stationed in a Russian village; 12 cases occurred on the first day, 60 on the second, 169 on the third, and 200 on the fourth day. Of the 900 men, 420 contracted the disease. This appears to be the most severe epidemic reported in the literature. It deserves notice that, owing to the embargo on German medical literature, this article was unknown to me and to British readers in general until August, 1916.‡

An excellent article by Goadby [10] appeared in May, 1916; he described the disease clinically and bacteriologically, and afforded a useful résumé of the literature on the subject. The first article in dental literature known to me on the existence of the disease among army troops was by Mendleson [11]. He regarded it as a microbial infection supervening on a general lowering of the vitality of the alveolar process. Eleven months after my first communication, and some nine months after it appeared in print, Taylor and McKinstry [12] described the disease as "fusospirillary periodontal gingivitis," and recommended what was substantially my treatment with arsenic and ipecacuanha, though without reference to my previous communications on the subject. In January, 1917, Captain E. E. Johnson [13], L.D.S., attached R.A.M.C., working at Millbank with the two last-mentioned observers, described the disease clinically in the *British Dental Journal*, and used the identical

* An angina (from *Ango*, or *ἀγχω*, I strangle) is a condition accompanied by the sense of suffocation.

† According to correspondence on file at the office of the D.M.S., Major Bowman's original paper was received at that office for approval and publication on or before December 23, 1915; publication was delayed pending consultation with the War Office.—Editor.

‡ This malignant form is, perhaps naturally, more common in the territory of the Central Powers than with us. Thus Heinemann [18] reports that of 25 cases seen at Adrianople in February and March, 1916, nearly all succumbed to noma within two weeks; and Sauerwald [19] describes an epidemic of 45 cases among convalescents from dysentery and relapsing fever, beginning suddenly with severe cases, death in the worst cases occurring in two to four days. Other cases under treatment recovered in ten days.

formula recommended by me.* In the spring Taylor and McKinstry published their second paper on the condition as a clinical entity, reporting 70 cases, and again overlooking the earliest work, as also does Captain McKinstry [20] in his article, with extensive bibliography, in the *Practitioner* of December, 1917. Marsh [14], in Australia, reported a severe case in a sailor with lips, gums and tonsils affected, and complete cure brought about rapidly by the use of the Fowler's solution and vinum ipecac. prescription. In June, 1917, in the *Journal of the American Medical Association* appeared a paper by Captains J. D. Campbell and A. R. Dyas of the Canadian Medical Service [15] on "Epidemic Ulcero-membranous Stomatitis (Vincent's angina) among Troops," based upon the study and treatment of 129 cases. They note seven cases of bronchial infection in which the sputum was loaded with Vincent's organism, and found these organisms in small numbers in 50 per cent. of the swabs from the throats of soldiers examined overseas. They also employed the arsenic and ipecacuanha treatment for the gingivitis. In France Ramond [16] has recommended treatment by silver nitrate.

The disease has become commonly known as "trench mouth" among the troops, and at first was not distinguished from pyorrhœa, and among both medical and dental officers for many months was commonly called pyorrhœa alveolaris, and treated as such. My report in 1915 was based on an examination of 100 cases, and since then more than 1,000 have been seen, and the seriousness of the disease as a devitalizing agent among troops cannot be emphasized too strongly.

The disease may be located not only in the mouth and throat, but also occasionally in the conjunctiva and glans penis.† It has also been reported in the lungs, and deaths have occurred from a severe infection of the bronchi and lungs. For convenience, the disease may be divided into three stages:—

(1) The patient complains of a "soreness and bleeding of the gums with tenderness of the teeth," and a general feeling of lassitude, indigestion and depression. Examination shows the margin of the gums œdematous and red or "spongy-looking," with a grey line of pus extending along the edge. On even slight pressure pus exudes in small droplets, and there is more or less profuse bleeding on even the slightest touch. The teeth may be tender when tapped and loose, having lost the gum attachment. The breath is foul and has a foetid odour, characteristic of the disease.

(2) The patient has the above conditions, with added ulceration of the mucous membrane of the mouth. The ulceration almost invariably appears first opposite the last molar teeth, and may extend forward and merge with the gingivitic condition described before. The ulcer is usually shallow and covered with greyish fragile membrane of necrotic tissue. It may, however, have a ragged, punched-out appearance and be quite deep. When the membrane is wiped away a bleeding red surface remains.

There may be associated tonsillar ulcers much the same in appearance. The patient may not complain of sore throat even when the ulceration is quite extensive. The sublingual glands are more or less enlarged and tender.

(3) The ulceration may advance to such a degree as to involve a large surface of the mucous membrane of the mouth. The teeth become very loose and may come out. On the other hand, a single ulcer may advance and burrow

* Captain Johnson writes: "I should like to thank Dr. Taylor and Captain W. H. McKinstry, M.D., D.P.H., R.A.M.C., for the trouble they have taken in making bacteriological examinations, and for their suggestions as to treatment. Since writing these notes my attention has been drawn to the fact that a formula identical with the one quoted above has appeared in the *Dental Record*. I wish to state that neither of the bacteriologists nor myself saw this copy, so the fact that the formulæ are the same is a coincidence."

† Last October I published a note [17] on a case of the coincident infection of mouth, conjunctiva, and glans penis with Vincent's organisms. According to Vincent, the first to call attention to this form of spirochaetal balanitis was Queyrat, who induced the condition by inoculating the organisms into the mucosa of the balano-preputial groove. It deserves suggestion that if Vincent's organism can thrive in the mouth without setting up serious disturbance, it may under like conditions thrive in the smegma, and so be responsible for some of the reports of spirochaetes found in the urine of cases of trench fever.

until the stage of noma is reached. The infection may be spread to the bronchi and lungs and cause death.

Fresh smears made from the gums or ulcers show practically pure cultures of Vincent's organisms (spirochaetes and fusiform bacilli). Carbol-gentian violet stains them a deep purple, and they are easily recognized. For a description of the morphology and cultural characteristics reference may be made to the *Proceedings* of the Royal Society of Medicine, 1916, vol. ix (Medical section), pp. 51-60.

DIAGNOSIS.

The disease when seen first may be called pyorrhœa alveolaris, and the two conditions may be associated, and undoubtedly pyorrhœa is a predisposing cause. However, when carefully examined clinically, the two conditions can be distinguished. The redness, œdema and profuse bleeding of the gums, with the pus present, and the peculiar foetid odour should be noted. Pyorrhœa alveolaris is not usually such an acute condition, and when it is acute careful bacteriological examination will usually reveal the cause to be, not the amœba usually described as the cause, but Vincent's organisms, although the amœba gingivalis may also be found.

Where ulceration appears, the question occurs of syphilis being the underlying factor. Many cases have been seen here in which a diagnosis of syphilis has been made, but the Wassermann reaction has been negative. Ulcers, due to syphilis, are not usually so acute as those due to Vincent's organisms, but in the tonsil they may be indistinguishable. A fresh smear may show large numbers of Vincent's organisms, but this condition is very frequently superimposed upon a syphilitic ulcer.

Vincent's organisms seem to select undermined tissues for growth. This is well illustrated in cases of mercurial stomatitis where Vincent's organisms are usually found in large numbers, and treatment for this condition causes great relief.

In all cases of ulceration of the throat, if possible, a Wassermann reaction should be done. In several hundred uncomplicated cases of Vincent's disease I have never found a Wassermann positive.

The membrane covering a diphtheric ulcer is quite tough and does not come away easily, and when it does is usually intact. The characteristic odour is not present.

ON THE FREQUENCY OF VINCENT'S ORGANISMS IN THE MOUTHS OF SOLDIERS.

It was decided during last December to examine 1,000 men in camp, both clinically and bacteriologically, to learn, if possible, the number of men who cleaned their teeth carefully and the number of men who did not, and the number of men in each of these groups showing Vincent's organisms present in numbers sufficient to be diagnostic; also the numbers of cases of clinically infectious gingivitis in each of these groups.

The men examined may be divided for convenience into two classes: those with clean and those with unclean teeth.

In the first group there were 816 men, and 314, or 38.4 per cent., of these showed Vincent's organisms present, but very few in number; 20 or 6.4 per cent., showed large numbers of spirochaetes and fusiform bacilli, and were, clinically, positive cases.

In the second group there were 184 men, and 139, or 75.6 per cent., of these showed a few Vincent's organisms present; while in 59, or 32 per cent., the organisms were present in preponderating numbers, and these cases were all clinically positive.

CHART I.

Condition of teeth	Number examined	A few Vincent's organisms present		Large number of Vincent's organisms present		Clinically positive Infectious gingivitis
		Per cent.	Per cent.	Per cent.	Per cent.	
Clean	816	314 or 38.4	20 or 6.4	20 or 6.4	20 or 6.4	
Unclean	184	139, 75.6	59, 32	59, 32	59, 32	

Thus it is shown that not only are Vincent's organisms much more prevalent in mouths where the teeth are not cared for, but clinically infectious gingivitis is also much more prevalent, and corresponds practically with the bacteriological findings.

Undoubtedly these ordinarily commensal organisms may become highly virulent where tissue is prepared for their

entrance by being undermined by pre-existing inflammatory conditions due to the accumulation of irritating matter, or to dietetic errors, or certain drugs, and by contact or direct transmission may cause the disease in otherwise healthy mouths.

TREATMENT.

Before any treatment is instituted careful examination should be made of not only the gums, but also of the tonsils, and particular attention should be paid to the small pockets found behind the lower molar teeth, where the presence of ulcers may not be noted unless the cheek is forced away from the teeth.

If ulceration is present either in the gum or tonsils, it must be treated medically before any dental or surgical work is done. Very severe cases may occur in men having perfect teeth and requiring no dental attention. Tonsillectomy has been done, in cases where a tonsillar ulcer healed slowly, with almost disastrous results, the infection rapidly spreading in the torn and lacerated tissue and causing ulceration of the whole operation area.

In treatment many drugs have been used. In the first report it was stated that "trichloro-acetic acid, silver nitrate, iodine, peroxide of hydrogen have all been used with some success, and salvarsan also has a marked effect on the condition." At that time the following prescription was recommended:—

R Vinum ipecacuanhæ ½ oz.
Glycerinum 1 dr.
Liquor arsenicalis q.s. ad 1 oz.

This to be used as a local application. The ipecac. is not only amoebicidal and spirochæticidal, but has a marked hemostatic action—a most important consideration where the gums bleed profusely. The arsenic is markedly spirochæticidal, and the whole mixture has very little taste.

Where it is used as an application to the tonsils or gums, we have sometimes added pulv. tragacanth to thicken the mixture.

In the last publication on the condition, issued as a pamphlet by the Director of Medical Services, Canadians, in 1917, an addendum stated that "by substituting a saturated solution of antimony and potassium tartrate for the arsenic in the above formula, results in the treatment of the condition seem to have been equally good." Since then this has been corroborated many times, and would seem to be an improvement on the arsenic, which is much more poisonous. A small quantity of "Colosol" arsenic (Crookes) was obtained, and in two cases seemed to cause rapid healing of the ulcers.

Where the disease has seriously involved the glands, or has spread to the lungs, salvarsan should be given intravenously. A dentifrice containing tartar emetic and pulv. ipecacuanhæ has been used in early cases with very good effect.

SUMMARY.

The condition may be described as an infectious disease of the mucous membranes of the mouth due to a spirochæte and fusiform bacillus (Vincent's organisms), causing severe inflammation which may progress to ulceration, accompanied by constitutional disturbances, such as fever, gastric disorder, loss of weight, and marked depression.

No mention has been made in this paper of the bacteriology of the disease known as "Infectious Gingivitis and Stomatitis," as this was published in January, 1916. Since then the clinical aspect of the condition and its treatment have occupied as much time as could be spared for this work. The relation of the spirochæte to the fusiform bacillus has still to be definitely worked out, and is more a matter of biological interest than of practical importance.

The disease is definitely a medical one, and not one for dental treatment alone, although dental surgeons should be instructed in the recognition, differential diagnosis, and the treatment both of the throat and mouth conditions.

The disease in a large percentage of cases is one of unclean mouths, and in the Army the facilities for a thorough toilet of the mouth and teeth once a day should be provided for every officer, non-commissioned officer and man, and should be insisted on. This is not only important from the local effect on every individual, but prevents the infection spread-

ing to men who do clean their teeth regularly, and who of necessity must be crowded together with men possibly having the disease.

Where the disease has reached the stage of ulceration a Wassermann reaction, if possible, should be done.

Bacteriologically, the disease may be diagnosed by making smears from the infected areas, when the spirochætes and fusiform bacilli can be easily recognized.

I should like to thank Captain C. K. Church, C.A.M.C., for his help in examining the group of 1,000 men reported in this paper.

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STUDIES ON STREPTOCOCCI RECOVERED FROM SICK AND WOUNDED SOLDIERS IN FRANCE. (A brief Review of previous Papers on Streptococci with a Report on the Types isolated from Twenty-five Selected Cases.)

By R. H. MALONE, M.D., C.M. McGill, Captain C.A.M.C., and L. J. RHEA, M.D. Johns Hopkins, Major C.A.M.C.

It is well known that streptococci differ in their pathogenic properties, morphological characters, and cultural reactions, and that they form a group of organisms, the members of which vary among themselves, and in this way resemble other groups of bacteria, for example, the typhoid-colon group. Some of them bear more than a casual relation to, and so frequently occur in certain diseases that some writers appear to believe that they are almost as specific in these diseases as *B. typhosus* is in typhoid fever; acute rheumatic fever is but one example. Streptococci vary considerably in virulence, and an appreciation of this fact must influence any conception of the future course—immediate and remote—of diseases due to, or complicated by, these organisms; for prognosis depends not only upon treatment and the factors concerned in immunity, in the broad sense, but upon the nature of the infecting organism as well.

The earlier classifications of streptococci were based upon pathogenic properties and morphological characters, such as variation in the length of the chains, and in the size, shape and arrangement of the individuals forming a chain. From such classifications as these the names *Streptococcus longus*, *brevis*, *pyogenes*, *mitior*, &c., are derived. The pathogenicity

of the various types is so little understood, and the morphology so inconstant, that classifications based on these characters alone are necessarily incomplete, and even apt to be misleading.

Later classifications, however, depend upon the reactions of streptococci in various culture media, and have as their basis the power possessed by these organisms of hæmolyzing red blood cells, and fermenting certain carbohydrate radicles. These cultural characters are, in our experience, constant, and bear a definite relation to certain serological reactions; they also have the advantage of being readily studied.

By their growth on blood agar to which no "sugar" has been added, streptococci are divided into two primary groups, hæmolytic and non-hæmolytic. The colonies of the former are characterized by the general absence of pigment and by the presence of a sharply defined encircling zone, free from hæmoglobin and red blood cells, the latter by the absence of such a zone and the presence of pigment. A narrow zone of hæmolysis is sometimes seen around the colonies of non-hæmolytic strains, but this can hardly be confused with the sharply defined clear zone produced by hæmolytic strains, for the zone is much smaller (narrower and shallower), the destruction of red cells is less complete, and a large number of them are seen immediately beneath the non-hæmolytic colonies, while few, or none at all, are seen beneath the hæmolytic ones. These points of difference can be recognized readily by using the low power of the microscope. A satisfactory method of demonstrating them is as follows:—

Punch out with a cork borer a cylinder of agar, including a hæmolytic colony, its clear zone, and a portion of the surrounding media; with a sharp safety razor blade make a thin vertical section through the colony and the entire thickness of the underlying agar. Lay the section flat on a clean glass slide, and examine it with a hand lens and the low power. Compare this with a similar section made through a non-hæmolytic colony.

The factors concerned in the production of the hæmolytic zone are not fully understood. This phenomenon has been said to depend upon the action of a hæmolysin, but of this we know but little, nor do we understand how the freed hæmoglobin and the bodies of the red cells are disposed of. It seems reasonable to suppose that they are not merely destroyed, but made use of in the metabolism of the organism.

The majority of the non-hæmolytic strains produce colonies of various shades of brown or green, and this occurs more often on blood agar containing 1 per cent. glucose. The pigmentation is due to methæmoglobin, but how it is produced we do not know. It has been suggested that it is formed from hæmoglobin by the action of acids derived from the carbohydrate in the media. This seems improbable, as streptococci grown in dextrose ascitic bouillon to which sheep's corpuscles have been added produce methæmoglobin very readily, even when the neutrality of the medium is maintained by the addition of secondary phosphates.

As some non-hæmolytic strains are not pigmented, Mandelbaum, Le Blanc, Lyaill and others have suggested that they should constitute a group by themselves. By their reactions upon blood agar streptococci would then be divided into three groups: hæmolytic, methæmoglobin producers, and "indifferent." The members of the suggested third primary group, however, are so closely allied to the methæmoglobin producers with regard to their pathogenicity, distribution in nature, morphological and cultural characters, that it would be misleading to place them in a class by themselves. It has also been shown that the serum of animals, immunized against one member of the hæmolytic group, will agglutinate other hæmolytic strains, but will not agglutinate members of the non-hæmolytic group, whether they be methæmoglobin producers or not; cross-agglutination, however, occurs between methæmoglobin producers and "indifferent" strains.

The ability of streptococci to ferment certain "sugars," or the lack of this property, is now largely used as a basis for the determination of subdivisions of the two main groups (hæmolytic and non-hæmolytic). The number of "sugars" used by different investigators has varied from few to many, and within certain limits the number of subdivisions increases with the number of "sugars" employed. Important as the fermentation reactions are in determining subdivisions of the two main groups, they cannot be used alone as means of identifying all the known strains of streptococci, as some

members of the hæmolytic group give the same sugar reactions as some of the non-hæmolytic group. To give an example, *Streptococcus pyogenes* (hæmolytic) and *S. mitis* (non-hæmolytic) ferment saccharose, lactose, and salicin, but not mannite, raffinose, nor inulin; there is, however, no cross-agglutination between these organisms, and the former is considered to be much more virulent than the latter.

Much of the difficulty in analysing the records of earlier workers, and comparing them with those of later investigators, must be ascribed to too great a reliance on sugar reactions as a means of differentiation, and the failure to make good use of the blood agar plate.

Classifications comprehensive enough to include all known streptococci are of the greatest importance, their value increasing as our knowledge of specific therapy advances; for from our collective knowledge of these organisms it is possible to form more rational conclusions with regard to their pathogenicity, the sources from which they are derived, as well as the treatment and prognosis of any given case. Beside the more comprehensive classifications others have been suggested, primarily with the view of separating the more pathogenic groups from the less pathogenic ones, rather than identifying the various members of each group. These "clinical" classifications are of assistance to the surgeon and physician, and at present fulfil the requirements of a routine laboratory examination.

Research on streptococci has done more than simply point out differences between closely allied members of a widely distributed and very important group of organisms; it has paved the way for more accurate knowledge based on serological reactions, and incidentally thrown some light upon the biology of bacteria in general.

During the past year we have been studying the streptococci isolated from various types of wounds, and the relation of this group of organisms to war wounds in general, and to their surgical complications.

The work was undertaken primarily with the hope that we might be able to assist the surgeon in forming an opinion with regard to the proper surgical procedure, subsequent treatment and prognosis in cases of streptococcal infection, for all of these depend in some degree upon the particular type of infecting organism.

For this report we have selected for analysis twenty-five of the cases studied. In these the lesions chosen for special study bore an indirect connection with the track of the missile and with the outside, or contained streptococci in pure, or nearly pure, culture. Such an indirect connection is seen, for example, in a shrapnel wound of the leg, where there is only bloody effusion in the knee-joint, without a fracture into the joint itself, or laceration of the capsule. The abscesses included in this report developed at such a time after the primary injury, or bore such a relation to it, as to warrant a conclusion that they were secondary infections. In other cases, as in the thoracic injuries, the wounds were closed, and streptococci were recovered in pure, or nearly pure, culture.

By such a selection of cases we hoped to determine the type, or types, of streptococci that lead to surgical complications of wounds rather than those found in the track of the missile, its lining, or the tissues immediately about it; further, we hoped to find streptococci in pure, or nearly pure, culture, or in such numbers as to be able to attribute the lesion to them. This would be difficult in cultures made from the track of the wound soon after injury.

The classification we have adopted is that suggested by W. L. Holman, and while we hold no brief for the system of nomenclature employed, this classification is comprehensive enough to include over 2,400 strains of streptococci, 50 per cent. of which are hæmolytic.

HÆMOLYTIC.	Lactose.	Mannite.	Salicin.	NON-HÆMOLYTIC.
<i>S. infrequens</i>	+	+	+	<i>S. faecalis</i>
<i>S. hæmolyticus</i> (1)	+	+	-	<i>S. non-hæmolyticus</i> (1)
<i>S. pyogenes</i>	+	-	+	<i>S. mitis</i>
<i>S. anginosus</i>	+	-	-	<i>S. salivarius</i>
<i>S. hæmolyticus</i> (ii)	-	+	+	<i>S. non hæmolyticus</i> (ii)
(iii)	-	+	-	" (iii)
<i>S. equi</i>	-	-	+	<i>S. equinus</i>
<i>S. subacidus</i>	-	-	-	<i>S. ignavus</i>

+ = Fermentation with acid production.

- = No fermentation.

CHART I.—KNEE-JOINT INFECTIONS.

No.	Date of injury	CLINICAL HISTORY		BACTERIOLOGICAL HISTORY			Remarks
		Nature of wound	Complications	Source of material for culture	Date	Type of streptococcus	
1	12.6.17	S.W. right knee, fracture head of tibia, joint opened and foreign body removed	Abscess above knee-joint 8.7.17; abscess popliteal space 23.7.17	Knee-joint fluid Abscess above knee " "	16.6.17 24.6.17 26.6.17 8.7.18	(Not identified) " <i>pyogenes</i> "	Amputation above knee, 23.7.17; discharged to England, "A" case, 28.7.17
2	1.6.17	S.W. right knee, fracture tibia, F.B. and cartilage of joint removed	Abscess popliteal space 22.6.17; abscess thigh, abscess below knee 4.7.17	Knee-joint fluid " " " " " " Abscess below knees	3.6.17 11.6.17 24.6.17 1.7.17 2.7.17 8.7.17	(Not identified) " " <i>pyogenes</i> " " "	Discharged to England, "A" case, 28.7.17
19	31.7.17	G.S.W. below right knee, F.B. removed from calf, no evidence of joint infection until 8.8.17	—	Knee-joint fluid "	8.8.17 10.8.17	<i>infrequens</i> "	Discharged to England, "B" case, 22.8.17; a comparatively mild case, the primary wound drained freely, the joint was always movable*
24	17.8.17	S.W. right knee, fracture internal condyle of femur, bone fragments removed, wound comparatively clean, closed	—	Knee-joint fluid " " "	19.8.17 21.8.17 22.8.17 28.8.17	<i>pyogenes</i> " " "	Discharged to England, "B" case, 29.8.17; first tapping showed streptococci, staphylococci, and bacilli (not "gas"); the bacilli disappeared after second tapping; staphylococci persisted, no streptococci were found fourth tapping; there was always active phagocytosis
26	18.8.17	S.W. right knee, fracture internal condyle of femur, capsule of joint lacerated	Abscess popliteal space 26.8.17	Knee joint fluid " Abscess popliteal space	20.8.17 22.8.17 6.9.17	<i>pyogenes</i> " "	Discharged to England, "B" case, 11.9.17
29	22.8.17	G.S.W. perforating left thigh	Abscess thigh 25.8.17; several hæmorrhages from thigh 29.9.17	Knee-joint fluid	11.9.17	<i>pyogenes</i>	Discharged to England, "B" case, 10.10.17; amputation above knee, 1.10.17
32	6.9.17	S.W. right leg below knee joint, fracture tibia, no evidence of infection in joint until 10.9.17	—	Knee-joint fluid " "	10.9.17 13.9.17 18.9.17	<i>pyogenes</i> " "	Discharged to England, "B" case, 22.10.17; from an abscess in left leg following S.W. through gastrocnemius <i>Streptococcus pyogenes</i> was isolated; no other types of streptococcus
39	5.10.17	G.S.W. left leg, popliteal space, F.B. removed, joint capsule closed 10.10.17	—	Knee-joint fluid (blood-clot)	10.10.17	<i>equi</i>	Discharged to England, "B" case, 13.10.17; mild infection; direct smears from the knee-joint fluid and blood-clot showed no organisms; growth was obtained from the clot alone
44	13.10.17	S.W. right knee, fracture internal condyle of femur, joint penetrated	Abscess right thigh 31.10.17	Knee-joint fluid Abscess thigh	15.10.17 31.10.17	<i>infrequens</i> <i>pyogenes</i>	Discharged to England, "B" case, 18.11.17; it is possible that both <i>infrequens</i> and <i>pyogenes</i> were present in the knee fluid and abscess; colonies of both are hæmolytic and very similar in appearance
45	12.10.17	S.W. inner side left thigh, compound fracture of femur, lower third, F.B. removed, joint not penetrated	Cellulitis outer side thigh	Knee-joint fluid " Pus from region of fracture	13.10.17 14.10.17 16.10.17	} <i>salivarius</i> and <i>mitis</i>	Died 18.10.17 general septicæmia; amputation, 14.10.17; organisms not encapsulated; Neufeld bile test negative
48	—	No wound or injury, reported sick with swollen left knee 13.10.17; blisters on both heels from boots; impetigo four months ago, lasting two months, no venereal history, teeth good, no tonsillitis	Abscess popliteal space 24.11.17	Knee joint fluid " "	20.10.17 1.11.17 4.11.17		} <i>pyogenes</i> and <i>salivarius</i>

* The clinical picture suggested infection by a non-hæmolytic strain. Growth in broth was turbid, with sedimentation. On replating, all colonies were hæmolytic, and gave the same sugar reactions as the original culture.

METHODS EMPLOYED.

In the case of open wounds cultures are taken from the deeper portions of the track with sterile cotton-wool swabs. Chest fluids are centrifuged and the sediments examined; often small pieces of clot will contain organisms when the fluid itself appears to be sterile. Knee fluids are taken in citrated saline, and centrifuged or examined directly, according to the amount of pus which is present. Smears are made on clean glass slides, and stained with Loeffler's methylene blue and with Hiss's capsule stain. The swabs are washed off in test tubes containing 5 c.c. of trypsin broth, and from this a blood agar plate is inoculated by surface streaking; broth and plate are incubated for twenty-four hours. Several

of the colonies resembling streptococci (hæmolytic and non-hæmolytic) are picked out, replated and incubated for twenty-four hours. Smears from each tube of broth are examined to determine the morphology of the streptococci present. If the cultures on the second plate appear to be pure they are transferred to the "sugars"; if impure, streptococcus colonies must be "fished" and replated until a pure culture is obtained. The appearance of the growth and the presence or absence of fermentation in the sugar media are recorded every day for a week. At the end of forty-eight hours stock cultures are made on trypt-agar, and the broth cultures examined for morphology in hanging-drop and strained specimens. At the end of a week, if the

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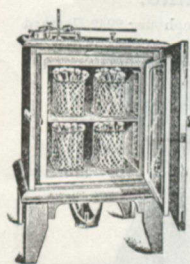
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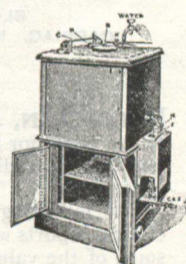
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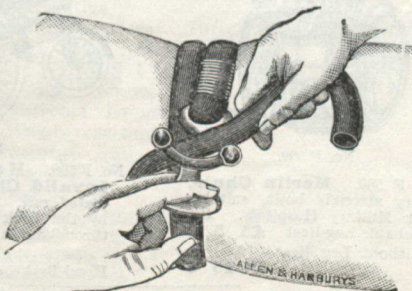
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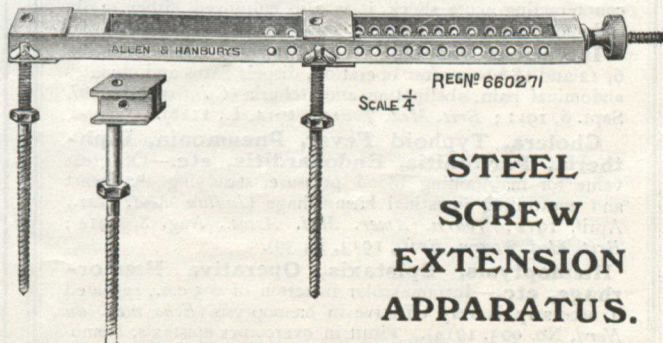
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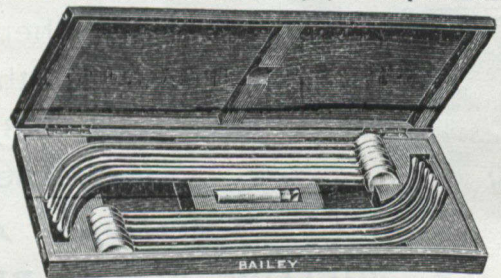
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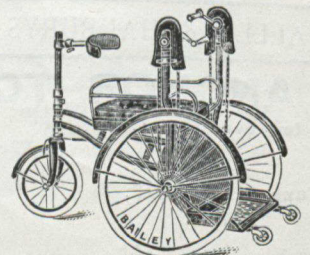
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CHART II.—THORACIC INJURIES.

No.	Date of injury	Clinical history	BACTERIOLOGICAL HISTORY			Remarks
			Source of material for culture	Date	Type of streptococcus	
4	21.6.17	S.W. back penetrating chest, F.B. lying on pleura removed; small tear in pleura followed by hæmorrhage; 26.6.17, blood-stained discharge and air blown out when wound was dressed; 27.6.17, chest tapped, no growth; 30.6.17, chest tapped, mixed infection; operation, resection of eighth rib, chest cleaned and drained	Chest fluid Chest wound	2.7.17 2.7.17	<i>pyogenes</i> "	Discharged to England 19.7.17, "B" case; culture from chest fluid showed streptococci, bacilli (not "gas"), and organisms resembling pneumococci
7	3.5.17	S.W. back penetrating chest, hæmothorax, three small F.B.'s in lung; chest tapped 14th, 19th and 20th; few cells, no organisms; 21.5.17, discharge of bile from chest wound; operation, diaphragm perforated; 25.6.17, chest tapped, streptococci; 4.7.17, blood culture, streptococci	Chest fluid Blood	25.6.17 4.7.17	(Hæmolytic) <i>pyogenes</i>	Died 18.7.17. P.M. report: Empyema bilateral, abscess liver, well drained; abscesses lungs and spleen, no general peritonitis
10	30.6.17	S.W. left chest, entrance above clavicle, exit at same level behind, close to vertebrae; hæmoptysis, large hæmothorax; temperature about 100° F. until 10.7.17, higher and more irregular from 11.7.17 to 17.7.17, maximum 104.4° F.; chest tapped 9.7.17 and 10.7.17, no growth; 13.7.17, chest tapped, streptococci; operation, treated with bismuth, iodoform and paraffin, and closed	Chest fluid	13.7.17	<i>faecalis</i>	Discharged to England, "B" case, 2.8.17
37	4.10.17	S.W. right back penetrating chest, hæmothorax; history of hæmoptysis; 8.10.17, operation, chest cleared and closed; streptococcus in chest fluid with pneumococcus and a few bacilli; 10.10.17, chest reopened and drained; 19.10.17, Carrel-Dakin treatment	Chest fluid "	8.10.17 10.10.17	<i>pyogenes</i> "	Died 20.10.17. P.M. report: Septicæmia, acute purulent pericarditis, empyema right, multiple abscesses of lungs
38	4.10.17	S.W. left chest, F.B. removed; 8.10.17, signs of hæmothorax; 10.10.17, chest tapped, no fluid obtained; 11.10.17, chest tapped, streptococci, B.I.P. and closed, hæmorrhage same evening	Chest fluid Pericardial fluid (P.M.)	11.10.17 13.10.17	<i>pyogenes</i> "	Died 13.10.17. P.M. report: Septicæmia, acute purulent pericarditis, empyema left, pyæmic abscesses in lungs
40	20.9.17	S.W. left chest, hæmothorax; 1.10.17, chest tapped, <i>Bacillus aerogenes</i> and streptococci; 2.10.17, operation, shell fragments removed from lung, B.I.P. and closed	Chest fluid " " " "	1.10.17 3.10.17 6.10.17 8.10.17 14.10.17 18.10.17	<i>pyogenes</i> " " " "	Discharged to England, "B" case, 28.10.17; no "gas" bacilli found after first tapping; the last three tappings contained <i>Staphylococcus aureus</i> as well as streptococcus
49	23.10.17	G.S.W. perforating chest, hæmothorax; 31.10.17, streptococci; operation, treated with flavine and closed; moderate temperature until 30.10.17, high and remittent from 31.10.17 until 10.11.17; chest tapped at intervals until 11.12.17; dry tap on 11.12.17	Chest fluid " " " " "	31.10.17 3.11.17 4.11.17 5.11.17 7.11.17 13.11.17	<i>mitis</i> " " " " "	Discharged to England, "B" case; chest fluid on each successive tapping showed a gradual diminution in the number of organisms; phagocytes always active
51	26.10.17	S.W. right chest, fracture scapula; 29.10.17, chest tapped; 7.11.17, chest tapped, streptococci, staphylococci, and an occasional bacillus; operation, F.B. removed from lung; treated with flavine and closed; hæmorrhage same night	Chest fluid " Blood (P.M.)	7.11.17 9.11.17 14.11.17	<i>salivarius</i> " "	Died 14.11.17. P.M. report: Empyema right, pleurisy left, purulent pericarditis, general septicæmia

CHART III.—WOUNDS OF THE SOFT TISSUES.

No.	Date of injury	CLINICAL HISTORY		BACTERIOLOGICAL HISTORY			Remarks
		Nature of wound	Complications	Source of material for culture	Date	Type of streptococcus	
8	3.7.17	S.W. left thigh, F.B. removed; hæmorrhage from large branch of femoral vein; septic temperature from 9.7.17 till death; 10.7.17, blood culture negative	Infected hæmatoma below quadriceps; septicæmia	Hæmatoma Heart's blood (P.M.) Wound left thigh (P.M.)	8.7.17 15.7.17 "	<i>pyogenes</i> " "	Died 14.7.17; General septicæmia; <i>Staphylococcus albus</i> associated with streptococcus in cultures from wound (P.M.)
22	16.8.17	Bullet wound perforating right thigh; No fracture; 17.8.17, blood-clot removed from infected hæmatoma, thigh very tense and painful, but no evidence of "gas" infection	Infected hæmatoma	Hæmatoma	17.8.17	<i>pyogenes</i>	Discharged to England, "B" case, 20.8.17; a non-hæmolytic streptococcus, not identified, was associated with the <i>pyogenes</i> ; it was present in small number.
31	4.9.17	S.W. right thigh multiple; wound dirty, no F.B.'s located; 10.9.17 operation for large dissecting abscess right thigh; high temperature till 14.10.17	Abscess	Abscess	10.9.17	<i>pyogenes</i>	Discharged to England, "B" case, 17.10.17.

CHART IV.—MEDICAL CASES.

No.	Onset of illness	Clinical history	BACTERIOLOGICAL HISTORY			Remarks
			Source of material for culture	Date	Type of streptococcus	
11	13.6.17	Admitted to Field ambulance with P.U.O.; at C.C.S., diagnosis "malignant endocarditis, lobar pneumonia"; admitted to base hospital, 13.7.17, septic temperature; signs of consolidation at bases of both lungs, mitral systolic murmur; 14.7.17, incontinence of urine and faeces: blood culture, streptococcus; died 24.7.17	Blood	14.7.17	<i>pyogenes</i>	Post-mortem report: Dilatation of right heart, no evidence of endocarditis, sub-epicardial and sub-pleural hæmorrhages, acute nephritis, septic spleen, general septicæmia; blood culture was taken in dextrose tryptic broth; in 5 hours the broth was cloudy, and in 18 hours large numbers of streptococci were seen in a hanging-drop preparation
12	31.5.17	A local case; admitted with hæmoptysis and pain in left chest; diagnosis "broncho-pneumonia"; 11.6.17, signs of pneumonia have disappeared, temperature remains 100° F. to 101° F.; 28.6.17, thrombosis of left basilar vein; 30.6.17, X-ray of lungs negative; 3.7.17, thrombosis of right basilar and right external jugular veins, temperature 103° F., heart negative; 9.7.17, œdema of thoracic wall, superficial veins of chest dilated; 12.7.17, superficial veins of abdomen dilated; 16.7.17, blood culture, streptococcus, white blood count 17,800, Wassermann negative; 18.7.17, pain in right side over liver, fluoroscopic examination suggests aneurysm of aorta rather than tumour; died 24.7.17; temperature throughout illness about 100° F., with occasional rises	Blood thrombus, superior vena cava P.M.	14.7.17 25.7.17	<i>mitis</i> <i>mitis</i>	Post-mortem report: Carcinoma of œsophagus with multiple metastases, general septicæmia, mural thrombus of heart, thrombosis of basilar veins, veins of neck and superior vena cava
16	5.8.17	Admitted from convalescent depot, 5.8.17, semi-conscious, cyanosed, pulse 160, temperature 105° F., radial pulse not palpable; died same night	Aortic vegetation from wall of aorta P.M.	6.8.17	<i>anginosus</i> and <i>salivarius</i>	Post-mortem report: Acute infective aortitis, myocarditis, cardiac failure, no evidence of endocarditis, chronic nephritis, septic spleen, central necrosis of liver; the vegetations were confined to the aortic wall; the valves were healthy, the aortitis was not of the syphilitic type; blood agar plate from vegetation showed hæmolytic colonies, non-hæmolytic colonies, <i>Staphylococcus albus</i> and some bacilli; the majority were hæmolytic; as the hæmolytic and non-hæmolytic strains gave the same sugar reactions, they were replated from the sugars; the former produced hæmolytic colonies only, the latter green colonies only, without any evidence of hæmolysis

CHART V.—TYPES OF STREPTOCOCCUS ISOLATED.

	Knees	Chests	Open wounds	Medical cases	Total
<i>Pyogenes</i>	6	5	2	1	14
<i>Pyogenes</i> and <i>salivarius</i> ..	1	—	—	—	1
<i>Pyogenes</i> and <i>infrequens</i> ..	1	—	—	—	1
<i>Pyogenes</i> and a non-hæmolytic	—	—	1	—	1
<i>Salivarius</i>	—	1	—	—	1
<i>Salivarius</i> and <i>mitis</i>	1	—	—	—	1
<i>Salivarius</i> and <i>anginosus</i> ..	—	—	—	1	1
<i>Mitis</i>	—	1	—	1	2
<i>Infrequens</i>	1	—	—	—	1
<i>Equi</i>	1	—	—	—	1
<i>Fæcalis</i>	—	1	—	—	1
	11	8	3	3	25

Streptococcus pyogenes was found in 17 cases.

" *salivarius* " " 4 "

" *mitis* " " 3 "

" *infrequens* " " 2 "

" *anginosus* " " 1 "

" *equi* " " 1 "

" *fæcalis* " " 1 "

A non-hæmolytic streptococcus (not identified) was found in one case.

fermentation reactions remain constant, the broth cultures are thrown away; but if any change has taken place the cultures are replated to test their purity; this is of the greatest importance when one is dealing with mixed cultures.

All cultures are made in trypsinized broth, prepared according to the method of Captain S. R. Douglas, I.M.S. (retired),

and on human blood agar made from trypsinized broth, because growth upon these media was found to be better than on the other media available in the war zone, and equally as good as that obtained in the various serum broth media which we have been able to test.

PREPARATION OF MEDIA.

Trypsinized Broth.—Take a fresh bullock's heart, free it from fat and blood-vessels, cut into small pieces, and pass through a mincing machine; add four litres of water; make the mixture faintly alkaline to litmus paper with 20 per cent. sodium or potassium hydrate; heat slowly to 80° C. for five minutes, and cool to 37° C. Make sure that the reaction is still faintly alkaline to litmus, add 30 to 40 c.c. of liquor trypsinæ co.; incubate at 37° C. until trypsinization is complete; this usually takes from three to five hours. Complete trypsinization is determined by the Biuret test.*

Now make slightly acid to litmus paper with glacial acetic acid, add 0.5 per cent. sodium chloride, and bring slowly to the boil for a quarter of an hour. Leave overnight in a cool place. Syphon off the clear fluid, make the reaction 0.6 acid to phenolphthalein, and heat in an Arnold sterilizer. When the reaction remains fixed the broth is filtered and autoclaved, or sterilized in the Arnold for fifteen minutes on each of three successive days.

Blood Agar.—The blood agar we have used for making plates contains 10 per cent. defibrinated human blood in

* Biuret Test.—Take 5 c.c. of broth, add 0.1 c.c. of 5 per cent. copper sulphate, mix, and slowly add 5 c.c. of normal sodium hydrate. A pink colour denotes complete trypsinization; blue, purple or lilac incomplete trypsinization.

3 per cent. tryptic agar (i.e., 3 per cent. agar in trypticized broth, reaction 0.6 acid to phenolphthalein). The tryptic agar is stored in 200-c.c. flasks, 150 c.c. in each flask. 15 c.c. of defibrinated human blood is added to each flask of melted agar at a temperature of 45° to 50° C.; the mixture is well shaken, and the plates poured immediately. This method ensures a thorough mixture of blood and agar, and gives a medium of constant composition. The plates are incubated overnight, and all contaminated ones are thrown out. A piece of sterile filter paper inserted in the cover of each plate will prevent the surface of the agar from becoming too moist.

Carbohydrate Media.—We have used three "sugars," lactose, mannite and salicin, and litmus solution, 30 c.c. per litre of broth as the indicator. The broth contains 1 per cent. of the "sugars" to be used, and is tubed in quantities of 5 c.c., and sterilized in the Arnold for fifteen minutes on each of three consecutive days. Andrade's decolorized acid fuchsin was used in a series of control experiments to compare it with litmus solution, and we have found it extremely satisfactory.

From our series of selected cases the following conclusions have been drawn:—

(1) In direct injuries of the knee-joint and indirect injuries with fracture of the femur or tibia, streptococci are usually found before the fifth day. In secondary infections where there has been no fracture into the joint, streptococci are recovered from the knee-joint fluid from the eighth to the twentieth day.

(2) In thoracic injuries with infected hæmothorax these organisms are found between the seventh and fourteenth day after injury.

(3) *Non-hæmolytic streptococci* are an uncommon cause of the surgical complications of wounds, except in cases of hæmothorax, where they are usually of the types found normally in the respiratory tract.

(4) *Streptococcus pyogenes* is the type most commonly found in infected wounds. It is also the most pathogenic. The evidence to support this latter view is as follows:—

(a) Of eight cases of infection in the knee-joint, five developed secondary abscesses in the thigh or calf. *Streptococcus pyogenes* was found in the knee fluid and abscess in each of these cases.

(b) Of the three cases of infection in the knee-joint which required amputation, two contained *pyogenes*.

(c) Four cases of infected hæmothorax ended fatally; three of these were due to *Streptococcus pyogenes*.

(d) This organism was recovered from the three cases of infected open wounds of the soft tissues, which were complicated by an infected hæmatoma or abscess.

(e) There was only one serious case of infection in the knee-joint (Case 45) that was not caused by *Streptococcus pyogenes*.

(f) There was only one mild case of an infected knee-joint (Case 24) in which *pyogenes* was the causative agent, and this case had the advantage of very early surgical treatment.

(5) So far as streptococci are concerned in the surgical complications of wounds of war, the type which is most common, and leads to the most serious results, is the same as is met with in civil surgery.

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A complete bibliography will be found in Holman's paper.

THE IMPORTANCE OF THE EARLY DIAGNOSIS OF SYPHILIS AND THE RELATION OF THE DARK FIELD EXAMINATION AND WASSERMANN REACTION TO DIAGNOSIS.

By A. B. JACKSON, M.B.Tor., Captain C.A.M.C.

(Read at a meeting of the Clinical Society of the Canadian Hospital, Etchinghill, Kent.)

THE *Treponema pallidum*, or *Spirochæta pallida*, enters an abrasion of the delicate skin of the glans penis, prepuce, or in some other locality of the body, such as the lips, tongue, tonsils, abdomen, &c., and there begins to multiply at once. It is not a pyogenic organism, and therefore does not stimulate the production of polymorphonuclear leucocytes. The tissues of the body do react to it, however, in that the

fibroblasts and endothelial cells proliferate and encroach upon the small blood-vessels. In the course of a few weeks—from two to six weeks—the process has gone so far as to markedly interfere with the nutrition of the surface epithelium. As a result only a small amount of friction is sufficient to displace the epithelium and leave a small erosive ulceration. It is at this time that the disease first becomes clinically manifest.

But it is of the utmost importance to bear in mind the fact that the process has been having its effect on the deeper tissues. The inguinal glands are, as a rule, enlarged and shotty by the time the primary lesion becomes apparent. Often the cervical glands and epitrochlear glands are involved as well, and as these can only become infected by the blood-stream, it means that the disease has become generalized.

It might be suggested that the lymphatic glands are not infected, but are reacting to the toxin absorbed at the primary lesion. I have found *Treponema pallidum* in the inguinal glands at this stage. As the *Treponema pallidum* is present in the inguinal glands, I conclude that it is present in the cervical and epitrochlear glands. This fact I hope to prove in the near future. Therefore, I consider that the infection has become generalized by the time the primary lesion becomes clinically apparent, or very soon afterwards, if treatment is not inaugurated immediately.

When the infection becomes generalized the central nervous system may become infected, and I hope to impress upon you the importance of this fact.

I have briefly described the pathology of a typical syphilitic lesion, but it is not always possible to make a diagnosis so easily. I do not wish to encroach upon the clinical aspect of it, although it is of the utmost importance, for, as MacDonald says, a syphilitic lesion is diagnosed by looking at it, or, as Lockhart says, "by looking for it." But many primary lesions are infected with secondary organisms and the picture is greatly altered. However, the *Treponema pallidum* is at the bottom of these lesions (in more ways than one), and it is in these cases where the dark field is useful.

The treponema is a delicate organism, and when removed from its natural environment soon loses its virulence.

Experiments of the Pasteur Institute, Paris, showed that in order to successfully inoculate monkeys the animals had to be brought to the source of the treponema. It was practically impossible to successfully inoculate them if the material to be inoculated was quickly carried from one room to the other.

I mention this to show the importance of not applying local antiseptics, such as bichloride of mercury, black wash, &c., until the dark field has been made and a definite diagnosis established.

Antiseptics readily destroy the superficial organisms, and make it very difficult and at times impossible to demonstrate the *Treponema pallidum*. The sores should be left alone, with a dry sterile or saline dressing if necessary. Caustics act in the same way. Do not cauterize a sore. The infection is not destroyed. It has probably become generalized already. Diagnosis is only delayed, and successful antiluetic treatment depends on early diagnosis.

Salvarsan treatment acts in the same way. It is of no use even to try to find the treponema in sores forty-eight hours after the first injection. I have seldom found them in primary syphilitic lesions twenty-four hours after the first injection.

But given a lesion which has received no antiseptic treatment, has not been cauterized and has been kept clean, it is an easy matter to demonstrate the treponema if it is present; and it is the *Treponema pallidum* that clinches the diagnosis in early cases.

The Wassermann reaction is dependent upon a substance—reagin—which is present in the blood as a result of syphilitic infection. This substance—reagin—is not formed at once, or at a definite and fixed stage of the infection. It is formed gradually, and only some time before the clinical signs and symptoms of generalized syphilis appear is there sufficient reagin to give a positive Wassermann. We are continually having men with primary lesions sent in for a Wassermann. Good! But it is too early to expect a positive reaction in most cases, and it is the custom here to have a dark field made rather than a Wassermann.

The *Treponema pallidum* is the cause of syphilis, and is present before clinical signs appear. The Wassermann reaction is a result of the generalization of the syphilitic infection, and is therefore late in appearing. It is the same in typhoid fever. In the first few days of the fever the typhoid bacilli are in the blood, and to make an early diagnosis a blood culture is made. The Widal reaction is the result of the infection, and does not become positive until the disease has been present for some time—namely, during the second week. Therefore, to make an early diagnosis of typhoid fever we look for the typhoid bacillus. Similarly, to make an early diagnosis of syphilis, we look for the cause of syphilis—the *Treponema pallidum*. We do not delay treatment, waiting unconcernedly for the Wassermann to become positive. Successful treatment depends on early diagnosis.

Allow me to give a few figures showing the importance of early diagnosis, also showing that the longer the infection has been present the more difficult it is to cure.

The Wassermann reaction is the most delicate test we have for controlling treatment. It becomes positive before the ordinary clinical manifestations of so-called secondary syphilis are evident. It remains positive after the clinical signs have disappeared.

I took seventy-two cases of syphilis and divided them into primary, generalized and late cases. Primary cases were those which showed only a primary lesion. Generalized cases were those that had rashes, mucous patches, condylomata, &c. Late cases were those which presented lesions, such as tabes, &c.

Of twenty-seven primary cases, after a full course of "606," 23 or 85.5 per cent. had a negative Wassermann.

Of thirty generalized cases, 9 or 30 per cent. showed a negative Wassermann after a full course.

While of fifteen late cases only 1, or 6.7 per cent., showed a negative Wassermann.

In other words, the longer the infection exists the more difficult it is to render the Wassermann negative.

Harrison gives a series of cases showing somewhat similar results. Of seventy-nine primary cases, after a full course of salvarsan, 66 were negative, or 83.5 per cent.

Of 141 generalized cases 82 were negative, or 58.1 per cent.; and of 31 late cases only 29 per cent. were negative.

This also shows the difficulty of rendering the blood negative the longer the infection has been present. Successful antisymphilitic treatment depends on the early inauguration of treatment, or, in other words, early diagnosis.

I have mentioned my views as regards the time syphilis becomes generalized. I have also mentioned that when syphilis becomes generalized the central nervous system is often involved, and as Mott says, "When once the trypanosome organism (*Treponema pallidum*) has entered the spinal fluid it is doubtful whether it can ever be eradicated." As to the frequency with which the cerebrospinal fluid is involved, Dreyfus reported the finding of pathological changes in the spinal fluid in nearly 80 per cent. of generalized syphilis. Gennerich believes that changes are present in nearly all cases, Mills found changes in the spinal fluid in fifty-six per cent. out of eighty-one cases of generalized syphilis, which cases did not show any clinical evidence of disease of the central nervous system.

It is much more difficult to drive the *Treponema pallidum* out of the central nervous system than out of other parts of the body. The best way to combat this is—never let the *Treponema pallidum* get into the nervous system. This can only be done by early treatment.

Early treatment depends on early diagnosis.

By means of the dark field examination an early diagnosis is possible.

AN ABORTIVE TREATMENT FOR GONORRHOEA.

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The gonococcus is readily destroyed by certain chemicals. Silver salts are most deadly to it, and consequently have been more popular in the treatment of gonorrhoea.

The object of abortive treatment is therefore to bring an active agent into direct contact with the organisms

before they have penetrated too deeply to allow this procedure. In order to do this there are several factors to consider, viz.: (1) to use a drug which is non-destructive or non-irritating to the tissues. (2) To make the technique simple, so that it can be carried out in any practitioner's office. (3) To keep our drug in contact with the organisms until they have been killed. (4) To have the entire cooperation of the patient and have him under complete control.

Ballenger [2] has recommended an excellent abortive treatment, which he calls "Sealed-in Abortive Treatment." He has personally informed us that he has met with absolute success in over one thousand cases. Our experience with several hundred cases at the base hospitals, Toronto, Canada, has been the same.

In order to get results with Ballenger's treatment we must pay strict attention to the following precautions:—

(1) The case must come under treatment during the first twenty-four hours after the discharge has shown itself. Some cases have yielded, after coming under this treatment within the first thirty-six hours, but none outside that period. In some cases treatment may be begun very early, as an anxious patient often reports to his physician on noting the first drop of pus. Our advice is to adhere to using this treatment on cases reporting within the first twenty-four hours after noting discharge. In the Army there should be greater opportunity for men to come under this treatment immediately, except in concealed cases, than in civilian practice.

(2) The treatment should be faithfully carried out up to seven days. Most cases will show no discharge or gonococci on the third or fourth day, while some cases clear up after a single treatment. After seven days, if the discharge persists, it is useless to continue this treatment, as the process will have extended beyond the possibilities of its scope. However, no harm is done in continuing the method up to the seventh day as the local condition is improved by it. Owing to incorrect observation by some patients treatment may be commenced too late, both surgeon and patient being in ignorance of the true date of the first appearance of the discharge. These cases, though not aborted, are not aggravated by this treatment.

(3) A diagnostic smear should be taken immediately the patient reports. This should not necessarily delay the first treatment while awaiting a bacteriological report in case a microscope is not at hand. A smear will keep indefinitely on a slide, but the gonococcus should be attacked before valuable time is lost. If no slide is handy an ordinary piece of window glass, properly cleansed, will suffice.

(4) The urine should be passed into two glasses to make sure there is no posterior urethritis before treatment is commenced. If both glasses are turbid it is useless to continue.

The method is painless, causes no great inconvenience to the patient, and is easily carried out.

The technique is as follows: A freshly prepared 5 per cent. solution of argyrol is used. Organic compounds deteriorate rapidly, so in order to be accurate a freshly prepared solution should be used each day. The proper amount of water should first be poured out and the argyrol powder sprinkled slowly on to the water, not the water on to the powder; in the latter case precipitation of the proteins in the preparation takes place, and the silver does not go into solution.

The patient should first empty his bladder and lie in a recumbent position. The parts are then cleaned, and a syringe holding no more than 30 minims is used to inject 25 minims of the solution into the urethra. No more than 25 minims should be used on any account. A great many failures have been due to distending the urethra with the solution. Our experience confirms this fact. All that is necessary is to have the argyrol solution in contact with the walls of the anterior urethra. Too much solution is liable to drive the gonococci back into the posterior urethra.

A simple method of injecting the argyrol is to hold the penis just behind the corona between the first and second fingers, palm uppermost. When the required 25 minims have been injected the fingers are pressed together, while a clamp, preferably a rubber-guarded intestinal clamp, is applied just anterior to the constricting fingers, care being taken that it is not too close to the meatus. This now leaves both hands free to work. The glans penis and the meatus are now thoroughly dried; ether may be used to an advantage, the lips of the meatus are separated, wiped dry, and brushed

over with collodion. We have found brushing between the lips and then allowing them to assume their normal position, rather than holding the lips together and sealing in that position, to be the more efficacious. The first brushing is allowed to dry before the second is applied, and so on. A fan may be resorted to hasten the drying process. The second brushing should extend from the frænum to well up on the dorsum of the glans, the third at right angles to this, thereby forming a firm anchorage for the cap, which should not be too thick or bulky. The whole process should not take more than five minutes. Before removing the clamp see that the collodion is thoroughly dry; then remove it cautiously. A failure to seal the first time should not discourage further attempts.

The collodion used should be B.P. non-contractile, and should be rather thick in consistency. If too thin the cork may be left out of the bottle, allowing the ether to evaporate until the required consistency is attained.

A small, soft camel-hair brush is preferable for applying the collodion.

Cotton-wool should not be used in the sealing-in process, as an effective seal cannot be attained with it.

The patient is now instructed to retain the seal for four hours at least—five or six, if possible. The seal is then removed. If difficult of removal acetone will dissolve it. He is then instructed to drink water freely. The seal is best applied in the morning and removed in the afternoon, which allows plenty of time for ample partaking of fluid, thus flushing out the kidneys, bladder and urethra between the times of removal of seal and bedtime. The patient should restrict his fluids from the hour of arising until the seal is applied, and take none during the period the urethra is sealed.

It is advisable to retain the patient three days after sealed-in treatment has been discontinued. Three days should elapse with both urines clear. Before discharging the patient a negative smear should be obtained. If any doubt is entertained as to the presence of gonococci a 1-500 anterior injection of silver nitrate may be given and retained five minutes. This is best given in the evening so as a smear may be taken first thing the following morning. The silver excites a temporary purulent discharge which should show the absence of gonococci. It is then safe to discharge the patient.

It should be pointed out that this method could be used with great advantage in the Army in the "post actum" prophylaxis of gonorrhœa. Our present method—viz., calomel ointment injections per tube, potassium permanganate irrigations, briefly held-in anterior injections of silver salts, &c.—have, unfortunately, not proved to be as successful as anticipated. The chief among the causes of failure after urethral prophylaxis may be given as (1) too long a time elapsing before the man gets it; (2) the failure to use preventive properly.

Sealed-in treatment will be absolutely prophylactic up to ten hours and very efficient up to twenty-four hours, while the ordinary methods become less efficacious after the prophylactic treatments.

Owing to the War argyrol has become very difficult to secure. This has driven us to search for other drugs which would be equally efficient or better. We are at present experimenting with nargol, flavine, and dichloramine T. (paratoluenesulphonamid) in a series of cases and shall report at a later date.

CONCLUSIONS.

- (1) Sealed-in treatment, in cases of less than twenty-four hours duration, is almost a positive abortive.
- (2) It is practically an infallible medical prophylactic.
- (3) If used in the Army it would cut down gonorrhœal infections to a small percentage.
- (4) Its economic value, as regards sick days lost, troops saved from infection, and thereby made available for service, the saving of expense to the public, the present and future health of the nation, and spread of urethral infections alone should commend it to the medical fraternity.

REFERENCES.

- [1] LUYB. "Text-book on Gonorrhœa." Baillière, Tindall and Cox.
- [2] BALLENGER. "Genito-urinary Diseases and Syphilis." Butterworth and Co., London. 1914.
- [3] "Social Hygiene," July, 1917.

PROCEEDINGS OF CLINICAL SOCIETIES OF THE C.A.M.C.

CANADIAN SPECIAL HOSPITAL, ETCHINGHILL.

MERCURIAL STOMATITIS.

In the course of a discussion upon "Ulcerative Stomatitis" at the meeting of the Etchinghill Clinical Society, held on December 12, 1917, Captain J. H. Reid, D.D.S., C.A.D.C., called attention to the need of insistence upon scrupulous oral cleanliness in the Venereal Hospital. If the teeth are well looked after before commencing mercurial treatment stomatitis is seldom severe. The symptoms manifested are in every respect similar to those found in Vincent's disease; the organisms, indeed, are the same, save that the patient calls attention to the disagreeable taste, and that, although the condition is troublesome and distressing, it is very rarely serious. He had seldom seen instances in which the teeth become loosened and lost as the result of the disease.

It is not absolutely necessary to discontinue the administration of mercury owing to the condition of the mouth; but the patient should be instructed to co-operate in every way with the dentist, in order that the mouth be kept clean during the treatment. It is absolutely useless to prescribe antiseptic mouth-washes for such patients without the necessary prophylaxis and dental attention.

After removing local irritants, deposits on the teeth, and loose suppurating roots, he recommended spraying the mouth with a warm saline solution, wiping the infected tissues with cotton dipped in hydrogen peroxide, in the process removing as much of the friable membrane as possible. This leaves a freely bleeding surface, which should be dried with absorbent cotton. He then sprays with the mixture (introduced by Major Bowman, C.A.M.C.) of equal parts of liquor arsenicalis and vinum ipecac. Before dismissing the patient he paints the ulcero-membranous tissues with a solution of iodine. It is not necessary to prescribe highly astringent mouth-washes. Soft diets should be recommended.

By this treatment he has had an average recovery in six to eight days.

THE ADVANTAGES OF EARLY DIAGNOSIS AND TREATMENT IN SYPHILIS.

In the course of a paper upon this subject, delivered to a meeting of the Clinical Society of the Canadian Hospital, Etchinghill, Captain G. Orville Scott, C.A.M.C., made the following observations:—

If I can impress upon every medical officer that every sore upon the genitals is to be regarded as specific until proved otherwise, then I actually save to the Government thousands of dollars, increase the efficiency of every unit in this area, and greatly help to keep the Overseas divisions up to fighting strength.

I have personally examined many men who developed a primary sore one week after contact, from which the *Treponema pallidum* could be obtained. Men come to me late in the primary stage, and often not until the disease becomes clinically generalized, with the same story: "I reported to my medical officer the first day the sore appeared. He told me not to worry, as it was too early to develop any specific infection. Keep it well washed with any antiseptic and it will soon disappear."

If primary syphilis be not early diagnosed and treated it becomes rapidly generalized.

Our statistics at Etchinghill Hospital show that if a patient be admitted in the early stages of primary syphilis his average stay in hospital will be twenty-one days. At the end of this period he has no open luetic lesions, and is therefore not a menace to his associates. He is discharged to his unit, but is obliged to return here at stated intervals for another thirty-six days, and thus would be available for a draft to France in fifty-seven days. On the other hand, if a patient be not admitted till he develop secondary lesions, his stay in hospital as an in-patient will be only slightly increased, averaging twenty-two days, but he will have to continue reporting for treatment over a period of about one hundred and sixty-five days. During all this time he is physically unable to perform full fatigue, and, of course, is not available for a draft. The balance sheet stands as follows: "Primary syphilis, available for France in fifty-

seven days; generalized syphilis, available for France in one hundred and eighty-seven days."

What is of infinitely more ultimate importance to the patient and the State is that the primary cases are probably permanently cured, while the generalized ones will, in a large percentage of cases, require further prolonged and extensive treatment.

THE CLINICAL SOCIETY AT No. 1 CANADIAN GENERAL HOSPITAL.

Meeting of November 1, 1916.

Colonel SIMPSON presiding.

THE following cases were presented:—

(1) G.S.W. chest; presented by Captain Bunn; pathological specimen shown by Major Ower, with blackboard sketches.

The chief point brought out in this case was the difficulty of finding or reaching localized collections of infected fluid in the chest. The operation in this case had drained one collection, but had failed to relieve another, which was strongly walled off by adhesions.

Colonel Bowie asked if it might not be advisable to resect a much larger piece of rib and break down all adhesions in the neighbourhood by introducing the hand; this would drain all adjoining pockets.

On further discussion, with comparison of cases, the view taken seemed to be that the procedure to be followed would depend largely on the type of adhesion found. Strong, firm adhesions such as this case showed could not be broken down without seriously damaging the lung. But where they could be cleared away more or less easily it was undoubtedly a most valuable step.

(2) S.W. of chest, multiple; case presented by Major Gwyn, specimen demonstrated by Major Ower.

A very well-marked case, showing some of the complications which may arise in G.S.W. chests. From the outset this patient showed very marked signs of chronic bronchitis, and for three to four weeks little else could be demonstrated. There was no complaint of abdominal trouble, merely the statement that the foreign body had gone through the diaphragm, and the demonstration by X-ray that a foreign body was present below the diaphragm on the left. Repeated punctures of the chest finally revealed pus in the left front. This was drained, but patient's temperature never fell, nor was there any cessation of the cough and abundant expectoration. This expectoration was negative for tubercle. The patient gradually sank and died. At autopsy were found the rather remarkable specimens here presented. The left chest was well drained, the lung collapsed, but showing throughout dilatation of the whole bronchial tree; the right lung very large, and presenting in a remarkable degree the condition of diffuse bronchiectasis and diffuse bronchitis. Down to the very terminal bronchioles the dilatation is very evident, and into every part a profuse purulent secretion has sunk. Below the diaphragm an unusual condition was found, viz., a perforation through the spleen of a missile and a piece of clothing. No sign of suppuration is evident, and the time which had elapsed between the wound and death makes it probable that local infection in this area had ceased.

(3) Adenocarcinomatosis of peritoneal cavity; case shown in ward by Captain Moffat.

An interesting case, to be reported later by Captain Moffat, of diffuse involvement of the peritoneum. The patient had arrived in the hospital with indefinite history, and promptly developed ascites and signs of intestinal obstruction. In the enormous amount of fluid removed no tumour fragments and no organisms could be demonstrated. In the rectum a large mass could be felt high up, and apparently pushing downwards from the sacral area. Exploratory operation was undertaken with a view to rectifying the obstruction if possible, or in the hope of benefiting a tubercular condition should it be present. At the operation there was still some fluid; the peritoneum and bowel were studded with small umbilicated nodules, which should have made one suspicious of new growth. The contents of the lower abdomen were densely matted together, and no relieving operation could be undertaken. Specimens were taken from the tissues and the wound closed. No seat of primary growth could be demonstrated. The patient improved and was sent out. The examination of the tissues showed adenocarcinoma of a rather peculiar type, in that scirrhous elements were beginning to predominate.

(4) A case of hemiplegia occurring in the course of acute nephritis with convulsions. Case shown in ward by Captain Logie.

A case of nephritis very acute in onset, but in a man of 35, with distinctly thickened arteries. After several hours of severe convulsions it was noticed that the patient was paralysed in leg, arm and face of the left side. The question, of course, is whether there has been hæmorrhage, or whether it is a condition of thrombosis, embolism, arterial spasm, or toxæmia of the nephritis. It is suggested by Major Gwyn that the case be followed and presented again, in the hope that the quick improvement so often seen in the cases of paralysis due to kidney disease might be seen.

Meeting of November 8, 1917.

Colonel SIMPSON presiding.

(1) Captain Logie showed the case of "hemiplegia in nephritis" shown one week ago. There is remarkable improvement. The face is clear, and the arm and leg have gained a considerable degree of movement. The patient is to be presented again.

(2) Captain McMurrich showed a case of herpes zoster of the chest, which had appeared after strapping of the side for pain, which the patient considered to be due to bruising. The eruption of vesicles is very extensive and very typical. Other conditions of skin required a note in passing. A very diffuse pustular acne on the neck and chest; several herpetic lesions scattered along the arms. Many of these umbilicated, and not unlike the discrete lesions of chicken-pox.* There had been no preceding fever, and the suggestion was made that the case was one better described perhaps as a generalized acute posterior ganglionitis.

(3) Specimens from a case of S.W. of chest, presented by Captain Bunn and Major Ower.

An unusual case with perforation into chest through diaphragm, through spleen into splenic flexure of the colon. It is quite possible that the foreign body was passed by bowel. When the patient arrived in the hospital a fæcal fistula had developed along the track of the wound through the spleen, through the diaphragm, and through the pleura. The two latter had been sewn up. On admission it was found that an area of the pleura posterior to the fistula had become a large infected pocket. This pocket was found on puncture, and was extremely foul; but no elements of fæces could be demonstrated. It was reached by operation through the now large mouth of the fistula and was "carrelled," there being drainage now from the bowel and from the posterior thorax. The upper chest was well walled off, and the lung above functioning well. The prospect of complete resolution was good, but the patient developed acute brawny infiltration of the tissues of the chest, and seemed to die from the effects of this. The specimens from the autopsy show very clearly the tract going through the spleen into the colon, and the well-drained pocket in the chest behind.

(4) A specimen of brain from case diagnosed as concussion, demonstrated by Major Ower.

Diffuse subpial hæmorrhage over cerebellum and posterior half of brain. There had been a small linear fracture of the occipital bone about $\frac{3}{4}$ in. to the right of the foramen magnum. There is a well-formed clot in the small artery coming round the base of the brain. No free blood in skull or in ventricles. The hæmorrhage did not appear to extend beyond the skull. Major Gwyn stated that he had seen the case in the surgical wards. There had been no local paralysis. Pupils were mid size and reacted to light. The one suspicious sign that could be evolved was a slight stiffness of the neck and a slightly marked Kernig's sign. Lumbar puncture had brought away only 10 c.c. of perfectly clear cerebrospinal fluid. The patient was quite delirious. The question was whether a decompression might have been of some service.

(5) History and X-ray plates of a case of massive collapse of the lung, following an abdominal operation.

History and physical signs of X-ray examination seemed to show that this was a very complete examination of this rather unusual condition. The X-ray pictures show very well the compression of the rib spaces, the solidification of the right side, the complete absence of the heart shadow on the left in the early days of the condition, and the final complete

* In the *British Journal of Dermatology and Syphilis* of December, 1917, Dr. W. P. Le Feuvre reviews the evidence in support of the view that herpes zoster and chicken-pox are manifestations of the same disease.—Editor.

replacement of the heart as the lung re-expanded. This case will be reported in full at a later date.

(6) Major Ower demonstrated specimen of trachea and lungs from a fatal case of the so-called mustard gas poison.

(7) Captain Fraser showed a case of shrapnel wound slightly to the right of the mid-line of the back of the skull. The case showed still persisting very marked left hemianopia. The condition had improved, though it is probable some degree of impairment of vision will always remain.

The Society then adjourned to the surgical wards, where Colonel Bowie showed several cases of knee-joints which had been treated by opening up, washing out and closing. The majority of the cases had done very well. He also showed a compound fracture of the right arm treated in the same way with good results.

Two interesting cases of abdominal wounds requiring resection of the intestine were shown. The cases had been doing very well as far as their operations were concerned, but had developed bilateral conditions in the chest, suggestive of bronchopneumonia or the collapse of the lung after abdominal operation, where the free action of the diaphragm is interfered with.

Meeting of November 15, 1916.

(1) Specimen from autopsy. Wound of the brain. Demonstrated by Major Ower.

Brain showing large ulcerating tract in the frontal lobe. Case had died shortly after admission. There were no clinical notes attached.

(2) Auricular fibrillation and V.D.H. Electro-cardiogram. Demonstrated by Captain Logie.

Colonel Sir John Rose Bradford discussed the case. He spoke largely of the discovery of auricular fibrillation.

Captain Moffat also spoke, and pointed out that in the cardiogram there were several well-marked phases of heart block. The case would be shown again at a subsequent meeting.

(3) Case of massive collapse of the right lung. Demonstrated by Major McDermott.

When the patient came in he showed pain over McBurney's point; loss of appetite; rise of temperature; pulse 104. Three days later the pain was still there, and he was feeling no better. Operation performed; given general anæsthetic. Operation did not take very long, and the patient went through it quite well. That evening, about two hours after coming out, he had a sudden sharp pain over the front of his right chest and great shortness of breath.

Seen by Major Gwyn, had following signs:—

Dulness to percussion over right lower back; vocal fremitus increased with hollow tubular breathing and fine râles. Owing to the darkness of the tent the inspection was interfered with, and the man was transferred to a hut ward, with the provisional diagnosis of post-operative broncho-pneumonia, or possibly beginning collapse. Two days later all the typical signs of massive collapse of the lung were present. The heart was entirely displaced to the right side, and the whole lung was solid; the whole chest sunken in. By next day there was marked change in the physical condition, there being well-marked resonance over the upper right front. It may be noted in passing that a day or two later this resonance was again replaced by absolute dulness and signs of collapse.

Sir John Rose Bradford discussed the case. He stated that before the War the condition was usually seen after abdominal operations. It occurred in cases where a general anæsthetic was given, and in cases where no anæsthetic was given, such as diphtheria and paralysis. Within twenty-four hours after operation patient with or without urgent symptoms sometimes developed signs of consolidation. Case might be mistaken for pneumonia. Collapse would be recognized by displacement of the heart. There was no expectoration usually at beginning, but later on. This is one of the reasons why it is apt to be confounded with pneumonia. Expectoration is different to that of pneumonia.

Sir John instanced cases of bullet wounds of a trivial nature which were followed by complete collapse of the lung opposite to side of injury. He stated there had been a considerable number of such cases, in nearly all of which the lung opposite to the side struck has been involved. The physical signs in the lungs are of two types. One set of cases where there is immobility and retraction, dulness on percussion, weakness, or extinction of breath sounds. These cases are very difficult to recognize, especially if ward is noisy.

The other type is quite easily recognized, having loud tubular breathing, more often amphoric. The signs change. One day there is weak breathing; next loud amphoric breathing. These signs are associated with the displacement upwards of the diaphragm. They last about three weeks or a month; sometimes only a few days. The condition is not due to the severity of the injury, but to injury of the chest wall. It is not limited to chest injuries. There is limitation of movement of respiratory muscles or bronchial obstruction. The diaphragm is high on the injured side. There are various complications. Quite often there is pleurisy and sometimes lobar pneumonia.

(4) Cases of thrombosis of the veins occurring as complications in wounds involving the chest.

Captain Bunn showed two cases in Ward "E," in which thrombosis of the veins with probable infection gave rise to some doubt as to what might be going on. There had been seven such cases in the ward in the last few weeks, and, generally speaking, they were of one of two types: one where the wound had involved the veins, the other where the thrombosis seemed to occur as symptoms of general septicæmia. The symptoms and physical signs were the same in both, viz., high and intermitting fever, with œdema, redness, and heat of the area of thrombosis. The others had progressed favourably. In six the arm alone was affected; in one the thrombosis was in the veins of the leg.

Meeting of November 22, 1916.

(1) Auricular fibrillation and V.D.H. Electro-cardiogram. Demonstrated by Captain Logie.

The case had been presented the previous week.

With regard to the present condition, Captain Logie said that the patient having passed a period of rest, the pulse had steadied down, but upon the slightest excitement it becomes irregular again. The heart is practically the same. In connection with the question which arose as to the presence of a second murmur, it is uncertain whether such is present or not.

Captain Moffat again discussed the case and spoke of digitalis treatment. He stated that clinically digitalis acts best and only in such cases as the present. At the Rockefeller Institute in New York the conclusion had been drawn that digitalis in any form has practically no effect on normal animal hearts. Its main effect is in such cases as auricular fibrillation. This view, however, is not held by all.

An unusual case brought into hospital some years ago was described. The patient had been shot through the pericardium with a revolver. The bullet went through and penetrated pericardial sac. The man had definite signs of fibrillation. The bullet was localized with the X-ray, and found posterior lying up against that organ.

Captain Moffat demonstrated the action of digitalis and its relation to ventricular contractions.

Captain Seaborn also spoke briefly. He laid stress on the fact that there must be a cumulative effect before a full result could be obtained.

Captain Barrager asked a question dealing largely with the myogenic and neurogenic origin of the heart impulse, and the position in which the treatment by digitalis now stood when considered in relation to the various theories of origin of heart impulse.

This was replied to by Major Gwyn and Captain Moffat.

(2) Massive collapse of the right lung, following abdominal operation. Demonstration by Major MacDermott.

The case had been shown last week.

The patient is now showing considerable improvement in his breathing, and at present has no distress. Still has a little cough. Sputum is fairly free. Chest is now very much clearer. The heart is back to the left side, and the breathing sounds, although very faint on the right side, are not so amphoric as they were. Diaphragm is a good deal lower.

Major Gwyn, in speaking of the case, said the most striking thing is that the heart borders and sounds are still away over to the right. There is dulness with increase of vocal fremitus. Breath sounds are now very tubular and loud. Front has been free, and collapsed, free, and collapsed again. Resonance is coming back.

(3) Arterio-venous aneurysm. Demonstrated by Major Gwyn.

A very interesting case of arterio-venous aneurysm following bullet wound. Case had little or no symptoms. There was a very distinct systolic thrill. Showed no secondary

effects. Pulse could be felt very distinctly in the vessels in the feet. Blood-pressure (systolic, diastolic) much lower below aneurysmal varix than in other leg. Murmur is heard fairly well. Very distinct arterial sound in other vessels.

The meeting then adjourned.

ADMINISTRATION NOTES.

THE ROYAL COLLEGE OF SURGEONS AND THE C.A.M.C.

MANY months ago the Royal College of Surgeons, the custodian of the Hunterian collections and so of what is truly the national Medical Museum of Great Britain, with great goodwill offered to receive and care for pathological specimens collected by Canadian medical units both overseas from England and in England. Several cases of the specimens so collected have already been forwarded to Ottawa, where Surgeon-General Fotheringham, D.G.M.S., has made arrangements for the mounting and preparation of such as are to form the nucleus of a museum of the C.A.M.C., and for the distribution of others to the museums of the Medical School for which they are ear-marked.

As a further evidence of their goodwill, the Council of the Royal College of Surgeons have now empowered Professor A. Keith, the Hunterian Professor, to set aside a room for a special Canadian exhibit. For some little time with the aid of a special fund, placed by the Government at the disposal of the D.M.S., a staff of experts, with Major F. Lessore, the distinguished sculptor, at their head, have been engaged at No. 16 Canadian General Hospital, better known as the Ontario Military Hospital, making wax and plaster models, coloured drawings, and coloured photographs of wounds and war deformities. It is this collection which will form the basis of the Canadian exhibit. This, it is hoped, will be thrown open in the course of a few days.

Apart from the special exhibit, officers of the C.A.M.C. on leave in London are strongly recommended to visit the general war exhibit at the College in Lincoln's Inn Fields. It is most instructive, containing material which, both from a surgical and a medical point of view, is of first importance.

Organization of Canadian Military Laboratories.

BECAUSE of the large number of Canadian laboratory units in England and the formation of new hospitals requiring different classes of laboratory examinations, it was decided in September, 1917, that some organization of these should be attempted. It seemed that where there was, for instance, a large general hospital unit in a certain area where there were also smaller hospitals; it was for many reasons unnecessary to have fully equipped laboratories in each of these.

The question of the training of officers in routine pathological work was also considered, and there having already been established in one of the larger Canadian areas a unit known as No. 1 Canadian General Laboratory, it was decided to use this as a training school, and the officer commanding this unit was also given a supervising position in regard to the other laboratories.

A circular letter of the D.M.S., No. 30.10.0, on the organization, scope, equipment, and supervision of the C.A.M.C. Laboratory Service in the United Kingdom lays down the following:—

Class A (central laboratories) will deal with all kinds of pathological and public health laboratory work. Hospital laboratories are of three categories. *Class B* will deal with general clinical pathological work, including Wassermann tests, tissue section, &c. Will not deal with sewage or water examinations or other strictly public health laboratory work. *Class C* will deal with such clinical pathological work as analysis and examination of blood, sputum, stomach contents, urine and faeces, also throat cultures, and other simple culture work. *Class D* will deal with hæmatological and urinary examination and analysis.

SCOPE OF WORK.

Laboratories will be limited in the scope of their work according to their classification, as set forth in Appendix I to the Circular Letter. Work presenting itself that does not fall within the scope of a particular laboratory will be sent to one of the other laboratories authorized to do such work.

EQUIPMENT.

Hospital laboratories will be equipped according to the nature and scope of the work they are to deal with. There will be three standard equipments, viz.: No. 33-X, No. 33-XX, and No. 33-XXX, as set forth in Appendix II to the Circular Letter. The particular equipment authorized for each hospital is laid down in Appendix I.

Officers in command of hospitals will render direct to the D.M.S. on the last day of each month a return of all laboratory equipment, including chemicals, stains, &c., on hand.

TRAINING OF REINFORCING PERSONNEL.

Officers and other ranks selected to reinforce personnel for laboratory work, after finishing their regular course of training as necessary at the C.A.M.C. dépôt, will be sent to No. 1 Canadian General Laboratory, Folkestone, to receive special instruction in laboratory work.

SPECIAL INSPECTION OF LABORATORY SERVICE.

Acting directly under the D.M.S. in such respect, the officer in command No. 1 Canadian General Laboratory will as often as required visit and inspect all laboratories to observe their work from a pathological, clinical, or public health standpoint. He will make suggestions regarding standardization of methods of collection and despatch of specimens, methods of tests and analysis, and methods of recording and reporting. He will also inspect equipment. This officer will be responsible for keeping informed concerning medical literature on subjects relating to laboratory service, and will keep laboratory officers informed concerning the same.

RULES FOR LABORATORIES.

Each request for a laboratory examination or analysis will be made on A.F.W.3212, duly signed by the medical officer concerned. (These forms in books of 100 are procurable on indent in the usual way.)

Where the examination or analysis is in connection with an individual case, the man's number, rank and name and unit will be given.

A laboratory ledger will be kept in which all reports will be entered before they are sent out. This record will show the number, rank, name and unit of the case, and briefly the result of the examination. The officer in command of the hospital and central laboratories will, not later than the 5th of each month, forward direct to the D.M.S. a monthly laboratory report for the preceding month as follows: (a) Number of examinations or analysis (classified); (b) concise description of special work done; (c) remarks concerning adequacy of equipment and personnel, and suggestions in general.

This organization does not limit the pathologist as regards research, and any special materials he may need for special work will be granted.

CORPS NEWS.

Army Medical Literature.

THE Medical Research Committee, which has done so much for the advancement of War Medicine and Surgery, has added to the debt owed to it by the publication of a monthly "Medical Supplement" of abstracts of articles bearing upon War Medicine published in foreign European journals. This is an official Government publication, and but a limited edition is published. Through the courtesy of the Committee a sufficiency of copies has been afforded to the D.M.S. to make a distribution of a copy to each medical unit of the C.A.M.C. The first issue appeared in January.

Two months earlier, in November, 1917, appeared the first issue of the *Medical Bulletin*, a review of War Medicine, Surgery and Hygiene, compiled and published under the auspices of the American Red Cross Society of France. That body has taken over for the United States Army the position occupied in Great Britain by the Medical Research Committee. The *Medical Bulletin* performs in regard to the medical literature of English speaking countries the work accomplished by the *Medical Supplement* in reference to foreign publications, and with equal courtesy the American Red Cross has afforded copies of their monthly issue for distribution to Canadian medical units, beginning with the January number.