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A MANUAL OF VENEREAL DISEASES

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A MANUAL OF VENEREAL DISEASES

BY

OFFICERS OF THE ROYAL ARMY MEDICAL CORPS

Introduction by
Sir ALFRED KEOGH, K.C.B., Director-General of the Army Medical Service.

History, Statistics, Invaliding, etc.,
Lieut. Colonel C. H. MELVILLE, R.A.M.C., Secretary to the Advisory Board.

Clinical Pathology and Bacteriology,
Colonel LEISHMAN, R.A.M.C.

Clinical Course and Treatment,
Major C. E. POLLOCK, R.A.M.C.

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PREFACE

At the forty-eighth meeting of the Army Medical Advisory Board, on July 23, 1903, it was decided to appoint a Sub-Committee to consider the question of the treatment of Venereal Disease in the Army. This Committee collected information from a considerable number of sources, statistical and otherwise, and at the same time propounded a series of questions, on the subject chiefly of diagnosis and treatment, to various acknowledged experts in this country, and to medical officers of experience, who were known to have paid particular attention to the subject of Venereal Disease, in the Army. At the same time Captain (now Major) C. E. Pollock, R.A.M.C., was deputed to visit various hospitals, both civil and military, on the Continent, with a view to collecting the latest intelligence as to the practice of experts abroad.

The answers of the various experts at home, and of the Army medical officers, referred to above, were published in the second report of the Sub-Committee, and the information collected by Captain Pollock, in the third report. The first report was mainly concerned with an analysis of statistics, and of the latest literature available on the subject. The Committee issued a final report on October 20, 1905, summarizing the information collected, and making many useful recommendations. The reports of this Sub-Committee must always remain a most valuable mine of information, and represent a great deal of work and investigation. It was felt however that the form in which they were issued was not one likely to appeal to the ordinary working Medical Officer, and at the 119th meeting of the Advisory Board, June 22, 1906, the suggestion was made that the information contained in these reports might be summarized, and placed in more readable form, so as to furnish medical officers of the Army, and others interested in the question, with a readily portable and convenient manual. At first it was thought that this might be managed by merely extracting from, and condensing the

letterpress of the original reports, but it was soon found that this was impracticable. It was therefore decided that the suggested manual should be merely based on the reports, and be prefaced by a short introduction relating to the history of Venereal Diseases in the Army, with a short account of the latest knowledge on the subject of the Spirochaeta Pallida, with especial reference to the best methods of microscopical investigation of the same. The general question of diagnosis and treatment has been entrusted to Major Pollock, who was very largely connected with the work of the Sub-Committee, while the subject of microscopical investigation has been undertaken by Major (Brevet Lieut.-Colonel) Leishman, R.A.M.C., Professor of Pathology at the Royal Army Medical College. At the same time I was instructed to undertake the general editorship, as well as the questions of History and Prevention.

The above sufficiently explains the genesis and object of this Manual. It is not intended as an exhaustive treatise, or to compete with any of the great systematic works, on the subject of Venereal Disease. It is intended merely to act as a con-

venient manual, for the use primarily of the Army Medical Officer, to assist him in his daily work, in the prevention and treatment of Venereal Diseases.

CHARLES H. MELVILLE, LT.-COL. R.A.M.C.,
Secretary Army Medical Advisory Board.

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INTRODUCTION

In selecting officers of the Army Medical Service to prepare a Manual of Venereal Diseases, the publishers have taken into consideration the vast amount of material available in the British Army for studying the subject. It is unfortunately true that British troops suffer from venereal disease to a much greater extent than most other armies; but it would be unfair to conclude from this that morality and physiological restraint are less prevalent amongst British than amongst foreign soldiers. The incidence of venereal disease in different countries depends upon causes which have little bearing upon the ethical aspect of the subject, although there is always a tendency, in dealing with it, to drag this aspect in. Statistics are especially misleading in this respect, and examples might be cited, which tend to show that in certain garrisons, where venereal diseases are least prevalent, the standard of public morality is lower than in neighbouring garrisons where the incidence is high.

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Much prominence has been given to the influence of temperance on the notable decline of venereal disease amongst soldiers in the United Kingdom since 1884, but, although there is, no doubt, some connexion between intemperance and exposure to infection, much might be suggested to detract from the importance of this influence, just as, on the other hand, much might be suggested to prove a close connexion between the decline of venereal disease and the general raising of the standard of cleanliness amongst the class of women by whom the infection is spread. The effect of wider knowledge, of better habitations, better water supplies, and better facilities for ablution and general cleanliness on the gradual decline of venereal diseases in this country during the last quarter of a century, can scarcely be questioned ; while to a lack of these essentials one must attribute the absence of any definite or progressive decline during the same period in garrisons in India and the Colonies, where the sanitary control of crowded bazaar populations is difficult and complicated. Venereal diseases are propagated, in fact, in filthy surroundings more than in cleanly surroundings, and it may be regarded as an axiom that the chances of avoiding infection are in direct proportion to the extent to which cleanliness and

personal hygiene are practised by those who run the risk of infecting or of being infected.

The question of prevention of infection by legislative control of prostitution opens up too wide a field for consideration in a short introduction such as this ; yet it cannot be passed over entirely in silence. There are many who, basing their assertions on certain statistical tables, declare that legislative control has not influenced the incidence of venereal disease one way or the other. But there can be no doubt that the low incidence of venereal disease in Continental armies is mainly due to systems of legislative control, and it is a significant fact that the two great Anglo-Saxon States, whose attitude in opposition to legislative control is similar, have a far higher incidence of venereal diseases in their armies than has any other country. Italy has proved by experiment the danger of removing this control and the advantage of restoring it ; and we, too, are proving this in India and elsewhere. The heated discussions that have arisen to obscure the question depend more upon differences of opinion regarding the nature and morality of legislative control of prostitution than upon a denial of the scientific fact that the spread of an infectious or contagious disease, be it of venereal or other origin,

can be and is limited by such measures as notification, isolation, and adequate treatment.

Recent discoveries regarding the pathology of syphilis, and the improved methods of treatment now practised in the British Army, by which continuous treatment can be carried out easily and without loss of efficiency, add a special value to those portions of the manual which deal with this part of the subject. They lead the way to a field in which much useful work may be done by every one whose duties bring him in contact with this class of disease; and the knowledge, which they place in his hands, provides an equipment, that was previously lacking, for rational and scientific study.

ALFRED KEOGH.

CHAPTER I

HISTORY: METHODS OF PREVENTION

"In the yeare of our Lorde 1494 in the moneth of December when Charles the French King tooke his journey into ye parts of Italie to recover the Kingdom of Naples, there appeared a certain disease throughout al Italie of an unknown nature which sundrie nations have called by sundrie names. The Frenchmen call it the disease of Naples, because the souldiers brought it from thence into Fraunce. The Neapolitans call it the French disease, for it appeared first when they came from Naples, and so other languages call it by other names, whereupon we need not greatly to passe, but rather what the true nature and cure thereof is." Thus begins the "Fifth booke of Maister John Vigo of Gennuai, of the French Pockes." I think the hint of the master may well be taken here, and that in a short manual like the present it would be out of place to dilate on the origin and history of Syphilis, whether it was, or was not, known to the Chinese,

in ancient days, whether it originated as above stated at Naples, or whether it was introduced by the sailors of Columbus on their return from America. But before proceeding to "passe to the true nature and cure thereof" it is necessary to say a few words on the history of Syphilis, and other Venereal Diseases in the British Army, during the latter part of the nineteenth century, and their effect on the total efficiency of the Army, as evidenced by the number of men reported "sick" daily from these causes, and the total loss to the Service due to them, as evidenced by their effect on the invaliding rate, and also to touch on the question of prevention.

As a basis for this study, I propose to take the statistics furnished by the two largest and most homogeneous sections of the British Army, those namely which serve in the United Kingdom, and in India respectively. This selection may seem somewhat arbitrary, but in the study of so complex a subject as the epidemiology of Venereal Disease, a question affected by so many side issues of ethics, and sociology, there is a distinct advantage in avoiding the many other influences, as of climate, surroundings, etc., which the inclusion of all the smaller garrisons scattered over the globe, some of them numerically quite unimportant, would

introduce. The period to which I propose to limit my study is that of the quarter century between 1880 and 1905. This, again, may seem an undue limitation, but this period is one during which the Army has continuously been of the same composition as regards age of individuals, and terms of enlistment, throughout; and at the same time of a composition in these respects, which it is likely to retain for as long a time as we can at present foresee.

To further simplify matters I have restricted the figures in the tables, and the curves on the plates attached, to those which refer only to Syphilis and Gonorrhoea, the two most important of the diseases of the class. Soft Chancre may be taken to vary pretty steadily with gonorrhoea. It is decidedly more important in India than in England, bearing to gonorrhoea, as regards the number of men constantly inefficient from each, a ratio of about one to four in the United Kingdom, and of slightly more than one to two in India. Its effect as a cause of invaliding is practically nil.

Appendix I and Plate I show, the former by the actual figures, the latter by graphic curves, the number of men constantly sick, and the number annually invalided, for syphilis and gonorrhoea, per 1,000 of strength of the troops stationed in the

United Kingdom, from 1880 to 1905 inclusive. The invaliding due to gonorrhoea is so small, never having in any one year in the period under review attained to ·2 per 1,000, that its variations are not in my opinion of sufficient instructive value to merit their being graphically represented, the figures only therefore are given for this item. Taking the numbers constantly sick, it will be seen that both syphilis and gonorrhoea tended to increase during the earlier years of the quarter century with which we are concerned, up till 1884, in the case of the former disease, and up till 1886 in the case of the latter. From the above dates we have a steady and continuous fall in the average numbers constantly sick from both diseases, the fall being more marked and more rapid, as the antecedent rise was also more marked, in the case of syphilis than in that of gonorrhoea. Thus while syphilis in 1884, when at its greatest height, accounted for a daily inefficiency of over 13 per 1,000, gonorrhoea never attained to a higher figure than 7·05 per 1,000, in 1886. On the other hand in 1900 when both diseases had fallen to their lowest figure, between 3 and 4 per 1,000, syphilis occupied a lower place, by ·14 per 1,000, than the other member of the group. The fall in the number of men

constantly sick from syphilis is remarkable, and not easy to account for. Probably there are a multiplicity of causes, but I have little doubt that increased temperance is by far the most important of all. In that case it may be said that the curves of syphilis, and gonorrhoea, should have maintained a more exact parallelism, since an indirect influence like temperance should affect both members of the group equally if at all. I offer the following explanation of this anomaly, as at least a possible one. Syphilis is probably in most cases contracted from the more degraded class of prostitutes, with whom an ordinarily self-respecting man does not consort when sober. The more respectable class of woman, when affected by this disease, will either seek treatment, or, frightened by her illness, abstain from further promiscuous intercourse. Gonorrhoea, being in its earlier stages more painful, leads both classes of women to seek immediate treatment, which few of them probably persevere in beyond the stage of apparent cure. A woman of either class infected by this disease therefore will for a short time abstain from promiscuous intercourse, but once the initial severe symptoms are over will return to her former mode of life. If this explanation were the true one we would expect

to see the two diseases continue to occupy their reversed position, and this, as the curves show, has been the case since the year 1900 with one exception. Even this exception might be twisted into an argument in favour of my theory, since it occurred in the year 1902, when so many troops returned from South Africa, and may be presumed to have been somewhat out of hand, in a moral sense. I do not, however, wish to labour the point unduly. The salient fact remains, that as temperance has increased, venereal disease has steadily diminished and syphilis much more markedly so than gonorrhoea.

Whether we may expect from this cause alone any further great reduction of Venereal Disease under present social conditions is to be doubted. Amongst every 1,000 men there will be always some whose passions are so unbridled that they will indulge in promiscuous connection at any risk, while there will be a larger number who will oscillate between discretion and promiscuity, according to their moral stability, this condition of moral stability depending largely on their sobriety at the time. It is this last class which can be most largely affected by the temperance movement, and as long as this continues to hold its present

influence we may hope to see the total rate low, and the more severe disease less prevalent than the other, for reasons already stated. The question then arises whether in a population so largely composed of Teutonic and Scandinavian elements the temperance movement can ever progress beyond a certain extent. Its rapid success of late years especially amongst the young soldiers at home does not necessarily point to an equally victorious career in the future, and in that case it is possible that we have reached, or at least approached, the zenith of temperance, and therewith the nadir of Venereal Diseases, in as far as they are conditioned by this influence. This is, however, verging on the question of prevention, which falls for treatment at a later stage.

The invaliding rate for syphilis shows no such steady fall as the curve of constantly sick. Since 1902 there has been indeed a steady fall, due probably to the introduction of the continuous treatment of syphilis, with which the name of Colonel Lambkin, R.A.M.C., is so honourably associated. In support of this it may be stated that in the Brigade of Guards, the treatment of the venereal sick of which has been most directly under this officer's supervision, no men have been invalided for syphilis

since the introduction of the continuous method in May, 1905.

The invaliding rate is, however, not on the whole markedly lower in 1905 than it was in 1880 (·65 per 1,000 as compared with ·71), and in this respect improvement is to be hoped for.

Turning now to the Army of India, we find curves and figures markedly different from those which we have just been considering. Starting with comparatively low figures in 1880 (*see* Plate 2 and Table 2) we have in both diseases a strong upward tendency dating in the case of syphilis from the year 1888, in which the Contagious Diseases Act was abolished in India. In the case of both diseases the maximum number constantly sick was attained between 1894 and 1896, since when the fall has been rapid and continuous. This fall has in the main been due to the introduction of the Cantonment Act of 1897. The main features of this Act are as follows :—

(*a*) Establishment of Cantonment General Hospitals for the reception of cases of contagious disease, as well as for other diseases.

(*b*) Power to compulsorily examine and detain

those suspected of suffering from such diseases.

(*c*) Power to exclude any persons from cantonments who do not comply with the provisions of the Act.

(*d*) Power to remove brothels and prostitutes.

(*e*) Exclusion of brothels and prostitutes from regimental bazaars.

(*f*) Prohibition of loitering and importuning.

Registration, compulsory examination otherwise than under (*b*), and jurisdiction outside cantonment limits, are not provided for.

Other causes which have co-operated are probably increased temperance, the personal influence of regimental and other officers, lectures on the advantages of temperance and continence, by chaplains, medical officers, and regimental officers, the placing of dangerous places out of bounds, the prolonged continuous treatment of cases of syphilis out of hospital, encouragement of games, athletics and rational amusements in barracks, etc. In India also, it may be noted that of late years syphilis has accounted for less inefficiency than has gonorrhoea. This is in part due to the fact that the treatment of cases outside barracks, which affects syphilis much more than gonorrhoea, has reduced

the number of admissions to hospital due to a single infection. It is noteworthy, however, that in India as in England when Venereal Diseases have been in excess syphilis has taken the lead, when they have fallen gonorrhoea has come to the front. In India, as in England, I attribute this largely to an increased habit of temperance. Throughout the period under review the Army of India has suffered more from Venereal Disease than the Army serving in the United Kingdom. This may be attributed to the inevitable ennui of Indian life, the lower class of the women, and their greater venality, and also their greater lack of cleanliness.

The invaliding rate due to syphilis, in the Army of India per 1,000 of strength is given in Appendix I and Plate 3. One is at once struck by the fact that these curves follow with remarkable parallelism the curves for the average constantly sick for this disease, the rise and fall being contemporaneous. The very marked difference here between the United Kingdom and India is very hard to explain. The relationship between the two sets of curves shown by the Indian figures is what one would expect and does not call for an explanation, that shown by the United Kingdom is paradoxical. The most feasible explanation would seem to be

that the invaliding rate in the United Kingdom is to some extent affected by the invalids sent home for change from foreign stations. These men are usually after a certain period of furlough either permanently discharged the Service or posted to the depôt, or home battalion. In the case of permanent discharge the fact would be recorded in the returns for the command from which the invalid came, but after he has returned to duty, any relapse of the disease resulting in permanent invaliding would be laid to the account of the United Kingdom. We can imagine then the invaliding for the United Kingdom being maintained at a steady rate by this gradual influx of cases from abroad. I have included a curve showing the numbers per 1,000 of strength invalided home for change, as well as those invalided direct out of the Service from India, with the combined curve showing the totals for both forms of invaliding. There is little to remark on except the accurate parallelism of the curves. The effect of the South African War on these figures is interesting. Evidently during its continuance medical officers were more chary of invaliding direct out of the Service, and more inclined to try the effect of change of climate first.

The main object, one might almost say the only justification, for the study of the history of any disease, is that such study may assist us in our struggle with that disease in the future. This leads us at once to the question of the Prevention of Venereal Diseases, a subject which has a history, and a stormy one, of its own.

The history of the systematic Prevention of Venereal Disease in England may be said to begin with the Contagious Diseases Act of 1864. By this Act provision was made whereby at certain places detailed in the schedule of the Act, on an information, not on oath, laid before a justice of the peace, by a superintendent or inspector of police, or by any registered medical practitioner, stating that the informant "has good cause to believe" that "a certain woman" is a common prostitute, and has a contagious disease, and within fourteen days before the date of the information, "was in a public place within the limits of a place to which the Act applies—for the purposes of prostitution" the justice might call on that woman to appear to answer the charge, and "on oath being made before him substantiating the matter of the information to his satisfaction order such woman to be taken to a certified hospital for medical examination." The

result of this examination was to be reported to the justice and if the woman were found to be suffering from contagious disease the justice could issue an order for the detention of the woman for treatment for a period not exceeding three months.

The places to which the Act was made applicable were Portsmouth, Plymouth, and Devonport, Woolwich, Chatham, Sheerness, Aldershot, Colchester, Shorncliffe, The Curragh, Cork, and Queenstown. The limits of these places were laid down with some liberality : Aldershot, for instance, extending as far as Pirbright, and even Eversley. This somewhat crude Act was repealed, and replaced, in 1866, by another Act which laid down that—

" Where an information on oath is laid before a justice by a superintendent of police, charging to the effect that the informant has good reason to believe that a woman therein named is a common prostitute, and is either resident within the limits of any place to which this Act applies, or, being resident within five miles of those limits, has, within fourteen days before the laying of the information, been within those limits for the purpose of prostitution " the justice shall issue a notice calling on such woman to appear at a time and place laid down in the notice. If the woman appeared, in

person or by proxy, or if she failed to appear (proof being given that the notice was served on her in due time to enable her to do so) the justice, if he thought the charge of prostitution substantiated, was empowered to order "that the woman be subject to a periodical medical examination for any period not exceeding one year, for the purpose of ascertaining at the time of each such examination whether she is affected with a contagious disease." The difference between these two Acts is worth noting. By the Act of 1864 the woman had to be charged with being both a prostitute and diseased. By the later Act the accusation of prostitution was held sufficient to carry the presumption of disease. This change is significant in its bearing on the inequality with which the two sexes are treated by almost all Contagious Disease legislation. This point will be referred to later. Provision was also made by this Act for the institution of "Certified hospitals," the appointment of visiting surgeons and inspectors of hospitals, these details being left to be carried out by the Admiralty or the War Office. The stations selected were the same as those detailed above with the addition of Windsor.

In 1869 another Act was passed adding the follow-

ing places to those already mentioned, viz., Canterbury, Dover, Gravesend, Maidstone, Southampton, and Winchester, and also extending the five mile limit mentioned in the Act of 1866 to one of ten miles, and also making the provisions of the Act applicable to any woman who being "resident within ten miles of those limits, or having no settled place of abode, has within fourteen days before the laying of the information, either been within those limits for the purpose of prostitution, or been outside of those limits for the purposes of prostitution in the company of men resident within those limits." In May 1883, up till which time the above Acts were in full force, an order was issued abolishing the compulsory examination of women, and from that period until the Contagious Disease Repeal Act of 1886, by which the above mentioned Acts were repealed, they existed in a state of suspended animation. Since the last named date there has been no renewal of them. The effect of these Acts is graphically shown in the accompanying plate (No. 4) showing the admissions for all Venereal Diseases in fourteen stations under the Acts, and in fourteen other stations not under the Acts from 1860–1898.

The first thing that strikes one on looking at

these two curves is their remarkable parallelism. In both curves we find a rise in 1867, less in the protected than in the unprotected stations. After 1869 the fall in the curve for unprotected stations is practically equal to that in the curve for protected stations, but the whole curve is throughout more irregular. Commencing in 1875 in the case of unprotected stations, and a year later in those classed as protected, we have a steady rise in both curves, the maxima being reached in 1883 in the former class, and in 1884 in the latter. The repeal of the Acts in 1886 is followed by a distinct fall in the curve referring to previously protected stations, a simultaneous fall showing itself in the other curve also. The main lesson to be gathered from these curves appears to be that the rigorous application of repressive measures directed against women suspected of prostitution cannot abolish Venereal Diseases, nor even prevent their increase. The utmost that such measures can effect is to control the tide, as shown by the very much more marked regularity of the "protected" curve, when compared with the "unprotected" one. The actual ebb and flow of that tide are not due to the presence or absence of repressive measures, but to the operation of social causes lying much deeper than any

mere police measures can hope to penetrate. The inherent vice of all such Acts as those above referred to is that they apply to one sex only, and that, the less aggressive sexually, of the two. It may be taken for granted that the number of men who lead irregular lives is considerably larger than that of the women who do the same. Taking all people who lead habitually irregular lives as possibly diseased, and the Acts of 1866 and 1869 assume this in the case of the woman, we have at the outset the the fact that the measures above prescribed can only apply to less than one half of the total number of the possibly diseased. But probably of that minority only a comparatively small proportion were actually caught in the mesh of the Acts. To quote from the final report of the committee of the Advisory Board, "the isolation of a particular section of "infected persons, namely, of diseased prostitutes, "cannot be considered an ideal method of arresting "the disease, while large numbers of infected persons "of both sexes remain free to spread the conta-"gion.

"It is noteworthy that in certain foreign countries "where the police supervision of prostitutes has been "carried out much more strictly than was ever "attempted in the United Kingdom, serious doubts

"are now expressed as to the efficacy of legal restraint "in arresting these contagious diseases.

"One of the most remarkable examples of diminu- "tion in prevalence of a contagious disease is afforded "by the history of syphilis in Sweden during the "past century. The main factor in bringing about "this diminution is considered by Professor Welander "of Stockholm, to have been the effective and, if "necessary, gratuitous treatment afforded in hospitals "by the State to patients of both sexes without the "stigma produced by police compulsion. The opinion "of many competent continental authorities is to "the effect that the voluntary submission to treat- "ment by infected persons of both sexes is more "likely to diminish the prevalence of Venereal Disease "than the compulsory treatment by police regulation "of a special class only.

"Taking into consideration the present state of "expert opinion abroad, and the opposition certain "to be raised in this country should the re-enactment "of a statute on the lines of the Contagious Diseases "Acts be proposed, the Committee has come to the "conclusion that, in the United Kingdom at any rate, "an attempt to grapple with the problem of venereal "disease by methods of compulsory isolation and "treatment is neither practicable nor expedient.

"Better results are likely to be obtained by the "diffusion of the knowledge of the serious consequences "of these diseases, and the provision of effective "treatment for both sexes under conditions to which "no penal stigma is attached. If this conclusion is "sound, the more necessary is it that trustworthy "methods of treatment should be thoroughly under-"stood by members of the medical profession, and "rendered readily available both in military and "civilian practice."

In India the experience of the working of Contagious Diseases Acts has been somewhat different. It is true (*see* Table II) that there was a marked rise in the admissions for all Venereal Diseases prior to the abolition of the Acts in 1888, but this abolition was followed by a very startling and serious aggravation of these diseases, until during the years 1894 to 1897 the number of admissions yearly, from this cause alone, amounted to half the strength of the garrison. This alarming state of affairs led to the New Cantonment Act of 1897, which was immediately followed by a rapid fall in the number of admissions. Still the fact remains that the original Act, though a severe one, did not stop the rise in the total number of admissions for Venereal Disease, during the later years of its being in force.

Whether, if the Act had been continued, the terrible incidence of the years 1894 to 1897 would have ever been reached may be doubted, but we have no reason to say that a rise would not have occurred. On the other hand the fall since 1897 has not been entirely due to the New Act. During the later months of that year, and throughout the earlier part of 1898, a large number of troops were engaged in active operations, beyond the Frontier, or living under practically field service conditions close to it. During 1899 troops were moved to South Africa, and for the next three years the Army of India consisted of men of steadily increasing age, and steadily growing experience of the country. The temperance movement must also be taken into account. Still, after all has been said, there is no doubt that this Act has had a good effect. It is in no sense an oppressive Act, and treatment in a special ward of a Cantonment Hospital does not convey the stigma that confinement in a Lock Hospital, and the periodical herding together of all prostitutes, for examination, did. Tables are appended giving the curves for admission for all Venereal Disease, for China and Straits Settlements, Gibraltar and Malta (the one for a time, the other constantly under a Contagious Diseases

Act), and for Egypt. These are interesting, but do not merit detailed attention.

They all teach the same lesson, and that is, that the main fluctuations in the incidence of Venereal Diseases are independent of the presence or absence of repressive Acts, and that, dating from the middle of the '90's there has been some other strong social influence in the Army (probably temperance) acting to reduce their prevalence; and this not in isolated commands only, but throughout the Army generally.

The following information as to the present position of the question of prevention on the continent, the measures adopted in various countries, and the prevalence of Venereal Diseases in certain Foreign Armies is extracted from the Report of the Committee of the Advisory Board.

"The prophylaxis of Venereal Disease generally, "but more especially syphilis, is at present attracting "considerable attention on the Continent. In Ger- "many and France there already exists legislation "for the control of prostitution and the prevention "of the spread of venereal disease. The leading "authorities are not, however, satisfied that as much "is being done as is possible. Societies, consisting "of members of the legal and medical professions

"and others interested in the public health, have "been formed to consider the subject with a view "to concerted action. The German Society holds "an annual Congress, while the French one meets "monthly.

"In France police regulations, which involve "registration and periodical examination, do not "seem to be very successful. This is ascribed to "prevalence of clandestine prostitution.

"At the German Congress for the Prevention of "Venereal Disease held at Frankfort, March, 1903, "most speakers expressed dissatisfaction with the "working of the present German police regulations, 'which are much the same as the French. At the "same time the general opinion was that some kind "of restriction is necessary.

"The plan of 'Control Strassen' seemed to "meet with a fair amount of approval.

"Prussian law requires notification in the follow-"ing cases :—

"(1) If the case is likely to be a source of venereal "contagion, e.g. secondary ulcers of the "mouth among employés in workshops, "or poor people living in overcrowded "dwellings.

"(2) Civil doctors must inform the Commanding

"Officer when treating soldiers for venereal
"disease.

"Recent congresses on the Prevention of Venereal
"Disease :—

"1. Congress for the prevention of syphilis in
"Russia.

"2. Discussion, British Medical Association meet-
"ing, 1899.

"3. First International Congress for the Preven-
"tion of Venereal Disease, Brussels, 1899.

"4. Committee appointed by the Medical Society
"of New York to inquire into the spread
"of Venereal Disease and means of its
"prevention.

"5. Second International Congress, Brussels, 1902.

"6. First Congress of the Deutsche Gesellschaft
"zur Bekämpfung der Geschlechts Krank-
"heiten, June 1903.

"In the Russian Congress various proposals were
"adopted for the Army, such as lectures to the
"men, keeping syphilitic cases under observation,
"etc. All these have either been adopted in the
"British Army already or are about to be so.

"At the Second International Congress, Brussels,
"the only resolution adopted which affects the
"army was as follows :—

"No. III. That all conscripts joining a regiment "be given a short pamphlet describing the dangers "of gonorrhœa and syphilis. This is also to con- "tain a note to the effect that the date of an attack "of venereal disease must be remembered in order "to correctly inform the medical officer of the fact, "should it be necessary later on; also a brief "reference to the dangers of alcoholic indulgence "and of tubercular disease.

"This pamphlet to be kept by the man on his "discharge from the army.

"MEASURES ADOPTED FOR PROPHYLAXIS IN ARMIES.

"3. *Comparison of the incidence of Venereal Diseases "in European Armies*

	Admissions per 1,000 of strength.				
	German	French	Aus- trian	Italian	British
1886 to 1890 (aver- age, annual) . .	27·1	51·1	65·3	94·3	212·4
In 1900	17·8	37·2	59·8	89·7	93·4

"Venereal Disease is prevalent in the Russian "Army. In 1899 out of a strength of 1,013,435 "men 34,228 were admitted for this cause=33·77 "per 1,000.

"In Warsaw lectures are given to the men in-

"structing them in the nature and dangers of "Venereal Disease, also recommending continence "and advising them to report sick early.

"In the French Army the following rules have "been adopted:—

"I. Lectures to the men.

"II. Monthly examinations of the men in private.

"III. Secret register of syphilitics.

"IV. No punishment is awarded unless the dis- "ease is concealed.

"V. Houses of diseased prostitutes are put out "of bounds.

"The French colonial corps suffer severely from "Venereal Disease. In most French colonies there "is no regulation of prostitution, and where it does "exist it is very inefficiently carried out.

"In the United States Army in Cuba weekly "inspections for the detection of venereal disease "were held. Those so suffering were treated in "hospital, or as out-patients confined to barracks."

It would not be proper to quit this part of our subject without suggesting, at least, the lines on which further progress in the Prevention of Venereal Disease may be hoped for. And first I would point out that the State is responsible, for placing the young soldier in a sexually abnormal condition,

particularly abnormal, considering the early marriage age of the class he springs from. It is therefore not only to the advantage of the State, it is its manifest duty, that it should do all in its power to prevent the young soldier from falling into those habits of promiscuous incontinence to which his position renders him so liable. This duty it can of course only carry out through its officers. And in saying officers I do not limit the term to the officers of any one branch, or department. Every officer in the Service, regimental officer, medical officer, and chaplain, every officer who is responsible for the moral and physical welfare of the men, or who wishes to see full ranks instead of depleted ones, is equally interested. To begin with, as officers of the Army, we are concerned solely with the men ; the women are outside of our purview. Now it appears to me that our work as regards the men may be divided into two parts. The first part is to influence the men towards continence. *Syphilis in-sontium* may occur undoubtedly, but is extremely rare, and it is safe to teach the young soldier that, if he lives a chaste life, his chances of contracting Venereal Disease are far less than those of his contracting smallpox. It may seem a counsel of perfection, and to a certain extent so it is. But it

is a fact that there are a large number of men who do practise continence for considerable periods, namely, those who put themselves into serious training for athletics, and that they are physically all the better for doing so. Again, there is a considerable social class, the Quakers, amongst whom moral and sexual purity is highly estimated, and I believe syphilis is almost unknown amongst them. The counsel may be one of perfection, but it is not therefore one of impossibility. Next it should be pointed out to the young soldier that not only is continence possible, and healthful ; but that incontinence, so far from being a sign of manliness, and a characteristic to be proud of, is a sign of weakness, and a thing to be ashamed of. Fortunately this feeling is already beginning to spread, and we may hope that in time it may be considered no more manly to be incontinent, than it is manly to get drunk. It is no question that the latter used once to be the general opinion of young men, and not so very many years ago. The former opinion still survives, though it is already less popular than it once used to be. Having got thus far the young soldier should next be told how he may best avoid the inevitable temptations to incontinence that attack the healthy male adult. The majority of

soldiers are fond of athletics, and the performance and practice of these should be encouraged. This is a matter which, of course, comes more directly under the regimental officer than the medical officer, but to show the value of this means of avoiding disease, not only on account of its physical effect, but also on account of the healthy moral tone that it can induce, I quote here at some length from a series of five lectures delivered by Professor Erik Pontoppidan to the students at the University of Copenhagen on "What Venereal Diseases mean, and How to Prevent them."

"There is, further, another development from which I expect a better outlook for the present young generation in respect to sexual health, namely, the development of *physical exercise.* Nothing counteracts so strongly the irregularities of the imagination and sensual affections consequent upon a lazy, sedentary life, accompanied with overfeeding and luxury, than bodily exertion and methodical, pleasant physical exercise. It develops force of character and energy, which are useful for all purposes in life, and ability to act; in short, a well trained body is not compatible with drink or sexual excesses.

"We have taken our '*Idræt*' from the English

sport, and it has, therefore, been of interest to me on visiting England, where the sport is a time-honoured institution, to examine the relation between it and the venereal diseases, particularly with regard to students.

"As everybody knows who has visited London and the big English towns, an unbridled, widespread and wholly uncontrolled prostitution is met with there, together with very deficient sanitary conditions in connection therewith, especially amongst the lower classes. Even the English army is sadly infested with venereal diseases. These things are evident, but I was told unanimously by doctors and people intimately acquainted with this subject that syphilis and other venereal diseases are not very frequent amongst students, or generally amongst young gentlemen of similar social position. The reason thereof was not on account of any moral superiority to the other classes. The explanation of the more fortunate position of these young men in that respect—in contrast to the students on the Continent—was unanimously attributed to the fact that it was not considered 'good form' amongst them, or generally admitted, to talk about women and sexual questions in the same way as, for instance, French *etudiants*, with whom *la femme* plays an

important part in their lives. The young Englishmen, on the contrary, are intent on their sport, it occupies all their leisure and claims all their interest. We have, as I have said, taken our sport from England: may we also adopt the manly character and fine feelings of the 'true gentleman' towards everything vulgar and unclean!"

I have said so much on the subject of temperance and its great influence on the question of the prevention of Venereal Diseases when discussing the historical part of our subject, that it is unnecessary to return to it here. This, then, is the first part of a rational system of prevention, to teach the young soldier that continence is possible, and healthful, and that it may be best attained by leading an active, temperate, clean thinking, clean talking life. The second part is to teach him the dangers of incontinence, and the possibilities of ill health that may result from a single false step. Thirdly and lastly, if in spite of all encouragement, assistance, advice, and warning, the soldier persists in a course of life that renders him from time to time incapable of performing his duties, the powers of discipline may fairly be called in to punish him for so doing, as in the case of the analogous vice of drunkenness. It may be objected that in punishing a man for

contracting Venereal Disease we are punishing him, not for committing a crime, but for being so unfortunate as to be found out. But this objection applies to all discipline. We do not punish a man for drinking, but for being so unfortunate as not to be able to conceal the effects of drink. His comrade with a stronger head may drink much more and escape detection. So, too, one man may by incontinence expose himself repeatedly to the risk of infection, and escape, while his unfortunate comrade falls a victim to his first false step. This cannot be helped. Captain Howell, R.A.M.C., in the Parkes Memorial Prize Essay, for 1901, gives a series of suggestions with regard to disciplinary measures which I reproduce here, from the Report of the Committee of the Advisory Board.

(1) That no official notice be taken of the first venereal admission or of any admissions for secondary syphilis, but that for every subsequent admission for Venereal Disease a "V" to be entered on the man's Regimental Defaulter Sheet.

(2) That all guards and fatigues missed by a man being in hospital for venereal disease (excepting first admissions and secondary syphilis admissions) should be made up

by the man on his discharge from hospital.

(3) That extra drills be imposed to regain the efficiency lost while in hospital.

(4) At home permanent passes, and in India shooting passes not to be granted to men having many entries for venereal disease.

(5) The number of "V's" in a man's Defaulter Sheet to be taken into consideration by the man's commanding officer before promoting him, or assessing his character on discharge.

(6) Any man who has suffered from syphilis not to be granted permission to marry until he has had a full course of treatment for syphilis, and has been clear of an entry for syphilis for at least two years.

(7) Any man who has had no admission to hospital for an officially fixed period, say one year, should have his previous "V's" cancelled.

(8) Regiments showing an annual admission rate for venereal disease much in excess of the average admission ratio for the whole Army should be debarred from proceeding on active service till all regiments showing less than the average rate have proceeded

to the front, and even then should, if possible, only be employed on the lines of communication.

The difficulty with all such disciplinary measures is, of course, the risk of their leading to concealment of disease. I would be inclined therefore to allow a man to have two primary attacks of Venereal Disease without making more than a Company Entry. The third primary attack should be made a Regimental Entry. The making up of lost duties is a practical idea. The hardened sinner would know quite well that the longer he stayed out of hospital concealing his disease, the longer he would probably have to remain in hospital for recovery, and the more guards, etc., he would have to make up. Particular notice should I think be taken of any man who, while under treatment out of hospital for secondary syphilis, was found to have contracted gonorrhoea or soft chancre. The Committee of the Advisory Board also suggested for consideration the publication of an Annual Return showing the incidence of Venereal Disease by units of the Army, and there is much to be said for this. So also for the system adopted by Lieut.-Gen. Good-enough of calling for monthly returns of admissions

for Venereal Disease by companies. In all such, however, only primary admissions should be noted.

The essence of the system that I suggest is that we should begin by placing a high ideal before the soldier as at least possible of attainment. I do not consider it a valid objection to say that the ideal is too high. We all know that the higher you place your ideal the higher you are likely to attain, and this ideal is attained by many men over prolonged periods, and by some men maintained until marriage. All other systems of prevention accept incontinence as a necessary part of male life, and aim at making it safe. They place the ideal, if it can in any way be called an ideal, as low as possible, and figures prove that they fail to in any way attain to their ideal, that is absolute safety. To use a now historical phrase "they put their money on the wrong horse." Let us at least try the high ideal, and instead of saying that incontinence is a necessity, say that continence is possible, and the best policy in the long run. We need never hope for absolute success, or to get an Army of Galahads, but we shall have the satisfaction of knowing that every diminution in the rate of Admissions for Venereal Disease means not only so many more healthy men in the ranks, but so

many more men who have learnt the virtue of self-restraint, and thereby benefited not only their bodies, but their characters. Human nature being what it is we must still have recourse to fear, and the danger of possible ill consequences, to keep men in the narrow path, and in the last resort the scourge of discipline to drive those that will neither lead nor be led therein, but the high ideal should come first.

CHAPTER II

SYPHILIS: DEFINITION—PATHOLOGY

Definition.—Syphilis is an infective disease usually acquired during coitus; the Spirochaeta Pallida gaining entrance through a minute abrasion in the mucous membrane of the glans or adjoining skin of the penis. A general infection of the system takes place within a few hours; unfortunately however, the clinical signs of this do not show themselves till some weeks have elapsed and even then are not always as definite as one could wish. The chief and most objectionable characteristic of the disease, however, is its tendency to recur after long intervals of perfect freedom, suddenly attacking the central nervous system or some important organ and leading to a rapid breakdown of the general system.

The Spirochaeta Pallida.—In view of the very general acceptance which has been accorded to the micro-organism discovered in syphilitic lesions by Schaudinn and Hoffmann, it has

been thought well to devote to it a separate chapter. It must, however, be borne in mind that complete proof as to its causative rôle in Syphilis is not yet forthcoming.

There is no need for an exhaustive account of the various micro-organisms which, at one time or another, have been found in syphilitic lesions and suggested by their discoverers as the actual cause of the disease. There have been some twenty-five of these brought to notice in the last twenty years, but few have met with any degree of support or confirmation and most have been speedily forgotten. The bacillus of Lustgarten [1] is almost the only one which survived its discovery, in 1884, and succeeded in holding the field until the suspicions as to its identity with the Smegma bacillus grew too strong for its further acceptance. Ten years later, Van Niessen [2] discovered an organism, closely resembling the Diphtheria bacillus, which met with some degree of support, but was finally discredited and, with the possible exception of the Protozoon described by Schüller,[3] no others have left any permanent mark on the history of the subject. It was, however, generally thought by bacteriologists that the disease

[1] The small figures in text refer to Bibliography Appendix II.

was of bacterial or of protozoal nature and that the failure to detect the germ was either due to faulty technique or to the fact that it might be of ultra-microscopic size.

The problem stood in this unsolved condition in April, 1905, when Schaudinn and Hoffmann[4] announced, in somewhat guarded language, their discovery of the spirochete which is the subject of the present chapter. It is not the least remarkable feature of this discovery that it should have been accepted so soon and so generally by those best qualified to judge ; this, no doubt, was in part due to the high esteem in which the work of the late Dr. Schaudinn was justly held, but, probably in greater part, to the fact that the spirochete, whose presence in primary and secondary lesions was recognized on all hands, was of such a nature that it could readily be distinguished from others. Its non-recognition up to this time was also easily accounted for by the fact that special staining methods were necessary for its detection and that such methods had only been available of recent years.

While the constancy of its occurrence in the primary and secondary lesions was soon recognized, the actual proofs of its causative rôle were, of course,

still lacking, but, considering how short a time has elapsed since its discovery, it is astonishing how large a body of evidence has accumulated in support of its being the long-sought cause of syphilis. Complete proof is still to seek, but it will, I think, be apparent, from a consideration of the evidence presented below, that, at the least, a very strong case has been made out in its favour. It may, at all events, be said that the spirochete of Schaudinn and Hoffmann is an organism "sui generis" and that it is only to be found in the lesions of syphilis. In their original description they spoke of two spirochetes, one of these, to which they gave the name of *Spirochaeta refringens*, was of considerable size and easily stained, the other was of extreme tenuity and could only be stained with difficulty; to the latter they gave the name of *Spirochaeta pallida*, in allusion to its pale-staining qualities. Their further experience, and that of many others who subsequently confirmed their work, soon showed that the latter, *Sp. pallida*, alone could be suspected of playing any part in the causation of syphilis. *Sp. refringens*, which will be described below, is frequently to be found in the secretion of ulcerated surfaces in cases in which there can be no suspicion of this disease.

For reasons connected with the biological position of the spirochete, into which it is unnecessary to enter, it was thought necessary to create for the spirochete a new Genus and, for this purpose, Vuillemin [5] suggested the name of *Spironema* in place of that of *Spirochaeta*. Schaudinn accepted this name, but, as it was found that it had already been employed in another connection, he suggested in its place that of *Treponema*. By this last name, *Treponema pallidum*, the organism is now correctly known, but the older designation of *Spirochaeta pallida* is in more common use and will be adhered to in the present instance. Such a procedure may be further excused since it is far from improbable that fresh light may be thrown on the biological position of the parasite, which might necessitate yet another change in the generic name.

Description.—The *Spirochaeta pallida* is an extremely delicate, thread-like organism, spirally twisted and presenting several points by which it may be distinguished, with comparative ease, from other spirochetes. The chief of these points are its extreme tenuity, the regularity and close twisting of the spirals, its weak staining affinities and its low refrangibility. In the fresh, unstained condition, it may be seen in the hanging-

drop and its motility studied, but this demands the best optical conditions and a considerable degree of proficiency in high power microscopy. In this condition it may be seen to be actively motile, the character of the movements being a rapid rotation on its long axis and a true movement or progression ; twisting and bending movements have also been described and Schaudinn has pointed out that, in distinction to most other spirochetes, when death brings its motility to an end, the rigid appearance of the curves is preserved and it does not assume the a-typical forms, with flattened out spirals, so often seen in other pathogenic spirochetes. Further details as to motility and structure are said to be made out with the help of the ultra-microscope and Scholtz[6] has recommended the unstained organism as being easier of detection than when stained in an ordinary film preparation ; in this I do not think many will be found to agree with him.

With a successful stained specimen the spirochete is readily detected and its main features may be studied. The first point which strikes the eye is the slender nature of the thread, the diameter is usually given as from a tenth to a quarter of a micron, but such measurements must be mostly guesswork, as it is almost beyond the limits of measurement

with the ordinary micrometers. The length varies considerably, the average being from 4 to 10 microns, though both shorter and longer forms than those are not infrequently met. The spirochete tapers at each end almost to vanishing point; apart from this, it is of remarkable uniformity of thickness throughout its length. The character of the spirals is one of the points, in my experience one of the most important points, by which it may be differentiated from other spirochetes; these are extremely uniform in width and depth and very closely approximated; in number they average from 6 to 14, but I have seen a single organism with as many as 22. The width of the curves, that is the distance from the summit of one convexity to that of the next, is very constant, 1. to 1.2 microns. This, I have assured myself by a large number of measurements, is a figure that is rarely departed from and is worth bearing in mind, as it is a point by which *pallida* may be distinguished from *Sp. refringens* and others, which are often encountered in suspected material. In the absence of a micrometer, these curves may be measured, with approximate accuracy, by contrasting them with the diameter of a red blood corpuscle, if any happen to be in the field; remembering that the average diameter of a red cell is 7·5 microns, it

will be seen that the spirochete, in this distance, will have made from six to seven turns (Appendix II, Fig. 1). In this manner the average width of the spirals can be ascertained with a fair degree of accuracy. If, however, an eyepiece micrometer is available, the value of whose divisions has been ascertained for the particular combination of lenses in use, the average measurement of the curves may be determined by taking the length of the spirochete in microns, counting the total number of the curves and dividing the former figure by the latter.

Much importance has been attached to the " rigidity " of the spirochetes, that is, their appearance of being twisted round an imaginary straight line, but, while such rigid forms are very frequent and, in some specimens, the only forms to be found, in others curved forms, loops, figures of eight and irregularly twisted spirochetes are not infrequent, and may lead to some confusion. These a-typical forms appear to me to be most frequent in films prepared from lesions which have been ulcerated for some time and it is possible that they indicate the death of the spirochetes, the rigid forms being such as were alive at the time the specimen was prepared. This view has been suggested to me by the appearances I have noted during a study of the

living spirochetes of relapsing fever and tick fever. The differentiation of such a-typical forms from other spirochetes will be dealt with below.

As regards the relation of the spirochetes to the other elements found in film preparations, they are almost always free and not intra-cellular ; at times, one may be seen apparently attached to a red blood corpuscle, while others are seen over-lying either red cells or leucocytes, but I have never observed definite phagocytosis, and the occurrence of true intra-corpuscular forms, although signalled in the early days of the discovery, has not been confirmed. At the same time there is good evidence that phagocytosis does occur in the tissues, as will be mentioned in the section dealing with the distribution of the parasite.

Great interest attaches to the finer details of the structure of *Sp. pallida*, but on this point there is no general agreement. Observers who have worked at this problem record very different results, the facts on the one hand pointing to the bacterial nature of the parasite, on the other to its being a protozoon. It would be out of place to go into this question at length and it will suffice to indicate the principal features that have been described, leaving on one side any attempt to reconcile the conflicting

views. Schaudinn himself was decidedly of the opinion that the parasite was a protozoon, closely allied though not belonging to the *Trypanosomata*. He was unable to make out any evidence of an undulating membrane, such as he had found in some other spirochetes, but he described and figured a delicate terminal flagellum, about half as long as the spirochete itself and sometimes bifid, a fact which he thought suggestive as to the possibility of longitudinal division. This flagellum could only be demonstrated by means of special flagellar stains—Loeffler's was the one with which he worked—and was not visible in specimens stained by Romanowsky's method. Schaudinn's observation has been confirmed by several others, though opinion is not unanimous as to the nature of these delicate little terminal threads, some regarding them as simple prolongations of the body of the spirochete. I have not, myself, been able to recognize this flagellum, though at times forms are met with in which one end appears to be extremely attenuated and not unlike the structure figured by Schaudinn.

The existence of a nucleus in the spirochete is uncertain. Dots have been described in the threads, either as dark staining bodies or as light unstained areas, which may possibly be of nuclear nature ;

but Schaudinn's original view that the nuclear chromatin was diffuse, extending as a thread of chromatin substance throughout the length of the spirochete, seems to be nearest the truth. Some very remarkable observations on the structure of *Sp. pallida* have been made by Krzystalowicz and Siedlecki [7] who describe true longitudinal division, an indication of an undulating membrane as well as a nucleus and centrosome. They also figure a flagellum, of a different nature to that just described, which starts from the neighbourhood of the centrosome and courses down the body of the parasite for a short distance, but does not project beyond its extremity. They further note the existence of short and comparatively thick parasites, in which the above details of structure are most evident, and they suggest that a process of conjugation occurs between individuals of different sexes. They conclude, as a result of their observations, that the parasite is, without doubt, a trypanosome. These remarkable observations are, as yet, un-confirmed and, from the extremely minute size of the organism, it is obvious that the interpretation of the finer details of structure is as difficult a task as could well be imagined.

A possible source of confusion, and, at the same

time, a possible solution of the difficulty, lies in the existence of the parasitic bodies found by Siegel [8] in syphilitic material and thought by him to be the cause of the disease. To these bodies he has given the name of *Cytorrhyctes luis* and he considers them to be of the same Genus as those which he has found in Smallpox, Foot and Mouth Disease and Scarlet Fever. This Cytorrhyctes, according to Siegel, follows a complicated cycle of development, which need not be described here, and some of the forms may, as has been suggested, represent stages in the development of *Spirochaeta pallida*. Although little or no support has been accorded to the *Cytorrhyctes luis* as being the causative agent of syphilis, there appears little doubt that these bodies are at times to be found in syphilitic material and the part which they play, if any, in the disease is one of the many points on which we must await further research. Negative results are, perhaps, of little value, but I may record the fact that in many hundred prolonged examinations of films containing *Spirochaeta pallida* I have not yet encountered the forms figured by Siegel.

Multiplication.—On this point there is also a divergence of opinion. While the majority hold that multiplication takes place by transverse

division, such as occurs in all bacteria, others consider that longitudinal division is the rule. It is, once more, the much-debated problem of the bacterial or protozoal nature of the pathogenic spirochetes. Forms may be observed in film preparations which lend support to either view. On the one hand, long spirochetes may often be seen presenting a constriction at or about the middle, an appearance of thinning and stretching which, if carried further, would certainly end in the separation of the spirochete into two new individuals. Similar forms are readily recognizable in the larger spirochetes, such as those of relapsing fever and tick fever, but we get little help from this fact as the same difference of opinion as to their interpretation exists here, although we have the assurance of several observers that they have seen transverse fission occur in spirochetes watched in the hanging-drop. On the other hand, in syphilitic films, one often encounters forms which it is hard to believe are not stages of longitudinal division. Two spirochetes closely entwined are, of course, capable of being interpreted either as evidence of recent longitudinal cleavage or as being due to a mere entanglement of two free individuals but forms which show an appearance of thickening at one extremity while the other is

prolonged into two distinct spirals are not so easily dismissed. Such forms are only rarely to be seen, but are very suggestive of longitudinal division; the minute size of the organism, even under the most powerful magnifications, must, however, be borne in mind and it is extremely easy to deceive oneself in endeavouring to interpret morphological details, such as this.

Artificial cultures of the spirochete have not yet proved successful, so no help is available from this source. Very numerous attempts have been made to cultivate the organism, every resource known to bacteriologists having been employed, but without success. At the same time, the spirochetes are able to withstand removal from their natural surroundings for a considerable time; thus, Landsteiner and Mucha [9] succeeded in keeping them alive in the hanging-drop for two days, while Volpino and Fontana,[10] working with fragments of tissue containing the spirochetes, thought that they observed an increase in numbers when the pieces were kept at a temperature of 37° C. They did not, however, find any evidence of a similar increase of numbers in the fluid in which the fragments were kept. This failure of cultures is on a par with the similar failure of artificial cultures of the other

pathogenic spirochetes ; for one can hardly accept, as equivalent to the ordinary bacterial cultures, the so-called cultures obtained by enclosing the spirochetes in collodion bags which are then kept in the peritoneal cavities of animals. To many, this failure is another piece of evidence in favour of the protozoal nature of the parasites.

Assuming the spirochete to be the cause of syphilis, the clinical evidence would indicate that it is possessed of extraordinary powers of longevity in the tissues and of resistance to the destructive action of the fluids and cells of the body. This being so, one would expect, if it were a bacterium, that it could be successfully cultivated. It is true that there are some bacilli which have as yet resisted all attempts at culture, such as the Leprosy bacillus, but such exceptions are rare. It is greatly to be hoped that the question will soon be solved, for, until cultures are obtained and experiments can be conducted with these cultures, Koch's canons cannot be satisfied and a certain element of doubt must remain as to the exact part played by the spirochete in the disease.

The question of the occurrence of *Sp. pallida* in tertiary lesions will be dealt with below and it need only be mentioned here that it is possible that the

rarity of the spirochete in this stage of the disease may be due to the fact that it has then assumed a form, as yet unrecognized, different to that with which we are now familiar. If the organism were a protozoon, analogy would lead us to expect a change of form and there is a certain amount of evidence, in connection with the other spirochetes, that such a change of form may occur, either in the tissues of the original host or in the body of an alternative host.

This question of the biological position of *Sp. pallida*, however interesting to those engaged in its investigation, would lead us too far from the purpose of this chapter, but it is one of greatest moment in the further extension of our knowledge of the exact relationship of the parasite to the disease. Proof of the existence of a "resting form" of the spirochete would clear up many of the difficulties with which the subject is beset and might afford the solution of the problem as to the connection between the spirochete and the later manifestations of syphilis.

Staining.—As has been said, the failure to detect the spirochete at an earlier date was due to the fact that special staining methods were necessary and such have only been available during the last few

years. While this is true, our extended experience shows us that its demonstration in film preparations is not such a difficult matter as was at first imagined and there are now a considerable number of alternatives to the method by which it was first demonstrated by Schaudinn and Hoffmann, viz. Giemsa's modification of Romanowsky's stain. On the whole, it is an organism which exhibits an extremely feeble affinity for the ordinary basic dyes employed in bacteriology and, although it may be coloured by the most powerful of those, the results are poor, owing to the deposit which usually occurs on the film and masks the delicate little threads.

The best results are certainly attained by some of the many modifications of Romanowsky's chromatin-staining method, although, for certain purposes, such as the demonstration of the terminal flagella, good results are claimed for the employment of some of the ordinary flagellar stains, for instance that of Loeffler.

Staining of Film Preparations. — It is necessary to observe certain precautions in preparing the film if the best, or, indeed, if any results are to be expected. The slide or cover-glass, on which the film is to be made, must be perfectly clean and free from grease; any of the methods recommended

for the preparation of slides for flagellar staining will answer the purpose, but perhaps the simplest is to pass the slide thirty or forty times through the flame of a bunsen burner. Next in importance, the film must be as thin as it is possible to make it. The material may be lightly rubbed over the surface of the slide or, if of fluid consistency, it may be spread by any of the means employed in the preparation of blood films. If, in either instance, the film is too thick, failure is sure to result, since the spirochetes will only take the stain when lying in a thin layer of the surrounding medium ; again, if the material is thickly spread, the formation of deposit is favoured, and, if this occurs, there is little hope of being able to recognize them.

In collecting the material for examination, say from a chancre, it is necessary to scarify the surface of the lesion with a needle or knife and to obtain a sample of the lymph from the deeper layers. A mere rub over the surface of any lesion is unlikely to yield any spirochetes, as experience has shown that these are found in the greatest numbers in the depth of the tissues and not in the superficial layers. The best plan is to allow the first drops of blood or secretion to flow away or to remove them by gentle wiping and only to collect the clear lymph which

exudes later when this is fairly free from blood. If there should be much blood in the lymph it is unlikely that many spirochetes will be detected. The flow of the lymph from the deeper parts of the lesion may be encouraged by gentle massage of the part. Borrel and Burnet [11] have advocated the excision of a small piece of tissue which is then rubbed up with the point of a scalpel in a drop of distilled water on a slide ; a drop of this emulsion is then transferred to a second drop of water, and, if necessary, one from the second to a third. In this manner they say that excellent films may be made from the thinnest dilution of the original emulsion and that the spirochetes may be detected with greater ease. Levaditi and Petresco [12] found that the spirochete would pass into the fluid of a blister if this was placed on unbroken skin, over or close to the lesion, but others who have tried this method do not speak so well of it. Puncture of glands with a hypodermic needle will often result in the demonstration of the parasites, but the same precaution must be observed of securing lymph as free from blood as possible.

Time spent in observing these precautions will not be wasted and the beginner will find that, the more trouble he takes at this stage, the higher percentage of successes will result.

Giemsa's stain, [13] which was the one with which the spirochete was originally detected, is still that which is most frequently employed for its detection and an account may now be given of the manner in which it is used. The staining fluid itself demands a considerable amount of trouble in the preparation, but may now be purchased from the usual dealers in microscopical necessaries made up and ready for use. The formula for the preparation of Giemsa's most recent solution is as follows.

Azur II, Eosin . . .	3 grms.
Azur II	8 grms.
Glycerine (Merck, chemically pure)	250 grms.
Methyl Alcohol (Kahlbaum I) .	250 grms.

The films are allowed to dry in the air and are then fixed, for 15 to 20 minutes, in absolute alcohol. (Hoffmann and Halle [14] recommend, instead, fixation by means of the vapour of a mixture of osmic and glacial acetic acids.) The alcohol is then removed by blotting the film with filter paper. The staining fluid described above is now diluted in a graduated glass, in the proportion of one drop of stain to one cubic centimetre of water. The diluted stain is poured on to the film and allowed to act for one hour ; at the end of this time it is washed off the film by means of a strong stream of water ; the film

is then blotted with filter paper, dried in the air and mounted in Canada balsam. In his latest description Giemsa adds that, for the purpose of staining spirochetes, it is well to add to the water, before it is mixed with the stain, 1 to 10 drops of a 1 in 1,000 solution of sodium carbonate. Over-stained specimens may be differentiated by soaking them in distilled water for 1 to 5 minutes.

The above method certainly gives very clear and sharply stained results, but the time occupied is long and, occasionally, with the greatest precautions, a considerable amount of deposit forms on the film; this it is extremely hard to get rid of, as the attempts to dissolve it off by alcohol and other expedients usually result in the spirochetes being decolourized. I am, doubtless, prejudiced in favour of my own stain, but it appears to me that it presents some advantages over Giemsa's in the above respects and, as it will probably be more accessible to the readers of this chapter, I may give an account of the manner in which it may be employed for the demonstration of the spirochetes. For this purpose it may be used in three alternative ways. The details are as follows :—

1. The procedure described [15] for ordinary blood-staining may be used, if the time is increased from 5 minutes to 30 minutes. In this method the

fixation of the film is carried out by the action of the stain and double the quantity of distilled water is added to the stain after 30 seconds, the two fluids being well mixed with the help of a needle passed backwards and forwards through the stain. The stain is then washed off in a little distilled water, the film blotted with cigarette paper, dried in the air and mounted in balsam.

2. In this, the "serum method," which is employed [16] for the production of chromatin staining in sections, is applied to the staining of films. The film, prepared with the precautions advocated above, is fixed with methyl alcohol for half a minute, this is blotted off with cigarette paper (which will be found much better than filter paper) and a thin layer of fresh blood serum is run over the surface of the film. The serum may be obtained from blood drawn from one's own finger in the same way in which a sample of blood is collected for the agglutination test. One drop only is required and is drawn over the film with the help of a needle. The excess is then removed by allowing the slide to remain on its end for a few minutes when the drop which has drained to the end of the slide is wiped off. The film is then allowed to dry in the air. When dry, the staining fluid is prepared by mixing, in a clean

watch-glass, an equal number of drops of Leishman's stain and distilled water. The mixture of stain and water is now poured on the prepared film and allowed to act for 25 minutes, at the end of which time it is washed off in a gentle stream of distilled water, the film blotted as before, dried and examined, either directly in a drop of cedar oil or after being mounted in balsam. The action of the blood serum is two-fold, it intensifies the action of the stain and it obviates the dangers of the preparation being spoilt by the occurrence of deposit. The staining, in a successful preparation, should be carried to such a degree that the nuclei of any cells that may be present should appear almost black. (*See* Fig. 1). If this is the case there will be little difficulty in detecting the spirochetes which will be seen to be sharply stained and easily recognizable with an ordinary twelfth-inch immersion lens.

3. As a third alternative, I have recently found good results from employing my stain without previous fixation of the film. The method is similar to that which I advocated some time ago for the staining of malarial parasites.[17] In this case the stain and water, in the usual proportion of two parts of water to one of stain (which will be found to be contained in about the same number of drops), are

mixed beforehand in a watch-glass and poured directly on to the unfixed film. Optimum staining takes place in about the same time as in method number 2, viz. 25 minutes, and the only additional precautions to observe are that the distilled water used for washing off the stain must be employed with great gentleness and that the blotting with cigarette paper must be done by slight pressure and without any rubbing. By this procedure the red cells are, of course, de-haemoglobinized and, in addition, a great deal of detritus is dissolved off from the film; the leucocytes and tissue cells remain and also bacteria as well as the spirochetes, should any be present in the film. This method appears to me to present the advantage that the greater freedom of the film from débris and extraneous matter makes the detection of the spirochetes easier. If the precautions mentioned above are observed, there does not appear to me to be any diminution in the number of the spirochetes, when compared with a fixed film from the same case. On the contrary, owing to the deeper staining of the spirochetes, they frequently appear to be more numerous than in the fixed films.

Of the three methods described the last appears to me the best because of the clearer character

of the film and because the spirochetes are much more darkly stained, so that, if they are only present in very small numbers, they are less likely to be missed. In searching the film one must remember that the thinner zones are those in which the spirochetes are most darkly stained and therefore most easy of detection.

Most of the other modifications of Romanowsky's method will demonstrate the parasites satisfactorily, that of Marino [18] having been specially advocated by Metschnikoff and Roux.

Of other staining methods, such as that of Reitmann [19] (phosphotungstic acid and carbol fuchsin), of Herxheimer and Huber [20] (Nile blue and Capri blue). Of Proca and Vasilescu [21] (Rossi's flagella stain followed by carbol gentian violet), and numerous others, it may be said that, while they doubtless stain the parasites with sufficient clearness, most are subject to the disadvantage of excessive deposit on the film and they do not appear to present any great advantages over one or other of the modifications of Romanowsky's method. As said before, the staining of the spirochetes is by no means as difficult an operation as was at first supposed and, as long as the film is prepared as directed above and a sufficiently powerful stain is employed, they may be detected with comparative ease.

To a different category belong the flagellar stains used to demonstrate the flagella of bacteria ; many of these have been advocated for the purpose of colouring the terminal flagellum of the *Spir. pallida*, described by Schaudinn. Although I have not been able to convince myself of the existence of this structure, some of these stains give very clear results and are useful for ordinary diagnostic work ; of those which I have tried Loeffer's [22] and de Rossi's [23] gave the best preparations, though the spirochetes are never so sharply defined as by the methods advocated above.

In general, the beginner may be advised to make trial of several alternative methods on films prepared from the same material and rich in spirochetes and to adhere to that which gives him the best results as regards simplicity of technique, sharp definition of the parasites and economy of time.

It is necessary, in view of the minute size of the organism, to employ a good oil-immersion lens, but nothing higher than a 1/12 in. is necessary for the purpose. Good illumination is, of course, essential and careful focussing of the sub-stage condenser greatly helps the search. Another important desideratum is patience ; at times the spirochetes may be rapidly found but, in the greater number of instances,

a careful search, prolonged, possibly, over several hours, is necessary and, unless this amount of time is devoted to the search, one would not be justified in concluding that the parasites were absent. The time occupied by so long a search constitutes one of the greatest objections to this procedure as a means of diagnosis, but the observer will find that, with practice, he will be able to shorten the period considerably and it is a matter of common experience that, with increasing facility of technique, the spirochetes are found in a larger proportion of cases and in greater numbers than in one's earlier attempts. Once the causative rôle of the organism is proved beyond doubt, no expenditure of time will be grudged in the search, as the discovery and identification of the spirochete will then mean absolute certainty of diagnosis.

Identification.—It will be remembered that Schaudinn and Hoffmann, in their original description, described in syphilitic lesions two spirochetes, *Sp. pallida* and *Sp. refringens*. The latter can hardly lead to error as it differs widely from *pallida*; not only is it stained densely with ordinary dyes but its greater thickness, its bold, flowing curves and its blunt extremities, once seen render its subsequent recognition a simple matter. The measurement

of the amplitude of the spirals in the way I have already recommended, will also help to separate the two organisms. Too much stress must not, however, be laid upon the different tint which they assume when coloured by Romanowsky's method. It is often stated that, under those conditions, *pallida* assumes a rose pink colour while *refringens* is stained a dark blue. In my experience, this is not to be relied upon as, with deep chromatin staining, such as one strives to obtain, *refringens* will often be found to have taken a deep purplish-red colour. All that can be said with safety is that, whatever the depth to which the staining is carried, *refringens* will always be found to be many degrees deeper in tint than *pallida.*

Sp. refringens may always be expected in films made from material taken from open or ulcerated lesions ; it is by no means confined to syphilitic lesions but is a common inhabitant of any open sore. Its pathogenicity, although not proved, is probable, and it may possibly be considered as one of the pyogenic organisms. In syphilitic lesions in which the surface is unbroken it is rarely to be found and, in open lesions, its numbers will be found to decrease the deeper one goes in the collection of material for examination.

Greater difficulty will be found in connexion with certain spirillar forms, frequently encountered, which partake partly of the characters of *pallida*, partly of those of *refringens*. Such forms as a rule, exhibit the staining reactions of *pallida* but differ from it in the lack of regularity and closeness of the spirals. In part of their course they may show curves indistinguishable from those of *pallida* while, in the remainder of the spirochete, these are either wide and irregular or altogether obliterated. Such forms are often twisted on themselves, forming figures of eight, circles or loops and are sometimes very short, consisting of but two or three curves. The question of their true nature is a very difficult one and it is by no means certain that all who have described them are referring to the same forms. It is, for instance, certain that a-typical forms of *pallida* are frequently encountered which depart widely from the classical type and are possibly to be regarded as dead or degenerate spirochetes ; at the same time, others are met with, thicker than *pallida* but more faintly staining than *refringens*, which, most probably, represent a third species. The name of *Spirochaeta pseudo-pallida* has been suggested for this organism, but more work is required on the subject.

The only spirochete, as far as we know at present, which is indistinguishable from *pallida* is that which was found by Castellani in the skin lesions of the tropical disease known as "Yaws" or "Framboesia" [74]. This disease presents several points of resemblance to syphilis and has even been regarded as being of this nature, but the resemblance is only superficial. While yaws is restricted to a comparatively narrow area of the tropics, syphilis is pandemic and it has further been shown that individuals, while suffering from the former disease, may contract syphilis which follows the usual course without modifying or being modified by the original disease.

The spirochete of Castellani is identical in appearance, staining reaction, etc., with the *Spirochaeta pallida*, as has been confirmed by many observers, including Schaudinn himself, but it is generally recognised that we have to deal with two species and not with one, and the spirochete of yaws is now known by the name orginally given to it by Castellani,—*Spirochaeta* (*vel Treponema*) *pertenuis*.

It is only in the restricted areas in which yaws is endemic that the similarity might give rise to any confusion in actual practice and the clinical symptoms of the two diseases are sufficiently distinct

to prevent errors of diagnosis consequent on this similarity.

An interesting point which may be mentioned here is the frequency with which *Sp. pallida* is found in association with that mysterious micro-organism the *Bacillus fusiformis*. This was first noted, independently, by Harvey and Bousfield[24] and by Launois and Loederich.[25] A developmental relationship between *B. fusiformis* and the spirochete found in Vincent's Angina[26] has long been suspected, though not yet proved to demonstration. A discussion of this interesting question would, however, lead us too far, and I will only add that, in my own experience, *fusiformis* occurs in the majority of films which contain *pallida* and were prepared from superficial and open lesions. The forms which I so constantly find are, however, smaller than those which one finds associated with Vincent's spirochete, and a careful study of them has left me with the impression that they *do* stand in some relationship to *Sp. pallida*. Larger forms of the fusiform bacillus are also encountered and it is at least conceivable that such may stand in a similar relationship to *Sp. refringens*. The frequent occurrence, also, of delicate little leptothrix filaments has been a feature of many of the films which

I have examined, and it appears to me possible that these may represent an intermediary stage between the spirochetes and the fusiform bacilli, since the distribution of the chromatin in these leptothrix filaments resembles very closely that which one finds in spirochetes, when the latter are stained for the purpose of demonstrating this material.

Staining of Sections. — The demonstration of the spirochetes in the tissues by the method now to be described, has been of great service in adding to our knowledge of their distribution in the various lesions of syphilis and in strengthening the chain of evidence as to their causative rôle. The ordinary staining methods were of no service for this purpose and it is hardly too much to say that the discovery of the method by which the spirochetes are coloured *in situ* is second only in importance to the discovery of the parasite itself. By means of it a large amount of the most valuable information has been recorded which has thrown a flood of light on the connexion of the parasite with the disease.

The method, which is usually associated with the name of Levaditi, had its origin in the work of Bertarelli, Volpino and Bovero,[27] who succeeded in staining the spirochete in sections by means of

a modification of Van Ermengem's flagella stain. This well-known method presents, however, the disadvantage that it is almost always accompanied by a considerable precipitate of metallic silver on the film and, when it is attempted to apply it to sections instead of to thin bacterial films, this precipitate is still heavier and tends to mask such delicate structures as the spirochetes. Levaditi [28] then introduced a great improvement by staining the tissues *en bloc*, in place of applying the stain to the section itself, and, in this manner, succeeded in getting excellent results. In the first method described below, he adapted Ramon-y-Cajal's [29] method of staining nerve fibrils in sections by impregnation of the tissue with nitrate of silver and subsequent reduction of the silver by pyrogallic acid. The spirochetes were then seen to be intensely stained by the silver and perfectly black, standing out from the other tissue elements with startling distinctness. The excellent coloured plates which accompanied Levaditi's article by no means exaggerate the picture which is presented by a tissue rich in spirochetes, as I have been able, in common with many others, to determine (Fig. 2).

Subsequently, [30] Levaditi published a further modification of this method, which, although some-

what more complicated, gives, in his opinion, still better results, inasmuch as it shows more of the spirochetes, when tested on the same tissue, than are put in evidence by his first method. This being so, it follows that, in material containing few spirochetes, success is more likely to result from the employment of his later method.

The details of both of these methods are given below in order that any who wish may be able to compare the results and select that which suits them best.

Method 1.—Small pieces of the tissue are excised and treated in the following manner :—

1. Fix in 10 per cent. solution of formalin.
2. Harden in 95 per cent. alcohol.
3. Wash in distilled water for several minutes.
4. Place the pieces in a solution of nitrate of silver, of the strength of 1·5 per cent., prepared with distilled water, and leave them in this solution for three days at a temperature of 38° C. (The best way of doing this is to place the bottle in the hot incubator.)
5. The silver is now reduced by placing the tissue for twenty-four hours in the following solution,—

Pyrogallic Acid . . .	4 grms.
Formalin	5 c.cm.
Distilled water . . .	100 c.cm.

6. Wash in distilled water, dehydrate in absolute alcohol and clear in xylol.
7. The piece is finally imbedded in paraffin and sectioned in the usual manner.

The sections, which should be as thin as possible, may either be examined directly after mounting in Canada balsam, or, if preferred, they may be counter-stained by Giemsa's solution, employed undiluted and allowed to act for three to four minutes. L. recommends that, if this is done, the section should be differentiated by means of a mixture of alcohol and oil of cloves.

Method 2.—In this, Levaditi takes advantage of the action of pyridine to hasten the impregnation of the tissue with the nitrate of silver. The use of this substance was introduced into histology by de Souza, who found that it had the power of penetrating tissues soaking in water with exceptional rapidity. The details are as follows:—

1. Small pieces of tissue, 1 to 2 mm. in thickness, are fixed, for 24 to 48 hours, in a 10 per cent. solution of formalin.
2. Harden in 96 per cent. alcohol, for 12 to 16 hours.

3. Wash in distilled water until the pieces sink to the bottom of the vessel.
4. Impregnate the tissue with a 1 per cent. solution of nitrate of silver to which is added, at the moment of use, 10 per cent. of pyridine. A considerable volume of this mixture should be employed and the tissue should be kept in it, in a stoppered bottle, for two or three hours at room temperature and, subsequently, at a temperature of about 50° C. for from four to six hours. The length of time for which the tissue is allowed to stand in the silver solution depends upon its permeability.
5. Wash rapidly in some 10 per cent. solution of pyridine.
6. Reduce in a 4 per cent. solution of pyrogallic acid, adding, at the moment of using, 10 per cent. of pure acetone and 15 per cent. (of the total volume) of pyridine. Reduction will be complete at the end of some hours.
7. Dehydrate in alcohol, clear in xylol and imbed in paraffin in the usual way.

In this latter method Levaditi recommends, if counter-staining is required, the use of Unna's

polychrome methylene blue, or toluidine blue, followed by differentiation with Unna's glycerine ether.

The advantages which L. claims for the latter method are two, the shortening of the time for which it is necessary to leave the pieces in the silver solution and the greater number of spirochetes which are demonstrated. The latter statement is, doubtless, correct but, in the tissues of a syphilitic foetus which I had the opportunity of staining by the former method, the spirochetes were demonstrated in such enormous numbers that it was hard to conceive that any remained uncoloured. With regard to the alternative methods of counterstaining, mentioned above, such a procedure is, I think, unnecessary; the results are never very satisfactory and the chief histological details are sufficiently brought out by the silver process to allow of the relationship between the spirochetes and the tissues being studied, The reasons for the comparatively poor results obtained by counter-staining are, partly, the action of the various solutions upon the tissues, and, partly, the degenerative changes which the tissues have undergone. A curious fact I have observed, in this connexion, is that the tissue in the immediate neighbourhood of the aggregations of spirochetes

appears to take the nuclear stain much better than the areas which are free from spirochetes. It would almost appear as if the spirochetes tend to collect and multiply in the zones which are freest from degenerative change.

Another method of silver staining has been recommended by Petresco [31]; in this, the tissue is hardened in absolute alcohol for 48 hours and subsequently put into silver solutions, of gradually increasing strength; the sections are examined rapidly and only exposed to the action of light for as short a time as possible, in order to avoid the reducing action of the light. The method does not appear to present any advantages over that of Levaditi.

Ravaut and Ponselle [32] have suggested the application of Levaditi's method for the investigation of the presence of spirochetes in the blood. They advocate the dropping of the blood to be tested into water, the collection of the fibrinous clot which results and its subsequent treatment as a piece of tissue by Levaditi's method. In this manner they claim that spirochetes may be detected even when present in very sparse numbers. I have not, myself, been able to find them by this method, but others may be more fortunate.

"Silver Spirochetes."—Mention must now be made of the fact that the spiral threads demonstrated in syphilitic tissues by Levaditi's method are not universally accepted as being the real *Spirochaeta pallida*. Soon after the publication of Levaditi's results and figures, Saling [33] entered the lists against the parasitic nature of the spirals and has published a series of articles in support of his views. Saling and his colleagues regard the spiral elements coloured black by L's method as being only tissue elements, either the finest nerve fibrils or fine filaments of connective tissue, which have been stained by the method of silver impregnation. These he has named "silver spirochetes," while the spirals stained by Romanowsky's method in films he calls "Giemsa spirochetes. The arguments advanced by Saling, Schulze [34] and Friedenthal [35] are opposed to the experience and opinion of the great majority of those who have practical knowledge of the question and it will suffice to give the principal points of Saling's argument, as gathered from his numerous contributions to a somewhat acrimonious discussion.

While Saling is opposed to the *Sp. pallida* altogether as being the cause of syphilis, regarding it as a harmless saprophyte, he is chiefly concerned in

proving that the spiral threads, found in sections of syphilitic tissues and organs, may also be demonstrated in sections of non-syphilitic material when the same staining method is used. Starting from the point that the method of Levaditi is adapted from that of Ramon-y-Cajal, which was devised for the purpose of staining nerve fibrils, his arguments all lead up to the identification of the spirals as normal elements of the tissues, altered by disease, by maceration and by the processes of fixation and staining to which the tissue has been subjected. The innumerable negative results which have been recorded in control experiments with non-syphilitic material he regards as fallacious, as such tissues were not in the same condition in respect of previous disease, maceration, etc., believing that, if they had been, they would have shown the "silver spirochetes" in similar numbers. The argument that the spirochetes are, at times, found in such numbers in sections of congenital material as to preclude the possibility of their being nerve fibrils he endeavours to confute by showing that modern neurologists have shown the ramifications of the finest nerve fibrils to be much more extensive than was supposed. The variable length and thickness of the "silver spirochetes" in sections of different

organs he also regards as strong evidence against their parasitic nature. In sections stained by others and sent for his inspection he is unable to distinguish the so-called spirochetes from what he regards as altered nerve fibrils or as fine filaments of connective tissue. His main argument, however, is that, while the silver spirochetes may be demonstrated in enormous numbers in sections of congenital material, films prepared from the same material and stained by Giemsa's method fail to show their presence, except in a few recorded instances and then only in very small numbers. The rest of his arguments are concerned with the difficulties encountered in differentiating *pallida* from *refringens* and other spirochetes and with the numerous and well known blanks in our knowledge of the life history of the spirochete and of its rôle in syphilis.

There is much useful criticism in Saling's work that may help to guard against a too hasty acceptance of the *Sp. pallida* as the cause of syphilis, but it is not easy to accept his views as to the so-called "silver spirochetes," at least for those who, like the writer, have stained and studied them. The least convincing portions of his articles are the reproductions, by photographs or otherwise, of his own specimens; the "silver spirochetes"

therein figured bear little resemblance to the silver stained spirochetes seen in a successful specimen from the spleen or liver of a case of congenital syphilis. Nerve fibrils are of course to be encountered in many of the sections, stained to the same depth as the spirochetes, but it is only at the first glance that they lead to any confusion. In my own specimens of congenital tissues, stained by Levaditi's method, the spirals are absolutely identical, in such points as the length, number of curves, amplitude and depth of curves, with those stained by Romanowsky's method in film preparations. The only difference to the eye is that the silver stained spirochetes are thicker, as one would naturally expect by this method of staining.

Without going further into the question, which will probably be settled e'er long, I may only add that I have recently had the opportunity of staining the organs of mice, which have succumbed to infection with *Spirochaeta recurrentis* (*vel Obermeyeri*), by Levaditi's method and have found that the spirochetes in this instance were sharply stained and, at the same time, retained *their* characteristics of length, amplitude of curves, etc., just as these were seen in ordinary film preparations. In no instance were the spirals in any degree similar to those met with in syphilitic material.

Distribution of the spirochetes in the tissues.—Our knowledge on this point is almost altogether due to the results of section staining by the silver method, which has not only shown the distribution in the various lesions, but has given much valuable information as to the relationship between the spirochetes and the various tissue elements.

In the primary chancre *pallida* may usually be demonstrated, either in films or in sections; as already mentioned, the best method of direct examination is to scrape the surface of the lesion, allow the discharge to become clear and then to prepare the film. With experience in the technique and patience in the search a large percentage of positive results will be obtained. If the surface discharge, only, is examined, the failures will be more numerous; the effect of local treatment must also be borne in mind as there is no doubt that local applications of mercury, etc., bring about the disappearance of both *pallida* and *refringens* from the superficial layers of the lesion. By the section method, the relation of the spirochetes to the tissue elements has been closely studied by many observers and it is seen that the spirochetes are mostly to be found in the walls or in the immediate neighbour-

hood of the smaller vessels and lymphatics where, at times, they occur in clumps and clusters of considerable size. They have also been found, though not so frequently, in the lumen of the vessels themselves. The sections also confirm the results of film examinations since they show that the spirochetes are most numerous in the deeper parts of the chancre. On the other hand, *refringens*, when present, is seen to be confined to the superficial layers and to be absent from the deeper ones. As regards numbers, the spirochetes are often very sparse, especially when the chancre is healing and the induration is diminishing ; this is not, however, always the case, as they have been found in great numbers in a chancre which was quite closed and nearly healed, and have even been found in sections of the cicatrix left by an old sore. In many instances however, the older of Levaditi's methods was that employed and it is difficult to compare such results with the more recent work which has, presumably, been carried out with the pyridine method which may thus have stained more of the parasites. In the near neighbourhood of the chancre Burnet and Vincent [36] have noted that the spirochetes are most numerous in the epidermal papillae near the ulcer and in the bundles of connective tissue under-

lying the epidermis. It is also of great interest to learn that *pallida* has been found in several cases in which the primary sore was extra-genital; for instance, Grouven and Fabry [37] found as many as thirty per field in films made from a chancre of the lip, while Kowalewski [38] has found them in a chancre of the eyelid.

The indurated glands following on the primary lesion have also been shown to harbour the parasite, both by puncture and film examination and by excision and impregnation with silver. In this situation their relation to the smaller blood vessels and lymphatics is similar to that noted in respect of the primary sore, viz. they are mostly found lying in the walls of the vessels, in the perivascular spaces and in the connective tissue surrounding these vessels. Much debate has arisen as to the occurrence of phagocytosis; although this does not appear to be common there seems little doubt that it does take place, while the silver-stained granules, noticed in the cells by many observers, may, conceivably, indicate that it takes place on a larger scale than is supposed and passes unnoticed owing to the rapidity of intra-cellular digestion.

In the various secondary eruptions of syphilis the spirochete has often been demonstrated. In

sections of a "rose spot," excised when three days old and stained by the silver method, Veillon and Girard [39] found that the capillaries of the papillae and of the sub-papillary zone were dilated, gorged with blood and showed in places around them a commencing infiltration of mononuclear cells ; the spirochetes were found in the terminal capillaries of the papillae and in some of the sub-papillary vessels. They regard such spots as being due to a true parasitic embolism.

The occurrence of the spirochetes in the blood is also of the greatest interest, not only as indicating the probable manner in which the disease extends throughout the system, but in view of the known infectivity of the blood in certain stages of syphilis. The occasions on which the parasites have been found in the blood are not numerous, but there appears to be no doubt that they are to be met with here. Leaving out of account, for the present, those instances in which they have been found in the blood of new-born syphilitic infants during life, the following may be instanced. Flügel [40] found them in the blood of a woman at the time she was suffering from a maculo-papular rash. Bandi and Simonelli [41] also detected them in the blood of a secondary case, taken from the neighbourhood of

an erythematous lesion of the skin. In addition, Hoffman [42] has shown, by experiments on monkeys which were inoculated with syphilitic blood, that the disease may be conferred in this way and has, further, noted that the blood in the secondary stage when tested in this manner, appears to be even more virulent than material taken from chancres or papules. Hoffman's experiments, of course, prove no more than that the blood in question contained the virus of syphilis but, taken in connexion with the rest of our knowledge of *pallida*, it is a fair assumption that the blood contained the parasite, though in numbers too small for detection by the methods at our command. This assumption finds further support in the fact that *pallida* was subsequently detected in the lesions of some of these monkeys while it has never been found in these animals in any other condition than that of experimental syphilis.

In most of the other lesions of secondary syphilis the parasite has also been found and, as a general rule, it may be said that the more infective the esion the greater the number of spirochetes that will be detected ; in my own experience, the greatest numbers occur in such lesions as mucous tubercles and condylomata. Such lesions are, however,

usually ulcerated and one will naturally find in association with *pallida* numbers of saprophytic or pyogenic bacteria and, probably, other spirochetes, such as *Sp. refringens*. This is especially the case in the throat lesions of the secondary stage of syphilis where the identification of *pallida* is complicated by the frequent presence of a common throat spirochete, the *Sp. buccalis*. If, however, the remarks on the identification of *pallida* are borne in mind, little difficulty will be found in distinguishing it from the others.

Among the numerous other sites in which *pallida* has been found may be mentioned the internal tunic of the aorta ; this was noted by Reuter [43] and subsequently confirmed by Schaudinn and is of importance in view of the fact that aortic scleroses have been thought to be late accidents of syphilis. Its discovery in the pus of an abscess in a syphilitic has also been reported by Flügel.[44]

The relationship, if any, which the *Spirochaeta pallida* bears to the tertiary lesions of syphilis is, at the present moment, uncertain. One of the strongest arguments against the causative rôle of the spirochete is the fact that it is but rarely found in tertiary lesions and, although a certain number of positive cases have been put on record, as will

be mentioned below, there is no doubt that their presence cannot be detected in the vast majority of these lesions, even by the silver method of Levaditi. It is possible that the spirochetes may, at this time, have assumed some other form, such as a resting stage, and, in this manner, have escaped detection; but it is also possible that these lesions are only late manifestations of the past action of the spirochetes or their toxins—if they form such poisons—and that, at the time at which the lesions are recognizable from their clinical symptoms, the parasites themselves have disappeared. Assuming the protozoal nature of the parasite, there is reason to anticipate that the latter possibility may be true, on grounds of analogy with other protozoal diseases; for instance, in "sleeping sickness," in the last stages of the disease, the trypanosomes cannot be found in the brain, although grave histological changes are always to be met with in the cerebrum and are the cause of the fatal coma in which most cases terminate.

At the same time, a certain number of instances have been recorded in which the spirochete *has* been found in undoubted tertiary lesions; thus, Spitzer [45] found them in sclerosed gummatous lesions and Doutrelepont and Grouven [46], by the

use of the silver method, have detected them in tertiary lesions in four cases. Alvares [47] reports their occurrence in film preparations made after death from the liver of a negro who, at the time of his death, was the subject of tertiary manifestations, including a typical glossitis and general adenitis. Tomasczewski [48] investigated a series of tertiary cases and succeeded in proving the presence of *pallida* in five instances. The cases were all of definite tertiary nature, of 4 to 8 years' duration and were the subjects of gummata, serpiginous syphilides, etc., and the spirochetes were found, not in sections, but in film preparations stained by Giemsa's method. T. notes that the spirochetes when found, were extremely rare and it was sometimes necessary to search the films for 6 to 8 hours to find a single parasite ; when found, however, they were unmistakable and presented all the features of Schaudinn's organism.

Some help is again to be had in this question from the results of animal experiments ; for instance, Buschke and Fischer [49] succeeded in infecting *Rhesus* monkeys with material derived from malignant ulcerated syphilides and from an ulcerated gumma from a case of syphilis of seventeen years' duration. The spirochete in these experiments was not found

prior to the inoculation of the material. Similar experiments were conducted by Neisser [50] who succeeded in infecting five out of seventeen monkeys by inoculation with material from tertiary lesions.

On the whole, it may be said that the occasional presence of *pallida* in tertiary syphilis and the results of the animal experiments just quoted are consistent with what is known, on clinical grounds, as to the rare, but occasional, infectivity of tertiary lesions.

The spirochete in Congenital Syphilis.—Shortly after the announcement of the discovery the spirochetes were found in the bodies of the offspring of syphilitic parents, either still-born or those which had survived their birth for a short time. The introduction of the silver method gave a great impetus to the study of the parasite in these cases and a large volume of literature has already accumulated bearing on this branch of the subject. The purpose of this book precludes any exhaustive analysis of this work, and it will suffice to indicate the principal points which have been brought out and their bearing upon the questions of the relationship of the parasite to the tissues and the explanation these observations afford as to the manner in

which hereditary transmission of the disease takes place.

A striking fact that emerges from a study of this subject is the enormous numbers in which the spirochetes are found and the wide-spread nature of their distribution in the tissues. There is hardly an organ or tissue in the body of the child in which the spirochetes have not been found and, in some instances, the numbers disclosed on examination of a section of a congenital liver or spleen are almost incredible. In cases in which the foetus has been considerably macerated the spirochetes can still be detected by the silver method and it will be recalled that Saling attributes to this maceration the alterations of the nerve fibrils which, in his opinion, constitute these "silver spirochetes."

The following list of the principal sites in which the spirochetes have been found in these congenital cases will give an idea of the manner in which the tissues of a syphilitic foetus may be saturated with the parasite, and, again assuming the aetiological rôle of the organism, will leave little room for wonder that the death of the offspring so often occurs. They have been found in the peripheral blood, the liver, spleen, lung, brain, stomach (in all its layers), mesentery and mesenteric glands, in the gall bladder

and bile duct, the thyroid and thymus glands, the walls of the bladder, the kidneys and supra-renals, in periosteum and in bone marrow, in the tonsils and the pharyngeal mucosa. They also occur in the uterus, ovaries, Graafian follicles and in the ovocytes themselves and have been detected in the urine and the meconium. In addition to the above, they have been found in numbers in the skin lesions, such as the bullae of Pemphigus, and in the peripheral nerves as well as in the optic nerve and retina.

As regards their relationship to the tissue elements this appears to be much the same as in the case of acquired syphilis ; the spirochetes are chiefly situated extra-cellularly and in the greatest numbers in the walls and in the immediate environment of the smaller blood vessels and lymphatics and at times they have been seen in the cells of the liver, lung and other organs. The enormous numbers frequently encountered quite bears out the well-established danger of infection from the handling of such diseased material. The finding of the spirochetes in the bile, the urine, the bronchial secretion, the nasal mucus and the meconium sufficiently indicates the infectivity of the discharges from syphilitic infants, while the reality of this danger has been proved by the positive results of

the inoculation of such material into susceptible animals such as monkeys. These observations also bear out the well-known risk of infection from a child suffering from hereditary syphilis, as proved by the numerous instances which have been recorded of infection of a healthy wet nurse through the suckling of a syphilitic child. It has been suggested that the finding of the spirochetes in these discharges may prove to be of diagnostic value and the attempts which have already been made in this direction have been attended with encouraging results.

It is possible that the great numbers of the parasites found in some of those cases may be due, as Simmonds [51] suggests, to the power of the spirochete to grow and multiply in the tissues, even when these are dead and in a condition of maceration. On the other hand, it appears to me possible that, while the silver method is capable of demonstrating both the living and the dead spirochetes, that of Giemsa may colour only those that were alive at the time the preparation was made ; such an explanation would be in accord with the fact that, in sections of congenital material stained by the silver method, great numbers of the spirochetes may be found, while, in film preparations, made from the same

tissue and coloured by Giemsa's method, few or none may be detected.

For further details of the distribution of the parasites in the tissues of congenital cases and of the relationship of the spirochetes to the tissue elements the reader may refer to the work of Buschke and Fischer [52], of Levaditi and his colleagues,[53] of Bertarelli, [54] Schlimpert, [55] Pasini [56] and others. The exhaustive histological studies of those observers are in close agreement and constitute an exceedingly powerful count in the indictment of the *Spirochaeta pallida*.

Great interest naturally attaches to the distribution of the parasites in the tissues of the parents and the infected offspring from the point of view of determining in what degree this accords with current views as to the mode of transmission in hereditary syphilis. It is recognized that infection of the child may result from previous infection of either or of both of the parents. In the case of the mother, this may either be by infection of the ovum or by way of the placental circulation, and these alternative methods of infection are quite borne out by the discovery of the spirochete in the placenta, the cord, and in the blood and tissues of the child; while germ-infection or "ovular" transmission

is supported by the finding of *pallida* in the ovaries, Graafian vesicles and even in the ovum itself. The infectivity of these tissues has, further, been abundantly proved by the results of animal experiments. With regard to paternal transmission, the subject of much controversy in the past, we now have positive knowledge, long in default, that the semen of a syphilitic father contains the virus of the disease, as shown both by the inoculation of testicular matter from infected monkeys into other monkeys, and, also, from the inoculation into monkeys of human semen from a man in the secondary stage of the disease.[60] The argument that the head of a spermatozoon is too small to allow of the penetration of the *Spirochaeta pallida* is not valid, as there is no reason why the spirochetes should not be conveyed to the ovum together with the spermatozoa and infect the germ cell at a subsequent stage of its development.

As regards "conceptional syphilis," i.e. infection of the mother from a foetus syphilized by spermatic infection from the father, an occurrence long suspected but difficult of proof, an interesting case has been put on record by Buschke and Fischer.[57] In this, the mother, previously healthy, but married to a syphilitic man, gave birth to a syphilitic child

and, subsequently, developed the disease, the spirochetes being found on aspiration of an indurated gland in her groin. Delayed conceptional syphilis, in which the mother is infected from the child and develops tertiary symptoms some years later, is explicable in view of the long periods for which the spirochete may remain latent in the tissues, as evidenced by its discovery in tertiary lesions, many years after the date of original infection. It appears, then, that the spirochete may not only pass through the placental circulation from the mother to the foetus but that it may travel in the opposite direction and carry infection from a syphilitic child, infected by the sperm of the father, to a previously healthy mother. There is, as yet, no evidence to be derived from the spirochete in support of the transmission of syphilis to the third generation, but there is strong presumptive evidence in the knowledge that the parasites may enter the Graafian vesicles and infect the ovum; it by no means follows that such infected ova are incapable of further development and of ultimate fecundation; such a child might survive and live to give birth to syphilitic offspring.

In general, then, it would appear that the distribution of the spirochetes in the tissues of the

parents and the offspring is quite in accord with our knowledge of the mode of transmission in congenital syphilis and, indeed, forms a tribute to the accuracy of much of this knowledge. It is true that the evidence rests chiefly on the results of the examination of the tissues by the silver method and that some doubts have been cast upon the validity of this evidence but, as has already been indicated, these doubts are entertained by a very small minority of observers and will probably vanish as experience accumulates. It must be further borne in mind that the evidence does not rest solely upon the "silver spirochetes" as, in a certain number of instances, in which the child has lived for some days or weeks, the spirochete has been demonstrated during life in the peripheral blood, in films stained by Giemsa's method. This proved existence of a "spirochete septicaemia" in cases of congenital syphilis constitutes a piece of evidence whose value it is hard to minimize.

Animal Experiments.—For long, nothing but failure attended all attempts to infect the lower animals by inoculation of syphilitic material and it was not until 1903 that Metschnikoff and Roux [50] succeeded in infecting a chimpanzee with material derived from a chancre of one month's duration.

Their work has been fully confirmed by many others and we owe a large proportion of the recent advances in our knowledge of syphilis to experiments upon monkeys, and, as will be seen, upon rabbits.

In regard to monkeys, the reactions differ according to the species employed in the experiment; in the case of the higher, anthropoid apes, inoculation of the human virus is followed, after an incubation period which varies from 15 to 60 days, by a typical chancre which becomes indurated and presents all the characters of the Hunterian sore. This is followed by the appearance of secondary symptoms, induration of the glands throughout the body, syphilides of various types, papular or ulcerated, mucous patches in the mouth, alopecia and scaly syphilides on the palms of the hands. The closest resemblance to the picture of the disease in man is presented by the chimpanzee, but in no instance has the disease progressed beyond the secondary stage; tertiary symptoms have never been observed. In the lower monkeys, such as *macacus*, *rhesus*, *cercopithecus*, etc., the resistance to infection is higher and the disease goes no further than the primary sore which develops at the site of inoculation and in them no secondary symptoms have been noticed. The specific nature of the disease in monkeys was

established, not only by the similarity of the symptoms to those in man, but by the fact that the disease could be successfully transferred from one animal to another, for many generations, the type of the disease being similar in all cases. It was further found that, once an animal had recovered from the effects of the inoculation—and death rarely ensues except in the case of very extensive ulcerations—it was rendered immune to inoculation with fresh syphilitic material. The histological characters of the lesions proved to be identical with those of the same lesions in human syphilis.

As soon as the discovery of Schaudinn and Hoffmann was announced, the lesions of monkeys, infected with this experimental syphilis, were searched for, the *Spirochaeta pallida* with positive results, not only in the primary sore but in the indurated glands and in the other manifestations of the secondary process ; similar results were obtained in the case of monkeys inoculated with material which had been "passaged" through other monkeys. The application of the silver method of section staining to the tissues demonstrated, also, that the spirochetes bore the same relations to the various tissue elements as those found in the lesions of human syphilis.

In the case of the lower monkeys, such as *Macacus cynomolgus*, as already stated, the primary sore only is produced and, as a rule, induration does not follow ; the specific nature of the lesion has, however, been established, in this instance also, both by the results of successive inoculations from monkey to monkey and by the discovery of *pallida* in the lesions. In this case the best procedure is to scarify the free margin of an eyelid and to inoculate the virus by rubbing the material well into the scarified point. This site has been selected on account of its comparative freedom from the risks of secondary contamination and accident. After an incubation period, which averages 23 days, a papule results at the site of inoculation which, in its histological characters, resembles the early stage of a human chancre. By observing due precautions as to technique a positive result is almost sure to be obtained on the inoculation of fresh material from either primary or secondary human sources. Thibierge and Ravaut [59] report that they succeeded in every case by this procedure and they regard the absence of induration in the sore as being due to the freedom from the results of secondary infection. It need hardly be added that numerous control experiments have been carried out by inoculating material

derived from other sources and the secretions from the genital organs in non-syphilitic conditions; in no instance did the characteristic lesion result unless the inoculated material was derived from a case of syphilis.

It was natural that advantage should be taken of those successful experiments to investigate the infectivity of the various stages and lesions of syphilis and the association of the disease with the *Spirochaeta pallida*. Such experimental work is now going on on a large scale and has already yielded valuable results. It was, for instance, by means of monkey inoculations that Finger and Landsteiner [60] demonstrated the infectivity of the sperm of a man whose secondary eruption was subsiding. Again, Buschke and Fischer [61] proved the infectivity of material taken from malignant, ulcerated syphilides and, also, from an ulcerated gumma, 17 years after infection; the spirochetes were not found beforehand in these cases and B. and F. suggest that this may have been due either to their being present in very small numbers or to their having assumed another form. Similarly, inoculation of blood, suspected to be infective, has, in the hands of Hoffmann [62] given positive results. In this instance the blood was derived from an in-

fection of six months' duration and was taken from a vein in the arm ; the *macacus* inoculated with this blood developed a chancre 20 days later. Hoffmann concludes from the shortness of the incubation period in this case, and from other signs, that *pallida* circulates in the blood, at this stage, in a form even more virulent than is found in chancres and papules.

Numerous other points of great interest have also been noted in the course of such experiments ; thus, Levaditi [63] and his colleagues, by the use of the pyridine method, have found that the chancre of the chimpanzee contains a much larger quantity of spirochetes than the chancre of the *macacus*, a fact which coincides with the variation in the character of the disease in the two *genera*. They have also found in the cicatrices of *Macacus cynomolgus* from which the 3 to 5 day old sore had been excised that *pallida* could still be demonstrated, as well as in the gland corresponding to the scar. Neisser's [64] experiments on the infectivity of tertiary lesions have already been mentioned ; out of 17 cases in which tertiary products were inoculated into monkeys he obtained 5 positive results and he is of opinion that every tertiary manifestation should be considered infective.

Altogether, it appears that in this monkey reaction we possess a most valuable means of diagnosis as well as a method of experimental pathology.

Rabbits have also been employed, of recent date, for inoculation experiments with the virus of syphilis. In this instance, the material is inoculated into the anterior chamber of the eye or introduced into the cornea after scarification. The results have been somewhat contradictory but, in most instances, interstitial keratitis develops with or without the appearance of a small tumour on the corneal surface. Siegel, under those conditions, finds in the corneal layers the organism which he has named the *Cytorrhyctes luis* which, in his opinion, is the cause of syphilis. Others, however, have not been able to confirm Siegel's work and consider his *Cytorrhyctes* a harmless saprophyte. It has, however, been suggested, as mentioned above, that it may stand in some developmental relationship to *Spirochaeta pallida* and it is possible that this may prove to be the case. There is, at least, no question as to the occurrence of *pallida* in the corneal lesions as Bertarelli,[65] Greef and Clausen[66] and others have found them in great numbers by the employment of the silver method. Scherber,[67] who repeated the experiments, found no spirochetes,

although a keratitis developed, but Bertarelli thinks that his failure was due to the examination of the tissue having been deferred too long, the spirochetes being encountered in the greatest numbers in the early days of the lesion and disappearing later, presumably to the deeper structures.

In a later communication Bertarelli [68] reports that he has been able to transmit the virus from rabbit to rabbit with 100 per cent. of successful results and that, in the process, the virulence of the virus becomes exalted. The spirochete was always to be found in great numbers and he also thinks it possible that secondary symptoms, such as paralysis, may follow inoculation of this "exalted" virus in rabbits. Inoculation of this virus, after passage through several rabbits, produced typical lesions in monkeys, thus demonstrating the specific nature of the lesions in the rabbit. He has also succeeded in reproducing the corneal lesions in guinea-pigs, dogs and sheep by inoculation of the rabbit virus of the fifth or sixth passage, the spirochetes being found in the sections of the cornea.

The Serum Diagnosis of Syphilis.—Of late years much attention has been attracted to the so-called "para-syphilitic" affections, the chief of those being general paralysis and tabes. The

syphilitic nature of those diseases, although not universally accepted, is generally suspected, and it is of interest to see if any fresh light is thrown upon this subject by research in connexion with the *Spirochaeta pallida.* Up to the present moment no observer has detected the presence of the spirochete in either of those diseases but strong evidence in support of their syphilitic nature is afforded by an examination of the body fluids in the manner now to be described.

The method by which the serum, cerebro-spinal fluid, etc., is tested is founded upon that which Bordet and Gengou devised for the detection of bacterial "anti-bodies" and is generally known as "the Bordet-Gengou reaction." The test is of a highly technical character and one that can only be carried out by experienced workers in a well-equipped laboratory so no attempt will be made here to describe it in detail. It will suffice to indicate that it is based on the deviation of the complement by the combination "antigène-antibody;" antigène meaning either the virus itself or some substance derived from the virus. It was introduced into the study of syphilis by Wassermann, Neisser and Brück [69] and their procedure, in outline, is as follows. They first obtained the syphilitic serum necessary for the test

by the inoculation of monkeys with products known to contain the virus of syphilis. After the lapse of a sufficient time, the serum was collected and "inactivated" by heating to 55°. C for half an hour. To this inactivated serum was then added the suspected syphilitic fluid, either the inactivated serum of a patient or a centrifugalized extract of some organ or tissue. Finally, some fresh "cytàse" or "complement" was added in the form of fresh serum derived from a guinea-pig. Into this mixture were then introduced "sensitized" red blood corpuscles, as employed in ordinary haemolytic work. If, now, it is found that haemolysis does *not* occur one may conclude that the complement added was no longer free in the mixture but had been deviated to or fixed by the combination antigène-antibody and it follows that the specific antigène or virus of syphilis must have been present in the mixture. In numerous control experiments, carried out in the same manner, the only variant being that the serum or extract of organs were *not* of syphilitic origin, rapid haemolysis of the sensitized red cells was found to occur.

The application of this method of serum diagnosis in cases of suspected syphilitic nature has already given results of the highest interest. By a varia-

tion of the procedure it may be employed as a test for the presence either of the specific antigène, in other words the *Spirochaeta pallida* and its products, or for the presence of the specific antibodies which represent the reaction of the organism to the present or past action of the virus. Its value in the solution of the real nature of the para-syphilitic-affections is especially great inasmuch as it has not yet been found possible to demonstrate the presence of the virus by more direct means. In a series of cases Neisser, Brück and Schucht [70] found that, out of a total of 262 cases of syphilis, in all stages of the disease, 172 or 65·5 per cent. gave a positive reaction to the Bordet-Gengou test, while, out of 85 non-syphilitic cases, only 5 reacted and they suggest the possibility of these having been cases in which syphilis was either latent or had not been recognized. In the case of general paralysis Marie and Levaditi [71] found that 63 per cent. gave a positive reaction and, further, that the amount of "antibodies" present in the cerebro-spinal fluid of these cases was largest in those of greatest severity and longest duration. The proportion of positive results in the case of tabes they found to be somewhat lower but, on the other hand, Schütze [72], after an examination of the cerebro-spinal fluid of 12 cases of tabes, got a positive reac-

tion in 8. Morgenroth and Stertz [73] fully confirm the above demonstration of the presence of specific antibodies in the cerebro-spinal fluid of general paralytics and tabetic patients and there is no doubt that the case in favour of the syphilitic nature of these diseases has received powerful support from the application of this method of the serum diagnosis of syphilis.

Whatever the verdict of the future on the *Spirochaeta pallida* and the final decision as to the part which it plays in syphilis it will, I think, be gathered from the above summary of our present knowledge that there is ample justification for our thinking it to be the long-sought cause of the disease. At the least, it must be conceded that, if the cause is still to seek, it must be one which lives in an extremely intimate condition of symbiosis with the spirochete of Schaudinn and Hoffmann.

Histology.—Every manifestation of syphilis when examined microscopically is seen to consist of a cell infiltration, principally in and around the smaller blood vessels. For practical purposes the exact nature of the infiltration matters little, but the fact that it possesses a marked tendency to form fibrous tissue is of great importance, as this explains the induration of so many syphilitic lesions. The degree of

induration depends on the normal structure of the part and the extent to which the fibrous change has progressed. Thus the Hunterian chancre feels like a piece of cartilage, the syphilitic lymphatic gland like a solid rubber ball, while the roseolar syphilide imparts no sensation of induration and the infiltration has to be looked for with a microscope. Excessive proliferation of epithelium sometimes take place as in the mucous tubercle or scaly papule. A useful fact to remember when examining a squamous eruption is that every scaly syphilide is distinctly indurated, a condition which at once distinguishes it from psoriasis. In the so-called primary and secondary stages of the disease this infiltration has a tendency to undergo involution and become absorbed, while in the tertiary lesions caseation and breaking down are the more probable terminations. (For Bibliography see Appendix II.)

CHAPTER III

SYPHILIS: DIAGNOSIS.

Diagnosis of Early Syphilis. — The earlier the diagnosis of syphilis can be made the better, but so long as any doubt exists in the surgeon's mind it is wiser to wait for confirmatory signs before committing a patient to the inconvenience and possible risk of a two years' course of treatment, to say nothing of the mental distress which most people suffer on being told that they have acquired syphilis. No two consecutive cases are quite alike, and with the possible exception of the Hunterian chancre no one sign by itself should be accepted as sufficient evidence to justify a diagnosis of syphilis. Until some reliable scientific test for syphilis is discovered, which can be readily applied by the ordinary surgeon, we must make a careful examination of the whole body and only form our decision after summing up all the points in favour of the presence of syphilis; negative points are of little value, and no reliance should be placed on these.

Indications as to the presence of syphilis are afforded by the state of the following : (*a*) The initial lesion ; (*b*) the lymphatic glands ; (*c*) the skin and mucous membrane ; (*d*) body weight. These are the main guides. Of less importance but sometimes useful are (*e*) headache ; (*f*) continuous mild pyrexia ; (*g*) anaemia ; (*h*) albuminuria.

In order to examine each case thoroughly it is well to adopt some routine plan ; the following is that in use at Vienna and is given as a suggestion.

Examination of the Patient.—Inquire as to the dates of exposure to infection and of the appearance of the sore ; occasionally definite answers are obtained, but, if, as so frequently happens the replies are vague, proceed at once with the inspection, for which purpose the man must be stripped. Begin with the sore or sores, noting the number, position and characters. Next, using both hands simultaneously, one for each side of the man's body, palpate the glands in both groins, the epitrochlear glands lying on the triceps tendon above the inner condyle and the sub-occipital and cervical glands. Note which of these are enlarged, and exclude those due to some cause other than syphilis. Now carefully inspect the whole surface of the body beginning in front and finishing with the dorsal

surface. Tell the man to stoop down, separate the buttocks and show the anus, on rising again he should hold up the soles of his feet.

Next place the man opposite a good light and tell him to protrude his tongue and move it slowly, so as to expose every part to view. Then using a glass tongue depressor to manipulate the parts, carefully examine the mucous membranes of the lips, gums and cheeks. Finally inspect the palate, fauces and tonsils; while doing so the surgeon must be prepared for an explosive cough with the expulsion of possibly infective mucus. Iritis should then be excluded, and to finish up with the scalp examined for specific alopecia.

The Initial Lesion.—Almost any lesion appearing on the penis after exposure to infection may be the starting point of syphilis, and however innocent it may at first appear the only wise course is to regard each of these as possible chancres and to await further developments before definitely excluding syphilis. It must be borne in mind that, pathologically, any syphilitic lesion is a granuloma and consists of small cell infiltration around the blood vessels with a strong tendency to fibrous formation; hence it is obvious that the naked eye appearance may vary widely according to the extent

of the infiltration and degree of formation of fibrous tissue. Thus the primary chancre may have a smooth, firm, button-like appearance, or it may present an excoriated surface with little induration, or it may look like a small hard pimple. Simultaneous infection of a soft and a true syphilitic chancre may have occurred, the former appearing at once and the latter at a later date. The experienced surgeon can often say from the appearance of the chancre that it is syphilitic or not so, but the beginner will be wiser if he waits till other signs clinch the diagnosis rather than be hasty and possibly make a mistake.

Extra-genital chancres present certain peculiarities which must be referred to. Thus on the fingers they not uncommonly suppurate and may be mistaken for boils ; within the mouth they are paler and not so prominent, but are surrounded by considerable induration. When situated on the skin there is always much surrounding oedema, the nearest lymphatic glands are enlarged and the sore refuses to heal under non-mercurial treatment ; the history, too, should arouse suspicion. Extra-genital chancres may easily spread the infection to other people ; hence if suspected, steps must be taken to prevent this happening. If on the fingers,

they should be kept constantly covered by some dressing; while if in the mouth the patient must be told not to use any utensils which might be shared by others.

Lymphatic Glands.—Soon after the appearance of the specific chancre, the lymphatic glands nearest to the sore, and very shortly afterwards those elsewhere, become enlarged and typically indurated. Besides syphilis there are, of course, many other conditions which will cause lymphadenitis, and this fact must be remembered when examining the lymphatic system in a suspected case of syphilis. The true specific gland, however, when palpated by the fingers, imparts a characteristic sensation which is unlike that produced by any other inflammatory condition. The gland is moderately enlarged, discrete, and when pinched has a firm elastic feeling, resembling that of a new and unused tennis ball. The condition which is most likely to be confounded with the specific one is the elongated tough and chronically enlarged gland, which most athletes have in one or both groins.

Another point to be remembered is that although the true syphilitic gland does not suppurate, yet the fact of one or both glands having suppurated does not exclude the possibility of syphilis. As

regards the different groups of glands, those in the groins being usually nearest to the sore are naturally first affected, and present a cluster of discrete amygdaloid or bullet-like bodies. The epitrochlear glands lie on the triceps tendon and are most easily felt when the hands hang in a position of pronation and semiflexion, unfortunately they are fr quently found enlarged without any obvious cause and in cases in which there is no suspicion of syphilis. In the neck the sub-occipital and cervical glands can be examined ; here, again, owing to the common occurrence of scalp lesions and the chronic pharyngitis induced by cigarette smoking, enlargement of the glands not due to syphilis is of common occurrence.

Skin.—The commoner eruptions of early syphilis are always symmetrical. They are—(1) The roseolar and macular syphilides. Their favourite sites are the upper abdomen and lower chest areas, together with the corresponding dorsal regions. The eruption is symmetrical, fades on pressure, may disappear in time, even when untreated, or may go to the formation of :—

(2) The papular syphilide. This may be of the small or large variety, is hard when palpated and at first of a raw ham colour, later on becoming

a dusky brown. These papules may become absorbed or vesicles may form which, in turn, may become pustular and form crusts or scales.

(3) The follicular syphilide situated around the hair follicles is another not so common variety. These may be large or small, are somewhat obstinate in yielding to treatment, and have a tendency to form circles with a large one in the middle, the corymbose syphilide.

A few remarks may be made with reference to the mistakes which are likely to be made in diagnosing syphilides. The condition which the Germans call *Cutis marmorata* consists of a livid network of vessels enclosing healthy skin; this point distinguishes it from a macular syphilide. Pityriasis rosea has a delicate pink appearance and, if the original patch be looked for, a buff coloured centre with a fringe of fine scales is seen. Psoriasis, when occurring in small discrete patches, may easily be mistaken for a syphilide. If, however, a patch of psoriasis be gently scratched with the finger nail quantities of fine silvery white scales come away, often in an adherent mass, leaving a deeply congested or even bleeding surface, and there is no induration at the site. A squamous syphilide, on the other hand, has dirty white scales in scanty quantities,

the lesion is indurated and frequently situated on the flexor surfaces of the limbs. Lichen planus presents an angular marking, has a burnished metallic surface and a distinctive violaceous colour.

Mucous Membranes.—In early syphilis the palate may present a simple congestion. At a stage corresponding to the appearance of the papular syphilide mucous patches frequently occur. They may be situated anywhere on the mucous membrane, but are most commonly found near the tip of the tongue, inside the lips or on the fauces and tonsils. At first they have a pale, white look, as if a drop of diluted white enamel had been let fall on the membrane. The margin is always sharply differentiated from the surrounding tissue, and this serves to distinguish it from the dead white patch of hypertrophied epithelium resulting from the irritation of a sharp tooth. The patch may resolve under treatment, or become ulcerated in the centre, or especially in the tongue, heaping up of epithelium may take place leaving a solid looking whitish patch. On the dorsum of the tongue the epithelium may be greatly diminished, giving rise to a bald patch.

At the anus condylomata are not uncommon. These are masses of hypertrophied papillae having

a pale pink to white colour and a moist surface. The sodden masses of dirty white epithelium seen in intertrigo must not be mistaken for condylomata.

Body Weight.—If the weight is recorded weekly in cases of early syphilis, a slight but continuous loss of a pound or two will be noticed each week for a couple of months or so. When mercurial treatment is begun, the weight again increases up to the normal. In doubtful cases this is a very valuable help in forming a diagnosis.

Other Manifestations of Early Syphilis.—(*a*) *Anæmia and Alterations in the Blood.* The anæmia of syphilis is described as being severe and imparting an earthy hue to the sufferer's face. In soldiers suffering from syphilis, without any other complication, it is uncommon to find any recognizable degree of anæmia.

Syphilis leads to a reduction in the number of red blood corpuscles and in the percentage of haemoglobin. Under mercurial treatment this loss is made good. Working on this Justus made an attempt to use the injection of mercury as a test for the presence of syphilis. The test is, however, much too delicate for general use and is not always reliable.

(*b*) *Headache.*—In early syphilis a persistent dull headache with exacerbations at night is some-

times met with ; apparently this is more common on the continent than among British soldiers who rarely complain of any.

(*c*) *Pyrexia.*—This is fairly common in early syphilis and is of the simple continued fever type, the evening rise being from 99 to 101 while the morning temperature varies from normal to 99.

Doubtful Cases.—In some cases the manifestations are by no means typical, and the diagnosis is consequently extremely difficult. The primary lesion may be very small and ill-defined or its previous existence may be denied : the lymphadenitis might be accounted for by some other cause ; the eruption may have escaped notice or may appear to belong to one of the non-syphilitic groups of skin diseases ; the mucous membranes may not show any definite lesion, in fact the principal signs of ill-health may be confined to slight anæmia and malaise.

In cases of this sort, as also in late syphilis where there is no definitely syphilitic lesion, the therapeutic test may be tried. This consists in administering mercury and noting if any improvement takes place. Before doing so weigh the man on three or four consecutive days in the same clothing, in order to obtain a fairly accurate idea of his proper weight. Then having excluded albuminuria, give full doses

of mercury, preferably by injections, together with moderate doses of iodides for a fortnight to a month and see what the result is. If the weight has distinctly increased and the general condition shows a marked improvement it is pretty safe to diagnose syphilis; too much attention must not be paid to what the patient may say as to feeling better, as many patients improve on any change of treatment. A slight improvement only does not count for much, as this might be due to other causes, such as greater care in eating and a lessened consumption of alcohol.

Table of Values in Diagnosis.—As a guide to beginners (especially "Bridge" players), the following suggestion is put forward. In this table, values, in accordance with their diagnostic importance, have been assigned to the usual manifestations of syphilis. Do not "declare" syphilis with less than a total of ten points.

Manifestation	Value
Hunterian chancre	9
Phagedaenic chancre	5
Indurated sore (not the result of cauterization)	5
Relapsing sore (breaking down after having healed under non-mercurial treatment)	3
Granulating sore on the skin of the penis, which refuses to heal under non-mercurial treatment	5

Manifestation	Value
Characteristic enlargement of groups of lymphatic glands, without other obvious cause	5
Roseolar or macular eruption (drug rashes excepted)	7
Eruptions not recognizable as belonging to any non-syphilitic class	2
Continuous slight loss of body weight not otherwise explicable	5
Anaemia, not otherwise explicable	2
Pyrexia, of simple continued fever type, lasting 2–3 weeks, not otherwise explicable	2
Continuous headaches with exacerbations at night	2
Continuous malaise	2
Mucous patches (if characteristic)	8
Condylomata	8
Alopecia of the syphilitic type	5

Summary of Diagnosis.—Before leaving the section on diagnosis, attention may again be directed to certain points.

No two consecutive cases are alike. The manifestations may be, and usually are, clear, and the diagnosis a simple matter, but on the other hand the signs may be most indefinite and puzzling. In any case of this kind, examine the whole body carefully and sum up all the points in favour of syphilis, do not place much reliance on the negative ones, and never trust absolutely to a single symptom unsupported by other evidence. Before accepting

any lesion as a sign of syphilis carefully inspect it, and be sure that it is not of non-syphilitic origin. Psoriasis in conjunction with a little thickened epithelium in the mouth has before now been labelled syphilis.

CHAPTER IV

SYPHILIS: TREATMENT — GENERAL REMARKS — PRECAUTIONS — MERCURIALISM — WHEN TO BEGIN—HOW LONG CONTINUE—GENERAL CLASSIFICATION OF PLANS

General Considerations.—The world's experience in the treatment of syphilis has demonstrated certain fundamental principles which must be borne in mind when dealing with this disease.

(1) There is only one drug which possesses the power of curing syphilis, viz. mercury, which is consequently our sheet-anchor at any and every stage of the disease. All other medicaments, not excepting the iodides, are merely useful adjuvants when dealing with certain manifestations, but do not replace mercury.

(2) The cure is effected by the metal mercury. It may be convenient or even advisable to administer this in the form of a mercurial salt, but the benefit is obtained solely from the amount of metallic mercury absorbed, no matter how this is introduced into the system.

(3) The curative action of mercury has distinct limits, which must be recognized. When a certain amount has been introduced, it ceases to exert a beneficial effect. An interval of rest must then be allowed. If this is not done, obstinate lesions of the mucous membranes make their appearance and the man's general condition suffers.

(4) Over-treatment is nearly as harmful as under-treatment.

(5) Each case must be treated on its merits ; no hard and fast rule can be drawn up which will meet every case. At the same time it is well to have a definite idea of what may be considered a minimum treatment for the average case.

Specific Action of Mercury.—Mercury when absorbed gains entrance to the special cells of syphilitic lesions and causes the nuclei to separate out, the cell then undergoes fatty degeneration and is absorbed.

Syphilis produces certain changes in the blood viz. the haemoglobin, number of red blood corpuscles, and the density of the blood are all diminished, while the lymphocytes are increased. Up to a certain point the administration of mercury causes a return to the normal, after which, if the administration is continued, a decrease in the

number of red blood corpuscles and the percentage of haemoglobin sets in.

Rate of Absorption of Mercury.—Mercury can be detected in the urine at the following periods after the administration is begun :—Injections two to three hours ; inunctions twenty-four hours ; by the mouth on the third day.

Mercury tends to accumulate in the body, especially in the liver and kidneys. It is mainly eliminated by the kidneys, and to a less extent by the intestinal secretions, saliva, bile, milk and sweat. Metallic mercury injected intramuscularly can be recovered from the urine for two to six months after the last injection.

Precautions before and during Treatment by Mercury.—Mercury is a powerful drug and when used in full doses, as in the treatment of syphilis, unpleasant and even fatal consequences may ensue if certain precautions are neglected. The following are the result of practical experience and must be observed.

(1) *The urine.*—Mercury is mainly excreted by the kidneys, but, if chronic nephritis is present, the execretion is much diminished or indeed ceases altogether. Before beginning treatment, therefore, the first and most important precaution is to examine

for albuminuria ; if this is found, try to determine its cause. If due to nephritis, NO MERCURY is to be given till the nephritis has cleared up. If nephritis can be excluded, the albumen may be due to syphilis ; in any case begin with a very small dose and examine the urine daily. If the albumen disappears, it may be concluded to be due to syphilis and full doses can be given. When albuminuria appears for the first time during treatment, it denotes that the maximum safe quantity of mercury has been introduced and the administration must be interrupted for a time. The urine must be examined at intervals to note when the albuminuria disappears and at least a full month allowed to elapse after this before any further mercury is given.

(2) *The body weight.*—Syphilis in an active form always causes more or less loss of body weight. Mercury, properly administered, results in a gain in weight up to a certain point. If an excessive quantity of mercury is given, the weight again diminishes. The weight must therefore be recorded before commencing a course of treatment and at regular intervals during treatment, and always before every injection. As long as the weight is increasing or remaining stationary the administration may safely be continued, but as soon as the weight shows

a steady fall, which cannot be accounted for by any other circumstance, the course must be interrupted and the urine examined for albuminuria. The body weight is, in fact, the most valuable and easily applied guide in regulating the administration of mercury.

(3) *Teeth and gums.*—Before commencing the treatment the teeth and gums should be looked at. If the patient is agreeable, it is certainly wise to have stumps removed and carious teeth filled, but when the cleanliness of the teeth is properly attended to, these measures are unnecessary ; it is much more important to have all tartar removed, as in spite of careful cleaning, tartar frequently leads to the formation of ulcers. As regards the tooth powder any kind will do, provided it is used. Some men complain of the tooth brushes being too stiff and causing pain ; this can be remedied by soaking the brush in hot water for a few minutes before using it. In the ordinary case no mouth wash is necessary. When ulcers in the mucous membranes of the mouth and fauces are troublesome, a simple and effective plan is to supply the man with tabloids of chlorate of potassium, and tell him to suck one two or three times a day ; this he will usually do, as the painful ulcer does not permit him to forget its

existence. If an astringent mouth wash is thought advisable, ordinary alum, 10 grains to the ounce of water, or infusion of quassia, is all that is required. The acetate of alum used at Aachen is very good but rarely necessary. This is prepared by dissolving 1 ounce of alum in 5 of water and 1 ounce of lead acetate in a similar quantity of water, the solutions are then mixed and filtered. The filtrate contains acetate of alum. This is diluted with 10 parts of water and a few drops of an aromatic essence added to flavour it.

(4) *Recent diseases.*—Men who have recently suffered from dysentery, severe diarrhoea, congestion of the liver, malarial fever or any debilitating disease, are not good subjects for mercurial treatment, and the administration should therefore be commenced with greatly reduced doses and the effect on the body weight noted. Cases of malignant syphilis, i.e. those in which what are usually described as tertiary symptoms appear very early in the course of the disease, do not tolerate mercury well, and it must be given sparingly at first. Lang of Vienna treats these cases with sarsaparilla alone, till the general health has improved and the symptoms of syphilis have become less marked.

One or two other cautions are usually given, such as avoiding smoking. When dealing with

the soldier it is difficult to make him give up smoking, and in most cases, unless the mouth and throat are affected, it is hardly necessary to insist on this. As regards diet, syphilis leads to considerable tissue waste and a liberal diet should therefore be given. Alcohol is rarely necessary, indeed most syphilitics are better without it. Over-indulgence in any alcoholic beverages has a most harmful effect on the course of the disease, in fact, as one authority used to express it, "You can preserve your syphilis in alcohol." When mercury is given by the mouth indigestible articles of diet, or any which are likely to cause gastro-intestinal irritation, must be avoided; when inunctions or injections are being used diarrhoea is much less likely to appear and dietary precautions are not so important. The general health should be as well maintained as possible. Out-door exercise and the playing of games are to be encouraged, but at the same time over-fatigue is harmful.

Mercurialism.—This may occur when any form of mercurial treatment is employed, and the longer the periods for which the drug is administered without intervals of non-treatment, the more likely is mercurial poisoning to occur; similarly the more energetic the form of treatment, the more probable is it that the system may become over-

charged. Weekly injections of cream continued for months are almost certain to produce a condition of mercurial poisoning, varying in severity with the amount of mercury introduced and the man's resisting powers. The earliest sign is loss of body weight, followed sooner or later by albuminuria; another quoted by Feibes of Aachen is cardiac palpitation; anaemia is usually noticeable. Stomatitis is however the symptom which usually draws the medical officer's attention to the fact that something is wrong and necessitates the man's admission to hospital for treatment.

As regards treatment the first thing to do is to stop the further administration of mercury; if the kidneys are excreting the drug the man will soon recover. The most effective plan of getting rid of the mercury and improving the man's condition is by the use of hot-air baths. Very few military hospitals are supplied with these, but they can be improvised by raising the bed-clothes on a cradle and inserting the nozzle of a bronchitis kettle. A temperature of 180° F. for 20 minutes should be employed at least three times a week, each sitting to be followed by a brisk rub with a hot bath towel and change of clothing as soon as perspiration has ceased.

Gaucher of Paris recommends natural sulphur waters twice a day for this condition ; small doses of the alkaline sulphates are also well spoken of.

Mercurial Stasis.—In this condition any mercury which has been introduced into the body is not absorbed, while at the same time the manifestations of syphilis are unaffected. Various explanations have been given. Gaucher of Paris thinks that the condition is due to the mercury forming an irritating compound which therefore does not circulate freely. He prescribes natural sulphurous waters, with the idea that the mercury is converted in a non-irritating sulphate and so allowed to circulate and exert its influence. A more probable explanation is that the excretory glands, especially the kidneys, are at fault. If undetected and the injection of mercury is proceeded with, after a time absorption recommences with alarming or fatal results, owing to the large quantity which has accumulated in the tissues. The only absolutely reliable way of checking the elimination of mercury, and ensuring that no accumulation is taking place, is by estimating the quantity of mercury excreted in the urine. Unfortunately the test for mercury in the urine is, owing to the minute quantity in any specimen, a somewhat troublesome and delicate operation.

The following test may be attempted :—

Take about 10 ounces of the morning urine, acidulate strongly with nitric acid and boil for a quarter of an hour. Then place a very small piece of clean copper foil in the neck of a small sized funnel so as to nearly plug the opening. Pour the urine into this funnel ; and allow it to escape drop by drop over the copper. Mercury if present is deposited on the copper ; it can then be volatilized by heating the copper in a glass tube. Or a minute piece of copper may be placed in the urine and left for 24 hours, the urine being kept warm during this time ; any mercury in the urine is deposited on the copper, which if polished shows a metallic mirror. If volatilized in the presence of iodine, crystals of the red iodide are formed.

Practical Rules.—We must now consider some very important practical points. These are :—

(1) When should the administration of mercury be commenced ?

(2) How long should the administration be continued ?

(3) The general scheme of treatment.

(4) Methods of administering mercury.

(1) **Commencement of Treatment.**—Treatment should commence as soon as a diagnosis of syphilis is made but not before, as the administration of mercury will either very much modify or altogether prevent the appearance of further symptoms. Hence if the surgeon commences treatment while still uncertain of his diagnosis, he must expect to remain in doubt throughout, a fact of which the patient will almost certainly become aware. The natural consequence is that the treatment will be only half-hearted all through, with probably unpleasant results should syphilis be really present. Unless sure of the diagnosis wait for confirmatory signs ; no harm is done by so doing ; it is the practice followed by the German experts, than whom there are no more painstaking scientists, and it is supported by the great majority of the experts, both civilian and military, whose opinion was specifically asked for by the special Committee of the Advisory Board for Medical Services. This waiting for further signs is not to satisfy an idle curiosity but to settle a question which gravely affects the man's future. If the surgeon can conscientiously state that syphilis is present, which if at all experienced he may well be able to do, there is of course nothing to be gained by waiting, and he can at once begin treatment.

An exception to the above rule is only permissible in the case of a doubtful syphilitic sore, situated on an important part, such as the conjunctiva, if likely to cause permanent damage to the eye, or if the lesion is on the lips, on account of the great danger of spreading infection.

(2) **For what Period should the Administration of Mercury be continued ?**—Expert opinions on this question differ widely; in France, Fournier's views, viz. that treatment should be continued (with intervals) for a period of six years, are generally accepted. In Germany, on the other hand, four years is usually considered sufficient, while in England most authorities are satisfied with two years treatment. In the army, owing to frequent changes of station, which affect medical officers as well as men, it is difficult to follow up a man's movements and maintain treatment for more than two years. Now if two years be accepted as a sufficient period of treatment, what is its value in curing syphilis ?

The only test of effectiveness, which can be applied in the present state of our knowledge, is the relative frequency with which tertiary symptoms occur among the cases which have been treated for varying periods and by different methods. Marschalko has

collected some valuable statistics on this question. His figures are taken from the larger dermatological cliniques of Germany, hence the incidence of tertiary syphilis is somewhat under-estimated, as many cases of visceral syphilis would not be included. The returns of Professor Neisser's clinique show that of all cases which have been treated on the "chronic intermittent" system for two or more years only 1·96 per cent. develop tertiary syphilis. Fournier's figures give 3·45 per cent. of tertiary syphilis after two years' treatment. From a statistical point of view Neisser's cases were somewhat few in number, as only carefully recorded ones were included; most of these were treated by inunction. Fournier's figures include a much larger number of cases, mainly treated by pills; but it must be mentioned that Fournier included among his tertiary syphilis many affections of the central nervous system which would not usually be ascribed to syphilis.

Taking the above figures as our basis and allowing for the occurrence of visceral syphilis, it may fairly be assumed that if we adopt a two years' treatment as our working rule, the proportion of tertiary syphilis, i.e. failures, should not exceed 5 per cent. of the number who contract syphilis, and at least one-third of those failures will not be manifested till

after the expiry of the soldiers' contract with the state. From a service point of view therefore we may hope to cure at least 95 per cent. of those who contract the disease, i.e. while in the army and reserve they will not show any further signs of the disease, and of the remaining 5 per cent. who may be expected to show some further signs of late syphilis, at least one-half will yield to treatment and be able to continue in the army and do their duty.

We may therefore rest assured that two years' treatment if thoroughly carried out, fulfils our professional obligation to our patients and the state. If experience demonstrates definitely that this period is insufficient, it can then be increased, but at present no such indication is forthcoming.

(3) **General Scheme of Treatment.**—With regard to methods of administration, duration of treatment, and the amount of mercury necessary, opinions vary widely. Speaking generally, two schools of treatment exist at the present time—

(*a*) The continuous school, who prefer to give a course of mercury for a definite period continuously, or with short interruptions only.

(*b*) The intermittent school, who give mercury for certain periods separated by intervals

which are, taken as a whole, of longer duration than the periods of treatment.

The continuous school may be further subdivided into—

(1) Those who give as much mercury as the patient can tolerate during the whole period of treatment.

(2) Those who diminish the dose of mercury as the manifestations of the disease disappear.

Broadly speaking, the continuous school embraces English and American physicians.

The intermittent school may also be subdivided into—

(1) The periodic intermittent school : those who give definite courses of mercury at regular intervals, irrespective of the manifestations of the disease. (Most of the French, many of the German and other continental experts are embraced in this group.)

(2) The symptomatic school : those who prescribe courses of mercury only when the symptoms of the disease are manifested. (Professor Lang of Vienna, his pupils, Professor Havas, and other Austrians and Germans prescribe treatment in this way.)

The continuous school prescribe mercury in some "mild" form, such as pills, and aim at keeping the patient continuously under the influence of mercury for a considerable period, with the idea that each recrudescence of the disease is at once nipped in the bud, till the virus becomes completely exhausted and a cure is obtained.

The periodic intermittent school on the contrary begin treatment by making a vigorous attack (called "traitement d'assaut" by the French) on the disease with the idea of crippling it at the start. A period of rest is then allowed to permit the system to recover from the poison of the disease and the effects of the mercury. Subsequent courses are ordered to forestall the phases of recrudescence which experience has shown may be expected to occur at certain times after the administration has ceased.

Good results may be obtained by following either plan, but if the continuous one is adopted the patient must be trusted to take his medicine himself a condition which is rarely fulfilled in army practice The periodic intermittent plan presents the great advantage that the treatment is entirely under the control of the surgeon and that very many fewer attendances are necessary, thus making much less

demand on the surgeon's time as well as the soldier's and consequently not interfering with his military duties to the same extent as when the continuous plan is employed.

CHAPTER V

SYPHILIS: METHODS OF ADMINISTERING MERCURY — MOUTH — INUNCTION — INJECTION OF SOLUBLE SALTS

THE various methods of prescribing mercury may be divided into two main classes, the "MILD" and the "ENERGETIC." The former are indicated when for any reason it is desired to exercise only a moderate mercurial influence, possibly for a considerable period, but when the choice is in no way restricted the energetic methods can be used on the periodic intermittent scheme and yield very satisfactory results, without necessitating so many attendances on the part of the sufferer or such constant supervision by the medical officer. The superiority of the energetic plans, from an army point of view, if not indeed in a civilian practice too, is at once evident. The various methods may be grouped in tabular form as follows :—

	Mild	Energetic
1. By the mouth	Pills,* powders,* mixtures.*	None.
2. By the skin	(1) Welander's bag. (2) Calomel plasters. (3) Mercurial Ointment on lint, binders or socks. (4) Perchloride baths, with or without galvanism.	(1) * Inunction with mercurial ointment. (2) Calomel vapour baths.
3. By injection.	(1) Soluble salts in reduced doses.	(1) Intravenous. (2) *Intramuscular of soluble salts in full doses. (3) *Intramuscular of mercurial cream. (4) * Intramuscular of the insoluble salts.

The methods which are marked with a * are suitable for the treatment of syphilis throughout the whole course of the disease, the others could no doubt be so used, but are of special advantage when some particular lesion has to be treated.

1. **By the Mouth.**—The administration of mercury by the mouth commends itself to many

surgeons and it undoubtedly possesses several advantages; thus it is clean and does not lead to soiling of the surgeon's hands or the patient's clothing. It is painless and therefore not objected to by patients, and as the patient is entrusted with the taking of the remedy himself, it entails the minimum of trouble for the surgeon. Against these advantages, however, must be set certain disadvantages. Absorption is slow, as shown by the time taken before mercury appears in the urine. It is a mild form of treatment and in the severe cases contracted in the tropics it rarely exerts a beneficial effect. In order to obtain a cure the administration must be continued for much longer periods without any intermission, as the effect of the drug is soon exhausted. There is considerable risk of setting up gastro-intestinal irritation, especially if large doses are employed; if this happens, treatment must either be stopped for a time or some other drug such as opium, which is not necessary for the cure of the disease, must be added to the prescription. Again, in army practice it is most difficult to ensure that the medicine is regularly taken; this is, indeed, the greatest objection to this plan. (For Formulae and Scheme see Appendix III.)

Inunction.—When properly carried out treat-

ment by inunction is one of the best ways of curing syphilis, but if patients are allowed to use their own discretion as to dosage, duration of rubbing, etc., the results, as might be expected, are very unsatisfactory. An important point is to have a clean, soft skin. At Aachen, the great centre for inunction, natural sulphur water baths are used. Where natural waters are not- obtainable, an ordinary hot bath is quite sufficient for the purpose. A very fair sulphur bath may be prepared by adding 1 to 2 ounces of the liquor calcis sulphurata to the ordinary full bath. When facilities for hot baths are wanting the directions given below as to washing must be carried out, if not, a sharp attack of dermatitis is almost sure to follow.

When out-patients are treated by this method, each man must set apart two sets of woollen underclothing. During the course one of these is to be worn night and day for a week, then changed, and the soiled one sent to the wash ; the clothing will probably be badly stained by the ointment. The general directions must be carefully adhered to in the case of out-patients.

The following plan of treatment for use in hospitals has been carried out and can be recommended :—

(1) Before the inunction is performed a hot bath

is given for 20 minutes. When baths are not obtainable the patients must be directed to wash their hands, the part of the body to be rubbed, and the part rubbed on the previous day, before inunction.

(2) The following is a useful and easily prepared formula for the ointment :—

R Ung. hydrarg. . . . . gr. 40
Adipis lanae (B.P.) . . . . gr. 20

Mix thoroughly and wrap in wax paper. One packet to be used for each rubbing.

These packets should be handed out by the medical officer to each patient, the time noted, and directions given as to how long the inunction is to be continued ; each patient rubs himself ; when the back is to be done the men sit in a circle and each man rubs the back of the man in front of him. The rubbing should be done slowly, exerting considerable pressure so as to force the ointment into the skin, and in cold weather the men should sit in front of a fire. A non-commissioned officer, or trained orderly, should be told off to watch the men.

When the prescribed time has passed, the medical officer must himself inspect the men before dismissing them to wash their hands. When properly done the skin should look as if it had been rubbed

over with black lead, not shiny and greasy. If there is any doubt as to whether the man has properly rubbed himself or not, the medical officer should order a further period of say 10 minutes' rubbing and watch the patient do this.

(3) The inunction is to be performed daily for 20 or 30 minutes. The course of inunctions is usually 42, but the number may be increased or diminished to suit individual cases.

(4) The parts are to be rubbed in the following order :—First day, both calves ; second day, both thighs, avoiding the hairy parts ; third day, the abdomen ; fourth day, both forearms. If the inunction is used on the back, the application must be made by another patient, or by a trained orderly.

(5) Special flannel underclothing (condemned sets do well for this purpose) should be worn night and day for a week at a time during treatment. (For plan of treatment see Appendix IV.)

Intramuscular Injection.—This method presents many advantages, and from an army point of view is undoubtedly the best. The treatment is entirely under the surgeon's control, the quantity of mercury introduced can be accurately measured, and provided ordinary precautions are observed there is no danger.

Many preparations have been advocated at different times but all of these fall into two main classes, the soluble and the insoluble.

At first sight the soluble salts present many attractions. Thus the solution can be prepared anywhere without special apparatus and at a moment's notice, so that if a rapid mercurial effect is desired as, for instance, to apply the therapeutic test for syphilis, this can at once be carried out as no special syringe or needle is necessary. The solution can be injected into any region, and there is no danger of embolism occurring.

When, however, it is a question of treating a case of syphilis by the injection of soluble salts, disadvantages are at once apparent. The most important of these is the fact that the quantity of mercury which can safely be introduced at one injection is very small. Take the perchloride of mercury, one-third of a grain is about as much as it is wise to use in one injection—this only contains one quarter of a grain of metallic mercury as against the 1 or 1½ grains in each injection of mercurial cream. Hence if energetic treatment of syphilis is desired, the injection must be frequently repeated. The second objection to the soluble salts for the routine treatment of syphilis is that all of them

cause more or less pain, in fact the amount of pain is excessive having regard to the small quantity of mercury introduced. The pain and frequent repetition of injection reduces the soluble salts to a much lower level of efficiency than the insoluble salts or cream.

If it is determined to use soluble salts, one of the most efficient and readily obtained is the perchloride of mercury. The following is a useful formula :—

R Hydrarg. Perchlor . .	8 grains.
Sodii Chloridi . . .	4 grains.
Aq. Destill . . .	400 minims.

Dissolve the chloride of sodium in the water and filter, to remove particles of dust, then add the perchloride of mercury.

Minims 10 for each injection; this contains one-fifth of a grain of perchloride = a little more than one-seventh of a grain of metallic mercury. Using the above dose, a scheme of treatment as follows is suggested; it must, however, be borne in mind that this scheme can in no way be regarded as being equally efficient with the scheme of treatment by injections of mercurial cream.

First Course—

Three injections a week for two weeks

= 6 injects = 6/5 gr. Hg. Cl_2 = ·87 gr. Hydrarg.

Two injections a week for six weeks,

$=12$ injects., $=12/5$ gr. Hg. $Cl._2 = 1{\cdot}75$ gr. Hydrarg.

Interval of one month.

Second Course—

Two injections a week for eight weeks,

$=16$ injects. $=16/5$ gr. Hg. $Cl_2 = 2{\cdot}36$ gr. Hydrarg.

During the remainder of the first year, the same plan to be continued, i.e., treatment to be administered for two consecutive months followed by an interval of non-treatment of one month. During the second year the treatment to be given for one month in each quarter of the year. This plan, if adopted, works out to the following results :—

In the first year treatment would occupy 32 weeks, and during the second year 16 weeks The total number of injections would be 98, or if two additional ones were given, 100. The total quantity of perchloride injected would be 20 grains containing very nearly 15 grains of metallic mercury. The above plan is probably as much as is given on any scheme for injecting soluble salts, yet when the number of injections required to introduce 15 grains of metallic mercury is contrasted with the 27 grains of metallic mercury injected in

18 injections when the cream is used, the superiority of the latter is at once evident.

The biniodide of mercury is strongly recommended by Lévy-Bing, who gives the following formula :—

R	Biniodide of mercury . .	2 grains.
	Pure iodide of sodium . .	2 grains.
	Sodium chloride . . .	¾ grain.
	Destilled water . . .	100 minims.

Ten minims for each injection; this quantity of the solution contains one-fifth of a grain of the biniodide. The percentage of mercury in this salt is 44·05, so that 10 minims of the above solution contain approximately ·08 grains of metallic mercury, a somewhat low dose. Lévy-Bing recommends 1 c.c. (= 17 minims) for each injection, and states that the dose may be increased to twice or even two and a half times this amount without any danger; he believes this preparation to be a very useful one in secondary or tertiary syphilis, and nearly equal to calomel injections in efficiency.

Many other soluble salts have been tried, but almost all of them possess some serious objection, and it is hardly worth while to enumerate them here.

CHAPTER VI

SYPHILIS: INJECTION OF CREAM—INSOLUBLE SALTS—INTRAVENOUS AND OTHER METHODS

Intramuscular Injection of Mercurial Cream.—For army purposes this is the most suitable method of treating syphilis, and it is undoubtedly one of the most efficient. The several points will now be considered in detail.

(*a*) *The cream.*—In the R.A.M.C. Journal for July, 1906, there is an excellent article describing the difficulties in making an ideal cream. From the surgeon's point of view the essentials of a good cream are :—

(1) That the mercury be finely subdivided and evenly distributed through the mixture.

(2) That the cream be stable, that is, that in the intervals between use no special precautions, such as standing on ice, should be necessary to prevent the mercury from separating out.

(3) That the cream be sufficiently fluid for injecting, without having to warm it before use.

(4) That the cream be of moderate concentration, 1 grain of mercury in 5 minims of cream is a good working strength. This permits of the dose being regulated to whatever the surgeon may desire, does not introduce unnecessarily large quantities of inert foreign matter, does not make a bulky injection thus avoiding mechanical pressure at the site of injection, and most important does not necessitate constant refilling of the syringe when a large number of injections have to be given.

No antiseptic substance need be added, as the cream is sterile and remains so. By having two creams (a hot and a cold weather one), of different composition but the same strength, and using the special paraffin instead of the liquid paraffin, the above desiderata can for practical purposes be obtained.

For formulae see Appendix V.

Dosage.—In order to determine the most advantageous dose of mercury when treating syphilis by injections of grey oil, Barthélemy and other authori-

ties in Paris made a series of scientific observations. The therapeutic value of the dose was gauged by estimating its effect on the condition of the blood, urinary excretion and the patient's weight. Their conclusions may be summed up as follows :

The quantity of mercury injected should bear a definite relation to the patient's weight ; thus for an ordinary (French) man weighing 8 to 9 stone, they found that 8 to 9 centigrammes of metallic mercury (7 cgm. = 1 grain nearly) injected once a week, for six weeks, gave the best results ; after the fifth injection there was a tendency for the red blood corpuscles to diminish and if more than six injections were given the haemoglobin decreased also. Following this course of six injections an interval of non-treatment for two months was necessary. In the case of a big man weighing 13 stone the dose may with advantage be increased to 14 or even 16 cgm. a week (2 to $2\frac{1}{4}$ grains). As much as 25 cgm. ($3\frac{1}{2}$ grains) have been given as a single injection without any unpleasant symptoms ensuing ; as a general rule, however, it is not advisable to exceed the doses they recommend, which are well within the limits of safety, and quite sufficient to meet all therapeutic requirements. Applying Barthélemy's rules to the British

soldier, who usually weighs at least 10 stone, we may with safety give a weekly injection of 10 cgm. (= 1½ grains of metallic mercury) once a week for six weeks. Experience may show that a weekly dose of 1 grain is sufficient, but the dose recommended is certainly not a dangerous one, and in the later courses it has the great advantage of allowing longer intervals between the courses with fewer injections in each, thus not making so great a demand on the soldier's or the surgeon's time.

Syringe and Needle.—The most suitable syringe for injecting cream is an all-glass one with a platino-iridium needle of rather large bore. The one at present supplied from the Army Medical Stores is very good when a dose of about 5 minims is being injected; for a 10 minim dose, however, its capacity is not sufficient, which consequently involves constant refilling of the syringe. This not only wastes a good deal of time, but necessitates the cream jar being kept open for long periods with the risk of dust getting into the cream.

For sterilizing the needle, heated olive oil is the safest and most convenient agent. It is not necessary to drop in bread crumbs to show when the oil has attained the proper temperature, for soon after the lamp is in position quickly-moving currents appear

in the oil, and a hot pungent smell is given off. The temperature of the oil is then between 120 and 140° C. Chemical solutions are not satisfactory when an oily mixture is to be injected. The needles must not be heated in the naked flame, as this melts the soldering and ruins the needle.

Before filling the syringe the cream must be well stirred with a glass rod, which has been passed slowly through the flame to burn off the adherent cotton filaments, and prevent these from being introduced into the cream. The cream must not be left uncovered for a longer period than is absolutely necessary, as this allows particles of dust to enter.

Preparation of the Skin.—Careful measures must be taken to render the skin aseptic or as nearly so as possible; neglect of this precaution will almost certainly lead to severe septic inflammation, owing to particles of infected epithelium being pushed into the subcutaneous tissue by the point of the needle.

A simple and effective method of preparing the skin is to take a piece of sal alembroth wool well moistened with methylated spirits, and rub the selected part till a red blush appears, showing that all the dead epithelium has been removed.

Site of Injection.—The best place in which to make the injection is undoubtedly the upper part of the buttock, for here the subcutaneous tissue is thick with a deep layer of muscle underneath. The only risk lies in penetrating one of the vessels, which are however less numerous above the level of the great trochanter. A good working rule is to keep to the level of the junction of the gluteal folds, making the first injection one inch to the left of this, the second one inch to the right, the third two inches to the left, the fourth two inches to the right and so on. In this way no two injections are made at the same spot and each buttock is taken alternately.

If for any reason the buttock is not available, a spot one inch from the middle line on either side of the vertebral column may be selected; the suprascapular fossae, or even the deltoids, may be made use of in the case of a patient confined to bed. When choosing any site, the points to be observed are that the subcutaneous tissue be thick and the parts not subject to free movements, thus the thighs are not to be recommended.

Technique of Injection.—The skin, having been prepared and syringe and needle sterilized, fill the syringe, attach the needle and push the piston lightly,

in order to fill the needle, then dip the point of the needle into the heated oil to remove the drop of cream which always exudes and which if deposited in the skin at the point of entry gives rise to a painful spot. Next thrust the needle into the selected spot to its full extent and detach the syringe. If a vein has been penetrated blood will flow from the needle within a second or two, in which case a fresh site must be selected; if no blood flows the syringe may be reattached and the injection completed. If the injection is made into a vein a fat embolism is produced with somewhat alarming symptoms such as fainting, intense dyspnoea, etc. These usually clear up with rest and no fatal results follow. When choosing the actual site of puncture avoid pimples, as these if injured always bleed rather freely and soil the soldier's clothing; and it is also well to avoid hairs, as these may be forced into the skin. A carbolized "glass" cloth should be spread out on the table for the surgeon to wipe his fingers on, if necessary, or on which the syringe may be laid for a moment if desired. "Glass" cloth is of firmer texture than lint so that if accidentally touched by an oily finger few if any filaments stick to the operator's hand.

After Effects of Injection.—An injection

of mercurial cream is always followed by more or less inflammation ; this may be of mild degree and merely be the result of chemical or mechanical irritation, on the other hand when due to the introduction of septic infection the inflammation may be of an extremely severe type and lead to most unpleasant consequences.

The-non septic sequelae are :—

(1) When cream is deposited in the true skin at the point of entrance of the needle a superficial painful swelling, lasting a few days, may result.

(2) About the fourth day after the injection a small deep-seated nodule can generally be felt at the spot where the cream was deposited ; this is not painful unless subjected to great pressure. It usually becomes absorbed about the tenth day following the injection.

(3) Sometimes a considerable amount of very painful induration is formed at the site of the injection , this is probably due to the introduction of foreign matter, such as particles of dust, cotton filaments, etc.

(4) Occasionally neuralgic pain along the great sciatic nerve is complained of ; this varies in intensity but is rarely severe and disappears in the course of a few days. The pain is probably due to the cream

being deposited on one of the lesser nerve filaments.

Mercurial cream is sterile, hence when septic troubles follow an injection, either the needle or the skin must be held responsible. When the infection only penetrates as far as the true skin, a superficial swelling, somewhat resembling a boil, ensues; this may resolve, or break down, leaving an unhealthy ulcer which slowly heals.

If the subcutaneous tissue becomes infected a very extensive abscess may form between the muscles and superficial tissues. These require the usual surgical treatment.

Scheme of Treatment by Injections of Mercurial Cream.—When treating syphilis by injections of mercurial cream, the danger of overdosing and its serious consequences must be borne in mind. Surgeons who regularly use this method of treating syphilis will soon evolve a scheme of their own. For the guidance of those who have not had much experience a tabular scheme is given in the appendix. This is based on the scientific investigation of this subject carried out in Paris and published by Lévy-Bing in his book on mercurial injections. This scheme is intended for the ordinary case which does not show any fresh manifestation during the time it is under treat-

ment. It has been in general use in Malta during the past two years and has given satisfactory results. It need not be followed exactly if the surgeon has any reason for altering it, thus he may prefer to give smaller doses with shorter intervals between the courses. In no case, however, should weekly injections be continued for more than two months at a time; if a dose of $1\frac{1}{2}$ grains be employed *six weekly* injections is the *maximum* permissible course. An interval of at least two months must then be allowed to elapse before injections are recommenced. Neglect of this simple precaution has, in many instances, been followed by severe stomatitis or even more unpleasant consequences.

During the first two intervals, the patient is to be inspected at least once a fortnight; during the third, if no fresh manifestations have appeared, he may be inspected only once a month.

If fresh manifestations should appear during the second or third intervals, these may be shortened to two or three months and an additional course given, provided there is no albuminuria. (For Formulae and Scheme see Appendix V.)

Insoluble Salts.—Many insoluble salts of mercury have been tried in the treatment of syphilis; very few of these, however, present any special

advantage, and the only one which is worthy of notice is calomel. Injections of calomel form one of the, if not the most effective, methods of treating syphilis; unfortunately it possesses several marked disadvantages. One of these is that the injections are almost always followed by very severe pain, and if strict asepsis is not maintained an abscess will probably form at the site of injection. Another objection to its use is that on account of its high molecular weight it does not lend itself to the preparation of a satisfactory emulsion.

In obstinate cases, or those in which the central nervous system is attacked and it is imperative to bring the disease under control at the earliest possible moment, it may be worth while to try injections of calomel, in spite of its drawbacks. As a routine method of treatment, however, its disadvantages far outweigh its advantages, and place it much below mercurial cream.

Bertarelli's method of injecting calomel is as follows :—10 cgm. of calomel and 1 c.c. of liquid paraffin or solution of gum arabic are placed in a special hollow glass cone, the interior of which is quite smooth and rounded; a glass lid fits over the top. A number of these are prepared and sterilized in the autoclave. A glass syringe with

a steel needle 4 c.m. long is used. The syringe is sterilized by boiling and then placed in 1 in 20 carbolic acid lotion. Before use it is washed through with alcohol. The skin of the part to be injected is sterilized with ether or alcohol, and 1 in 1,000 perchloride of mercury. The cover is then removed from the cone and the nozzle of the syringe inserted into the liquid. By working the piston up and down several times the calomel is intimately mixed with the paraffin and is easily injected through the needle. Bertarelli says this method is more satisfactory than using the minute flasks of Scarenzio. The quantity of calomel which is actually injected is considered to be about 7 cgm. (one grain nearly). The injection is made deeply, the needle being inserted to its full extent vertically to the surface.

A preparation, largely used in Germany, is the salicylate of mercury. The following is a convenient formula :—

Hydrarg. salicylat. . . .	grs. x.
Paraffinum liquidum . .	m. 100.

10 to 15 minims to be injected once a week.

This salt must be finely triturated before being mixed with the paraffin, so as not to block the needle. The special advantages of this preparation are (1) it can be prepared by simply mixing with the

paraffin, no prolonged stirring being necessary; (2) it can be sterilized by heat as often as required, without undergoing alteration; (3) vigorous shaking before use is all that is required to ensure proper consistency of the mixture; (4) it is not affected by heat or cold, and is therefore suitable for use in any climate without special precautions to ensure its remaining fit for immediate use. It is not so active as the mercurial creams or grey oils, but is sufficiently so for use in the later courses.

The following plans of treatment are what might be called "Occasional" methods, by which is meant that these sometimes offer special advantages in particular manifestations of the disease, but are not to be recommended for routine use in all cases.

Intravenous Injection.—This method was first described by Bacelli in 1893, and was extensively tried by Mr. Ernest Lane. The following description is taken from his paper in the *British Medical Journal* of 1896.

The skin of the arm having been carefully sterilized, apply a bandage above the vein selected, in order to render this prominent. Twenty minims of a 1 per cent. solution of cyanide of mercury (or a similar solution of perchloride of mercury can be used) are then drawn up into a sterilized syringe

having a fine platino-iridium needle, the needle is then thrust obliquely into the vein and the point is moved about to make sure that it is free within the lumen of the vessel (it is very easy to transfix the entire vessel); the bandage is then removed and the solution slowly injected. Provided the injection is made into the lumen of the vessel and not into the surrounding connective tissue, no inflammation or other disturbance is experienced. If the veins are very small, the injections cannot be carried out.

This method is undoubtedly one of the most rapid for obtaining an antisyphilitic effect, and in urgent cases, such as lesions of the central nervous system, it may be of great service. As a routine method of treatment it does not offer sufficiently great advantages.

Calomel Vapour Baths.—This method was formerly largely used, but has lately been rather neglected in favour of the more accurate and less troublesome plans which we now possess. Sometimes an obstinate syphilide will yield rapidly to calomel fumigation; it is, however, a fairly energetic method of prescribing mercury and hence must not be used concurrently with other plans.

Half a drachm of calomel should be sublimed

at each sitting, using Lee's apparatus; two or at most three sittings a week should be prescribed, preferably in the evening, so that the patient can get into bed (in blankets) at once, while the skin is still warm from the hot air.

Welander's Mercurial Bag.—This is a mild method and especially indicated for adults who may happen to contract some severe illness, such as Malta fever, during the early stage of syphilis and while mercurial treatment is still necessary; it is also useful for pregnant women who are near term, or for congenital syphilitic children.

A cotton bag is made large enough to cover the whole front of the chest, leaving the upper seam open. This is turned inside out each morning, and a drachm of mercurial ointment (B.P.) is spread on the inner surface of one side; the bag is then inverted and worn night and day with the prepared side next to the skin; at the end of a fortnight a new bag is taken into use. The course should last for a month at a time.

Blaschko introduced a special fabric called "mercolint," which is merely cotton impregnated with mercurial ointment, a sheet of this being worn inside a vest: this has the disadvantage that the mercury is not replaced as it becomes vaporized.

Calomel plasters containing roughly 25 per cent. of calomel in diachylon plaster were introduced by Quinquaud; a piece 4 inches square is applied to the skin and worn for a week. These do not seem to possess any special advantage. Lang spreads a drachm of mercurial ointment on the skin at night, applies a bandage over this and washes the skin in the morning.

Similarly mercurial ointment has been placed on binders, and been allowed to rub itself into the skin by the body movements during the day. This is an ancient way of treating children; it may be used for adults, too, but it must be borne in mind when employing any of these skin methods that if the person is liable to profuse sweating, as the result of his occupation or playing games, absorption becomes very rapid and mild symptoms of mercurialism will appear; hence in these cases the person must be cautioned only to wear the binder at night. Smearing mercurial ointment on the socks is an effective if crude method of introducing mercury; it might be of use on service.

The Mercurial Bath.—Of other methods which have been made use of for the administration of mercury in the treatment of syphilis, the mercurial bath deserves some attention.

In the case of soldiers returning from tropical service, who may have become debilitated in health from other causes in addition to syphilitic disease, it is not uncommon to find multiple cutaneous syphilitic lesions, showing a marked tendency to necrosis and ulceration. In such cases the use of the bath containing mercury in solution is frequently found to be of service. The drug appears to exert a local curative effect on the cutaneous lesions, in addition to its recognized influence by absorption.

All the precautions directed to be observed during mercurial treatment must be scrupulously observed in the case of such patients.

The mercurial bath may be prepared according to the following prescription :—

Mercuric chloride . . .	60–180 grs.
Ammonium chloride . . .	1–3 drs.
Water (at 100° F.) to . . .	30 gallons.
or	
Mercuric chloride . . .	60–180 grs.
Diluted hydrochloric acid . .	1 dr.
Water (at 100° F.) to . . .	30 gallons.

The patient may remain in the bath from ten minutes to half an hour. The water in the bath

must not be allowed to become too cold, and the patient must not become chilled after the bath. The baths may be continued till the cutaneous lesions have healed, when mercurial treatment may be carried out by other methods appropriate to the case.

Zittman's Treatment.—This form of treatment is especially indicated for elderly or debilitated people of feeble constitution. Good results have been obtained at Netley in the case of soldiers invalided for syphilis from the tropics, especially in those suffering from cutaneous lesions. A hot room is required, and the formula (*see* Appendix VI), is somewhat complicated.

Administration of Mercury per Rectum.—(C. Audry, *Annal. de Dermat. et Syphilis*, March, 1906.)—Attention has lately been called to a plan of treating syphilis by the administration of mercury per rectum. Each suppository is made up to contain 3 centigrammes of metallic mercury in cacao butter, and one is inserted each evening for a month, after which a few days' rest is allowed. It is claimed for this plan that it possesses all the advantages of administration by the mouth without giving rise to stomatitis or diarrhoea, and that it is

therefore suitable for people who are very susceptible to mercurial pills. It is, however, a mild method of treating syphilis and of no use in severe or obstinate cases.

Comparative Values of different Methods of Treatment.—In the British army both medical officers and their patients are liable to frequent changes of station. Different medical officers may naturally prefer different methods of treatment, at the same time it is essential that the treatment of the disease should be carried out systematically. After considering this question and the evidence at their disposal, the Sub-Committee of the Advisory Board drew up the following scale of equivalents, so that a soldier who has been under one form of treatment may, on change of station, continue his treatment by some other method.

(1) One injection of mercurial cream containing $1\frac{1}{2}$ grains (= 10 c.gm.) of metallic mercury, is equivalent to—

(2) Three injections of a soluble salt (say, perchloride of mercury containing one-fifth grain in each injection); or to—

(3) Seven inunctions of mercurial ointment using 20 grains of mercury daily; or to—

(4) Twenty-one pills each containing 2 grains hydrarg. cum creta, three pills administered daily.

The above scale of equivalents represents energetic treatment for one week.

CHAPTER VII

SYPHILIS: IODIDES—SARSAPARILLA—SOME SPECIAL LESIONS—FITNESS FOR SERVICE

The Iodides.—Next to mercury the iodides are the most useful preparation we possess in the treatment of syphilis, but it must be clearly understood that the iodides are in no sense a substitute for mercury even in the late stages of the disease. They are useful all through the disease; thus Lang of Vienna prescribes small doses of iodide of potassium alone during the very early secondary stage while awaiting the appearance of the eruption; this is to give relief from the headache which so often precedes the general manifestation of the disease, but is in no way looked on as an attempt to treat the disease.

During the so-called secondary period, if the mucous membranes are affected, the beneficial action of mercury is greatly assisted by the simultaneous administration of iodides, while in the

later stages of syphilis the absorption of gummatous masses is largely brought about by iodides, which even then, however, should not be relied on alone but used in conjunction with mercury.

The iodides are most usually prescribed as iodide of potassium, sodium or ammonium, or as a combination of all three. The official dose of iodide of potassium or sodium is given as 5 to 20 grains, and, as a general rule, a 10 grain dose three times a day is sufficient; in many cases, however, this dose has been enormously exceeded without any bad results. Some people are very susceptible to iodine and develop symptoms of iodism with relatively small doses; when the iodism takes the form of an eruption the addition of small quantities of arsenic may serve to prevent this. Iodides should be taken after meals, even then they may give rise to dyspepsia; in these cases a small tumblerful of warm water taken half an hour before eating, by washing away any remains of the iodide adhering to the stomach wall, will often give relief.

Occasionally it may occur that the iodides for some reason cannot be given by the mouth, if so, iodide of potassium in quantities up to a drachm may be successfully administered in 4 ounces of water as an enema. This does not give rise to

any irritation, and the therapeutic effect is satisfactory.

Iodine may also be prescribed as the tincture in doses of 10 to 30 minims three times a day in tea or coffee. Iodoform in pills 5 to 15 grains daily has also been used with success. These last two forms of administering iodine are to be looked on as exceptional methods, and only to be employed when the ordinary plans fail to influence the disease. Iod. albacid is a compound of iodine and albumen, containing 10 per cent. of iodine which can be prescribed in pill or tabloid form, 15 grains twice or thrice daily. It is a mild preparation and easily taken; as it keeps well even in the tropics, it is most suitable for patients who have to travel and wish to take a supply of medicine with them.

Iodipin is a compound of iodine and sesame oil, containing 25 per cent. of iodine. It is especially useful in chronic debilitated cases of syphilis, as it does not exercise any depressing effect. Its action is slower than that of iodide of potassium, but its effect is very much more lasting, as after a course of iodipin, iodine can be recovered from the urine up to a year. Feibes of Aachen injects 23 cc. daily for a month or more. Lambkin injects 10

to 15 cc. daily for ten days, and reports that this is absolutely painless. The solution requires warming before use to let it run freely through the needle. Feibes specially recommended it for tertiary syphilis affecting the central nervous system. Iodipin is also made up to contain 10 per cent. of iodine, and can be given in capsules by the mouth.

Plan of Administration.—The iodides of potassium and sodium should not as a general rule be ordered for more than fourteen consecutive days, after which an interval of one week should be allowed. If given continuously for long periods they cease to act beneficially, and, on the contrary, produce marked depression.

Sarsaparilla.—This drug at one time enjoyed a great reputation as a cure for syphilis, it then fell into disfavour, but has recently been recommended again. It is one of the ingredients of Zittmann's decoction.

Lang of Vienna uses sarsaparilla very largely in the treatment of malignant or cachectic syphilitics, in fact he relies on sarsaparilla to remove the most urgent manifestations of the disease before proceeding to administer any mercury. His formula is as follows :—

Take 30 ounces of sarsaparilla root and macerate

for two hours in 200 ounces of water; the solution is then evaporated down to 15 ounces. The dose is 2 to 3 ounces of this concentrated solution daily.

A freshly made infusion is recommended by all writers on this drug in preference to any alcoholic tincture or extract.

On the Treatment of certain Manifestations of Syphilis.—*Lesions of the Mucous Membranes.*—The usual lesions met with on the mucous membranes within the cavity of the mouth are, (1) a superficial ulcer on the tonsil; (2) the early mucous patch with a glistening surface, on the lips or tongue—these two are generally early symptoms occurring in untreated cases; (3) the deep painful ulcer on the gums between the teeth, commonly the result of tartar on dirty teeth and a prolonged administration of mercurial pills; (4) the late mucous patch on the tongue, occurring at the site of some chronic irritation such as a sharp tooth after a number of injections have been given continuously without sufficient intervals of rest; (5) bald patches with or without fissures—these appear late in the disease, in cases which have been imperfectly treated and have indulged in excessive smoking or drinking strong spirits; (6) the sloughing gumma of the palate or fauces, seen in debilitated

men invalided from the tropics with syphilis. There are certain points common to all of these which require attention. They are, (1) to insist on cleanliness of the mouth and teeth; (2) to remove all sources of irritation and forbid smoking; (3) to give short courses of iodides, which seem to have a specially beneficial action on lesions of the mucous membranes.

As regards mercury in these affections, if none or very little has been given, a full course should be commenced at once, preferably by injections, as pills rarely do much good; when, however, a considerable quantity of mercury has already been introduced, the administration should be at once suspended and a short course of iodides given instead.

Local Treatment.—This is by no means always necessary, and if daily applications of strong irritating solutions are employed indiscriminately for every form of lesion of the mucous membranes, more harm than good is sure to result. It may be remarked in passing, that many German authorities do not employ any local treatment for mucous patches, as they regard these as merely an ordinary manifestation of the disease which will yield to constitutional treatment.

(1) The most suitable application for the early

superficial ulcer of the tonsil is a solution of about 20 grains of nitrate of silver to the ounce of water, on alternate mornings for a week or so.

(2) The early mucous patch will yield most readily to the following plan : First dry the surface with absorbent cotton wool, then apply a 10 per cent. solution of chromic acid and immediately afterwards either the stick of nitrate of silver or a 25 per cent. solution, on alternate mornings for a week to ten days. The chromic acid sinks into the tissues, where the silver nitrate coming in contact with it chemical action takes place with an excellent effect on the lesion ; if the solutions are allowed to mix outside the tissues they are quite inert. Other remedies which have been recommended are, a 1 per cent. solution of perchloride of mercury in equal parts of rectified spirit and water ; tincture of iodine ; forty per cent. solution of zinc chloride ; acid nitrate of mercury : the last two seem to be unnecessarily severe for the purpose.

(3) The deep painful ulcer of the gums is to be thoroughly cleansed by spraying with peroxide of hydrogen, after the tartar has been removed ; next the surface is to be anaesthetized with a 10 per cent. solution of cocaine, and then well swabbed

with acid nitrate of mercury B.P., or a 40 per cent. solution of zinc chloride. In all these three conditions the most important local treatment consists in frequently washing the mouth with water as hot as can be borne by the man; in fact this, together with constitutional treatment, will often get rid of the trouble in a few days.

(4) The late mucous patch of dirty white epithelium rarely requires any special treatment beyond the removal of the source of irritation, and the same may be said of

(5) The bald patches, provided the general treatment has been properly carried out.

(6) The sloughing gumma of the palate or fauces must be thoroughly sprayed with peroxide of hydrogen; this converts the sloughy membrane into a creamy froth, which can be washed away with gargle, leaving a fresh surface to which any mild antiseptic may be applied; as long as the membrane is left, no drug can reach the diseased surface underneath.

Obstinate Cutaneous Syphilides.—Some syphilides, such as the small follicular and squamous palmar syphilides, are most refractory to treatment; in these cases a mercurial ointment rubbed in locally will often hasten absorption. The white precipitate

ointment of the B.P. diluted with an equal part of lanoline, the mercurial ointment similarly reduced to half its strength, or the oleate ointment are suitable for this purpose.

Gummata.—Sometimes indolent gummatous ulcers are met with on the surface of the body, which do not respond to local treatment, such as scraping and the application of ointments. These will frequently take on a healthy action after one application of blistering fluid. If this fails surgical treatment, i.e. the excision of the whole ulcer with suturing of the edges may be tried, or, if too extensive for this, the surface should be refreshed with a sharp scalpel, and the cavity packed with some stimulating preparation, such as oil of turpentine.

Fitness for Service while under Treatment.—*At Home.*—As long as the primary sore remains unhealed the man should be kept in hospital to avoid the risk of infecting his comrades in the barrack room. With this exception it may be taken that, as a general rule, men undergoing treatment are fit for all duty at home, and indeed do much better if employed in the open air than if shut up in hospital. A few will require readmission, either on account of some infective lesion, such as mucous patches appearing early in the course of

treatment, or on account of some lesion like iritis, which demands indoor treatment; the percentage of readmissions is, however, small, and likely to become less with our increasing experience in the continuous treatment of syphilis.

Service Abroad.—With few exceptions syphilis will yield to careful treatment in any climate; if therefore energetic treatment has been carried out for at least two months, and the disease has yielded readily to this, there is no reason why a man should not be considered fit for service in most stations abroad; the main exception is West Africa, to which, because of its very debilitating climate, no man should be sent till he is looked on as cured. If, on the other hand, the disease does not respond to treatment, and the man has several readmissions for manifestations while undergoing treatment, it would not be wise to send him out of the United Kingdom.

Active Service.—To be passed fit for active service, a man should have completed one year under treatment and have been free from all signs of the disease for the previous six months. Under certain conditions this rule might be relaxed; thus, if the climate at the front is a good one like that of South Africa, and the man had completed six months'

energetic treatment without any fresh manifestation of the disease, he might be allowed to proceed, provided some arrangement existed by which treatment could be recommenced within three or four months. This might be managed by having one medical unit with each force equipped with the materials for injecting mercurial cream, and making the medical officer with the regimental unit responsible that the man attended.

Statistics of recent campaigns show that only a very small percentage of men are lost to the fighting strength of a force on account of syphilis, and it may be remarked that these figures refer to a period when the treatment of syphilis was not so thoroughly organized as it is now.

CHAPTER VIII

GONORRHOEA

GONORRHOEA is a specific disease caused by the gonococcus of Neisser, which usually invades the urethral mucous membrane during coitus. Before proceeding to discuss the treatment, a brief reference to the anatomy of the urethra, the general pathology and diagnosis of the disease is required.

Anatomy.—For our present purpose the urethra consists of two portions, viz. all in front of the constrictor urethra, which is spoken of as the anterior urethra, while that beyond this muscle is called the posterior urethra, and is continuous with the bladder when full. Along the upper surface of the anterior urethra are Littré's glands, and many lacunae which are especially numerous along the floor of the bulbous portion, while opening into the posterior are Cowper's glands, the ejaculatory and prostatic ducts.

Pathology.—Until Finger published his investi-

gations into the life history of the gonococcus within the urethra, the disease was looked on as an acute inflammation and treatment was accordingly directed to allaying this instead of attacking the gonococcus which causes the inflammation.

Finger showed that the gonococcus on gaining entrance to the urethra lodges on the mucous membrane and forms colonies; these multiply rapidly producing fresh centres which spread over the surface of the urethra, till at the end of a week or ten days from the date of infection the whole urethra is involved up to the commencement of the bladder and at the same time every lacuna and duct opening into the urethra is invaded, their lining membranes being affected in the way about to be described. As the gonococci grow they produce extremely irritating toxins; these cause considerable inflammation of the mucous membrane with oedema and increased secretion which appears as a clear mucoid discharge; as the disease progresses serous exudation, mucus, pus and epithelial cells combine to produce the familiar creamy discharge. The serous exudation welling up between the epithelial cells opens up a path along which the gonococci grow to reach the sub-epithelial layer; in this position they are to a very great extent protected from the

action of any medicament introduced into the urethra; obviously, therefore, if we can begin treatment before the gonococcus has gained a sheltered position, our task is much simplified; even if the gonococcus has penetrated the epithelial layer a vigorous attack may dislodge it, whereas if we adopt passive treatment and allow the germ to establish itself in the sub-epithelial layer of the urethra and ducts opening into it, the task of ejecting it becomes very much more difficult and indeed in some cases almost impossible.

During the early stages alcohol increases the oedema of the mucous membrane and so facilitates the passage of the gonococcus to the deeper layers, hence its extremely harmful influence on the disease. Active treatment by washing away the superficial gonococci and their toxins cuts short the acute stage of the disease. When the process of cure commences the gonococci from the deeper layers are carried to the surface in the serous exudation. Irrigation increases this exudation and at the same time removes the germs and their products. It is, however, very doubtful if any irrigation or injection will effectively penetrate the ducts opening into the urethra.

Gleet, i.e. chronic gonorrhoeal discharge shows

that the gonococci are still present and living somewhere in the urinary tract, most probably in the prostatic ducts or in one of the other ducts opening into the urethra or even in the sub-epithelial layer of the urethra. Alcoholic excess or sexual indulgence excites these foci to fresh activity and the disease may again assume the acute form. If the focus is situated underneath the urethral epithelium the consequent inflammation leads to the formation of fibrous tissue, soft at first, which is called a soft infiltration; later on this tissue contracts and a stricture is formed.

Some men respond rapidly to almost any form of treatment, while in others the disease is most refractory. Is not this difference to be explained by the presence of anti-toxins in the one case and their absence in the other? It seems possible that in the near future cases of chronic gonorrhoea will be treated on the lines of bacterial vaccination.

Diagnosis. Symptoms, Discharge.—*Early acute cases.*—When the disease comes under observation at an early stage, say three or four days after infection, the lips of the meatus tend to stick together and a bead of mucoid discharge can be expressed from the urethra; the man usually

complains of some tickling in the urethra but no definite pain.

Acute cases.—It is at this stage of the disease that the man usually presents himself for treatment. The urethral discharge is thick and yellow and micturition is extremely painful.

Sub-acute cases.—When the disease has progressed beyond the acute stage and is passing into the chronic one, there is a variable amount of watery discharge and micturition is not attended by discomfort.

Chronic cases (*Gleet*).—When the disease has reached the chronic stage there is usually a bead of clear discharge when the man gets up in the morning, sometimes this may continue all day ; there is no pain on passing water.

Microscopic Examination of the Discharge.—In every case of gonorrhoea coming under treatment for the first time, the discharge should always be examined microscopically in order to confirm the diagnosis and to obtain further evidence as to the stage which the disease has reached. For this purpose a minute bead of the discharge is spread out on a cover glass or slide and a smear preparation made just as in the case of a blood film ; when the discharge is very scanty care must be taken not

to press the glass on to the glans penis as if this is done numerous other germs are picked up and may obscure the gonococci. It may even be necessary to pass a loop of platinum wire into the urethra in order to obtain a specimen of the discharge. When there is no visible secretion but gonorrhoea is suspected, the man should be made to pass water into a urine glass. After standing for some time any mucus or sediment present is to be centrifuged and the deposit stained for gonococci.

Staining.—For ordinary routine staining of gonorrhoeal pus, a saturated watery solution of methylene blue is the best stain. When the gonococci are relatively scarce, Schütz's stain may be used as a differential one or, if greater accuracy is required, Gramm's method should be employed, the gonococcus not being Gramm-fast. No staining method can be absolutely relied on to prove the absence of the gonococcus, and if this point is of very great importance, cultivation must be resorted to; this is, however, troublesome and not practicable for the ordinary surgeon.

Schütz's stain.—Make a saturated solution of methylene blue in a 5 per cent. solution of carbolic acid. Stain the film in this for 5 to 10 minutes, and wash in water. Then dip the film for 3

seconds in a mixture of 5 drops of strong acetic acid in 20 cc. of distilled water, and wash in water. All organisms except the gonococcus are decolourized. Counterstain lightly with a dilute solution of aqueous safranine. Gonococci and epithelial cells are stained blue, pus cells and their nuclei salmon coloured.

Early acute cases.—The discharge from these cases, when examined microscopically, is found to consist of epithelial cells, very few or no pus cells and quantities of gonococci, the pairs lying scattered all over the field. The prognosis in these cases is good.

Acute cases.—In these the pus cells are abundant, occupying the whole field. The gonococci are mostly found in circular groups as if some body were present which had caused them to undergo a positive agglutination ; very few pairs are found free. Some of the gonococci forming the groups appear to lie within the leucocytes, but most of them outside ; epithelial cells are few in number.

Sub-acute cases.—Pus and epithelial cells are the principal constituents ; the gonococci are few in number and lie free, no longer in groups.

Chronic cases and threads.—In the gleety discharge, threads and sediment obtained from the urine we find mucus the predominating characteristic, pus

cells are numerous, epithelial cells less so, while the gonococci are very scarce, indeed a prolonged search may be necessary in order to detect a single pair.

Differential Diagnosis.—When a man presents himself with a thick purulent discharge escaping from underneath a long inflamed foreskin, the question at once arises as to whether we are dealing with balanitis or gonorrhoea. A smear of gonorrhoeal pus will present the characters described under those of the acute case, while if the disease is not of a gonorrhoeal nature the film shows in addition to quantities of pus cells a large variety of other germs, the most noticeable among which is a short thick bacillus and some large diplococci which might be mistaken for the gonococcus.

In a few cases, especially if instruments have been used without sufficient precautions, a purulent discharge will be found to contain staphylococci or streptococci.

A simple urethritis, that is a purulent urethral discharge which does not contain any pyogenic germs must be rare in soldiers, as after examining several hundred specimens from different cases only three instances of this were noted.

Examination of the Urine.—Inspection of

the urine gives a fair idea of the extent to which the urethra is affected (a most important point in the treatment); and in chronic cases which have no discharge from the meatus, such as those admitted for epididymitis, examination of the urine will often enable us to determine the presence of a chronic gonorrhoea.

The examination is carried out by means of "Thompson's two glass test," as follows :—Give the man two urine flasks—ordinary tumblers do well or, at a pinch, the large bottles in which drugs are supplied may be used—tell him to pass four to six ounces of urine into the first glass and his remaining urine into the second. Take hold of these glasses by their upper portions and look through them at a window. The first glass contains, in addition to the urine from the bladder, the washings of the anterior urethra, while the second one has the secretion from the posterior urethra. The first glass, therefore, gives some idea of the state of the anterior urethra, and the second one that of the posterior urethra. If possible, the urine which is passed on first rising in the morning should be seen, as this contains the accumulated secretion of the night. Some plan of preventing exchanges of urine among men in military hospitals must be employed, for a man anxious to

get out of hospital will by arrangement produce perfectly clear urine. The simplest plan is to make the men pass their water one at a time in front of the wardmaster, who then locks it up pending the medical officer's arrival. At late stages of the disease, when the secretion is scanty, the urine, if sufficiently dilute, will appear to be clear, a fact which the soldier soon learns. Before discharging a man, it is well to make him pass water in the presence of the medical officer himself, so that there may be no possibility of trickery.

One or two fallacies in the two glass test must be mentioned. A mild degree of posterior urethritis may simulate an anterior urethritis, as the small quantity of secretion in the posterior urethra is passed into the first glass leaving the second one clear. Should this be suspected, the urethra is to be syringed out before applying the test, any turbidity present will then have come from the posterior urethra. In very acute cases of gonorrhoea, all the pus in the anterior urethra may not be washed out into the first glass and so cause a turbidity in the second one.

Phosphaturia will cause a turbidity which, however, clears up at once when a drop of acetic acid is added.

Bacilluria will cause a slight degree of cloudiness

in the urine ; the microscope will reveal the true cause.

Many degrees of turbidity are met with, not only when the man first comes under observation, but also as the disease progresses and the result of the treatment becomes apparent. Some kind of note should be kept of the condition of the urine, as it forms one of the most important guides to treatment. We are therefore confronted with the problem of finding such simple terms as will convey to our minds what the condition of the urine was when last seen. The following terms have been used for two years and found to answer fairly well, they are therefore given as a suggestion.

Turbid.—Applied to a very opaque urine found in well-established acute cases.

Cloudy.—A urine sufficiently dense to prevent objects such as the window bars being distinguished when looked at through the urine ; this is the condition most commonly found in gonorrhoeas of moderate severity.

Hazy.—A urine of such density as only to permit of window bars being indistinctly seen when looked at through the urine.

Clear.—Applied to any urine when the bulk of it is clear (there may be threads or mucus in its lowest portion).

In addition to the above terms which describe the general condition of the urine with sufficient accuracy, other terms are required to denote the varying conditions of mucus so frequently found in gonorrhoeal urine. The following have been used satisfactorily.

Mucus (abbreviation = M *). Used when mucus is present, but of no definite appearance or character; this means a catarrhal condition of some portion of the urethra resulting either from the irritation of the disease or from a too prolonged treatment.

Flocculent mucus (abbreviation = FM). This term is used to denote a urine which contains quantities of fine particles of mucus floating evenly distributed throughout the specimen like snowflakes or minute granules of boiled sago. This condition is usually found in the urine of a man in whom treatment has been suspended too soon and is the first sign of a relapse.

Mucous cloud (abbreviation = MC). This term is applied to the well-defined rounded mass of semi-transparent mucus containing threads and generally found floating at the lower part of the glass like a

* The abbreviations save writing, when recording the daily changes in the urine.

miniature cumulus cloud. It occurs in chronic cases, rarely contains any gonococci and but few pus cells ; probably it is derived from the prostate, it is very persistent.

Mucous deposit (abbreviation = MD).—This is a thick even layer of mucus and pus filling up the lowest portion of the glass. It is of frequent occurrence during hot weather and in these cases the disease is generally very resistant to treatment ; if examined microscopically it is found to contain numerous pus cells, gonococci and phosphatic crystals.

Threads (*also called floaters*).—These are found in the chronic stages of the disease in clear or nearly clear urine, sometimes they subside to the bottom of the glass and are only seen when the urine is shaken up. The easiest way to obtain a specimen is by catching one in the point of a pipette and transferring it to a slide where the urine can be drained off. The true thread is a cast of one of the follicles opening into the urethra ; coarser stringy particles of mucus are also found which are not true threads.

Endoscope and diagnostic bougie.—When a case of anterior urethritis has reached the chronic stage and failed to respond to treatment, the explanation is

usually to be found in the existence of a chronic inflamed patch of mucous membrane, an inflamed follicle, a tiny ulcer or what the Germans call a "soft infiltration" or a definite stricture. The urethra is to be examined by means of the endoscope or diagnostic bougie. This bougie has an acorn-shaped head, the blunter end of which is attached to the stem, so that it will readily pass beyond an early narrowing of the urethra, but when being withdrawn the shoulder, on meeting any constriction, conveys sense of resistance to the hand. By measuring the distance of this spot from the meatus, its position can be located; an ulcer or tender spot may be found in a similar way.

Two patterns of endoscope are used, those in which a light is reflected into the urethra and those in which the lamp is passed down the cannula. The first kind enable instruments to be used through the cannula, but do not give a very good illumination; some of these are made to allow of the urethra being inflated in order to detect early infiltrations. If Valentine's pattern is used, the instrument must be passed into the urethra for its whole length before withdrawing the guard, the urethra is then to be dried out with a swab and the lamp passed. The urethra is viewed as the instrument is with-

drawn ; it must never be passed into the urethra without the guard being in position. When seen through the endoscope, the normal urethra presents a pale pink to red rosette, the numerous rugae running towards the centre and completely obliterating the canal. In the condition called soft infiltration, only one or two deep grooves are visible, the mucous membrane looking smooth and tense ; when a definite stricture has formed, the canal remains patent. Infected follicles stand up like bright red rosebuds.

Treatment.—The question of treatment may be dealt with under the following headings—

(1) General management of the case ;

(2) Drugs ;

(3) Methods of urethral medication.

(1) General Management.—It is usually recommended to keep the patient in bed for the first week or so ; Finger does not endorse this advice ; as he says that a gonorrhoeal patient kept lying idle in a warm bed is very prone to suffer from nocturnal erections which have a most harmful influence on the disease ; he recommends gentle walking exercise, and keeping the man employed, provided his work does not demand much physical exertion.

Diet. This should be light and plain, the following

articles being forbidden: alcohol absolutely, all spices, rich dishes, coffee, asparagus, pickles and acid fruits.

The bowels are to be kept freely open: the urine should be rendered dilute and unirritating, for which purpose barley water in large quantities is to be given.

Hot baths are comforting and exercise a beneficial effect on the early stages of the disease.

The patient must be cautioned as to the danger of infecting the conjunctivae. Some plan should be adopted to prevent the discharge from soiling the clothing; placing cotton wool under the foreskin is not sound, as it tends to retain the discharge. A better plan is to make a loosely fitting cover for the penis with some absorbent material to project beyond the end of the penis and so hold the discharge.

(2) *Drugs.*—These may be divided into (1) For internal use, and (2) for local use in the urethra.

The drugs which are supposed to have a specific action in gonorrhoea are: sandal wood oil, cubebs oil, balsam of copaiba and turpentine; all of these, but especially turpentine, are inclined to upset the digestion. Less nauseating and probably more effective in the acute stage of the disease are urotro-

pine, salol, salicylate of soda, boric acid and benzoate of ammonium or benzoic acid : the latter is especially indicated in cases which have the thick mucous deposit with phosphatic crystals. Fournier recommends full doses of the balsams during the stage of decline and at the same time limits the quantity of fluid swallowed so as to concentrate the active principles of the balsams in the urine.

The remedies which have, at different times, been recommended for urethral injections during gonorrhoea are so numerous that only a few of the more recent ones, which have established a definite claim to consideration, will be noticed here.

Potassium permanganate.—This is cheap and in early cases a very effective drug. It can be used as an injection, $\frac{1}{8}$ gr. to the ounce, or, as an irrigation, 1 gr. to the pint in early cases, and up to, but never exceeding, $2\frac{1}{2}$ grs. to the pint in later cases. This drug is less irritating than any of the silver preparations, and provided the disease has not attained the chronic state, will nearly always yield good results.

The most powerful agent we have for killing the gonococcus is nitrate of silver; unfortunately this drug is very irritating to the mucous membrane (unless used in very dilute solutions), and it precipi-

tates in the presence of the sodium chloride in the urine losing much of its therapeutic value. The newer silver preparations (combinations of nitrate of silver with organic substances) are very effective in destroying the gonococcus and are without the disadvantages of nitrate of silver. The best known of these salts are protargol, albargin, icthargan, argonin, largin, argentamine and argyrol.

Protargol. This salt is generally used for injections. Neisser recommends beginning with a solution of 1 gr. to the ounce and gradually increasing this up to 4 or even 8 grs. to the ounce. It can also be used for irrigating the urethra, 10 to 20 grs. being used to the pint of water. It is to be dissolved in cold distilled water. If hot water is used, the salt is liable to break up and become inert.

Largin may be used in the same strength and for the same purpose as protargol.

Argyrol contains a very large percentage of nitrate of silver and can be used for injections in strengths of 5 to 20 per cent.; it has been very well spoken of, but its cost is prohibitive for army purposes.

Albargin and icthargan are mostly employed for irrigations, $2\frac{1}{2}$ to 5 grs. being used to a pint of water. They are specially indicated when the acute stage

has passed off, but may be used at any time, if they cause the patient no discomfort. They are very much more expensive than the permanganate; hence for economical reasons it is well to begin with the permanganate and keep the expensive silver salt in reserve till the permanganate has had a fair trial.

Nitrate of silver.—This salt has been used as an injection in very early cases in 1 to 2 per cent. solutions with the idea of aborting the disease; the treatment is, however, very painful and the results are uncertain. One to $2\frac{1}{2}$ grs. to the pint of water forms a useful solution for irrigating chronic cases with. It is also used in 1 to 2 per cent. solutions for the treatment of local lesions in the urethra, being applied by means of Guyon's syringe. The other silver salts do not seem to have held their position as medicaments. A few other drugs may be mentioned, such as picric acid; this was recommended as an injection, 1 to 2 grs. to the ounce being used; it has been reported to cause excessive secretion. Formalin 2 to 5 minims to the ounce, and icthyol in 1 to 2 per cent. solution, have also been well spoken of.

To deal with the catarrh which sometimes remains after the gonorrhoea has been cured, astringent

injections are employed. A few formulae are given in Appendix VII.

Methods of Urethral Medication.—These may be roughly classified as (1) small syringe, (2) large syringe, (3) irrigation, (4), by means of instruments.

(1) *Small Syringe Method.*—The syringe should have a blunt cone-shaped nozzle, so as not to penetrate the urethra, and a capacity of $\frac{1}{3}$ to $\frac{1}{2}$ oz. It should be disinfected each time after use. For *anterior urethritis* Neisser and Finger both favour this method, using protargol. They, however, strongly insist on the following points being observed : (*a*) The injection must be of sufficient volume to gently distend the mucous membrane, and thus allow the solution to get into contact with every portion of its surface ; about one-third of an ounce is the quantity usually required. (*b*) The injection must be retained for some time ; Finger directs that *each* injection be held for two minutes on the first day, three on the second, increasing the time daily up to fifteen minutes. (*c*) At least three injections should be given daily, at intervals of eight hours, say at 6 a.m., 2 p.m., and 10 p.m. (*d*) The strength of the solution should be as much as the patient can tolerate.

(2) *The Large Syringe Method.*—This method

may be used for either anterior or posterior urethritis. It is somewhat tiring for the medical officer and soils his hands, but gives good results. A four or six-ounce metal syringe, an ordinary ear syringe answers fairly well, to which a blunt rubber nozzle is attached, is filled with solution selected. With his left hand the surgeon seizes the man's glans, while with the right he presses the nozzle of the syringe into the meatus. With a short, sharp push the urethra is fully distended, and the fluid immediately allowed to escape by withdrawing the syringe. This is repeated till the syringe is empty. Should it be desirable to inject the bladder, first wash out the anterior urethra, then refill the syringe, and maintain steady pressure till the sphincter yields, allowing the fluid to run into the bladder. After a few minutes the man should be told to empty his bladder into a glass vessel, and show this to the surgeon.

(3) *Irrigation Method.*—Apparatus required : An irrigator can, or better, hanging glass vessel, with five feet of rubber tubing, a push stop-cock, and a Maiocchi's double-channel glass nozzle. The irrigator should be five feet above the man's penis ; when the anterior urethra is being irrigated, reduced pressure may be used by only opening the stop-

cock half-way, or if no stop-cock is employed the rubber tube may be partially compressed by the fingers, while if it is desirable to fill the bladder, the tap should be fully opened. In acute cases the best and cheapest solution to use is potassium permanganate, beginning with 1 grain to the pint and never exceeding 2½ grains to the pint. The solution should be about body temperature, and the irrigation employed each morning, or, if no discomfort is experienced by the patient, a second irrigation may be given in the evening.

To apply this treatment the surgeon, wearing a mackintosh apron, should be seated opposite to the patient, and the latter's penis pulled through a hole in a piece of waterproof reaching down to a slop bucket. Turn on the tap, and wash the glans thoroughly, then, keeping the tap open, slowly apply the nozzle to the meatus, and, increasing the pressure by opening the tap a little more, allow a pint of fluid to run through. The fluid will run up to the sphincter, but usually not beyond as long as the outflow tube is left open ; if it is desired to fill the bladder, close the escape tube by pressing the finger on it, and tell the patient to try to pass his water ; this relaxes the sphincter and allows the fluid to flow into the bladder. When the man

feels that his bladder is full, shut off the stream, and let him empty his bladder into a glass vessel. Note how much he can hold comfortably, and whether the solution shows much change as the result of having been in his bladder. The irrigation (as also the large syringe injection) thoroughly washes out the urethra, carrying away all gonococci lying on the surface and in the folds of the mucous membrane. It also has the effect of massaging the epithelium, which subsequently sets up a certain amount of oedema and serous exudation in which the deeper-lying gonococci are carried to the surface. Occasionally, marked oedema of the penis may occur; this will subside if left alone. Irrigation may be employed at any stage of the disease, and is not contraindicated by epididymitis.

(4) *By means of instruments.*—For chronic cases, in which the above plans have failed to obtain a cure, one of the following is to be tried—

Bougie.—Passing a large bougie sometimes has an excellent effect on a chronic case, although it is not quite clear why this should be so, for any instrument which will pass through the meatus is not large enough to stretch the urethral mucous membrane.

Dilators.—The expanding dilators are made of

such a size that, when closed, they will pass through any ordinary meatus, but when in the urethra can be expanded, so as to thoroughly stretch the mucous membrane. Kollmann's pattern is designed to allow of flushing the canal with the dilator expanded and in position.

Guyon's and Ultzmann's instillations.—Both of these plans consist in introducing a few drops of a strong solution of nitrate of silver into the urethra at the site of any inflamed patch. In both a syringe and catheter are used, the eye of the catheter is brought as nearly as possible over the spot and, by means of a screw piston, one or two drops of the solution are allowed to escape. The apparatus may be improvised by using a fine soft catheter and a hypodermic syringe.

Endoscopic medication.—When the endoscope reveals an inflamed patch, local applications may be made by means of a swab through the cannula of the instrument. Text-books also describe the destruction of inflamed follicles by means of the electric cautery or slitting these up with a specially designed knife.

Prostatic massage.—When the gonococcus has succeeded in establishing itself in the prostatic ducts, the only possible way of getting rid of it from

this situation is by massaging the prostate. This can be done by inserting the finger into the rectum and expressing the contents of the prostatic follicles ; the bladder should first be filled with some antiseptic solution. An electric masseur has been invented for this purpose, but beyond being cleaner it is doubtful if it offers any advantage.

Selection of Method and Drug.—Having determined the extent of the urethra affected and the stage of inflammation which the disease has reached, the surgeon has to decide with what drug, and by what method, he will attack the gonococcus. Experience will soon lead him to adopt one or other method, but for the guidance of those who have not had much to do with the treatment of gonorrhoea, the various conditions likely to be met with are enumerated below, with treatment suitable to each. It may be remarked here that the treatment of many cases of gonorrhoea is most disappointing and that the surgeon will occasionally almost despair of ever effecting a cure in certain obstinate cases.

Anterior Urethritis.—*Early acute*, cases in which the discharge has not yet become definitely purulent, may be treated by (1) Injections. Begin with one grain of protargol to the ounce and increase the strength daily till 4 or even 8 grs. to the

ounce is being used; the increase is to be made according to the patient's sensations when the injection is being made, thus if there is no pain the strength can be increased, but the man should never suffer acute pain as the result of the injection. The injection is to be made at least three, or, better, four times in the day and each injection is to be held as long as the patient can bear it.

(2) Large syringe. The anterior urethra can be washed out by means of the large syringe at least twice daily, using potassium permanganate 1 gr. to the pint.

(3) Irrigation. Half to one pint of a solution of 1 gr. to the pint of potassium permanganate may be used as an irrigation in the morning, or again in the evening, or even three times in the day, if the patient experiences no discomfort. An irrigation in the morning, followed by one or two injections in the evening, often acts very well. When dealing with soldiers, the irrigation treatment yields better results than either of the syringe plans.

Acute stage (with purulent discharge and turbid urine in the first glass). The ordinary case of gonorrhoea may be treated as detailed under the early acute stage. Occasionally one meets with an excessively acute form in which the discharge is profuse and

possibly blood-stained, the penis is swollen, the man looks decidedly ill and complains of intense pain on attempting to pass water. In such a case it is hardly wise to apply any treatment which involves much mechanical disturbance of the urethral mucous membrane ; any local treatment employed should be merely for the purpose of facilitating the escape of the pus, for example injections of warm water or weak permanganate solution given very gently and only penetrating a short way into the urethra. The treatment should be restricted to making the urine as unirritating as possible by giving large quantities of fluid to drink together with alkalies, infusion of buchu, etc. Morphia suppositories relieve the pain to a great extent. Hot hip baths also have a beneficial effect. Ice bags may be applied to the penis. Should retention occur, a full injection of morphia into the perineum with the addition of adrenalin, and followed by a hot bath, may succeed in reducing the swelling sufficiently to permit of the bladder being emptied. If a catheter has to be passed, and this should if possible be avoided, a urethral injection of a 10 per cent. solution of cocaine with a few drops of adrenalin should be given a quarter of an hour before passing the instrument. In a day or two the intensity of

the attack should have sufficiently diminished to permit of the ordinary treatment being resumed.

Sub-acute stage (in which the discharge is thin and watery, pain absent or slight, and the first glass only very slightly clouded). Injections of protargol beginning with 2 grains to the ounce, irrigations of potassium permanganate 2 grains to the pint, or better irrigations with albargin beginning with $2\frac{1}{2}$ grains to the pint and increasing to 5 grains to the pint. The large syringe if preferred may be used instead of the irrigation apparatus.

Chronic stage (with no pain on passing water, a gleety discharge and a clear urine containing a little mucus and threads).

Injections of protargol 4 to 8 grains to the ounce may be tried; or irrigations with albargin 5 grains to the pint, or nitrate of silver 1 to 2 grains to the pint. These plans of treatment may be successful, but frequently something more will be required. If available the endoscope should be employed, in order to determine what particular condition is keeping up the discharge. If an infected follicle is detected, one of the expanding dilators is to be used, or a large bougie passed, and immediately afterwards an injection or irrigation employed in order to wash away the gonococci which have

been expressed. If the surgeon possesses the requisite means and skill, the follicle should be slit up or destroyed by means of the galvanic cautery. An ulcer if present should have a strong solution of silver nitrate (4 to 10 grains to the ounce) applied to it by means of one of the instillation plans. Soft infiltrations require stretching preferably with the expanding dilator.

It should be remembered that a chronic mucoid discharge may be set up as the result of irritation, the irritation being a consequence of the disease or of a too prolonged treatment ; if so definite threads are not likely to be found.

Posterior Urethritis.—(Both glasses show more or less turbid urine, the first usually more so than the second.)

When the whole urethra is affected the small syringe is useless, as the fluid injected does not reach the posterior portion, or if it does the quantity is quite insufficient to influence the course of the disease.

During the acute stage the urinary antiseptics, such as urotropine, should be given ; when the subacute stage is reached the balsams are to be preferred ; the active principles of all these drugs being excreted by the kidneys act on the gonococci while the urine lies in the bladder.

Acute stage.—Irrigations with potassium permanganate 1 to 1½ grains to the pint; the anterior urethra is always to be well flushed out first, then closing the out-flow fill the bladder as full as the man can comfortably bear. After a few minutes the man should empty his bladder into a glass vessel and show the contents; at first while the disease is acute the fluid returned has a turbid brown appearance, as the disease subsides the fluid returns nearly in the condition in which it was introduced. The large syringe (Janet-Franck) may be used in the same way, first washing out the anterior urethra and then filling the bladder; it is, however, a very tiring method for the medical officer if many cases have to be treated.

Subacute stage.—The same methods as above, using potassium permanganate 1½ or 2 grains to the pint, or better albargin 2½ to 5 grains to the pint. The other silver salts, such as icthargan in the same strength as albargin, or protargol 10 grains to the pint, may be used if desired.

Chronic stage.—The same methods as above, using albargin 5 grains to the pint, or nitrate of silver 2 grains to the pint should be tried. If these fail after a fair trial, the prostate has probably become affected, and prostatic massage should be

employed immediately before or after filling the bladder with a solution of some preparation of silver nitrate.

Complications Anatomical and Functional.—*Phimosis.*—A long foreskin, if inflamed and swollen, prevents proper treatment being carried out by making the meatus inaccessible. In these cases the disease is usually well established, hence it is wiser to try to reduce the inflammation sufficiently to expose the meatus rather than to slit up the foreskin ; a fresh wound exposed to gonorrhoeal discharge does not heal nicely, and as the parts are tender the patient objects to the manipulation necessary in using injections or irrigations. A narrow meatus prevents the free escape of the discharge and may even interfere with injections · it is questionable, however, whether the meatus should be slit up.

Irritable sphincter.—In some men the urethra and sphincter are so sensitive that any attempt to irrigate produces a spasmodic contraction. This irrita bility generally passes off in a few days, but in very early cases where it is important to begin the treatment as soon as possible, an injection of cocaine may be given to permit of the first one or two irrigations being carried out.

Penile oedema.—This occasionally follows the use of irrigations; it comes on suddenly soon after the treatment has been applied. If left alone it will subside in a day or two, and treatment can then be resumed.

Haematuria.—This is sometimes seen after irrigations and is generally of mild degree. If it occurs it is wiser to suspend the irrigations till all traces of blood have disappeared from the urine. Occasionally it may be quite marked, and is then almost certainly due to cystitis.

Chordee.—In cases treated by irrigation this complication is rare. When the spasm is actually present the time-honoured practice of applying cold water affords considerable relief. In order to prevent a recurrence full doses of potassium bromide by day with a morphia suppository at bed-time should be tried.

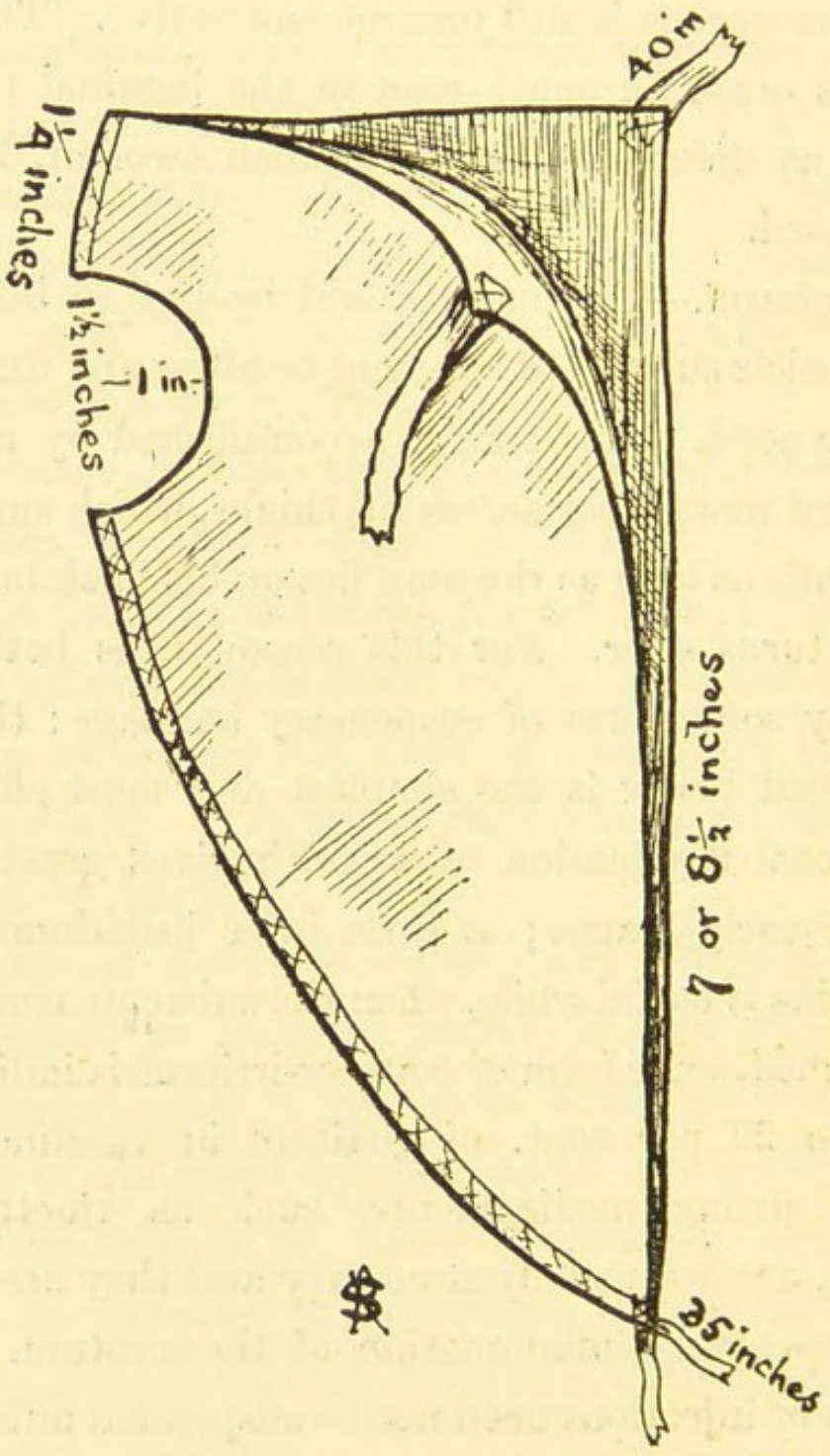
Nocturnal Erections.—These are somewhat common when the posterior urethra is affected, and are a frequent cause of persistent acute inflammation, owing to the great hyperaemia of the parts annulling the effects of local treatment. Treatment must be directed to preventing the occurrence of erections by giving full doses of sedatives, especially potassium bromide.

Complications due to Extension along the Natural Passages.—*Epididymitis.* — This may occur at any time after the posterior urethra has become infected ; frequently an epididymitis coming on without obvious cause is the first indication that the gonococcus is still present and active. The first sign is often an acute pain in the inguinal region. The vas deferens is at first much swollen, knotty and hard.

Treatment.—The man should be put to bed and the testicle supported so as not to allow any dragging on the cord. This can be accomplished by placing a folded newspaper across his thighs, which supports the testis as long as the man lies on his back but fails if he turns over. For this reason it is better to employ some form of suspensory bandage : the one described below is the simplest and most efficient. The local application of warmth gives great relief in the early stages ; a little later belladonna and glycerine is useful while, when the subacute condition is reached, some form of counter-irritant is indicated. Ten to 20 per cent. of guaiacol in vaseline does well ; strong medicaments, such as tincture of iodine, are not usually necessary and they are liable to cause severe inflammation of the scrotum. Irrigation or injections need not be suspended unless the

testis is so painful as to prevent the man leaving his bed without great discomfort. Internally the urinary antiseptics should be given in full doses.

Horand's Suspensory Bandage.



Lower point.

N.B.—This diagram shows the bandage folded.

This is cut out of calico, and is usually made in two sizes, the measurements of which are noted on the diagram. The double line on the curved margin shows where the two halves are joined to complete the bandage. A broad tape is sewn to each of the upper points and two finer ones to the lower point.

To apply the bandage.—Place the lower point under the scrotum, carry the finer tapes backwards, round the thighs, and tie off in front of the abdomen. Next raise the swollen testicle as high as it will go, and support it with one hand, using the other to place as much cotton wool under the testicle as is necessary to keep it in this position. Bring the bandage over the whole, passing the penis through the aperture left for it ; pass the broad tapes round the waist and tie off in front. The smaller tapes should then be interlaced with the broad ones and retied, as they have a tendency to slip down. A little more wadding may be required at the sides to adjust the pressure evenly.

Abscesses.—These probably arise owing to the duct of an infected gland becoming blocked and so preventing the escape of the inflammatory products.

They may occur in the penis, one of Littré's glands being the starting point ; or in the perineum, due to infection of Cowper's glands ; or the prostrate itself may be the seat of suppuration. Wherever situated they are to be opened as soon as pus is detected and drained in the usual way ; it is of interest to examine

the pus for gonococci, as these are commonly found. A urethral fistula does not usually remain.

Bubo.—These occur occasionally in connexion with gonorrhoea, and are to be treated in the usual way; gonococci are not often found in the pus, at least by microscopical examination. Many of the so-called non-venereal bubos are probably due to old encysted gonococci, at least the frequency of a history of gonorrhoea is somewhat striking.

Cystitis.—This occurs to a greater or less extent whenever the posterior urethra is affected, but does not demand any special treatment. Very rarely the gonococcus invades the ureters and even reaches the pelvis of the kidney, giving rise to a pyelitis with considerable constitutional disturbance. Should this happen the man is to be kept at rest in bed, placed on milk diet with barley water, etc., and all treatment except the administration of urinary antiseptics suspended.

Venereal Warts.—These have been ascribed to the irritation caused by gonorrhoeal discharges and some authorities even go so far as to say that the presence of venereal warts is diagnostic of gonorrhoea; this is much too sweeping a statement to make. The little growths are most commonly found in conjunction with phimosis, and it is difficult, if not

impossible, to cure them permanently unless the foreskin be removed. This is one of the first steps which should be taken. As regards the local treatment of the growth, if they are pedunculated, as is frequently the case, the pedicle may be snipped through and the base touched with an escharotic, liquefied carbolic acid being the most generally useful drug. If the warts consist of masses of sessile-strawberry-like growths the attempt to remove them surgically is always unsatisfactory. Portions may be removed under cocaine and adrenalin anaesthesia or a ligature may be temporarily applied to the penis, as the growths are very vascular and the bleeding obscures the parts to be operated on. If the patient is not pressed for time he can attend twice or three times a week as an outpatient and have some medicament applied. Nitric acid is very painful, glacial acetic acid is not pleasant, carbolic acid is not painful but does not penetrate sufficiently and takes a long time to effect the destruction of any large mass. Copper sulphate, caustic potash, washing soda in crystals and a large variety of substances have been recommended at different times. The most satisfactory application is equal parts of liquor epispasticus and tincture of iron. Whenever any irritating preparation is used on or near

the glans penis it is always advisable to cover the surrounding surface with a layer of vaseline or other greasy substance, as this prevents any extension of the irritation.

Spread of Infection by means of the Blood Stream.—The gonococcus occasionally gains admission into the circulation and sets up a true septicaemia. The parts most commonly attacked are the joints, giving rise to a subacute arthritis of very obstinate nature. Gonococci have been found in the fluid withdrawn but are not plentiful. As to treatment no drug appears to have any special action; it is as well to treat the urethral focus, if any evidence of the presence of the gonococcus can be found there, and to continue the administration of urinary antiseptics. Locally, a counter-irritant or heat is to be employed.

Any portion of the body may be attacked and such conditions as iritis, phlebitis, endocarditis have been shown to be due to the presence of the gonococcus.

Gonorrhoeal ophthalmia.—This condition requires immediate treatment, hence if suspected the pus should be examined microscopically for gonococci and in the meantime treatment should be begun. Nitrate of silver is the most efficient

drug, but on account of the extreme irritation it causes must be used in very dilute solution, such as half a grain to the ounce of distilled water. The solution requires to be used frequently, say, every quarter of an hour by day and at least two hourly by night. Better results are obtained by using one of the newer silver salts such as protargol 1 grain to the ounce or albargin $\frac{1}{4}$ grain to the ounce, every half hour by day and every two hours by night. Much of the success depends on the thoroughness with which the washing out is done : the solution must be made to penetrate into every corner of the conjunctival sac and the margins of the eyelids require special attention. If the disease has become fully developed when the case is first seen heroic measures are excusable in order to save the eye : cocaine may be applied to make the surface insensible, and then a 1 per cent. solution of silver nitrate, or 2 per cent. protargol or a $\frac{1}{2}$ per cent. albargin solution used for the first two or three applications, after which the weaker solutions should be employed.

Test of Cure.—How is one to know when a man is cured of gonorrhoea ? This is always a very difficult question to answer, in fact it used to be said in Germany that every attack is curable with the exception of the first ; this is of course an exaggera-

tion, but it emphasizes the difficulty of the question. No infallible test has yet been devised. The ancient test of squeezing the pipe to produce a drop of discharge is absolutely useless, as can be easily shown by applying the "two glass test" to a number of men who fail to produce any secretion after vigorously squeezing the penis.

The following plan will suffice in most cases, although it is by no means free from error. When the urine has been clear and free from threads for two days, stop all treatment for another two days. If still satisfactory put the man on full diet with beer and if possible also pickles and employ him on all fatigues. If the urine is still free from evidence of disease at the end of at least four days of this regimen, the man may be discharged as cured. If threads persist one of these should be fished out and examined microscopically for gonococci; failure to find these does not prove their absence, and if many pus cells are present a strong suspicion may be entertained that some are still lurking in the recesses of the urethra or its accessory glands. An injection of a 1 per cent. solution of nitrate of silver may then be tried; this will produce a free discharge, in which the gonococci may be detected. If the question is of great importance cultivations should

be made from the discharge; this requires a skilled bacteriologist.

Recapitulation of the Main Points in Treatment.—Gonorrhoea is caused by the gonococcus, remove this and the disease ceases. The gonococcus at first is on the surface and open to attack.

Don't wait till it has established itself in the sub-epithelial layer and has to a great extent become protected from the action of any medicament introduced into the urethra.

The secret of obtaining rapid cures is early treatment, therefore impress on every man that, if he has exposed himself to infection, he is to report sick, if he has any *suspicion* of having contracted gonorrhoea. From the fourth to the eighth day after infection, each day passed without treatment means one to three *weeks* longer in hospital. See each man's urine daily (not another man's, as the soldier will show this if he thinks he can get out of hospital by means of this trick) and vary your treatment according to the state of the urine, taking into consideration any pain which the man may have suffered.

Weak solutions used frequently are preferable to strong ones at longer intervals. Do not order

treatment too strong or too long; if the results are disappointing, try a few days' complete rest. Before discharging a man as cured, apply some test to make sure that the disease has been eradicated.

If a true relapse takes place, the gonococcus has been lying latent in one of the accessory glands, most probably the prostate.

Fitness for Active Service.—When examining soldiers as to fitness to proceed on active service, the medical history sheet is of course seen. If this shows repeated entries for gonorrhoea, it is as well to enquire as to any indications of stricture and even to pass a bougie. If, however, there is only one, or at most two entries and the man has been doing full duty for at least three months, no further notice need be taken. In the case of a recent admission for gonorrhoea, in which the man has been less than three months out of hospital, it would be advisable to see a specimen of his urine and make certain that the disease has been cured.

Medical officers in charge of cantonment hospitals in India are likely to have under their care women suffering from gonorrhoea; for their benefit these notes are given.

Gonorrhea in the Female.—*Diagnosis.* In acute cases with free discharge this is a simple

matter as the microscope will reveal the presence of the gonococcus in the pus. In the chronic case, however, the diagnosis is often most difficult as there is little or no sign of the disease, which nevertheless is capable of infecting any man who consorts with her. The gonococcus selects the urethra and cervix uteri in the female, hence any discharge from these openings should be most carefully examined microscopically; if no discharge is visible, a platinum loop may be passed into the canals and some of the secretion examined; the most likely time to find the germs is at the end of menstruation, when the superficial epithelium is being cast off. Even then the gonococci are few and far between and may not be detected; if the diagnosis is of great importance, a portion of the membrane must be sent to a bacteriologist for culture tests.

Treatment.—The vagina should be douched out two or three times a day to remove any discharge, using a mild antiseptic lotion, such as boric, permanganate of potassium or one in a thousand nitrate of silver. The most important thing is, however, to destroy, if possible, the gonococci in the urethra and cervix; for this purpose swabs on a long probe dipped into a 1 per cent. solution of silver nitrate, or 1 per cent. protargol, or 1 per cent. albargin solu-

tion, or a favourite application on the continent is ammonium sulpho-icthyol, are to be passed into the urethra and cervix, and as far as possible brought into contact with every portion of the mucous membrane. The application is to be made daily or, if this causes too much pain, every second day, and continued till the secretion fails to show any gonococci for at least a week ; the woman may then be regarded as cured.

CHAPTER IX

SOFT CHANCRE—CHANCROID—THE VENEREAL SORE

THE soft chancre is a contagious ulcer of the genitals caused by the inoculation of the bacillus of Ducrey ; it is auto-inoculable in contradistinction to the hard sore ; it may become phagedaenic, especially if situated under a long foreskin.

Diagnosis.—This may be established by inoculating the patient with a little of the discharge. To confirm the diagnosis the bacillus of Ducrey should be found microscopically.

Ducrey's bacillus is a short thick rod, which stains readily with any basic aniline dye, but is quickly decolourized by acid or alcohol, and also by Gram's method. When stained by watery gentian violet it shows a tendency to bipolar staining. Its characteristic arrangement, as a Strepto-bacillus in short or long chains, is of more use in diagnosis than its staining reaction (Leishman).

Queyrat recommends the following stain :—

Ziehl's fuchsin, 10 drops ; saturated solution of methylene blue, 7 drops ; distilled water, 20 cc. Stain for ten minutes.

The protoplasm is coloured red, the bacilli and nuclei violet.

Treatment.—There are two main lines of treatment ; the first is to attempt to destroy the bacilli and so convert the specific sore into a simple ulcer, the other is to maintain surgical cleanliness and trust to the natural powers of recovery.

Under the first plan may be included the complete excision of the sore with suturing of the wound ; this plan, although theoretically excellent, has been very disappointing in practice, as the wound almost always becomes infected by the specific bacilli, hence the result is merely to produce a much larger sore.

The bacilli may be destroyed by keeping the surface of the chancre at a high temperature, or an attempt may be made to destroy the bacilli along with the diseased tissues, by means of the actual cautery or of chemical escharotics ; the latter methods, however, are likely to cause considerable inflammation of the parts and hence should be reserved for small sores of recent origin. The most satisfactory

method of obtaining a constant high temperature is that employed by Welander of Stockholm ; he applies a moist dressing to the surface of the penis, outside this, Leiter's coils are wound, and, by means of a special apparatus, water kept at a temperature of 130° F. is made to circulate ; the sore is thus kept at a temperature of 106° F. After 24 hours of this treatment, all. the bacilli are killed, and the chancre has become a simple ulcer ; if possible, the application of heat should be continued for three days, as the high temperature greatly facilitates healing, which, under this treatment, should be complete in eight days. The great objection to this plan is that a special heat regulator is required for each case under treatment.

Heat can also be applied by means of Hollaender's hot air apparatus. In its present form this is a somewhat severe procedure and is in fact merely another form of cautery ; it might possibly be modified so as to become a really useful form of treatment. The actual cautery may be applied to the chancre or a glowing cautery may be held as close as possible to the sore, without actually touching it, for fifty seconds. Bathing, with very hot water for an hour at a time, is stated to hasten the process of healing.

The two substances most often used for the purpose of destroying the bacilli are nitric acid and pure carbolic acid. The former is very painful and causes a great deal of oedema. Carbolic acid is much less irritating and probably more efficacious, it should be applied lightly to begin with, and then well rubbed in. Silver nitrate is not to be recommended as a germicide in chancres, as it fails to sufficiently penetrate the tissues, and it gives rise to great irritation.

On the whole the destructive plan of treatment does not yield very satisfactory results, and it always leaves more or less induration which may, if seen by a surgeon who is not acquainted with the treatment which has been followed, give rise to the idea that the sore was originally a hard one.

In most cases better results will be obtained by the employment of milder measures than those given above.

The point is to thoroughly cleanse the surface of the sore, and get rid of all pyogenic germs which are usually abundant there. Peroxide of hydrogen sprayed on will get rid of the yellowish covering so often met with; if this remedy is not available, frequently changed dressings of moist boric lint

are useful. When the surface has become clean and fresh, the chancre should be treated much like an ordinary indolent ulcer. The following general rules may be of service to those who have not had an extended experience.

When there is much discharge, use wet dressings in preference to dry powders, as these are likely to mix with the discharge, forming scabs which retain the pus and prevent healing. Ointments, as a general rule, are less effective than non-greasy preparations. The application should be varied from time to time according to the state of the sore, thus a stimulating preparation for a few days followed by a soothing one accelerates the process of repair. Mercurial preparations must not be used if there is any suspicion of syphilis, as the course of the disease may be so modified as to obscure the diagnosis.

A great variety of preparations have been recommended at different times, but after a little experience each surgeon will naturally select his favourite formulae. A certain number are given in Appendix VIII as a suggestion for those who have not had much experience in the treatment of soft chancres.

Chancre with Phimosis.—When a chancre

occurs under a long foreskin, there is often a great deal of inflammation, and the prepuce cannot be retracted. If left alone phagedaena may ensue; the most rapid way of exposing the sore is to slit up the prepuce, this should not be done until a trial has been given to the following plan. Syringe out the foreskin with any mild antiseptic and then inject carbolic oil or an oily emulsion of iodoform. The oil seems to act mechanically, keeping the surfaces apart and allowing the discharge to escape freely.

Phagedaenic Chancre—The best treatment is, of course, the continuous hot bath with some mild antiseptic in the water. Very good results can, however, be obtained by dusting the sore thickly with one part of iodoform and three of charcoal, and applying a boric fomentation over this; the dressing should be changed every four hours, after spraying with peroxide of hydrogen. Strong antiseptics, such as nitric or pure carbolic acid, must be used with care, as they are apt to destroy the remaining vitality, and so lead to an extension of the gangrenous process.

Fitness for Active Service.—As long as a soft chancre is present, it is not advisable to permit

a man to proceed on active service, as at any time a bubo may form and incapacitate the man for some considerable time. If the medical history sheet shows a recent entry for soft chancre, special attention should be paid to the inguinal lymph glands when examining the men for active service.

Bubo.—Bubo, or acute inflammation of the inguinal lymphatic glands, may occur in connection with soft chancre, gonorrhoea, or as the result of strain tearing the efficent lymph vessels, or in consequence of the absorption of septic matter through an abrasion in the skin. In all probability the lesion following soft chancre is also due to the absorption of pyogenic germs at the site of the sore. The bacillus of Ducrey causes a rapidly breaking down swelling, which is very liable to spread and lead to extensive destruction of the neighbouring parts. The gonococcus appears to have the property of remaining encysted for long periods without causing any trouble, but on the occurrence of some slight mechanical injury it becomes active and soon leads to the formation of an abscess.

Treatment.—The first and most important point is to place the patient in bed and insist on absolute

rest. The next is to apply pressure in the hope of promoting absorption. As to local applications, sometimes hot fomentations, at others counter-irritants, or again soothing remedies, such as belladonna and glycerine, may be found to give best results according to the case.

If suppuration takes place freely, the abscess is to be incised and treated on the usual surgical lines. When, however, suppuration is limited to a few minute centres, it is better to give an anaesthetic and thoroughly scrape the swelling, removing all diseased tissue. The wholesale excision of lymphatic glands is hardly to be recommended, as the healthy tissue is taken away along with the diseased and lymph-oedema may ensue. The sharp spoon does not remove the healthy portions of the gland.

In some cases the gland assumes a chronic indurated condition, which will neither resolve nor suppurate. In such cases the following plan will often promote absorption. The swelling is to be painted each morning with tincture of iodine. The negative electrode of a galvanic battery is then to be applied for ten minutes, using about 5 milliampères, or stronger if the man can bear it. If no improvement results in a week, an attempt to

induce suppuration by injecting 5 minims of pure carbolic acid should be made. If, as usually happens, this is successful, the gland can be dealt with by incision and scraping.

Appendix I

(*See pages* 7–12)

UNITED

AVERAGE NUMBER CONSTANTLY SICK AND 1,000 OF

	1880	1881	1882	1883	1884	1885	1886	1887	1888	1889	1890
SYPHILIS.											
Constantly sick.	9·53	10·17	10·28	11·61	13·15	12·31	10·34	10·31	10·13	9·09	9·95
Invalided . .	·71	·44	·61	·63	·56	·53	·48	·64	·93	1·05	·81
GONORRHOEA.											
Constantly sick.	6·71	6·50	6·93	6·93	6·99	7·03	7·05	6·34	6·06	6·25	5·97
Invalided . .	—	·05	·10	·01	·07	·05	·02	·05	·03	·07	·03

INDIA

AVERAGE NUMBER CONSTANTLY SICK AND PER 1,000 OF

	1880	1881	1882	1883	1884	1885	1886	1887	1888	1889	1890
SYPHILIS.											
Constantly sick.	—	8·08	8·81	8·84	8·46	10·77	11·41	8·76	8·39	15·91	18·13
Invalided . .	—	·49	·42	·46	·18	·35	·18	·35	1·11	·95	1·05
GONORRHOEA.											
Constantly sick.	—	6·67	8·22	8·46	9·89	10·64	10·17	10·02	12·36	13·11	12·55
Invalided . .	—	—	·01	—	·01	·01	·01	—	1·	·01	·01

KINGDOM.

INVALIDED FOR SYPHILIS AND GONORRHOEA PER STRENGTH.

1891	1892	1893	1894	1895	1896	1897	1898	1899	1900	1901	1902	1903	1904	1905
8·82	9·46	9·10	8·79	8·09	7·79	6·66	6·28	5·18	3·09	4·18	4·67	4·49	4·09	3·14
·72	·70	·74	·83	1·05	1·30	1·04	1·29	1·06	·83	·90	1·27	·88	·92	·66
5·55	6·10	6·25	5·81	5·41	5·03	4·82	4·55	4·01	3·23	4·22	4·21	5·13	4·35	3·95
·04	·07	·04	·12	·02	·10	·16	·11	·07	·05	·09	·10	·09	1·69	1·49

INVALIDED FOR SYPHILIS AND GONORRHOEA STRENGTH.

1891	1892	1893	1894	1895	1896	1897	1898	1899	1900	1901	1902	1903	1904	1905
15·35	14·49	17·65	22·54	25·16	24·97	23·76	17·29	13·17	10·93	9·42	8·33	8·36	5·45	4·80
1·69	1·09	·34	1·41	1·74	1·90	5·57	4·44	2·28	·97	·75	1·42	1·02	·68	·80
10·92	11·45	13·55	14·24	15·67	14·70	15·65	10·68	9·38	10·26	8·93	9·27	8·31	7·60	6·52
·01	·03	·04	·15	·16	·12	·35	·26	·15	·08	·03	·07	·09	·13	0·8

Appendix II

(*See* Chap. II.)

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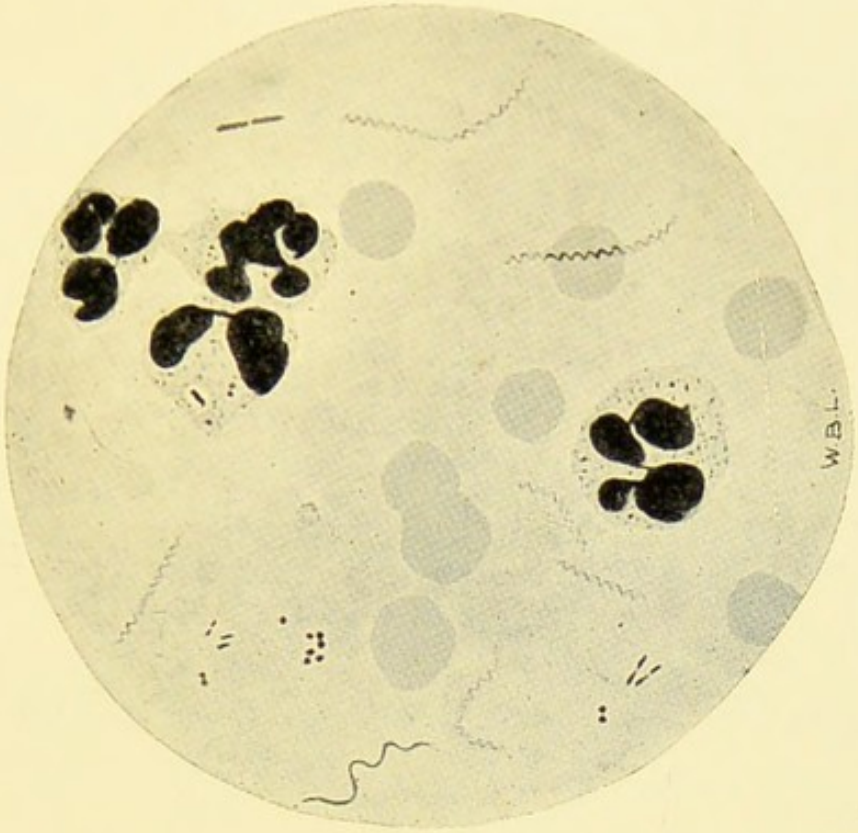
Description of the Figures accompanying the Chapter on *Spirochaeta pallida*

Fig. 1.—Film preparation from a Condyloma; showing several examples of *Spirochaeta pallida* and one of *Spirochaeta refringens.*

Stained by Leishman's stain—method No. 2—and drawn with Zeiss's camera lucida. Zeiss apochromatic 2 mm. objective and No. 6 compensating ocular. Tube length, 160 mm.

Fig. 2.—Section of Spleen from a syphilitic foetus.

Stained by Levaditi's method No. 1, and drawn with Zeiss's camera lucida. Zeiss apochromatic 1·5 mm. objective and No. 6 compensating ocular. Tube length, 145 mm.



(*See page* 62.)

Fig. 1.—Film preparation from a Condyloma; showing several examples of *Spirochaeta pallida* and one of *Spirochaeta refringens*.
Stained by Leishman's stain—method No. 2—and drawn with Zeiss's camera lucida. Zeiss apochromatic 2 mm. objective and No. 6 compensating ocular. Tube length, 160 mm.

(*See page* 72.)

Fig. 2.—Section of Spleen from a syphilitic foetus.
Stained by Levaditi's method No. 1, and drawn with Zeiss's camera lucida. Zeiss apochromatic 1·5 mm. objective and No. 6 compensating ocular. Tube length, 145 mm.

Appendix III

(*See page* 142)

MERCURIAL PILL FORMULAE AND PLAN OF TREATMENT

The commoner preparations given by the mouth are —

Pills.—

Hydrarg. c. Creta 1 to 2 grains, three to five times daily (or in powder).

Pil. Hydrarg. 1 to 2 grains, two to three times a day.

Salicylate of mercury $\frac{1}{5}$ of a grain, three times daily.

Tannate of mercury, $\frac{1}{2}$ grain, three to five times a day.

Green iodide of mercury, $\frac{1}{6}$ to $\frac{1}{3}$ of a grain, three times a day.

Perchloride of mercury, $\frac{1}{7}$ of a grain, two or three times daily.

(The last two pills are favourite ones in France.)

Perchloride of mercury is commonly ordered as a mixture, from $\frac{1}{2}$ to $1\frac{1}{2}$ drachms of the liquor hydrarg. perchlor (BP) being prescribed with some vegetable infusion. Iodide of potassium in the proportion of 5 to 20 grains to each ounce of the mixture is very commonly added, thus forming a biniodide of mercury

with free iodide of potash. In Paris the perchloride is sometimes ordered in the form of a tabloid with directions to dissolve it in coffee, wine or other drink which the patient may fancy.

The following plan of treatment has been drawn up in order to indicate what may be considered to be an efficient course. The preparation used as the standard is a pill containing 1 grain hydrarg. cum creta :—

	Months.	Pills.
First Course :—		
One month, taking 6 pills a day	1	180
Interval of 3 days without pills	—	—
One month, taking 4 pills a day	1	120
Interval of 7 days . . .	—	—
One month, taking 3 pills a day	1	90
Interval of 1 month . .	1	—
Second Course :—		
Three months, taking 3 pills a day	3	270
Interval of 1 month . .	1	—
Third Course :—		
Three months, taking 2 pills a day	3	180
Interval of 1 month . .	1	—
Fourth Course :—		
Three months, taking 1 pill daily	3	90
Interval of 3 months . .	3	—
Fifth Course :—		
Three months, taking 1 pill daily	3	90
	21	1,020

Patients should be inspected once a week while under treatment, particular attention being paid to the mucous membranes of the mouth and tongue. The

effect on each individual must be carefully watched, and the treatment varied to suit each case. After the third, fourth, and fifth courses, a short course of potassium iodide, 15–30 grains daily may be administered with advantage.

Appendix IV

(*See page* 145.)

PLAN OF TREATMENT, FOR TWO YEARS BY INUNCTION

	Months.	Grains H.G.
First Course :—		
42 daily inunctions . .	1½	840
Interval 3 months. See patient once a fortnight . .	3	—
Second Course :—		
42 daily inunctions . .	1½	840
Interval 3 months. See patient once a fortnight . .	3	—
Third Course :—		
30 daily inunctions . .	1	600
Interval 6 months. See patient once a fortnight . .	6	—
Fourth Course :—		
30 daily inunctions . .	1	600
Interval 6 months. See patient once a month if free from manifestations . .	6	—
Fifth Course :—		
20 daily inunctions . .	⅔	400
	23⅔	3,280

The above scheme is suggested as a working plan for the ordinary case, and is to be modified as required to suit any particular individual.

Appendix V

(*See page* 151.)

FORMULAE FOR CREAMS (*R.A.M.C. Journal*, July, 1906)

Form "*O*" :—Mercury ʒi by weight.
Lanolin, ʒiv by weight.
Paraffin liq. Carbol, 2 per cent. } ad ʒx fluid

10 minims of cream contain 1 grain of mercury.

At a temperature of 80° F. this cream separates, an oily layer equivalent to about a fourth of the bulk forming on the surface. At lower temperatures (50° F.) it is viscous and clumsy for use in a hypodermic syringe. It is too dilute, necessitating a bulky injection.

Form "*A*" :—Mercury, 2 parts by weight.
Lanoline, 3 parts by weight.
Paraffin liq. Carbol, 2 per cent. } ad 10 parts fluid.

1 grain of mercury in 5 minims.

This is a useful cream, which would be improved by omitting the carbolic acid. At temperatures up to 85° F. the globules of mercury sink but do not coalesce, stirring before use is all that is required. It is comfortably fluid at temperatures of 50° F. The strength is convenient for dosage purposes.

Form S 2 :—Mercury, 2 parts by weight.
Lanoline, 3 parts by weight.
Paraffin special to 10 fluid parts.

1 grain of mercury in 5 minims.

This appears to be a most useful formulae, but would have to be tested practically.

PLANS OF TREATMENT BY INJECTION OF MERCURIAL CREAM

A. Each injection contains *one and a half* grains of metallic mercury.

	Months.	Grains Hg.
First Course :—		
6 injections, one each week. .	1½	9
Interval, 2 months . . .	2	–
Second Course :—		
4 injections, one each fortnight.	2	6
Interval, 4 months . . .	4	–
Third Course :—		
4 injections, one each fortnight.	2	6
Interval, 6 months . . .	6	–
Fourth Course :—		
4 injections, one each month .	4	6
—	—	—
Total 18 injections	21½	27

This plan has been used for two years in Malta with satisfactory results. If considered advisable, the second and third intervals may be reduced to three and four months respectively and an additional course of injections given.

Plan B. Each injection contains *one* grain of metallic mercury.

	Months.	Grains Hg.
First Course :—		
8 injections, one each weekly .	2	8
Interval, 2 months . . .	2	–
Second Course:—		
4 injections, one each fortnight.	2	4
Interval, 2 months . . .	2	–
Third Course :—		
4 injections, one each fortnight.	2	4
Interval, 2 months . . .	2	–
Fourth Course :—		
4 injections, one each fortnight.	2	4
Interval 3 months . . .	3	–
Fifth Course :—		
4 injections, one each fortnight.	2	4
Interval, 3 months . . .	3	–
Sixth Course :—		
4 injections, one each fortnight	2	4
	—	—
Total, 28 injections	24	28

The objection to this plan is that a greater number of injections are required to obtain the same effect as by Plan A.

Appendix VI

(*See page* 167.)

FORMULAE FOR ZITTMANN'S TREATMENT

The following formula gives sufficient for one patient for six to ten days :—

Bruised sarsaparilla root, 4 oz., is digested for 24 hours in 280 oz. of water.

To this the contents of No. 1 package are added, and the mixture boiled while the contents of No. 2 package, placed in a linen bag, are suspended in the vessel.

No. 1 package.—Fennel seed, Anise seed } Of each 80 grains.

Liquorice root cut up, Senna leaves } Of each 240 grains.

No. 2 package.—Powdered alum, Powdered white sugar } Of each 120 grains.

Calomel, 80 grains.

Cinnabar, 20 grains.

The mixture is kept just boiling till its bulk is reduced to a gallon. It is then strained through a fine cloth, and put up in bottles holding a little more than a pint. These are labelled Zittmann's Decoction No. 1 (Strong Dec.).

No. 3 package.—Cardamom seeds, Cinnamon bark, Liquorice root } Of each, 60 grains.

The contents of No. 3 package are then added to the residue, together with 280 ounces of boiling water, and the whole is simmered down to a gallon. This is strained and bottled as before, and finally labelled No. 2 (Weak Decoction).

Pills R Hydrarg. subchlor., gr. 2.
Extract. colocynth., gr. 2.
Extract. hyoscyam., virid. gr. 2, make 2 pills.

The room must be kept at a temperature of 80° F.

The diet is not to contain sugar or spices.

The evening before the treatment is begun two pills are given. Next morning the patient has a light breakfast at 7 a.m. During the first four days, at 9, 10, 11, and 12 noon, the patient drinks half a pint of the strong decoction very hot. Smaller quantities may have to be used at first as the mixture is rather nauseating.

Patient is kept in bed to sweat.

At 12.30 a light lunch is given, and at 3, 4, 5, and 6 p.m. a half-pint of the weak decoction cold.

The patient allowed up for an hour in the evening.

An alcohol rub or massage may be employed.

About 6 p.m. the patient has a good dinner, but without green vegetables. This routine is continued daily up to the fifth day, when the patient is allowed up and has a bath. On the same evening he has two more pills, and the next day the decoction as before, up to the fifteenth day. This finishes the treatment.

Appendix VII

(*See page* 200.)

FORMULAE FOR USE IN GONORRHOEA

For Irrigation :—

(1) Potassium permanganate gr. xx.
Distilled water, ℥ xx.

1 to 2 ounces to each pint of water.

(2) Albargin, gr. 50.
Distilled water, ℥ 20.

1 to 2 ounces to each pint of water.

(3) Nitrate of silver, gr. 20.
Distilled water, ℥ xx.

1 to 2 ounces to each pint of water.

(4) Sulphate of zinc, gr. 30.
Water, ℥ 20.

1 to 2 ounces to each pint of water.

For Injection :—

(1) Protargol, gr. 4.
Distilled water, ℥j

1 part to 3 of water to begin with, then equal parts of protargol solution and water, finally using the solution undiluted.

Occasionally the strength may be increased to 8 grains to the ounce for obstinate cases.

(2) Zinc permanganate 1 grain, distilled water, 6 ounces ; use with an equal quantity of warm water.

(3) Sulphate of zinc, 15 grains ; subacetate of lead, 20 grains ; tincture of opium and tincture of catechu of each 2 drachms, water to 6 ounces. Dilute with at least an equal quantity of warm water to begin with.

(4) Ultzmann's injection. Zinc sulphate and powdered alum of each 4 to 12 grains ; liquid carbolic acid, 4 minims ; water to 6 ounces.

(5) Zinc sulphate and zinc sulpho-carbolate of each 1 grain ; water to 1 ounce.

Appendix VIII

(*See page* 229.)

FORMULAE FOR USE WITH SOFT CHANCRES

Wet Dressings :—

Boric acid, grs. x to the ounce.
Tr. iodi m 5 to m x to the ounce.
Dilute nitric acid B.P. m. 30 to the ounce.
Carbolic lotion 1 in 40 to 1 in 60.
Formalin m. 10 to m. 20 to the ounce.
Copper sulphate grs. x to the ounce.
Zinc chloride, 2 to 5 grs. to the ounce.
Tr. benzoin co. applied undiluted.
Nitrate of silver, gr. x to the ounce.

Dry Applications :—Iodoform alone or mixed with an equal part of boric acid (freshly ground coffee is supposed to mask the objectionable smell).

Dermatol, airol, nosophen, europhen, are all proprietary drugs, and it is claimed for them that they have the same effect as iodoform without the disagreeable smell.

A very good preparation is 1 part of salicylic acid, 2 parts of iodoform, and 5 of some neutral salt like zinc oxide or boric acid. Unna recommends 1 part of salicylic acid to 2 of iodoform ; this is however a somewhat irritating preparation.

If there is no suspicion of syphilis, black wash or calomel powder may be employed.

Appendix IX

REGISTERING ATTENDANCES (SYPHILIS)

Checking the attendances of men and entering up their treatment is always a troublesome matter. The following plan has been found to answer satisfactorily at Malta.

In the case of men not yet diagnosed, the loose sheet is employed. In the first space the man's name and number, etc., are entered for identification purposes. In the second, the date on which the sore appeared together with any other suspicious symptoms while in hospital under treatment. The following squares are dated at the top, for whichever day of the week these men are inspected. When seen, the man's weight is entered together with any note, such as, "glands suspicious," to which the medical officer desires to have his attention drawn when next the man is seen. When the inspection has been concluded the man is told to come again in a week or fortnight according to circumstances, and in the square corresponding to this date an entry "Ob" is made. On any given day the medical officer only has to glance down the squares of this date to see who should attend on that particular day.

In the case of men on the register, a large book is ruled out as shown in the accompanying form, making

CORPS 4, R. BGDE. ROLL OF MEN ON SYPHILIS REGISTER. [SPECIMEN PAGE.]

Rank and Name	Remarks	January				February				April		
	Began Treatment, etc.	5	12	19	26	2	9	16	23	2	9	
Pte. No. 652 Atkins, J.	1-5-05. Completed final course 1-12-06. Last signs, 2-10-05.	10.12.				Ob.						
Pte. No. 780. Smith, G.	1-6-06. 4 months pills; 6 injs. Muc. patches 1-10-06.	No signs. 9.10.		No signs. 9.11.		Inj.						
Pte. No. 213. Brown, C.	1-10-06. 20 inunctions, 1 month pills. Ulcer tonsil 10-12-06.	K.I. Ulcer tonsil Ag.No_3 local. 10.0 .	Omit K.I. Ulcer improved No local. 10.2.	K.I. Ulcer healed. No signs 10.3.	Omit K.I. No signs 10.2.	4 F. Begins course Injs fort-nightly. 10.3.		3 F.				

the first two spaces, however, slightly larger. If more than one corps is treated, it saves confusion if the different corps are kept on separate pages. In the first square the man's name and number is entered, in the second space the following particulars are noted: Date on which treatment originally commenced, summary of treatment previous to any entry on this page, date of last manifestation of the disease. If this is done, a glance is sufficient to place the medical officer in possession of the salient points in the man's syphilis history and to enable him, after examining the man, to determine at once what further treatment should be employed. In the succeeding squares the man's weight, treatment, any signs, etc., are entered, and on the date on which the man next attends the treatment then due to him is noted. At intervals, say once a quarter, the above particulars are entered in the man's syphilis sheet.

Syphilis Sheet

The attached form is suggested: in this the headings are re-arranged in order to give more room for practical details. The note on the nature of the sore has been dispensed with as affording no useful information; the approximate time and place of infection are retained, the latter is of some use as an indication of the local incidence of syphilis, while if the disease has been contracted for some months before treatment is commenced, relapses may be expected. A new station should be entered on the sheet. Treatment should be entered by courses, or months if no definite system of courses is adopted, as this greatly facilitates the work of summing up the treatment when a man is transferred to a new station.

SPECIMEN OF SUGGESTED SYPHILIS SHEET.

SYPHILIS SHEET.

No., Rank and Name : 652, Pte. Smith, G. *Corps :* 4/R.B.
Station : Pembroke.
When and where contracted : London, Sept. 1906.
Malta *Register, Serial number* 13/06.
Placed on : 3/11/06. *Struck off :*.....
No. of months under treatment.....
Primary sore : Unknown. Did not report sick.
Lymphatic glands : General shotty enlargement.
Skin : Early macular syphilide on abdomen and back.
Mucous membranes : Superficial ulcer right tonsil. Early condylomata anus.
Other symptoms : Anaemia, nocturnal headaches.

Date.	Treatment	Dose	Progress	Weight	Urine
3/11/06	Injection cream Hg. Local to ulcer and condylomata.	gr. 1½		10.0	Normal
10/11/06	Do. do. do.	gr. 1½	Ulcer tonsil healed condylomata gone.	10.2	
17/11/06	Injection cream Hg.	gr. 1½	Rash faded.	10.3	
24/11/06	Injection cream Hg.	gr. 1½	No signs.	10.3	
30/11/06	Injection cream Hg.	gr. 1½	,,	10.4	
1/12/06	Injection cream Hg. End of first course. Interval.	gr. 1½	,,	10.5	Normal
	Interval.				
15/12/06	No treatment.		No signs.	10.7	
29/12/06			,,	10.6	
12/1/07			,,	10.7	
26/1/07			,,	10.5	
	Begins 2nd course.				
9/2/06	Injection cream Hg.	gr. 1½	No signs.	10.6	Normal

No., Rank, Name..... *Corps*..... *Where and when contracted*.....

.....Register, Serial No..... *Placed on*..... *Struck off*..... *Months under treatment*....

Primary sore..... *Lymphatics*..... *Skin*.....

Mucous membranes..... *Other symptoms*.....

1st month. January, 1907. 5 weekly injections, cream gr. 1½ each. Weight, Urine, Mucous patches on tongue, local treatment.	2nd month. February, 1907. 1 injection, cream gr. 1½. K.I. one week. Weight, Tongue healed.	3rd month. March, 1907. Interval of non-treatment. No sign of syphilis. Weight, 31-3-07.	4th month. April, 1907. 2 injections, gr. 1½ each. Urine normal. Weight,	5th month. May, 1907. 2 injections, gr. 1½ each. Weight,	6th month. June, 1907. Interval of non-treatment. Weight,	Total for six months. 10 injs. gr. 1½ each. K.I. one week.
7th month. July, 1907. Pills Hyd. c. Cret. gr. ij. each, twice daily. Weight,	8th month. August, 1907. K.I. for 21 days, 20 grs. daily. Omit Pil. Weight,	9th month. September, 1907 Pil. Hyd. c. Cret., gr. ij. twice daily. Weight,	10th month. October, 1907. Omit Pil. No treatment. Weight,	11th month. November, 1907. Pil. Hyd. c. Cret., gr. ij. twice daily. Weight,	12th month. December, 1907. No treatment. Weight,	Total for six months. 3 months pills. 1 month K.I.
January, 1908.	February, 1908.	March, 1908.	April, 1908.	May, 1908.	June, 1908.	Total for six months

This is another form of suggested Syphilis Sheet based on the French Army plan. Each square is 2 in. square, and contains all necessary notes for the month's treatment and progress. Each half-year's treatment is summarized in the narrow column on the right. This plan would show at a glance how far the man had progressed in his treatment. The squares could be continued overleaf.—C. E. P.

Syphilis Register

A few alterations are suggested here. Under the "T" should be noted where the transfer has come from, and if this is within the United Kingdom or the same command abroad, the man should be omitted from the annual return to prevent the name from appearing twice over. The columns "Days in" and "Days out of hospital" might well be omitted altogether. In the remarks column only admissions for syphilitic lesions should be noted as "R," although the man may have continued to receive treatment for his syphilis while in hospital for some other disease.

This entry was asked for originally with the idea of obtaining some definite information as to the comparative values of different forms of treatment; many re-admissions would of course reflect adversely on the treatment employed.

Annual Return.

A specimen of a suggested annual return is attached, to take the place of the present one, which is incomplete. The suggested form gives as complete a summary of the incidence of syphilis during the year as it is possible to furnish.

It would be better to omit all reference to the total length of treatment, or else mention it in the medical transactions. The admissions to hospital for fresh manifestations occurring during treatment should be restricted to those men who have completed the whole course of treatment, and the plan in use at the time of the admission should also be given in the notes under medical transactions.

SUMMARY OF THE TREATMENT OF SYPHILIS IN THE COMMAND, (or.....DISTRICT) 190—

	Mily. Hospl. Valetta	Mily. Hospl. Cottonera	Forrest Hospital.	Mily. Hospl. Imtarfa.	Total Malta		Valetta	Cottonera	Forrest	Imtarfa	Total Malta
No. of cases remaining on the Syphilis Register from 1905	21	14	31	6	72	No. of cases struck off the Register on completion of treatment in 1906 . .	7	16	14	—	37
* No. of transfers received from other commands .	2	31	11	2	46	* No. of cases transferred away from Malta, still under treatment . .	14	15	16	7	52
No. of men who were placed on the Register during 1906	13	6	6	6	31	No. of cases remaining under treatment 31-12-06	34	19	2	5	60
No. of men who have been under treatment during the year or part of the year	36	51	48	14	149		55	50	32	12	149

Contracted in Malta, 27.

† No. of cases which have required admission while under treatment :—once, 0 ; twice, 0.

No. of cases which have relapsed after completing full course of treatment, 0

* Transfers between stations within the United Kingdom or within commands abroad are not to be shown in the line for transfers ; this should only include transfers from or to abroad.

† Re-admissions only to be given in the case of men who have completed their full treatment and been struck off during the year.

Appendix X

RECORDING CASES (GONORRHOEA)

When ordering each day's treatment, it is important to know the condition of the urine on the previous day, as also the treatment then employed ; when dealing with a large number of men it is impossible to remember the exact particulars of each case. The following plan has been found to answer satisfactorily in practice and to give all the necessary information. When the man is discharged, the number of days under treatment, complications, etc., can be entered up in tabular form for the purpose of compiling statistics. Quarter sheets of foolscap are hectographed as shown below ; the ward orderly places these in order for the medical officer, the patients parade, and as their names are called they show their urine. The medical officer has the man's particulars in front of him, and can decide at a glance what treatment he wishes to adopt, the ward orderly, standing at his side, enters this up in his day book. By using abbreviations the writing can be much reduced.

GONORRHOEA SHEET.

Name : 7251 Smith. 4/R.B. *No. of admission :* 1st. *Date of last one :* .....

Admitted : 1/1/07 *Discharged :* 20/1/07 *Days in hospital :* 20.

Remarks on admission : Early acute anterior.

Date	1st Urine	2nd Urine	Treatment	Remarks
1/1/07	Cloudy.	Faint haze.	C.B. gr. j. P.I. gr. j. Bubebs.	Smear = Many Pcs. Gcs in groups and free.
2/1/07	Less cloudy.	Clear.	Continue.	
4/1/07	Haze. M.	,,	A.B. 2½. P.I.2 grs. Bubebs.	
7/1/07	Clear. M.Th.	,,	C.B. gr. j. P.I. 4 grs. twice. ,,	
10/1/07	Clear. M. no Th.	,,	Omit C.B. P.I. 2 grs. twice ,,	
12/1/07	Clear.	,,	,, P.I. 1 gr. ,,	
14/1/07	,,	,,	Omit all.	
16/1/07	,,	,,	,,	Beer 16th to 19th = 4 days.
20/1/07	,,	,,	,,	

Abbreviations explained (similarly others may be used) :—C.B. –Condy irrigation to bladder, strength in grains to the pint. A.B. –Albargin irrigation to bladder, strength in grains to the pint. C.I. –Condy injection to anterior urethra, strength in grains to the ounce. P.I. –Protargol injection to anterior urethra, strength in grains to the ounce. M. –Mucus. Th. –Threads. Pcs. –Pus cells. Gcs. –Gonococci. E.A. –Epididymitis on admission. E.T. –Epididymitis while under treatment.

TABLE I. (*See page* 7.)

FOR TROOPS IN THE UNITED KINGDOM.

From 1880–1905 inclusive.

Average No.'s per 1,000 of strength:—

Constantly sick for Syphilis ——————

Invalided for ditto .. .. - - - - - - - - - -

Constantly sick for Gonorrhoea .....

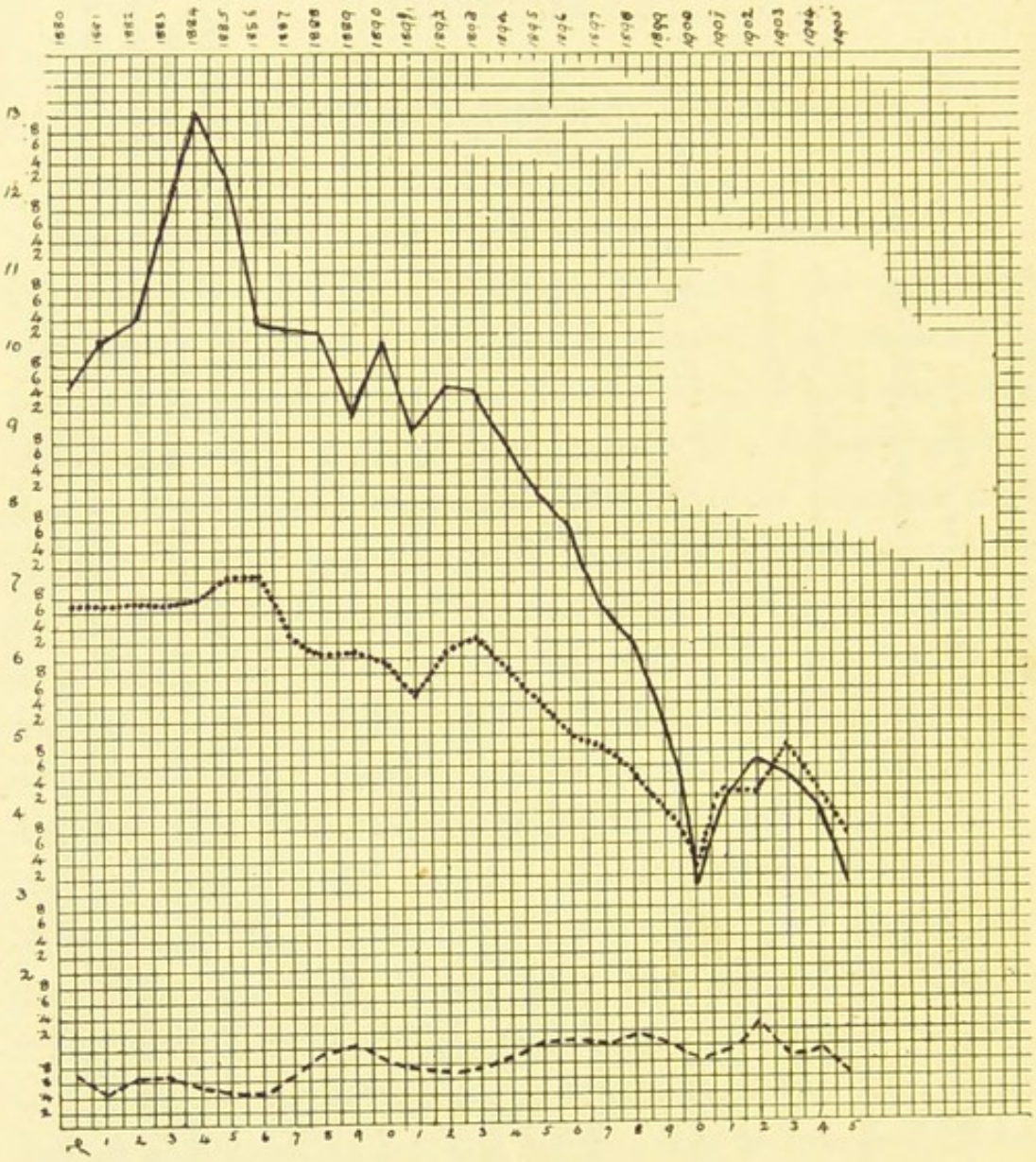


TABLE II. (*See page* 12.)

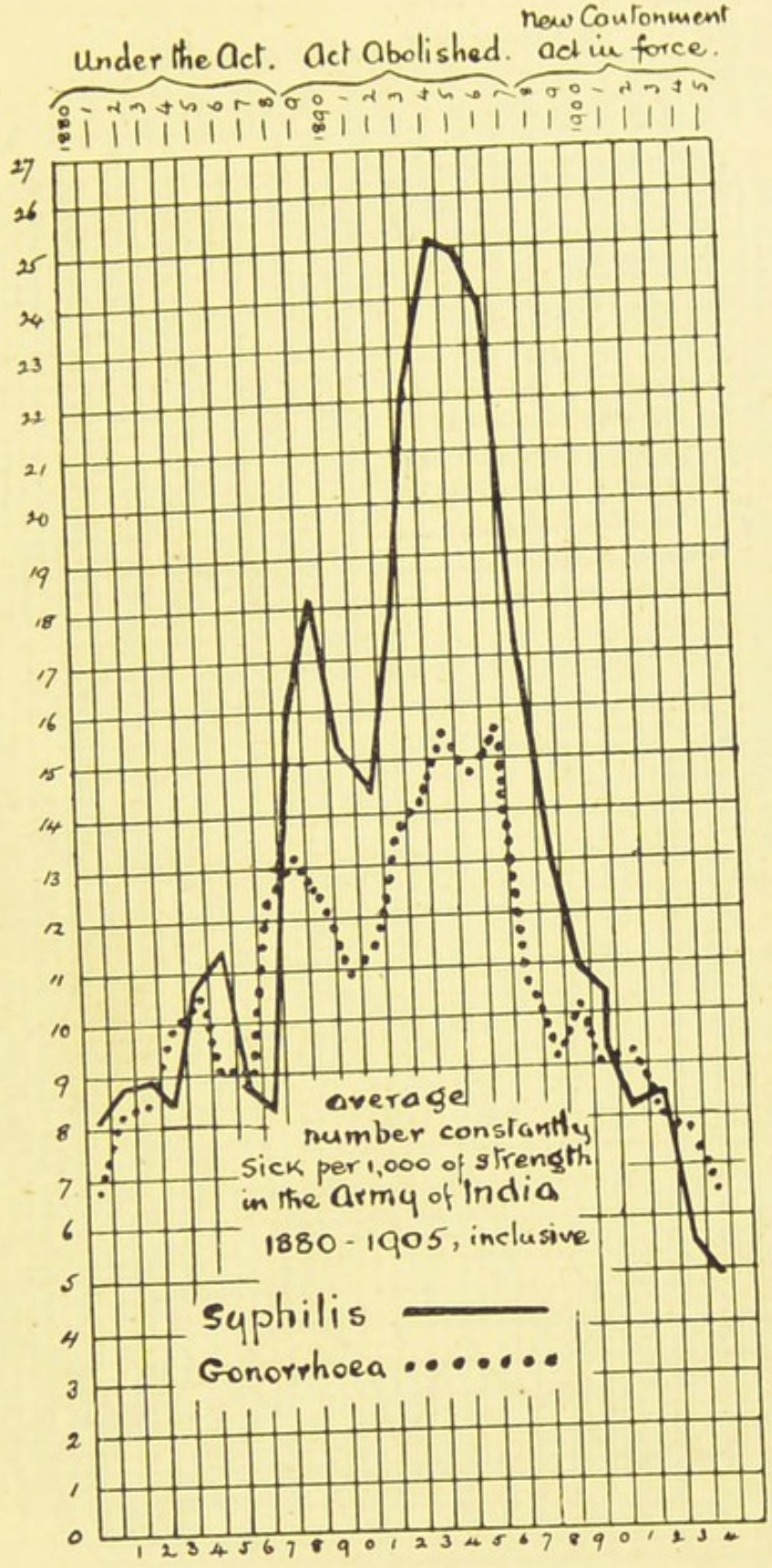


TABLE III. (*See page* 14.)

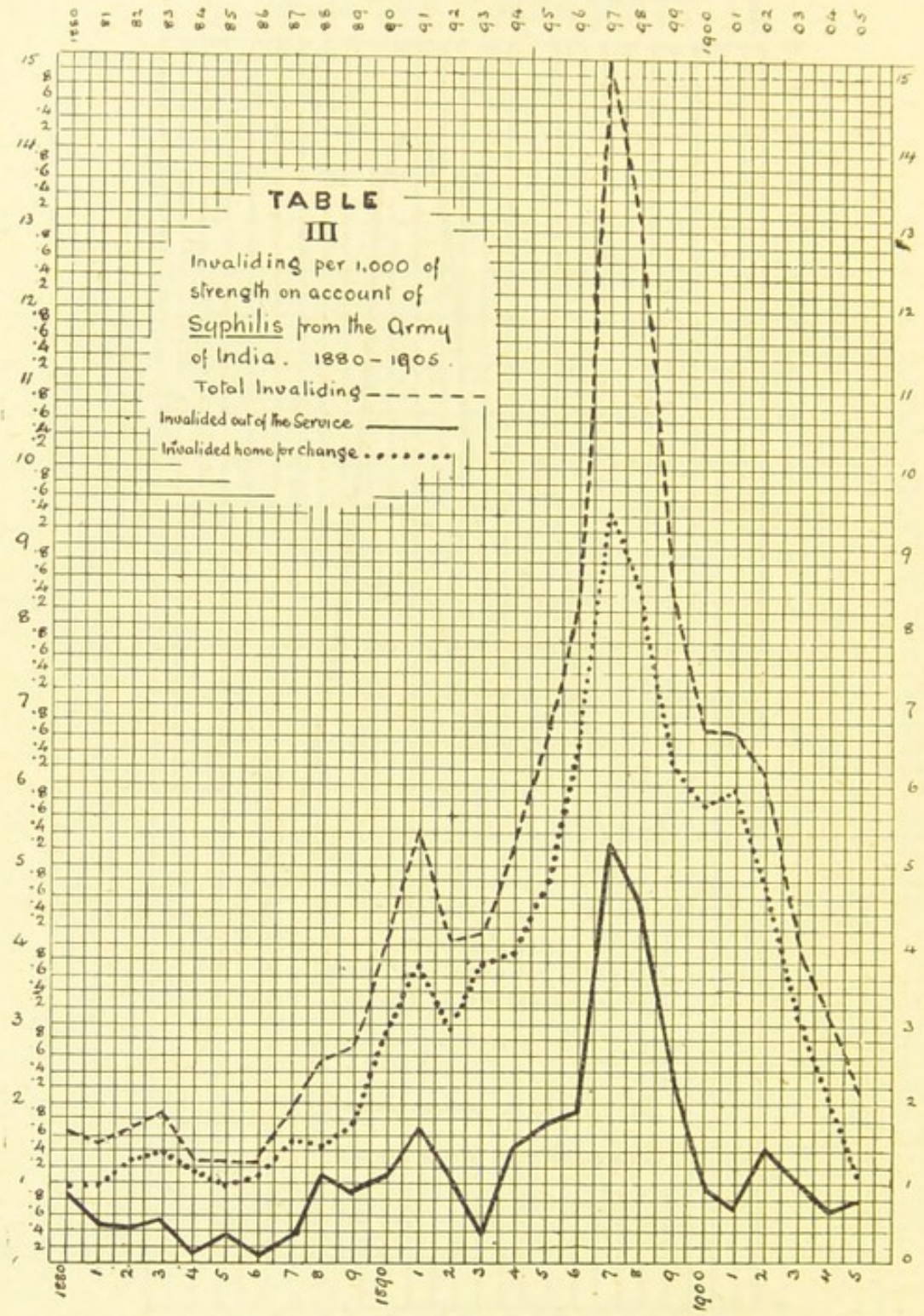


TABLE IV. (*See page* 19.)

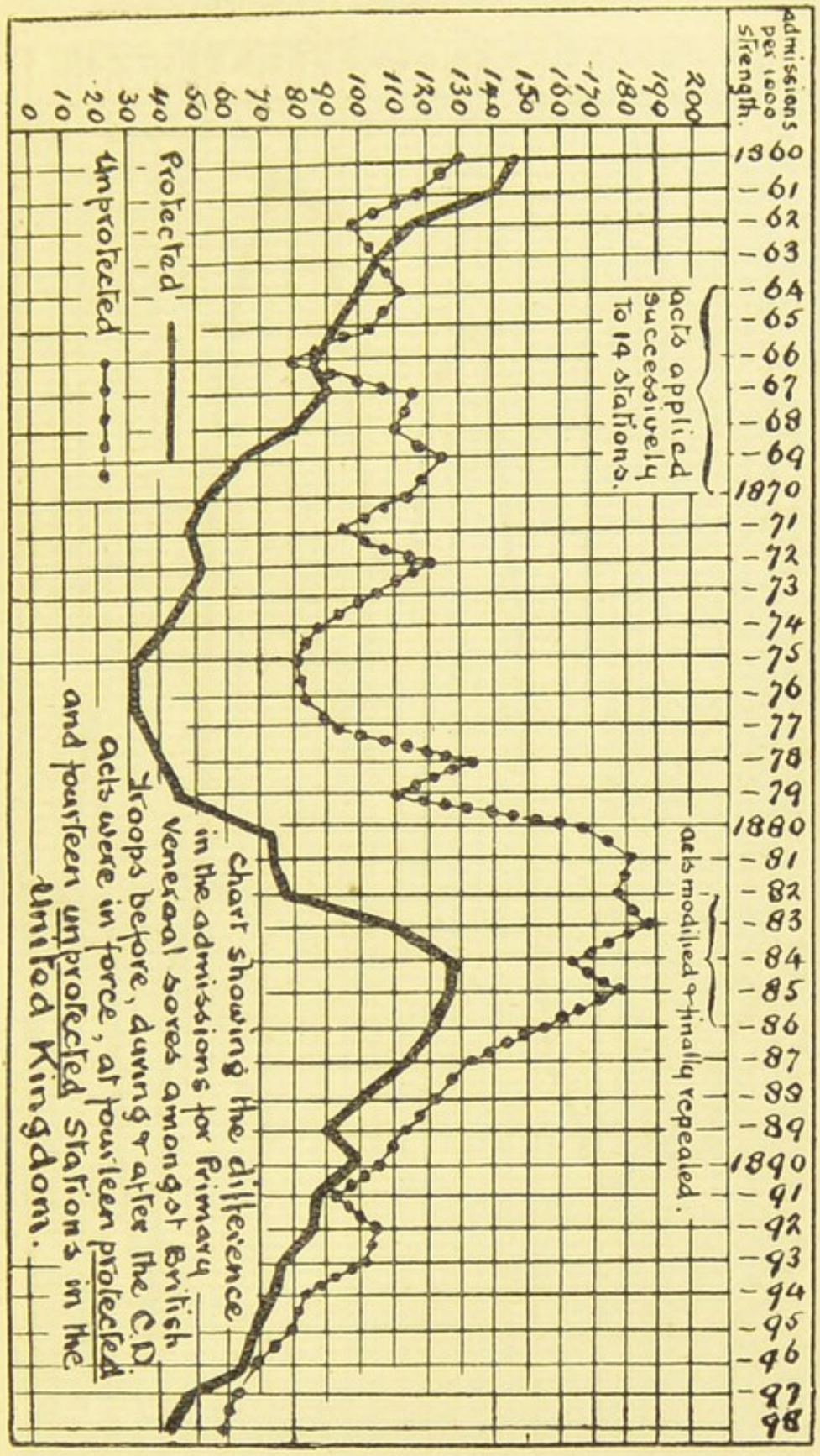


TABLE V. (*See page* 24.)

Admissions per 1,000 for all Venereal Diseases, China and Straits Settlements, 1879–1901.

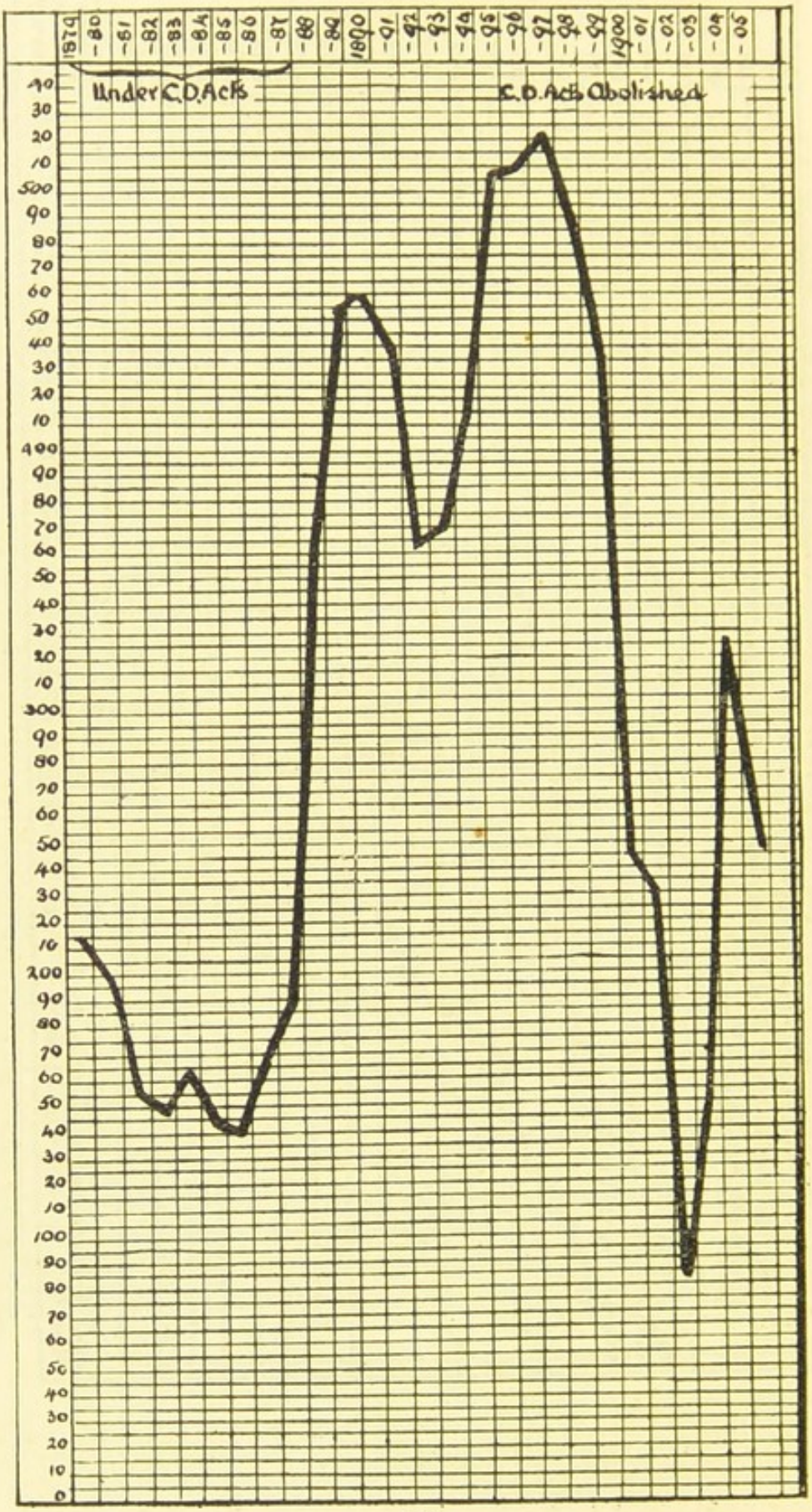


TABLE VI. (*See page* 24.)

Admissions per 1,000 for all Venereal Diseases, Gibraltar and Malta, 1879–1905.

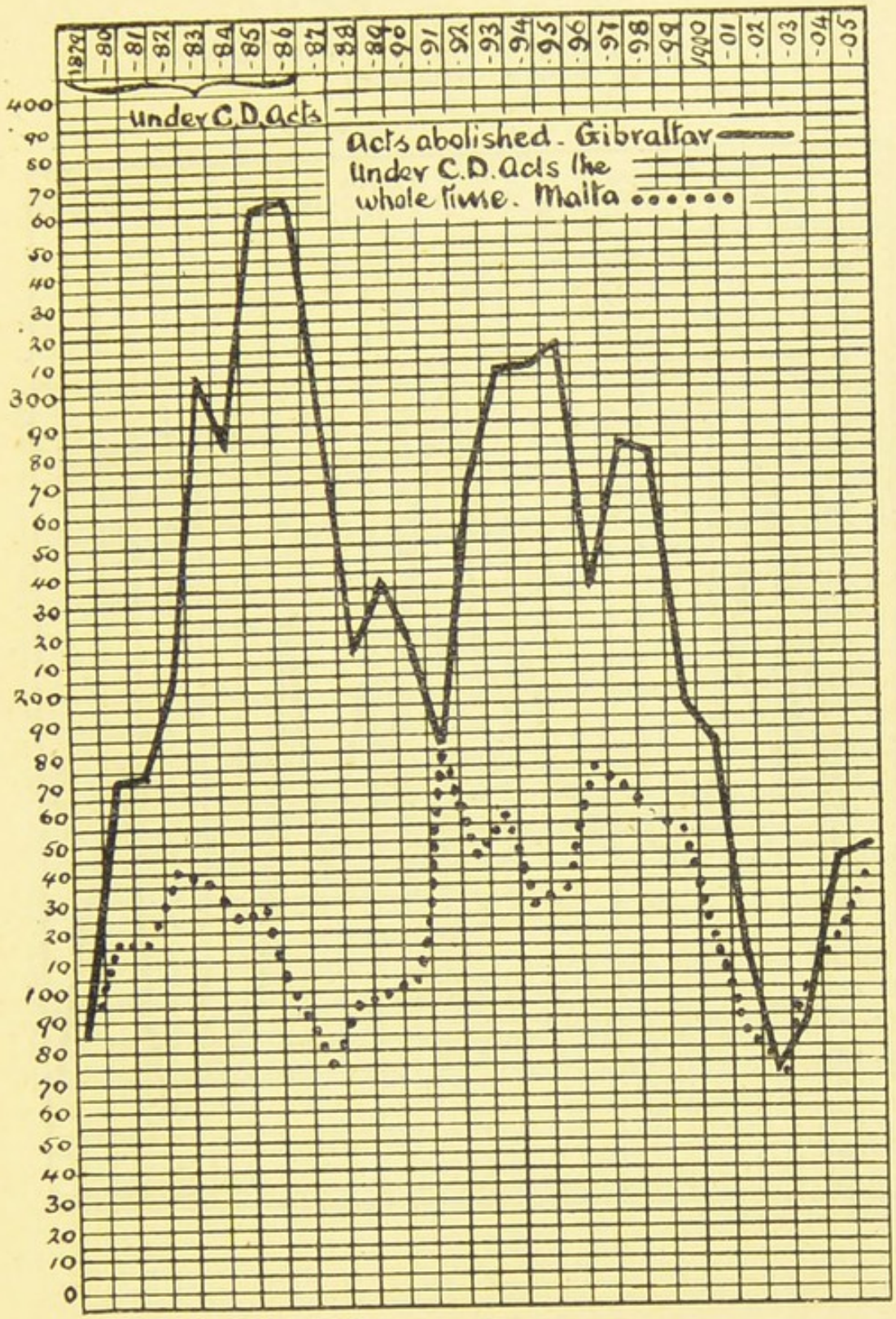


TABLE VII. (*See page* 24.)

Admissions per 1,000 for all Venereal Diseases, Egypt, 1893–1901.

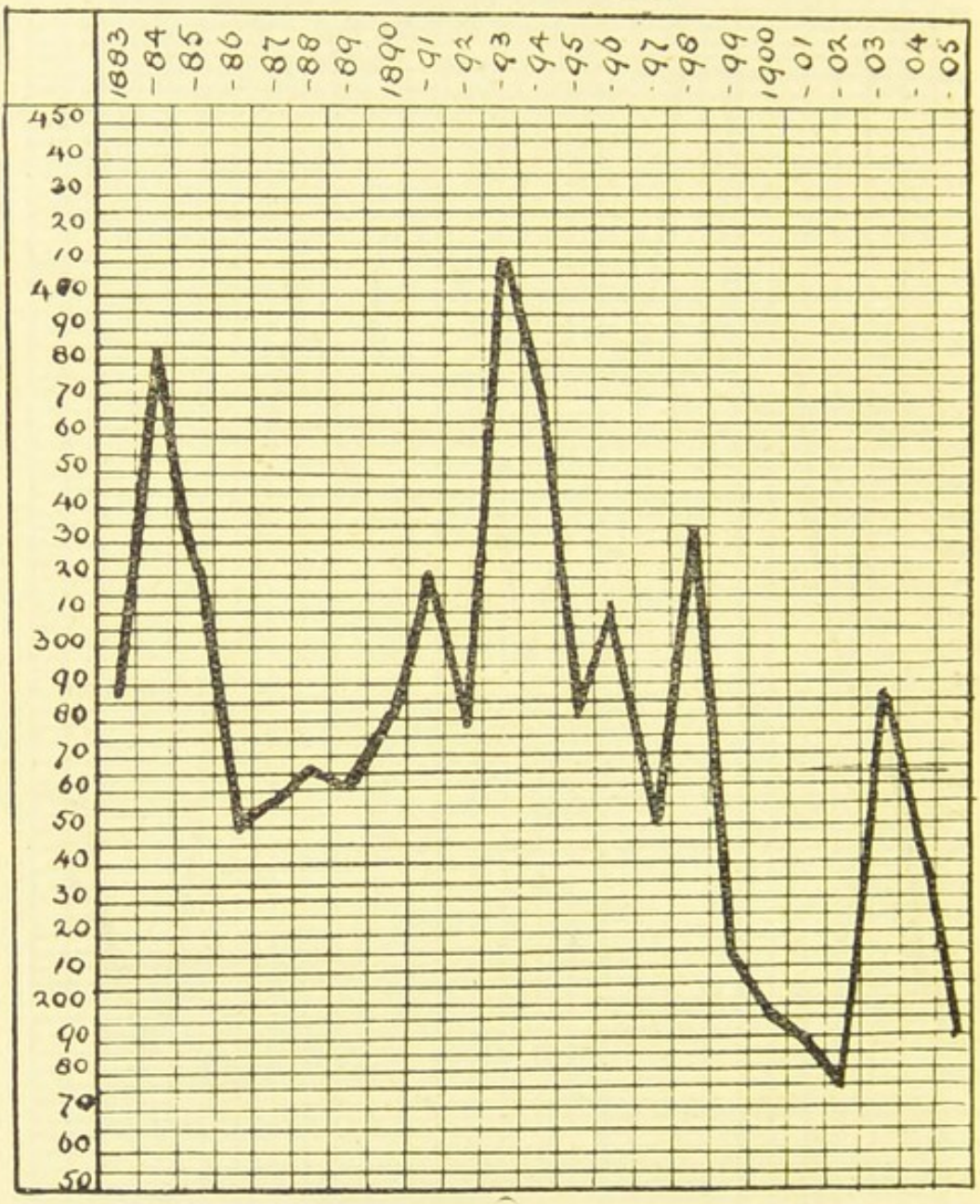
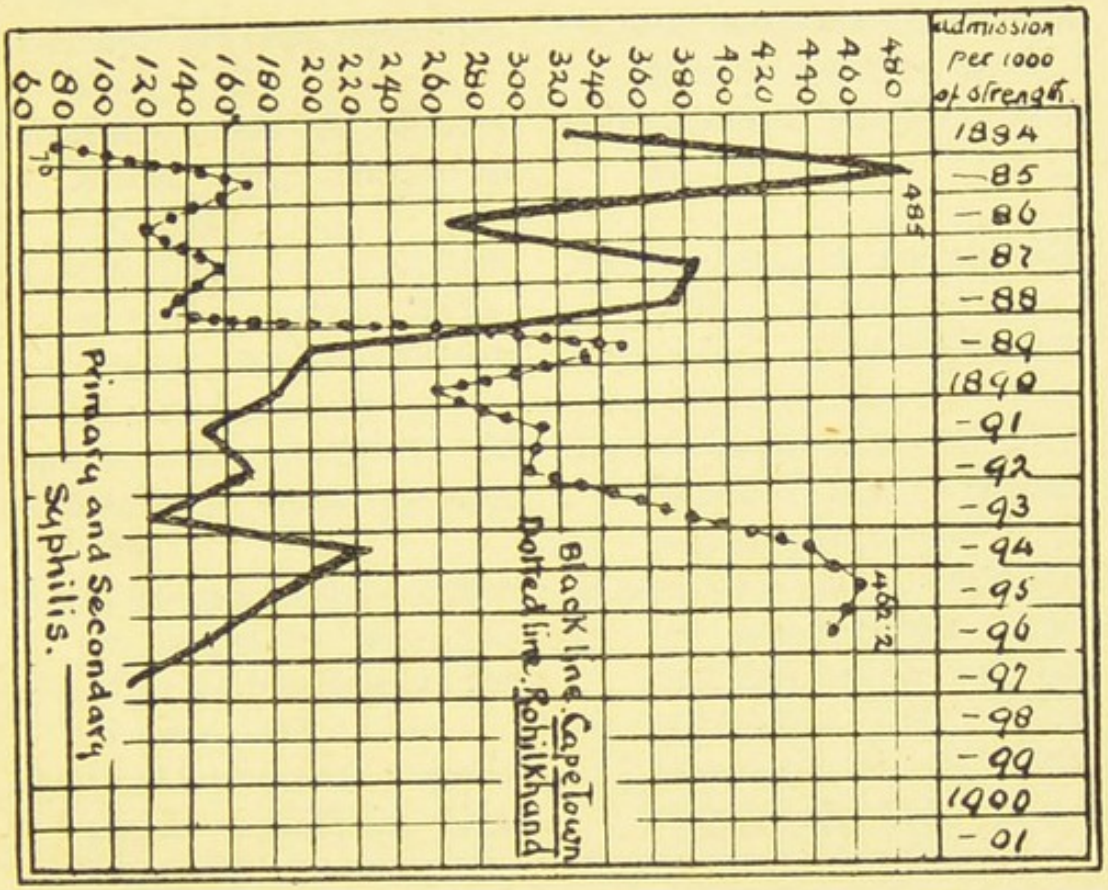


TABLE VIII.

Admissions for Syphilis, Cape Town and Rohilcund, 1894–1901.



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