

recommence smoking? The absolute prohibition from all forms of tobacco should be maintained for at least twelve months and then afterwards the patient, if so inclined, may begin to smoke moderately and tentatively a mild form of tobacco. In my experience the class of patients in whom tobacco amblyopia is most frequently met with is that of workmen who are able to smoke at their work—for example, bricklayers, bootmakers, and plasterers—and that it is rare among those the character of whose employment renders smoking impossible during working hours.

## TROPICAL DYSENTERY.\*

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AMONGST the diseases of special interest to the physician practising in the tropics the group of morbid conditions known by the term of "dysentery" ranks only next in importance to enteric fever. Unfortunately, as Manson<sup>24</sup> points out, our knowledge is not in proportion to the importance of the subject and in the latest monographs on the disease it is evident that considerable doubt exists in the minds of eminent climatologists, who have made a special study of the malady, as to the exact boundary line between simple diarrhoea and dysentery. It is, however, only in very recent years that the difficulty of diagnosing dysentery has become appreciated and a few years ago writers used to describe what is now considered to be a group of diseases as a well-defined malady and give its etiology, symptoms, and pathology in precise terms. It would be well, therefore, to start by defining what we mean by "dysentery," and the definition suggested is that "dysentery is an inflammation of the large bowel, associated with pain, tenesmus, some slight pyrexia, and a large number of stools, consisting of mucus or mucopus, with micro organisms but with or without blood." I think the last phrase is important. In view of Dopfer's work<sup>13</sup> during the past year, and the evidence which he has submitted that simple diarrhoea may be an abortive form of dysentery and that all cases of acute diarrhoea occurring where dysentery is prevalent should be regarded as suspicious, and, where possible, bacteriological methods resorted to for diagnosis in preference to the rough-and-ready test of the character of the stools.

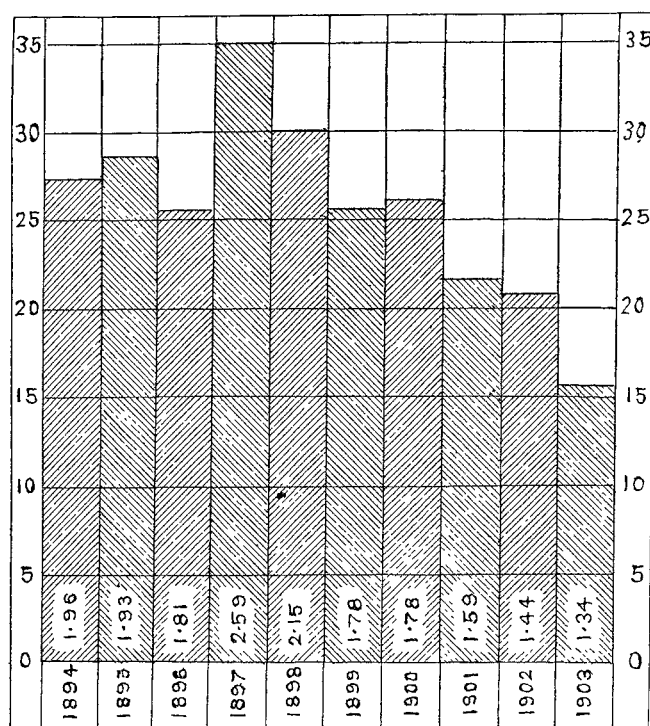


Chart showing the incidence of dysentery per 1000 British troops in India and the number constantly sick from the disease per 1000 of strength during the decennium 1894-1903.

The incidence of dysentery is variable, as statistics must, in a disease of this nature without the aid of a properly

equipped laboratory, depend to a considerable extent on the diagnostic idiosyncrasies of individuals. The last Army Medical Department Report shows the incidence of the disease in India to be 16.9 admissions per annum per 1000 of strength of British troops and the number constantly sick for the same proportion of the military population to be 1.34. The incidence has diminished of recent years, as can be seen by the accompanying chart which shows in a graphic form the admissions and number constantly sick per 1000 in the British garrison in India during the last decennium for which statistics are available. It is a fairly well established fact that epidemics of dysentery are usually post-enteric—that is, they usually appear after epidemics of typhoid fever. Firth<sup>18</sup> and Washbourn<sup>37</sup> point out that this occurred in South Africa, and Scheube<sup>32</sup> gives typhoid fever as a predisposing cause of dysentery. In the classification of the varieties of dysentery much difficulty and confusion of ideas have arisen, and as Firth points out, "it is doubtful whether the literature of any disease is more encumbered with a mass of names indicating the nature of the disorder or the author's conception of its pathology than is that of dysentery."<sup>18</sup> Terms founded on a pathological basis such as "catarrhal," "ulcerative," and "gangrenous" have been passed on from text-book to text-book and are used by Manson, Scheube, and even such a recent text-book on pathology as Stengel's<sup>33</sup> (p. 547), and in an article just published in THE LANCET,<sup>40</sup> but as was pointed out by Taylor as far back as 1901 the "disease is essentially the same in all varieties."<sup>35</sup> Such terms merely indicate clinical conditions found in the various stages of a single pathological process, and it would be well, therefore, to dismiss this older classification and adopt the one now used by Osler—namely (1) amoebic dysentery; and (2) bacillary dysentery. This nomenclature was, I think, first suggested by Davidson,<sup>11</sup> but he added to it a third variety, which does not really exist, as his "dysentery of war" is simply a form of bacillary dysentery.

The amoebic type of the disease is essentially endemic in its character and is defined by Firth<sup>20</sup> as "a chronic affection of the small and upper part of the large intestine," but Osler describes it briefly as "a colitis, acute or chronic, caused by the amoeba dysenteriae."<sup>29</sup> The bacillary variety on the contrary is essentially acute or, to use an old word, fulminating in its character. It is usually strictly limited to the large intestine.

*Causes of dysentery.*—In considering these we must subdivide the heading into (a) predisposing causes; and (b) exciting causes. Let us first consider the causes which predispose to the disease. We find that these fall under four chief divisions—namely (1) age, (2) sex, (3) occupation, and (4) conditions of lowered vitality. (1) Age.—Dysentery may occur at any age, but in my experience it has a singular predilection for the extremes of life, children and old people being peculiarly liable, the former, doubtless, on account of their well-known liability to catarrh of the intestinal mucous membrane which is itself a predisposing cause of the disease according to Scheube (p. 466).<sup>32</sup> (2) Sex.—According to most authorities this does not exert any influence, but Scheube<sup>32</sup> cites pregnancy as a predisposing cause, and it is within the experience of most physicians who have lived in the tropics that when dysentery occurs in a pregnant woman, or during the puerperium, the prognosis is very grave indeed. (3) Occupation.—Davidson<sup>11</sup> asserts that agriculturists are attacked more frequently than persons whose calling is carried on indoors, and according to Lancarol persons who labour in the heat, such as stokers, cooks, and mechanics, are peculiarly liable to the disease. The occupation of the soldier predisposes to dysentery, especially on active service, as his duties and mode of life involve, of necessity, great liability to chill, and the ingestion of bad or irritating food, indifferently cooked, both well-recognised predisposing causes of the disease. Moreover, on service men and officers are occasionally, as occurred in Ladysmith, unable to obtain remedies for catarrhal conditions of the bowel, which, as we have seen, undoubtedly predispose to true dysentery. (4) Conditions of lowered vitality.—There can be no doubt that in conditions of health the pathogenic organisms of dysentery, enteric fever, cholera, and other diseases pass through the intestinal tract in association with the luxuriant flora and fauna which normally flourish therein, without causing any inconvenience, and that it is only when the mucous membrane of the bowel is the subject of some inflammation, irritation, or impaired nutrition that it forms a suitable nidus for the amoeba or bacillus dysenteriae.

\* The superior figures occurring throughout the article are references to the bibliography at the end.

Such conditions of reduced vitality may be induced by a variety of circumstances, first and foremost among which I would place "chill," which Manson declares to be a "powerful excitant of dysentery,"<sup>24</sup> and Scheube considers, above all things, to be mentioned as a predisposing cause.<sup>32</sup> Next I should place "unfavourable hygienic conditions," such as overcrowding, contamination of the soil with sewage, and an impure water-supply. Epidemics of the disease are therefore peculiarly likely to occur in war and as an accompaniment of famine, and Scheube says, "In almost every long campaign or siege the outbreak of an epidemic of dysentery amongst the combatants, amongst the besiegers as well as the besieged, is a common occurrence."<sup>32</sup> Such epidemics have occurred in all ages, as Munson refers to an outbreak of dysentery in the army of Henry V. at Agincourt,<sup>27</sup> whilst the ravages of the disease during the Franco-Prussian war of 1870 and in the garrison of Ladysmith in 1900 are familiar instances in recent times. Enfeeblement through previous disease is a predisposing cause on which both Scheube<sup>32</sup> and Manson<sup>24</sup> lay great stress, and the diseases which are most likely to be followed by dysentery are the two great debilitating diseases of the tropics, malaria and enteric fever. In this relation Buchanan has pointed out that dysentery frequently forms the "terminal disease" in chronic invalids, such as malarial cachectics, tuberculous invalids, and lepers,<sup>3</sup> and my personal experience in a large cantonment general hospital at Umballa confirms this observation. Next in importance to the foregoing I would place "abuse of alcohol." Scheube says, "inebriates usually have severe attacks,"<sup>32</sup> and the writings of all military observers go to show that the intemperate soldier is the one most subject to dysentery and its most terrible sequelæ, tropical abscess of the liver. German writers mention such predisposing causes of dysentery as insufficient or superabundant nourishment, disorders of the digestion, hæmorrhoids and excessive venery, but I fail to see how these can act otherwise than by impairing the general nutrition. Finally, all authors are agreed that the ingestion of rotten and indigestible articles of food, and especially unripe fruits, predisposes to dysentery, but these again have no specific action and simply act by exciting a catarrhal condition of the mucous membrane of the intestine and thereby rendering it vulnerable to the various micro-organisms about to be referred to.

With regard to the exciting causes, these are in amoebic dysentery the *entamoeba histolytica* and in bacillary dysentery the *bacillus dysenteriae*, "a specific bacillus of which there are various strains."<sup>28</sup> I propose to refer to these two varieties separately, as they are in reality two distinct diseases in which the pathological changes are similar but not identical.

*Amoebic dysentery.*—This variety is essentially slow developing in its nature, although acute attacks are not uncommon. It is styled by Firth and others "endemic dysentery," and it appears to have little tendency to break out into definite epidemics, as is the case with the other form of dysentery. The organism producing amoebic dysentery belongs to the animal kingdom and has been placed by Leuckhart in the rhizopoda class of the protozoa, or one-celled animals. An amoeba was first described by Lambl in 1859 and subsequently by Loch in 1875, but to Schaudinn is due our present exact knowledge of the genuine organism. He found that many kinds of amoeboid organisms occur in the human intestine and that some of these are not true amoebæ at all but merely amoeboid stages in the development of the higher forms of the protozoa such as trichomonas, lamblia, and other infusorians. Genuine amoebæ he divided into two classes: (1) those provided with a shell, the thecamoebæ; and (2) those that have no other covering, or gymnamoebæ. "At least one of the former and two of the latter sort are now known to occur in the intestine."<sup>42</sup> The two naked forms are genuine parasites, but one of them is harmless and the other one of the most dangerous of pathogenic protozoa.<sup>42</sup> Schaudinn<sup>41</sup> has re-named the former, hitherto known as the amoeba coli, the *entamoeba* and the latter hitherto known as the amoeba dysenteriae as the *entamoeba histolytica*. The *entamoeba coli* was found in from 20 to 60 per cent. of healthy stools by Schaudinn and is a shapeless mass of protoplasm not showing much differentiation into ecto- and endoplasm but possessed of a well-marked nucleus. It is difficult to find in healthy fæces, as its habitat being in the upper regions of the colon it dies out as the intestinal fæces become firmer on their passage down the bowel. If, however, the downward

course of the fæces is hurried by saline purgatives the amoebæ can be readily detected, as Schuberg has shown. "The amoebæ have two distinct cycles of development; one vegetative or asexual taking place in the naked state, the other displaying a primitive but unmistakeable form of sexuality and occurring inside of a capsule resembling an egg-shell and termed a cyst. In the vegetative form the amoebæ either simply split in two or their nucleus divides into eight daughter nuclei, each of which takes a portion of the protoplasm so as to form a characteristic brood of eight young amoebæ, which come apart. In the other or sexual cycle the amoeba rounds itself off, comes to rest, and contracts and surrounds itself with a gelatinous coat which becomes the cyst wall. The two nuclei, after undergoing reconstruction and chromosomic reduction, divide into halves, which copulate, so as to form two fresh nuclei, each containing half of the two parent nuclei. Each of these copulation nuclei now divides twice and the divisions form eight young amoebæ which, however, cannot leave their cyst until it has been taken in by a new host and has had its wall softened in the stomach and duodenum."<sup>42</sup> The pathogenic *entamoeba histolytica* differs materially from the foregoing. It possesses a tough ectoplasm which enables it to force its way between the layers of the mucous membrane and produce the undermined ulcers of tropical dysentery. Schaudinn has actually observed the organism in scrapings of the bowel from an experimentally infected cat. "The two sorts of amoeba differ also in their reproduction. The pathogenic form in its vegetative stage divides into two or forms new individuals by budding. Brood formation does not occur. The process of encystment is also quite different. It comes on when the patient is beginning to recover from his attack of dysentery and the fæces are becoming solid. The nucleus gives up most of its chromatin in granular form to the plasma and its remains are expelled. The plasma now projects from its surface a number of little knobs, each containing a particle of chromatin and measuring from three to seven micra in diameter. These break off after a while and each becomes surrounded by a capsule which ultimately becomes quite brown, hard, and opaque. These 'spores' are then expelled with the fæces and serve to infect a fresh host."<sup>42</sup>

McWeeney<sup>43</sup> states that so far back as 1902 he believed that the amoeba coli or rather, I presume, what we now know as the *entamoeba histolytica*, was causative of one form of dysentery and in the very excellent paper from which I have quoted above he holds that "one of Schaudinn's experiments seems quite conclusive." In this experiment this great investigator, whose untimely death we all deplore, dried a small quantity of fæces from a case of undoubted dysentery in air and satisfied himself microscopically that it contained no cysts of *entamoeba coli*, but only the small brown spores of *entamoeba histolytica*. The cover-glasses were then removed from the slides actually examined and the fæces washed off with about one cubic centimetre of sterile water and administered in food to a young cat whose stools had been proved to be free from amoebæ. Three days later the cat began to pass slimy fæces streaked with blood. These were found to be swarming with typical *entamoeba histolytica*. Next day the animal died from dysentery. The necropsy showed characteristic ulceration of the large intestine with crowds of amoebæ in all stages of penetration into the intestinal wall. Schaudinn administered quantities of the fæces of this cat to another one but it remained healthy. He then gave a small quantity of the dried fæces originally used and within six days amoebæ appeared in the fæces. This cat, which was older and stronger than the first one, developed dysentery and "died in about a fortnight."<sup>42</sup> From this experiment it would appear that amoebæ taken by the mouth appear to be harmless and that "it is to the dried-up, cyst-containing fæces present in dust and water that we must look for the propagation of dysentery." Kruse and Pasquale, as is well known, produced dysentery by the introduction of amoebæ per rectum, but McWeeney considers that this rectal transference can hardly be realised under natural conditions. Whether the amoebæ contained in the fæces from the acute stage will, if gradually dried, become converted into cysts outside the body is not clear, but it is obvious that the dejecta of dysentery must be prevented from getting access to drinking water or being conveyed by flies to food. The *entamoeba* and Shiga's bacillus appear to be antagonistic and both Schaudinn and Castellani<sup>45</sup> have failed to find them in the same bowel.

*Bacillary dysentery.*—Although it is evident from the

foregoing that the amœba dysenteriae is clearly the exciting cause of many cases of dysentery it is equally evident that there is a very large amount of dysentery which is not due to amœbæ. In support of this we find that Bruce, Washbourn, and Birt<sup>1</sup> failed to find amœbæ at all in the large number of cases they examined during the South African epidemics. Major W. W. O. Beveridge<sup>1</sup> discovered amœbæ in only three out of 147 cases examined in the Army Medical Service laboratories at Pretoria. Strong and Musgrave noted 766 cases of bacillary to 561 of amœbic dysentery in their investigations in Manila, while Rogers states that the bacillary is much the most common form of the disease in Calcutta.<sup>30</sup> The credit of first recognising a definite bacillus which was capable of producing dysentery is due to Chantemesse and Widal who showed by experiments on animals that a bacillus closely allied to the bacillus coli communis was frequently present in the stools of epidemic dysentery and capable of producing the disease in cats, but the question of the exact form of bacterium responsible for the disease was hotly disputed until Shiga of Tokio isolated a bacillus from the type of disease occurring in Japan and "proved its specificity by demonstrating the agglutination of its cultures by blood serum."<sup>18</sup>

Two years later Kruse discovered an identical bacillus in an epidemic of dysentery which prevailed in Rhenish Westphalia. At much the same time Flexner in the Philippines isolated from certain persons suffering from dysentery a bacillus presenting close resemblance to Shiga's.<sup>21</sup> Flexner's work was confirmed soon after by Strong and Musgrave in their study of dysentery among the American troops in Manila, while Drigalski in an outbreak among the Prussian Guards, Pfuhl among men returned from the China expedition, and Muller in an epidemic at Sudsteiermark have all described an identical bacillus. Vedder, Duval, Park, and Carey in the United States, Rosenthol in Moscow, Rogers in Calcutta, Vaillard and Dopter at Vincennes, Firth in India, and Bruce in South Africa, have all recovered from the stools of dysentery occurring in the places named, bacilli which, if not practically identical, at least very closely resembled the bacillus first described by Shiga in 1898.<sup>13</sup> In short, from the most diverse parts of the globe has accumulated a mass of evidence indicating that there exists an epidemic form of dysentery, characterised by a special bacillus whose constant presence in the intestinal discharges and agglutination by the blood serum of those affected lead Osler to state: "It is now generally conceded that the severe epidemics of dysentery occurring in the tropics are of the bacillary type and the same form prevails in temperate climates."<sup>29</sup> The consideration of this organism will, however, be more appropriately discussed under the heading of "Recent Bacteriological Investigations," so we pass on to consider the prevention of dysentery.

*Prevention of dysentery.*—1. General. Scheube<sup>32</sup> states that the general prophylaxis of dysentery demands careful attention to general hygiene and the personal avoidance of the predisposing causes and goes on to say: "The circumstance that dysentery does not now appear in the tropics with the same frequency and severity of 30 or 40 years ago is to be ascribed to the improvement in hygienic conditions, especially in regard to water-supply, which has taken place during recent years and to the more rational method of treatment practised by the doctors of the present day."<sup>32</sup> In order to prevent the disease spreading the intestinal evacuations should be disinfected, as should also night commodes, utensils, privies, &c., as well as the soiled linen and bed linen used by the sick."<sup>32</sup> He further recommends that when constipation occurs in the East only mild aperients should be taken and quotes, without comment, the advice of Lancrol to take cold baths throughout the year as a prophylactic. In the last recommendation few physicians will concur, as the use of the cold bath conduces to "chill," and those of us who have lived for many years in the tropics know well the risks attached to the luxury of a cold tub and studiously avoid it even in England. Indeed, it is not unusual for patients to trace clearly the onset of an attack to a severe chill and my own first personal experience of the disease supervened after a severe wetting and consequent chill during the rainy season of 1898. To prevent dysentery in the tropics I would suggest that the following rules be strictly adhered to, and that, having themselves grasped their importance, all officials should be induced, by precept and practice, to enforce obedience to this simple code on their subordinates. 1. Drink only boiled or preferably sterilised water, by which I mean water not

bacteriologically sterile but which has been heated to 80° C., a temperature which is sufficient to kill non-spore-bearing organisms and certainly the bacteria of dysentery, cholera, enteric fever, and most other communicable diseases. 2. Clothe warmly and wear a so-called cholera belt to avoid chill being communicated through the abdominal wall to the intestine. 3. Be temperate in food and drink and remember that alcohol is a luxury and not a necessity of life, especially in the tropics. 4. Seek medical advice at once when constipated or suffering from diarrhoea, however mild in character, and avoid drastic cathartics. 5. Isolate all cases of dysentery rigorously, regard cases of diarrhoea occurring during epidemics as suspicious and disinfect with care all diarrhoeic stools and the bedding and clothing of all persons affected with dysentery or suspicious diarrhoea.<sup>22</sup> Special.—On active service or exploration parties these rules require little modification except with regard to alcohol, which is, of course, not to be obtained, the essential points being the provision of pure, or at least comparatively sterile, water for the troops, the early recognition of abortive forms of the disease, and the prompt isolation of all dysenterics with careful treatment of their stools, clothing, and bedding.

*Treatment of dysentery.*—We are confronted at the outset with a serious difficulty. We find that the treatment of the two varieties of the disease is hopelessly mixed up by each and every authority, even in the most recent articles on the subject such as that of Dr. C. B. Sheldon Amos,<sup>40</sup> and that it is almost impossible to differentiate the remedies which are to be recommended in the variety due to amœbæ from those suggested for the bacillary type of the disease. Osler considers that amœbic dysentery is not very amenable to treatment by drugs, but I have seen many cases of dysentery apparently due to amœbæ readily cured by the ordinary remedies. As, however, it must frequently be impossible in practice to decide the type of disease at the outset of treatment it will, I think, be best to discuss the therapeutical measures available as a whole and merely to divide our remarks under the classical headings of "acute" and "chronic."

*Treatment of acute dysentery.*—In approaching the important subject of the treatment of an acute illness, such as dysentery, it is best to divide our remarks under different headings indicating the therapeutical lines on which our treatment is based. This is only done by one of the many authors I have consulted—namely, Dr. I. Burney Yeo—and I recommend to the consideration of every physician practising in the tropics this author's excellent article on the treatment of dysentery in the first volume of his "Manual of Therapeutics."<sup>39</sup> The indications which will assist us in the treatment of dysentery are five in number: (1) to relieve the pain and tenesmus; (2) to avoid all irritation of the inflamed mucous membrane; (3) to promote intestinal antiseptics by removing foul accumulations and arresting putrefaction; (4) to counteract any morbid agency in the blood as far as may be; and (5) to support the patient's strength by suitable diet. Let us consider these indications.

*Firstly, to relieve the pain and tenesmus.*—As the use of opium has been unhesitatingly condemned by the older writers in the treatment of acute dysentery, the evidence of Washbourn and Faichnie<sup>16</sup> is of value as expressing the most recent views on the subject. Washbourn<sup>38</sup> goes so far as to say that he has seen lives saved in South Africa by the introduction of a morphine suppository, so there is now no doubt that the first indication of the treatment of acute dysentery is to give opium in some form or other, not to act as an astringent but simply to moderate and control the painful contraction of the intestines which produces what is known as tenesmus. Yeo<sup>39</sup> suggests that the drug should be given in the form of an enema, and recommends the administration of 15 minims of the tincture in an ounce of cold mucilage of starch. It must, however, be remembered that in dysentery the anal mucous membrane is intensely irritable and the passing of a rectal tube may be the cause of great suffering, so that rather than resort to the device of brushing the entrance to the bowel with a solution of cocaine, as has been suggested by some writers, I have invariably preferred to give a quarter or a third of a grain of morphine hypodermically. I have found this effective in relieving both tormina and tenesmus and this appears to be the treatment to be adopted on expeditions or in camp when suppositories and material for enemata are rarely available. Dr. Amos emphasises the utility of opium in an article just published in THE LANCET.<sup>40</sup>

Secondly, to avoid irritation of the inflamed mucous membrane. In this relation I may point out that many years ago Sir William Gull summed up the treatment of acute dysentery in three words, viz., "Rest, warmth, and ipecacuanha." This was not only smart and epigrammatic but it had the advantage of being correct, and Washbourn,<sup>34</sup> after his exceptional experiences in South Africa, has little to add to the aphorism of the great Gull. To avoid irritation of the inflamed mucous membrane we must apply the first two of Gull's trinity of remedies. Rest is absolutely essential and in all cases the patient should remain in bed and use a bed-pan. The frequent stools and tenesmus soon produce coldness of the surface and extremities, so to maintain the individual's vitality he must be kept warm by means of plenty of blankets and hot-water bottles if necessary, and Yeo recommends that opium liniment should be gently rubbed into the abdomen.<sup>39</sup> All foods which leave a residue prone to decomposition must be avoided, and Manson<sup>21</sup> objects even to milk in acute dysentery if the tongue is foul and limits the diet to weak chicken broth, barley, and rice water, with a little egg albumen till the tongue cleans. Milk is, however, considered the best food in all cases by Scheube<sup>32</sup> and Yeo,<sup>39</sup> while Osler<sup>29</sup> recommends "milk, whey, and broths." In my own experience milk can be taken if the stools are watched. It should be boiled or sterilised, diluted with almost equal parts of barley water, and rendered alkaline by the addition of five grains of bicarbonate of sodium or one drachm of saccharated solution of lime to each pint. If curds appear in the stools the milk must be peptonised to limit, so far as possible, the amount of undigested milk passing through the pylorus, but if, notwithstanding this precaution, curds are still present, then it is essential that milk should be given up and the diet limited to whey, broths, and egg albumen. In all cases clear soups flavoured with the juice of fresh vegetables can be given as they leave no residue behind and are most grateful to the patient as a change from milk. Ewart<sup>15</sup> and Nash<sup>28</sup> very strongly recommend this kind of broth in the treatment of typhoid fever and we may take it that in the acute stage dysentery must be treated on much the same lines as enteric fever. Nash says that "too rigid an application of the exclusive milk diet spells disaster in many cases. I can call to mind more than one case of typhoid fever which has been admitted to hospital most desperately ill, not so much through the disease *per se* as through loading of the intestinal tract with massive milk curds producing both harmful toxins and mechanical irritation." Stimulants should not be exhibited as a matter of routine. As Faichnie<sup>18</sup> points out, they are rarely necessary and should only be given in small quantities when the prostration of the patient is very great. A teaspoonful of brandy in a teaspoonful of hot coffee is recommended by one authority.<sup>39</sup>

The third indication for treatment is to attempt to produce intestinal antiseptics. This can, of course, be merely an attempt as the bowel may be regarded as a forest crowded with flora and fauna of the most varied and septic character, but although it may be useless to try to render the intestinal mucosa aseptic it may be possible to place it in a position which will discourage the growth of a delicate organism such as the bacillus of dysentery appears to be. There are three ways in which we may attempt to treat this indication—namely: (1) by saline aperients which sweep all foul accumulations and organisms from the intestinal tract in a more or less mechanical manner; (2) by the administration of certain drugs said to be specific; and (3) by washing out the bowel *per anum* by means of astringent and antiseptic fluids. In the tropics the best preliminary treatment for all cases of diarrhoea is a dose of castor oil with or without from 15 to 20 minims of liquor opii sedativus, and Manson believes that slight cases of dysentery are often checked thereby and require no further treatment except rest and a bland non-irritating diet for a few days. Having done this the physician must elect whether he will resort to the saline, specific, or lavage method of treatment.

With regard to the saline treatment, this method has many adherents amongst officers of the Royal Army Medical Corps serving in India and in most hospitals in that country one or other of the following mixtures is well known: 1. Magnesium sulphate, one drachm; tinctura zingiberis, ten minims; acidum sulphuricum dilutum, five minims; chloroform and water to half an ounce. 2. Sodium sulphate, one drachm; and aqua fœniculi, half an ounce. The first is Buchanan's original formula and the latter his modification on discovering that sulphate of sodium gave, on the whole, better results than

sulphate of magnesium.<sup>7</sup> The mode of administration is to give a tablespoonful of one or other of these mixtures every hour until the motions become faecal and then every three or four hours for one or two days. If the stools become watery and show no tendency to take on a faeculent character the saline treatment must be promptly stopped, and the ipecacuanha resorted to, and I would point out that Washbourn,<sup>38</sup> from his recent experience in South Africa, regards ipecacuanha and magnesium sulphate as both specifics for the disease but he regards ipecacuanha as the most efficient, as he has seen it cure cases where magnesium sulphate has failed. Personally, I always start with the saline treatment when I can rely on the patient being efficiently nursed and the character of the stools intelligently watched, but in other cases I resort to ipecacuanha, which I consider almost a specific for the disease. We will therefore discuss it under the heading of specifics.

"Specific" treatment.—Scheube<sup>32</sup> says: "The principal drugs used in the treatment of dysentery are calomel and ipecacuanha, the effects of which do not depend solely on their aperient and emetic qualities. The drugs must be regarded as having a 'specific' effect, a fact which does not seem as yet to have been fully acknowledged, at least as far as German text-books are concerned." Manson says he can offer no explanation of the action of any drug in dysentery and admits that we use them empirically, but thinks that "ipecac and simaruba really seem to have some sort of specific action on the disease or its cause, but in what way it is impossible to say." Yeo<sup>39</sup> thinks that ipecacuanha may be microbicidal and arrest the growth of the organism, whether *amœba* or *bacillus*, producing the disease, while Fayrer points out that the mortality of all varieties of dysentery in India, which was 11 per cent. before its use, fell to 5 per cent. after its introduction.<sup>32</sup> The method of exhibiting the drug almost universally adopted in military practice in India is to interdict food for three hours and then to give 20 minims of liquor opii sedativus in a small quantity of water. Half an hour after the opium 30 grains of powdered ipecacuanha are given in the form of freshly prepared pills or as a bolus. To prevent vomiting the patient is directed to lie perfectly still in a darkened room and not to drink, speak, or move for three or four hours. He must be cautioned not to swallow his saliva and a nurse should remain by his side with directions to wipe away any salivary secretion on the slightest indication from the patient. Ipecacuanha prepared without the emetic principle was much vaunted at one time, but its use was abandoned by most Indian practitioners before the South African war, when it was extensively used and found most unsatisfactory. I believe Day's remarkable experience of the failure of the drug to cure dysentery was due to his using this preparation.<sup>10</sup> He reported 60 cases in 26 of which he used ipecacuanha *sine emetina* and opium, with the result that nine died, and 32 in which he administered sulphate of magnesium with only one death. Scheube and Kartulis<sup>32</sup> are strong advocates of calomel in the treatment of dysentery, but I have no personal knowledge of its use, as with an experience of several hundred cases I have been so fortunate as to have had only one or two fatal cases under the "saline plus ipecac" treatment. I do not propose to confuse the issue by referring to the numerous other drugs which have been exploited at various times as "specific" for dysentery, as with the exception of *Monsonia ovata*, advocated by Maberly, their utility does not seem to be well established in the treatment of dysentery in its acute stage.<sup>25</sup>

The lavage treatment.—Osler<sup>29</sup> says "that the treatment of dysentery by topical applications is by far the most rational plan," but I think this statement requires qualification. It is unquestionably a valuable method of treatment, but it is only applicable in subacute and chronic cases, at least in the tropics where the services of skilled nurses are comparatively rarely obtainable. I merely refer to this method for the sake of completeness as the results of the two previous lines of treatment are so good. For instance, Buchanan<sup>29</sup> has treated 855 consecutive cases by salines with only nine deaths, giving a case mortality of only 1.05, and these, I think, are almost as good results as can be hoped for in the treatment of an acute illness.

The fourth indication is to counteract any morbid condition of the blood. This is a most important indication and one which has recently attracted much attention. Where dysentery occurs in a malarial subject quinine must be exhibited in full doses, and Maclean goes so far as to



recommend that 20 grains of quinine should always be administered before the ipecacuanha treatment is begun. The morbid condition of the blood which has recently been shown to be frequently associated with dysentery, especially on the Indian frontier, is, however, diminished alkalinity, which Wright has shown to be a frequent cause of scurvy. It must, therefore, be borne in mind that a condition resembling ordinary dysentery may be simply a variety of scurvy, and it may be well, therefore, to test the alkalinity of the blood by the method advised by Wright in all cases of dysentery in which the origin is obscure. Recently in Somaliland a succession of cases of dysentery were found to be due to "acid intoxication" and were relieved by antiscorbutic treatment.<sup>41</sup> Yeo<sup>39</sup> says: "In scorbutic cases the fresh bael fruit has been strongly commended by Anglo-Indian physicians. Lemon and lime-juice may also be given and fresh ripe fruits and vegetables, but Leishman states that ten grains of lactate of sodium three times daily rapidly cures all conditions due to diminished alkalinity. The cases of dysentery one occasionally comes across in Indian practice in which native *hakims* are successful by giving abundance of fresh fruit after English remedies have failed are of course scorbutic ones, so the recognition of this indication for treatment is a very important one in every way.

The fifth and last indication is to maintain the patient's strength. This must be done by suitable diet, as indicated under our second heading, and the administration of stimulants in some cases but not as a matter of routine. Few will agree with Yeo's suggestion<sup>39</sup> that port and burgundy may be used in acute cases, and the custom of most physicians in the tropics is to prescribe brandy or champagne in the comparatively rare cases in which alcohol is necessary. "Ether and caffeine hypodermically and saline injections have been employed with success in cases in which life appeared to be endangered by hæmorrhage and anæmia with prostration and collapse."<sup>39</sup> Sparteine has also been used with success.<sup>40</sup> After the very acute stage is over and when the appetite is returning the strength must be supported by a fairly liberal diet. Egg-and-milk flavoured with nutmeg is an agreeable and nutritious food. Pounded sweetbread, chicken, or mutton may be given with strong soups and the many varieties of bland farinaceous food of which rice and bread are the types. During convalescence all indigestible articles of diet should be rigidly excluded, but abundant light, nutritious food allowed and the appetite encouraged by the administration of the various bitter tonics, such as cinchona, gentian, and nux vomica. As with enteric fever, so in dysentery, it must be kept constantly before us throughout the illness that our duty is not merely to the patient but to the community and our first aim in all treatment should be to prevent the spread of the disease, which is undoubtedly communicable, and to do this it is essential that all cases of actual dysentery and also all suspicious cases of diarrhoea should be promptly and efficiently isolated and their stools, clothing, and bedding carefully dealt with as recommended in the section on prevention.

*The treatment of chronic dysentery.*—We now turn to the treatment of chronic dysentery, a condition all too familiar to physicians who have practised in the East. The indications requiring treatment are here merely three in number: (1) to promote a restoration of the diseased mucous membrane; (2) to counteract any morbid tendency in the blood; and (3) to support the patient's strength by proper diet.

1. Manson's routine<sup>24</sup> in treating all cases of chronic dysentery, a method of which I have had some personal experience, is to give a short preliminary course of ipecacuanha—30, 25, 20, 15, 10, and 5 grains on successive evenings, with rest in bed and milk diet. He then proceeds to give a short course of very small doses of castor oil, with or without opium, three times daily, regulating the dose according to the amount of action produced. If this treatment does good he proceeds to give a mixture of simaruba and cinnamon, with or without some intestinal antiseptic, such as salol or  $\beta$ -naphthol. These measures failing he has to resort to direct topical applications. Osler<sup>29</sup> and Manson<sup>24</sup> are agreed that these are of the utmost value in the treatment of dysentery, but on one important point the two great authorities differ. The latter insists that topical remedies should never be applied when acute symptoms are present, whereas the former gives the technique for their use in the acute stage of the disease. Nitrate of silver injections are now considered by most authorities to be the best form of local application in chronic dysentery, but solutions of quinine are strongly

advocated by Osler<sup>29</sup> in amoebic dysentery, this being with one exception the sole instance in which a remedy peculiar to one type of dysentery is advocated by any of the authors I have consulted. The treatment of chronic dysentery by nitrate of silver injections was introduced by Hare of Edinburgh, and first used in England by Stephen Mackenzie of the London Hospital. It has been most efficacious in many cases in my own practice and is best given in the following way. The bowel having been cleared with a dose of castor oil a large enema of warm water with a little boric acid or bicarbonate of sodium added should first be given, and when the whole of this has escaped from 40 to 60 ounces of a solution of nitrate of silver, half to one grain to the ounce, should be introduced by means of a "long tube passed slowly into the bowel, as far as it will go without kinking. It is better to fill the bowel by gravitation, using a funnel and tube rather than a syringe." The patient should be directed to retain the injection as long as possible and if appearing to do good it should be repeated twice weekly. Osler points out that it is quite useless to give small injections of nitrate of silver and states that he has never known argyria to follow the prolonged use of the drug. Indications (2) and (3) must be combated on much the same lines as those indicated above in the treatment of the acute stage. If, as is unfortunately frequently the case, the patient fails to get well notwithstanding most careful dieting and active therapeutical efforts the sooner he is sent to Europe the better, and in such cases the advantages of a course of treatment at Carlsbad or of the system of rectal douching practised at Plombières should be brought to the patient's notice.

*Recent bacteriological investigations.*—For the purpose of this paper I obtained the following strains of bacillus dysenteriae—(1) Shiga's bacillus I.; (2) Shiga's bacillus II.; (3) Flexner's bacillus; (4) Vaillard's bacillus; (5) Kruse's bacillus; and (6) bacillus dysenteriae (non-pathogenic). For the first of these cultures I am indebted to Captain Harvey, assistant professor of pathology, and for the remaining five to Major Fowler, assistant professor of hygiene at the Royal Army Medical College, London. To economise space I have arranged the morphological and cultural characteristics of the various bacilli in the accompanying table which shows clearly their resemblance to, and difference from, the other members of the coli group of micro-organisms. The following points, however, merit brief special references: (1) flagella in dysentery organisms; (2) sugar and caffeine media; (3) agglutination; (4) vitality; (5) clinical bacteriological examination; and (6) evidence of pathogenicity.

*Flagella.*—The dysentery organisms were at first considered to be non-motile and most of the text-books and earlier monographs state that Brownian movements are marked but flagella are not present.<sup>1</sup> It is, however, now recognised that the bacillus is always motile when recently recovered from the stools and only loses its motility in sub cultures. Vedder and Duval were the first to demonstrate, by a modification of van Ermengen's process, that the bacillus possesses "a number of lateral flagella of great fineness but considerable length."<sup>26</sup> These results have been confirmed by Birt and Eckersley, who have demonstrated flagella in eight strains of the organism, including Vaillard's bacillus.<sup>3</sup> The best method of demonstrating flagella is Stephens's modification of van Ermengen's stain. The following description of the method is by my comrade Captain Grattan of the Royal Army Medical College:—

1. Take a twenty-four hour culture of an actively motile bacillus.
2. Prepare a thin emulsion of the bacilli.
3. Spread on a clean slide. The slide is best cleaned by heating over gauze.
4. Fix for one to three minutes in a mixture of (a) osmic acid 2 per cent. two parts; tannic acid 20 per cent., one part. Do not waste this fluid; pour the excess back into the bottle.
5. Wash off thoroughly.
6. Add a few drops of nitrate of silver solution 1 per cent. which constitutes B solution.
7. Knock off excess of stain but *do not* wash.
8. Add a drop or two of C solution: gallic acid saturated solution, one cubic centimetre; liquor ammoniæ fort. two cubic centimetres; freshly mixed. The slide should be flushed with this solution very quickly and then washed thoroughly.
9. Dry and mount.

*Sugar media.*—An alkali albumin called nutrose has been used by various German investigators and by an Austrian army surgeon, named Doerr, for preparing the special sugar media above referred to for differentiating the bacillus dysenteriae from the other members of the coli group. I have used it in these investigations preparing the media from the following formula: Mannite or special sugar, 1 part; sodium chloride, 5 parts; nutrose, 1 part; and water, 100 parts. The nutrose and mannite or sugar are dissolved by

TABLE SHOWING THE MORPHOLOGICAL AND CULTURAL CHARACTERISTICS OF *BACILLUS DYSENTERIÆ* AND THE ALLIED GROUP OF MICRO-ORGANISMS.\*

Micro-organism.	Character.	Motility.	Flagella.	Growth on nutrient agar.	Gelatin stab.	Peptone and salt.	Neutral red shake.	Litmus milk.	Sterile potato.	Agglutination with dysenteric serum.
Shiga's bacillus dysenteriae I.	Short rod with rounded ends. No spores. Length 1-3 $\mu$ .	Motile in recent cultures from stools. Gradually loses motility in sub-cultures.	2-6. Mostly terminal. Rather short and thick.	Semi opaque. Resemble the growth of bacillus typhosus but are more transparent.	Similar to bacillus typhosus, but film which spreads out from puncture usually absent.	Faint haziness which rapidly clears. No indol.	No appreciable discharge of colour.	Becomes feebly acid. After 4 days' incubation acidity has been estimated as equal to 6 per cent. decinormal alkaline solution. No clot.	Transparent or whitish growth, which becomes brownish red or dirty grey, with discoloration of potato at edge in a few days.	Usually only agglutinates with serum from animal immunised by special strain of bacillus dysenteriae.
Shiga's bacillus II.	"	"	"	Has a characteristic odour called by the Germans "Spermeruch."	Growth not seen till 48 hours and then only slight white growth.	"	"	"	"	"
Vaillard's bacillus.	Shorter than Shiga, otherwise similar.	"	Numerous fine, reticulated, very long and readily seen (Birt).	"	"	"	"	"	"	"
Flexner's bacillus.	Similar to Shiga.	"	Long, thick, and terminal.	"	"	"	"	"	"	"
Kruse's bacillus.	"	"	Usually 2 terminal.	"	"	"	"	"	"	"
Pseudo-dysenterial bacillus.	Generally somewhat larger than true dysentery bacillus.	"	Variable.	"	"	"	"	Slightly acid at first. Afterwards slightly alkaline.	"	Very variable.
Bacillus typhosus abdominalis.	Longer than either bacillus dysenteriae or bacillus coli. "Oval ends" (Muir and Ritchie).	Sub-cultures always very motile.	8-12.	More opaque than those of bacillus dysenteriae.	Similar, but surface film usually present.	"	"	Slight acidity after some days.	For several days apparently no growth. Later slight pellicle with velvety surface.	Nil.
Paratyphoid bacilli.	"	Not so motile as bacillus typhosus but more so than bacillus coli.	Variable.	"	"	"	A, Usually no change. B, Sometimes fluorescence.	Paratyphoid A produced acid like bacillus typhosus and Paratyphoid B produced alkali.	Variable.	Nil.
Bacillus coli communis.	Shorter and thicker than bacillus typhosus.	Motility is not so marked as bacillus typhosus.	2-6.	More opaque than bacillus typhosus.	Whiter, thicker, more opaque, and showing gas bubbles.	Indol production marked.	Canary yellow colour produced and gas bubbles	Marked acid and clot.	In 48 hours distinct brownish film which rapidly spreads and becomes thicker.	Nil.

\* In addition to the culture media and other tests shown in the table the effects of Gram's stain, bile salt broth, mannite nutrose broth, raffinose nutrose medium, salicine nutrose medium, caffeine medium, and agglutination with enteric fever serum were also tried. The effects were as follows. *Gram's stain*: "decolorised" with all nine bacilli. *Bile salt broth*: "acid, no gas" for the first eight bacilli; "acid and gas" for the bacillus coli communis. *Mannite nutrose broth*: "unchanged" for the first five bacilli; "growth and acid" for the pseudo-dysenterial bacillus; "acid" for the last three bacilli. *Raffinose nutrose medium* and also *salicine nutrose medium*: "acid and growth" for the pseudo-dysenterial bacillus; "unchanged" for the other eight bacilli. *Caffeine medium*: "growth" with the bacillus typhosus abdominalis and the paratyphoid bacilli; "no growth" with the other seven bacilli. On testing with enteric fever serum the agglutination result was "marked" with the bacillus typhosus abdominalis and "nil" with the other eight bacilli.

the aid of heat, and after filtration five cubic centimetres of neutral litmus are added. The reaction of the various members of the coli group on these special media is shown in the attached table.

*Caffeine medium*.—A medium prepared as suggested by Birt in the *Journal of the Royal Army Medical Corps* (vol. v., p. 731) was used and it was found that none of the strains of bacillus dysenteriae showed any signs of growth, whereas the bacillus typhosus flourished luxuriantly.

*Agglutination*.—Shiga attached much importance to the agglutination of his bacillus with the blood of a patient suffering from the disease and it was shown that a precipitate was given in dilutions as high as 1 in 200. The reaction is not given during the first week of the disease but from the tenth day onward increases rapidly in favourable cases. As in enteric fever, the dilutions which give agglutination if charted show a curve which indicates the progress of the disease. If a steady rise is shown the progress is favourable

but if the agglutination power of the blood remains stationary or diminishes the case usually ends fatally. The value of the test has, however, been greatly discredited during the past two years and Birt says: "Since, however, the serum of dysentery convalescents may clump one or more of the whole series of colon and dysentery groups in higher dilution than Shiga's bacillus itself, it alone is unreliable as a means of identification. This is not the case with the serum of goats immunised against Shiga's bacillus."<sup>1</sup>

*Vitality*.—All varieties of dysentery bacillus are killed by a temperature of 58° C. in an hour according to Birt,<sup>1</sup> or by a temperature of 60° for half an hour according to Firth.<sup>18</sup> It is very readily destroyed by disinfectants, 1 in 20 carbolic acid, or 1 in 2000 perchloride of mercury, destroying it in from three to five minutes. Firth found that bacilli lived on rags for 21 days and Leutz states it will survive in shaded and moist soil for several months.<sup>18</sup> It has lived for 55 days in tap water at ordinary temperature, and for 88 days at a

temperature of 37° C. Rosenthal has recovered the dysentery organism from milk after three weeks, from butter after nine days, and from fruit and vegetables after 11 days, so that the necessity for carefully cooking all food supplies during an epidemic is very apparent.<sup>12</sup>

*Clinical bacteriological examination.*—Take a small quantity of the mucus and prepare a film in the ordinary way. It will be found that very few organisms are present and in this respect the dejecta differ very widely from normal stools or those of enteric fever or cholera which invariably teem with bacteria. To prepare cultures wash a small quantity of the mucoid material with sterile water and shaken up with a little bouillon; then prepare agar plates either by inoculating liquefied and cooled tubes with a couple of loopfuls or by sweeping a bent rod, moistened with fluid, over agar placed in a Petri dish. Incubate at 37° C. for twenty-four hours and colonies of bacillus coli will appear, but on further incubation at the same temperature for 24 hours small colonies may be seen which will prove to be Shiga's, or some other variety of dysentery bacillus, if these organisms are present.

*Pathological evidence of the specificity of bacillus dysenteriae.*—The evidence of the pathogenic effects of the various strains of this organism on man is, necessarily, somewhat small, but if not convincing it is certainly presumptive. Strong reports a case in which a Philippine prisoner under a capital sentence was induced to swallow a culture of the organism. He died from acute dysentery, which set in 48 hours after swallowing the culture, but the value of this evidence is discounted by the fact that the disease was epidemic in Manila at the time. Shiga made an emulsion of one-twelfth part of an agar slope in sterile bouillon and had it injected into his own back. Slight pyrexia resulted and a small abscess formed at the site of the inoculation but no diarrhoea resulted. Shiga's blood serum, however, showed active agglutination with the bacillus some days afterwards. Flexner records a laboratory accident in which one of his assistants accidentally aspirated a small quantity of the fluid culture into his mouth. Notwithstanding prompt expectoration and the free use of a weak disinfectant mouth wash, severe diarrhoea, with bloody and mucous stools, tormina, and tenesmus, developed in 48 hours. On laboratory animals, Shiga, Kruse, Vaillard, Flexner, and Firth<sup>13</sup> have caused marked enteritis chiefly affecting the large bowel and showing various pathological changes identical with those of dysentery. The lesions are best marked in rabbits, cats, young pigs, and dogs. Horses react strongly to inoculation with the bacillus and have been killed by a small dose. The channel of experimental infection which produces the best results is subcutaneous injection. "Ingestion with food and by an oesophageal tube, after preliminary neutralisation of the gastric contents, or exhibition of an irritant have not been successful, while even the direct introduction of pure culture into the small intestine after laparotomy in a dog produced no appreciable result."

*Conclusions.*—1. I think that we may take it as bacteriologically proven that notwithstanding slight cultural differences the various strains of bacillus dysenteriae isolated by Shiga, Flexner, Vaillard, Harris, and Firth are simply varieties of the same organism. Bruce's "G Bacillus" resembles them, but I have not included it in my limited observations, as it was isolated from a single case, and when it arrived in England it was almost dead and had to be revived by prolonged recultivation. In addition to these pathogenic strains of the organism there are several varieties of so-called pseudo-dysentery bacillus which are non-pathogenic and are to be distinguished from the true bacteria of dysentery by the fact that they act on carbohydrates unaffected by Shiga's and the other pathogenic bacilli and they fail to produce enteritis in animals. Whether, however, these bacilli represent degraded or transitional forms of the true bacillus it is, as yet, impossible to say. 2. That symptoms and intestinal lesions identical with those found in man supervene after the subcutaneous inoculation of rabbits with the cultures of the various strains of bacillus dysenteriae. 3. That the dysentery organisms have considerable vitality. They will live on clothing for at least three weeks and are said to maintain their virulence in damp soil for months. When spread on bread crumbs, or similar articles of food, they survive for about a week. 4. They are, however, very readily destroyed by heat or by weak solutions of perchloride of mercury or the higher phenols. 5. The specific agglutination reaction with the serum of persons suffering from acute dysentery can generally be obtained within two weeks following the onset of symptoms but is

often poorly marked. It is, however, of some value and the blood of all patients suffering from a prolonged attack of diarrhoea should invariably be tested with several strains of the bacillus and the stools subjected to a microscopical examination, as my chief desire in this paper is to call attention to the fact that the character of the stools alone is not to be considered as the test of the presence or absence of dysentery.

I think the most important lesson to be drawn from my investigation of the literature on this subject, and my very limited bacteriological work with the organisms of dysentery, is that the profession has only begun to realise its ignorance of a very great subject and that the clinical entities, which we have hitherto styled dysentery, are not one disease but a group of maladies of very varying degrees of severity, ranging from the acute dysentery so familiar to those of us who have served in India or South Africa, to the simple infective diarrhoea which occurs in infants and adults. Simple diarrhoea may be, and often is, an abortive form of dysentery, as has been shown by the work of Dopter and Jurgens during the early part of 1905. During an epidemic of dysentery there are always a number of cases which are in reality dysentery but because no blood appears in the stools are regarded as simple diarrhoea, and it is these cases which constitute a grave source of danger to the community as they may infect others and give rise to attacks of true dysentery. Jurgens has recently examined the stools of 25 cases of simple diarrhoea which occurred during an epidemic of dysentery in a camp at Gruppe.<sup>13</sup> He failed to recover the bacillus dysenteriae but the serum of one of the cases agglutinated with a strain of the organism. Dopter<sup>13</sup> examined bacteriologically the stools of 11 cases of diarrhoea occurring during an epidemic of dysentery last spring. Seven of these cases were very mild; the bacillus dysenteriae was, however, recovered from one of them, but the serum reaction in all of them was negative. The remaining four cases did not yield to ordinary treatment and ran a prolonged course, but only symptoms of diarrhoea were observed and no blood appeared in the stools. In one of these cases the bacillus dysenteriae was isolated but in all the serum reaction was positive. In October last a case of chronic diarrhoea was handed over to me for treatment. The patient was the son of an officer, and aged 17½ years. He went to Egypt with his parents at the age of two years and returned 18 months later. Since then he had resided continuously in England, and until about two years ago had never suffered from looseness of the bowels. Subsequent to an attack of influenza he developed diarrhoea which had gradually got worse but he had never passed blood. When he came under treatment he was passing from six to ten stools daily and was considerably emaciated. I examined the stools and found amœbæ in abundance, but in order to check my work I sent a sample of the stools to the Royal Army Medical College laboratories, where Captain Harvey, assistant professor of pathology, confirmed my opinion that an amœboid organism, probably the entamœba histolytica, was present. The boy has accordingly been treated as a case of dysentery with the most happy results, as he is now passing solid stools after two years of continuous diarrhoea. It is therefore all-important that laboratory aid should be sought in all cases of diarrhoea, whether acute or chronic, as such cases as I have described may, under tropical or active service conditions, become potent factors in the propagation of dysentery.

In the light of this recent work I submit that all cases of diarrhoea occurring in the tropics should be treated with the same precautions as if they were manifest cases of dysentery and in hospital should invariably be isolated and their stools sterilised in some simple form of steriliser, or by means of disinfectants. In the Indian hills all faecal matter should be received on pine needles and burnt as suggested by me in a communication to the *Journal of the Royal Army Medical Corps*, entitled "The Goux System and its Application to India" (Vol. VI., p. 662). If acute diarrhoea and dysentery were recognised in the service as infectious diseases, promptly isolated, and careful disinfection of clothing, bedding, and stools carried out, I believe we should hear less of epidemics of dysentery both in tropical countries and on active service. The Japanese have shown us a good example in the recent war, as they fully recognised dysentery as a communicable disease with, we are told, the happiest results. In conclusion, I maintain that if we can in future warfare secure for His Majesty's troops a pure, or, at least, an innocuous, water-supply, an intelligent conservancy, and

the prompt recognition and isolation of suspicious cases of diarrhoea we can confidently hope for comparative immunity from the fell disease, or rather diseases which have been the scourge of all armies in the field since the day of Agincourt.

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A CONTRIBUTION TO THE STUDY OF  
PHLYCTENULAR OPHTHALMIA.

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THE idea that phlyctenular ophthalmia is due to infarctions of dead or attenuated tubercle bacilli has occurred to many clinical observers. It is a hypothesis that suits very well the recognised features of the disease, but no direct verification has hitherto been obtained in support of it either from the histological or from the experimental side. By a recent employment, however, of the delicate methods invented by Sir A. E. Wright and his collaborators for measuring the fluctuations that are produced in the opsonic power of the blood by the invasion of pathogenic organisms, we believe that we are able to throw some light upon this vexed question.

During the past 12 months, acting upon a suggestion of Sir A. E. Wright, we have been testing the opsonic power of the blood against the tubercle bacillus in all cases of

phlyctenular conjunctivitis that have presented themselves in the out-patient department of St. Mary's Hospital. The number so examined is now well over 50 and the samples of blood examined amount to nearly 200, so that we may claim to have established a broad basis for our conclusions. A preliminary note on the results was presented to the Ophthalmological Society in November, 1905,<sup>1</sup> in which, without putting forward any very positive conclusion, we were able to announce that the blood of such patients behaved in a manner which was altogether typical of a definite tuberculous infection—that is to say, that its activity in opsonic action on the tubercle bacillus fluctuated in a marked and definite manner above and below the normal according to the progress of the case. Since that time we have proceeded in a more elaborate fashion by procuring the attendance of patients at the laboratory for the daily sampling of their blood, and it is a selection from the much more conclusive data so obtained that we wish to submit on the present occasion.

The blood of a patient suffering from genuine phlyctenular ophthalmia is generally found to be markedly deficient in opsonic power to the tubercle bacillus but not to other bacteria, such as the staphylococcus, at the outset of the case, but if the patient be adequately treated (without recourse to tuberculin, be it understood) the opsonic index rapidly rises and reaches a maximum coincidently with the healing of the ulcers. It then begins to fall rapidly and in a few days is far below the normal, as if from exhaustion of the mechanism. At this low figure it will remain if the observations be continued for an indefinite time, and if, as so often occurs, a relapse takes place the same sequence of phenomena will be reproduced. In a minority of cases, generally older and more vigorous subjects, the opsonic index as regards tubercle will be found to have risen already much above the normal. Here it will remain with temporary falls till healing occurs and then takes a terminal drop as in the former category. We have not yet met with a single exception to this course of phenomena in phlyctenular conjunctivitis.

The simplest type of case is presented in Chart 1. The

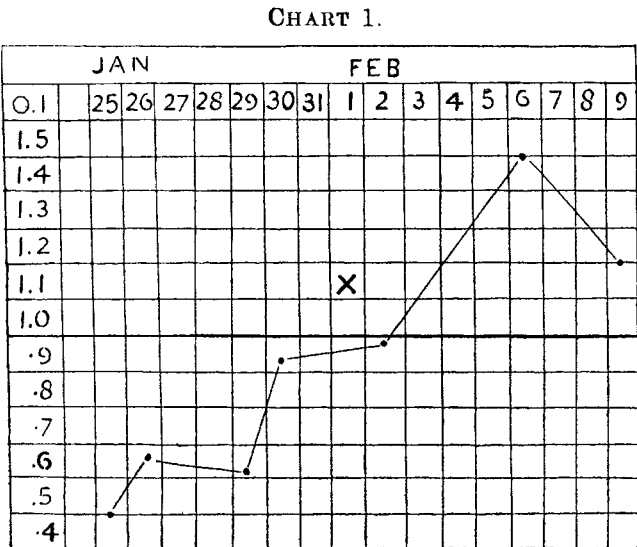


Chart of opsonic index. X, Disappearance of ulcer.

patient, a girl, aged 18 months, was a badly nourished child who was taken to St. Mary's Hospital for a well-marked ulcer on the margin of the cornea on August 18th, 1905, with the usual photophobia and blepharo-spasm. Treatment was initiated with iodide of iron, atropine ointment, and fomentations, and the patient continued in attendance until Oct. 31st, when she was discharged cured. The blood was only examined for its opsonic index on one occasion during this attack—namely, on Sept. 1st, and the index was found to be 1.0—i.e., normal. On Jan. 25th of the present year she was brought back with a fresh attack and this time it was determined to have a complete record of the case. Accordingly the mother was persuaded to bring the child as nearly as possible daily to the laboratory and the annexed chart was obtained. The eye presented a single phlyctenular ulcer on the edge of the right cornea: yellow oxide of mercury ointment was used on this occasion with a mixture of rhubarb and soda internally, the child's

<sup>1</sup> Transactions of the Ophthalmological Society of London, vol. xxvi., p. 232.