

"Frosts occur at night only, and snow is exceptional." The exact number of sunny days is not known, but is said to be large. The relative humidity, though not known for this place, is probably not very different from that at Aiken, which is 59 per cent. for December, January, and February.

The especial advantages claimed for this region as a health resort are "its dry, balmy, bracing air, with conditions favorable for constant out-of-door life"; its dry, sandy soil; the pines, and its easy accessibility.

Camden would appear to be a good resort for the open-air treatment of pulmonary tuberculosis, for cases not suitable for the colder regions or altitudes; also for convalescents from influenza, pneumonia, or pleurisy, and for those who merely desire to escape the dampness and cold of the Northern winter.

Edward O. Otis.

CAMP DISEASES.—There are no diseases peculiar to the soldier, but those by which he is chiefly affected are such as not infrequently occur among males of the military age in civil life. The conditions of military service, however, are often such that various factors predisposing to deviation from the standards of health are greatly increased in potency; while the directly exciting causes often operate much more frequently, act over longer periods, and, in the case of infectious diseases, not rarely assume greater virulence. Since all these diseases have their counterparts in civil life, any extended discussion of their etiology, pathology and symptomatology is unnecessary in this connection; and the treatment of such diseases also varies in no wise from that employed by the more advanced members of the medical profession throughout the civilized world. There remains, then, for discussion the relative importance of various diseases as affecting the health of troops; the predisposing causes, in so far as they are influenced by military service and conditions; the special methods of infection and the dissemination of infectious material; and, finally, the means of preventing such diseases, as based chiefly upon the special military conditions by which the occurrence of the disease is favored or brought about.

Excluding traumatism, the causes which chiefly impair the health and efficiency of troops, in garrison or during campaign, may be grouped according to their relative importance, as follows:

1. Diseases of an infectious character, the spread of which, in the military service, is favored by the aggregation of young and susceptible individuals, ignorant or careless in regard to matters of personal hygiene, living under conditions implying intimate personal relationship, constant contact and, frequently, overcrowding. In many instances the necessities of military service require an existence in unhealthful localities, favorable to the development of pathogenic micro-organisms and under circumstances in which their opportunities for dissemination and entrance into the system are much greater than in civil life. In addition, the occurrence of these diseases is also often markedly favored by depression of the powers of vital resistance, depending upon great fatigue, exposure to inclemencies of weather, insufficient or improper food, impure water and vitiated air. These diseases assume far greater importance during active service in the field than in garrison, being the chief cause of inefficiency among troops during campaign.

2. Diseases due to immoral or intemperate habits; as favored by an enforced celibacy, the absence of wholesome home restraint and the monotony often attaching to garrison life. These diseases are factors of the first importance in time of peace in raising the sick rates of an army, but during active warfare or field service they sink into comparative insignificance.

3. Diseases the causative agents in which are unknown, but which appear to be largely excited by exposure to cold, wet and dampness, whether they be found in camp or garrison. These affections have but little tendency toward a fatal result, and their importance from the military standpoint lies in the considerable proportion of temporary unfitness for service which they

produce. The number of soldiers who are temporarily incapacitated for all or part of their duty, from these causes, is always large.

4. Affections due to extremes of temperature. Such are obviously related to climate and season, and are largely influenced by nature of service; being naturally much more frequent among troops on campaign than among those in garrison.

5. Disease due to an improper dietary; this being largely dependent upon facility of supply and transportation, and hence being obviously more frequent among troops on active campaign or serving at remote, isolated, and newly established stations.

6. Disease directly induced by military service. This may be of a functional or organic nature, and is largely dependent upon the muscular labor involved in the execution of military movements, the method of disposing the equipment upon the person, and the mental condition often resulting from field service and conflict. Pathological conditions of this character are rarely observed in garrison, but are by no means infrequent during campaign.

In the detailed consideration of the diseases of the soldier, it is obvious that only such as exert a certain positive influence upon military efficiency require discussion. To consider a number of rare affections, from the liability to which the soldier is no more free than the young man of the military class in civil life, and upon the occurrence of which military service appears to exert neither positive nor negative influence, is clearly both unnecessary and undesirable.

I. INFECTIOUS DISEASES.

ASIATIC CHOLERA.—*Occurrence.*—The military history of cholera begins with the year 1757, when the British troops in India suffered greatly from its attacks. It is said that one division of 5,000 men had 500 deaths from cholera in a single day. In 1817, according to Rosse, in a force under Hastings the onset of a cholera epidemic was so sudden that sentries fell as if struck by lightning, and it required three or four men to stand a tour of guard duty of two hours. In five days there were 5,000 deaths, and the command was almost destroyed. In 1821, cholera made such ravages in the armies of Turkey and Persia that it forced military operations in Mesopotamia to be brought to an end. In the years 1830-1831 cholera extended all over Europe and was shortly afterward brought to this country. Troops were attacked at a number of stations. At Fort Dearborn, on the present site of Chicago, it is stated by Rosse that 200 men out of a garrison of 1,000 were admitted to hospital with cholera in the course of seven days. During the Crimean War there were 7,375 cases of cholera in the British army, with 4,513 deaths. In the French army, at the same time, there were 12,258 cases with 6,013 deaths. Among the French troops composing the ill-fated Dobrutschka expedition, it is said that at one time no less than 10,000 men lay dead or struck down by cholera. Out of one battalion, besides those already dead, 500 sufferers were carried in the wagons. Coustan states that in one division of 10,590 men there were 2,036 deaths. In 1866, during the war between Austria and Prussia, more deaths occurred from cholera, in the armies of the latter country, than resulted from battle. At the close of the Civil War our troops suffered severely from cholera; there being, in 1866, 2,813 cases and 1,269 deaths. In 1867 there were 504 cases and 230 deaths, and in 1868 there were 7 cases and 3 deaths. Cholera almost destroyed a body of recruits marching from Leavenworth to Fort Hays, in Kansas, and was also epidemic at Fort Riley and other stations. It was carried by recruits from New York to California, Louisiana, Texas and Georgia. In 1866 it also broke out in Brazil and the Argentine, and was carried by the armies into Paraguay. In the outbreak of 1873, in this country, our army was little affected, there occurring but 12 cases with 8 deaths; and since that year there have been no further deaths from this cause in our service. The

French army has suffered with the civil population during the various outbreaks of cholera in France and Algeria. Rosse states that in Paris, for the period 1832-49, and again in 1853, the mortality from this cause was 14.76 per thousand among the civil population, and 42.59 per thousand among the garrison troops. In many later instances, however, especially in the outbreaks of 1884 and 1893, the greater care as to sanitary conditions in the military service preserved the soldiers, while deaths occurred in the surrounding civil population. In the British army, during the decade 1888-97, cholera occurred among troops in India, Egypt, China, and Ceylon. In India, for this decade, the admission rate per thousand was 1.8; the death rate, 1.29. Cholera figures almost annually in the returns for the Russian army, certain military garrisons of which are located in regions at which the disease endemically prevails. Recent figures for cholera in the Russian army are as follows:

	Admissions per 1,000 strength.	Deaths per 1,000 strength.
1890	0.06	0.02
1891	4.3	1.83
1892	1.61	.46
1893	1.00	.35
1894	.40	.10
1895	.01	.002

Dissemination and Infection.—The specific causative agency in cholera is given off chiefly by the bowels, and to a less degree in the vomitus. The length of time during which the stools of a cholera patient are infectious is unknown, but it probably is a considerable period. As with typhoid fever, apparently healthy persons appear at times, during an epidemic, to act as hosts for the bacilli and play a part in the propagation of the disease. While the disease at times follows contact with the sick, it may fairly be regarded as only slightly contagious and not likely to be contracted except by indirect infection. The latter undoubtedly occurs by way of the alimentary tract. There is no proof that air ever serves as the vehicle for the transmission of cholera bacilli; though in this disease, as in typhoid fever, its dissemination by this means should be regarded as possible. Water has long been recognized as the chief agent in the spread of cholera; and abundant circumstantial evidence to this effect is fortified by a number of instances in which the specific etiological factor has been discovered in suspected water by bacteriological investigation. Many instances have been reported in which the infection of a water supply was followed by outbreaks in communities further down the stream. In the epidemic of Hamburg, in 1892, the part played by an infected water supply was most marked; the proportionate number of cases being eight times greater in that part of the city in which unfiltered water was supplied, than in the part in which the drinking-water was partially purified by sand filtration. Recently, among the British troops at Umballa, in India, an epidemic of cholera promptly ceased as soon as a supply of sterilized water was provided for drinking purposes. Cholera bacilli flourish best in sluggish streams, and especially in water containing a considerable proportion of organic matter. Under certain circumstances, not as yet fully understood, the bacillus is capable of rapid multiplication in water, but many saprophytic micro-organisms are hostile to its development and appear to destroy its vitality in the course of a few hours or days. Any specific contamination, however small, is capable at times of imparting to enormous quantities of water the power of originating the disease. Earth undoubtedly may serve as a medium for the development of the bacillus outside the human body. At Lucknow, 90 soldiers out of 600 died of cholera apparently as a result of placing fresh sand, taken from the bank of a river used as a general bathing place, in a filter from which water was drawn for the use of the command. Food contaminated by cholera discharges also serves as an agent for the spread of the disease. This is

rarely directly infected, but is contaminated by manipulation with unclean hands, by contact with infected objects, by dust containing the specific germs, or by the agency of flies which have recently fed on cholera discharges. In India, medical officers now regard the latter as one of the more common agencies by which the spread of cholera is accomplished. In the Burdwan prison, where other means of infection were scarcely possible, it is said by Buchanan that an epidemic was directly traceable to flies which were carried over the prison wall by a high wind blowing from the direction of some native houses, in which the disease had occurred. During the outbreak in the Gaya jail, Macrae found that milk to which flies in the jail were given access invariably became infected with comma bacilli; and he concluded that "flies should be looked on in the light of poisonous agencies of the worst kind during cholera epidemics." The cholera bacilli may be carried in fomites, particularly in baggage, rags, or clothing, soiled with the faecal discharges of the sick. Under such conditions they retain their vitality for considerable periods, though they are readily destroyed by sunlight and desiccation. As in typhoid fever, the disease germs may be carried into camp or barracks on the shoes of individuals who have visited an infected latrine or locality. Marching troops, when infected, have done much to spread the disease to districts in which it was previously unknown.

The period of incubation of cholera is usually about three days, but this, under rare circumstances, may extend to as much as ten days.

Predisposing Causes.—Cholera prevails endemically in India, from which it extends from time to time. It appears to be a settled fact that where the disease prevails in an endemic form it does not occur in great epidemics. A severe outbreak appears to confer upon the locality attacked a more or less complete immunity; the durability of which, so far as India is concerned, appears to last for a number of years. A high temperature is a predisposing cause of great importance; but while many epidemics have ceased with the advent of cold weather, this is by no means always the case. In the tropics, cholera prevails to the greatest extent at the close of the dry season. A moderate rainfall tends to cause the further development of the disease, but where the rains are heavy and continued, a marked diminution in the occurrence of cholera is observed. There is a general consensus of opinion that the incidence and severity of the disease are greater among negroes than among whites. In the United States, during the epidemic at the end of 1866, the mortality among the white troops was 77 per thousand, while among the colored troops it was 135 per thousand. When the disease prevails endemically, the native population appears to enjoy a considerable but not absolute immunity to it. In the Hedjaz and in the sparsely populated parts of Arabia, it is said by Fauvel that the disease manifests only a feeble tendency to propagate itself among the native population. This immunity, however, is not shared by strangers visiting a locality endemically affected. As a race, the Chinese appear to be notably free from the ravages of cholera, probably chiefly from their general use of sterilized water in tea. In any outbreak of this disease, numbers escape attack through their hereditary or gradually acquired powers of resistance. For epidemics of cholera a stratum of moist soil pervious to air, in which organic material is decomposing, affords the most favorable condition. General sanitary defects, by which the specific fouling of soil and water is possible, are essential to the development of an epidemic.

It has long been observed that the poorer quarters of a community suffer by far the most during a cholera visitation. Epidemics also prevail more severely in low-lying regions than on high ground. Insufficient, poor, or coarse food, improper clothing, and inadequate shelter favor the occurrence of cholera; and physical and mental depression are both markedly predisposing causes. Overcrowding is also a factor of importance. Those affected with catarrh of the intestinal tract and diseases of the

digestive apparatus are particularly susceptible to cholera infection.

Prophylaxis.—In view of the fact that in practically every instance of an outbreak of cholera, in regions or communities in which it is not endemic, its origin has been traced to importation from abroad, it is manifest that where practicable a system of quarantine should be established as soon as the danger of an introduction of the infection is recognized. No person from the infected locality should be admitted within the military lines without undergoing examination, and after detention under observation for a period of ten days. All clothing and similar articles should be disinfected before being passed; supplies intended for food, unless carried through the affected district in unbroken packages, should not be admitted. Special cholera hospitals, in readiness for an outbreak, should be established and provided with a special staff of attendants. They should not be located at too great a distance from the troops, from the rapid nature of the disease. Such hospitals should possess separate facilities for the isolation and treatment of suspects as well as well-defined cases of cholera.

When the disease prevails, all soldiers suffering from diarrhoea, no matter how insignificant it may appear, should be regarded as suspicious and should be subjected to the same vigilant supervision as applies to recognized cholera patients, for many of these cases, though mild, are nevertheless true cholera and capable of disseminating this disease. Because of their apparently innocent nature these cases often escape the attention their importance demands; and unless it be borne in mind that they are a grave menace to all with whom they are associated, and are treated as such, they can be regarded only as most dangerous sources for the dissemination of disease—far more so than the severe cases which attract attention from the outset. Frequent inspection of latrines should be made and the character of the discharges noted in this connection. Convalescents from cholera should be kept isolated, and the evacuations from the bowels should be disinfected, until bacteriological examination demonstrates that the specific micro-organism causing the disease has disappeared from the discharges. Such individuals should be returned to their respective organizations only after a disinfecting bath and after donning a complete outfit of clothing sterilized throughout. The antecedents of each case of cholera should be investigated, and all those who have been in immediate association with the patient should be placed under observation.

As cholera germs can live and multiply for a time outside the body in the presence of decomposing organic material, more particularly that of animal matter, there should be a thorough removal of every sort of filth and refuse from the camp or garrison. Thorough cleansing, airing, painting, or lime-washing should be carried out wherever indicated. It should not be forgotten that, although desirable at all times, measures of cleanliness taken beforehand are of far more value for protection against cholera than policing which is delayed until after the disease has actually made its appearance. All water used for drinking purposes should be sterilized, preferably by heat. Under all circumstances, in time of cholera, an immediate and searching examination of the sources and conduits of the water supply should be made, when it is in any way open to the suspicion of impurity. When pollution is found to have occurred, every care should be taken to prevent such pollution from continuing and the water from being utilized. When the water supply is believed to be at fault, bathing of the person, except with boiled water, should be discouraged. For marching troops, great care should be taken to prevent the use of water from the supplies of infected towns. Tea has been much used by British troops during outbreaks of cholera in India, as being more palatable than ordinary boiled water. Acidulated drinks containing sulphuric acid, acetic or citric acid, may sometimes be given with advantage. Red wine is also recognized as destructive to the cholera bacillus, and a ration of this, taken diluted in water, might well be issued during an

epidemic. The food supplied should be abundant, simply prepared and readily digestible. Particular care should be taken to insure the condemnation and rejection of any food of unsound character capable of exciting a diarrhoea. With the exception of acid fruits protected by an outer rind, as oranges and lemons, no article of food should be eaten that has not been subjected to a boiling temperature in its preparation. Under no circumstances should the use of uncooked vegetables in salads be permitted. All food and drink should be carefully protected against access by flies, since some of these may have previously come in contact with cholera discharges. Prior to use, all vessels used for the cooking, serving, or storing of food should be sterilized by immersion in boiling water. The purchase of food or drink by the men at points outside of military control should be prohibited. The hands of all should be washed before eating. Troops should be well clothed, sufficiently to protect against cold, chilling and moisture. It is during outbreaks of intestinal disorders that the use of the abdominal band is of most advantage. The clothing should be frequently changed, washed, and sunned.

There should be no unnecessary exposure to sun, rain, or night air; and no drills or fatigue other than to furnish occupation and needful exercise. The size of the guard and the length of the tours of duty should be reduced as much as military conditions permit. In addition to fatigue, nothing is more conducive to the spread of the disease than fear and unusual excitement, and a quiescent state of mind should be enjoined upon all. In general, the troops should be regarded as engaged in campaign against an insidious and implacable enemy, and the attention of every officer should be devoted to superintending the conduct of his subordinates with special reference to this view.

In time of impending epidemic, troops should be scattered. A change of soil and locality often appears to be of advantage, and camps should be moved as often as a new case appears. Troops that have fallen back before the advance of the disease have often escaped seizure, or have avoided further sickness if withdrawn subsequently to their attack.

A temporary abandonment of an infected locality is strongly to be recommended. When the disease has actually occurred, efforts at disinfection should be primarily directed toward the vomitus and faecal matter. These should, as far as possible, be burned. If the cases occur on board transports, the excreta should be received in vessels and not discharged overboard, particularly if in harbor. The disinfection includes that of the barracks, tent, or place occupied by the sick, and the articles of clothing and bedding with which they may have come in contact; and upon its promptness and thoroughness, together with isolation of all those attacked by cholera and their attendants, depends the arrest of the epidemic. If due care in regard to cleanliness and disinfection be observed, there is comparatively small risk that the disease will spread to those who nurse or otherwise attend upon the sick.

As a method of prophylaxis against cholera, inoculations with a specially prepared virus have been systematized and successfully practised in India by Haffkine.

A large number of individuals—upward of 100,000—have been inoculated by him against cholera; among them a number of white and native soldiers in the British service. While the results have varied greatly, they are on the whole distinctly favorable. Among 1,526 non-inoculated soldiers at Dinapore and Cawnpore, there were 25 cases, while among the 268 inoculated there were no cases. In Calcutta, from the tenth to the four hundred and fifty-ninth day after inoculation, cholera visited 26 houses. Among the 263 uninoculated inmates there were 14.45 per cent. attacked; while among the 137 inoculated the proportion attacked was only .75 per cent. The East Lancashire regiment also received weak protective inoculations. Some months later it was exposed to cholera, and the death rate showed the prophylactic value of the inoculation. According to Simpson, 654 in-

dividuals who were not protected against cholera had, during the next two years, a mortality of 10.86 per cent.; while of 402 members of the same households, inoculated by him, the mortality from cholera, during the same period, was but 2.99 per cent.

BUBONIC PLAGUE.—*Occurrence.*—With the recent occurrence of plague in the Philippine and Hawaiian Islands, this disease at once assumes a practical importance to the army medical officer. Plague has not in recent years figured to any extent among the diseases affecting troops; but numerous epidemics have been reported in the past. The destruction of the Assyrian army, recorded in 2 Kings, was probably due to plague; and the disease described by Thucydides as affecting the 200,000 men immured in Athens, during the Peloponnesian War, presented the symptoms of the catarrhal form of this disease. Plague ravaged the armies of the Crusaders, and it is said that in the first Crusade no less than 50,000 men died of this disease before Antioch. The soldiers of Cromwell died of plague as well as typhus; and it prevailed among both French and English during the first occupation of Egypt. In 1816 plague was introduced into Arabia by the Egyptian army, and it has since prevailed there endemically. An epidemic of this disease is said to have occurred as late as 1828, in the Russian expedition against Turkey. Plague prevails endemically in China, Western Asia, Northern Africa, and perhaps India; from which points it has from time to time extended. It has recently visited Uruguay, Brazil, Mexico, and, in this country, California. It has also been lately transported to New Zealand, Madagascar, South Africa, New Guinea, and a number of islands in the Pacific, among which are possessions of our own. Recently it has occurred among the employes of the Quartermaster's Department at Manila.

Predisposing Causes.—The mortality from bubonic plague varies with different epidemics. Race exerts a marked influence both on the occurrence of the disease and the mortality. Of late years, whites in the Orient have rarely contracted the disease; and, when so affected, the mortality is low. In the epidemic at Hong-Kong, in 1894, Lawson states that the percentage mortality of those attacked was as follows: Europeans, 18.2; Japanese, 60; Malays, 100; Chinese, 93.4. The disease is pre-eminently favored by want, privation and lack of proper sanitation. Meteorological conditions appear to have little influence on the occurrence of plague.

Propagation and Dissemination.—Plague has arisen so uniformly in unclean places that filth is regarded as an essential factor in its propagation and spread. Almost without exception, plague centres have been characterized by a soil polluted by decomposing animal material and by the overcrowding of a dirty and insufficiently nourished population. Plague bacilli have been isolated from the dust of infected houses, and the affection is generally regarded rather as a ground than a water disease. When the microbe is removed from a soil saturated with organic filth, it appears to lose much of its virulence. In the epidemic in Hong-Kong, in 1894, Lawson was impressed with the part which dust and dirt played in the transmission of the disease. The bacillus has been shown to be capable of surviving for two weeks in water, and hence the supply used for drinking and purposes of cleanliness should be pure. While the disease appears undoubtedly to be transmitted by air, this is possible only within a small radius, and there is considerable evidence to show that it may be transmitted by means of food. The disease may be spread by means of clothing and other articles which have been used by plague patients; but is most often disseminated by human intercourse. Aoyama believes that the plague bacillus gains entrance to the body largely through skin wounds, and much less frequently than has been supposed by way of the respiratory and alimentary tracts. The fact that there may be no local manifestations at the point of entrance is important.

A large number of animals, particularly rats, mice, and small rodents, are susceptible to the disease. Rats die in great numbers in pest-smitten districts, sometimes before the epidemic occurs in human beings. There can be little doubt that these animals play the most important part in distributing the disease over wide areas, when it has once broken out. This has been abundantly proved in the case of Bombay, where observation has shown that the emigration of plague-infected rats to districts comparatively free from the disease has been attended by an extensive outbreak in those places. In addition to the pus of suppurating buboes and the blood, the bacilli have also been found in the sputum, urine, and faeces of both men and animals. Further, it has been shown that the flea is frequently an agent by which inoculation is made from affected to sound animals. Pest bacilli have been found in the stomach contents of these insects, and fleas taken from plague-afflicted rats have been made the means of communicating the disease to healthy animals. Nuttall, Yersin, and Ogata have found pest bacilli in large numbers in the bodies of flies in an infected locality. Even after forty-eight hours' retention in a clean receptacle without infected food, infected flies were full of virulent plague bacilli. The experiments of Nuttall and Ogata also tend to show that ants and mosquitoes may be the carriers of this disease, the latter producing infection by direct inoculation. Bed-bugs appear to digest and destroy the bacilli. From the facts stated, with regard to the powers of comparatively rapid multiplication of the bacillus, its wide dissemination by the excreta and by animals and insects, it may be understood how extensively soil and habitation may become infected and how difficult it may be to arrest the ravages of the disease. The important part played by infection of a locality is strikingly shown by the rapid fall in the number of cases where an infected site is abandoned and the inhabitants placed in tents.

General Principles of Prophylaxis.—The most important safeguards against the development of plague are cleanliness of person and surroundings, good drainage, free ventilation, and a war of extermination against rats and mice. In addition, the prophylactic use of Haffkine's anti-plague serum appears to be of great importance. When the disease makes its appearance, the sick should be at once isolated in tent hospitals, and all who have come in close contact with them, or have been exposed to the same conditions, should be quarantined and kept under observation for ten days. The belongings and surroundings of the patient should be carefully disinfected. The sputum, urine, faeces, and dressings from suppurating buboes should be burned. Only healthy persons, free from abrasions, sores or ulcers, should be allowed near the sick; and such should be required to maintain scrupulous personal cleanliness and take a disinfectant bath once daily. The troops should receive abundant food and pure water; and the necessity for personal cleanliness and the frequent change of clothing impressed upon them. The use of well-fitting shoes and great care of the feet is necessary, since there is considerable evidence to show that inoculation usually takes place in the lower extremities. Soldiers should avoid infected districts, except under competent authority.

If proper care be taken, the liability of white troops to contract this disease appears slight. At Hong-Kong, in 1894, of 300 British soldiers who volunteered to assist in the sanitary policing of infected houses, but 10 contracted the disease; in Poona, in 1897, of over 900 white soldiers so engaged, not one became infected. In the latter instance the precautions taken included a hearty meal before beginning the work of the day; the retention in camp of all cases of slight ailment or those presenting cuts or abrasions; immediate disinfection by antiseptic solutions of cuts or bruises incurred during the work, and the thorough sunning of the clothing worn, for the rest of the day, after return to camp.

In addition to the destruction of rats, preferably by traps and ferrets, precaution should be taken to prevent infection by means of insect life. Such individuals as

recover from the disease should be kept in quarantine for at least a month. Kitasato has found the bacillus of plague in the blood as long as three weeks after the beginning of convalescence.

The system of preventive inoculation against plague, as devised by Haffkine, has been carried out on an extensive scale in India during the past six years. As with cholera, the method has been systematically tested by inoculating a certain portion of the inhabitants of districts exposed to infection, leaving others uninoculated; and then observing the proportion of cases of the disease, and of fatal cases, among the two classes. The results have been distinctly successful.

At Poona, inoculation was practised with anti-plague serum on the native followers of the artillery troops stationed at that point. While everything was done outside of inoculation to prevent the spread of the disease, in 859 uninoculated there were nevertheless 143 cases with 98 deaths; in 671 inoculated there were 32 cases with 17 deaths. Had the inoculated, living under the same roof, belonging to the same families and sharing the same food and drink, been equally affected, the proportionate number of deaths would have been 77. The inoculation, therefore, reduced the death rate 77.9 per cent. In 1898, at Hubli, 3,815 persons not inoculated with anti-plague serum had 446 attacks, while 26,428 persons twice inoculated had only 31 attacks. If the latter had suffered proportionally as much as the non-inoculated they should have had 3,089 attacks. Such examples might be largely multiplied. In a statement published in June, 1899, Haffkine states that in the large number of inoculations made with anti-plague serum the difference in number of attacks occurring in inoculated and uninoculated was over 80 per cent., often approaching 90 per cent. The lowest in his experience was 77.9 per cent. The case mortality also was only half as great among the inoculated.

CEREBRO SPINAL MENINGITIS.—Occurrence.—No great epidemics of this disease appear to have occurred among troops, but the affection is one which prevails in all armies and is remarkable for the high mortality given by those affected. Sharp but distinctly localized outbreaks occur annually in all the larger armies; and in our own service cases of the disease were reported in all but six years of the period 1868-98. The affection may fairly be regarded as a camp disease; more deaths occurring in our army in the calendar year 1898, during the war with Spain, than had occurred altogether in the previous sixteen years of peace. For the period 1868-84 the death rate from this disease was .05 per thousand strength; for the decade 1885-94 it was .02 per thousand, while for the fourteen months, May, 1898, to July, 1899, the death rate was .70 per thousand. In the German army, during time of peace, the admission rates are much the same as our own under similar conditions, being given as follows:

Period.	Admissions per 1,000 strength.
1881-82 to 1885-86.....	.063
1886-87 to 1890-91.....	.07
1891-92 to 1895-96.....	.08
1895-96 to 1897-98.....	.07

Among our troops the admission rate per thousand strength was .11 for the period 1895-98. In 1898, cerebro-spinal meningitis was the greatest factor in the total mortality of the Belgian army, amounting to .35 per thousand.

Predisposing Causes.—The disease is most common in individuals of the military age. Though want, privation and poor ventilation usually seem to predispose to the disease, there is abundant evidence to demonstrate that these conditions are not essential to its causation. The disease usually occurs during winter and early spring, although it may make its appearance at any time. For the period from May, 1898, to July, 1899, the death rate in our army from this disease was .13 per thousand strength during the month of January; about twice as

high as in any other month of the period. For December it was .07; for June and July, 1898, it was .06 and .05, respectively. Hirsch, Notter and Firth, and others state that the disease is unknown in the tropics. During the period of fourteen months just mentioned, however, the death rate from this cause was .71 per thousand strength for troops serving in the United States; .34 for troops serving in Cuba; .16 for those in Porto Rico, and .26 for those in the Pacific islands. An epidemic of a most fatal type occurred on a transport at Casilda, in southern Cuba, during the occupation of that island by our forces. Of those attacked, all died within thirty-six hours. The epidemic abruptly terminated on sending the troops ashore.

Infection and Dissemination.—It is difficult to offer any satisfactory explanation as to the manner in which infection occurs or to the way in which the specific micro-organism is eliminated from the affected individual. Whether it enters the body through the alimentary or the respiratory tract, or through lesions of the integument, it is not possible to say. It is probably directly communicable from the sick in a mild degree only; but there is considerable evidence to show that the infection may be introduced into a locality by infected persons and things. Abbott and others are inclined to the belief that cases occurring during an epidemic are infected from some common source, and that they are predisposed to such affection by some unusual local condition. This opinion is supported by the fact that the disease shows no special tendency to progress along continuous lines or through contiguous localities. It has been known to appear in two regiments in a camp, while a third, located between the infected regiments, escaped. Love states that at New Orleans, in 1847, the disease attacked one regiment which was quartered in poor barracks, built on a damp soil and which was supplied with poor clothing, while an adjacent regiment, more favorably housed and clothed, escaped entirely. Depressing influences, whatever their nature, appear to be a predisposing cause.

Prophylaxis.—With present defective knowledge concerning this disease, it is difficult to formulate any rational scheme of prophylaxis against it. While rigid isolation of the sick has not been shown to be imperative, still this precaution should invariably be taken in the military service. As with typhoid and measles, free ventilation should be assured, and no considerable aggregation under one roof of those sick with this disease should be allowed. As a not unreasonable precaution, all discharges and excreta should be promptly disinfected and accidental inoculation on the part of attendants guarded against.

As far as the troops are concerned, free ventilation, an abundance of good food, and the avoidance of fatigue should be included in the scheme of general prophylaxis.

DENGUE.—While dengue is not a disease which appears to be especially affected by the conditions of military service, our troops have suffered equally with the surrounding civil class during the epidemics which have from time to time occurred. Since dengue is a disease confined to tropical and sub-tropical countries, the only posts in this country which have been visited are those located in the south and southwest. During 1893 the affection prevailed in several garrisons. In 1894 the disease occurred at Fort Ringgold, attacking 154 men out of the 178 stationed at this post. In 1897 dengue appeared at Fort Sam Houston; 144 cases developing among the garrison of 522, and over 100 cases being treated among the families of soldiers and civilians at the post. During the same year the garrison at Fort McIntosh suffered also. Recently a large number of cases of this disease have occurred among our troops in Cuba and in the Philippine Islands, causing much temporary inefficiency.

The cause of dengue is unknown. Its outbreak is favored by high temperature and geographical location more than by any other factors; it occurring chiefly during summer and early autumn and being checked by frost. In its distribution, dengue closely resembles yel-

low fever. Overcrowding and filth appear to favor its occurrence. The mortality is small, and for soldiers otherwise in good health it may be regarded as *nil*. The disease, therefore, is only of importance as it incapacitates for duty. The specific cause of the affection is supposed to be given off in the saliva and excretions, and perhaps from the skin. Its incubation period is only a few hours, a fact which may explain its almost simultaneous appearance in large bodies of men.

Prophylaxis.—In the lack of knowledge as to the cause or means of spread of this disease, it is not possible to formulate definite plans for its prevention. Since the ubiquity of the virus is so great in this disease, the establishment of quarantine would scarcely be effective even if it were justifiable. The isolation of the sick, with the disinfection of all excreta, clothing and surroundings, might be practised, but would probably not be of any great value in checking an epidemic. It is fortunate that the disease is mild in type, is of short duration and leaves no after-effects—thus being of comparatively little importance to the military sanitarian.

DIPHTHERIA.—Occurrence.—Diphtheria is a disease which is of somewhat rare occurrence among soldiers. It is less common during active field service than in garrison, where it not rarely retains a foothold in old, badly constructed barracks for long periods, yearly outbreaks occurring during each season of cold weather. The disease is relatively frequent among troops living in casemates—though at Fort Yates it occurred for a number of years, despite every effort to the contrary, among soldiers quartered in old decayed log barracks. At the same post, the troops living in barracks of recent and more sanitary construction were rarely affected.

Figures for this disease show a somewhat lessened prevalence in our army as compared with those of England, France, and Russia. In the German army the admissions for diphtheria per thousand strength have been as follows:

Period.	Admissions.
1881-82 to 1885-86.....	1.2
1886-87 to 1890-91.....	.92
1891-92 to 1895-96.....	.93
Year 1896-97.....	.57

In the Austrian army, for the year 1897, only one case occurred for each 10,000 men. In our own service statistics would seem to show that the disease has of late years decreased in both frequency and virulence. Whether this is actually the case, or whether the reduction merely depends upon more accurate modern methods of diagnosis and treatment, is a question which cannot be definitely decided, but it is probable that both factors should be taken into consideration. During recent years, however, according to Coustan and Viry, the disease has steadily increased in the French army. In our own service the admissions for diphtheria, per thousand strength, since 1860, have been as follows:

Period.	Admissions per 1,000 strength.
1861-66 (civil war).....	3.39
1868-84.....	.55
1885-94.....	.43
1895-98.....	.78
Year 1897.....	.43
Year 1898 (Spanish War).....	.36

Dissemination and Infection.—The causative agent is transmitted from the sick in the discharges and secretions of the affected surfaces. In diphtheria affecting the throat and fauces the disease is transmissible chiefly through infected particles of mucus or flecks of membrane, which may be ejected from the mouth or nose by the act of coughing or sneezing. When the disease occurs among those in attendance on the sick, its origination is usually brought about by infection in this manner. It should be noted that the bacillus of diphtheria is very resistant to drying, and when dislodged from the throat in bits of false membrane it may retain its vitality for a long time. When such particles of membrane are dried

and reduced to dust, infection may occur from the inhalation of air in which such dust is suspended. All clothing and other articles which have been in contact with the sick and upon which saliva has been allowed to dry may serve in this way to spread the infection. Abbott states that diphtheria bacilli have been found in the hair and on the shoes of nurses in a diphtheria ward, also on a broom used in the same ward. The bacilli may be inadvertently conveyed to the mouth after handling infected articles, and, in fact, any direct or mediate contact with the sick offers opportunities for infection. There is no evidence that the disease is ever transmitted by water. Milk, specifically infected during handling, has been known to give rise to diphtheria. Among the lower animals, cats may be affected with this disease. While diphtheria bacilli are capable of development on any mucous or abraded surface, for the military service infection may be considered to occur through the mouth and nose only. The period of incubation is difficult to determine; symptoms of invasion often appear within thirty-six hours after infection, but though they are rarely delayed more than four or five days, they may be absent longer and a quarantine of suspected cases for ten days is advisable. Convalescents from diphtheria should be regarded as sources of infection so long as the specific bacilli can be detected in the throat or secretions. The duration of infectivity appears to be, on an average, about thirty days, though it may be as long as three or four months.

Predisposing Causes.—Though widely diffused, diphtheria prevails chiefly in temperate and cold, damp climates. Low-lying districts, possessing a soil favorable to the development of microbes and rich in decaying organic matter, usually show a greater prevalence from diphtheria, especially if subject to the continued prevalence of cold winds with a high rainfall. In our army the disease is far less frequent in the southern garrisons. Its greatest incidence occurs in winter and early spring, probably largely through less free ventilation of barracks and the depressing influence of a vitiated atmosphere. The part long thought to be directly played by sewer gas in the production of diphtheria was undoubtedly due to accompanying influences of the above nature. Overcrowding is a factor of great importance in the spread of the disease, as is also inadequate sanitary police. Epidemic diphtheria, according to Klebs and others, has a well-defined relation to manure and compost heaps, in which the germs find favorable conditions for development. From this it would seem that the disease should occur more frequently among mounted troops, and such in fact appears to be the case. While figures for our own service are scarcely large enough for reliable comparison, it has been found by Longuet that in the French army, for the period 1872-85, the proportion of diphtheria cases among cavalry and infantry was in the ratio of ten to three. In the German army, 1874-82, diphtheria was more than three times as common among cavalry as among infantry. In general, persons who have been affected with diphtheria are especially liable to future attacks, as are those who suffer from acute or chronic inflammations of the pharynx or tonsils.

Prophylaxis.—In the prevention of diphtheria the provision of dry, sunny, well-aired barracks, free from overcrowding, is important. No accumulation of filth or refuse, and particularly stable manure, should be permitted in the vicinity. Dampness arising from the use of too much water in cleansing barrack floors should be avoided, as often producing tonsillar inflammation upon which a diphtheritic infection may be engrafted. Laveran regards the general use of antiseptic mouth washes by soldiers as of advantage during the prevalence of the disease. When the disease has actually occurred the sick should be at once isolated and clothing, bedding, and other articles which have been exposed to infection promptly removed and disinfected. The squad room of which the infected individual had been an inmate should be disinfected. All discharges from the point of diphtheritic invasion should be received into a strong germicidal solu-