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SANITARY COMMISSION.

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HINTS

FOR THE

CONTROL AND PREVENTION

OF

INFECTIOUS DISEASES,

IN

CAMPS, TRANSPORTS, AND HOSPITALS.



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REPORT

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THE attention of the Sanitary Commission has been directed to the fact, that most of our Army Surgeons, now in the field, are unavoidably deprived of many facilities they have heretofore enjoyed for the consultation of standard medical authorities. It is obviously impossible to place within their reach anything that can be termed a medical library. The only remedy seems to be the preparation and distribution among the medical staff, of a series of brief essays or hand-books, embodying in a condensed form the conclusions of the highest medical authorities in regard to those medical and surgical questions which are likely to present themselves to surgeons in the field, on the largest scale, and which are, therefore, of chief practical importance.

The Commission has assigned the duty of preparing papers on several subjects of this nature, to certain of its associate members, in our principal cities, belonging to the medical profession, whose names are the best evidence of their fitness for their duty.

The following paper comprising "*Hints for the Control and Prevention of Infectious Diseases in Camps, Transports, and Hospitals,*" prepared by a member of the Commission, belongs to this series, and is respectfully recommended by the Commission to the Army.

J. FOSTER JENKINS, M. D.,

Secretary.

New York, October, 1863.

Hints for the Control and Prevention

OF

INFECTIOUS DISEASES IN CAMPS, TRANSPORTS, AND HOSPITALS.

The diseases that owe their origin and diffusion to specific infectious poisons, though comparatively few in number, are the most troublesome and fatal that can afflict an army. Often have great forces been crippled, and the objects and hopes of many a campaign have been defeated by such diseases; while not unfrequently the same silent enemies of military quarters, camps and transports, have humbled the proudest armies, and brought thousands of brave men to their graves, even after their arms had achieved success in the field.

Prevention of infectious diseases especially important in armies

The occurrence of small pox, measles, epidemic dysentery, and typhus, in camps, barracks, or transports, and the prevalence of these diseases, together with gangrene and other infections in military hospitals, are calamities that deeply concern all persons who are responsible for the welfare of the soldier, or the efficiency of the national forces: and as it has been demonstrated by repeated observations and varied experience, that such diseases owe their diffusion and endemic prevalence to hygienic neglect, and that proper sanitary measures will not only tend to limit and prevent the prevalence of such infectious and contagious maladies, but will also diminish the severity of other diseases, every military officer needs to have a practical comprehension of the

What maladies are particularly to be dreaded.

They owe their prevalence to hygienic neglect.

Sanitary measures the antidote.

Every military officer should understand the application of such measures.

Design of this paper.

The poison of infectious diseases, how communicated, and how transported.

Every infectious disease depends upon special conditions for its activity or diffusion.

Those conditions are within human control.

Epidemic influence.

The localizing causes of epidemic diseases to be controlled or prevented.

The practical object of this paper.

special measures required for sanitary protection under the various circumstances of exposure to disease, and to the inconveniences of army life. With this view, we submit the following *practical hints upon the means of arresting and preventing the prevalence of infectious diseases in camps, barracks, transports, and hospitals.*

The infectious maladies to which we shall particularly allude, are among the most strongly characterized of the zymotic diseases, and, with the exception of a single group, the specific poisons upon which they respectively depend are unquestionably capable of being communicated from the persons sick to persons uninfected. And in the exceptional group, in which we place certain very fatal maladies, the infecting poison is, in some instances, susceptible of transportation by porous substances, or vessels with contaminated air, acting as the media or vehicles of such transmission or transportation. But, without entering upon elaborate definitions, it is sufficient that we comprehend the fact that every infectious disease depends practically upon certain specific conditions for its activity, and for the communication or spread of its infectious cause, whether to individuals or communities. The most essential of these conditions are primarily within human control, and to such conditions only does the design of this paper permit us to refer. But we do not lose sight of the fact that there sometimes exist general epidemic influences, the nature and cause of which are not fully comprehended or controlled by science, and that diseases which primarily depend upon such influences, may not at all times be completely submissive to human agency. But there is good reason for believing that the material agencies by which even the most epidemic types of disease are *localized* and rendered positively *infectious*, may be controlled, anticipated, and prevented, by properly directed sanitary measures.

As it is the sole design of this paper to set forth in a practical way the facts upon which effectual measures may reasonably be based for controlling the infectious maladies that most afflict armies and recruits, we propose to give to these facts the plainest possible statement, without reference

to theoretical and mooted questions. And the purpose of these pages will be fully attained, if they furnish such timely and practical suggestions as the hygienic exigencies of hospitals and crowded military quarters continually demand.

These hints to meet exigencies in the military service.

The several diseases to which particular reference will be made, in these pages, may, for the practical ends we have in view, be considered in three classes, viz :

Classification for the purpose of this paper.

SMALL-POX, MEASLES, SCARLATINA,	} <i>Exanthematous contagions ; spread by communication with the diseased person, —mediately, or immediately.</i>	Class I.
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TYPHUS FEVER, HOSPITAL GANGRENE, ERYSIPELAS,	} <i>Contingently contagious and infectious diseases ; perpetuated and spread both by personal and endemic conditions of hygienic neglect.</i>	Class II.
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TYPHOID FEVER, ASLATIC CHOLERA, YELLOW FEVER,	} <i>Endemic infections, caused and perpetuated by external localizing conditions ; and diffused as well as localized by the neglect of personal and local hygienic measures.</i>	Class III.
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THE FIRST CLASS comprises the more important exanthematous infections. It is conceded that all these, as personally communicable poisons, or contagions, are susceptible of limitation and control by means of domestic or personal isolation of the sick, and of the things and places infected by them ; but experience shows that such isolation, to be effective, especially if in the presence of strongly localizing conditions, or epidemic influences, must be vigilantly and intelligently managed. Though the essential primary causes of the exanthematous fevers are yet unknown, we may, for all practical purposes, regard it as an ultimate fact that *they are spread by communication with the infected and sick persons,—mediately or immediately.*

The exanthematous diseases.

Domestic quarantine or isolation.

The more important where localizing and endemic influences exist.

The diffusion of these contagions by the sick.

Small-pox the most dreaded infection until JENNER'S discovery.

Small-pox.—The facts relating to this most contagious malady are too well understood to need any statement of them in this paper. It is the most strongly marked type of specific poisons, and the certainty of its contagious quality, and the liability of its infectious diffusion, made it the scourge of the civilized world until JENNER discovered the prophylactic power of vaccinia or the cow-pock.

Vaccination and its value in armies.

The value of vaccination in armies has been lucidly set forth, and in a very practical manner enforced, in a special report or monograph upon the subject [*Medical Document, E*], by a committee of associate members of the Sanitary Commission. Cordially commending to surgeons and commanding officers that valuable embodiment of information upon the subject of vaccination and the protection it affords, we will here quote the concluding sentences of that report:

Report of Prof's. Smith and Stillé.

Conclusions of that report.

“1st. That primary vaccination is a positive protection, within certain limits, against small-pox. 2d. That there is a period of life when that influence declines, and that the history of epidemics teaches that small-pox will attack a variable proportion of the vaccinated if exposed to its influence. 3d. That the mere *possibility* of such a decline renders re-protection necessary. 4th. That in re-vaccination we have an almost infallible restorer of that protection and preventive of the spread of variolous epidemics. Hence, that re-vaccination in all bodies exposed to variolous contagion is *imperatively* demanded. 5th. That the operations of vaccination and re-vaccination are unattended with danger to those subjected to them. The committee would therefore earnestly recommend that the Sanitary Commission make such representation to the proper authorities as will secure the re-vaccination of all soldiers who cannot prove its performance upon them within the previous five years; and that arrangements be made by which good vaccine virus may be distributed by their agents to the medical officers.”

[*Signed.*]

FRANCIS G. SMITH, M.D., Ch'n.

ALFRED STILLE, M.D.

Imperative as the duty is that every soldier and every person employed in the army should be protected by vaccination, that duty has been and will continue to be so frequently neglected and so unreliably executed, that officers in charge of troops—especially if they be recruits freshly from the rural districts—will need to be watchful against the outbreaks of small-pox, and to be prepared promptly to institute effectual measures, not only of domestic quarantine for infected persons and things, but of such thorough re-examination and re-vaccination as may be found necessary for the permanent protection of all from the variolous infection. However thorough may have been the previous inspections and vaccinations in a given company or corps, the possibility of some defects in such duty, as well as the probabilities of the presence of new and unprotected persons, render it expedient to repeat such measures.

The duty of vaccinating apt to be neglected or carelessly performed.

Duties of the medical officer.

Constant watchfulness against the appearance of small-pox.

To officers in charge of recruits for the army, we earnestly recommend that, at the earliest practicable hour after reaching the first place of rendezvous, all men in their care be effectually protected by vaccination.

Importance of early vaccination of recruits.

General sanitary measures, and the isolation or domestic quarantine of patients and their clothing, should apply alike to small-pox, measles, scarlatina, and other febrile contagions; and, notwithstanding the fact that certain epidemic influences may prevail, it is not the less true that intelligently directed sanitary measures against the sources of these nuisances are sure to be rewarded with good results. The value of such measures against *typhus* and *gangrene* are popularly conceded, and the following cases will serve to illustrate the importance and utility of specific measures to limit the prevalence of exanthematous diseases in camps:

The necessity of special sanitary regulations to prevent the spread of the exanthematous diseases.

A short time previous to the battle of Chancellorsville, the — regiment of Maine volunteers had in hospital and upon its sick list, upwards of eighty cases of small-pox. The same regiment had thirty men sick with measles at one time on its hospital roll at Antietam a few days subsequent to the great battle there, in September, 1862. Orders for transportation, from its first rendezvous, to join the army were received while the measles were beginning to appear in one company. No timely and effectual measures were

Extensive prevalence of both small-pox and measles in a regiment in the field.

The results of neglecting sanitary measures.

instituted to prevent the introduction or to limit the diffusion of either of those infections, and as a consequence, many lives were sacrificed, and the military effectiveness of the regiment has thereby been nearly destroyed.

Scarlatina decimates a new regiment, and its localizing conditions nearly destroy the corps.

80 per cent. of the strength of the command hopelessly lost

The localizing causes of the endemic produced other diseases.

Measles introduced into four new regiments at the same encampment.

Effectiveness of domestic quarantine.

Neglect of such measures resulted in great losses.

Arrest of scarlatina by means of the same measures that arrested measles.

In the month of December, 1862, a first-class new regiment arrived in New York, *en route* to the seat of war, from its rendezvous in Massachusetts. A case of scarlatina appeared during the trip hither. The men were assigned to close and insalubrious quarters in the lofts of a warehouse in this city. The cases of scarlatina continued to multiply from day to day and from week to week, until nearly two hundred cases had occurred, and until one of the most promising regiments ever organized had become so broken down by this cause that the dead, together with discharged invalids, amounted to an aggregate of nearly two full companies. This regiment left its pestiferous quarters in the city, after a detention of about two months, with its military effectiveness diminished, as estimated by its veteran colonel, fully *thirty per cent.* upon its original strength of one thousand men. And it is worthy of mention here that the local conditions that had rendered scarlatina so fatally endemic, also prostrated the strength of every man, and induced various inflammatory and *typhous* maladies which broke down the health and vigor of men who seldom had known sickness previously.

In the autumn of 1862, four full regiments of nine months' men were ordered to encamp, while waiting transportation, in the vicinity of the Bay of New York, upon a plain that had already been much used as a camping ground. Measles had already appeared in one of the regiments, and soon the infection had extended to the three other commands. In one regiment only was the malady subjected to an effectual and rigidly enforced domestic quarantine. In that camp the measles ceased with the occurrence of the second case. In the three other camps no such measures of personal isolation of the sick were adopted until upwards of three hundred cases of that disease had occurred.

In the camp mentioned, where measles was arrested, the utility of effectual domestic isolation for arresting the spread of scarlatina had been tested in a case of that disease

which occurred from exposure of one of the soldiers who visited the infectious quarters of the Massachusetts regiment which we have mentioned. In this instance, the case of scarlatina was removed a short distance from the lines of the encampment the hour that the evidences of his disease appeared, and a rigid domestic quarantine of the sick man and his clothing was established. His nurse was the only other victim of the infection. After a detention of a few weeks, when these four regiments were sent forward to the field, the one last mentioned had its full quota of men; while the three others had only about two-thirds the number of soldiers who, a few weeks previously, had gone into their encampment in full health—except the single company in which the measles first appeared.

Ultimate results in these four regiments.

We might add other illustrative instances of the pernicious effects of the exanthematous contagions in camps, but they would all tend merely to strengthen this cumulative testimony to the hygienic utility and military necessity of special restrictive measures for arresting and preventing the spread of this class of diseases. And what is true of exanthematous contagions, is practically, though in a modified sense, true of other diseases that depend upon specific and infectious poisons. The special sanitary measures, which such poisons require for their control, may all be comprised under the simple rule that—

Preventive sanitary measures against exanthematous diseases necessary in the army.

The immediate sources of infectious poisons should be properly isolated from uninfected persons, the localizing conditions of their endemic prevalence should be removed, and every circumstance that adds to their virulence or tends to give them existence or activity, should be prevented or controlled by sanitary measures.

A general rule to be observed in relation to all infections.

The statements and suggestions that follow in these pages will present practical illustrations and specific applications of this rule; and the fact will constantly appear that such hygienic measures against infectious poisons and their immediate causes, are also the most effective sanitary works for the general prevention of disease and the improvement of health.

Applications of this rule.

Regarding all cases of infection and contagion, whether

Infection is an evil that must be continually anticipated and guarded against.

Infection may exist under good management.

individual or endemic, as preventible evils, it might be claimed that they never should occur under proper medical and military administration ; but as SURGEON-GENERAL HAMMOND has justly remarked, in his treatise on Military Hygiene, "even with every effort dictated by the most thorough acquaintance with the science of hygiene, and the most conscientious endeavors to discharge faithfully the duties of his office, the medical officer of a hospital will sometimes find diseases originate under his eyes which can only owe their source to infection."

Diversity of infectious poisons and agencies of infection.

In resuming the consideration of the specific infections, it is proper to remark *in limine*, that, in the classification given in this paper, these poisons may be regarded as having widely diverse causes, operating by means of different agencies, most of which are amenable to hygienic regulations. The exanthematous poisons, though positively contagious and transportable, are measurably susceptible of preventive sanitary control ; and most other infectious poisons, though more dependent upon contingencies for their operation, and therefore more difficult of such restraint, are not less submissive to it when directed by proper intelligence.

The immediate agents are susceptible of control.

Why measles and scarlatina cause greater loss to the army than small-pox.

To small-pox and vaccination is due the separate consideration given in the monograph [*Medical Document, E*] to which we have referred. Measles and scarlatina, though less dreaded, are actually the causes of greater danger and loss to the army than small-pox, for much greater numbers of soldiers are liable to the former maladies, and the sequelæ of those fevers are often fatal, or apt to produce lingering impairment of health. Hence those maladies, though popularly regarded as being simply the inevitable scourges of childhood, do actually demand vigilant measures for their prevention and control in the army.

Recapitulation of special measures for the sanitary control of the exanthematous contagions.

Sanitary Regulations for preventing the spread of the exanthematous contagions. 1st. The patients and all infected things—at least, all the personal clothing worn during the period of eruption—should be immediately separated from all persons that are liable to contract or to communicate the contagion ; and such domestic or limited quarantine should be

enforced, as will insure entire security against its diffusion. Both the nurses and the infected clothing of such persons should be treated as in quarantine. Purification of persons and places exposed to the infection should be effected by means of washing, and thorough ventilation, while all clothing and porous materials must be disinfected by washing, at boiling heat, if practicable, otherwise by sufficiently protracted ventilation—which, in the case of articles contaminated by small-pox, should be aided by fumigations of chlorine or bromine. And in case neither a high heat nor strong fumigations of the latter chemicals can be applied to such contaminated materials, let them be destroyed by fire. Boiling heat, or high steam, is the surest disinfectant of small-pox and all other contagions. Even a temperature of 140° F. effectually neutralizes the virus of vaccinia.

Personal isolation or domestic quarantine.

Infected persons and places, how to be treated.

Clothing and porous materials.

Special disinfecting agents.

The transportation of patients having small-pox or measles should in all cases, when practicable, be provided in vehicles exclusively employed for the purpose; and, in any case where an ambulance or saddle has been used for conveying a small-pox patient or his clothing, it should be placed in quarantine until properly purified. Tents and equipage that have been immediately exposed to the exanthematous infections, should be washed with boiling water.

Ambulances, tents, and equipage, how managed.

It should be borne in mind that a low temperature tends rather to increase than diminish the activity of the exanthematous poisons and most other febrile contagions. It is only upon the yellow fever miasma, and other infections which depend upon warmth and moisture, that cold acts as a disinfecting agency.

Frost or cold does not destroy the exanthematous infections.

SECOND CLASS OF INFECTIONS.—Typhus fever, hospital gangrene, and erysipelas, are here grouped for consideration as infectious maladies, and sources of specific poisons that obey similar laws of generation and of prevention, and which also depend upon a given class of hygienic agencies for the mitigation of their activity.

Typhus and the infectious poisons of the second class.

No army surgeon can be uninformed respecting the infectious nature, and the peculiar activity and perils of this

The dangerous nature of these infections is well known.

Means of protection from them should be definitely understood.

class of contagions in hospitals and crowded quarters, and as even the subordinate officers in wards, and the commanding officers in military quarters, where any of these diseases are found, ought definitely to understand the requisite measures for providing sanitary protection against them, the following concise statement is here given, without explanation, and at the pleasant risk of recapitulating, in a very synoptical manner, the special information and hygienic regulations which every medical officer in charge of a military hospital may justly claim as his own. Were an apology required for reiterating such statements of accepted medical knowledge, or for reducing these statements to aphorisms, we need but refer to the circumstance, "that it stands prominent as a fact in military history, that serious evils frequently arise in armies from the ravages of contagious fever; and that, as contagion is a contingent evil, it is obvious to common sense, that the chances which give rise to its action ought to be precluded with every possible care." [Dr. ROBT. JACKSON *on Armies*, p. 368.]

The object of thus stating what sanitary measures are required.

"Contagion" a contingent evil.

Active warfare demands a choice of evils and some exposure to disease.

However excellent the plans providing for medical service in hospitals and in the field, and however well directed may be the sanitary regulations of great armies, active warfare involves the repeated and almost constant occurrence of contingencies that necessitate a choice of evils, and require much exposure to causes of disease. The crowding and accumulation of men which occur in war, tend to produce and perpetuate infectious maladies. Hospitals and transports are frequently overcrowded from the very necessities that war creates; while the regulations of encampments are made to crowd upon given areas populations more dense than can be found in any city. Our army regulations permit crowding in the regimental camp at the rate of 86,000 men to the square mile; while in hospitals and transports the natural evacuations and bodily excretions, the suppurating wounds, the gangrenous parts, and the uncleansed persons and clothing of vast numbers of soldiers in an unhealthy condition, are combined to vitiate the local atmosphere. Under such circumstances of inevitable insalubrity, the worst of endemic infections may suddenly spring into fatal activity, and almost any imported *virus* of disease will readily become

Endemic and infectious poisons resulting from overcrowding, etc.

Encamping soldiers at the rate 86,000 to the sq. mile.

Special sources of infection in hospitals and transports.

localized. It is manifest, therefore, that hygienic measures for the control and the prevention of infectious contamination will mainly consist in sanitary works for the preservation of atmospheric purity, and for the special restoration of such purity to the places, things, and persons contaminated. To accomplish this object, sanitary science commands the abundant resources of police regulations, engineering, chemistry and medical science.

The restoration and preservation of atmospheric purity the main object.

To be accomplished by the resources of chemistry, engineering, and sanitary police.

Localizing and Endemic Causes of Infections of the Second Class—Putrid Contagions.—1. Overcrowding and special hygienic neglect of wards, barracks, quarters, tents, or transports, may justly be regarded as the most active and common localizing condition, and the chief originating cause of typhus, and of that state of the blood and the nervous system that primarily establishes the gangrenous process, and renders simple erysipelas malignant and contagious. Any apartment or place that has generated or localized any of these dangerous infections, should, if practicable, be immediately and entirely vacated by all sick and wounded persons; but if such removals are impossible, let there be made the best practicable distribution of patients, and election of places and apartments for them, and, as a protective measure, let no delay be made in commencing the best methods of purification. These are—

Localizing and endemic causes of infection.

The chief cause of typhus is overcrowding.

How gangrene and erysipelas become contagious.

Infected wards and places to be vacated.

Distribution of patients.

2. Thorough cleansing and ventilation, constantly and rigidly enforced;

Special disinfection.

3. The immediate and effectual employment of appropriate and most available disinfectants. The following are the best:

Ventilation and cleansing.

In hospital wards, barracks, transports and contaminated quarters.

{	Chlorine and the Alkaline Chlorides,	}	In solution and upon evaporating cloths.
	Nitrous Acid vapor, or		
	Bromine vapor, carefully employed;		
	Permanganate of Potassa,		
	Nitrata of Lead, or		
	Sulphate of Iron (copperas);		
Charcoal powders, Gypsum, Quicklime, or			
Coal-tar compounds.			

Chemical disinfectants:

In wards and quarters.

For special cleansing of latrines, sewers, sinks and other external nuisances.

{	Coal-tar compounds, Chloride of Lime,
	Sulphate of Iron, Charcoal, and
	Gypsum, Quicklime, or dry Earth; after proper
	cleansing and water-flushing.

For sinks and external nuisances.

Removal of surface filth, etc.:
Drying of humid surfaces.

4. The immediate removal of all surface-filth, garbage, and decomposing materials, and the drying of such localities and all wet surfaces by means of surface drainage, dry sand or earth, and desiccating with lime or charcoal if at hand.

Special ventilation and the standard supply of air.

5. Order such improvement in the ventilation of all occupied apartments as will insure the steady supply of *not less than from twenty to forty cubic feet of fresh external air to each person every minute by day and by night*. Also let into all places an abundance of sunlight.

Sunlight.

Systematic drainage.

6. If the infected quarters or place must continue to be occupied many days, institute a system of thorough and deep drainage of the entire locality; also take measures for securing the best water-supply.

Water-supply.

Cheerfulness and hope.

7. From the first, and continually, call into operation all proper means for increasing the cheerfulness, hopefulness, and general *morale* of all patients and attendants, and let all the principles of hygiene be brought into their fullest operation in the persons and apartments, and throughout the entire locality in which endemic infection prevails or is liable to prevail.

Attention to hygienic laws.

Hygienic management of patients and wards.

Special Hygienic Management of Patients and Wards: Ventilation, Disinfection, Distribution, Isolation, etc.

Only one kind of infectious disease to be allowed in a single ward.

1. Avoid allowing more than one of the types or kinds of really infectious disease at one time in the same apartment. This rule is particularly important in managing the infectious diseases comprised in the Second class.

Patients not to be aggregated in great numbers.

2. Prohibit the accumulation of large numbers of patients suffering from these maladies in one apartment or upon a small area; and if ever it should be necessary to have anything like the usually allotted number of patients in a ward, let the ventilation of such an apartment be improved and kept in the most effectual operation. When practicable, there should be an allotment of from 1,500 to 2,500 *cubic feet of air-space* to each patient in such a ward.

Ventilation and air-space must be increased in an augmenting ratio upon the numbers
eg g a ted.

3. The most scrupulous cleanliness should be rigidly enforced in everything that pertains to the patients and to their apartments. In no case should a sponge or towel, or any article of clothing that has been used upon one of this class of patients, be used upon any other patient, unless the article so employed has first been effectually cleansed and boiled. All such contaminated articles must be treated as being held for the time in domestic quarantine, and they should not be released from such rigid restrictions until after having been washed and subjected to a boiling heat, unless treated by direct application of vapor of bromine, chlorine, or permanganate of potash in solution. The attendants upon the sick with these maladies should give scrupulous attention to personal cleanliness.

Importance of scrupulous cleanliness.

Personal clothing, towels, sponges, etc. to be specially disinfected, etc.

Cleanliness of nurses and attendants.

4. Thorough dryness should be always enforced in the sick-room; the floors should be dry-cleaned, and the local atmosphere specially desiccated by means of strong through and through air currents, or, in the absence of such ventilation, by the use of special *dryers*, e. g., quicklime, or sulphuric acid, distributed on shallow plates; or very dry sand laid as a coating on the floors, and frequently removed. On shipboard with infectious diseases, such *drying* of the local atmosphere is of special importance; and it is proper to remark that the writer has succeeded best in securing such desiccation by means of *special* ventilation, dry-cleaning the floors, and the free use of dried sand coatings, with the employment of quicklime, etc., as here mentioned.

Importance of dryness; special means of local desiccation.

Means for producing a dry atmosphere in wards or on shipboard.

5. Patients with other diseases should not be permitted to visit wards devoted to typhus or other infectious maladies, and in guarding against the spread of any of the infections, of the second as well as of the first class, there should be no unnecessary intercourse between the apartments assigned to the different diseases.

Nature and extent of personal isolation required for infectious diseases.

6. Whatever other diseases or surgical cases may, from necessity, be suffered to remain in the same ward, or upon the same floor with the second class of infections, all un-

All unhealed wounds to be absolutely precluded from the presence of infections of second class.

healed amputations or open wounds must be kept out of their presence and beyond their influence.

Sanitary measures should be both reasonable and effective.

The universal experience of military surgeons and officers of hospitals has shown how indispensably important it is that a reasonable and effectual system of domestic and personal hygiene, based upon the principles and maxims here stated, should be intelligently enforced wherever the infectious pests of armies spring up. And it may be remarked, that the same localizing conditions and the same sanitary neglects that we have mentioned in reference to the most virulent of endemic febrile infections, seem to be equally as active and fully as important in the production and endemic diffusion of the causes of camp dysentery and the fatal diarrhœal affections that follow in the trail of armies.

The special regulations that control and prevent the worst of febrile infections, also prevent other endemic diseases.

Camp dysentery contingently infectious and communicable.

And whether personally communicable or not, the latter maladies are often seen to be as much dependent upon endemic and localizing causes, in hospital wards and other localities, as typhus and hospital gangrene. Were we to group that class of maladies for consideration in these pages, we might properly place them in a separate or sub-class, and regard them as being somewhat allied to both the second and third classes of infections. The maladies here referred to, when occurring in crowded military quarters, transports, or hospitals, should be regarded as being contingently infectious. In these diarrhœal maladies it is admitted that the dejections from the bowels tend to perpetuate and spread the same maladies. And this process may properly be denominated infectious, though there is not as definite a period of *incubation* as that which characterizes the febrile types of infection.

Such diarrhœal endemics must be treated as contingently infectious.

Third class of infections.

THIRD CLASS OF INFECTIONS.—At the risk of some just criticisms upon this classification—an arrangement adopted solely for a practical object—we have, for the occasion, grouped together the three remarkably distinct and fatal diseases—*typhoid fever*, *cholera*, and *yellow fever*.

Reasons for this peculiar grouping.

Whatever may be true and whatever doubtful in the history of these maladies as regards the mooted question of

personally infectious qualities, that question is so involved in indefinite contingencies and consequent doubts, that it is practically of very subordinate importance. It is only necessary to our purpose to refer to the causes that tend especially to localize and to perpetuate these maladies. Dependent upon widely different sources, these diseases agree in their dependence mainly upon *external* agencies, and in a manifest tenacity of their specific poisons or infection in the locality in which they respectively become localized. They are emphatically endemial maladies, and cholera claims also to be the type of an epidemic of widest range; but when localized, the infected locality of any one of these is a place of danger. This is most emphatically true of the specific and unknown cause of yellow fever, and is, contingently, not less true of the most active causes respectively of cholera and of enteric and typhus fevers. And it is demonstrated by experience that, to give sanitary security against these dreaded diseases, the causes of their infectious poisons must be removed, or, otherwise, that all susceptible persons, tarrying or visiting such infected places, must be prohibited therefrom. All effective sanitary regulations, for controlling and preventing these diseases, have both these necessary conditions of security in view.

The separate consideration of the leading points, to be kept in view in the sanitary control of each of these maladies, will set forth this subject in a practical light.

Typhoid or Enteric Fever.—Various morbid agencies are usually combined in producing this fever, but we will specify that which is most important and widely-acting, and which is most directly connected with the question of a specific infectious cause. This has been denominated by Dr. Murchison the *pythogenic* infection, or the specific miasm of sewers and neglected latrines—the pest of camps and badly drained towns. Says Dr. J. B. UPHAM, in his report upon this fever, published by the U. S. Sanitary Commission (*Medical Document K*, p. 9): “Its essential causes are by no means well ascertained. * * * Among the immediate causes must be named the ordinary excitants of disease in camps.”

The mooted question of personal communicability not discussed in this paper.

The special conditions and localizing causes alone considered.

External more bid agencies predominate as causes of this class of infections.

Persistency and localization of this class of fever poisons.

The sanitary protection of an exposed population can only be secured by removal of the local causes of infection, or by immediate removal of the people.

Typhoid fever; its causes often complex; what endemic agencies the most positive and widely acting.

The localizing and infecting poison of latrines and sewers; the fever poison of camps.

Typhoid fever
poison contin-
gently infectious,
and by what
agencies.

The fact is now well ascertained that this fever is, under certain contingencies, infectious and communicable through the agency of the bodily excretions of the sick, but the greater truth is, that effete animal and organic matter in a state of putrescence, as in badly policed camps, barracks and latrines; and, especially, the mephitic effluvia from sinks, etc., are the most powerful localizing causes of its endemic prevalence.

How rendered
endemic.

Special preven-
tive measures.

Special sanitary measures: 1st. Remove from the pestilent locality the sick, and as many other susceptible persons as practicable, and place them in salubrious quarters.

Removal of per-
sons to healthful
localities, purifi-
cation of the in-
fected places.

2d. Wherever patients with typhoid fever are placed, let effectual measures be instituted to remedy overcrowding, filth, humidity, neglected bodily excretions, latrines, sinks, sewers, and all other causes that tend to augment and localize the infection of this malady as an endemic.

Perils of expos-
ure to the local or
atmospheric in-
fection far great-
er than from the
sick persons.

3d. In general, pursue the same course of hygienic care and sanitary police as in typhus, but with greater care, if possible, to abate external nuisances, and comparatively less concern for any degree of absolute isolation of the sick persons. The alvine dejections, and the chamber vessels, previous to exposure should be treated with some prompt disinfectant: This must be attended to in all diarrhoeal diseases.

Cholera, what
is known of laws
governing its lo-
calization and
endemic preva-
lence.

Cholera.—With as limited and even less certain knowl-
edge of the essential causes of cholera, the laws which
govern its endemic prevalence are perhaps as well known
as those that relate to typhoid fever. And without the
least evidence of co-relation of these maladies, or their es-
sential causes, still it may be remarked that the same con-
ditions of hygienic neglect tend to localize either malady
and to perpetuate its infectious power, when a foothold is
once obtained. The same sanitary measures apply to both,
—with this remark, that there is more urgent necessity
for immediately removing all uninfected persons from places
where cholera is really endemic. It is also, perhaps more
urgently important, in the case of cholera, that the evacua-
tions from the stomach and bowels should be instantly re-

Avoidance of
infected localities.

Choleric evac-
uations from the
sick to be special-
ly treated.

moved and carefully kept from exposure in any way to other persons than the patients themselves.

The same disinfectants are required as in the management of the 2d class of infections, especially should there be a free application of quicklime or the alkaline chlorides in the immediate control of all excretions from the patients, as well as for the preservation of atmospheric dryness and purity. The ventilation of hospital wards and all infected places should be as perfect as possible.

Special¹ disinfectants.

Yellow Fever.—Infected *places* and infected *materials*, not the persons suffering from this fever, are the recognized sources of danger. The question of a specific infection or poison seems in this instance to relate mainly to *locality* and to porous and retentive materials from an infected place.

Yellow fever; habits of its infectious poison.

Infected places and things—not the sick—are the sources of danger.

The facts relating to the nature and treatment of yellow fever are concisely and well stated by Prof. J. T. METCALFE, in his valuable little monograph published by the Sanitary Commission [*Medical Document, L.*] The few facts that demand specific notice in this place in reference to the control and prevention of the infection of this fever may be stated as follows:

Prof. Metcalfe's report to the Sanitary Commission

1. The infecting cause of yellow fever may be conveyed from place to place by vessels and by porous and retentive materials of various kinds that have been exposed in places where this fever is endemic, or that have elsewhere become contaminated by the presence of infected materials.

Infecting causes of this fever, how conveyed from place to place.

Persons, how infected.

2. The positive means for destroying the infecting cause or specific poison of this malady, are, *first*, a freezing temperature; or *secondly*, a temperature, of 212° F.—boiling heat; *thirdly*, destruction of the infected things by fire.

Special agencies for disinfecting or destroying the poison that produces this fever.

Any of these methods may be employed to destroy the infecting poison which clings to vessels and things—the second method, by means of a boiling heat, being the most available and probably the most certain in its operation. [*See Special Report on Heat as a Disinfectant. Proceedings of the National Quarantine and Sanitary Convention,*

Extremes of temperature—frost and heat—how rendered avoidable for disinfection.

1860.] But the 1st method—cold—is nature's sure means of destroying the endemic cause of this tropic pestilence, and it is alone competent to the work of instantly terminating its prevalence in any given district of country.

Localizing causes of other epidemics aggravate the epidemics of this fever.

3. The localizing and endemic causes of other zymotic maladies seem to augment the virulence of yellow fever, and in regions specially liable to this fever, hygienic neglect may justly be regarded as an important tributary cause of its endemic prevalence. So true is this on shipboard, that not unfrequently this pestilent malady breaks out with great virulence as soon as the unclean vessel reaches the region or zone in which it is possible for yellow fever to prevail.

Perils of unclean transports in the zone of yellow fever.

Special measures for limiting the ravages of this pestilence.

4. The immediate removal of the entire population,—excepting only those persons that have once had the fever,—from the infected locality, is the first and most necessary sanitary measure to be adopted in any place, when yellow fever has become endemic; and this protective measure is equally important in a single apartment or building, a particular compartment, side, or deck of a ship, or in an entire street or neighborhood that has become infected.

Removal from the locality infected.

Quarantine regulations; what their nature, and what their utility.

5. Regulations to prevent unnecessary intercourse with infected places may, in particular instances, be essential to protection against the distribution of materials that would communicate and spread this fever, which naturally tends to limit itself to definitely bounded localities. As Dr. METCALFE very justly says, in the report mentioned on the preceding page, "To abandon quarantine restraints on yellow fever, is to place a price on human life, and barter it for trade."

General considerations respecting sanitary regulations for infectious diseases.

Sanitary Measures against Infectious Diseases in Transports and Crowded Quarters.—In the foregoing pages we have endeavored to convey a correct idea of the paramount importance of intelligent and unceasing attention to personal and local hygiene, whatever may be the special measures required for preventing the activity or spread of infectious poisons.

Purity of the local atmosphere, and proper cleanliness of person, and of quarters, can be preserved in hospitals and transports only by the most vigilant effort and exact discipline. In hospitals, the vitiating influences are peculiar and numerous. Said Baron LARREY, before the French Academy, last year, "The natural excretions of the patients, their foetid breath and perspiration, the expectoration of gases and liquids, alvine dejections, evacuations, and urinary fistulæ, all these joined to accidental secretions, the suppuration of wounds and ulcers, and the putridity of hospital gangrene, are so many mephitic beds from which may arise the most formidable epidemics in field and general hospitals, on the trail of armies in campaigns, exhausted by all the fatigue and privations of war; and above all, in the disastrous conditions of *encombrement*" (crowding).

Vigilance and strict discipline necessary to prevent atmospheric contamination in hospitals and transports.

Baron Larrey's remarks upon this subject.

We need not enumerate the sources of a vitiated atmosphere and consequent endemic infections in camps and barracks; they are known to every soldier. M. BAUDENS' remark that the infection of fever in the Crimea, "had one foot in the camp and one in the field hospital," is fully explained when he states that "the quarters for troops shine with the greasy filth of daily neglect," and that "on review day, the fine battalions left, as they passed, the marked and well-known stench of the barracks."

M. Baudens' remark.

Results of neglect in hospitals and camps.

In transports, whether with troops for the field, or with sick and wounded men, the perils of overcrowding, bad ventilation, uncleanness, bad diet, and want of exercise, combine to induce the worst degrees of infection, and to diminish the vital powers of all who suffer such privations. Fortunately the greater part of the water transportation during the present war has been by the river and bay steamers, whose ample decks and open ventilation have been the best of safeguards against the diseases that most infest transport ships. Yet even at this stage of progress of the national arms southward, numerous instances have occurred which illustrate the peculiar perils of transports even under favorable circumstances. The following passage is from the report of Surgeon J. H. BRINTON, upon the hos-

The worst conditions of local insalubrity, how combined in neglected transports.

Advantage for ventilation of river and bay steamers.

Surgeon Brinton's report upon hospital gangrene.

pital gangrene in the western hospitals. In his special report to the Surgeon-General, Dr. Brinton says: "The development of this disease on the route seems to have been owing to the fact that the transportation of the wounded was effected by means of crowded and ill-ventilated boats, and that the trip by the Cumberland and Ohio rivers frequently occupied several days. During this time these patients, who had already undergone much suffering, were exposed to all the influences most apt to engender this disease. In contrast with this fact, it was found that, as soon as the Louisville and Nashville Railroad was opened, so that the wounded could be conveyed from city to city in one day, all importation of gangrenous sores into Louisville ceased. The development of hospital gangrene during the boat transportation is a noticeable fact, and is strikingly analogous with the same phenomena observed among our paroled wounded prisoners from Richmond, received into the Annapolis General Hospital some months since."

Increasing need of care in the sanitary management of transports.

In the transport ships for troops upon the sea coast and the Gulf, the evils of crowding, lack of ventilation, and the presence of infectious diseases, have already produced serious results in a number of instances; and, as the war progresses, there will be constantly increasing necessity for much greater care in the sanitary management of such transports. Especially is an intelligent medical supervision of the transports now needed, to guard against the introduction and spread of the infection of typhus fever, which has again obtained foothold in our cities. The perils to which the patients in military hospitals both at the North and the South will be exposed when typhus gains access to them or to the transports, would be greater than all the casualties of battle or of the sea. Already the fact has become too apparent that the insalubrious condition of the returning transports is localizing and extending the prevalence of typhoid fever and dysentery.

Typhus present in our cities: its approaches to the army must be vigilantly guarded.

Typhoid fever, diarrhoea, and dysentery, in transports.

Hints upon hygienic management of transports.

The practical importance of this subject, as well as the peculiar exigencies of the transport service, justify the following brief suggestions upon the hygienic management of

transports with reference to the prevention of infectious maladies. These suggestions the reader will please regard merely as practical applications of principles already enunciated in the foregoing pages.

The points that demand consideration concerning the hygienic management of transports, are,—

Points to be considered relating to transports and to the troops upon them.

1st. Those that relate to the vessel; previous to embarkation, and subsequently, when crowded with passengers.

2d. Those that relate to the soldiers, previous to embarkation, and subsequently, while they are on board the transport.

The Transport.—Cleanliness of the vessel; this is an essential point, and it will seldom be properly attended to before the embarkation, unless the medical officer intelligently advises the proper authorities upon the subject. Transports that have been long in service, and upon voyages of several days duration, need to be frequently and thoroughly cleansed, and all the spaces between decks and to the very keelson, should be limewashed. Transports upon which any infectious endemic has recently prevailed, should either be thrown out of service, or be subjected to such processes of cleansing, fumigation, and ventilation, as will remove all local infection: Chlorine, nitrous acid fumes, or bromine, may very readily be used for this purpose; and, in the case of yellow fever infection, if such a transport must be employed before it can be sent to the region of frost, its spaces should all be flooded with super-heated steam. Water should be abundantly supplied in sound casks and tanks, and of as good quality as can be obtained: If it contains much organic matter, let freshly burned and clean charcoal, or the permanganate of potash, be supplied for use in its purification. Of buckets and lavatories let there be full supply on deck, that it may be practicable to enforce the proper observance of personal cleanliness. When soldiers are detained several days upon transports, great advantages

1st. Sanitary condition and wants of transports. Cleanliness.

Special management of vessels that have transported infectious diseases.

Chlorine and nitrous acid fumigations.

Use of steam.

The water supply.

Incentives and means to personal cleanliness.

will be attained in personal health and comfort, no less than in respect of protection against endemial and infectious agencies, by the habit of daily ablution of the entire body. Water-closets and spouts must be amply sufficient and properly arranged, even for short voyages, or the most offensive sources of disease will be sure to exist. Ventilation: A transport should have means of effective through and through ventilation, from the bows to the stern, and from the upper deck to the keelson, and this is provided in some measure by the ship's hatches, gangways, and counterports; but the special improvements or works for ventilation in ordinary transports, consist mainly in greatly increasing the area and the places of *egress for foul air*: This is best effected, temporarily, by increasing the area of the windows and air-shafts at the stern, and, if admissible, elsewhere. The *ingress of fresh air* is easily provided for after establishing the channels and amount of outlet. Wind-sails for ingress can be multiplied indefinitely, and when no properly made wind-sails are at hand, any sailor can rig studding-sails for the same purpose. Each deck must have its independent channels for supply of fresh air, and for the egress of foul air. The lower or closed decks of steamship transports, should have shafts or *areas* of outlet for foul air, at least equal to *four square feet* for every 100 men. The total area of the fresh-air *inlets* should considerably exceed that of the foul-air *outlets*; and upon the proper adjustment of the outlets and the intelligent management of the inlets depends the problem of extemporized means of ventilation in ships. The estimate given above, will provide 1,000 cubic feet of fresh air per hour to each man, in a vessel sailing five knots an hour; but, if no special outlets are provided, even twice the number of wind-sails, all injecting, would fail even to supply at the rate of 100 cubic feet per hour. So simple are the principles of naval ventilation, that with the aid of an intelligent shipmaster, temporary means for effectual ventilation may be instituted without cost or delay, in any transport. The proper management of the ventilation, together with the strict cleanliness and police of the ship, are indispensable every hour that soldiers remain upon a transport.

Cloacal arrangements.

Ventilation.

There must be ample means of egress for foul air.

Wind-sails, how extemporized.

Each deck to have independent channels of supply and egress for air: the area of egress to be not less than 4 sq. ft. to 100 passengers.

Pro rata supply of air, how estimated.

Principles of naval ventilation are simple.

Attention to the air-supply not to be neglected an hour.

Sanitary Regulations for Soldiers upon Transports.—

Previous to embarkation upon outward voyages, there should be an inspection to prevent any infectious or other important disease from being brought on board, and every man should be vaccinated, or exhibit evidence of previous vaccination. In embarking sick and wounded men, the same vigilant caution should be exercised to exclude infectious diseases from the transport; and when any infectious malady must be transported by water, a special compartment, or an entire ship, should be provided exclusively for that purpose. The practical importance of these rules cannot be over estimated when typhus and hospital gangrene are rife. The question as to which part of a transport should be selected for the isolation of infectious cases of disease, may best be determined by the officers in charge. Dr. Robert Jackson recommends the section under the bows of the ship; and, in a sailing vessel, that may be best; but in transports, propelled by steam, the stern of the ship is probably best. It is particularly important that the sick-bay or hospital have a separate gangway, and ready access to the galley; also, that it be furnished with a portable culinary apparatus, and with air-tight close stools. And especially must the sick-bay have independent and ample means of ventilation, and be suitably lighted. Personal cleanliness, and rigid sanitary police, in all that affects personal habits, clothing, diet, and exercise, are so peculiarly important on shipboard, that all regulations and penalties relating to this subject, should be rigidly enforced. Any inattention to these things, on the part of medical officers, and any letting down of military and police authority, might prove more fatal than the casualties of a battle-field. The special management of the sources of infection, whether they be indigenous, or introduced, upon transports, should conform to the principles that have been stated in the former part of this paper; and it is vitally important that there should be the greatest fidelity and vigilance in the supervision and execution of all the details of sanitary regulations for this purpose. Especially must the most scrupulous cleanliness of the men and their clothing,

2d. Sanitary government of soldiers upon transports.

Importance of a preliminary inspection: Vaccination.

Importance of separate transportation for patients with infectious maladies.

Section of a transport best adapted for "sick bay" or hospital.

Vital importance of rigid discipline and sanitary police.

Perils of relaxing such authority.

The sanitary management of transports requires the most exact application of hygienic knowledge.

Exercise and
cleanliness.

their habits and their quarters, be enforced by military authority; and, at stated periods of the day, every man who is not in hospital should be compelled to vacate the 'tween decks, to take exercise in the open air, and the disposition to hibernate in sloth and neglect must be effectually opposed; while such cheerful exercise and games as can be permitted should be encouraged.

As in hospitals, and crowded barracks, so in transports, the problem of sanitary security is the problem of abundant air-supply, cleanliness, local purity, and general obedience to physiological laws.

The probabilities of prevailing
endemics of infectious disease
as the war progresses.

Although the infectious types of disease have not yet prevailed very extensively among the national forces, it is to be expected that the greater hardships and perils of campaigns now commencing, together with the attendant insalubrity of climate and localities, the crowding of hospitals, transports and quarters, and greater exposure to special sources of infection in the South, will demand the most intelligent attention of medical officers to the questions presented in these pages. But if timely and effectual sanitary measures are adopted, and every controllable source of pestilential infection or general disease is anticipated by preventive means, our vast armies will certainly be spared the sweeping pests of typhus, camp dysentery, and hospital gangrene, and be protected from the scourges of scorbutus, typhoid fever, and cholera,—diseases which in all European armies have proved far more destructive than all the projectiles and sabers of the enemy.

Value of timely
preventive measures.

The results to
be anticipated

APPENDIX

Special Disinfectants and their Applications.—That there can be no substitute for *fresh air* to meet the physiological requirements of respiration and health should be indelibly impressed upon every mind. Better that all substances at present employed as disinfectants and deodorants were at once prohibited by the Medical Department than that such agents should practically tend to be regarded as *substitutes for a pure atmosphere*. But the necessities and privations of army life, the multiplied agencies of disease, and the vitiating conditions attendant upon wounds and sickness, create necessities for the employment of chemical and other artificial agencies to mitigate, and, in some measure, prevent the otherwise inevitable contamination of the local atmosphere of crowded hospitals, transports, and quarters; and it is only such necessary demands for the employment of disinfectants that justify even the occasional allusion we have made respecting them in preceding pages. They are simply aids in restoring and preserving healthful purity, and not substitutes for cleanliness and pure air.

For the convenience of persons who may have occasion to refresh the memory with the more practical facts relating to special disinfectants, and the best method of their application, the following notes are added in reference to this subject:

The principal disinfecting agents may be classified as follows:

<i>Absorbents and retainers of noxious effluvia, particularly the ammoniacal and sulphuretted gases.</i>	}	Charcoal,
		Sulphate of Lime (Plaster Paris),
		Sulphite of Lime,
		Silicate of Alumina (Porous Clay).

<i>Absorbents of moisture; chemical agents that act upon organic matter, and re-combine some of the elements of noxious effluvia.</i>	}	Quicklime,
		Sulphuric Acid,
		Hydrochloric Acid,
		Nitric and Nitrous Acids.

Soluble salts that are particularly available for arresting processes of decomposition, and for controlling phosphuretted and sulphuretted gases.	} Nitrate of Lead, } Chloride of Zinc, } Proto-Chloride of Iron, } Proto-Sulphate of Iron.
Antiseptics that act diffusively and rapidly, though less permanently than some others. Active in destroying compound gases.	} Chlorine Gas, } Hypochlorite of Soda [<i>Labarraque's solution</i>]. } Chloride of Lime.
The most prompt and efficient antiseptic known.	} Bromine.
Antiseptic, and of great power as an oxidizer, and as an available source of ozone.	} Permanganate of Potassa.
Antiseptic and deodorant; capable of a great variety, extent, and economy of applications, and acting with considerable energy and permanency.	} Carbolic Acid and Coal-tar compounds.
Destructive of contagious virus and all transportable infections.	} Heat.
Destructive of Yellow Fever miasma, and of the malaria that produces the "Paludal Fevers."	} Frost.

Considered *theoretically*, we may regard all disinfecting agents under the following heads, and perhaps this would be the more scientific arrangement of them:—1. *Absorbents of moisture and of noxious effluvia*; 2. *Oxidizers* [ozone the most active], and *Deoxidizers*; 3. *Other chemical agents that break up noxious compounds*; 4. *Agents that form indestructible compounds with putrescent materials; or that destroy cell-life and the cryptogamic and infusorial organisms.* But as the present state of chemical and medical knowledge only enables us to make such general statements respecting the theoretical action of disinfectants, we will follow our first classification by a few practical statements concerning each of the articles mentioned.

Charcoal.—Freshly burned and broken, this substance will absorb from 10 to 14 *per cent. its own weight* of gases and moisture from the atmosphere during the period of 24 hours; and it is capable of absorbing 90 times its own volume of ammonia, or 55 times its own volume of sulphuretted hydrogen. Properly applied, charcoal is an arrester of putrefaction, and, as such, it is worthy of more extensive employment in

the better preservation of animal food when served out in an unwholesome state by the regimental quartermasters. As a disinfectant or deodorant for extensive use in masses of putrescent material, and for local purification, fresh charcoal is of acknowledged value. The British Sanitary Commission, in the Crimea, ordered whole ship-loads of peat charcoal, which they used in the progress of their work of purification in the hospitals, barracks, or camps in the East. A Report of that Commission states that "perhaps the best deodorizing compound was one used by the inspectors in all their works. It consisted of *one part of peat charcoal, one part of quicklime, and four parts of sand or gravel.*" It should be remembered that the preservation of the disinfecting power of charcoal powder depends upon its being both fresh and dry.

Sulphate of Lime, Sulphite of Lime, and Porous Clay.—All these substances are valuable absorbents of ammoniacal and sulphuretted effluvia, and they constitute exceedingly convenient vehicles and auxiliary menstrua for some of the more potent and expensive antiseptics. The much vaunted French disinfectant, known as the disinfecting powder of Messrs. Corné & Demeaux, consists of about 94 per cent. of finely ground gypsum and 5 or 6 per cent. of coal-tar or the "heavy oil of coal-tar." McDougall's powder, and the Ridgewood disinfectant, consist of carbolic acid combined with the sulphate of lime and porous silicate of alumina, respectively, as will be noticed upon a subsequent page. Hypo-sulphite of lime possesses the property of absolutely arresting fermentation or the catalytic processes. The several substances of this first class, and their compounds, particularly those with carbolic acid or coal-tar, are among the most valuable disinfectants, especially when large quantities of cheap and effectual articles of the kind are required.

Quicklime.—With sulphuretted and with phosphoretted effluvia, and with humid vapors, freshly burned lime unites with great avidity, and as an absorbent of moisture and a chemical base for many acids, it is of peculiar value; but lime also eliminates or sets free the ammoniacal gases, and, like the acids of our second class of disinfectants, it is of *less permanent* value than some other agents. It is one of the most convenient antiseptics, and for local applications, as in whitewashing, sprinkling, desiccating damp surfaces or putrescent substances, and for temporarily arresting putrefaction, it is invaluable. Lime should be used dry and unslacked, except it be for the special purpose of combining with carbonic acid gas; for the latter object it should be reduced to a creamy hydrate, and, in overcrowded wards and barracks, it may be usefully employed in this way, distributed in shallow plates. Distributed in like manner, *sulphuric acid* may be employed for diminishing the humidity of the atmosphere in a closed and damp apartment; but for this purpose it is usually better to resort to strong currents of air, by means of through and through ventilation, when practicable.

The topical applications of the acids, particularly of the *nitric acid*, in arresting gangrene, are well understood by surgeons. *Nitrous acid* is a valuable antiseptic, and the production and application of its fumes constituted the famous disinfecting process of Dr. Carmichael Smyth.

The *fumes of nitrous acid* that so long had fame for disinfecting purposes in the barracks, hospitals, and navy of Great Britain may be readily produced by heating a mixture of nitrate of potassa and sulphuric acid in an iron or porcelain dish. Persons who resort to this method of fumigation, should bear in mind the fact that strong fumes of nitrous acid are dangerously irritating to the throat and lungs. These fuming acids are powerful oxidizers, but their avidity for water, together with their peculiarities of chemical affinity, render their value as disinfectants somewhat uncertain.

Nitrate of Lead.—Practical considerations place this salt at the head of odorless disinfecting salts most available for certain local applications, such as deodorizing a close apartment, and the bedding, etc., of sick persons, by means of a solution distributed on shallow vessels or upon saturated cloths. The nitrate of lead is the basis of "Ledöyen's liquid."

The *permanganate of potassa* is far the most efficient salt of this kind, and its cost alone should limit its employment. It is a chemical agent of different and far greater powers than any of the metallic salts in this third class.

Chloride of Zinc.—Though more powerfully antiseptic than nitrate of lead, it is not as valuable a deodorant. It is most to be valued for its property of promptly arresting putrefactive processes. As "Sir Wm. Burnett's disinfectant," it is widely known.

Both this salt, and that of lead, last mentioned, may be employed to delay decomposition in a corpse, in the absence of an embalmer. This is best accomplished by wrapping the dead body in a folded sheet that is saturated with either of these salts.

The Proto-chloride and the Proto-sulphate of Iron.—These are valuable and very cheap agents for aiding in the control of ammoniacal and sulphuretted effluvia. Being soluble, and very cheap, these salts are capable of varied and convenient applications, separately, or in combination with other deodorizing materials.

Chlorine and its alkaline compounds.—The common preparations of chlorinated soda and chloride of lime act with great efficiency when the carbonic, sulphuretted, or ammoniacal gases are brought into contact with them. As their special uses require no explanation in this place, we simply append brief directions for generating chlorine gas where it may be required more immediately and copiously than it would be given off by the alkaline chlorides or hypochlorites.

Ready method.—Pour dilute hydrochloric, sulphuric, nitric, or acetic acid upon chlorides of lime, zinc, or soda. This may be done gradually by means of a glass or lead syphon, or by the capillary syphon of lamp-wick, dropping the acid upon the chloride, if desirable to evolve the chlorine steadily for many hours.

Cheap method.—Mix 6 parts of peroxide of manganese with 8 parts of table salt (chloride of sodium) in a lead or iron vessel, which should be set freely within another vessel of larger capacity; pour upon the mixture of manganese and salt 13 parts of sulphuric acid, which may be diluted with water to abate the rapidity of the evolution of the gas. Heat the vessel containing this mixture by means of hot water or steam, if more rapid evolution of the gas is required.

Ordinary method.—Mix four parts of fuming hydrochloric (muriatic) acid with one part of coarse powder of peroxide of manganese, adding water, as may be desired, to abate the rapidity of evolution. Apply moderate heat. The vessel may be of a kind to permit the use of the acid and the heat. The heat, however, by this method, is not indispensable.

A very neat method of evolving chlorine in hospitals and transports, is to put a few ounces of the black oxide of manganese into a stout glass bottle of large size, rig a bulbous pipette to a perforated cork or stopper, and fitting an india-rubber bulb upon the headless bulb of the pipette, fill the pipette with muriatic acid, and evolve the chlorine at pleasure by occasional pressure upon the elastic cap.

Bromine and its compounds.—This most powerful antiseptic has recently been brought into requisition in the military hospitals as a special disinfectant and arrester of gangrene. It is applied both topically and diffusively. Bromine is exceedingly penetrating and energetic in its action, and consequently is to be manipulated and applied with proper caution. It is principally employed in its pure liquid form, or in combination with bromide of potassium. Special caution should be used not to respire the strong fumes or any pulverized compound of bromine, as its effects when inhaled are suffocating. The following concise statement of the best methods for applying this potent disinfectant, we quote from Dr. M. GOLDSMITH, Medical Director of Military Hospitals at Louisville, Ky., to whom the medical profession is largely indebted for its successful introduction as a topical and prophylactic agent for the control of hospital gangrene and erysipelas:

DIRECTIONS FOR USE.

1. *For Fumigation.*—Place vessels, containing *one ounce* of the solution at different points of the ward, and in number sufficient to secure in the latter the constant presence of the odor of bromine.

It should be borne in mind that, if the vapor of bromine comes in contact with the vapor of water, hydro-bromic acid is formed; therefore, when there is much of the vapor of water disengaged in the apartment, the quantity of the vapor of bromine must be correspondingly increased.

2. *Topical Application of the Vapor.*—A piece of *dry* lint is to be placed over the diseased part; over this is to be placed another piece of lint, *moistened with the solution of bromine*; over this, a *third* piece *spread with simple cerate*; the whole to be covered with oiled silk and bandage, so arranged as to retain the vapor in contact with the diseased surface as long as possible. The solution is to be removed as often as it becomes exhausted by evaporation.

3. *The Solution, in Substance, as a direct Application, in Hospital Gangrene, Diphtheria, Gangrene of the Tongue,* and other diseases of this nature:—The parts are first to be dried by the application of charpie; then the sloughs, if thick, should be trimmed out with forceps and scissors as much as possible, for the thinner the slough the more effective is the remedy. The parts having again been dried, the solution is applied by means of a mop, or a pointed stick of wood, in quantity sufficient to saturate the sloughs. If the sloughs undermine the skin, or dip down into intermuscular spaces, the solution must be made to follow, with the pointed stick, or by means of a glass syringe.

If the application has been effectual, all odor from the diseased surface ceases, and the sloughs become somewhat hardened. The remedy should be re-applied every second hour, as long as any odor of putrefaction is present, or as long as the sloughs appear to be diffuent. It is not always necessary, especially when the sloughs are diffuent and thin, to use the solution in its full strength; it may be weakened by the addition of water, as the disease subsides.

The points to be especially attended to, in the use of the solution of bromine, are two: 1. The solution should be applied in strength and frequency sufficient for the impregnation of *the whole of the sloughs*; 2. To secure this end, the application *should be made by the surgeon himself*, and never be trusted to a nurse. If the sloughs are thick and cannot well be trimmed, the bromine may be introduced into the thickness of the slough by means of a hypodermic syringe.

After the topical application of the solution, the parts, when so situated as to render it practicable, should be subjected to the influence of the vapor. (See par. 1.)

Surgeons will do well to bear in mind that bromine is a new remedy for the purposes indicated above. The directions for its use, given here, are those followed in the military hospitals of this city; it may be found advisable to modify them as experience with the remedy accumulates. It is, therefore, earnestly recommended that the subject be studied diligently, that the effects of the remedy be carefully watched, and that the application be varied as new facts are developed in its use.

The investigation of the evidences respecting the antiseptic and prophylactic powers of this new disinfectant has reasonably confirmed the opinion of its great utility. But to secure its beneficial effects, its application should be made with proper care and thoroughness. It claims to arrest the destructive progress of gangrene, erysipelas, etc., and utterly to destroy the personal and the diffused virus of such maladies. To accomplish this effectually, the bromine must be applied to every mole-

cule of the virus, and this is to be effected by means of the pipette syringe, the pointed stick, the scissors, and the solution, for local applications; and by its pungent and volatile vapors in wards and other infected places. This disinfectant certainly promises to be a great boon to our military hospitals.

Permanganate of Potassa.—A special order from the Medical Bureau at Washington [*Circular, No. 12*], calls the attention of medical officers to “the virtues of permanganate of potassa as a disinfectant and deodorizer.” This is a soluble substance peculiarly convenient of application and remarkably certain and efficient in its effects as a disinfectant. Its employment as a deodorizer and prophylactic is limited mainly to topical applications, to gangrenous parts or putrescent materials, and to general effect upon the atmosphere of contaminated apartments, by means of evaporating cloths saturated with a strong solution of the permanganate. The oxidizing and antiseptic effects of the permanganate of potassa upon organic and putrescent matter are remarkable. It is the most sensitive test for the presence of organic matter, which it oxidizes with wonderful facility. [*See remarks upon this subject in Hammond's Hygiene.*] As this is an expensive and delicate substance, it is to be employed economically, upon saturated cloths or in dilute solutions upon plates. For purifying offensive water for purposes of beverage, etc., a standard solution should be dropped into the vessel of water, *until the tinge of the permanganate begins to appear*. The rapid and effectual oxidation of the organic (*putrid*) elements of impure water and other substances, even of the atmosphere itself, when brought in contact with solutions of this salt, and the consequent and almost instant deodorization of such impurities, render this disinfectant of priceless value for practical purposes. And as all preparations of manganese are therapeutically tonic, probably the minute quantities of this salt that would be taken in drinking the water purified as above described, would only act beneficially. “Condy's Disinfectant,” “Darby's Fluid,” and all the vaunted preparations of “Ozonized water,” etc., are but solutions of permanganates. The salts are cheaper and more reliable than such nostrums, and are now supplied by all medical purveyors in the army.

Coal-tar Compounds—Carbolates.—The carbolate of lime has been employed to some extent in our camps and hospitals. McDougall's powder consists of carbolate of lime, sulphite of lime, quick-lime, etc. The Ridgewood disinfectant consists of carbolic acid, proto-chloride of iron, etc., combined with fullers' earth. Either of these, which are furnished by the medical purveyors, appear to be quite as valuable as the more expensive article of M. M. Corné and Demeaux's, which is used at the Imperial Camp at Châlons, and was found highly serviceable by Baron Larrey, after the great battles of the late Italian campaign. Coal tar, in almost any form, is available for disinfecting sewers, etc., and in the

dry powders mentioned, it is available for delaying the process of decomposition, whether in a corpse, or in refuse material. Carbolic acid has the antiseptic powers of creasote, and is largely sold for that article. The antiseptic properties of coal-tar, its effect upon mephitic gases and putrescent material, the permanency of its operation, and the cheapness of the article, render it available for extensive application in neutralizing and arresting cloacal and noxious effluvia in the processes of animal decomposition. A distinguished Medical Inspector of our army, when cut off from ordinary medical supplies, effectually and quickly abated the nuisances pertaining to an extensive old fortress, by means of an extemporized mixture of coal-tar, procured from the gas-works upon the premises. For use in chamber vessels, close-stools, etc., a neat fluid preparation may be made, after the formula of M. Dêmeaux, by mixing equal parts of coal-tar, alcohol, and hot soft soap. With the progress of knowledge respecting the chemistry of coal-tar and other hydrocarbons, the precise value of this class of disinfectants will be better understood. Coal-tar certainly has remarkable efficacy in arresting putrescence and controlling its effluvia.

Heat.—As a means of immediate disinfection of contaminated garments, bedding, and even of close apartments, ships, etc., heat is at once a cheap and most effectual method. The boiling of infected clothing, etc., is admitted to effectually destroy any contagious poison. And practically, upon a large scale in such work, experience proves it is best to employ steam as the means of heating. Upon this subject, see remarks and plans of M. Baudens [*Hospitals and Health of Troops*, Am. ed., pp. 238-204]; also, a Report on Heat as a disinfectant, in the Transactions of the National Sanitary Convention, 1860. It is probable that no circumstance contributes more directly to the perpetuation and spread of the typhus poison, than the accumulation and bad management of contaminated clothing, etc., that ought, under all circumstances, to be purified as soon as it leaves the patient or the bed.

Frost or Low Temperature, when continued a sufficient length of time, will effectually destroy both the miasma that produces yellow fever, and the paludal malaria that produces intermittent and remittent fevers; but such low temperature has no effect to arrest those fevers in the persons suffering them. It is worthy of note, that a freezing temperature does not appear to mitigate the activity of the personally infectious poisons, or contagions; though, with certain exceptions, it arrests putrefaction and the catalytic or fermentative processes.

For the Commission :

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