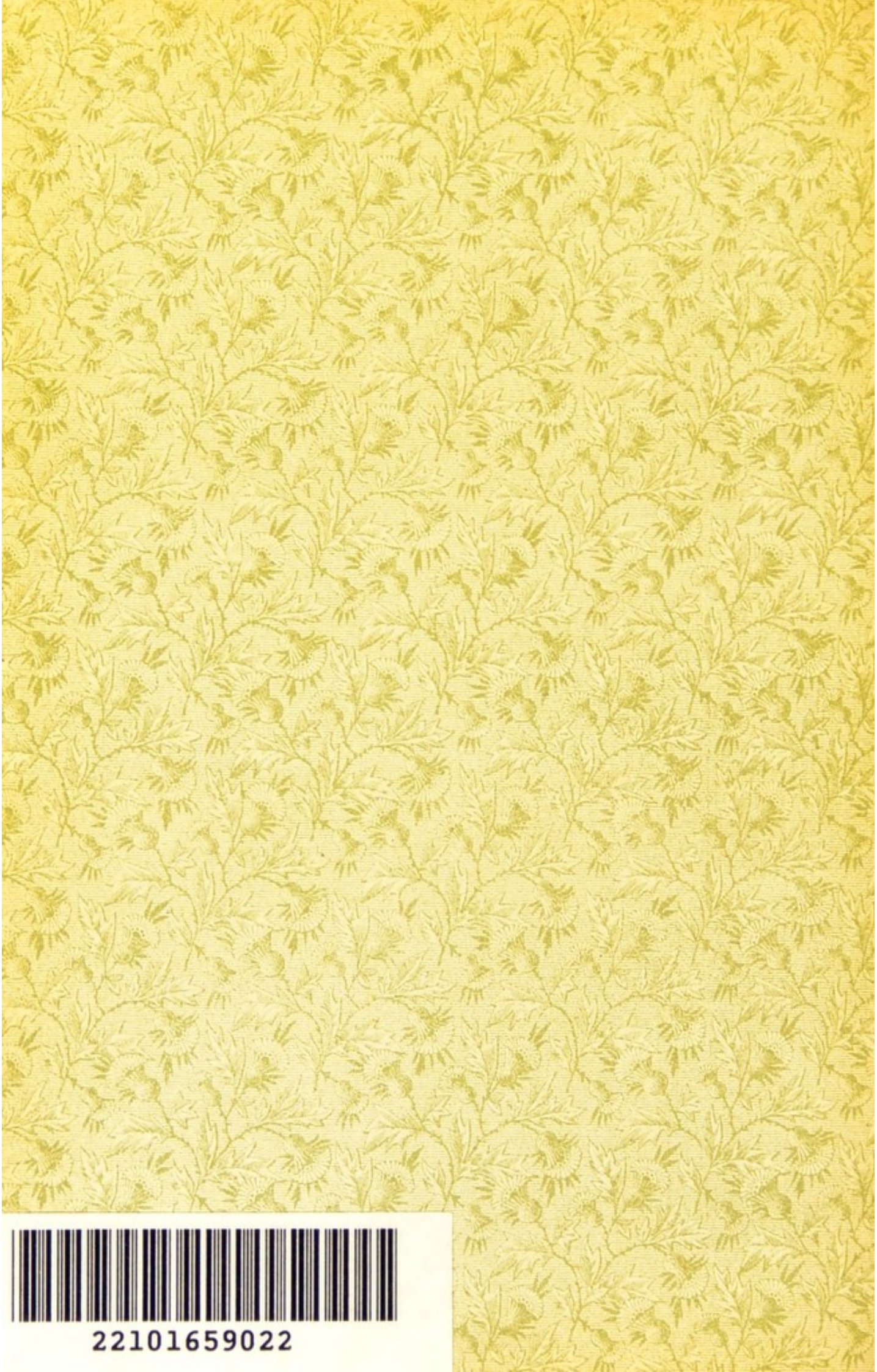
A treatise on epidemic cholera and allied diseases / by A.B. Palmer.



Compliments of the Author.

PREFACE.

In the preparation of this work on Epidemic Cholera, the object has been to collect and present in an acceptable form an account of the more important facts observed, the investigations made, and the more authoritative opinions expressed respecting the disease from the earliest authentic history up to the present time.

So much of its history has been referred to as was judged sufficient to illustrate its general character and the method of its spread, and to give an idea of its causes, essential and accessory; and a fuller account has been given of the means of its prevention, and the principles and details of its treatment.

In the attempt to accomplish these objects many sources of information have been sought and consulted, embracing treatises, articles in medical periodicals, the reports of investigators, of sanitary authorities, and of Boards of Health. In these publications a variety of views have been met with upon almost every point, and those views have been recorded whose authors, from their investigations, their experience, or their high professional character, were thought to be entitled to express opinions.

Not only the results of the recent investigations of Koch, of Emmerich, of Kline, and of many others have been given, but the observations and opinions of those who have encountered the disease in its home in Asia, and as it has appeared in its several migrations over Europe and this Continent. The views of various members of the profession of the present time and our own country have been given, of men who have followed the literature of the subject and whose reputation as physicians, medical teachers and writers, entitled them to be heard.

My own attention has been given to the subject for many years, and my experience with the disease has extended through three cholera seasons in Chicago. During those three seasons, and especially during the summers of 1852 and 1854, a very large number of cases came under my care in public and private practice, and thus an opportunity has been afforded for the formation of opinions from my own observations as well as from those of others, and these opinions I have not failed to express.

On the subject of treatment I have felt entitled to speak with confidence, and it has certainly been with deliberation, and I have not hesitated to use some of the language of my own previous publications when it best expressed my present views.

I have added a more brief account of some of the Diseases Allied to Epidemic Cholera, including Summer Diarrhœas, Cholera Morbus, and Cholera Infantum, diseases of great importance from their yearly visitations and their fatality among children.

Although this work is intended for the Medical Profession, it has been written in language which will make it intelligible, at least in all matters of history and prevention, to the general reader.

That the present time, when there is so much prospect of an early visitation of Cholera to this country, affords an appropriate occasion for the presentation of a work of this kind, is apparent.

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ASIATIC CHOLERA.

CHAPTER I.

DEFINITION, HISTORY, AND ETIOLOGY.

By the term Cholera, when the article *the* is prefixed, is now understood a specific, infectious, epidemic disease of great violence, having a rapid course, marked by purging and vomiting of a watery fluid, by great thirst, and, as the case advances, by painful spasms of the muscles of the limbs and abdomen, by coldness, sweating, and a shrunken and blue condition of the surface, by arrested circulation and collapse, proving speedily fatal, in the absence of early treatment, in a large proportion of cases.

To designate the disease more particularly, a number of qualifying terms have been added.

It is called Asiatic Cholera from its local origin in that division of the globe; Epidemic Cholera, from its diffusion over extended spaces (regions) and its falling upon large numbers of people; Malignant Cholera, from its great severity and fatality; Serous Cholera, from the abundant serous discharges commonly present; Spasmodic Cholera, from the severe paroxysmal cramps usually experienced; Cholera Asphyxia, from the great retardation of circulation and respiration so likely to occur in the severer forms

and later stages ; and Specific Cholera, from its peculiar, identical character, and its presumed dependence upon a particular, specific, material poison, as its cause.

Admitting the origin of the word to be from the Greek, χολή, bile, as most assert, the term cholera is an evident misnomer, since a flow of bile does not occur in the disease ; but, on the contrary, there is a marked deficiency, and as the disease approaches its acme, there is an abnormal absence of bile in the pale, watery discharges. But if the word be derived from χολέρα, a gutter or water-spout, there is an evident appropriateness in the application of the term, from the pouring forth of the discharges as from a water-spout.

But etymological consistency is not universal in medical nomenclature.

History.—In a work like the present, intended to be specially practical, and which must be comparatively brief the full details of the prevalence of this affection cannot be entered upon ; neither can all the speculative opinions respecting it be given ; and only so much of its literature can be referred to as shall present the most rational and best sustained views of its nature, its causes, its prevention, and its treatment.

In attempting to give an outline of the history of Cholera, if we go back of the year 1817, we encounter the difficulty of not being able to ascertain whether the disease described is the same as that now known as Specific Cholera. That a disease called cholera, which prevailed sometimes in an epidemic and often in a very severe form, was known to Hippocrates 400 years B. C., is shown by Dr. John Macpherson, of London, in a recent edition of his work on "Annals of Cholera from the earliest period to the year 1817" ; and the same view is taken by Dr. John C. Peters,

of New York, in his History of Cholera published by the United States Government in 1875.

Most of the symptoms now so well known as occurring in Asiatic Cholera, such as diarrhœa, vomiting, lividity, retraction of the abdomen, cramps of limbs, hollowness of the eyes, loss of voice, and suppression of urine, were described, not only by Hippocrates B. C. 410, but by Celsus A. D. 7, by Galen A. D. 131, by Ætius A. D. 360, by Paulus Ægineta A. D. 700, and by Serapion A. D. 890.

In A. D. 1000, in 1349, in 1453, in 1500, and so down to the 17th and the 18th century, accounts of such a disease are found.

It is, however, impossible to identify it with, or distinguish it from, the now recognized Asiatic disease.

Indeed, cases will occur sporadically, but not of a specific character, which one of large experience in Asiatic Cholera would find it very difficult from the symptoms to distinguish from that disease. This is especially true of a variety of vomiting and purging occurring in cases of Malarial Fever, where only the greater readiness in yielding to treatment, and the sporadic or endemic, rather than the spreading epidemic, prevalence would render the distinction possible.

It is, however, extremely probable that the same disease which has within the present century spread over Europe and America, producing so much alarm and devastation, has existed in India at least for an indefinite period. It seems very probable that genuine Asiatic Cholera has been endemic in Malabar for at least 300 years, and probably for a much longer time, and that it became epidemic at various times, spreading throughout extended regions ; and it is now declared by Macpherson, upon what he regards as good authority, that in 1817 it approached Calenthe from

Patna Sylhet and Kishnagar, and that its origin is not, as has been so often stated, in the Delta of the Ganges.

The history of Cholera, as it occurred in 1817 and since, has been fully, and for the most part accurately, written, and is generally harmonious, though there is not among the historians full agreement on all particulars. In that year it arose about May or June, after previous seasons of excessive rains and alternate droughts, and of epidemic sickness and mortality, and after a great pilgrimage, which occurred in March and April of the same year. It sprung up almost simultaneously in several particular localities about Calcutta. It gradually spread, according to Dr. Peters, in various directions from the province of Nuddea, from Jessore, etc., and by the 11th of July it was known to be present in Atna, 300 miles N. W. of Calcutta. For a time it was confined mostly to the illy-provided and filthy native inhabitants, threatening to sweep off a large portion of them; but by September it began to attack the English residents, after 36,000 native cases had occurred. According to the statement of Dr. James Johnson, who wrote so ably on the diseases of India, the disease did not originate in one particular spot, in Jessore or elsewhere, and spread from that as by a contagion ; but he asserts that it sprung up at different remote points, at such short intervals as to convince him that its general diffusion must be referable to some unknown causes of a more general operation than contagion; but inter-communication was going on by the millions of pilgrims to and from Juggernaut, and the poison may have been carried in a quiescent condition faster than its effects have traveled.

This region, whether or not it may be called the "birthplace" of Cholera, was certainly its *nursery*, and it is well to consider the conditions which there existed.

The population was dense and the native people were poorly fed and lodged and wretchedly provided for in all respects, and filth universally prevailed. "Putrid exhalations from the constant and rapid decomposition of animal and vegetable matter abounded." The use of foul and unwholesome water was indulged in, and what are now universally regarded as the most "unhygienic" conditions were present.

In two months, in the City of Jessore alone, ten thousand of the inhabitants were swept off.

Calcutta stands upon an almost perfect level of alluvial and marshy ground which was formerly covered with stagnant pools. About four and a half miles east of the city is a large but shallow lagoon of salt water, from which a canal is cut pretty nearly to the town, and towards which all the drainings of the city flow. Many of the natives cannot approach the "bad-water" without attacks of nausea and headache.

"The English portion of the town is a city of palaces, but the Black Town is filled with wretched houses and miserable huts which are clustered around large filthy tanks, in irregular groups, and are connected by narrow, winding, unpaved streets. The air of the Black Town is offensive to the smell from the presence of decomposing refuse and filthy waters." (Peters.)

It is unnecessary for the present purpose to trace minutely the history of this first authenticated outbreak of this terrible disease. It is sufficient to state that it extended up the Ganges, and in fact in almost every direction, until a large part of India was scourged by it.

It spread often in opposition to winds and currents, generally in the track of human footsteps and commercial intercourse, being most severe among the natives, but

attacking European soldiers and citizens, carrying off many in the acute stage, others by the sequelæ, dysentery being the most frequent, while others recovered, some speedily from the acute disease, others more slowly from the low fevers, dysenteries, and other conditions which followed.

Sir Gilbert Blain concluded, from his observation of this epidemic of Cholera, "that the disease was capable of being transported from one place to another and to possess the power of propagating itself, by the acquisition of fresh material with which to assimilate; but subject to particular laws, with which we might never become acquainted." After seventy years of observation, investigation and study, the mysteries of Cholera and its spread are not yet entirely solved. The greatest prevalence of the disease has always been where bad hygienic conditions prevailed, though it has exceptionally gone into situations where no unusual filth or squalor existed; but it is difficult to find a place in which human beings are accumulated where some degree of filth, or decomposing, excretory, or offensive matter does not exist.

Though as a rule it progressed in accordance with some rational principles, there were often eccentricities in its progress which were not readily accounted for. Sometimes it would make a complete circuit around a village, and leaving it untouched pass on to other points. Then, after the lapse of days or weeks, it would suddenly return and seriously affect the village.

A curious fact, not only at this period of its history but throughout to the present time, is that it not only comes to but goes from a locality, even when only a few of the inhabitants are attacked, destroyed, or dispersed. In some places, however, it lingered much longer than in others, and in some certain cities in India it has scarcely been

absent for any considerable time since its first appearance in 1817.

In most places it has visited, it has disappeared entirely for long periods, and in many there have been no revisits up to the present time.

In 1821 the Cholera first extended to the West beyond the confines of Hindostan; previous to which, in 1820, it had gone East to China and surrounding regions; and in most of the localities it repeatedly appeared.

In its westward travels it came to the Islands of Kishme and Ormentz, and to the city of Muscat on the Arabian side of the Persian Gulf. To these places it was thought to have been brought by the course of travel—by soldiers and ships.

In 1819, 1820 and 1821 it occurred again in Bombay, destroying 150,000 people during those years. Persia was subject to its ravages five different times from 1821 to 1830. In 1822 it appeared in Astracan at the mouth of the Volga on the northern shore of the Caspian sea.

It however soon subsided here, and did not appear again in the Russian Empire until 1829, when Orenberg was attacked.

In 1830 it again appeared in Astracan when the mortality was excessive.

Later in the same year it was at Moscow, and in June, 1831, at St. Petersburg and Archangel; and in a few months later it was in Hungary, Berlin, and Vienna, reaching the seaport town of Hamburg in October. It has generally been stated that the Asiatic Cholera first made its appearance in England, in Oct. 1831, at Sunderland, near Newcastle; but it is now believed that cases occurred on board of ships of war lying on the river Medway below London earlier in the season. It is stated that ships from

foreign ports were performing quarantine in a creek of the Medway.

In the month of June, 1831, numerous vessels arrived from Riga on the Eastern side of the Baltic Sea, where Cholera was then raging. These ships were said to have *no sickness* on board, but they came from infected regions.

Early in July two cases occurred on board the English men-of-war. In August other cases occurred, the attacks being sudden with watery evacuations, cramps, cold sweats, and suppression of urine; and some had the well-marked signs of fatal blue Cholera.

The disease soon became epidemic on various ships. Persons coming from a distance in perfect health were attacked in from *sixteen hours* to two days or a week.

From the seventh to the ninth of August thirty sudden cases occurred, and from that time to October 120 persons were seized, and from then to the middle of January several other seizures had taken place.

No similar disease had ever been noticed in the Medway before; and no case occurred on board the ships of war until three weeks after the merchant vessels arrived from Riga, and were confined there in quarantine near the war ships.

Dr. James Hall, R. N., who gives this account, says: "It was more than probable that the cause was a miasma *radiating* from the ships that had been affected with cholera, for the most violently affected ships of war were those that lay nearest to these vessels." If this fact stood alone it would still be of great interest, but as it is only one of many similar facts it has much significance.

But the Cholera as it occurred in Sunderland received more attention. This town had about 20,000 inhabitants,

and was the point from which the disease spread to other places on the British Isles.

It was a filthy place, situated about twelve miles below Newcastle on the Tyne, and at that time employed seven hundred ships and five thousand sailors in the coal trade. These vessels went to every part of Great Britain. As early as August 5th a sporadic case was observed, and for the next two months occasional seizures took place which manifested all the essential features of the specific disease. But the first case that made a strong impression and convinced the public that genuine cholera had arrived, took place October 5th, 1831.

The next appearance was October 17th; the next three cases were in a father, his son and daughter, living near the place of the first case. They were workers on boats which brought down coal. Then more followed, but the disease had disappeared by January 22nd. Nineteen deaths in one day was the highest mortality.

Vessels had arrived at this port from Hamburg, *but as there had been no actual* cases of the disease on board although coming from an infected city, it was thought by some the poison could not have come from that source. Ships, however, from St. Petersburg, Cronstadt and other ports, where Cholera prevailed, had come to Sunderland, and it is not decided upon which particular vessel the poison was imported. Quite likely upon more than one. The disease, however, spread from this focus to Newcastle-upon-the-Tyne, and many other places in the north of England; to Haddington, Edinburgh, Glasgow, and other towns in Scotland. During the winter it appeared in London, and the next spring in Dublin, Belfast, Cork, and other places in Ireland; and also in Paris and different parts of France.

From the facts already related, it is not surprising that the freedom of intercourse by emigrant ships and merchant vessels, should result in the occurrence of the disease in North America.

From the 28th of April to the 3rd of June, 1832, four ships arrived at the mouth of the St. Lawrence River carrying nearly four hundred emigrants, among whom fifty-nine had died of Cholera on their passage.

These vessels were all from Ireland—two from Dublin, one from Cork, and one from Limerick. On the arrival of these vessels at Grosse Isle, the quarantine station, the sick were detained, but the comparatively well were sent on their journey, and distributed not only throughout Canada, but also the United States.

There was uninterrupted intercourse by boats between the quarantine station and Quebec and Montreal; and between the second and fifth day of June, 7,151 emigrants arrived in Quebec from the quarantine station, and nearly 30,000 arrived during the spring and early summer months of that year. The first well authenticated cases of Cholera on this side of the Atlantic occurred at Quebec.

On the 7th of June, the steamer Voyageur left the quarantine station with a large load of emigrants for Montreal. In consequence of a storm a part of the emigrants were left at Quebec. A number of these emigrants, wet, depressed, and exhausted, stopped at a lodging house where they were crowded together, and early the next morning one of them was attacked with Cholera; and during the day and evening six other cases occurred in the same boarding house. The day following fifteen cases were reported with fourteen deaths. The disease now spread throughout the city, and in two weeks one thousand were reported, fifty-six of which were at the boarding house, the seat of the first case.

On the passage of the Voyageur up the river from Quebec to Montreal, two emigrants were attacked with Cholera, and one was dead and the other dying when the vessel arrived at that port.

The numerous emigrants from these infected ships and places spread the disease, or at least it accompanied them, to their several destinations in different parts of Canada, and the State of New York, at different points.

The first well authenticated case of Cholera in the City of New York occurred on June 30th, in the person of an emigrant, but suspicious cases were observed before that; and, the next year after, the statement was made by one who knew, that there had previously been several cases which from prudential motives were not reported; and it is probable that the germs of the disease were brought directly to the city in vessels from infected localities in Europe, independent of those ships that arrived in the St. Lawrence, and even previous to their arrival. The health record of the spring and early summer months of 1832, Dr. Peters states, cannot be found, which furnishes negative evidence of a design to suppress the facts. It is probable that then, and since, infected emigrants have been hastened through this great port of entry to North America, and it is feared that at different times diseases have been thus scattered over the country. The spread of this disease throughout the North-West was apparently hastened by the movement of the United States army. What is known as the Black Hawk War was in progress in 1832. A body of troops which had gone west from New York, embarked on the 1st of July at Buffalo upon a steamboat, intending to pass around the lakes to the then frontier settlement of Chicago, near and beyond which the services of the troops were supposed to be required. This steamboat had been

previously used for the transportation of emigrants; but whether it was infected, or the infection was brought from the east by the troops is not known; but before reaching Detroit River, the cholera made its appearance on board and two deaths had taken place. Several others were soon after attacked, two of the crew of the steamer died, and the rest of the crew positively refused to proceed farther. The troops were necessarily landed, the sick were cared for, but the panic was so great that a large part of the soldiers deserted. Other soldiers were at Detroit awaiting transportation to Chicago.

They were in quarters on the banks of the river, in a filthy locality surrounded by grog-shops. The Assistant Surgeon stated that on the 4th of July there were not ten sober men in the command.

On the 6th two men who had been employed to communicate with the steamer before mentioned, which had arrived with the Cholera from Buffalo, were attacked in Detroit, and died close to the building occupied as barracks. Many other cases rapidly followed, and up to the 20th of July in the command of seventy-eight men there had been forty-seven cases of Cholera and twenty-one deaths.

Citizens of Detroit were attacked, and the authorities required the removal of the troops. Some were taken to Fort Gratiot, above Detroit; others were sent on to Chicago. New cases continued to occur; the exigencies of the service required the remnant to go on to Rock Island and St. Louis, and the pestilence was thus sent broadcast throughout this region.

The Cholera appeared at New Orleans near the close of October, after a steamer had arrived which had had several cases on board. So fearfully rapid was the spread of the disease in this low and then filthy city, that, as was stated

by Surgeon Thomas Lawson, afterwards Surgeon General U. S. A., "in forty-eight hours it reached the lowest plantation on the Mississippi, desolating almost every spot inhabited by man." He further says: "In New Orleans the effects of the epidemic were first manifested among the dissolute or intemperate; those who were necessarily or accidentally exposed to the inclemency of the weather; those who were without the means of providing themselves with wholesome food and raiment, and among the miserable occupants of the damp, filthy and crowded hovels of the upper Faubourg. Having desolated the suburbs, the disease invaded the heart of the city, striking down men, women, and children indiscriminately. Here again the disease exhibited some of its eccentricities, for in many instances a house was wholly exempt from its ravages, while those on every side were places of mourning and distress."

Six thousand deaths were reported to have occurred among the remnant of 35,000 inhabitants in about twenty days, during this brief prevalence of the pestilence. Surgeon Lawson and all the other attendants of the Hospital suffered from attacks.

In confirmation of this account by Surgeon Lawson, and as a means of impressing the lesson which the further history of Cholera in New Orleans affords, I give place to the following statement from a recent New Orleans publication, having the sanction, it is understood, of Dr. Joseph Jones, one of the most learned and distinguished sanitarians and physicians of that city or this country:

In that city "the population was 55,084 in 1832, and the cemeteries swallowed up 8,099 of these in the twelve months, a death rate of 147.10 per 1,000. But these figures do not convey the whole truth. Yellow fever was

prevailing, and when the cholera appeared in October, having been brought by the steamboat Constitution from St. Louis, fully 20,000 of the inhabitants had fled. Of the remaining 35,000, no less than 6,000 were swept off by the cholera in the space of about twenty days. One-sixth of the population perished. As Dr. Jones, recent President of the Board of Health, says, in speaking of it: 'The air was polluted by the unburied and putrefying corpses which accumulated in piles in the cemeteries across the streets. Trenches could not be dug with sufficient rapidity to cover the putrefying and molding corpses, and frequently putrid corpses were exposed in digging the graves. The stagnant water became contaminated, and the ditches and gutters were reeking with the foul, putrid drainage from the graveyard.' Of the cause of this unexampled affliction Dr. Jones also says: 'With the accustomed ignorance, indifference and incompetency of the civil authorities of New Orleans, the cholera found this city in a filthy condition; gutters reeking in filth, the streets quagmires of mud and filth, the houses built upon low, ill-drained sites, the privies overflowing with urine and excrement; the drainage canals choked; the cemetery located in the heart of the city, badly constructed, badly drained and crowded with corpses.'

"The people in their ignorance resorted to the craziest expedients. Cannon were fired, tar was burned in the streets and burning tar barrels covered the cemeteries, affording a brilliant illumination for the carnival of death. The disease appeared on the 24th of October, and its duration was brief. Had its ravages extended from early spring through the sweltering summer more than half the population must have been swept away. It re-appeared the following year, and claimed 1,000 more victims out of the small population which remained to risk the terrors.

"In 1848, the latter part of November, it came again, and the records show that 1,646 died from it before the close of December. Continuing through January, February, March, April and May, 1849, it increased in violence and claimed 3,176 victims. By that time the population had increased to 122,000, so that the epidemic was nothing like so malignant as it had been sixteen years before."

The introduction and spread of Cholera in Rhode Island, in Connecticut, in Massachusetts, in Maine, in New York, in Philadelphia, in Delaware, in Maryland, in the District of Columbia, in Virginia, in South Carolina, in Pennsylvania, in Ohio, in Kentucky, and in various particular localities might be interesting, but no new principle could be inferred from any of those details, and nothing would justify conclusions different from those the facts already stated would produce.

The disease continued in some localities until 1835, when it entirely disappeared from the country, not to appear again until 1848.

During this interval, and indeed since 1817, the cholera had continued in India and other portions of the Eastern Continent, and at length it commenced again its migration Westward and Northward. It pursued a course similar to its former travels, and spread over the United States, not in the same channels, but in a similar manner, and lingered in an active form in some situations until the arrival of a fresh wave in 1854, and still another in 1865–66.

The latest epidemic prevalence of Cholera in this country up to the present time reached our shores in 1873; a very full account of which, with many opinions of physicians respecting its causation and mode of introduction, was prepared under the direction of Dr. John M. Woodworth, then Supervising Surgeon of the United States Marine

Hospital Service, and was published by Congress in 1875.

The early cases of the disease occurred at New Orleans. From this locality it spread northward, becoming epidemic at points attacked, though it was not so widely spread as on former visitations. From the equivocal character of some of the cases, especially the initiative ones, and the doubtful history of their origin, differences of opinion were held as to the affection being genuine Asiatic Cholera. Some regarded it as a fatal form of disease which they called American Cholera, believing it to have its origin in certain local and malarial influences, and to be endemic rather than epidemic, and not a foreign importation.

Others, less numerous and not of as high authority in the profession, rejected the idea of its being "Cholera" at all, believing it a "pernicious bilious fever of an algid type," or "congestive malarial fever." A large majority, however, of medical men who had actual experience with the disease in hospitals and private practice, unhesitatingly pronounced it genuine Asiatic Cholera of foreign origin, imported across the Atlantic as in former and more widespread epidemics.

Its milder form, or more restricted prevalence, is thought to have been due to the more general diffusion of sanitary knowledge and the greater care in management, and not to any material change of type in the disease itself. It prevailed more in the smaller towns than the larger cities of the Mississippi Valley, but this is attributed to the prompt, intelligent, and successful efforts made in the cities by physicians and health boards to control its spread.

If this view be correct, if Cholera can be so much controlled under energetic municipal regulations, it is very hopeful for the future, should quarantine and other means fail in preventing its introduction in the country.

At the present time almost every medical man throughout the United States is familiar with the leading principles of Sanitary Science, and the masses of the people, to an extent unknown in the past, have their attention directed to the subject and have an appreciation of its importance. With this state of things at present, and with the advancement in knowledge and interest in matters of health, which is sure to be made in the future, we may hope that this scourge will never again produce the terrible ravages among us it has in the past.

Without appearing to much extent beyond the great Mississippi Valley, the disease, after some months, again disappeared, and up to the present writing (May 1885), no well authenticated cases of the disease have appeared in this country. The foregoing narrative has been carried to this extent as a basis for conclusion as to the etiology of the disease, and the means of preventing its occurrence and spread. The occurrence of the present or very late epidemic in Asia and Europe, in the method of its spreading, presented no new general facts and illustrated no new principles.

The history has been summarized from the facts as found recorded, without reference to any hypothesis as to the nature of the cause producing this disease.

Causes of Cholera.—On this subject there have been extensive observations, many experimental researches, and an abundance of speculation going on ever since the disease was recognized in 1817. Though by these means much positive truth has been established and more probability has been shown, the whole truth is far from having been brought to light.

That Cholera is a definite and specific disease—has essentially the same features under whatever circumstances it

occurs—is the conclusion of all observation and experience. It has proceeded with essentially identical features in defiance of many natural barriers that have been presented, under opposite extremes of season and climate, over lofty mountains, across wide seas, through heat and cold, moisture and dryness; and wherever it has gone, though there are differences in individual cases, in the aggregate of numbers the same phenomena have been presented.

These facts, so perfectly attested, seem at once to force upon the mind the conclusion that some specific cause of the disease exists, some very peculiar influence, and we can scarcely conceive of anything that will comport with the facts but the presence of some subtle material substance—a Cholera poison.

Every disease, as everything else, must have an adequate cause. A migratory disease—a disease which travels on, which comes and goes in the manner the Cholera comes and goes—must have a cause that is migratory—that comes and operates and disappears, and what, in our conceptions, can do that but a material substance?

As no such agent can operate where it is not, it must be capable of applying itself to, or of entering the body.

Assuming that a material substance acting upon or within the body causes Cholera, to which department of matter, *dead* or *living*, does it belong? It cannot, of course, be supposed that an amount of matter could have existed in India or elsewhere in a compressed state, which could have so expanded or been carried as to reach over so large a portion of the earth's surface as has the cause of Cholera, without multiplying its substance as it progressed.

We know of no method of multiplication—of the appropriation of material for its production—but by a process of life. No matter thus multiplies but living matter. There

are no elements, so far as we know or can conjecture, in the air, or in the earth, or in the waters, which are capable of undergoing chemical changes that could produce such results. Assuming, then, that organic, multiplying, living matter is the *materies morbi* of cholera, what further can we infer of its nature?

We know that there are living protoplasmic organisms of minute size, extensively distributed in the air, in water, and in animal bodies. We know further that these minute substances, or microbes, as they are called, have the power to produce certain changes in organic matter, particularly the different fermentations.

May we not, then, from these facts and premises reasonably infer that an organic, protoplasmic, living, multiplying, minute, active material, capable by its presence of exerting actions that result in the production of changes either in the solids or fluids of the body, is the essential cause of this specific disease?

This seems to me a rational and consistent, if not a certain conclusion.

This view is strengthened by the very unsatisfactory character of the various other hypotheses that have been put forth or suggested to account for the results. Although the Cholera originated in a hot and moist climate, and is more likely to spread in one of that character, yet mere heat and moisture or density of the air cannot be the cause, as it has prevailed in every climate and at all seasons—in every state of the atmosphere, as to dryness or humidity, density or rarity. Neither does it depend upon any appreciable electric state, as the most opposite states of electricity may be present where the disease prevails. Though the presence or absence of ozone may modify the action of the cholera cause, this agent cannot be that cause itself, as

Cholera has prevailed both where there was an abundance and a deficiency of that active state of oxygen.

There is no evidence whatever that there is any special telluric emanation of an inorganic character which is capable of any such action. Though the presence of filth in the soil, in the water, and the air has a most decided influence upon the development and spread of this disease, is perhaps essential to it, yet ordinary excretory, decomposing, and offensive matter cannot be *the* cause, as such filth has abounded ever, without the constant production of this specific disease. Filth has existed wherever human beings have been congregated almost universally and from time immemorial, but Cholera has not thus existed everywhere and at all times. In its present wide-spread form it is modern.

The belief that Cholera is dependent upon micro-organisms is further strengthened by the analogy of facts now satisfactorily established.

The influence of organic ferments in inducing chemical changes, such as the conversion of sugar into alcohol, has long been known. Pasteur's observations and experiments with micro-organisms in producing morbid actions; the facts respecting their causative effects in the Milzbrand, Anthrax, or Splenic fever in cattle, in the Chicken Cholera in the domestic fowl; and especially the facts brought to light by Dr. Oberneuer and confirmed by many others of the effects of *Spirilli* in the production of Relapsing Fever, and many other facts of a more or less similar character, prepare us to accept the *germ theory* of infection as applied to this disease.

But what do we know from actual observation or scientific demonstration of this material, or these *Microbes*; of the forms they take, the places and conditions of their

productions, the elements in the body they attack, the conditions necessary to their morbific activity, and the special changes wrought which are capable of producing the phenomena of Cholera?

It must be acknowledged that, notwithstanding the recent careful, exact, and laborious investigations of Koch, of Hunter, of Carter, of Maurin, Lange, and of all the German, the French, and the English commissions in India and Egypt, and of others, our knowledge is very limited, is really rudimentary and exceedingly imperfect on most of these points.

To enter upon a discussion of all the different facts which have been alleged and denied, of the different theories that have been plausibly sustained and effectually exploded, or the allegations and hypotheses which still are before us, but are in uncertainly and doubt—are "*sub judice*"—would take us into a field too extensive for the limits of this work. It, however, seems proper that various conclusions, which with some degree of authority have been put forth, should be stated, as well as the results of more recent investigations, especially those which are the outcome of the labors of those gentlemen connected with the U. S. Army and the Marine Hospital service, and which have been published by our national legislature.

These conclusions are not given here as the exact truth. On the contrary, some points will be seriously opposed in what may be subsequently said; but this work is not presented as containing merely the opinions of the author, but as giving a view also of prevalent opinions on the subject.

On page 8th of the publications of 1875 just alluded to, we find the following propositions, bearing especially upon the etiology of the disease. These are claimed to be con-

densed from the vast mass of cumulative evidence which has been laboriously collected by a multitude of Cholera students in both hemispheres:

"I. Malignant Cholera is caused by the access of a specific organic poison to the alimentary canal; which poison is developed spontaneously only in certain parts of India, (Hindostan.)

II. This poison is contained primarily, so far as the world outside of Hindostan is concerned, in the ejections—vomit, stools, and urine—of a person already infected with the disease.

III. To set up anew the action of the poison, a certain period of incubation with the presence of alkaline moisture is required, which period is completed within one to three days; a temperature favoring decomposition and moisture, or fluid of decided alkaline reaction hastening the process, the reverse retarding.

IV. Favorable conditions for the growth of the poison are found. (1) In ordinary potable water, containing nitrogenous organic impurities, alkaline carbonates, etc.; (2) In decomposing animal and vegetable matter possessing an alkaline reaction; (3) in the alkaline contents of the intestinal portion of the alimentary canal.

V. The period of morbific activity of the poison—which lasts under favorable conditions, about three days for a given crop—is characterized by the presence of bacteria, which appear at the end of the period of incubation, and disappear at the end of the period of morbific activity. That is to say, a cholera-ejection, or material containing such, is harmless both before the appearance and after the disappearance of bacteria, but is actively poisonous during their presence.

VI. The morbific properties of the poison may be pre-

served in posse for an indefinite period in cholera-ejections, dried during the period of incubation, or of infection matter, dried during the period of activity.

VII. The dried particles of cholera-poison may be carried (in clothing, bedding, etc.,) to any distance; and when liberated may find their way direct to the alimentary canal through the medium of the air—by entering the mouth and nose and being swallowed with the saliva—or, less directly, through the medium of water or food in which they have lodged.

VIII. The poison is destroyed naturally either by the process of growth or by contact with acids: (1) those contained in water or soil, (2) acid gases in the atmosphere, (3) the acid secretion of the stomach."

IX. It may also be destroyed artificially: (1) by treating the cholera-ejections, or material containing them, with acids; (2) by such acid (gaseous) treatment of contaminated atmosphere; (3) by establishing an acid diathesis of the system in one who has received the poison.

Commencing on page 36 and extending to page 61 of the same volume, in the chapter on Etiology of the Cholera Epidemic of 1873, are found the following propositions, with facts gathered from the history of that epidemic and other sources, intended to illustrate and sustain each statement.

Proposition I. That Asiatic Cholera is an infectious disease resulting from an original poison, which, gaining entrance into the alimentary canal, acts primarily upon and destroys the intestinal epithelium.

Proposition II. That the active agents in the distribution of the cholera poison are the dejections of persons suffering from the disease in any of its stages.

That in these dejections there exists an organic matter

which, at a certain stage of decomposition, is capable of reproducing the disease in the human organism to which it has gained access.

Proposition III. That Cholera-dejecta coming in contact with and drying upon any objects, such as articles of clothing, bedding and furniture, will retain indefinitely their power of infection. That in this manner a sure transmissibility of the Cholera infection is effected, and that a distinct outbreak of the disease may occur by such means at great distances from the seat of the original infection.

Proposition IV. That the specific poison which produces the disease known as Cholera, originates alone in India, and that by virtue of its transmissibility through the persons of infected individuals, or in the meshes of infected fabrics, the disease is carried into all quarters of the world. That Cholera has never yet appeared in the Western Hemisphere until after the route of pestilential march has been commenced in the Eastern World, and that its epidemic appearance upon the North American continent has invariably been preceded by the arrival of vessels infected with Cholera patients, or laden with emigrants and their property from infected districts.

Proposition V. That the respiratory and digestive organs are the avenues through which individual infection is accomplished; that through the atmosphere of infected localities, Cholera is frequently communicated to individuals; that water may become contaminated with the specific poison of Cholera, from the atmosphere, from surface washings, from neglected sewers, cess-pools, or privies, and that the use of water so infected will induce an outbreak of the disease.

Proposition VI. That the virulence of a Cholera demonstration, the contagion having been introduced into a

community, is influenced by the hygienic conditions of the population, and not by any geological formation upon which they may reside.

Proposition VII. That one attack of Cholera imparts to the individual no immunity from the disease in the future, but that the contrary seems to be established.

The Executive Committee of the Public Health Association of the United States issued a Memorandum on Cholera, June 20th, 1873, when the disease was beginning to prevail in the Mississippi Valley. In this they say that while Cholera is an importation, its propagation is greatly aided by local causes, "and that the neglect of sanitary duties promotes its spread. This is as true now as on its former visitations." They then urge a resort to the most effectual *Purification* and the best known means of Disinfection, and that this work should be carried on in every locality *before any cases of Cholera occur;* and that in the *presence* of the disease these sanitary duties should be enforced in every household throughout the entire district. They report that the local conditions that chiefly promote the outbreak and propagation of Cholera are:

(1) Neglected privies.

(2) Filth—sodden grounds.

(3) Foul cellars, and filthy or badly drained surroundings of dwellings.

(4) Foul and obstructed house drains.

(5) Decaying and Putrescent Materials, whether Animal or Vegetable.

(6) Unventilated, damp and uncleaned Dwellings and Apartments.

They urge that all these *sources* of mischief should be speedily removed.

They further say that Personal Health requires Pure

Drinking Water, Fresh and Substantial Food, Temperance, Rest, and Bathing of the Body.

They urge disinfection but say there can be no substitutes for cleansing and fresh air.

For disinfection of Privies, Water Closets, Drains and Sewers, they advise eight to ten pounds of Sulphate of Iron dissolved in five or six gallons of water, with half a pint of crude Carbolic Acid added to the solution and briskly stirred. If the Carbolic Acid is not at hand the Copperas may be used without it. "Pour a pint of this in every water closet pan or privy seat once or twice a day." I would here suggest that where a privy is constructed upon the abominable plan of digging a large and deep hole in the ground, and especially if rendered tight by mason work and cement, and the accumulation of years is allowed to take place in it—the only escape of foulness being into the air—more than a pint, or many pints of the solution will be required to disinfect such a horrible mass.

The committee, however, say it should be added to privy-vaults, large masses of filth, sewers and drains, until it reaches and disinfects the foul material. Chamber vessels, it is thought, should be treated by this material.

Other disinfectants—the Chlorides of the metals, especially of Zinc—are directed for the same purpose. Quick-lime Whitewashing is also advised for walls, etc.

Apartments, upholstery, bedding and clothing, etc., used by the sick of Cholera or of Diarrhœa, are to be cleansed and disinfected. Much stress is laid upon the importance of *pure water*, upon general cleansing and scavengering and the prevention of crowding. They conclude by repeating the watch-word against this destructive enemy—*cleanse*, CLEANSE, CLEANSE.

The official reports to the Privy Council and Local Gov-

ernment Board of England, written mostly by Mr. Simon, whose name is so well known in Science, take similar ground, illustrated by many items of history in the spread of the disease; and Professor Parkes, the eminent sanitarian, and Dr. Buchanan, scarcely less distinguished, write to the same general effect; and Dr. Buchanan, at the present time connected with the Government Health Department, says that the discoveries of Koch, admitting their correctness, do not alter the practical conclusions from what they were when a different kind of micro-organism was thought by some to be the specific cause of Cholera.

The general tone of these reports is to the effect that the specific cause of the disease is to be found chiefly in the discharges from the alimentary canals of the patients with Cholera or having the Cholera Diarrhœa—and yet they often say that these discharges must undergo change before they are infectious, and that the disease is not catching in the sense that small-pox and measles are. Particularly clear views on these points did not seem to be entertained, and in many minds they are not more clear at the present time.

These were the current views in this country and in England ten and twenty years ago. These propositions may be regarded as fairly expressing the prevailing sentiments of the profession as to the essential cause of Cholera ten years ago, and are given as part of the history of the subject.

Since then Cholera has attracted comparatively little attention from the profession in Europe and this country until its revival in India and its appearance in Egypt in 1883, and its spread into Southern Europe during the summer of 1884.

Since this time the subject has occupied a prominent

place in the professional mind, and a summary of the latest researches into its etiology seems to be called for.

Before proceeding to an account of these most recent researches, some of the particular views which have attracted most attention from different observers and investigators on special points of etiology may be noticed.

The evidence of the existence of a peculiar poison of some kind as an essential factor in the production of Cholera is so abundant, and the doctrine of a specific malarial infection has received such general assent, that no further testimony or discussions on that point are deemed necessary.

As to the particular characters of that poison, how it originates, by what means it is multiplied and conveyed, and how it enters the system, and when there as to the mode of its producing its effects, there are more speculative opinions than demonstrated facts; but these opinions belong to the subject we have in hand.

Dr. John Perkins of London, formerly Medical Inspector for Cholera in the West Indies, is strongly of the opinion that *places* rather than persons are infected, and that the existence of the poison and its spread are chiefly dependent upon *telluric* and meteorological conditions; and not a few writers of the past have maintained that the disease was caused by an abnormal alteration of the constitution of the air, due to the occurrence of "pandemic waves" in the atmosphere, without however denying that in such "waves," whatever that term meant, there was a peculiar poison.

The theory of Professor Pettenkofer, of Munich, given to the profession a few years since, has received much attention and credence. He regards the virus of Cholera as an organized substance, produced in the soil of regions in which the disease is endemic. He thinks it contained in

the intestinal discharges of Cholera patients, but that it is not a product of the intestines, and that the germs of the disease do not multiply within the human organism. He teaches that when choleraic discharges pass into certain soils the seeds of the infection germinate and produce a new crop of organisms of a miasmatic nature. An attack of the disease is caused by these miasms ascending into the air and becoming absorbed into the body. The production of this miasm requires a moderate degree of humidity of the soil, and when either very dry, or saturated with moisture, it is not generated. Porosity of soil is favorable to its production, and though isolated cases may happen in houses built on rocks or on impervious clays, yet epidemics of the disease cannot occur in such places.

Professor Vogt, of Berne, in 1875 announced that, having carefully studied all the theories in reference to Cholera, he gives the first place to that of Pettenkofer.

Many facts respecting the restriction of the disease to particular geological formations are adduced as favoring the theory. However, the facts related respecting the spread of the disease among the ships at the quarantine station in the Medway below London in 1832, and other numerous instances of the multiplication of the poison on ship-board away from all soils, would seem to show that the virus is not exclusively multiplied in the soil. Professor Pettenkofer does not admit that potable water plays a part in the propagation of Cholera, and contends that the disease is not directly communicable from person to person. His formulated conclusions are, that to cause an epidemic of cholera there must be: "(1) A specific germ; (2) certain local conditions; (3) seasonal conditions; (4) certain individual conditions (*receptivity* or unusual susceptibility to contract the disease)."

Dr. Bryden, an eminent East Indian sanitarian, holds that the Cholera virus is generated in the soil in the lower provinces of India and is indigenous to these localities—that it spreads to other situations but is unable to maintain itself in the higher situations for more than four years. The poison may become dormant without losing its vitality, its active state depending upon meteorological influences. He denies that it results from human intercourse or that it can be spread, at least so as to prevail out of its natural province, by human agency. He thinks the moist atmosphere is the invariable vehicle; and that the direction of its movements depends upon the prevailing winds. Still, he admits that individual cases can be produced by transmission from persons affected or from fomites, but that no large numbers of such cases can be produced by such means. These views differ but little from Pettenkofer's—and they seem to be those which have controlled the experts of the English Government in India. The prevailing opinion among so many intelligent observers in a locality where there is such abundant opportunity for studying the subject, is entitled to a hearing, and probably contains at least some truth.

Dr. J. Snow, of London, contends for the water carriage theory—which is, that the poison is carried chiefly, if not exclusively, in potable water, and is propagated through this medium.

German writers are divided as to this theory; but the opinion in Holland and among the medical officers of the United States Army is strongly in its favor.

Dr. C. Macnamara, whose experience in India renders him a high authority on the subject, strongly maintains that contaminated water is a fruitful source of the disease. Many others are of this opinion; and it scarcely admits of

a doubt, that the use of drinking water containing organic impurities, when Cholera is prevailing, tends to produce attacks; but whether the specific poison is conveyed in it, or whether it only affords conditions in the system favorable to the action of the poison which is furnished from other sources, is not so clear.

The belief that the Cholera infection is capable of being communicated through the air, whether it arises from the earth, from impure water, from the dejections or the bodies of the sick, or from fomites, is common among those who depend upon observation uninfluenced by theories; and the facts which sustain this belief are abundant. Lebert, whose careful observation of facts rendered him a high authority on subjects of this kind, contended for this view; and very recently M. Ramon de Luna, in the French Academy of Science, stated that he believed the cause of Cholera is always found in the atmosphere, that it exerts its action through the respiratory organs; that it is specially during the passive condition of the individual, particularly during sleep, that its chief incubation takes place, and that the poison—microbe or ferment—acts principally on the blood corpuscles, preventing proper oxidation, and so leading to gradual suffocation; and that preventive measures must act through the air. He regards the fumes of nitrous acid as the most efficient agent as a preventive, and mixed with air, as a remedy also.

In a Cholera Conference held in May, 1885, Professor Pettenkofer still contended that the cause of Cholera is produced in the soil, and his position implied that it passes into the system through the air. In the discussion he compared the Cholera infection with that of common or marsh malaria, which, though communicable by inoculation, still depends upon the soil. He declared that a distinction

should be observed between artificial and natural infection, and insisted that the results of experimental infection do not show the manner in which epidemics of the disease arise and are maintained.

While he did not deny the influence of traffic or intercommunication on the spread of Cholera, though formerly he decidedly questioned it, he still believed it exaggerated, and that this alone is not sufficient to call forth an epidemic in a location, and that season and the conditions of place must be entered as factors.

Professor Virchow, who participated in the discussion, said, he would not deny that the soil had to do in the multiplication of the Cholera poison. It was certain that the *poison could be multiplied out of the body*, but it could be multiplied elsewhere than in the soil,—of course then in the air or in water. He spoke of its multiplication on ship-board, and as an example cited the case of the transatlantic steamer Franklin; and he might have referred to many other instances, where the cause of the disease certainly spread independently of the soil. He saw no difficulty in agreeing with Professor Pettenkofer, provided the latter abandoned his *exclusive* view.

Professor Pettenkofer finally said, that he originally considered the contagion of the disease as of the highest moment, but that observation of the varying behavior of Cholera, according to *time* and *place*, had compelled him to ascribe to these latter factors special importance.

The preceding historical sketch of the leading facts of the origin and spread of Cholera, and of the most authoritative opinions respecting the causative conditions of its prevalence, has dealt with the subject in a general way, but without attempting to throw special light upon the question at the present time so much under discussion,

viz: as to what that special material poison producing the disease is. That there is a special substance concerned in the production of the disease has been assumed, and some reasons have been given for the belief that it is organic and living. Beyond this our account has not gone.

On the more definite question now to be considered, as to the form and particular characters of this substance, many investigations have been made and many conjectures indulged.

Dr. Giell, of Munich, was perhaps the first to clearly express the positive opinion that Cholera was produced by a special poison of organic origin. This he did during the epidemic of 1832.

Among the earlier writers on the subject of infective poisons, embracing the poisons of Malaria, of Yellow Fever, and Cholera, was our distinguished countryman, Professor J. K. Mitchell, of Philadelphia. His little work, published in 1849, on the "Cryptogamous Origin of Malarious and Epidemic Fevers," in theory anticipated many views now entertained on grounds of more positive or discovered facts.

Before his writing, Sir Gilbert Blane said, "An infection may be aptly compared to the seeds of vegetables or the eggs of animals, which require a nice concurrence of certain degrees of heat, moisture, rest, nutriment, etc., to animate them." This was before *bacteria* were understood as now, but the essential notion of the "Germ Theory" of disease is contained in this quotation, and in other original and clearly expressed views of Dr. Mitchell. He believed that the germs of infection were low forms of vegetable life, and he made a clear distinction between the germs produced and multiplied *in the bodies of the sick*, as in small pox and other *strictly contagious* diseases, and those

produced and multiplied *exterior* to the human body and independently of it, as in the malarial fevers, and other diseases *simply infectious*. He placed Cholera among the latter, and thought the account of its production and spread was alone explicable on the theory of its infectious, rather than its contagious, character. But he had no direct observations of the special material of the cholera poison to go upon, and his doctrine, like most of those since put forth, was theoretical rather than demonstrative.

Since the microscope has been in more general use, since bacteria have been so extensively and carefully studied, and the "germ theory" of disease has taken a more definite form, many attempts have been made to discover the particular germs which are believed to produce Cholera, and from time to time announcements have been made that certain fungi, or micro-organisms or vibriones have been found in the alimentary canal and in the discharges of cholera patients, which have been thought by their discoverers to be the essential causes of the disease.

During the epidemic of 1849, Dr. Swayne, Dr. Budd and Dr. Britton, of England, each saw certain cells in cholera discharges which they conjectured were fungi belonging specially to the disease. In 1866, Dr. Klob, of Vienna, found certain octrahedral bodies in the discharges which he fancied were the cause of the disease. About the same time Dr. Hallier, of Jena, mentioned twenty different kinds of fungi found in the discharges. Lissauer, however, declared that he had experimented with all these fungi and that they were innoxious; and various microscopists declared that the organisms described were common in other conditions and not at all peculiar to Cholera.

Dr. C. Macnamara, before referred to, after a prolonged investigation, was obliged to confess that he could find

nothing peculiar to the disease in cholera evacuations, and abandoned all faith in the existence of discoverable specific cholera organisms.

In 1874, Dr. Nedswetzky described organisms which he regarded as so connected with the disease that he called them Cholera Bacteridians. The same year, however, Drs. Cunningham and Lewis, in a sanitary report to the Government of India, stated that after much investigation they found no evidence of the presence of bacteria in the blood of cholera patients and could detect nothing specific in cholera discharges. Various animals were experimented on with these evacuations. They were injected into the blood and introduced into the alimentary canal. A certain proportion of deaths in the more sensitive animals was thus produced; but materials not choleraic were used in a similar way and with similar results upon similar animals. These experiments proved nothing as to the character of the poison. Others have seen, or fancied they saw, various organisms at different times, and have published much on the subject. Among these was Dr. J. Wyman, of our own country, but nothing was positively settled by him.

These statements show the amount of our knowledge, or rather of our ignorance, on the subject of the particular *Materies Morbi* of Cholera up to ten years ago. Since then until within the last two years no investigations have been made for want of opportunity in Europe and America, and for want of investigators in Asia.

Since the appearance of Cholera in Egypt in 1883 and its threatened, and now realized, advance into Europe, much interest has been revived in the subject, and commissioners have been sent to Egypt and India to pursue investigations; and the attention of the investigators has been chiefly directed to the discovery of the specific cause of the

disease. It is unfortunate for the establishment of settled opinions, but not, perhaps, for determining the truth, that the French and German commissioners differed in their conclusions as the result of their investigations; and Surgeon General Hunter, of the British Army, who was at the seat of the disease in India, differed in many respects from both.

The Chief of the German Commissioners was Dr. Koch, the man who first succeeded in cultivating outside of the body the earliest discovered disease-microbes, the bacillus of the cattle-anthrax, and who later first demonstrated the microbe of tubercle, and who is thought to have proved its connection with the phenomena of tuberculosis.

The French Commission consisted of two of the most trusted assistants and co-workers of M. Pasteur, M. M. Roux and Thuillier, presided over by Dr. Strauss. Both started out with some preconceived notions, and, as on so many other occasions with microscopic investigations of the extremely minute, they appeared to find what they sought. This remark is not intended to throw discredit upon the investigations, but to state a fact which it is proper to bear in mind. Great confidence is felt in the integrity, the care and the skill of Dr. Koch; and there is no reason to question the motives or fairness of the members of the French Commission; and the English Surgeon General, it is presumed, had only a desire to arrive at the truth.

Dr. Koch's observations, experiments and conclusions have received most attention and inspired most confidence, and an account of them will be more fully given.

Before starting out on his mission he had received from India preparations of the intestines of persons who had died from Cholera, and in their tissues he had found col-

onies of a peculiar microbe which he had not seen before, and which he suspected might be the cause of the disease. On his arrival in Egypt he followed up this clue, and in every one of the cholera cadavers he examined he found the same organisms. He found nothing in the blood of a peculiar character to which he could attribute a specific influence in the production of the disease. In addition to his experience with cholera intestines in his laboratory in Berlin, he was encouraged in examining the intestines of the victims of Cholera in India by finding there more marked lesions than the accounts in the text-books had led him to expect. These microbes he describes as rod shaped, and therefore called bacilli; about half the size of the tubercle microbes, but much more plump and thicker than the latter, and differing from others in being slightly curved or comma-shaped. In some instances the curves were more marked, presenting a semi-circular shape, and still more rarely forming a double curve like an S, suggesting the junction of two individuals. They were capable of being cultivated in meat infusion and other nutrient fluids, multiplying rapidly, some growing out into long threads, and occasionally assuming a distinctly spiral or cork-screw appearance, reminding one of the spirilli of relapsing fever. They grew in milk without coagulating it or changing its appearance. They were chiefly, indeed almost exclusively, located in the lower part of the small intestine, were in great numbers there, and were deeply imbedded in the mucous membrane of the part, invading the glandular structures. In some cases, where there were infiltrations of the blood, the microbes penetrated to the muscular coat. As long as the dejections remained fecal but few of these bacilli were found in them, but when the discharges became of the inodorous, rice-water character, then comma-

shaped microbes were found in abundance, and all others that may have been there before, disappeared. When this stage of simple rice-water discharges was passed, then peculiar bacilli became less abundant, common septic bacteria multiplied, and the evacuations became fetid.

Dr. Koch, in his report to the Imperial Board of Health, July 26th, 1884, gives many details of the conduct of the microbes under cultivation, and as affected by various agents and conditions.

Alkalies favored and acids checked their growth, though not all acids acted alike. They flourish best in a temperature between 30° and 40°C., (86°—104°F.), but they still grow in a temperature as low as 16°C. (56°F.) They were completely frozen at a temperature of 10°C. (50°F.), but their vitality was not destroyed. In an atmosphere of carbonic acid, excluding oxygen, their growth was arrested but they were not killed. Their growth under favorable circumstances is exceptionably rapid, quickly attaining its height, and after a brief stationery period as quickly terminating. When substances containing other forms of bacteria are added, as the intestinal contents, or choleraic evacuations mixed with moistened earth, or on linen and kept damp, the comma bacilli multiply with great rapidity, outnumbering all others that may have been present. In two or three days, however, the comma microbes begin to die off and other bacteria multiply. The same substantially occurs in the intestines, as before intimated. A very weak solution of iodine did not check their growth. Alcohol at first checked their development when mixed with nutrient fluid in the proportion of one in ten, a degree of concentration which, according to Dr. Koch, renders it impracticable for treatment.

Common salt, added to the extent of two per cent., did

not influence their growth. Sulphate of iron, to the same extent, stays the growth but does not kill the microbe. It may, however, Dr. Koch thinks, arrest putrefaction and really remove what may be the most destructive process to the comma bacilli. Alum in solution, of the strength of 1 in 100; Camphor of 1 in 300; Carbolic Acid, 1 in 400; Oil of Pepperment, 1 in 2,000; Sulphate of Copper, 1 in 2,500; Quinine, 1 in 5,000; Bichloride of Mercury, 1 in 100,000, prevented the growth of the cholera bacilli. An important fact stated by Dr. Koch is, that drying not only arrests their growth but readily kills them. This is in contrast with the anthrax bacilli, which in a dry state retain their vitality much longer. In the perfectly dry state where nutrient fluid is entirely withdrawn, in from one to twenty-four hours the comma bacilli are dead. If this is thoroughly established as a fact with the specific cholera microbes, and it be further shown that they do not produce spores which endure drying better, it is a matter of more importance than can be readily estimated. It was found that when articles soiled with cholera discharges containing these microbes, were kept quite dry for twenty-four hours the life of these microbes was entirely extinguished.

Assuming that the comma bacilli constitute the *Materies Morbi* of Cholera, fomites can be readily disinfected by drying with only a moderate degree of heat.

But do Koch's observations and experiments satisfactorily prove that the comma bacilli are the specific cause of Cholera? I fear for the present it must be concluded that the proof falls short of scientific demonstration. Indeed, Koch himself does not regard it as perfect, only as highly probable.

To complete a sketch of the report made by Dr. Koch, the negative results of his examinations should be men-

tioned. He found no microbes in the blood of cholera patients; and in cases where the patients died from the secondary effects of the disease, due apparently to septic infections through the lesions produced by the ravages of the specific bacillus, no specimen of that bacillus could be found. In the matter vomited he only found this bacillus in a few cases, where the reaction was alkaline, and where the vomited matter seemed to have been brought up from the intestines. In the lungs he found the bacillus rarely, and only where he supposed that vomited matter had been taken into the air passages. And finally, and most important, although numerous corpses of persons who had died of other diseases were examined for the bacillus, in none of them was it found.

But we cannot overlook other statements than those made by Dr. Koch.

"The French Commission in Egypt found, like Dr. Koch, in the bodies of those dying of Cholera they examined, a vast variety of microbes, varying according to the portion of intestine examined and the duration of the disease. One of the most frequent forms was a small bacillus, recalling the bacillus of tubercle. It was most frequently met with in the lower portion of the small intestine, and formed nests, which invaded the sub-mucous tissues without ever penetrating the muscular coat." (Dr. Godson). This bacillus, the French report states, is without doubt the same on which Dr. Koch laid so much stress. But the report further states that in three cases of the disease which proved fatal in from ten to twenty hours, cases where according to Koch the bacilli should have been found abundantly, after the most minute search not a trace of that bacillus could be discovered; and in a fourth similar case but very few were found, and after many sections were made.

The French Commissioners concluded that this bacillus was only one among others that found a favorable place in the cholera intestines for rapid development, and was a consequence, not the cause, of the disease. They, therefore, turned their attention elsewhere, and thought they discovered the cause in the blood, in the shape of pale particles floating between the blood corpuscles. These particles were of low refraction and difficult to observe unstained, were slightly elongated and narrowed at the centre like the figure 8, and much smaller than, but comparable in shape to, the lactic ferment. These they found in great numbers in the blood of every one of the cholera patients they examined. They were difficult to stain and the color was not retained, so that satisfactory preparations of them were not made.

In the blood of cholera patients, collected with every precaution to insure purity, and maintained for 24 or 48 hours at a temperature of 38°C. (93°F.), these particles multiplied themselves, sometimes forming little chains. The serum of the blood in which they were developed in most cases was slightly but distinctly acid in reaction. All attempts to cultivate these particles in artificial fluids failed. Dr. Koch declared that these particles were not microbes, but imperfect blood disks, which may be seen in healthy blood even, but are greatly augmented in number in many febrile disorders; and further that these bodies had been before described by others.

Numerous attempts were made by both commissions to communicate the Cholera to various animals, by giving choleraic fluids and tissues in their food, injecting them in their bowels, and transfusing cholera blood into their veins, but none of them presented the phenomena of Cholera, though one chicken, subjected to a diet contaminated with

rice-water discharges died, but with what symptoms is not mentioned, on the third day of the experiment.

Dr. Koch continued his investigations in India with the same general results as from those conducted in Egypt, and the account of them here given is from his report since his return from India.

The negative results with the lower animals prove little, as it is probably true that they are insusceptible to the influence of the cholera poison, whatever it may be, or in whatever manner administered. Others, however, who have experimented upon animals with cholera discharges have reported that the disease has been communicated to some of them. They are not subject to the disease taken spontaneously in the localities where it prevails.

Dr. Koch, while in India, examined the waters in one of the foul tanks or filthy ponds from which the people surrounding them obtain their water supply, and where Cholera was prevailing. In the specimens obtained when the Cholera was prevailing, the comma-shaped bacilli were found in considerable abundance. In the specimens taken when the disease was declining, very few were discovered, and only in one taken from a particularly filthy portion of the tank.

It very recently appears that others have preceded Dr. Koch in some of his discoveries, though but little account was made of them at the time. In a report on the microscopical examination of the blood and excretions of cholera patients, made in 1855 by Dr. Hassell, of London, comma-shaped bacilli or vibrios were described; and Prof. F. Pacini, of Florence, and Dr. J. S. Bristowe, of London, are said to have discovered cholera microbes of a similar character to Koch's, previous to his investigations. These claims tend to confirm the truth of Koch's discovery, rather than to detract from his merits.

Dr. E. Kline, of London, an experienced and distinguished investigator, however, in an article in "Nature" asserts that he has inspected specimens prepared by Dr. Koch from the rice-water evacuations of cholera patients, and that he possesses preparations of evacuations from patients obtained in an epidemic diarrhœa in Cornwall, in 1883, and in them, among other microbes, "are undoubtedly bacteria, which in shape and size and mode of staining so closely resemble the comma-shaped bacilli of cholera that he is unable to discover any differenee between them."

Dr. Kline has since visited India, where cholera was prevailing, for the purpose of pursuing investigations, but reports that he has been unable to confirm various conclusions which Dr. Koch regards as established. The differences between Drs. Kline and Koch continue, but the adherents of the latter contend that the former's observations are less reliable, and his modes of investigation less exact than those of the latter.

In Surgeon General Hunter's report to the British Foreign Office on Cholera in Egypt, he takes the ground that Cholera is a non-contagious disease, and he does not believe even in a specific germ, nor in importation of a poison as a necessity; he seeks, and thinks he finds, in the condition of the country itself the cause and the origin of the epidemic outbreak, and he therefore concludes the disease endemic in Egypt. He believes that telluric influences foster the disease, and climatic or meteorological conditions light up an epidemic. He, of course, has little confidence in the discoveries of Koch, and rejects the interpretation put upon what the latter professes to have seen.

Since Koch's reports, Dr. Carter of Bombay has described the discovery of an organism which he figures, and which resembles the comma-bacillus of Koch. It is represented

as more spiral shaped, and is a spirillum rather than a bacillus. This organism was not found in every case of Cholera examined, while it was found, though rarely, in the stools of dysentery and diarrhœa. Its real character was not tested by cultivation, so that nothing conclusive was shown.

Drs. S. Maurin and Lange, who have been pursuing investigations in Marseilles where the Cholera has been prevailing, announce that they have found *Mucor*, which they believe to be the actual agent in producing Cholera. This mucor they think is the mature form of the comma-bacillus, from which it is developed.

It is said to appear on the fourth or fifth day after discharge on the putrefying stools of cholera, and nowhere else. It has the form of a Mycelium, the tapering ends of which are surmounted by cup-shaped sporangia, which burst on the slightest agitation, discharging vast numbers of spores. These spores require contact with some *putrid organic matter* in order to produce their germination, when they develop into a mucor of another form, which these observers think excites the diseased action when taken into the system. This, they say, sporifies again and produces the bacilli of Koch.

The comma-bacilli they think are in themselves innocuous, but on a putrid medium and in contact with air they develop the first mentioned mucor, and renew the cycle before described.

This first mucor possesses in a high degree the power of resisting the action of the reputed disinfectants. It vegetates freely in ten per cent. solutions of carbolic acid, and endures a temperature of 302°F., but when the heat is carried beyond this it breaks down; and it is also destroyed by a ten per cent. solution of tincture of iodine.

This account seems consistent with the opinion expressed by many that cholera discharges take on their infective character some time after they leave the body; and it is also consistent with the supposition of the production of *spores* which are different in appearance, and in susceptibility to the action of other agents; and also different from the bacilli in the place and conditions of their development.

Others have found other results by experiments and investigations. Mr. Richards, an English surgeon in India, is reported to have found, in experiments upon pigs with the discharges from cholera patients voided at certain stages of the disease, that very poisonous effects are produced if the discharges are given soon after they are voided; but after a time when decomposition takes place, which will occur in a few hours, the poisonous quality is lost. He thinks the poison is chemical rather than organic, but would probably admit that the chemical compound was produced by the action of an organic ferment.

Still others report that very specific changes occur in the blood corpuscles, increasing as the disease continues and increases in violence, while, as was stated, Koch found nothing peculiar in the blood.

Still more recently, Surgeon Major Timothy Richard Lewis, M. B., Assistant Professor of Pathology in the Army Medical School, at Netley, England, states that "Comma-like bacilli, identical in size, form, and in reaction with aniline dyes, with those found in choleraic dejecta, are ordinarily present in the mouths of perfectly healthy persons." He does not report any culture-tests in the case of these faucial bacilli; and Professor Lewis is not sufficiently known as an investigator on these subjects to render his authority conclusive; but the statement from such a source

is sufficient, taken with the other statements just referred to, to arrest attention and cause us to suspend positive judgment until further testimony is presented.

If such bacilli are in other situations than in cholera intestines and discharges, or in water or air where Cholera is prevailing, the fact will appear to show that cholera intestines furnish a favorable soil for their development rather than that they are the exclusive cause of the disease.

It is evident from all these statements that the whole truth in relation to the etiology of Cholera is not yet demonstratively determined.

While it is admitted that comma-shaped bacilli are found in other situations than in cholera discharges and the intestines of cholera patients, yet it is alleged that none of these have all the characteristics, especially under cultivation, of Koch's cholera microbe, and that the latter is absolutely peculiar to Cholera.

In the German Cholera Conference, already referred to, held in May, 1885, Professor Koch opened the discussion upon the facts respecting the cholera bacteria obtained since the conference of July, 1884.

He held that the arguments of Finkler and Prior, of Kline, and of Emmerick*, who oppose the bacillar origin of Cholera, had been refuted, and that from confirmed experiments the conclusion had been reached that the true comma-bacillus is present nowhere else than in Cholera, and

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*It is stated that Dr. Emmerick has since come around to Koch's doctrine; but he still contends that Koch's vibrio, though possibly developed only in connection with Cholera, is of secondary importance. He describes different organisms which he calls Neapolitan Cholera bacteria, which he found in different organs in the blood, and to which he attributes effects.

that in this disease it is never absent. He described his experiments upon Guinea pigs with the cultivated bacilli, and states that when solutions of soda were injected into their stomachs, followed by meat infusion containing the bacilli, and immediately afterwards laudanum was injected into the peritoneal cavity (one c.cm. for every two hundred grammes of weight), the pigs were narcotized, and after a time recovered from this, but the next day appeared ill; their hair was rough; there was weakness of the hinder extremities and of the muscles of the back, and they died in from one to three days. Dissections showed infiltration of the small intestines which, as well as the stomach and cæcum, were filled with a colorless, alkaline, flaky fluid which contained a pure culture of comma-bacilli.

It is added that therapeutical experimentation upon animals injected with the comma-bacillus has to the present only shown that large doses of Calomel, or the administration of Napthalin, prolonged the life of the animal one day. (Med. News, May 30, 1885).

Professor Virchow, who presided at the conference, gave as his opinion that experiments with animals are not absolutely required, [reliable?] inasmuch as not all the diseases common to mankind are transmissible to animals. The symptoms present in animals infected with Emmerick's fungus may easily be mistaken for those of Cholera, while there are many substances which can produce precisely similar conditions. As long ago as 1847, by the injection of putrid materials into the blood of dogs, he produced not only similar anatomical changes, but also excited vomiting, diarrhœa, and other symptoms of Cholera, thereby producing parallel manifestations, though he had guarded himself against considering the two conditions identical. He regarded Koch's experiments as inconclusive.

A young Catalonian doctor, Jaime Ferren, reports that he has found in Spain that Koch's theory was only partially correct. He professes to have discovered that when the comma-bacilli were mixed with animal gall, or with secretions from the human stomach, little eggs were deposited, and these he thinks the actual cause of Cholera. He inoculated himself and others with this material, diluted, inserting it into one or both forearms, and found that after four or five hours a fever occurred with the pulse from 114 to 120, and the temperature 40°C. The patients complained of being weak and feeling ill, with loss of appetite, vomiting, cramps, and loss of sleep. In forty-eight hours, however, all symptoms disappeared. In no case, it is alleged, has there been a fatal result, and it is hoped that this may prevent the appearance of Cholera.

In our own country there has been no opportunity for original observation and experiments in relation to the doctrines of Koch, or those of the other experimenters, but various opinions have been expressed on the subject of Koch's theories by members of the profession whose views are entitled to respect.

Professor Austin Flint, Sr., seems to have much confidence in the views of Koch as to the comma-bacillus being the essential cause of Cholera. Prof. N. S. Davis rejects and even ridicules the whole bacterial theory; and Dr. Frank H. Hamilton says in reference to Cholera, that "Microscopical studies have taught us absolutely nothing."

Dr. A. N. Bell, the sanitarian, of New York, says: "We know no more of the Cholera germs than before Koch went to Egypt and India to find the comma bacillus, and according to the report of the English Commission and the recent discussion at the Royal Medical and Chi-

rurgical Society it has turned out to be a *common* bacillus with no peculiar significance."

As to Ferren's experiments but few in this country have expressed opinions. Even if the "little eggs" are the actual cause of Cholera, and they produce the alleged symptoms when introduced into the arms, proof is still wanting that this will prevent attacks of Cholera. Indeed, an attack of genuine Cholera does not necessarily prevent a second attack, and the utility or usefulness of this "Cholera Vaccination" the future must determine.

The weight of all these various statements will be different in different minds, but few can regard any of the questions raised as to the essential cause of Cholera as fully settled.

Thus the matter stands at the time of this writing respecting the most recent investigations. What further may come of the further prevalence of the disease in Europe and its presence in this country, should it come here, to throw light upon its causes, it is impossible at present to predict.

Admitting the reality of Koch's discovery—that the comma-shaped microbes are present in all cases of Cholera and are nowhere else—they may be a result, or a concomitant, and not a cause of the disease. It does not seem possible that the mere presence and local physical action of these minute microbes, however numerous, confined to the lower part of the small intestines, could produce the peculiar and terrible phenomena of Cholera. It must be, if they are the cause, that they reach, either themselves or a poison to which they give rise, other parts of the organism —certainly the blood, and in their course the organic nervous system. It is possible that they set in motion a series of changes, chemical or vital, in the fluids and solids of the

body, which reach and operate on all the parts and tissues. This view is strengthened by the fact that in other cases micro-organisms excite chemical changes which give rise to *poisons* capable of diffusion and of producing constitutional or general effects upon the actions of the system. The analogy of the ferments is striking as their effects are seen in the chemical changes they induce in sugar and other organic substances out of the body, producing the alcohols, carbonic, lactic, and acetic acids, and many other substances in the process of putrefaction and decay.

It is now known that certain alkaloids having toxic properties, called *Ptomaines*, are produced by putrefactive changes in dead bodies, and it has lately been suggested that such substances may be produced in a diseased living body, and that this may be the case in Cholera. M. Villiers has examined some bodies of cholera victims, and reports having found some of these ptomaines in considerable quantities in the intestines, but much less in the kidneys, and only a trace in the liver and blood. It is certainly possible that some substances of this kind may be the immediate cause of the cholera phenomena, and these materials may be produced by specific germs. This may prove to be the fact, and the severe toxic symptoms in other diseases, in the specific fevers, etc., may have a similar explanation. This, subject, however, like many others in the profounder departments of physiology and pathology, is not fully understood.

The processes in the body, of digestion, and nutrition, of molecular rearrangements and the formation of excrementitious matters and the products of decay—indeed, nearly all the processes of life and death—appear to be affected by ferments, and ferments are living organisms. These physiological processes are as inexplicable as are

the pathological; and the phenomena of Cholera appear more mysterious and are more striking than other phenomena because they are more uncommon, more violent, and more terrible. A very small amount of a ferment, as of yeast, or the ferments which change milk and apple juice, will produce great changes; and so the cholera poison, whatever it may be, produces its effects not simply by a local physical action upon any one tissue, but by the changes it induces, creating a pervading poison other than its mere self.

But however interesting and ultimately profitable all this knowledge or conjecture respecting the particular article which constitutes the *materies morbi* of Cholera and the mode of its action may be, it is of more practical importance at the present, that we give our attention to the controllable conditions which favor its production and action, and to the acknowledged means of preventing the occurrence of the disease. All this, in the present state of the subject, is to be learned more by observation of the conditions and prevalence of the disease in places and persons, than by studying the appearances and by work with the microscope in the laboratory.

History, in relation to this subject, *is Science, teaching by example;* and hence so much space has been occupied in the narration of the facts respecting the appearance and spread of Cholera, of the scientific investigations which have taken place, and the opinions which have been formed in regard to its causes.

The question as to whether Cholera is *contagious* has long been under discussion, but often without a clear appreciation of what, in the present state of science, should be considered a contagious disease.

The distinction made by Dr. J. K. Mitchell, before re-

ferred to, between a contagion and a simple infection has not always been borne in mind. A contagion is a poison generated in the body of a sick person and conveyed from the sick person, by whatever means, to another, producing the same disease. Such disease is produced in *no other way;* and though influenced sometimes by external conditions it is not dependent upon soil, climate, or meteorological states. Small-pox, the Vaccine disease, Measles, Syphilis, etc., are examples of strictly contagious affections. An infectious disease is one produced by a specific poison, by something that infects, but which material does not necessarily have its source in the body of a sick person, and is not necessarily conveyed from person to person. Ordinary malarial fever is an example of this.

The term infection is often used as indicating any material which infects—which is specific in its characters, and which when entering the body produces a definite disease, whatever may be its origin or place of increase; but when the term *infection* is used in contrast with *contagion*, it means a poison generated and multiplied outside of the body, and one which is not communicated by contact with persons, or is not caught by one from another.

If Cholera is produced by a poison which is generated and multiplied exclusively in the body of a person sick with the disease, and that poison is communicated from the sick to the well by contact, by proximity, or by fomites, then Cholera is a strictly contagious disease. If, on the contrary, the cholera poison has its origin, is produced and multiplied, outside of the body, and independent of it, in the soil, in water, or in the air, and is received into the body producing its effects independent of other persons, then it is an infectious disease in contradistinction from a contagious one.

From the facts which have been presented respecting the history and spread of Cholera, it is impossible to confidently place it in either of these exclusive classes.

When a disease is produced by an infectious poison which has its origin either within or without the body, and is multiplied both within and without it, it is then, in modern phraseology, a *miasmatic contagious* disease.

If the specific poison of Cholera, whether originating within or without the body, is multiplied both within and without it, and may be received into the system either without or with the intervention of persons, then Cholera is a Miasmatic contagious disease—or an infectious-contagious affection. All the observed facts taken together clearly impress my mind with the conviction that the disease belongs to this latter class. That it is not strictly and exclusively contagious I am thoroughly convinced. This conviction arises from the whole history of the disease, including my own observations and experience with it.

An illustrative example of many other similar facts occurred under my observation in the introduction of Cholera into Chicago in 1852. It was my duty, as the official Medical Adviser of the Health Officer on that occasion, to make careful observations of the introduction and spread of the disease, which duty I performed. Some cases of the disease had occurred during the preceding summer of 1851, but it had entirely disappeared during the autumn and winter. The first case in the city or vicinity in 1852 occurred about the middle of May. The disease for weeks before had been approaching from the South up the Mississippi and the Illinois rivers, and was prevailing at the head of the navigable waters of the Illinois, at the town of La Salle. This is situated about forty miles from Chicago, and the two cities are connected by a canal. Boats were passing on this

canal between the two places. One arrived in Chicago from La Salle very early in May, some eight or ten days before the middle of that month. There had been no case of Cholera on that boat, nor of Diarrhœa, or any other sickness that could be ascertained. The boat needed repairs and was placed in the dry dock. A workman—a German mechanic, was among others employed in repairing the boat. He resided about one mile from the dry dock in the south part of the city. About the time of his employment on the boat he was attacked with Cholera at his home and soon died. This was the first case of the season. The next case occurred about three days later in the person of a man about 35, a laborer of somewhat intemperate habits, living in a small, poor house, in the center of a block, surrounded by larger buildings, situated about one-third of a mile east from the river, where the boat from La Salle was lying, and more than a mile from the residence of the first man who had the disease. This second man was in the midst of filth in the soil and the air, in his house, and upon his person. He had not been near the boat, nor in the south part of the city, and had no connection whatever with the first patient. His case was a severe one, was seen by me in the advanced stage of the disease, and it was speedily fatal.

The next case appeared in a woman in the North part of the city, three-fourths of a mile from the last one, and nearly two miles from the first. She had not in the meantime left her home, and had had no communication with either of the other victims. From that time the disease appeared in all parts of the city without regard, as far as could be ascertained, to inter-communication, affecting, first and most, persons in the low and filthy parts of the city, and in some of the higher and cleaner parts, but where the people used drinking water from wells, instead of the pure water from

Lake Michigan; and during the season of its prevalence, which lasted until November, it attacked largely emigrants, particularly those from Sweden and Norway, who that year came in great numbers to Chicago, to be distributed over the Northwest.

The emigrants did not bring the Cholera with them, but coming directly from ship-board, mostly through New York, they were hurried upon crowded emigrant trains, and many of them upon crowded steamers from Buffalo, and passing around the lakes, first coming with all their filth upon them and around them into a cholera atmosphere in Chicago, they brought the conditions of great susceptibility to the disease but not the disease itself; and often while the propeller on which they came was lying in the river, and before they landed or came in contact with or in the vicinity of persons having the disease they would be attacked in large numbers. This speedy seizure tended in their cases to show that the incubative period of the poison was very short. The inference from these facts seemed to me inevitable, that poisonous germs were brought, probably from the atmosphere of La Salle, possibly in fomites, almost certainly in some way from that place to Chicago on that or other canal boats; and finding in the latter place, in the filthy and moist earth, in the potable waters, in the foul atmosphere, and perhaps in the uncleanly persons, conditions favorable to their multiplication, the whole city in its air, and probably in its soil, its water, and its persons, was invaded by the specific cause of the disease. There was, as spoken of by Sir Gilbert Blane, as with the seeds of vegetables or the eggs of animals, a nice concurrence of certain degrees of heat, moisture, nutriment, etc., the conditions which favored the rapid multiplication of these germs, and the speedy effect upon those having, in the lan-

guage of Pettenkofer, "individual conditions, receptivity or unusual susceptibility to contract the disease." It may be objected to these conclusions, that individuals with cholera diarrhœa might have come from La Salle or elsewhere and brought the contagion in their persons; or that, as the disease was in the city the season previous, germs may have been dormant for all this length of time and have been brought into activity by the warmth of spring. These suppositions cannot be positively disproved. The possibility may be admitted; but I cannot believe that germs from the discharges of persons, even if it had been shown that such persons had come into the city with the developed disease upon them, could have found entrance into the alimentary canal of these individuals, so nearly simultaneously, in such distant situations from each other. If this case stood alone, and the facts of all other cases in the history of the disease pointed in another direction, it might be set aside as inconclusive; but it is in accordance with so many others which have been made a matter of record, that the conclusions naturally drawn from it seem sustained. It is possible that cholera germs remained over from the previous year, but there had been no evidence of it during the long interval; and this view is opposed to the observations and opinions of Dr. Koch. He found no permanent dormant state of his comma-shaped microbes; and the general history of the disease shows that when it leaves a place for months, it does not return without fresh importations.

That the poison is multiplied outside of the bodies of the sick with Cholera, I have no doubt; that it is also multiplied within such bodies I think exceedingly probable. That the poison is conveyed to persons without contact or near proximity to those having the disease, I positively

know; that it may be communicated by such contact or proximity is very probable; but when the Cholera is prevailing in a locality, that those who come in contact or close proximity with the sick are not very perceptibly more liable to it than those who avoid such contact or proximity is in accordance with my observations, as it is in accordance with the observations of most—I may say all—others who have had large experience with the disease.

While, therefore, not denying its possible contagiousness, I dissent from the opinion that, as in small-pox, the poison is produced exclusively, or even chiefly, in the bodies of the sick; and I do not think that the disease is ordinarily produced by this poison's being conveyed unchanged to others. I cannot think that it is chiefly, much less exclusively, produced by particles from the alimentary canal of the sick being conveyed to the alimentary canal of others. When this is regarded as the exclusive method of communication, and all preventive measures are directed to this point, to the neglect of others, a great error is, in my judgment, committed, and a great injury inflicted.

In the recent work of Dr. James Cunningham—an author who for thirty-three years has been an active medical officer and physician in India, and for twenty years has been at the head of the medical department there—entitled, "Cholera: What can the State do to prevent it?"—the idea of the strict contagiousness of Cholera is vigorously opposed, and the practical consequences of acting upon that idea are as vigorously denounced. He declares that quarantines, inspections, blockades, disinfection of excrements, etc., have been shown to be of no use in India, and the only preventive measures of value are *cleanliness*, *good sewerage*, *pure water* and *fresh supplies*.

Whether Dr. Koch, or the French Commission to Egypt,

or any one else, has discovered the essential cholera germ, I simply do not know. If anyone has, I see nothing in such discovery inconsistent with the views just expressed. Koch's comma-shaped bacillus may be produced and multiplied in the earth, in water, or in the air containing organic matters for its food, *as certainly many other bacteria are multiplied in such situations.* If Koch's bacillus is killed by drying, its *spores*, which he has not yet discovered, or at least has not fully identified, may have a vitality which resists drying and various other agencies destructive to the fully developed bacillus. These spores may float in the atmosphere, as spores of various bacterial ferments do, and spring into development and activity under favorable circumstances, as various other spores are constantly doing.

These disease-germs, in whatever form, may spread by multiplication where the conditions are favorable, may be wafted by winds, may flow in streams, or be carried by intercommunication—by vessels, by trains, by caravans, or by persons; and almost certainly they have been brought across the ocean exclusively in ships.

In this view the inferences as to quarantine, disinfection, and prevention generally, are obvious. As I have substantially expressed elsewhere (See Science and Practice of Medicine, Vol. I, pp. 416–417.)* I now repeat.

From the history of the disease we learn that the localities most liable to its spread, other things being equal, are those which are low, moist, and particularly those that are *filthy.* By *filth* is understood effete or decomposing materials, mostly organic, which are offensive to the senses, or injurious to the human organism. Filth, thus defined,

*In the work referred to in the text, a summary of my individual views is given, and I shall make free use of it in this much more extended monograph on the subject.

appears to afford a soil, a habitat, and the supply of nourishment—the conditions of the existence and multiplication of disease germs in general, and of cholera germs as well as of the germs of other diseases. Warm climates and seasons are more favorable to the spread of Cholera than cold, and a densely populated town than a sparsely settled region. It is more liable to follow water courses and thoroughfares; partly because these are usually more low, densely populated, and filthy, and partly because the poison is conveyed by inter-communication. All experience has shown, (and this should as a practical matter be particularly emphasized,) that the existence of effete and decomposing organic matters in the soil, the water, and the air, favors the spread of the disease, probably by furnishing a pabulum for the development of the poison, and a nidus for its existence and action in the bodies of those inhaling the foul air or imbibing foul ingesta.

With regard to the classes of persons most liable in the same locality to be attacked and to become its victims, the intemperate, the destitute, the filthy, the vicious, the enfeebled, the terrified and the degraded, are immeasurably more subject to its ravages than those in opposite conditions. Yet, when the poison is abundant and possesses great activity, no class or condition can claim an exemption; but the cases are so rare in which the poison is sufficiently intense to affect perfectly healthy and vigorous persons, who place themselves under the most favorable hygienic circumstances, and avoid all predisposing or accessory causes—in short, who obey all hygienic laws—that the violations of these laws become the conditions of attacks. In other words, the predisposing and accessory causes, in a vast majority of cases at least, become necessary antecedents to the production, and certainly to the prevalence, of

the disease. So much have the habits and state of individuals and their surroundings to do with the prevalence or suppression of this scourge, that it may be stated as a general proposition, that the "cholera poison owes its potentiality to the conditions in which it finds the subjects of its invasion."

The existence of effete and decomposing matter in the body as well as in the soil, the water, and the air, seems to favor the operation of the cholera poison. Dr. Wm. B. Carpenter, of London, years ago arranged the generally recognized predisposing causes of Cholera and other zymotic diseases under these heads, viz.:

1. Those which tend to introduce into the system decomposing matters that have been generated in some external source; such as the ingestion of putrescent food, of water contaminated with sewerage or other decomposing matters, and the inspiration of air charged with putrescent emanations.

2. Those causes which occasion increased production of decomposing matters in the system itself; such as any unusual source of degeneration in the tissues, as excessive muscular exercise, injuries, fear, despondency, derangement of secretions and excretions, etc.

3. Those influences which obstruct the elimination of decomposing matter naturally or excessively generated within the system, or abnormally introduced into it from without. Under this head are placed insufficient supply of air, a high external temperature (which slackens the respiratory process and the combustion of effete matter), ingestion of alcohol which produces a similar effect, and the sudden occurrence of a cooler and moister atmosphere, as a rain storm after much heat, thus checking the secretion from the skin.

All these causes appear to produce their injurious effect chiefly by introducing or retaining foul matters in the system. But other causes render the system more liable to attacks, and to these special attention should be given. The taking of excessive quantities of good, or of indigestible or irritating articles, such as unripe or decaying fruit, fish, especially shell-fish in certain conditions, sweets in excessive quantities, cucumbers, melons, etc., tends to produce attacks; and irritating cathartic medicines which tend to denude the mucous membrane of the intestines of its epithelium, or any medicines or other substances which produce catharsis or a diarrhœa, are particularly liable to produce an attack of Cholera when the disease is prevailing in a locality.

From the foregoing facts and considerations the following summary of conclusions seems to be justified:

Cholera is produced by a specific poison—a distinct *materies morbi*—doubtless organic and germinal, capable of multiplying with great rapidity under favorable circumstances. The locality of the origin is in India; but whether it first sprang from the soil, from water, or was developed in the air, or in the human organism, is not positively known; but that it is capable of multiplying in all these situations and elements there is reason to believe.

This poison is capable of extension over considerable areas by multiplication, and it may be carried by currents of air, by water flow, by ships and other vehicles, by fomites, and by persons; and when transported even in minute quantities into a place where the conditions are favorable, by its multiplication it may produce wide spread disease.

The conditions most favorable to its multiplication in a locality are high temperature, moisture of soil and air, and

especially *filth*, or effete and putrefying organic matter in the soil, the water, and the air of the place.

All the epidemics that have occurred in Europe or America within our knowledge have commenced in Asia, and have been aided in their travels, if not exclusively carried into other quarters of the globe, by means of human intercommunication.

Quarantine is therefore useful, but to render it effectual and certain, it should extend to all vessels or vehicles and persons, coming from ports or places where the cholera poison exists, whether cases of Cholera have occurred in such vessels and vehicles or not; and vessels from cholera ports should not be allowed to approach within several miles of the shore. The time in quarantine should continue until the most rigid system of disinfection has been practiced, or until time has destroyed the poison.

In the present uncertainty as to the particular germs which produce the disease, and the effects of particular germicides upon them, the comparative value of different means of disinfection is not known, but as a high degree of temperature destroys the vitality of those low organisms with which we are acquainted, it is inferred that among the most efficient means of disinfecting ships and other vehicles and objects, is subjecting them to a temperature of 212° F., or over, for a considerable length of time. To apply such heat or other disinfectant to every part of a ship where germs may linger, is a matter of the utmost difficulty, and hence the complete exclusion of such vessels, though perhaps impracticable, would alone be certainly effectual. From the difficulties in carrying out quarantine regulations perfectly, many observers have lost confidence in their efficiency, and there is reason to fear they cannot be made effectual.

The most important local condition tending to prevent the occurrence and spread of Cholera in a place subject to the importation of the poison is *cleanliness in its fullest sense—cleanliness of soil, of air, of dwellings, and of persons.*

Of personal conditions and habits tending most to prevent attacks when the cholera poison is present or apprehended, *temperance* in its widest sense is of greatest importance. This consists in the moderate use of everything necessary and proper, and the complete avoidance of everything unnatural, injurious, and improper. This rule would exclude the use of alcohol as an article of diet or luxury; and actual observation and experience confirm the conclusions of science. While the person is well no medicine is needed, as no specific preventive is known. When ill with the premonitions or the actual attacks of the disease, treatment should be promptly applied and with discrimination and vigor, and this will be described later on in this work.

CHAPTER II.

THE PHENOMENA OF CHOLERA — ITS SYMPTOMATOLOGY AND PATHOLOGY.

The external symptoms of Cholera, or at least the descriptions of them, are familar to all students of the subject, and as there is no controversy about them they will not require a long discussion.

The disease is divided into *four* stages, though some writers make a greater number. These stages, as is the case with the more or less arbitrary divisions into stages of most other diseases, run into each other, and are not always well defined; neither do they all exist in every instance, but in their general outline may commonly be observed.

The *first* is the *Premonitory Stage*, marked by general lassitude, dull pain above the eyes, sometimes constrictions in the calves of the legs, disturbed digestion, abdominal uneasiness, slightly coated tongue, and *diarrhœa*. This stage is not always observed, and when it is, is liable to vary much in the number, severity, and duration of the symptoms; but it usually may be traced, the premonitory diarrhœa, usually painless and watery, occurring in a very large proportion of the ordinary cases, and continuing from several hours to some days before the full development of the disease, or the arrival of the

Second Stage, which is marked by active vomiting and purging of a fluid which soon becomes of a rice-water

appearance; by great thirst, coldness of the surface, severe spasmodic pain or cramps, particularly in the abdomen and extremities. In the commencement of this stage the pulse is sometimes a little excited, and not unfrequently quite firm, but it soon becomes more and more feeble as the impression of the poison is more profound, and as the exhausting discharges continue. Toward the latter part of this stage, the surface becomes much shrunken and more or less blue, and may be comparatively dry or covered with perspiration. When the disease is severe, this stage only lasts a few hours—in less violent cases it may last a day or more—when, if reaction and improvement do not occur, it passes into the

Third, or Stage of Collapse, marked by loss of circulation, labored respiration; the skin being shriveled, livid, and usually bathed with cold perspiration. The discharges sometimes continue in this stage, though less profusely; at other times they are suspended, even that from the skin, either from exhaustion of the fluids of the system, or from a suspension of nearly all vital action; the patient becoming more quiet and comatose. During some parts of the second stage a ringing in the ears usually occurs, and the voice becomes husky and peculiar. These symptoms usually continue throughout the remainder of the disease, the huskiness of the voice increasing in the third stage until the patient is able often to articulate only in a whisper. Those who survive the active onset of a severe attack, especially if the disease passes into the third stage, are liable to the

Fourth Stage, presenting the characters of a low irritative fever, generally accompanied by protracted local congestions, or a low form of inflammation of the mucous membrane of the intestines, particularly of the follicles,

of the mesenteric glands, and other abdominal viscera, and of the brain and spinal marrow. Occasionally cases of cholera morbus, or what has been called English Cholera, occur, and also serous vomiting and purging during the progress of malarial fevers, which, in their external symptoms, resemble very nearly genuine epidemic or Asiatic Cholera; yet they differ in the essential cause, and certainly as regards fatality—the former class of cases being almost always amenable to proper treatment, even if the treatment be not commenced until an advanced stage; while the mortality of the latter, when the same apparently advanced condition is permitted to occur, is too well known. Dissimilar causes not unfrequently produce similar, though perhaps not in every respect identical, effects, and these cases of sporadic and accidental Cholera are not produced by the specific poison which gives the epidemic variety its virulence.

In the above sketch we have a brief account of the more prominent external symptoms of Cholera, but a more careful study of them will give a more complete idea of the disease.

The diarrhœa spoken of is specific in its character, and doubtless it depends upon the same essential cause as the more fully developed attack, and may therefore be included under the term Asiatic Cholera. If, however, it is included in cholera statistics, the aggregate will be greatly augmented in every epidemic, and the proportional number of recoveries will be immensely increased. Many of these diarrhœas terminate spontaneously without a full development of the disease, and a still larger number will recover by very simple early treatment. If one practitioner or school of physicians records these cases in the statistics of cures with a certain remedy or system of treatment,

and another does not, such statistics would give the most false impressions; and such has been the case in the reports of the success of exclusive systems.

When a diarrhœa of this kind with three, four, or five liquid stools in a day is accompanied by moderate vomiting, but which does not go on to the violence of symptoms of the second stage as described, the term *Cholerine* is applied by Lebert and others. This Cholerine for the most part comes on without the preceding occurrence of a common diarrhœa from other causes, and like the simple cholera diarrhœa it may terminate favorably either spontaneously or with very simple treatment. The term Cholerine is by many applied to the diarrhœa without vomiting.

This cholera diarrhœa is accompanied with loss of appetite, weakness, and a sense of abdominal uneasiness; but is commonly without pain, and is apt, with people ignorant of its nature, and not alarmed about the Cholera, to excite but little attention. This neglect, though sometimes not serious in its consequences, is apt to be a fatal error, for in a large number of instances it is the beginning—the first stage of the serious form of the disease,—the stage in which, by prompt and judicious treatment, it can almost always be controlled.

In many instances this diarrhœa shows a disposition to return while the epidemic continues; and at any time may lead to the full development of the disease. In some cholera epidemics the proportion of cases of the specific diarrhœa is greater than in others; and each individual case usually terminates either favorably, or in the second stage of Cholera, in from a few hours to three or four days. Serious lesions of the intestines are apt to be produced, there may be a weakened condition, and sometimes a typhoidal state supervenes after an attack of the Cholerine.

Although the identity of Cholera is preserved in its leading phenomena, wherever it occurs, yet each epidemic has some peculiarities of character and severity. It may commence in a place with milder cases at first, increasing in severity until a climax of intensity is reached, or the first cases may be most severe, abating later; but often the last cases that occur in a waning epidemic are as severe as any that have preceded. A smaller or larger portion of the people in a locality may be attacked, and some streets and special localities may suffer much more than others, where the hygienic conditions appear to be similar.

In the fully developed or *second stage*, the profuse purging may precede the vomiting, or they may commence simultaneously, or the vomiting may be first. The earlier discharges from the bowels may be more or less fecal when not preceded by the usual watery diarrhœa; and the first discharges from the stomach may contain the remnants of food. The discharges from either the stomach or intestines may at first contain bile; but this soon disappears, and the rice-water or whey-like discharges follow. Sometimes the discharges are more of a greyish color than rice-water or whey. Sometimes they contain a flocculent whitish matter, and sometimes they are quite transparent. On more careful examination they are found to be alkaline in reaction, to contain triple phosphates, lime salts, and much chloride of sodium, epithelium from the intestinal membrane, and rarely shreds of tissue and blood corpuscles. They contain bacteria of various kinds, and, according to Dr. Koch, the comma-shaped variety, at the height of the discharge, in large numbers. The matters vomited from the stomach seldom contain Koch's bacilli, and, as he thinks, only when the matter comes up into the stomach from the intestines.

The evacuations usually take place without pain, but cramping muscular pains generally occur soon after each discharge. The amount of discharge varies in different cases, but it is usually large, sometimes a common chamber vessel being half filled at one evacuation. Sometimes the discharge is much more scanty; and rarely at the height of the epidemic influence, the patient is suddenly stricken down and falls into a state of collapse without any evacuations at all. In such cases there may be an accumulation in the intestines and stomach, but not necessarily any considerable amount. The vomiting is generally free when the purging is so, but the relative proportion is not always preserved. The vomiting is affected sometimes by a single effort, but oftener by a series of them, and the fluid is poured forth with but little retching.

These tempestuous discharges continue usually from eight to twenty-four hours, when either collapse and death result, or the discharges diminish, and are often changed, becoming yellowish or green with bile pigments or altered blood corpuscles.

At the height of the discharges from the bowels they are odorless, or have only a slight mawkish odor; but when they are changed in color, a fecal or putrescent odor is likely to be perceived.

The *thirst* during the active evacuations, and often after, is *intense*, but indulgence in drinking any *considerable amount of fluid of any kind during the active period of the disease induces vomiting*. The tongue at first is whitish and moist, it is almost always cold, but may soon become dry, when it is likely to be protruded with difficulty. The upper part of the abdomen is sometimes sensitive to pressure, and the muscular walls over its whole surface are usually tense and retracted.

The cramps are *very painful* and induce a peculiar cry, which is husky and high pitched. These cramps are most in the lower extremities, but are also in the muscles of the abdomen, in the hands and arms, and occasionally in the face. Muscular contractions sometimes continue after death.

The temperature of the surface, particularly of the limbs, is reduced, sometimes sinking in the axilla to 93.5° F., and in one case Lebert found it as low as 88° F. The patient, however, does not complain of a sense of coldness. On the contrary, he usually prefers to have the surface, especially the limbs, exposed, and complains of a sense of internal heat. The actual temperature of the internal parts of the body, as found by the thermometer introduced deeply into the rectum, is usually increased, so that the sense of internal heat is not fallacious.

As reaction takes place in favorable cases and the external heat increases, the internal heat abates, and a more normal equilibrium is restored.

The skin during the active discharges loses its elasticity and natural color—is shrunken and purple; the hands are shriveled like those of a washer-woman, but are dark purple instead of being bleached. During these symptoms the secretion of urine is very slight or completely suspended, and its retained elements probably contribute to the morbid effects.

The pulse is often normal in frequency, but becomes smaller as the second stage advances towards the third, until in the latter stage it becomes imperceptible at the wrist.

In favorable cases the vomiting and purging abate, the pulse becomes stronger, the temperature of the surface increases; and after such increase of the temperature, it is seldom greatly reduced again, whatever may be the sub-

sequent course of the disease. This return of surface warmth, and activity of circulation, is called the reaction.

The respiration, though free at the beginning of the attack, becomes oppressed and labored as the disease advances; the blood is ~~returned~~ retarded in its passage from the right to the left side of the heart, oxygenation is impeded and the asphyxiated state approaches. This state increases as the discharges continue, the blood loses its serum and salts, and all the tissues are deprived of properly oxygenated blood. It is venous in character, circulating very slowly and with great difficulty through the capillaries, producing the deep blueness of the surface described.

As the *third* stage or that of collapse occurs, these symptoms of depression, of obstructed circulation and respiration increase. The voice, which before was husky and feeble, is now reduced to a whisper, the pulse is very small and thready or imperceptible at the wrist, and the intellect, which before had remained comparatively clear, (though generally there is a remarkable degree of indifference as to results,) now becomes cloudy, and a comatose condition usually comes gradually on. The temperature of the surface often now increases, whether the case terminates in reaction and slow recovery, or death, rising to 99° or 100° F., constituting what has been called the *tepid stage*, in which there is neither coldness nor external high fever. The patient during all this time is conscious of his danger, but is comparatively indifferent not only to the result but to all things except water and sleep. He calls almost incessantly for water, and desires to be undisturbed so that he can sleep. The discharges in this stage diminish, and generally entirely cease from the stomach, and often from the bowels; the sweats, which may have been profuse, diminish or cease, and the patient after lying a short time, usually

a few hours, in a semi-comatose condition, often with his eyes partly open, the conjunctivæ deeply congested, dies in an asphyxiated and complete comatose state. In some cases, however, he lingers in this collapsed condition for twenty-four hours or more, and occasionally recovery from this state slowly takes place.

When such recovery occurs, the *fourth* stage, or that of *cholera typhoid*, generally follows; and sometimes this supervenes without the patient passing into so profound a state of collapse. This typhoidal state seems to depend not so much directly upon the cholera poison as upon the pathological conditions occurring during the more acute progress of the disease.

The symptoms are those of a low form of typhoid or typhus fever, with evidences of intestinal lesions, and of a low inflammatory condition of different organs, and in most cases of the membranes of the brain and spinal cord. This fever varies in its continuance and its results. In my own observation most of the cases have convalesced slowly, but sometimes imperfectly, after from ten days to three or four weeks.

During the active stage of the acute disease, the urine, as already stated, is greatly diminished or completely suppressed. In some cases where reaction takes place giving hope of recovery, the secretion of the urine is not restored as in the favorable cases, and in a day or two symptoms of uremic poisoning appear; convulsions seldom occur, but a deep sopor, in which the patient after some hours dies. The condition leading to this is a congestion and croupous or exudative inflammation of the kidneys, by which the uriniferous tubes are clogged up and the secretion of urine is thus prevented.

Other complications sometimes accompany or follow the

disease. Among the most important are gastritis and enteritis of a marked character; pulmonary congestion; meningitis, without so markedly the typhoid state; the formation of coagula in the right heart and pulmonary vessels; hemorrhage from the bowels; an eruption of roseola; abscesses in different parts, and sloughing of the cornea; and, in more numerous cases than of any of these complications, dysentery follows the ordinary attacks of cholera. In our epidemic in Chicago many cases of this kind occurred.

Morbid Anatomy and Pathology. The pathological anatomy of Cholera has been studied with care, and many statements have been made concerning it, but these statements are not uniform, and the appearances are not in all cases marked and characteristic of the disease. Dr. Joseph Coats, of Glasgow, in his late Manual of Pathology says, that the anatomical changes in what is known as British Cholera, a non-specific disease, are "identical" with those in the epidemic form, or Asiatic Cholera. Although this statement seems based upon a superficial knowledge of the subject, and is doubtless incorrect, it is an evidence that the pathological changes peculiar to this very specific disease are not distinctly understood by the profession at large. Dr. Coats says that, in both diseases to which the general term of Cholera is applied, "it is clear that a very violent irritation of the mucous membrane of the intestines is produced." "The most marked *post mortem* appearance in the intestine is a remarkable rosy injection of all the vessels of all its coats, so that a red appearance is visible even in the serous coat whenever the body is opened. The mucous membrane is swollen and the closed follicles prominent. Occasionally a decidedly inflammatory condition is present, which may be even of a dysenteric character.

"The condition of other parts of the body is directly referable to the enormous withdrawal of water from the blood. The blood itself is thick, dark, and imperfectly coagulated. The skin, serous membranes, and all the soft tissues are shrunken, dry, and parchment-like. The membranes of the brain are frequently injected. The kidneys present the characters of a slight parenchymatous inflammation."

Dr. Bristowe, with more discrimination and with much justice says, "The appearances found after death in Cholera differ according as death takes place in the stage of collapse or in that of reaction." "In the former case the body retains much of the shriveled characters and lividity which is presented during life, and the dependent parts are more or less deeply congested."

"The tissues of the body are preternaturally dry, the muscles firm and dark colored, and the systemic veins loaded with blood which is manifestly thicker and perhaps darker than normal. For the most part the serous cavities are empty of fluids, and their surfaces sticky to the feel, and they not unfrequently present subserous petechial extravasations.

"The right cavities of the heart are more or less distended with dark colored, imperfectly coagulated blood. The left ventricle is sometimes firmly contracted and empty, sometimes contains a little fluid blood or clot. The lungs are usually much diminished in weight, pale, anæmic, and dryish on section. Sometimes however they are congested and œdematous below, and they may be more or less congested throughout.

"The liver presents no decided departure from health; and the gall-bladder is full of bile. The spleen is generally reduced in size. The outer surface of the bowels is

often injected and of a rosy tint. Their mucous membrane is sometimes of a nearly uniform pink tinge, increasing in intensity towards the cæcum; or it may present irregular patches of congestion with submucous extravasations; or it may be quite pale. It often exhibits a corrugated and sodden appearance, and the solitary and peyer's glands are for the most part enlarged. The contents consist of an opaline or gruel-like fluid, which is sometimes white, and sometimes pink from admixture of blood. The mucous lining of the stomach is often congested, mammillated, and the contents generally resemble those of the bowels. The kidneys are congested on the venous side, so that the medullary portions and the superficial veins are injected, while the cortical substance remains more or less pale. The urinary bladder is firmly contracted, and empty, or containing a little pus-like fluid. The brain presents numerous *puncta cruenta.*

"If death occurs during reaction, the tissues are found moist; blood occupies, perhaps in equal degree, both sides of the heart, and not unfrequently thick fibrous coagula are prolonged thence into the aorta; the lungs are congested and œdematous; and the contents of the intestines present the appearance of pea-soup. Besides, pneumonia is sometimes met with, and sometimes distinct inflammation of the intestinal mucous membrane."

He further says, "the blood is not as much inspissated as is commonly believed, but it is more adherent to the blood vessels than natural. The proportion of albumen and salt to its other solid constituents is diminished; and the white corpuscles are often increased relatively to the red. The rice-water fluid as found in the intestines is alkaline, is in a state of rapid decomposition, evolves gases (chiefly nitrogen and carbonic acid), and contains besides

bacteria, shed epithelium in abundance, mucine, albumen, and also butyric acid, acetic acid, ammonia, lucine, and inorganic salts. It does not, however, contain urea. There is no doubt that after death the mucous surface of the bowels is denuded of its epithelial covering, which is found in flakes and suspended in the intestinal contents. But it is uncertain whether this is merely a post mortem change, or a lesion occurring during life. It is probably the latter, however; for there appears to be a similar tendency to shed the epithelium in almost every other part in which epithelium exists, especially in the bladder and urinary passages, in the bronchial tubes, and in the ducts of the liver and the salivary glands. Dr. Thudicum shows that during the period of collapse there is very little urea in the blood and the tissues, but that its quantity increases during the period of reaction, and soon, if urine is not secreted, becomes excessive,"

These quotations from the recent works of Dr. Coats and Dr. Bristowe give a fair and pretty full account of the morbid anatomy of Cholera, as contained in the text-books of the day.

The account given by Dr. Koch, from his recent investigations in Egypt and India, differs in some respects, and is appended.

In the majority of cases examined by him, he found evidence of severe inflammatory lesions of the intestinal mucous membrane, often with hemorrhage, and he notes the rarity with which the intestinal contents are of the watery character so marked in the evacuations earlier in the disease.

From the accounts given in the text-books he had imagined that the Cholera intestines would show slight changes, and would be filled with clear "rice-water" fluid.

He had evidently not examined all the text-books on the subject. Though a large majority of Dr. Koch's cases presented severe intestinal lesions, in others the changes were slighter, and he met with some which to a certain extent corresponded with the ordinary accounts in the text-books. As previously stated when giving an account of the discovery of the bacillus, he found after careful researches no evidence of an infective material or of specific changes in any other organ, and he concentrated his attention on the alimentary canal. He found cases in which the lower segment of the small intestine, immediately above the ileo-cæcal valve extending some distance upward, was of a dark reddish-brown color, the mucous membrane being covered with superficial hemorrhage. In many cases the mucous membrane appeared to be superficially necrosed, and covered with diphtheritic patches. The intestinal contents in such cases were not colorless, but consisted of sanguinolent, ichorous, putrid fluid. Other cases showed a gradual transition to a less marked change. The redness was less intense, and was in patches, whilst in others the injection was limited to the margins of the follicular and Peyerian glands, giving an appearance which is stated *to be quite peculiar to Cholera.* In comparatively few cases were the changes so slight as to consist in a swollen and opaque condition of the superficial layers of the mucous membrane, with delicate rosy-red injections, and some prominence of the solitary follicles and Peyer's patches. In such cases the intestinal contents were colorless, but resembling meal-soup, rather than rice-water. In only a solitary instance were the contents watery and mucoid. Here, especially where the margins of Peyer's patches were reddened, was found the invasion of bacteria, occurring partly within the tubular glands, partly between the epithelium and base-

ment membrane, and in some parts deeper still. Not only the comma-shaped bacteria which he regards as specific, but others of various forms and sizes were found accumulated within and around the tubular glands, and he concluded that, in these situations and lesions, the specific pathogenic bacilli prepared the way for the other forms, just as in the necrotic, diphtheritic changes in the mucous membrane in diphtheria, bacteria were found. These intestinal lesions were the only ones that attracted the particular attention of Dr. Koch. He found that after these putrefactive changes occurred, produced, as he thinks, by the common bacteria, the specific comma-shaped variety disappeared. He found them in adundance only in the less advanced lesions. He seems rather to deprecate the use of the so-called disinfectants, as, if they produce the designed effect, they destroy the ordinary putrefactive bacteria which, he suggests, counteract the specific pathogenic ones, which latter are the real cause of the cholera phenomena.

While we must regard this subject with great interest, and give credit to Dr. Koch for what he has discovered, we are not prepared to generalize very largely from his facts; and more must be known before we can rest our convictions upon a solid basis, and draw from *post mortem* appearances many positive conclusions of practical value. Some observers assert that certain peculiar morbid changes as well as certain materials are found in the blood and particular organs, while others declare their inability to find anything of this nature distinctive of the disease. The presence of Ptomaines or toxic alkaloids, as noticed by the French pathologist, Villiers, has not been demonstrated in a sufficient number of cases to justify positive conclusions on the subject, and, in view of all that is but partially known

or entirely unknown, it must be confessed that the morbid anatomy of Cholera, as well as our knowledge of the essential nature of the disease, is at present far from being in a satisfactory state.

The theoretical pathology—the explanation of the phenomena of the disease—the rational connection of the essential cause with the effects, all must admit is clouded with obscurity. That some material is produced by the presence of living germs which is poisonous, which causes such rearrangement of the molecules as to produce the phenomena we observe, we can believe; but of the mode in which these effects are produced, and of the steps of the process, we must confess our ignorance.

That an impression is made upon the whole organism, and especially upon the organic nervous system, we must conclude, as well as that an intense irritation of the mucous membrane of the alimentary canal is produced.

It can hardly be supposed that a denudation of the epithelium of the mucous membrane of the intestines could of itself give rise to such an exudation of the serous portion of the blood as takes place in the active stage of Cholera. Some more general impression must be made on that system which controls circulation, secretion, and calorification—which modifies nutrition and all the functions of vegetation or organic life. There is equal mystery in other matters. We do not understand how so small a quantity of apomorphia, injected into the tissue of the arm, will produce prompt emesis, or a similar injection of elaterium will produce purging. We do not know why so small a quantity of pilocarpin will produce such a flood of perspiration, or why a grain of morphine will produce such profound sopor; or why a few drops of Prussic acid will suspend all life processes.

The poison of Cholera does produce irritation of the alimentary canal and vomiting and purging. It does produce a loss of a large portion of the serum of the blood; and that loss produces other changes and obstructions of functions which are observed. But there is something more than that, which produces these severe results. Collapse and death are sometimes produced by that poison without any material loss of blood serum; and in cases of common cholera morbus, or in purging from the action of hydragogue cathartics, as much loss of fluids as occurs in most cases of Asiatic Cholera may take place, but without the same fatal results. Certainly more local inflammation of the intestines than commonly occurs in Cholera frequently takes place without the same results as in this disease; so that from every consideration, etiological and pathological, we must conclude that the poison operates upon the general system, and certainly upon the organic nerves.

The particular pathological condition that causes such serious consequences, resulting in so large a proportion of cases in collapse and death, has been a subject of controversy among pathologists, and various speculative explanations have been attempted. It must be acknowledged that the primary and special danger in Cholera lies in the occurrence of collapse. On the one hand, and with most, this state of collapse has been attributed chiefly, if not exclusively, to the profuse discharges, and the consequent drainage from the blood of its serum, leaving it thick and incapable of free circulation through the smaller vessels, and the consequent suspension of organization and nutrition. On the other hand, it is affirmed that collapse is not due to the excessive dischages; that those discharges are really eliminative of the poison, or the products of the

poison causing the disease, and are to be permitted and even encouraged, rather than checked.

Of this latter view Dr. George Johnson, of London,, was the earlier and chief advocate, but it has found favor with the great Hygienist and Physician, Dr. Parkes, of the British Army Medical School, and with so accurate a thinker and high authority as Dr. Thos. Watson in the last edition of his classical lectures.

Spasm of the arterioles occurs to so great an extent as to cut off the circulation in tissues, and so as often to prevent secretion from the kidneys and liver; and the starting point of such spasm has been believed by many to be in the pulmonary arterioles. That spasm of the extreme vessels occurs, I think there can be no doubt, and that it exerts a decided influence upon results is extremely probable; but that the profuse discharges contribute to the collapse and are in a vast majority of cases a chief factor, is, in my mind, rendered certain by the results of observation, and of experience in treatment.

It is true that the phenomena of collapse are not identical with those from simple loss of blood from hemorrhage, where the quantity is simply reduced by the loss of all its ingredients. The loss of the watery portions of the blood with the retention of the corpuscles and other matters, some of them effete, is quite different from a hemorrhage; and the collapse of Cholera for this reason alone may well be regarded as different from syncope. But there is another element present, as already intimated,—a profound poisonous impression upon the organic nervous system, causing spasm of the arterioles of the lungs and of the general systemic circulation as well.

That the ganglionic or organic nervous system is early and profoundly affected by the cholera poison is evident

from various considerations. Though these nerves of organic life are not always found perceptibly changed in structure after death, they are sometimes softened and enlarged, and their functions in the progress of the disease are modified, diminished, and in severe cases readily overpowered. That portion of the brain and nervous system which is engaged in thought and mental sensibility is left comparatively undisturbed, while all the functions depending upon the organic nerves, such as nutrition, secretion, exudation, circulation, and respiration, and their consequences, as animal heat, and the general molecular movements of the system, are either enfeebled, suspended, or greatly modified. Digestion seems entirely suspended, and glandular secretions, particularly of the liver and kidneys, are either suspended or greatly diminished. The circulation of the blood, so directly under the control of the organic nerves, is much retarded, apparently to a great extent, at least, by spasm of the smaller vessels of the surface; the vital fluid retiring to and congesting some of the internal organs. Respiration is diminished and labored; the blood, consequently, is not well oxygenated, and animal heat, especially at the surface, is reduced.

Not only these functions are disturbed, indicating wrong organic nerve action, but the morbid phenomena connected with the alimentary canal indicate the same thing. The simple presence of irritating materials in the intestines could not produce all the results.

While these general morbid phenomena are occurring, and frequently as the first in the train of apparent symptoms, the circulation and secretion of the mucous membrane of the alimentary canal become specially deranged. The ganglionic system everywhere, but more particularly in the stomach and intestines, governs the capillary circu-

lation. The paralyzing, deranging influence of the cholera poison upon the organic nerves produces the derangement of action which causes the diarrhœa, and it increases in its effect during the more active stage of the disease. The blood flows into these vessels in unusual quantities, producing hyperæmia, irritation, and copious discharges, consisting of the thinner parts of the blood, which contain a large portion of its salts. The blood is thus deprived of its more fluid portions, of its salts, and, by diminished respiration, of its oxygen; and being moreover loaded, at least later, with effete matter from the suppression of the secretions of the kidneys and liver, is unfit for the uses of the system. The spinal nerves then become deranged in their functions and the most painful spasms occur. When the disease in a grave form arrives at this stage and is uninfluenced by treatment, collapse and death are the usual results.

When, from the somewhat less severe form of the disease or greater powers of endurance, a patient survives these conditions, the increased quantity of blood in the mucous membrane of the alimentary canal produces an inflammatory hyperæmia, and in many cases a decided degree of inflammation. This inflammatory action, since the discoveries of Koch, we must now conclude, is induced, at least in part, by the presence of the micro-organisms. There is usually, however, no organizable plastic matter poured out, but a material something like the exudation of diphtheria; and one of the products of the disease is an infiltration of a peculiar granular matter into the mucous membrane, and particularly into the glands of the intestines. The investigations of Harner, of Pirogroff, and many others, including Dr. Koch, and the delineations of Lebert, go to show the marked inflammatory character in many cases of the hyperæmia

and exudation, when death does not occur too soon to allow of its development. Not only the alimentary canal, but the membranes of the brain and spinal marrow sometimes, and also, the lungs are occasionally involved in inflammation, especially in the cases which are somewhat protracted.

The only marked appearance approaching to uniformity, in the bodies of those dying in the collapsed or asphyxiated state of Cholera, is that of congestion or hyperæmia, with swelling in the glandular structure of the intestinal membrane, and with the peculiar infiltrations into these glands already referred to, the latter especially occurring oftener in the more protracted cases.

It is an error into which many fall to attribute to a single cause what may be the result of the co-operation of several causes.

It cannot be doubted that impeded circulation of the blood through the lungs, and imperfect oxygenation of that fluid, contribute largely to the fatal results; but yet it is true that such obstruction of circulation and deficient oxygenation *very seldom* occur until the blood is rendered thick and incapable of circulation by loss of its fluids and salts, and by the retention within it of various effete and injurious matters, though probably the blood is rendered still more injurious by the presence, in addition, of a specific morbid poison. The loss of the fluids is by no means the sole cause of the fatal symptoms, as patients occasionally die without such loss; but such cases are the very rare exceptions, and in ninety-nine out of every hundred deaths from Cholera, the loss of the fluids is a chief and even essential element in the complex condition producing the results. The practical importance of these pathological views will be more fully appreciated when the subject of treatment is considered.

In reviewing the ground already passed over, it may be stated that Cholera is essentially produced by a peculiar poison, the exact nature of which is not yet fully demonstrated; that this poison is aided in its production and diffusion by certain local conditions, the chief of which is filth; that the action of this poison in the system is promoted by the presence in the blood of decomposing organic materials; that the effects of the poison are early manifested upon the ganglionic or organic system of nerves; that very generally, among the earliest and most important morbid effects which the paralyzed and deranged condition of the nervous force produces, are congestion and irritation of the mucous membrane of the alimentary canal, and profuse exhalations from its surface, leading to a watery diarrhœa, and at length to violent vomiting and purging of a nearly transparent fluid; that losses of the fluid portions of the blood, together with the retention of certain excrementitious matters, aided probably by the direct action of the peculiar cholera poison, so change the physical, chemical, and vital conditions of that fluid and of the tissues, as to produce spasms of vessels, and cramps of various muscles; to produce obstructed circulation and respiration, and finally collapse and death. That occasionally, though very rarely, the cholera poison effects such changes in the blood, and in the actions of the nervous system, as to suspend the necessary life functions and cause speedy death without the loss of fluids; but that such cases are so few and exceptional as to afford no basis for a rule of practice in the ordinary forms of the disease.

However unsatisfactory these views of the pathology of Cholera may be, they are at present, perhaps, the best we can express, and at any rate are such as our limited knowledge on the subject enables us to present. It is hoped that

the present prevalence of the disease in southern Europe, and the improved methods of investigation now in vogue, may throw additional light upon the obscurities of the subject; but the investigations should extend beyond the mere search for pathogenic micro-organisms, however important that search may be, if we are to learn all that may be known respecting this disease. The phenomena in the spread and course of the disease, without and within the system, should not be overlooked, as at present they seem to be, in the eagerness of the search for the specific cause.

CHAPTER III.

THE DIAGNOSIS, PROGNOSIS, AND PROPHYLAXIS OF CHOLERA.

The diagnosis of Cholera, when the disease is prevailing as an epidemic, when it has evidently been imported and is carrying off its victims in multitudes, affords no difficulty even to intelligent non-professional persons. When it presents itself in isolated cases, or is the first in a locality, there may be serious difficulties in distinguishing it, and mistakes have been made even by able and experienced physicians.

The conditions with which it is most likely to be confounded are *Cholera Morbus*, or what is called among British writers English Cholera; the vomiting and purging which sometimes accompanies Malarial Fevers; Cholera Infantum in children; the action of acrid or narcotico-acrid poisons; and the specific cholera diarrhœa may readily be confounded with common summer diarrhœas, which sometimes prevail as local epidemics.

The clinical distinction between some cases of Cholera Morbus and Asiatic Cholera can only be made with certainty by the history of the prevalence of the disease, by the results of treatment in more than one case, and by the extent of the asphyxiated condition in proportion to the amount of discharges that occurs. In Cholera Morbus, though the discharges are usually tinged with bile, they are

by no means always so—often, indeed, they are serous and nearly transparent—are as much so, and as abundant as in most cases of Asiatic Cholera. The coldness, the sweats, the cramps, the "washer-woman's" condition of the hands, the thirst, and the depression may be exceedingly similar; but the blueness is not as profound, the indifference to results is not as great, and proper treatment is much more sure to procure relief. In both diseases, if the discharges are arrested, and the collapse is not too profound, the recovery may be speedy. Even after decided collapse, a genuine cholera patient may soon recover. "I have seen," says an experienced writer, "a man stand in his door on Wednesday, who on Monday was in perfect collapse;" and I have myself seen in numerous cases patients who had approached the condition of profound collapse, in two or three days resume their ordinary labor. A common case of Cholera Morbus would scarcely recover sooner. Even on *post mortem* examination the distinction could not certainly be made, unless comma-shaped bacteria are always present in genuine Asiatic Cholera and are not present in any other disease. The fact that in the last appearance of Cholera in the Mississippi Valley, prominent physicians on the ground were for a long time divided in opinion as to its genuineness, illustrates the difficulty of a positive diagnosis from the symptoms. Still, the occurrence of a number of cases with the history of its introduction will enable the diagnosis to be made with sufficient certainty.

In some cases of vomiting and purging in malarial fevers the symptoms more nearly resemble those of Cholera than do the symptoms of ordinary cholera morbus. If occurring, as is usual, near the time of the chill, the blueness is greater and the collapse more speedy, and the result more likely to be fatal than in the last named disease. But

these cases more readily yield to treatment, as a rule, than cases of Asiatic Cholera; and the more marked periodicity manifested in the preceding and succeeding history, and the character of other cases occurring in the same locality, will usually leave the diagnosis satisfactory.

I should here state, and emphasize the fact that, in the year 1554 in Chicago, a degree of malarial influence was prevailing at the same time with the cholera poison, and that the two influences were manifested together in many cases of disease. An attack of *ague* would often bring on genuine cholera symptoms which were almost certain to prove fatal without the most prompt anti-malarial treatment. An attack of Cholera with the usual symptoms, if arrested, would be followed the next day, or the day after, with another attack, unless an anti-malarial remedy was freely given in the mean time. In these cases a diagnosis might be obscure. This matter will be referred to again when we come to the subject of treatment.

Cholera Infantum is to be distinguished from the Cholera, by the subjects it attacks, by its being confined to the heated season and mostly to cities, by its being more protracted in most cases, and by the special character of the symptoms—less blueness, etc. The absence of the same form of disease in adults and the history of its prevalence will aid in making the distinction clear.

Cases of mineral poisoning have been confounded with Cholera by experienced physicians. But the sporadic occurrence, the greater pain in the stomach and bowels, the account of the taking of a suspicious substance, and a chemical examination of the vomited matters, or of the stomach in fatal cases, together with the peculiarity of symptoms, will determine the diagnosis. The symptoms of the Cholera Diarrhœa are so similar to some forms of

non-specific or ordinary diarrhœa that a positive diagnosis is often difficult. The discharges in the former are usually more watery, and are less painful than in the latter; but when a watery diarrhœa occurs during the prevalence of Cholera in the locality, it should be regarded as specific in character, and receive attention accordingly. It is not safe to allow such a diarrhœa to continue, even for the shortest time, whatever may be thought to be its cause or character. Immediate treatment is demanded. A diarrhœa induced by irritating ingesta, by taking cold, or by whatever means, when the cholera poison is present, is very apt, if not arrested by treatment, to result in a full development of the Cholera.

The general *prognosis* in a full attack of Asiatic Cholera is very grave. The mortality varies in different epidemics, in different special localities, and as it occurs in different classes of patients; but, as a general fact where large numbers are taken into the account, about one-half, or rather more, of those who have the active vomiting and purging, die, unless early and efficiently treated.

The prognosis in individual cases will be varied by the severity of the attack, the age, previous condition and power of endurance of the patients, and very largely by the stage of the disease in which treatment is commenced, and the method of treatment employed, and especially by the promptness and faithfulness with which the best method is carried out. When the stage of collapse has occurred, only a very small proportion recover; and yet occasional recoveries take place, even after all efforts at restoration cease. One who has a large experience with the disease and its treatment will judge with a degree of accuracy of the prospects of a patient seen, but it is impossible to convey to others in words the full grounds for such judgment. The

activity of the vomiting and purging, the blueness of the surface, the general expression of the countenance, the failure of the pulse, the time the disease has continued, and the rapidity with which it is hurried on from one stage to another, are the most important conditions on which to base a prognosis.

THE PREVENTION OF THE OCCURRENCE AND SPREAD OF CHOLERA.

The *prophylaxis* in an infectious disease, fatal in so large a proportion of the cases attacked as is Cholera, becomes a matter of supreme importance. This of course consists in the avoidance and removal of its causes; and the principles concerned have been foreshadowed in the discussion of its etiology. As the infection has been brought over long spaces chiefly by marine vessels, and has invariably, it is confidently believed, been brought to this country by ships, the question of quarantine seems first to present itself. The usual, or at least the frequent, inefficiency of quarantine regulations has caused many in the past to regard them as comparatively, if not absolutely, useless. That on land a strict and efficient quarantine is impracticable is conceded by most observers. I have already stated that, in my opinion, to render quarantine regulations in sea going vessels certainly effectual, ships from a port or a region where Cholera prevails must be entirely excluded, whether Cholera or cholera diarrhœa has appeared on board or not. The position which, by the history of the disease and my own observations, I have been forced to take, that the Cholera germs are not exclusively, or chiefly, multiplied in the intestines or other parts of the human body, nor exclusively in the soil, or the water, but that they may multiply in the organic matter in the air, in

the hold of a ship, and in various fomites, and that they may be carried to considerable distances, I fear long distances, by currents of air as well as by personal intercommunication, leads naturally to the conclusions that ships from infected regions must be excluded without reference to disease on board, and must be kept a long distance from the land, especially from a filthy port. This may not be practicable—I fear it is not, especially in the present state of opinion as to the manner in which the poison is communicated—and hereafter, as heretofore, I fear that marine quarantine will not exclude the disease. Even the vessels that visit the ships for the purpose of enforcing the quarantine, if they pass from such ships to the shore, may convey germs, and a single bacillus or the sporule of a bacillus may multiply in a favorable position and produce extensive disease.

Failure of quarantine regulations has occurred during the whole authentic history of Cholera. Doubtless there have been particular instances where quarantine restrictions, even imperfectly enforced, have prevented the occurrence of the disease in situations where it otherwise would have come; but, as M. Colin says, this is not known, and the failures have been so numerous that the system, as practiced, cannot be regarded as a success.

Not to mention the steady progress of the disease in its former travels from Asia to Western Europe and America, I see in a leading American medical journal of the date of September 25th, 1884, that the two countries in Europe, whose government officials, central and local, were the most prompt in proclaiming quarantine after the epidemic character of Cholera in Southern France was realized, were Italy and Spain; and not only was quarantine proclaimed in those countries, but it was enforced with all the vexa-

tious and minute restrictions of a mediæval infatuation, and that not merely against ships or travelers from infected places, but against all comers from whatever quarter.

Notwithstanding all this, the very first countries after France to develop Cholera were Italy and Spain. In Naples alone, a city about the size of Boston, 13,000 cases and 5,000 deaths have occurred within a month. The filthiness and squalor of that city is unquestionably the explanation of the great prevalence of the disease; but with all its precautions in the way of quarantine, the disease was introduced because, no doubt, the quarantine was not conducted in a proper and efficient manner. It was managed as for Plague, and in that disease it would be more effectual; and for this reason, that the Plague is a strictly contagious disease while *Cholera is not*. The plague poison is produced and multiplied in the bodies of the sick, and communicated from person to person, or by fomites from the bodies of persons, and is not multiplied in the air or carried in it to any considerable distances, while the cholera poison *is* multiplied outside of the body, as well as probably in it, and *is* carried to much greater distances in the air than is the plague poison. It is strange to me that explanations so reasonable, so much in accordance with the history of the disease and with recent, and in fact with all, experience, do not receive more attention and acceptance.

I can only repeat that quarantine, in order to be effectual, must be conducted differently from what it has been heretofore; and too much reliance must not be placed upon disinfection. The germs of Cholera are very subtle, may be very tenacious of life, and may elude the reputed germicides.

On the whole, then, quarantine, as practiced and as practicable at the present time, is unreliable; and if depended upon is delusive. I fear the same must be said of

disinfection as applied to ships and persons with the view of destroying the pathogenic germs; though *as a means of cleanliness—of arresting putrefactive changes and the multiplication of the poison—it may be of great use.* It is difficult to disinfect the atmosphere of a city or large district, and if the specific germs are multiplied in the atmosphere, as are other germs, and as I cannot doubt these are, disinfection must be uncertain.

The French Journal of Hygiene of a recent date, in an extended article, takes the ground that land quarantine is entirely useless and deceptive, and marine quarantine is uncertain and not to be relied upon. Pettenkofer, of Berlin, and many others reject it as useless. All now agree that the chief, if not the sole, reliance must be placed on hygienic measures.

I have before me directions for restricting the spread of Cholera, of the Boards of Health of a large number of states, recently issued; and the insertion of some of them, with a synopsis of the contents of others, as a practical guide from what may be regarded as authoritative sources, seems proper. At any rate, they show the present prevailing opinions on the subject of prophylaxis.

One of the best of this class of documents is that of the Board of Health of the state of Michigan, issued July, 1884, and this is given entire. An analysis and approval of this document is contained in the Journal D'Hygiene of Paris of recent date, and it has received the commendation of other hygienic authorities, and may be regarded as reflecting the common sentiment of health authorities on the subject.

To the Officers and Members of Local Boards of Health in Michigan:—

GENTLEMEN:—The increase of cholera in certain parts of Europe, the probability that it may be brought to the larger cities

of this country, and spread from them, or that by some traveler, immigrant, or returning tourist it may be brought to almost any town in this State even before it appears on the sea-board,* make timely the publication of what seem to be the best means of preventing and restricting the disease.

PROPER DIRECTION OF EFFORTS.

Asiatic cholera is not caused by anything ordinarily in this State or country, therefore efforts for its prevention or restriction should be directed especially toward the prevention of the introduction of that invisible cause of the disease which is produced in and spread by each infected person; and in case the disease shall reach your locality, to the restriction and destruction of that cause with the greatest possible haste and thoroughness. Even now, by a cleaning up of filthy places, most communities can be put in better condition to control and destroy the infection of cholera should it be introduced. But when cholera appears something must be done besides cleaning up.

WHO WILL KEEP IT OUT OF YOUR JURISDICTION?

By reason of the tide of immigration, this country is especially liable to the introduction of communicable diseases; and by reason of its exceedingly imperfect support of the National Board of Health, the National Government supplies little or no protection to the public health by means of any system of notification, inspection, disinfection, etc., such as the National Board of Health might be enabled to supply; and inasmuch as all quarantine powers in this State are vested in the local boards of health, it

* In 1873 something like this occurred. Three distinct outbreaks of cholera in widely remote parts of the United States were traced to the unpacking of personal effects of immigrants who had come to New York city on uninfected vessels exciting no suspicfon there that they carried the infection of cholera. Within thirty-six hours after they unpacked their effects, the first cases of the disease occurred. This was at Carthage, Ohio; Crow River, Minnesota; and Yankton, Dakota. Small-pox was recently brought into Wisconsin by German immigrants who came on steamer Salier, landing at Baltimore May 15, reaching Black Creek, Wis., May 19, and taken sick May 21, 1884. Small-pox has also just been introduced into Shelby county, Iowa, in a similar manner, by immigrants who came through Baltimore. Small-pox was recently brought to LeRoy, Michigan, by an immigrant who left Bremen, on steamer Weser, May 22, landed at New York June 4, reached LeRoy June 9, and was taken sick June 8, 1884.

behooves local boards of health to be prompt to act and to continue persistent in action, so far as it is possible, for the prevention of the introduction of cholera.* So little can be hoped for, however, from irregular local quarantines, that every board of health should also be prepared to restrict the disease. Newly-arrived immigrants should be under the surveillance of your health officer.

CAUSE OF THE DISEASE.

Recent microscopical and experimental researches in Egypt and Calcutta, made at the expense of the German government, by Dr. Robert Koch, one of the most successful detectives of disease-causing germs, seem to demonstrate, what general observation of the disease had already indicated, that Asiatic cholera is caused by the growth and reproduction in the body of innumerable bacilli or one-celled plants of a kind peculiar to this disease, invisible to the naked eye; that these bacilli may enter the body by the air inhaled, but are far more likely to enter by food or drink taken into the stomach; that they are present in the excreta of a person sick with cholera, and in his clothing soiled thereby, and may be on almost everything that comes in contact with his body.

PREPARATIONS TO RESIST CHOLERA.

There is probably nothing in Michigan from which cholera germs can be developed; but there are many places in which they might thrive and reproduce when once introduced from abroad.

The investigations of Dr. Koch show that the bacillus of cholera can live and reproduce its kind indefinitely in certain but not in all substances outside the body, namely, in certain alkaline but not in acid solutions; and as the normal condition of the stomach is acid, that it cannot live in the human stomach in its normal condition. The intestinal juices being normally alkaline, the bacillus can, probably, reproduce itself therein without limit whenever it can pass through the stomach. This makes it of

* Sections 1708 to 1712 inclusive, and section 1695 of the Compiled Laws of Mich., 1871, give local boards of health authority in certain manner to inspect and restrain travelers, remove infected persons, and take possession of and disinfect baggage, goods, premises, and to make regulations respecting articles capable of conveying infection. Sections 1706 and 1707 require the board of health to "make effectual provision" for the safety of the inhabitants whenever a disease which endangers the public health shall occur within its jurisdiction.

especial importance that in times of danger from cholera, the stomach should be kept in its naturally good condition.

Because of the possibility that the cholera bacillus may find lodgment and multiply in various kinds of moist filth, it is important that everything about the house, cellars, barns, premises, alleys and streets, should be cleaned up and kept dry, and as clean as possible, and that there should be a general disinfection of all places liable to become infected. Especially should privy-vaults, sewers, cess-pools, drains, and similar places, be thoroughly and often disinfected with a strong solution of copperas, which may be made acid by the addition of sulpuric acid. The cholera bacilli are said to thrive in nutritive alkaline solutions, and the contents of most privy-vaults are alkaline; hence the importance of such thorough and frequent disinfection as shall kill any of the germs which may find lodgment there.

RESTRICTION OF CHOLERA.

One of the chief means of restricting cholera is to disinfect immediately and thoroughly all the discharges from those sick with cholera, or with the premonitory diarrhœa, and to disinfect or burn at once completely all their cast-off clothing, bedding, etc.

The fecal discharges are not as infectious when first voided as they soon become, hence the importance of immediate disinfection. Thrown without disinfection into a privy-vault, cess-pool, or sewer, the fluids vomited, and especially the discharges from the bowels of a cholera patient may soon infect all its contents, and render it a source of infection to those who approach.*

All the discharges from the body,—the vomit, the discharges from the bowels, etc., should be received into vessels containing some concentrated disinfectant, such as chloride of zinc, copperas, or sulphate of zinc, to which may be added sulphuric or other mineral acid.

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*In 1873, a colored boy went to Columbia, Ky., from Lebanon, Ky., where the county fair had been held, and where cholera was then present. He suffered from diarrhœa, and used a privy which was large and full, but from which no sickness had previously been traced. He was found in a state of collapse, and died in the stable. Nearly every person who entered that privy within a few days thereafter was taken sick with cholera. Farmers who came in from the country and only visited it once were stricken with cholera. The privy was disinfected, after which no cases were traced to it.

Clothing soiled by a cholera patient, if laid aside and allowed to remain moist, soon becomes especially dangerous. It is, therefore, important that all such articles be immediately burned or placed in a strong disinfecting solution until such time as they can be burned, or boiled, washed, and dried. (Dr. Koch's experiments indicate that the bacilli of cholera are destroyed by being thoroughly dried for three hours or more.)

The diarrhœa preceding cholera is frequently painless, and there is, therefore, during the occurrence of cholera, great danger of cholera being spread by the discharges of persons yet able to travel about.* During the first stages of cholera, and especially during the initiatory diarrhœa, prompt medical treatment is important and useful, both for the benefit of the individual and as a means of checking the spread of the disease.

It has been a practice in England, and should be the practice everywhere, when a man is found sick with cholera, to learn by inquiry what privies he has visited, and at once send an officer on the back track to disinfect them. For reasons just stated, notice should at once be sent to the board of health of a locality from which a case of cholera has come.

Great care should be had to prevent the contamination of the water-supply by choleraic discharges, as by drainage into wells, springs, or other water-supply, from a privy-vault, sewer, drain, or cemetery. The use of water from a source liable to be infected with cholera excreta should be promptly stopped.

Bodies of those dead from cholera should be wrapped in a cloth wet with a zinc solution, and at once buried; the zinc solution to be made in proportions as follows: water one gallon; sulphate of zinc eight ounces; common salt four ounces.

DISINFECTION OF CLOTHING, ROOMS, ETC.

It is best to burn all articles which have been soiled by a person sick with cholera. In the glowing fire of a large furnace is a good place to burn clothing. Great care should be taken to burn quickly and thoroughly whatever is burned, and not simply warm up and spread the infection.

Articles too valuable to be destroyed should be exposed for one

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*See foot note on opposite page.

hour to a dry heat of from 240° F. to 250° F., or three hours at a temperature of 150° F., or be treated as follows:

Cotton, linen, flannels, blankets, etc., should be treated with the boiling-hot zinc solution (one-half of the strength of that mentioned in the preceding paragraph), introducing them piece by piece, securing thorough wetting and boiling for at least half an hour. Heavy woolen clothing, silks, stuffed bed-covers, beds, and other articles which cannot be treated with the zinc solution, should be hung in the room during fumigation, pockets being turned inside out, and the whole garment being thoroughly exposed. Afterward they should be hung in the open air, beaten and shaken. Carpets are best fumigated on the floor, but should afterward be removed to the open air and thoroughly beaten. In no case should the thorough disinfection of clothing, bedding, etc., be omitted.

After a death or recovery from cholera, the room in which there has been a case of cholera, whether fatal or not, should with all its contents be thoroughly disinfected by exposure for several hours to strong fumes of burning sulphur, and then it should for several hours, if possible for days, be exposed to currents of fresh air.

Because of the innumerable ways in which the infection may be scattered about the house and premises where there has been a case of cholera, the entire house and out-buildings, including cellar, wood-shed, and privy, may well be disinfected.

Rooms to be disinfected must be vacated. For a room about ten feet square, at least two pounds of sulphur should be used; for larger rooms, proportionately increased quantities, at the rate of two pounds for each one thousand cubic feet of air-space.

Close the rooms as tight as possible, place the sulphur in iron pans which will not leak, supported upon bricks, or over a sheet of zinc, set the sulphur on fire by hot coals or with the aid of a spoonful of alcohol lighted by a match, be careful not to breathe the fumes of the burning sulphur, and when certain the sulphur is burning well, leave the room, close the door, and allow the room to be closed for twenty-four hours.

Privies, cess-pools, drains, water-closets, sewers, gutters, etc., should be frequently and liberally treated with copperas solution made in the proportion of one and one-half pounds of copperas to one gallon of water.

CARE OF THOSE SICK WITH CHOLERA.

The law (section 1706, Compiled Laws of 1871) requires the local board of health to provide nurses, if necessary. There is no excuse for failure to care for those sick with cholera. They are less dangerous to the community if well cared for than if neglected. A careful nurse will frequently wash the hands in a disinfecting solution, and always avoid taking into his body with his breath, food, or drink, any dust or fluid contaminated with any of the excreta from one sick with cholera. Neither food nor drink should be taken by the nurse while in the room with a person sick with cholera. If there is possibility of the infection of the water, it should be boiled before it is drank. By proper attention to cleanliness, ventilation, disinfection of discharges, and of whatever has been in contact with the sick, and by taking proper care as regards kind of food, regular eating, rest, and sleep, and especially by guarding against taking the specific cause into the body, with his breath, food, or drink, a person in good health may nurse a cholera patient with a reasonable expectation of escaping the disease.*

LEGAL DUTIES,—PROMPT NOTICES OF OUTBREAK.

The duty of householders and of physicians to give the local board of health prompt notice of the first and of every case of a disease dangerous to the public health; and of the board of health and the health officer to take prompt measures for the restriction of the disease, have been so fully and so often set forth in circulars from the State Board of Health that they need not be repeated here in connection with so dangerous a disease as is cholera.

Notice should at once be sent, on the first appearance of cholera, to the Secretary of the State Board of Health, Lansing, Mich.

I also insert directions of the Secretary of the Michigan State Board of Health respecting Cholera and Railroads, issued August, 1884:

Cholera may be carried by a person (in his intestines), and probably by infected clothing, baggage, etc. If Cholera is introduced

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*"That cholera patients are not dangerous to their attendants has been proved in this epidemic in the Military Hospital, where not a single attendant has suffered from the slightest choleraic diarrhœa."—Port's report to Cholera Commr. for the German Empire, on the Epidemic of 1873-4 in the Garrison of Munich.

into Michigan, it will probably be by some person traveling by railroad, who may be taken sick before getting off the train. It is, therefore, important both for their own safety and for that of the public that all railroad employés shall have clear ideas of the best means of restricting Cholera.

Cholera seems to be caused by a special poison associated with a living *bacillus*, invisible to the naked eye, which, when once introduced,reproduces itself with extraordinary rapidity in the intestines of man, in nutritive alkaline solutions, in moist filth, moist clothing, etc.

To prevent cholera we must prevent the introduction into the body of the specific germ or poison. Though in a perfectly healthy stomach the germs of cholera may be killed before reaching the intestine, it is not safe to trust too much to the resisting powers of nature, because the taking in of a large number of cholera germs might cause the disease in a person in perfect health. The cause of cholera is probably destroyed by thorough and long continued drying, by great heat, and by several ordinary disinfectants. Thorough exposure to the fumes of burning sulphur will probably destroy it.

INSTRUCTIONS.

I. Everything about the premises, alleys, and streets around depots should be cleaned up and kept dry, and as clean as possible, and there should be a general disinfection of all places liable to become infected. Especially should privy vaults, cess-pools, sewers, drains, and similar places be thoroughly and often disinfected with a strong solution of copperas (one and one-half pounds of copperas to one gallon of water) which may be made acid by the addition of sulphuric acid. The cholera bacilli are said to thrive in nutritive alkaline solutions, and as the contents of most privy-vaults are alkaline, it is important that there be such thorough and frequent disinfection of privies as shall kill any of the germs which may find lodgment there. As a precaution, this should be commenced at once. By a free use of dry earth (road dust from a clay road) many dangerous places may be improved.

II. Great care should be had to prevent the use of water contaminated with choleraic discharges, or otherwise rendered impure. Such contamination may occur by soakage from privy-vaults, and in other ways too numerous to mention, and which only intelli-

gent care, both at stations and on the cars, can guard against.

III. At lunch-rooms and eating-houses care should be had to prevent contamination of food or fruits. The utmost cleanliness should be required on the part of all servants and attendants. Not only the water used for drinking and cooking, but that used in washing dishes should be from a source entirely free from suspicion.

IV. Especial care should be taken that the water carried on the cars comes from a source free from any suspicion of contamination. Water-coolers should not stand and be filled in car closets, because the air in the privy will then come constantly in contact with the water, the foul air being drawn into the cooler as the water is drawn out to be drank.

Especial care should be taken to keep closets on cars clean and dry.

V. Great attention should be paid to the bedding in sleeping cars, and to the upholstery of seats wherever there is a possibility of contamination by choleraic discharges. Such contaminated articles should at once be burned.

VI. Cars which may have become infected should at once be emptied of well passengers; and, as soon as possible, be thoroughly disinfected. As soon as emptied of passengers, an infected car should, first, while tightly closed, be exposed for several hours to the fumes of burning sulphur, using at the rate of two pounds of sulphur for each one thousand cubic feet of air space. It should afterwards be thoroughly aired, and made perfectly dry throughout.

VII. If cholera occurs here, it may be best for trunk lines to run a hospital car with each train, so that if a passenger is taken sick he may at once be removed and avoid risk to other passengers; or that all trains have cars sufficient so that one car may at any time be emptied and devoted to any persons who may be taken with cholera.

VIII. Agents and conductors should at once notify the health officer, or the local board of health,* of a case or a suspected case of cholera on a train or at a station, and should keep watch of such a person until he is placed in charge of the proper authorities. Care should be taken to learn what privies the patient may have

*There is a board of health in every city, village, and township in Michigan.

used, and where he may have used the car privy, and a suitable person should at once be sent on the back track, and notice be given by telegraph, to disinfect all discharges which may be found and all privies and privy-vaults which may have been used by him.

IX. Notice of a suspected case of cholera, and of what has been done with regard to it, should also at once be sent to the Secretary of the State Board of Health, at Lansing.

A copy of a circular addressed to local boards of health, on restriction and prevention of cholera, will be sent to any railroad officer or employé on application to the Secretary of the State Board of Health, Lansing, Mich.

HENRY B. BAKER, M. D.,
Secretary.

In the memorandum of the Board of Health of Tennessee, Dr. J. Berrien Lindsley says: "Cholera in Tennessee shows itself so little contagious, in the sense in which small-pox and scarlet fever are contagious, that, if reasonable care is taken where it is present, there is almost no risk that the disease will spread to persons who nurse or otherwise closely attend upon the sick. But Cholera has a certain peculiar infectiveness of its own, which, *where certain local conditions exist*, can operate with terrible force, and at considerable distances from the sick. It is characteristic of Cholera (and as much so in slight cases where diarrhœa is the only symptom, as of the disease in its more dreadful and alarming forms) that *all matters which the patient discharges from his stomach and bowels are infective.* Probably under ordinary circumstances the patient has no power of infecting other persons except by means of these discharges; nor any power of infecting even by them, except in so far as particles of them are enabled to taint the food, water, or air, which people consume." How does this differ from other contagions? "Thus, when a case of Cholera is imported into a place, the disease is not likely to spread,

unless in proportion as it finds, locally open to it, certain facilities for spreading by *indirect infection.*"

How can this "indirect infection" take place but by the multiplication of the poison outside of the body; and what is the proof that this poison originated exclusively in the bodies of the sick, and is chiefly, much less exclusively, contained in the discharges from the stomach and bowels? The practical conclusion from these views of the Tennessee Board of Health, (and they appear to be the *current* views of the present day in this country,) is, that all cholera discharges should at once be disinfected or destroyed. *To this practice there can certainly be no objection. It doubtless should be done, as it probably destroys one means of infection;* but if this be depended upon for arresting the disease in a locality, it will be followed by disappointment, and when so depended upon as to prevent, in any degree, the most strenuous efforts for improving the general hygienic condition of the place, such dependence will do great harm. The conditions favorable to this "indirect infection" are those which favor the multiplication of the pathogenic germs, whether in or out of the body; and the great remedy, so far as a remedy is possible, is freedom from decomposing organic matters in the body, in the water, in the soil, and in the *air.* We are thus brought to the one conclusion of all who think and write on this subject, that the removal of *filth*, the securing of *cleanliness* is the chief, and the almost exclusive, reliance in restricting the spread of Cholera.

This report very properly says: "*Measures of cleanliness taken beforehand are of far more importance for the protection of a community against Cholera, than removal or disinfection of filth after the disease has actually made its appearance.*"

When the Cholera is prevailing, prompt attention to all looseness of the bowels is urged. It is added that: "Excess in drinking, sometimes resorted to from a mistaken idea of warding off the Cholera, has exactly the opposite effect. Spirits are useless as a corrective of impure water."

"*Suggestions relative to Epidemic Cholera of the Massachusett's Board of Health,*" takes very similar ground to those documents already quoted. This publication states that: "*The discharges from the bowels are without doubt the chief source of infection;*" and of course urges their destruction or disinfection as an exceedingly important item of preventive measures.

Of the disinfectants, a solution of Bichloride of Mercury, 1 part to 1,000, is given the preference; though subjection of articles to be disinfected to a temperature of 212° F., or over, for an hour, either by boiling or baking, is advised; and the discharges from the bowels are directed to be received in saw-dust and to be burned in a hot furnace. This would be practicable only in hospital practice; and some, among them Pasteur, are of the opinion that in burning, whether of saw-dust or of linen charged with the cholera virus, particles are apt to escape combustion, or destruction by dry heat, and to be driven off in the air, to be wafted about by breezes and received into the system through the air, thus producing their poisonous effects.

In the directions issued by the Maryland Board of Health, it is stated that: "Temperance and regularity of life, in all respects, are required to be observed in a particular degree to ward off an attack of Cholera;" and that "the exciting causes of the disease are moral excitants, especially fear and anger; intemperance in the use of fermented or spirituous liquors, or in eating and overloading the stomach; acid drinks, or large draughts of cold water;

the use of crude, indigestible food, particularly vegetable, excessive exertion or fatigue in the heat of the day, exposure to the night air, sitting in currents of air, and particularly sleeping with too light covering."

I see in various accounts much said about *fear* as a cause of Cholera. That the depressing influence of that passion, especially when it has the effect, as it sometimes has, to induce a diarrhœa, operates as an accessory cause in the production of the disease, I think true; but I have no doubt that its influence has been overrated.

An oriental legend states that, "A Dervish, travelling, met the Cholera, to whom he said, where are you going?" The Cholera replied, 'I'm going to Bagdad, to kill 20,000.' Some time afterwards the same Dervish met the Cholera returning, and said, 'You vagabond, you killed 90,000.' 'No, no,' said the Cholera, 'I killed 20,000; fear killed the rest.'"

In my observation the indifferent and the careless, who felt no anxiety and took no precautions, have been swept off in greater numbers than those who were anxious and fearful, and who were thus induced to attend to the first symptoms of the disease. When the attack has actually occurred, indifference, and not anxiety or fear, is the prevailing mental state. The inhabitants of Bagdad, in the fatalism of their creed, doubtless said, "Allah rules," and yielded themselves in stoical indifference to their fate. Legends often contain a truth; but this is an exaggerated one, which is equivalent to a falsehood.

The *Memorandum concerning Cholera of the State Board of Health of New York*, says: "That for Cholera to be diffused from continent to continent over the earth, it must have three factors for its cultivation:

1. A centre of pollution for its *cradle*.
2. A ship for its *transport*.

3. A number of towns *prepared for its reception and development.*"

Of these factors the first two are not under our control. The centre of pollution in India is too far away; and the ships, it is presumed, will continue to come; and the quarantine that would be effectual and certain is impracticable. The third is the only factor we can control; and this requires the cöoperation of government, state and municipal, of Boards of Health, and of the people at large. The same conclusion from these premises is arri ved at, viz: The use of preventive sanitary measures, consisting of all means for annihilating all local conditions or factors which favor the multiplication, the spread, and the operation of the poison. The direction to householders is summed up in the following statements:

"To make careful sanitary inspection;

"To drain stagnant pools and low grounds near dwellings;

"To clean all sewers and house drains;

"To cleanse and disinfect cellars, privies and all filthy places; and

Examine and protect the purity of drinking water."

It is claimed by Prof. A. Flint, Sen., that the history of Cholera in the City of New York, in 1866 and 1867, showed that by prompt measures of disinfection, thoroughly applied, an epidemic of the disease may be "stamped out." He relates that, in anticipation of the prevalence of Cholera in 1866, the Metropolitan Board of Health, then recently organized, adopted a system of disinfection, whenever and wherever cases of the disease might occur. A disinfecting corps was organized under a discipline of a military character, and wagons loaded with disinfecting material were in readiness with horses in harness prepared to move at a moment's notice.

Cases of the disease occurred during the summer of 1866, in 362 houses more or less widely separated from each other; but in no instance did the disease extend proximately beyond the house in which a case or cases occurred.

In 1867, twenty-seven deaths from Cholera occurred in the City of New York, five in Brooklyn, and 18 at the military port in the Harbor of New York. The same measures were employed for stamping out the disease as in 1866, and with the result of preventing its general spread.

These are interesting facts of great value, and worthy to be permanently recorded and universally remembered. But yet it is impossible to know whether the disease would have extensively prevailed had not these measures been resorted to. The element of demonstration is wanting, and there is needed the evidence of the cumulative proof of more than two such instances to render conclusions positive. A limited number of cases have occurred elsewhere, where the general hygienic conditions were not unfavorable, but where the same disinfective measures were not used.

Burning soiled clothing and enveloping the premises in chlorine gas were the principal means of disinfection used.

The Circular of the State Board of Health of South Carolina, after giving general directions as to the removal of filth, etc., gives these special precautions.

"1. The avoidance of exposure to Cholera—having no fear of it will not prevent an attack.

"2. Leaving the locality as soon as the disease appears.

"3. Remaining away long after it has disappeared."

To those who cannot escape, the circular advises the usual precautions.

It says: "The *contagium* of Cholera, unlike that of eruptive fevers, Small-pox, or Scarlatina, is not propagated by personal contact. Danger does not occur from ministering

to the sick. It comes from getting a small portion of the evacuation upon the person, the hands, or the clothing, a minimum of which finds access to the bowels, through the mouth, and poisons the individual. The hands, therefore, should be carefully washed before eating or drinking."

This seems to convey the idea that the cholera poison is contained only in the discharges from cholera patients, and can produce its effects only by being swallowed. This, it cannot be too often stated, is not true—certainly not shown to be true—and the previous recommendation to leave the place when the Cholera appears would seem to be unnecessary if people would only be careful not to swallow any of these cholera discharges. The simple fact is that when Cholera is prevailing in a locality, the whole atmosphere, and often the soil and water of the place, contain the germs, and those persons who are susceptible will be affected by these germs whether they are in proximity to the cholera patients—whether they swallow particles from the evacuations, or not. On this point, Dr. Frank H. Hamilton, of New York, has, since the preceding sentences were written, expressed the following opinion which fully accords with what I have repeatedly intimated or stated: "It (the cholera poison) may be conveyed for considerable distances by the air. How far it is thus conveyed it would be impossible to say, but probably much would depend upon the force of the wind and other atmospheric conditions. * * * Those who have denied, or permitted themselves to doubt, that Cholera can be thus conveyed have, it seems to me, either been inexperienced or they have closed their eyes to the testimony which the experience of almost every epidemic supplies in such abundance."

Dr. Hamilton, from his own experience, entirely rejects the view that the germ only finds its way into the system

through the mouth and the stomach. He says, "It may be one of the modes of propagation, but that it is the sole or even principal mode has no foundation other than Koch's unproved, and to me improbable, theory that the comma-bacillus is the true germ of the Cholera."

He further says: "There is quite as much reason to believe that it is conveyed into the system by the respiratory organs, and that it diffuses itself throughout the entire body through the circulating system like any other septic infection, and that the specific symptoms and the specific cholera intestinal secretions are the results of a general systemic infection."

In the South Carolina circular the following means of disinfection are advised:

Corrosive Sublimate	60 grains.
Alcohol	1 ounce.
Aniline Green	1 grain.
Water	1 gallon.

Mix.

The green is added simply to color the solution, so as to render accident less likely to occur.

The circular of the State Board of Health of New Hampshire says: "Eternal vigilance is the price of health," and it advises the usual precautions as to cleanliness, etc.

In the Suggestions concerning Cholera of the Board of Health of Connecticut it is said: "The *Contagium* of Cholera is not repropagated outside of the body except in unsanitary localities." "Vile, filthy, undrained or unsewered tenements, filth-saturated soil from leaky drain-pipes, an atmosphere reeking with the gases of decay, soil polluted with the putrefactive compounds from garbage, kitchen slops, sink drains, *shallow, overflowing privy vaults,* (Italics mine) and the over crowded haunts of vice and crime, in which misery compels the poor also to seek

A New Work on Cholera.

"Every physician will and ought to make observations from his own experience; but he will be able to make a better judgment and juster observations by comparing what he reads and what he sees together."

Your attention is invited to a new work now ready, entitled: "A Treatise on Epidemic Cholera and Allied Diseases," by A. B. Palmer, M. D., LL. D., Professor of Pathology and Practice of Medicine in the College of Medicine and Surgery, in the University of Michigan, author of "The Science and Practice of Medicine," etc.

This publication, so timely in view of the probable visitation of Epidemic Cholera in this country, consists of a volume of about 200 pages, neatly and substantially gotten up, and bound in cloth. It contains a summary of the literature on the subject brought down to the present time, including the recent investigations of Koch and others; and in it the causes, methods of prevention and treatment will be fully discussed, and definite directions will be given.

The reputation of the author as a practitioner, teacher, and writer, and his large experience in Cholera during three seasons of its prevalence in Chicago, is a guarantee of the character of the work.

In order to render it readily accessible to all who may desire it, the price has been put down to One Dollar, and for this sum it will be sent by mail, postage paid, to any address in the United States or Canada.

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EPIDEMIC CHOLERA.

THE AUTHOR'S PREFACE.

In the preparation of this work on Epidemic Cholera, the object has been to collect and present in an acceptable form an account of the more important facts observed, the investigations made, and the more authoritative opinions expressed respecting the disease from the earliest authentic history up to the present time.

So much of its history has been referred to as was judged sufficient to illustrate its general character and the method of its spread, and to give an idea of its causes, essential and accessory; and a fuller account has been given of the means of its prevention, and the principles and details of its treatment.

In the attempt to accomplish these objects many sources of information have been sought and consulted, embracing treatises, articles in medical periodicals, the reports of investigators, of sanitary authorities, and of Boards of Health. In these publications a variety of views have been met with upon almost every point, and those views have been recorded whose authors, from their investigations, their experience, or their high professional character, were thought to be entitled to express opinions.

Not only the results of the recent investigations of Koch, of Emmerich, of Kline, and of many others have been given, but the observations and opinions of those who have encountered the disease in its home in Asia, and as it has appeared in its several migrations over Europe and this Continent. The views of various members of the profession of the present time and our own country have been given, of men who have followed the literature of the subject and whose reputation as physicians, medical teachers and writers, entitled them to be heard.

My own attention has been given to the subject for many years, and my experience with the disease has extended through three cholera seasons in Chicago. During those three seasons, and especially during the summers of 1852 and 1854, a very large number of cases came under my care in public and private practice, and thus an opportunity has been afforded for the formation of opinions from my own observations as well as from those of others, and these opinions I have not failed to express.

On the subject of treatment I have felt entitled to speak with confidence, and it has certainly been with deliberation, and I have not hesitated to use some of the language of my own previous publications when it best expressed my present views.

I have added a more brief account of some of the Diseases Allied to Epidemic Cholera, including Summer Diarrhœas, Cholera Morbus, and Cholera Infantum, diseases of great importance from their yearly visitations and their fatality among children.

Although this work is intended for the Medical Profession, it has been written in language which will make it intelligible, at least in all matters of history and prevention, to the general reader.

That the present time, when there is so much prospect of an early visitation of Cholera to this country, affords an appropriate occasion for the presentation of a work of this kind, is apparent.

A. B. P.

University of Michigan,
Ann Arbor, July, 1885.

shelter, furnish in the most inviting form the essential conditions for the repropagation of the *Contagium* of Cholera. Less aggravated instances of unsanitary conditions are proportionately dangerous. A warm, moist atmosphere, into which putrefying organic matter is discharging the gases of decay, is favorable to the development of the germs of Cholera. The water from wells polluted by filth from closely adjacent vaults or drains, and also water from other sources defiled by sewerage, if in addition it be infected by the specific contagion of Cholera, has long been recognized as one of the most active agents in the spread of the disease. Impure water prepares the system for the reception of Cholera and renders it less able to resist its course." It might be well to add to this last sentence what doubtless was in the mind of the author, that impure water, by introducing decomposing matter into the system, furnishes a nidus for the action of the specific poison, however introduced into it, whether the foul water contains the specific germs or not. Scarcely any statement could be more true, nor could the truth be more appropriately expressed than in this quotation from the paper of the Connecticut Board of Health, written, it is presumed, by the secretary, the lamented Dr. Chamberlain.

There is nothing worse than the "shallow, overflowing privy-vaults," generally of the poor, polluting the soil, unless it be deep, cemented privy-vaults, generally of the rich, the receptacles of excreta for years, polluting the air. When these deep privy-vaults have their walls of mason work and cement, and are kept tight, (which, however, is seldom the case) there is no escape of the chronic putrefaction but into the air; and when the privy is under the same roof with the dwelling, or connected with it by sheds or a corridor, this vileness escapes into the atmosphere daily and nightly, is

breathed by the inmates, and is there as a vehicle for disease germs, or to invite the presence and favor the action of such germs. In time the impression upon the senses is blunted by use, and the family go on, it may be, in contentment as well as in filth. If there is no masonry or cement in the vault, or if the cemented walls be cracked, the same chronic putrefaction has years before it to soak through into an adjoining well or water course; and when a route is established, disease germs as well as foulness may readily pass into the drinking water of a family or a neighborhood. That these abominations of our domestic life, and in villages and smaller towns and country situations of our highest civilized life, have not attracted more attention and called forth more vigorous condemnation among sanitarians and all people of decent lives and common sense, has long been to me a matter of surprise.

But that this subject is receiving attention from some quarters the following extract, found in a foot note in the recently issued circular on the prevention and restriction of Cholera, of the Iowa State Board of Health, shows: "Sir Robert Rowlinson, writing recently in the Pall Mall Gazette on the seed beds of Cholera, says the following of privy vaults: "As to the most fruitful seed beds of Cholera, strange as it may appear, these are not found in the apparently most dirty places—as, for instance, where there is not a single common privy, and human excrement is visible over the surface—but rather in towns having common privies and cess-pits crowded among cottages in which cess-pit refuse is stored weeks, months and years. These foul places are the true seed beds for Cholera, and woe be to the inhabitants of towns and villages so encumbered, if Cholera be introduced, for it will rage as fire rages among heaps of dry combustibles."

Sir Robert Rowlinson says, "strange as it may appear," this is the case. But it does not appear strange to me at all. It is the most natural thing in the world that it should be so, from the nature of the case. It has long been believed that fermenting, decomposing, human excrement is the most common lodgment of the germs of Typhoid Fever, and the most frequent source of that disease; yet in China where such excrement is left upon the surface for certain periods, and is everywhere visible in their towns, however offensive and disgusting to the sight, it is not as much so to the smell as are the contents of the hidden privy vaults; and as a proof of the less noxiousness of the open exposure, it should be mentioned that among the dense Chinese population Typhoid Fever is comparatively rare. Both common sense and medical history show that what Sir Robert Rowlinson says is true.

The importance of cleansing privy vaults is stated in all the documents from the State Boards of Health, but no report examined, except that from Iowa, has referred especially to deep vaults, and in none has the difficulty of cleaning out such vaults been mentioned, and, further, in none has a word been said in denunciation of the abominable system. Thanks are due to the writer in the Pall Mall Gazette for calling attention so forcibly to the subject; and to the Iowa Board of Health thanks are due for quoting the statement, though in a foot note. The whole system of deep privy vaults should be abolished entirely. A box should be prepared and placed, not beneath the surface, but the privy structure should be elevated and the box placed above ground, and the exuvia should have thrown upon it from time to time, daily if used by many persons, sufficient dry earth to absorb all offensiveness, and mechanically and chemically to mingle with and render inoffensive

the fecal matter. Coal ashes will do, but not as well as dry, pulverized, clayey-loam. Such a privy will undoubtedly require some care, though comparatively very little, and it can at any time be cleaned out with scarcely any disagreeableness to the sight or smell. The compound is ready to be returned to the soil as a harmless and inoffensive manure, supplying material for the sustenance of vegetable life. Health, life, and the economies of the soil demand the adoption of this plan. By returning this organic matter soon to the soil, though in an offensive form, the immense population of China has been sustained, while all other ancient countries adopting other systems, sending into the sea or giving to the winds these matters, have exhausted their soil and gone to decay. In agriculture it is perfectly well known, that when organic and mineral matter is continually taken from the soil by crops and nothing is returned, the exhaustion of that soil is only a question of time. With our farmers the return is chiefly from the excrement of cattle. When the abounding life of a country is of human beings rather than of brutes, the human residua must be returned to the soil or barrenness and ruin will follow. But this subject is urged here in reference to the prevention of Cholera. The foulness and dangers communicated to dwellings and neighborhoods by these privies, constitute them the most decided nuisances of our town, village, and country life.

Dr. J. H. Rauch, in a recent address presented to the conference of the State Boards of Health, says: "It is simply nonsense to talk about relying upon sanitary measures alone to combat a disease like Cholera." Of course he favors all local sanitary measures in reference to the prevention and diminution of Cholera and all other epidemic diseases, but urges very strongly in addition quarantine

measures. He thinks Asiatic Cholera is "pre-eminently a quarantinable disease," and that America, from its separation from the other continent by a wide ocean, and from its less age and accumulation of filth, is a country favorable to the success of quarantine regulations.

One of the most authoritative reports on the prevention of Epidemic Cholera in America was adopted and issued by the American Public Health Association and the conference of the State Boards of Health at their meetings in St. Louis, Mo., in October, 1884.

This report states that "there are three essential factors to the prevalence of Cholera in this country as an epidemic,—(1) The importation of the disease by means of ships more or less directly from its only place of origin in India; (2) Local unsanitary conditions favorable to the reception and development of the disease; (3) Persons sick with the disease in some of its stages, or things infected by such sick persons, to carry it from place to place. These three factors naturally suggest the methods of combatting the disease for which there is needed practical work—international, national, and inter-state, state and local."

But little confidence is expressed in inland quarantine when Cholera is introduced into a country, although efforts in this direction are thought advisable.

It is recommended that the general government maintain, while the importation of the disease is threatened, a national Health service, such as shall by rigid inspection at the port of embarkation, question and determine as to freedom from disease and infection of all persons and things from infected districts, and shall secure the surveillance of such persons and things while on shipboard, and, when necessary, detention at quarantine stations on this side for treatment and disinfection.

It is advised that officers be sent to infected regions abroad, whose duty it shall be to give notice, by telegraph when practicable, of the existence or appearance of the disease to some constituted authority of this country, and to give notice of the departure for any port in the United States of any vessel known to be, or suspected of being, infected. The central authority receiving such notice shall at once transmit it to all state and local health authorities in the places interested.

These means, it is thought, will delay and lesson the chances of invasion, but may not prevent it. In case the invasion occurs, it is advised that Congress appropriate money to aid the State and local boards of health in "stamping out" the disease.

This report makes the statement that "the cause of Cholera is contained in the discharges from persons affected by the disease, or in things infected by such discharges."

Based upon this assumption, isolation of individual cases and isolation of places where the disease exists are advised, and a system of inland quarantine, of inspection and disinfection of persons and effects, vehicles, etc., is recommended. Isolation hospitals are recommended to be erected by local boards of health, etc.

These means may be of service in lessening the chances of the introduction and spread of the disease, and are worthy of respectful consideration; but all means yet tried have hitherto failed to be effectual.

In my judgment, experience proves that the poison of Cholera is not confined to the discharges from the intestines of cholera patients, and its propagation is not limited to the swallowing of such discharges; and any practical deductions based upon the assumption of such exclusive notions must be defective.

More can be done to prevent the occurrence and spread of Cholera by local sanitation, by the removal of filth of every kind, by securing pure air, pure water, and wholesome food, than by efforts at inland quarantine or even the "stamping out" by disinfection.

Work for local sanitation should be done, while that for quarantine and disinfection should not be left undone. Local sanitation, cleanliness, temperance, and regularity are the "weightier matters of the law," while quarantine, isolation, and disinfection, though by no means the "mint and cummin," are of less importance in practical health preservation.

The official advice of the hygienic authorities of France and Germany, for the prevention of Cholera, does not differ materially from that of the other countries from which we have quoted, but individual opinions differ in some particulars among those of high authority in the profession.

Professor Grisolle is of the opinion that quarantine regulations and disinfecting fumigations are useless.

M. Colin agrees as to the inefficiency of quarantine cordons, but favors the doctrine of contagion; and, while stating that the means of transmission are numerous, he thinks the disease communicable through the discharges from the intestines, as well by those of the preliminary diarrhœa, as by those of the fully developed disease.

The French Journal of Hygiene advises the burning of the discharges as soon as possible, and approves of the recommendation of the Michigan Board of Health, given on preceding pages in full.

The official directions of the Consulting Committee of Hygiene of France advise isolation as far as practicable, but think it effectual only where a sea intervenes, and then only in case of an island, where all intercommunication

can be prevented. The disinfection of travelers is declared ineffectual and impracticable. Heat is thought the most effectual for clothing; but persons must be retained a long time in quarantine in order to make them safe from carrying the disease, and this is thought to be impracticable as not being submitted to unless the disease is actually present in the persons retained.

The public local measures of prevention advised are similar to those given by others—cleanliness being the burthen of the directions.

The individual and private measures of prevention are similar to those which have been given from others. All wholesome personal rules of living should be strictly observed. Calmness of mind, avoidance of over fatigue and prolonged watching with the sick; prolonged baths; chilling the body; sleeping with too light clothing or before open windows after a heated day; large drafts of cold water; avoidance of all impure waters—boiling the water when it is suspicious, the day beforehand, and excluding it afterwards from polluting sources; the use of various table waters from distant springs; good ripe fruit in moderate quantity, and such only; taking only cooked vegetables; and avoiding all great changes in diet when that diet is ordinarily wholesome, are the chief personal recommendations. In the advice it is added that nothing is more dangerous than the taking of an unaccustomed quantity of brandy or of other alcoholic liquors. Iced drinks, if taken freely, are also condemned.

When the disease is prevailing it is strongly urged that all disturbances of digestion should receive immediate and skillful attention.

In this document it is further stated that transmission is often from the cholera discharges or the specific evacuations

from the stomach and bowels, and that the discharges may communicate the disease when the attack is mild or in the diarrhœal stage, as well as when in the severer or more fully developed forms.

Disinfectants are advised to be applied to these discharges, and Sulphate of Copper, Chloride of Lime and Chloride of Zinc are the articles preferred for this purpose. Solutions of these should be placed in the vessel before it is used. The epidemic influence is thought not to be carried for a great distance through the air, but the limits of that distance no one attempts to define.

The document finally concludes with the statement that it is "perfectly established" that the cholera germs come from the digestive tube, and are carried into the digestive organs of the victims. I must here repeat that the fact that this is the only, or even the chief, method of communication is not proved.

The following table, the result, as it is alleged, of a long and carefully conducted series of experiments by M. Miguel, (Pharm-post) showing, according to his experiments, the comparative value of various drugs which have been used as antiseptics, will doubtless be interesting to those who have occasion to use these agents. The figures represent the weight in grammes that was required of the drug to prevent decomposition of one litre of neutralized chicken broth:

	Grammes.		Grammes.
Mercuris Iodine	0.025	Chlorine	0.25
Silver Iodide	0.030	Iodine	0.25
Hydrogen Hyperoxide	0.050	Gold Chloride	0.25
Mercuriæ Chloride	0.070	Platinum Chloride	0.30
Silver Nitrate	0.080	Bromine	0.60
Osmic Acid	0.150	Iodoform	0.60
Chromic Acid	0.200	Bromoform	0.70

	Grammes.		Grammes.
Copper Chloride	0.70	Sulphur	2.00
Chloroform	0.80	Saltpetre	2.00
Copper Sulphate	0.90	Chloride of Sodium	3.00
Salicylic Acid	1.00	Phosphoric Acid	3.00
Benzoic Acid	1.10	*Carbolic* Acid	3.00
Cyanide of Potassium	1.20	Alum	4.50
Picric Acid	1.30	Tamine	4.50
Ammonium Chloride	1.40	Arsenious Acid	6.00
Zinc Chloride	1.90	Boric Acid	7.00
Thymol	2.00	Methyl Alcohol	95.00
Natro Benzine	2.60		

Napthal is worthless as an antiseptic if entirely free from phenol.—(The Cincinnati Lancet and Critic).

A committee appointed by the American Public Health Association, of which Surgeon G. M. Sternberg, U. S. Army, was chairman, has made a "Preliminary Report on Disinfection and Disinfectants," a synopsis of which may well be added, as the latest authoritative expression on this subject made in this country.

The report commences by defining *disinfectants* as agents destroying specific infectious materials, and by distinguishing them from *antiseptics* which arrest putrefactive decomposition, and from *deodorizers* which simply destroy or overcome odors. Antiseptics and deodorizers may act as disinfectants, but not necessarily, and the distinction is important to be made. As an example, Sulphate of Iron will arrest putrefactive processes, but is not thought to be efficient in destroying disease-causing germs. The same is true of several other articles. They may be useful by arresting putrefactive changes, as in connection with these disease germs are often found, and their multiplication is promoted by such changes, but the germs need to be completely destroyed, and this is done by disinfectants rather than by antiseptics. For disinfecting excreta or destroy-

ing germs in them, the committee think Chloride of Lime occupies the first place.

They recommend as their Standard Solution No. 1, *best Chloride of Lime four ounces, and soft water one gallon.* A pint of this is to be added to each discharge from the bowels or stomach in Cholera or Typhoid Fever, etc. This should be allowed to stand ten minutes before being thrown into the water closet or a vault.

Standard Solution No. 2 is made by dissolving two drams of Corrosive Sublimate, and two drams of Permanganate of Potash in a gallon of soft water. This is used in the same way as No. 1.

Standard Solution No. 3 is made by adding to one part of Labarraque's Solution, five parts of soft water. Used similarly.

A *disinfecting powder* is advised to be made by pulverizing thoroughly *one ounce of Corrosive Sublimate, with nine pounds of Plaster of Paris,* and then adding one pound of Chloride of Lime. Keep dry in a pasteboard or wooden box, and sprinkle it freely upon excreta, etc.

To cleanse the person soiled by infective discharges, Standard Solution No. 3 is advised.

To disinfect articles of clothing, it is recommended that they be plunged while in the sick room, and immediately after removal from the person or bed, into *boiling water,* or into one of the following solutions:

Standard Solution No. 4. This is made by dissolving four ounces of Corrosive Sublimate in a gallon of water. If the water be heated the solution is more ready and complete. A dram of Permanganate of Potash may be added to give the solution color. One ounce of this Standard Solution added to a gallon of water will make a proper solution for disinfecting clothing.

Any solution containing Corrosive Sublimate should not be kept in a metal vessel, but in glass, a wooden tub, or earthen crock.

Dry heat, in a properly constructed disinfecting chamber, in a hospital for instance, raised to 233F. and maintained for some hours, will be effectual in disinfecting clothing, etc.

The method of disinfecting a sick room when occupied can only be by free ventilation and cleanliness. When unoccupied, the walls may be washed in a solution made by adding four ounces of the Standard Solution No. 4 to a gallon of soft water.

Fumigation by closing the room and burning Sulphur is advised, but is thought by the committee not reliable, and the other means of disinfection are recommended to be added. Many, however, regard the Sulphur fumigation as very efficient.

In all cases as little furniture as possible should be in a sick room where there is infectious disease, and ventilation as free as possible during the sickness should be insisted upon.

For disinfecting privy vaults, free quantities of Corrosive Sublimate are recommended, the quantity to be governed by the amount of fecal matters present.

For disinfecting ingesta, boiling for at least half an hour is the most effectual. Water may be filtered on a small scale by using a tin or glass funnel, and a fresh sheet of chemist's or druggist's filtering paper. This report has received much attention and its recommendations are regarded favorably by sanitarians.

As this work is intended to give not merely individual opinions but the current views of the most enlightened and authoritative portions of the profession, I have thought it proper to refer so largely to this broad range of statements,

especially on the etiology and prophylaxis of Cholera, even at the risk of apparently unnecessary repetitions, and the sacrifice of entire unity by the presentation of opinions not entirely in accordance with my own.

There has just appeared in the August number of the *American Review*, five short but interesting articles from as many prominent physicians and sanitarians, on the question, "Can Cholera be arrested?"

While there is nothing specially new, not already discussed, in these articles, a brief synopsis of their principal statements will give an impression of others opinions at present prevalent.

The first writer, Dr. John B. Hamilton, Supervising Surgeon-General of the Marine Hospital Service of the United States, says: "It has little bearing upon the question whether or not the bacillus of Koch or of Emmerich be accepted as the true cause of Cholera, for the methods of their growth, propagation and cultivation are the same." * * "The object of all attempts at disinfection is to destroy germs, and the object of quarantine is to exclude them until the process of disinfection is complete." He refers to the fact that "every consular officer is now bound by existing regulations of the State Department of the United States to inform the Government of the existence of any contagious disease in the district to which he may be assigned; and in the event of the departure of a vessel from an infected port to any port in the Republic, he is also required to inform the local health authorities of the port of destination." This system was devised by the late Surgeon-General Woodworth, and is as complete as it now can be made. Some of its details are given, based upon positions respecting the causes of Cholera such as have been given. Dr. Hamilton says: "The practice of deten-

tion alone is a delusion and a snare," for the reason that the germs of the disease have an undefined limit of vitality, remaining active long under favorable conditions. They require to be *destroyed* by disinfection; and he refers to the method of disinfection of vessels in quarantine, proposed to be carried into effect by the board of health of the State of Louisiana. The details of this plan appear to be very thorough, but as its efficiency has not been sufficiently tested the full particulars need not be given. Persons and effects are to be disinfected by the usual methods, and the vessels are to be treated by means of a powerful tug-boat, provided with flushing hose, steam syphons, a battery of twelve furnaces for the evolvement of germicide gases (sulphurous acid gas is to be used) which are to be driven into the ship's hold by a powerful fan at the rate of six thousand feet per minute, displacing the infected atmosphere and destroying germs. Dr. Hamilton thinks if this plan is carried out with strictness it should succeed. He has less confidence in the ordinary methods of quarantine, and there is nothing peculiar in his advice as to means of arresting the spread of the disease when once introduced in a locality.

Dr. J. H. Rauch, of Ill., is the author of the next article, and the substance of his views as to the importance of quarantine has already been given. He regards the Cholera as a "foreign enemy to us," whose invasion should be prevented by international comity and strict quarantine, isolation, disinfection and sanitary measures.

The next essay is by Dr. John C. Peters, of New York, who has already been referred to as the historian of the disease. He speaks with much confidence of its always being imported into this country in ships, of the poison being in the discharges from the alimentary canal, and he

accounts for the early spread of the disease and its breaking out in isolated and distant localities in a city by the poison being in the discharges of those who have the diarrhœa without the full development of the disease—in its being spread by the ambulating cases which may not be suspected of having the specific affection. He also expresses more confidence in the prophylactic and curative effects of the mineral acids than my observation and experience have enabled me to entertain.

A solution of one pound of corrosive sublimate to 500 pounds of water is spoken of as the best disinfectant for clothing and other fabrics; and he says this disinfectant can be swallowed in quantities sufficient to "kill all the germs in the system of the patient (!)" as well as to destroy those in the clothing and discharges to which it is applied.

Dr. H. C. Wood, of Philadelphia, contributes the next article. He regards drinking water as a principal vehicle by which the Cholera germs are conveyed, and advises that all suspected water be thoroughly boiled before being used. When the disease is in a populous locality he advises all who have no other duties in life save to protect themselves, to flee to the mountains, to the wilderness, or to some isolated situation, or to go in vessels to the Northern ocean; while those who must remain should observe all sanitary rules; and he denounces the taking of brandy with water under the delusive expectation of rendering infected water harmless. He advises adding two drops or so of sulphuric acid to each tumbler of water, with the prospect of at least impairing the activity of the Cholera germs, neutralizing the lime in the water and improving the general health.

Scrupulous cleanliness and great care not to swallow any of the matter from Cholera patients are urged upon those

who come in contact with them; the speedy disinfection or destruction of all soiled articles, and free ventilation of the sick room. He says the only two disinfectants to be used for destroying the Cholera germs, are chlorinated lime and corrosive sublimate.

Dr. Charles A. Leale is the author of the last article in the *Review*. He also thinks much depends upon the drinking water, and advises that it be well boiled before being used where there is the least suspicion of its containing germs, but he says "alum is a powerful and perfectly safe water purifier," and that a small quantity may be added just before it is used.

This writer seems to have had experience with the disease in 1866, and expresses much confidence in its being controlled in sanitary homes where early and proper treatment is resorted to.

Drs. Hamilton and Peters declare their want of confidence in the inoculation practice of Dr. Ferran, of Spain, and for this reason, if no other, that one occurrence of Cholera, unlike small-pox, does not prevent subsequent attacks. Dr. Leale also expresses want of confidence in the measure, while Dr. Wood says, "more extended researches are necessary before any conclusions can be reached." The latest telegraphic intelligence from Spain at the present writing (July 20, 1885) seems to indicate the utter worthlessness of the procedure.

In all these articles the contagiousness of Cholera is assumed, and it also appears to be assumed, that the contagium is in the alimentary canal and the discharges from it, and from these is conveyed to the alimentary canal of others as a necessary condition of producing the disease.

I need not repeat that in my judgment it is not proven that this is the only source of the infection, the only mode

of its conveyance, or that the alimentary tube is the only part upon which the poison directly operates.

A few additional remarks suggested by my own experience with Cholera, and which have not appeared in the quotations from others that have preceded, will close what I have to say on the prophylaxis of this affection.

The views entertained of the mode of propagation of the disease, or of the cholera poison, and of the local character of many of the predisposing or accessory causes which give that poison its potency, and my repeated observation of the effects of such local conditions, have impressed me with the great importance of giving special attention to the particular, often very limited, localities especially affected in a city or town, and to the groups of persons among whom the disease prevails.

In such particular localities where the disease is raging, it will usually be found that many are crowded together under unfavorable hygienic conditions; and when this is the case, no pains or expense should be spared to remove instantly every such condition, and to effect a *dispersion* of the persons thus grouped. Due regard, however, must be had to the safety of others where these persons may be sent. If those who have been thus exposed to even a marked concentration of the poison are thoroughly bathed, and especially if disinfected, and have a complete change of apparel, and are in their new situations placed in clean, and well ventilated apartments, under favorable hygienic conditions, the danger to others among whom they may be placed will be exceedingly slight; and even if the persons removed should have attacks, if their discharges are disinfected or destroyed, and proper preventive measures are taken, the danger of the spreading of the disease will be reduced to a minimum, and many lives will be likely to be saved.

As there will usually be difficulty in finding places among others for persons fleeing from a locality specially infected, it would be a most wise and humane provision to have temporary buildings or tents erected in the most favorable positions in the neighborhood of an infected city, where such persons may be taken and provided for under the most rigid sanitary regulations. The propriety of such procedures, and their immense influence in arresting the progress of the disease and saving life, cannot be questioned, nor can they be too strongly insisted upon by those who act as guardians of the public health.

The influence of the use of alcoholic drinks upon the occurrence of attacks of Cholera, when the poison is prevailing, has been mentioned as unfavorable on the authority of Dr. Carpenter, and some of the papers of advice quoted have taken similar grounds. But as there is a lingering opinion among some that these drinks act as preventives to the disease, the subject seems worthy of a further statement.

The results of all modern research and of the profoundest professional reasoning respecting the physiological action of alcohol, as well as all observation everywhere of its influence upon Cholera, concur in the conclusion that so far from being a preventive to the disease, however used, it especially predisposes to attacks, and renders the cases, when occurring, more severe. It interferes with the process of respiration, favors the accumulation of effete and decomposing materials within the body, and tends to irritate the mucous membrane of the stomach and bowels. When taken in any considerable quantity, it cannot fail to irritate the nervous centres and derange the functions of organic as well as of animal life, and it has not the slightest claim to be regarded as an antidote to the cholera poison.

In the table showing the comparative power of different disinfectants it bears no comparison with other articles used as such. While the largest quantity of any of the other substances to destroy the organisms or prevent their action in a litre of broth was given as seven grammes, ninety-five grammes of alcohol were required to produce the same effect. It cannot be added to impure potable water in sufficient strength to destroy bacteria in it, or correct any form of impurity, nor can it be introduced into the alimentary canal of sufficient strength or in sufficient quantity to exert a detrimental influence upon the microbe, without affecting most seriously the human organism. Alcohol is in fact more poisonous to human beings than to microbes; and from all authority worthy of the slightest consideration, indulgence in it in ever so moderate quantities is at least useless, and its free use is disastrous.

There are no known specifics for destroying the cholera poison which can be safely taken into the system for that purpose; and all medication should be avoided unless symptoms occur. Even the acid drinks, advised by many, seem to me as likely to derange and irritate the stomach as to destroy bacteria, and very little reliance can be placed upon them. My own observation of their use, which has been quite large, has not convinced me of their utility. The system should be kept in as natural, as uniform, and as healthy a condition as possible, with the mind calm, active, and cheerful.

As a final remark on prophylaxis, reserved until now to render it more conspicuous, when Cholera is prevailing, *cathartics, especially of an active or irritating kind, should be particularly avoided.* I have repeatedly known a simple dose of Sulphate of Magnesia to produce hypercatharsis, resulting in a full development of Cholera. Should

much constipation occur, which at such times is very seldom, a simple enema might be given, and possibly a dose of castor oil; but the operation of the oil should be immediately followed by an opiate if repeated movements are threatened.

CHAPTER IV.

TREATMENT OF CHOLERA.

In discussing the treatment of Cholera the same general plan will be pursued as in the preceding chapter upon the Etiology and Prophylaxis of the disease. An historical account in very brief outline will be given of the treatment that has been pursued since the disease was recognized in the earlier part of this century; and the therapeutical views of different physicians will be referred to with occasional comments upon them; and afterwards the method of treatment which my own experience has enabled me to confide in will be described as fully as will be deemed necessary, and as explicitly and clearly as possible.

Since the present appearance of Cholera in Western Asia and in Europe, professional attention has been occupied with questions relating to the causes and prevention of the disease rather than with its treatment. This is by no means to be condemned, as prevention is always better than cure; but while the essential cause eludes scientific demonstration, and preventive measures are not completely successful, therapeutic measures cannot be overlooked by a profession, whose object is by every means to relieve suffering and save human life.

It would at first seem strange that a disease so specific in its essential course, so identical in its nature, and so uni-

form in its leading phenomena, should have been for so long a time under extensive observation and discussion without a greater uniformity of opinion and practice in its treatment. There are differences of opinion not only as to details, but as to the therapeutical principles concerned, and not only as to what should be done, but as to what should be avoided.

But notwithstanding these differences, we shall find a general concurrence among those of practical experience in the use of some of the more important agents, and I am sure the agreement would be much greater in the profession, if only those who have had sufficient experience had been the writers on the subject; if theories had been depended upon less, and facts more; and especially if, in describing the use of remedies and applying them, there had been more discrimination made as to the time or stage of the disease in which the remedies are indicated, and as to the doses, their frequency, and the manner of administration in each stage, and as to the effects to be produced in each stage and case. In other words, if, instead of saying a certain remedy or combination was useful or not useful in the disease, more particular descriptions were given of the time and manner of using it, if its advantages and dangers were pointed out in each stage and condition—the advantages to be obtained and dangers to be avoided in each case—the subject would at least have been better understood, and the principles and methods of treatment would have been more settled.

To say, for instance, that the Opium treatment in Cholera is useful, or that it has failed, or is injurious, (all these statements may be seen,) without stating anything as to the particular time and manner of its use—without stating its particular application to special cases—would con-

vey no proper idea of its virtues or its dangers; and yet it must be confessed, that the literature of the subject abounds in such and various other general and equally vague expressions, and this state of things must be taken into the account in estimating the value of testimony for or against any remedy.

The appreciation of the importance of these considerations as to medicines in general is by no means modern. In one of the ancient books attributed to Hippocrates, who is so justly regarded as the Father of Medicine, there is an extended discussion on the subject "of the time for prescribing." One of the chapters is headed: "The opportunities of prescribing are various, fleeting, and sometimes inappropriate," and a section of the work is devoted to the subject of "Incorrect judgment as to the time of action."

To no disease is such a discussion more appropriate, and to none will it apply with such force as to Cholera, especially the *fleeting* character of the opportunities, as the disease passes through its various stages in so short a time. That all these considerations should be borne in mind, not only in judging of the value of testimony as to the efficiency of different remedies, but in the proper management of cases, is too evident to require further discussion.

One of the earliest and best accounts of the treatment of Cholera published in this country is contained in a report of the College of Physicians of Philadelphia to the Board of Health of that city, prepared by Drs. John Bell and D. Francis Condie, in 1832.

These able physicians of the past generation commence the account of the treatment by this statement: "The Cholera has not been found to be less under the control of an appropriate treatment than any other disease equally

rapid in its course. When remedies of a proper kind have been administered in the early stage of the complaint and judiciously managed, a favorable termination has, in a majority of cases, been the result. The difficulty is to induce patients to apply sufficiently early for medical aid —with the loss of a few hours the chances of recovery are greatly diminished." They quote Annesley, who had experience in India, as saying: "If the disease be taken at its commencement, or within an hour after the seizure, it is as manageable as any other acute disease, but the rapidity with which it runs through its course requires the most active exertions before it can be checked, and the loss of an hour may cause the loss of a life."

These statements correspond so exactly with my experience that I refer to them with great satisfaction.

The first remedy which Drs. Bell and Condie mention, and the one the good effects of which appear to have been at the time most generally acknowledged, and the early employment of which is most insisted upon, is *blood-letting*. This may appear strange to us of these days, but we can well afford to listen to what is said on the subject: "Bleeding from the arm in the first stage, when the pulse is full, and the temperature not reduced, is often sufficient to cut short the disease. The patient always feels immediate relief, particularly when the head has been much affected. The bleeding should be performed in a horizontal position, and the patient remain quiet for some time afterwards. We are directed by Dr. Dryden to increase the flow of blood from the arm by the friction of the surface of the body with flannel cloths wrung out of hot water, or by bleeding during immersion in the warm bath."

A treatise on Cholera by Mr. Bell (G. H.), of Edinburgh, is quoted as saying: "In no case in which it has been pos-

sible to persevere in blood-letting until the blood flows freely from the veins, and its color is recovered, and the oppressed chest is relieved, will the patient die from that attack of the disease."

The patient is not to be bled to syncope, as it is stated that it is extremely difficult to induce fainting in cholera patients. The opinions of various other physicians of experience in Asia and Europe are quoted in favor of bleeding in the disease, and the authors add: "Our own experience in the epidemic in Philadelphia convinces us that it is a most valuable remedy—one we should say of paramount importance. In this opinion we believe we should be joined by a large number of our medical brethren in this city." They further say, "the absence of the pulse is no prohibition to the use of the lancet, unless it be accompanied by other symptoms of debility, and the system has been exhausted by previous evacuations," etc.

In depressed cases they advise dry heat, sinapisms, friction, etc., to precede, and they quote Dr. Le Fevre as saying, "that in some cases the pulse ceases to beat very early, but upon opening a vein the blood flows slowly at first, gradually the current becomes fuller and stronger, the pulse beats very sensibly, and the heart thus relieved is enabled to carry on the circulation."

Broussais advised leeching instead of vene-section; but Le Fevre and others prefer cupping where the latter is not resorted to.

Dry frictions, rubefacients, dry heat, blisters, vapor baths, and warm baths are mentioned, but none of them are regarded of great value, and the use of warm baths is rather discouraged.

The first internal remedy mentioned by these authors is *Opium*, and it is introduced with the remark that "no rem-

edy has been proposed in the treatment of Cholera which has so great a mass of testimony in its favor as Opium. Nearly all physicians, whatever may be their opinions of the nature of the disease, employ it in some shape, at one time or other of the disease." Some give it in very large doses, others in smaller, and Orton is quoted as saying, "that probably a single dose of Opium alone, given at the very commencement of the disease, would be found in a great majority of instances to put an effectual check to its progress." He warns, however, against an excessive use of the remedy. "When given in large doses, its secondary, perhaps its immediate, effects are an increase of that oppression of the vital powers which so strangely marks the intense degree of the disease." He, however, advises four grains for the first dose, in substance rather than tincture, and if a favorable change is not produced, in smaller doses after.

Others, it is mentioned, object to it entirely. Among these are the Polish physicians, a few of the German, and those of Warsaw and Riga.

The fact is, Opium may be very useful or seriously harmful, as we shall see hereafter, even when given in ordinary doses, and this depends upon the stage of the disease, and the quantity and the manner of its use.

Calomel is the next remedy discussed. Its common use is mentioned—the giving of enormous doses of it is discouraged, but its "judicious" administration in connection with other remedies is commended. The value of this article will be more fully discussed in due time.

Emetics are next mentioned in this report, and their use, except in the beginning, or in a late stage of the disease and under peculiar conditions, is not commended. The Mustard Emetic is spoken of as having obtained some vogue in Great Britain.

Purgatives are next considered, but their use, with the exception of that of Calomel, is condemned, at least until some time after the active symptoms are passed, and then only in particular cases.

Enemas are mentioned, but not with much favor, excepting in the later stages where soreness in the lower bowels remains, when flax-seed tea and laudanum lavements are commended.

"*Internal Stimulants*"—Ether, Brandy, Ammonia and others, in the latter stages with much depression, are suggested; but it is mentioned that at all times they require much judgment and great caution in their use.

Sub-nitrate of Bismuth is mentioned with extravagant praise by some, and disparagement by others, but without the expression of any decided opinion as to its virtues.

Saline Remedies—the Carbonates and Neutral Salts—are discussed at considerable length, and authorities are quoted as to their usefulness, especially when, before a full development of the disease, there is unusual acidity of the *primæ viæ;* but no strong testimony is given in their favor.

On the question of *Drinks* in Cholera, various opinions are quoted—some approving of and others opposing cold drinks; and similar contradictory statements are given respecting warm drinks; but as we shall hereafter see, during the active stage of the disease *any drinks* in considerable quantity will induce vomiting, and will do very little in allaying the thirst which is so extreme; but when the stomach will retain and absorb them, they are indicated for restoring to the blood the water of which so much has been lost.

The treatment of the stage of "Reaction"—the *fourth stage* or the *Cholera Fever*—is given. The principal pathological state is regarded as congestion of the liver, lungs,

and head; and topical bleeding is advised as the most successful remedy.

The debility which follows a protracted attack will, it is stated, require supporting diet and proper care of particular symptoms.

In the appendix of this report are given various returns from British regiments and various military hospitals in India, in reference to Cholera.

In the treatment of Cholera in this service, Blood letting, Opium, and Calomel, were the chief remedies.

The returns in detail are given of the 14th Regiment Hospital from the 14th to the 31st of March, 1828. There were 94 admissions with 74 recoveries and 20 deaths. A large portion of those who recovered were bled to the extent of from 14 to 26 ounces, and had Calomel in scruple doses, with laudanum in various quantities. Many had blisters to the epigastrium; and laxatives at a later period.

Dr. Burrell of the 65th Regiment returns 100 cases of Cholera. Of these 88 were bled, and of these only two died. Twelve were not bled of whom eight died. The mortality in all was ten per cent.

All these cases were soldiers who doubtless received attention very soon after the disease appeared, and such results are due to the prompt attention received. But the treatment could not have been bad on the whole, or the results would have been quite different. When left to themselves much more than half perish.

All this occurred when bleeding in all acute diseases was much in vogue—before the practice approached to that of a *lost art*,—and when the profession generally held opinions similar to those entertained to the last by the late Professor Gross, and by the great French physician, Boullaud.

While not condemning the bleeding practice, I am, how-

ever, of the opinion, that at least an equal number of cases might have been saved by the early and prompt application of other remedies, without so general a use of the lancet.

It was mentioned by Dr. Taylor, who returned 7,459 cases to whom medicine for cholera symptoms were given, quite likely embracing cases of cholera diarrhœa, where only 441 deaths occurred, or about 6 per cent., "that it was worthy of particular notice, that the greater number if not all of the deaths in the tabular returns were of patients to whom brandy had been administered."

The preceding extended statements of this report are given as specimens of the account given in the early history of Cholera in India and this country, respecting treatment. And the fact is shown that where the treatment was early and prompt, a success followed which justified the statement of Drs. Bell and Condie, in their opening remarks quoted, to the effect that the disease is much under the control of early and judicious treatment.

A brief account of the treatment advised in the leading text books, will give a fair history of professional opinion on the subject up to the present revival of cholera literature within the last two years.

Dr. Barlow of Guy's Hospital, London, in his work on the Practice of Medicine, published about 30 years ago, says, "Check the diarrhœa. This is best done by opium and astringents." "If it persists, let a grain or two of calomel and two grains of opium be given. If decided choleric symptoms set in, give half a drachm of compound chalk powder with opium, with half a drachm of sal volatile in cinnamon water; if not checked have recourse speedily to calomel and opium, repeated often or not, as may be required. When collapse is setting in withdraw the opium. When the collapse sets in we can do but little."

Dr. S. H. Dickson, then of Charleston, S. C., in his work on Practice, published forty years ago, says: "Opium I regard as of indispensable utility. In the early stage it is often found to be the only medicine required." He thinks it has lost reputation in the hands of some because: "1st, Too much was expected of it; 2d, It was misapplied." He says "It is not indicated in those attacks in which the stomach, struck torpid, fails to empty itself of its irritating and poisonous secretions. It is not sufficient of itself to remove the collapsed condition nor is it adapted to the choleric fever. But in a vast majority of ordinary invasions, it is most useful."

Calomel he also approves of in doses of from 5 to 20 grains.

Acetate of lead he advises, but oftener as an astringent enema.

Emetics he thinks useful only occasionally, and cathartics are disapproved of. He quotes Hahnemann as saying that "camphor is the true and only remedy for Cholera," but expresses no opinion as to its effects.

He mentions Sir James Murray's suggestion of placing the body in an exhausted receiver to determine to the surface in collapse as "plausible and ingenious, which amounts to dry cupping on a large scale." He speaks of Dr. Cartwrights's success in the treatment of Cholera at Natchez as unusual, which was accomplished by free doses of Calomel, Capsicum, and Camphor. To this mixture Dr. Dickson added Opium with gratifying results. When symptoms of narcotism occurred he omitted the Opium and substituted Ammonia.

Dr. Dickson regards the stupor of the latter stage as belonging to the disease rather than to the effects of narcotics.

Dr. Niemeyer, in his "Practice," advises Opium early, but when collapse approaches he regards its continuation as contra-indicated, and resorts to applications of *cold compresses* over the abdomen, and advises small and repeated drinks of ice-water; but says free drinks, especially if warm, will speedily be rejected. He speaks of the use of "stimulants" in certain advanced stages or cases, but not with much clearness or warmth.

Sir Thomas Watson, in the earlier edition of his famous "Lectures" published about forty years ago, seemed to have little confidence in any mode of treatment; but he could not judge independently of the matter, as he had seen only six cases. Three of these he saw late in the disease, and they died soon. The three others he saw early, and they recovered under the use of large doses of Calomel.

In a later edition of his work he favors the views of Dr. George Johnson, of London, who advises laxatives of Castor Oil or Rhubarb, and opposes the use of astringents. It is, however, worthy of particular notice that after the oil had passed through the alimentary canal, Dr. Johnson gave doses of Laudanum.

The views of Dr. Johnson have received favor from some, though not from many physicians in this country.

Dr. T. H. Tanner, whose work on the "Practice of Medicine" received a large share of popular favor some years ago, says of the curative treatment of Cholera: "Only three points seem certain—except during the premonitory stage, the purging is not to be checked; Opium is most injurious; and the patient is to have cold water, or soda water, and ice ad libitum." Had he omitted the words, "excepting during the premonitory stage," the advice would have been just as bad as it could be. It must be presumed

that Dr. Tanner never had any considerable experience in the disease. Doubtless more error could be compressed within as short a compass, but I have seldom seen it. But further notice will be taken of these views when the course of treatment which I shall advise is taken up.

Dr. William Aitken, in his elaborate work on the "Science and Practice of Medicine," and who speaks with some authority from his general experience in India, says: "In the treatment of Cholera there are three periods to be provided for: (1) The period of diarrhœa which so frequently precedes Cholera. This indication of intestinal lesion must be distinctly recognized as the starting-point of all other symptoms and the true source of all danger. (2) The algid period or collapse; and (3) The period of reaction."

The checking of the diarrhœa is to be aimed at, and for this purpose Opium is the most important remedy. He advises the horizontal position to be at once assumed and maintained; Opium, with or without cordials, to be at once commenced with; and that the induction of perspiration be brought about. The amount of opiate to be given must be governed by the extent of nervous prostration, the rapidity of the dejections, and the extent of vascular depletion.

He gives the following formula as well adapted to this early stage:

℞. Pulv. Opii..... grs. xii.
Camphor..... grs. xxx.
Pulv. Capsici..... grs. ix.
Spts. Vin. Rect..... q. s.
Conserve Rosar..... q. s.
Misce et divide in pil..... xii.

Repeated as required.

Even a moderate laxity of the bowels should receive treatment.

When vomiting, rice-water purging and cramps set in, it is generally then too late for Opium, he thinks. The opinions of Drs. Macpherson and Macnamara are referred to as favoring the extreme importance of Opium in the early stage of the disease.

Dr. Johnson's eliminative treatment with castor oil is referred to particularly by his pupil Dr. Macnamara, who tried it on a large scale in India, but with total failure, and final abandonment of the practice.

In the *algid* stage with vomiting, rice-water purging, and collapse, acid drinks are advised. A mixture of Dilute Sulphuric, dilute Acetic Acids, of each ♏ x v; Carbolic Acid half a drop; water an ounce and a half is advised; and Opium may be added to the first and second doses, as existing circumstances may indicate. Aromatic stimulants with opium are commended, but nothing else that is peculiar is worthy of special record in Dr. Aitken's work.

Dr. Lebert, whose writings on practical subjects are marked by such evidences of extensive knowledge and good sense as to demand attention, in his article on Cholera Asiatica, in Ziemssen's Cyclopædia, says: "Opium is the sole and only agent that has in general a real preventive character in cholera diarrhœa, and especially in the more intense and obstinate forms. Legion is the number of agents recommended; but in almost none, even the most complicated, is opium lacking."

In the full attack, especially if the opium has been resisted in checking the diarrhœa, when the stomach is filled with a large quantity of rice-water fluid, he thinks medicines can hardly develop their action, the mucous membrane not absorbing them. With ordinary medicines in common crude forms this is very true. When the vomiting and purging is frequent and copious, pills, or crude

powders of opium or anything else, are likely to be rejected, or to be mingled with so large a quantity of fluid as not to be relied upon for effects; and it is not surprising that theoretically and from experience this want of confidence in medication should be expressed. If some of these difficulties cannot be overcome the practitioners may well despair.

Clysters, Dr. Lebert says, pass off readily and are therefore next to useless.

Numerous experiments, he says, have been made with subcutaneous injections. Quinine in this way has been highly lauded, but he thinks that proofs of its efficacy are not complete. Morphine hypodermically, in doses of from a sixth to a quarter of a grain, though, as he believes, useless against the attack, allays the tormenting pains and cramps of the second half of the attack. When the discharges from the bowels begin to abate, he says they may be further checked by astringent enemas.

Some other items of symptomatic treatment are described, but none are of a marked or important character.

Dr. Bristowe of London, in his work on practice, with characteristic skepticism and medical nihilism, says, that no treatment of the premonatory diarrhœa, if it be choleric, will be of any avail in averting the disease; and when the symptoms of the fully developed disease set in all treatment is useless. Cold water should be allowed to allay thirst; and placing the patient in a warm bath, he thinks, may promote his comfort. He speaks of the temporary improvement from the injection of saline solutions into the veins, but says the patient usually sinks into collapse again and dies.

Dr. C. Macnamara, in his article in Quain's Dictionary of Medicine, advises Opium in the diarrhœal stages, mus-

tard over the abdomen, the patient to remain in bed, and ice to be given; and if the disease passes into the second stage, still give a pill containing one grain of opium and four of acetate of lead, continuing the ice as desired, but prohibiting the patient from drinking water or any other fluid beyond what he gets from the ice. Firmness on this point is described as essential. Ether may be inhaled to relieve cramps, aided by friction. After collapse, omit Opium and give Sulphuric Acid drafts.

Dr. Austin Flint, in his work on Practice, strenuously advises the Opium treatment in the earlier stages of the active disease. Morphine he regards as the most eligible form. A salt of this alkaloid is to be placed dry upon the tongue, and for an adult a grain for the first dose is seldom too much. The patient should be restricted to a very small quantity of water, lest vomiting be promoted, or small bits of ice may be given often.

In the last edition of the work the author discusses the Hypodermic use of Morphine, and says it tends strongly to arrest the vomiting, purging, and cramps, but it does not afford proof of its curative efficacy. There is not as much tolerance to large doses used in this way as by the stomach or rectum, and it must be used with care as to the dose.

In the stage of collapse large doses of Opium are to be avoided; at least deep narcotism is to be avoided. After full collapse little can be done.

Dr. Bartholow, in his volume of Practice, advises prompt attention to the diarrhœa, preferring for the purpose of checking it the following mixture.

℞. Acid, Sulphuric, Aromat., Tinct. Opii deodorat, āā ℥i. M. Ten to thirty drops in water every hour or two.

When more decided Cholera symptoms occur, hypodermic injections of Morphine and Atropine are strongly ad-

vised (1-6 grain of Morphine and 1-120 grain of Atropia.) If thirst is excessive, ice should be allowed *ad libitum*, small pieces of it to be swallowed often.

Carbonic Acid water and effervescing drafts are mentioned as useful. Other remedies for allaying vomiting are advised; the one preferred is the injection of a scruple of Chloral Hydrate in solution in a proper quantity of water, hypodermically, every hour or two. It acts best when administered with or alternated with Morphia.

Dr. Blumenthal states that Hydrate of Chloral had been used in the hospital at Riga with the effect of early arresting the vomiting and purging.

Dr. Brown-Séquard depends upon very large doses of Opium every twenty minutes until the cholera symptoms are arrested.

He thinks a good method of administration is by subcutaneous injections of morphine.

Dr. Wm. Pepper recommends the use of Bromide of Potassium in the collapse of Cholera. He advises forty-five grains in three ounces of water every twenty minutes by mouth or by enema. It is given as a wonderful quieter of irritation of the sympathetic nerves, which irritation he regards as the cause of the collapse.

The influence of the organic nervous system upon the phenomena of Cholera has long been recognized, and efforts have been made to correct its derangements in this disease.

Dr. Wood, a practitioner of Michigan, has for several years past on various occasions, in Medical Journals and elsewhere, expressed his views upon the nervous origin or the influence of the organic nervous system in the production of the cholera symptoms, and has urged on theoretical grounds the use of Bromide of Ammonium in free doses, as a cure for the disease. I am not aware that his views or

those of Dr. Pepper have had the sanction of a large experience, and it is possible that, in this as in so many other cases, what is thought to be true by an enthusiastic, if not a clear, insight has brought a large return of conjecture from a moderate investment of fact.

Dr. John Chapman has also contended that the origin and proximate cause of Diarrhœa and Cholera are to be found in the nervous system, and that their cure is to be sought through the agency of this system, and is to be effected by means of the local application of ice, and his well known ice-bags. Hyperæmia of the spinal and sympathetic nervous centres, so acting as to deprive the capillary vessels of their wonted supply of blood, he contends, is the cause of the symptoms, and he proposes to remove this by the persistent application of ice-bags along the whole spine, so long as symptoms of the disease continue.

Others have advised the sudden application of cold to the surface by affusion, or by frictions with ice, followed by warm frictions and coverings; and reaction from very depressed conditions is sometimes induced by these measures.

The foregoing references to the treatment of Cholera are deemed sufficient to give a history of its therapeutics up to the time of the revival of its literature within the past few months.

Though the recent investigations into the etiology and pathology of the disease have thrown very little light directly upon its treatment, yet speculative inquiry upon the subject has been excited and some interesting suggestions have been made.

An attempt to refer to all the suggestions that have appeared in the medical journals within the last few months on the subject of treatment would be alike unsuccessful and vain.

The statements would range from expressions of utter-nihilism and hopelessness to the opposite extreme of unquestionable confidence in almost absolute specifics. One would cure the disease by the electrical bath. Another by an emetic of thirty grains of Ipecacuanha, and two grains of Tartrate of Antimony, followed by free draughts of hot water, and that by a dose of Castor oil. Another would use hypodermic injections of Ether, another of Fowler's solution with Morphine; another would depend upon a compound of Chloral Hydrate, Soda Bicarbonate, Comp. Camphor Tinct., Capsicum Tinct., and Hydrocyanic Acid, by the mouth, together with Chloral by Enema.

Another, whose conclusions are said to be based upon "carefully conducted and successful experiments," declares that "the only remedy found to do any good was the inhalation of the fumes of Nitrous Acid mixed with air."

Another would instantly stop the vomiting and purging by applying a blistering fluid over the course of the right pneumogastric nerve in the cervical region—painting in the hollow behind the ear down to the angle of the jaw.

Another would give small, repeated, and persistent doses of Permanganate of Potash. The Permanganate is to be given in solution, of the strength of one grain of the pure salt in four ounces of distilled water, in doses of a teaspoonful every ten minutes by the watch. While another would give his patients no medicines and let them run their chance, as he did in a body of troops under his charge where sixty per cent. died. This was probably about the number that would have succumbed had he treated them with medicine in which he had no confidence, and which he therefore would have applied in a routine and unskillful manner.

In India, a five grain pill, composed of one part of Opium,

two of Asafœtida and three of Black Pepper, for the Cholera Diarrhœa and the early stage of the more active disease, has had great popularity—was ordered kept on hand in the regiments by Surgeon Gen. John Murray—and is thought to have saved many lives. Horner's Anti-Cholera Mixture has had great popularity. It is as follows:

℞. Chloroform, Tinct. Opii, Spts. Camphor, Aromatic Spts. Ammonia āā f. ʒiss, Creosote gtts iij, Ol. of Cinnamon gtts vij, Spts Vini Gall. f. ʒij. M. Dose ten to twenty drops in ice water every five minutes.

These must suffice as specimens of the various articles and modes of treatment that have recently been advised and suggested.

From the foregoing account of therapeutical measures in Cholera it will be inferred that no definite and positive course of treatment has been settled upon in the general mind of the profession.

Taking this in connection with the fact that statistics upon a large scale, however it may have been where more limited numbers under special care are concerned, show that from the earliest period of its authentic history until the present time, as patients are generally seen and managed, from forty-five to sixty per cent. of fully developed Cholera attacks have proved fatal, we might infer that there is little power, or at least little choice, in remedies.

On the other hand, particular statistics seem to show that there is both power and choice in remedies; and such statistics are sufficiently numerous and are on a sufficient scale to give them weight.

It can scarcely be doubted, from the recorded facts and opinions given, notwithstanding the opposing views of medical nihilists, that the cholera diarrhœa, which is admitted to be included in the specific disease, is capable

of being arrested in a large majority of cases; and opium, in some form or combination, has too much practical authority in its favor, and too much of the results of experience is reported, to justify its being ignored or condemned.

It is equally certain in my own mind that, in the early stage of the active vomiting and purging, where a full development of real Cholera has occurred, prompt and judicious treatment has very great influence in controlling results; and my convictions, based upon the observation of about two thousand cases during three epidemic seasons, are very positive to the effect, that there are few diseases more susceptible of being influenced in their final consequences as to life or death by treatment than Asiatic Cholera; and that there are very few where the services of a prompt and skillful physician, with the necessary qualifications of faith, courage, and energy, can be made more useful.

Most other acute diseases with which we meet will, in a large proportion of cases, terminate favorably if left to themselves, uninfluenced by medication. This is not the case with Cholera. More than one-half who are attacked will die under the most favorable hygienic circumstances and with good nursing; and among the poor and ignorant, in the class under more unfavorable hygienic influences—in the class in which the disease more particularly prevails—an enormous percentage will die without medical treatment. The most favorable statistics with which I am acquainted where no medicines were used, were those already referred to, occurring in barracks where rest and quiet could be immediately enforced, where good nursing was secured, and where sixty per cent. of deaths resulted. Wherever, then, under treatment with considerable numbers, a large proportion of cases recover after a full attack

of the disease, decided effects must be attributed to the treatment. That such has been the case is within my knowledge, and upon this is based my belief of the influence of medication. This belief is confirmed by the further observed facts, that in other cases similarily situated, in the same class of persons, in the same neighborhood, and occurring at the same time, in which cases timely and proper treatment was not applied, the disease proved fatal in nearly every instance. These experiences have been repeated too many times to leave a lingering doubt in my mind.

I am fully aware that these statements may be regarded as of a very radical character, and that many will not only question them but will not believe their correctness. But I am encouraged to state my convictions of the general curability of the disease, when I see it reported in the early history of the Cholera in India that out of 94 cases of the genuine disease admitted to the Fourteenth British Regiment Cholera Hospital, 74 recovered and 20 died; and in the sixty-fifth regiment out of 100, only 10 died; and when Dr. Taylor, surgeon in the same service, returned 7,459 cases treated for Cholera with only 441 deaths, or about six per cent., and that, too, under treatment the usefulness of some items of which may be questioned, and which the skeptics would probably denounce as injurious. In the whole history of the disease, 7,018 out of 7,459 cases, even including in them cholera diarrhœa, never recovered without medical treatment.

All these cases, it is presumed from their occurrence among soldiers under strict observation and discipline, were treated early and attended carefully; and these are conditions which I insist upon as necessary to success.

The plan of treatment which I shall advise is not claimed

to be strikingly novel or peculiar. All the remedies prescribed have been used by others, and no new principle of either pathology or therapeutics is pretended to have been discovered. There is no pretention of a specific. All that is claimed is success in the prompt application of familiar remedies to the indications presented in the different stages and conditions of the disease. The particular form and combination in which some of the remedies are to be used, the extent to which their effects are to be carried, and the importance and manner of counteracting effects which may be detrimental to some conditions, though useful and important to others, may present some features not always recognized.

The disease passes through its different stages in so short a time, and different features present themselves in such quick succession, that whoever treats Cholera most successfully must be on the alert, and must judge from experience in similar cases of the significance of the symptoms observed, the manner of meeting them, and the means of anticipating others; in short, he must use his best intelligence, judgment, and diligence in adapting his treatment to each particular case.

There is no little dffiiculty in describing the treatment adapted to any acute disease which rapidly changes its aspects; and particularly is there difficulty in giving a clear, discriminative, and intelligible description of the varying treatment in Cholera. Indeed, in the details of proper management, so much depends upon the peculiarities any particular case may present, the different degrees of rapidity with which it may pass through its different stages, the constitutional and other special conditions of the patient in various respects, the different manner in which remedies may be borne, the special impression upon various organs

and functions which may be produced by them, etc.—so much of the appearances of the patient from which we form conclusions, can be learned only by experience—and in the doses and timing of medicines so much must be left to the judgment, that a full and correct representation of the best treatment with all its adaptations, cannot be made without illustrations.

As the best means, however, of approximating to such a representation, I shall first express some general views of indications and the means of fulfilling them, based upon pathological and therapeutical principles, and afterward attempt a more minute and specific account of the manner in which I would apply these principles—of the special mode of procedure in the treatment of cases.

It is to be regretted that recent investigations as to the essential cause and the pathology of Cholera, however valuable they may prove in the end, have failed to throw any particular light upon the treatment of the disease. Admitting that the comma-bacillus is the cause of Cholera, we are not informed how it may be destroyed in the system, or how its effects may be directly neutralized. Neither has any material light been thrown upon the special changes that take place, producing the phenomena. We are left to uncertain inferences from what we know or conjecture of general physiological and pathological principles; and in treatment, though we may receive some suggestions from these principles, we are left to the guidance of *experience*, which here as elsewhere, if limited and not well guarded against false inferences, may prove fallacious. Still, as has been observed by another, the teachings of old experience are more to be relied upon, both as to prevention and cure, than any of the revelations of the present.

In the absence of such a positive pathology as reveals

clearly the nature and succession of the essential morbid actions, and points unerringly to all the proper remedies, in the absence also of ascertained specifics, the attention of the physician should rest upon such morbid conditions as he believes to be present, and his efforts should be directed to the correction or removal of such conditions; and if the primary or essential diseased condition, and the means for directly removing it evade his knowledge or power, he must direct his efforts to the correction or removal of the obvious disturbances of the functions; and thus, by putting the system as nearly as possible in its normal condition, prepare it to endure the shock of the morbid cause, and assist it by every possible means, as a sailor would a disabled ship, to weather the storm.

It has already been stated that the cause of Cholera makes an early and decided impression upon the ganglionic system of nerves—those nerves presiding over the respiratory, circulatory, secretory, and assimilative functions; and that as a consequence these functions are, each in its peculiar mode, and all more or less seriously, disturbed. The stomach and bowels are generally the seat of such decided irritation, and the source of such peculiar and profuse discharges, that they are regarded by many who have written upon the subject as points of a primary and principal morbid impression. But whether the impression upon the mucous membrane is entirely primary, or whether, as I believe, these morbid phenomena are largely the results of the impressions upon the nerves of organic life, the symptoms themselves are of the greatest importance; and in a large majority of instances require first, and most imperatively, the attention of the physician; for, whatever may be said by those who have studied this subject in the closet rather than at the bedside, if this irritation be not allayed

and these discharges be not controlled, neither nourishments nor medicines are retained in the system, the patient is soon deprived of a large part of the fluid portions of his blood, the remainder becoming unfit for its uses, and he is soon exhausted, and often speedily carried beyond the reach even of hope.

It must, however, be borne in mind that this irritation and these discharges are not the sole causes of the depression and collapse—in fact that in some of the most rapidly fatal cases no evacuations occur—and that diminished circulation, diminished respiration, diminished external animal heat, and diminished glandular secretions (of the liver and kidneys) are more constant symptoms than profuse evacuations, and therefore, in the treatment, other conditions than the vomiting and purging are entitled to constant attention.

In this view of the subject there appears to be an indication to correct the morbid state of the organic nervous system; and to correct the action of those organs whose natural functions have been perverted, whether from the direct impressions upon them, as from the alleged presence of the comma-bacillus in the walls of the small intestines, or from a failure of that nervous influence or that blood supply, upon which their integrity depends. There is a more particular indication, often first in time as well as in importance, when the gastro-intestinal irritation and exhausting discharges are conspicuous, as they generally are, viz., *to allay that irritation and arrest the discharges*.

Admitting these premises, the important question is, by what means can these indications be best fulfilled.

It must be admitted that there are obscurities and uncertainties respecting the influence of remedies upon the organic nervous system, and especially are we in the dark as

to the remedies which will do most towards correcting those derangements produced by the cholera poison.

The Bromides certainly appear to influence favorably some conditions of irritation of the organic nerves, and it is quite possible they may do much in controlling this form of irritation; but the test of this is experience, and this I have not had with these articles in this disease. I am not aware of the extent of Dr. Pepper's experience with them in the collapsed condition of Cholera in which he recommends them, nor do I know what experience has been had with the Bromide of Ammonium in an earlier stage of the disease. But the suggestion of the use of these remedies is worthy of being entertained. They may prove to be more efficient than we now know.

The Chloral Hydrate produces its effects largely upon the organic nervous system, and its alleged good effects in controlling the vomiting and purging are likely to be from its operation upon that system. Indeed, the effects of Opium and Camphor and other agents of the kind operate largely in this way.

Counter-irritation is another mode of impressing the organic nerves, and the operation of a blister over the vagus is upon this principle, and may do more good than has yet been demonstrated.

Similar remarks may be made respecting the application of Chapman's ice bags to the spine, and also respecting the application of cold compresses over the abdomen, or the dashing of cold water over the surface followed by warm frictions, or the wrapping in warm blankets; or frictions with ice alternated or not with warmth.

The administration of a mustard, or salt and mustard, emetic in the early stage of an attack, and before free emesis has occurred, may arouse this system, and may ac-

count for the good effects this is supposed sometimes to have.

When the organic nervous system is deranged in chronic diseases, hygienic measures, sea-bathing, shampooing, general tonics, etc., are the measures usually brought in requisition; but in Cholera immediate effects are to be realized, and the other measures suggested, when not interfering with remedies whose effects are better established, may be worthy of trial.

There is in Cholera so much prostration, such an appearance and such real danger of rapid sinking and fatal exhaustion, so much spasm and pain, and such profuse discharges, that anodynes, and what are called stimulants, are resorted to almost instinctively, and Alcohol and Ether are often given. Opium, though so useful when properly managed, may be administered with too much freedom and too little discrimination, especially when the disease is advanced, and mischief may be done by it.

There can be little doubt that opium, alcoholic mixtures, chloroform, etc., particularly when given in free doses, tend to depress rather than exalt the energy of the nervous system of organic life. Though this may not be the effect of these articles uniformly and in all doses, it certainly is often and generally so, even in their primary actions, when administered in large quantities. If alcohol, in certain quantities and under certain circumstances, does temporarily remove depressing influences and thus excite the nerves, still by tending to deprive the blood of its oxygen, diminishing the natural effects of respiration, and retarding other vital changes, its secondary effects become often powerfully depressing. The same is true of opium and other narcotics, in a greater or less degree. These facts should not be lost sight of; and while these articles may be useful, and opium

particularly, even in pretty free doses, quite essential for fulfilling the indications of allaying irritation, and arresting vomiting and purging, regard should always be paid to their depressing effects on the vital powers. No language can be too strong in condemning their use in large quantities, in the *advanced* stages of the disease. Both principles and experience are against the practice, and facts, under my own observation, have convinced me that many lives have been sacrificed by it. *Alcohol is very seldom useful in Cholera under any circumstances.* It not only fails to meet the indication of sustaining the vital powers, but it also usually fails to exert a beneficial influence over the vomiting and purging; in fact, it increases the irritation of the mucous membrane, and disposes it, as well as the brain and other parts of the system, to inflammation and its consequences, in case the patient survives the earlier stages of the disease.

Opium, in proper doses and combinations, in the earlier stages of Cholera, before the vital powers are much exhausted, and while irritation of the stomach and bowels is the most prominent symptom, is *the great remedy* in the disease, or, at least, one of the prominent and essential items of a correct treatment. It is by far the most potent remedy we possess for allaying that irritation, arresting the flow of fluids to the mucous surface, and controlling the debilitating discharges; and when these effects are produced by its use, the system, by other proper aids, is generally enabled to rally and struggle successfully against the morbid influences. But when the powers of life are low, when the blood is deficient in oxygen, loaded and black with carbon, the free administration of an article which in full doses produces even in healthy persons similar effects, can but be productive of severe and fatal results. I dwell upon this

point because of its exceeding importance, and will recur to it again when describing the particular mode of managing cases.

In selecting articles to correct the nervous disturbance and regulate the nervous energy, we should prefer those which will not diminish the oxygenation of the blood, and which will be in less danger of producing secondary or in larger doses primary depression. Opium, alcohol, chloroform, and ether diminish oxygenation of the blood, from which serious consequences arise in the natural course of the disease, and much more frequently and more permanently than they excite, they depress nervous and muscular action.

With reference to the indication for regulating and sustaining the nervous action, it will be safer to use such articles as quinine, coffee, mustard, ammonia, capsicum, camphor, valerian, cassia, and the bromides. A mustard emetic, if given at all, must be for a temporary arousing effect, or to effectually clear the stomach of irritating material when the vomiting is not free; and advantage must be taken of the calm immediately following its operation to introduce other remedies.

When the system is laboring under the poisonous effects of Prussic acid, opium, alcohol, chloroform, or other narcotics, we resort to electricity, sudden dashings of cold water upon the surface repeated at intervals, artificial respiration, or to other means to secure the inhalation of an abundance of fresh air, often, if possible, made richer by the addition of more oxygen, or sometimes made stimulating by the vapor of ammonia. In the depression of Cholera these agents are not to be entirely overlooked, and they have in some cases an important range of applicability.

To fulfill the indication of correcting the wrong going

organs, various remedies are used. The stomach and bowels, the liver, the kidneys, and to a less extent the heart and lungs, require special attention.

To correct the exhalant and other functions of the stomach and bowels, to allay the irritation and arrest the profuse discharges, opium, in my opinion, as anticipated by preceding remarks, is the chief remedy. In order that it be retained and have a speedy effect, abstinence from drinks in considerable quantities must be enjoined, and the medicine given in minute division, triturated with some other substance; and its effects may be aided by counter-irritation over the epigastrium, and indeed over the whole abdomen, and sometimes it may be aided by various astringents. The acetate of lead is regarded by many as the most powerful of the astringents; but it affects the purging more than the vomiting, and controls this purging much more manifestly when given by enema, after an impression has been made upon the stomach with opium. When thus used in a moderate quantity of fluid, and combined with a quantity of laudanum varying with the condition of the patient and the amount of opium previously taken, the effect is often most happy.

To excite the liver to its natural secretion, and modify other secretions, thereby relieving the blood of much of its effete matter, Calomel should be given in repeated doses. When thus operating it usually changes the whole character of the disease. The use of this article I consider of exceeding importance. My observations upon it have been careful and abundant, and I think I cannot be mistaken. The discharges may often be checked without its use, and temporary improvement produced; but unless the secretion of the liver be excited (and calomel, when properly given and retained, tends powerfully to excite that secretion), the

cholera discharges are likely again to return, and severe consequences follow. The indication for calomel exists in the early stages of the disease and continues present until the symptoms are controlled, the action of the liver restored, or until a sufficient quantity is given to produce all the beneficial effects of which the medicine is capable.

I am by no means insensible to the injurious effects, both proximate and remote, which the free, or even moderate, use of mercury under many circumstances produces. I have no sympathy with that class of practitioners forever seeing some "liver complaint" or "bilious obstructions," and hurling heroic doses of calomel, or everlasting "blue pills," at these so often imaginary difficulties. But mercury is a medicine of power, and has its uses; and Cholera is one of the diseases in which its remedial virtues are greatest. In this disease it seldom produces salivation or other remote injurious consequences, and even if it did so much more frequently, considering the extreme danger of the patient and the good effect it produces, we should be justified in its use. It possibly has an effect upon the bacteria in the alimentary canal, though of this proof is wanting.

To excite the action of the kidneys, diuretics may be given whenever the stomach will retain them, and when they will not interfere with other more necessary remedies, or produce any other unpleasant effects. Oil of turpentine, spts. nit. dulc., infusions of juniper and broom, and digitalis are among the articles of this class. They are however so uncertain in their operations, that they should not be given at the risk of disturbing the stomach or bowels.

To counteract the deranged state of the sanguineous circulation, which is always great in the full formed stage, amounting to a considerable degree of obstruction in the

capillaries, and to a decided obstruction of the circulation from the right to the left side of the heart through the lungs, with a general congestion of the internal organs, various means have been suggested and practiced. Any course which will contribute to the first indication—that of arousing the organic nerves and regulating the general nervous energy—will do much to accomplish this; but there are other means which act more directly in effecting this object, among which is *blood-letting*.

This may seem a desperate remedy, and certainly should be used with the greatest discrimination and caution. There is, however, much testimony in its favor entitled to the highest respect, as we have seen, and my own experience enables me to express the opinion with confidence, that there is a class of cases occurring in the robust and vigorous, marked by a degree of hardness of pulse, by a violence of pain or cramp, without very free discharges, where, at the proper time—the early stage of congestion—duly aided by other means, and these perhaps stimulants, it will operate most beneficially. McIntosh has long since shown, and his observations have been abundantly confirmed, that bleeding, in the congestive or cold stage of intermitting fever, affords the greatest temporary relief, and would be generally indicated in the cold stage of the ague, were it not for the more remote consequences, the continued debility and impoverishment of the blood which would follow.

I have resorted to bleeding in Cholera only in a small proportion of cases, as the large majority of those I have treated in the disease have been foreign emigrants, debilitated from recent sea voyages, or others whose vital powers were low; but whenever I have practiced it under the other circumstances described, I have been pleased with the

result. The cramps, pains, blueness, and oppression of breathing have been relieved, and all the symptoms have taken a milder form.

Another means for the relief of this congestion in Cholera, less hazardous in its effects, is the use of dry cupping. The cups should be applied along the spine and over the abdomen. A large cup or common tumbler, suddenly applied over the stomach, will often produce a marked effect in allaying the nausea and vomiting, and in enabling the stomach to retain medicines until they can make an impression.

Nearly akin to this and to blood-letting, combining in some degree the advantages of both, and avoiding some of the disadvantages of the latter, is the ligation of the extremities, near the trunk, thereby detaining for a time a portion of the blood in the vessels of the limbs, and when the necessity for its detention has passed by, allowing it to return into the general circulation. Whether the blood may not be deteriorated by this detention, so as to be in danger of unpleasant effects, has often suggested itself to me; but I have not been able to discover evidence that this is the case, and if it be not, this plan must possess some advantage over blood-letting. I have practiced it frequently and with satisfactory results. It should be observed that the movement of the blood through the veins is not absolutely arrested, but only retarded, as anastomoses with the deeper veins not compressed by the ligatures allow a slower flow to go on. Besides the general effects, it often relieves in a marked degree the cramps in the limbs thus treated. Sinapisms, frictions, external warmth, and other modes of cutaneous irritation, directly conduce to the relief of congestion, and sometimes act beneficially in arousing nervous energy.

Quinine has already been referred to as being useful in fulfilling the indication of arousing and sustaining the nervous energy; and by this mode of its operation, or in a more direct manner, its action tends decidedly to remove internal congestions—to equalize and free, as it were, the restrained and obstructed internal circulation. It thus becomes a means, and a most powerful one, of answering the indication for regulating the deranged circulation, upon which so many serious consequences depend. Though I have no personal knowledge of its having been used hypodermically in Cholera—hypodermic injections were little in vogue when I treated the disease—I should have no hesitancy in injecting a solution of it into the areolar tissues, where the indication for its use was present, and the stomach was not able to retain and absorb it. It might thus be given in the stage of the most active vomiting and purging, and probably would act as beneficially in this as in other stages of the disease. That it has an immediate effect in relieving the symptoms of congestion in malarious fevers, and that too perhaps independently of its antiperiodic influence, is quite certain; and the analogy between the congestive state of a malarious fever and the algid condition of Cholera is quite apparent. At all events, whatever the mode of its action,—whether by sustaining the nervous energies, or by some other means more directly relieving the system of capillary, pulmonal, or general visceral obstruction and congestion, or by some peculiar antidotal influence neutralizing the effects of the Cholera poison, as this article seems to neutralize the poison of periodic fevers—it has a decided beneficial effect in the disease, and after the stomach is quieted by opium, and very probably before, if used hypodermically, the chances of recovery are decidedly enhanced by the administration

in divided doses of from a scruple or a half drachm to a drachm of quinine. Where much opium has been given, it enables the system to bear that article better, preventing to a considerable extent its depressing effects. Quinine, since my experience in Cholera, has been used hypodermically in the disease and, as reported, with very beneficial effects.

As Cholera prevailed in Chicago, particularly in 1854, its cause was mingled with the malarial poison, and as is the case with various other diseases in the West and South, the Cholera was modified by malaria, and, in most of the cases, assumed more or less of a periodical type. A patient seized with a malarious chill, when the Cholera poison was present and acting upon the system, would often have that chill merged into the phenomena of Cholera.

Profuse vomitings and purgings of a serous fluid, accompanied with cramps and other phenomena strikingly resembling genuine Cholera, not unfrequently occur in malarious fevers when no epidemic Cholera influence is present; and when such Cholera influence prevails, the occurrence of the phenomena of fever will very often *precipitate a Cholera attack;* and though the symptoms for the time being are controlled, they will recur with increased violence with the reappearance of another paroxysm of the fever—the weaker affection becoming merged into the stronger. In all such cases, *a full antiperiodic quantity of quinine is an absolute necessity*, and here certainly from half a drachm to a drachm, in divided doses, must be promptly introduced into the system, the whole being given some time before the period for the recurring paroxysm, which must be presumed to take place in twenty-four hours. The type may be tertian, but as this cannot be known beforehand, and the return of another paroxysm would be

likely to be fatal, action must be taken as though it were quotidian. *A recurrence must be prevented.*

The importance of quinine in such cases is measured by the difference between success and failure—between the life and death of the patient. There is here the imperative indication of interrupting the malarious paroxysm, which the quinine will do, while at the same time it fulfills the other indications before referred to.

If these views are correct, and of their correctness I have the most abundant reasons to be assured, no language can be too strong in urging them upon the attention of the profession. The malarial influence is by no means confined to the West and the South. In various localities in the Middle and even Eastern States, Intermittent and Remittent fevers, more or less perfectly marked, have a considerable prevalence, and the malarial poison, in sufficient quantity to modify other diseases, is still more widely diffused. Quinine is exceedingly important in the treatment of Cholera everywhere, but is *peculiarly* and *inexpressibly* so in all those cases mingled with and influenced by the malarial poison.

To correct that condition of the blood which arises from deficient respiration, and from a loss of its watery and albuminous portions and its salts in the discharges, free, full inspirations of the freshest air must be encouraged, and a solution of common salt and bicarbonate of soda may be given, when the stomach will, without inconvenience, retain it; and chicken broth or beef tea, well salted, must not be omitted. The Chlorate of Potash is another article which, on chemical principles, and from its analogous effects in other diseases, would be suggested; but I have no experience with this salt in Cholera, and can therefore only suggest its use.

Saline solutions have not only been given by the mouth, to correct these conditions of the blood, but they have likewise been injected into the veins; and in this the object aimed at is commendable, but the operation of injecting the veins is a delicate and dangerous one, even under the most favorable circumstances of superior apparatus and skilful hands, and cannot be adopted with benefit in general practice without much care. Its effects have hitherto for the most part been only temporary.

From some recent experiments upon the detached heart of the frog, made by Dr. Sidney Ringer of London, he concludes that in injections of fluids for the purpose of keeping up the action of the heart when failing, neither water alone, at whatever temperature, nor a solution of the salts of soda alone, or of the salts of lime, or of potassium singly, will produce the effect. He therefore suggests that in making injections into the veins in the "life-or-death case" of the collapse of Cholera, the fluid should contain not only "Sodium bicarbonate, but likewise physiological quantities of the salts of Calcium and Potassium."

According to the best physiological authorities the quantity of the various inorganic salts in a quart of human blood serum is as follows:

Potassium Chloride.....	5.8 grains.
Sodium Chloride.....	89.2 grains.
Potassium Sulphate.....	4.5 grains.
Sodium Phosphate.....	4.3 grains.
Sodium Carbonate.....	24.6 grains.
Calcium Phosphate.....	4.6 grains.
Magnesium Phosphate.....	3.5 grains.

M.

These ingredients mixed and added to a quart of tepid distilled water would make a solution as near as may be having the properties of normal blood serum,

These inorganic salts carefully weighed out and preserved ready for use, dissolved at the time in the pure water and injected at a proper temperature, in proper quantity, and with all necessary instruments and precautions would possibly be followed by better results than have heretofore been produced by Saline injections into the blood in these extreme cases. As profound collapse is so generally followed by death, any means affording the slightest hope of success should not be neglected; and this modification of previous treatment by intravenous injections seems worthy of a trial.

Another method of supplying fluid to the system after its loss, in the collapsed or semi-collapsed conditions, has recently been suggested. It consists in injecting fluids in free quantities into the cellular tissue. Large hypodermic syringes are to be used, and the injections repeated in various situations. The water should be blood warm, and may be made slightly alkaline and saline by the addition of a little soda and common salt. Pure water, however, would, on the principles of endosmosis, be more readily absorbed. This treatment, it seems to me, would be less dangerous than the injections into veins, and in these desperate cases would seem quite worthy of trial. As yet, however, it has not had the test of extended experience.

We have now passed over the leading indications in the treatment of Cholera, and have referred in somewhat general terms to the principal means by which these indications are to be fulfilled, and it now remains to attempt a more particular account of the details of procedure—of the particular stages and conditions indicating particular remedies and combinations, and the dose and timing of each article or compound applicable to the various conditions which occur. In doing this it will be necessary to refer

again to the different remedial agents just considered, and something like repetition cannot be avoided; but it is better to repeat many things, rather than to fail in giving a distinct idea of the treatment to be pursued. It is not easy to combine in the same train of remarks the pathological and therapeutical principles involved, and the minute details of procedure.

In an active and severe case of Cholera, the disease passes through so many stages in so short a time, and these stages are so variable in their duration, and each requires such modifications of treatment, that the patient, in order to be skillfully managed, must be visited very frequently; the amount of medicines taken and retained, and every symptom and condition must be particularly inquired into, and, if the memory be at all treacherous, should be carefully noted down. The nurses must be faithful and sensible, and must have the most definite and explicit instructions in every particular. The physician must be cool and collected, and must have every faculty of his mind fully awake and concentrated upon the work. He who cannot come up to these requirements, who has not the health, or the vigor, or the courage—who has not indomitable perseverance and sleepless vigilance, and who, moreover, has not some definite ideas of the proper treatment, and some confidence in remedies, will consult his own peace of mind, and the interests of the community, by avoiding, as some do, the treatment of all cases of this disease.

When, during the prevalence of Epidemic Cholera, a patient is affected with the premonitory symptoms of the disease, and especially if diarrhœa be present, he should immediately be sent to bed in a comfortable and well ventilated room, with warm covering, adapted, however, to the temperature. The state of the skin should be inquired

into, and if not in perfect condition as regards cleanliness a warm bath, or sponging with warm soap and water or saleratus water should be used. A powder, consisting of from one to three grains of *opium* with the same amount of *camphor*, well triturated with sugar (or the equivalent of this powder in laudanum and spirits of camphor), should be immediately given, and if the discharges are inclined to be watery, colorless, and destitute of bile, from two to six grains of calomel, or its equivalent of blue pill, must be added. This dose must be repeated in from an hour and a half to three or four hours, if the discharges are not completely arrested, and the sensations of abdominal uneasiness removed. After from eight to fifteen grains of calomel are given, unless the symptoms assume considerable severity, this article may be omitted, but the opium and camphor must be continued until a decided narcotic influence is produced, or until all symptoms of the diarrhœa are removed. Should the diarrhœa not yield readily, acetate of lead or tannin should be added to the opium, in from two to four grain doses; or what is still more effectual, enemata of ten grains of the lead with a teaspoonful of laudanum in three or four ounces of some simple fluid, plain water answering every purpose, at a temperature a little above that of the room, must be given and repeated once an hour, or oftener if not long retained, and if the discharges are not arrested. In many cases a few grains of quinine (two, three, or four) given at first with each dose of the opium, will cause the latter article to be better borne, and the combined effect will be an improvement upon that produced without the quinine. I have often prescribed pills, containing sulph. morphine one-fourth of a grain, and sulph. quinine two or three grains, one to be taken immediately, and repeated once in from one to four hours as may be

required; and these doses in a majority of cases will be quite sufficient to arrest all the symptoms. The quinine may be continued until a scruple or sometimes more has been given. Mercury, however, should not be omitted where any considerable severity of symptoms exists, and where the cholera tendency is manifest in the colorless condition of the discharges; for, though without the mercury the symptoms may be arrested, they are much more liable, after a few hours, to return when this article is not used. Where mercurials, however, are used with opium, such returns of the symptoms are exceedingly rare. When, by these means, the discharges are completely arrested, the next day a mild laxative of syrup of rhubarb, or of equal parts of the syrup and tincture of rhubarb, or castor oil with a few drops of oil of turpentine and tinct. opium, may be given with advantage. A simple opiate should follow its operation, if there be pain or a tendency to a continuance of the catharsis. At the commencement of the treatment, or at any time during its course, a sinapism to the abdomen may be useful. The blandest diet should be insisted upon, and the patient kept quiet until restored. These means are almost as certain to arrest the disease, if resorted to and persevered in, as quinine is to arrest an ordinary attack of intermittent fever.

When the Cholera is prevailing, physicians should strongly advise those who depend upon them for medical directions to keep about them medicines adapted to the disease, and should give them instructions respecting their applications in case of emergency; but still, the rule should be to send for advice as soon as possible after symptoms appear. Many lives may in this manner be saved.

But the premonitory stage is sometimes absent, or so slight as not to receive attention, and is frequently so neg-

lected, or so short in duration, as not to become the subject of treatment, and the case passes into the second stage—the full development of the active disease occurs before aid is sought. In the early part of this stage, before the deep blueness occurs, and while considerable warmth is present, especially if the disease seems to be of a forcible character, with severe pain and spasms, the treatment may commence by a moderate bleeding, or what is safer, by ligation of the extremities, detaining in that manner a portion of the blood from the circulation. Several cups may be applied over the stomach and abdomen; all drinks, in larger quantities than just sufficient to wet the passages, must be instantly and peremptorily prohibited, and, whether the preceding means be used or not, the following powder administered in a teaspoonful of water:

℞. Opium..... grs. ij.
Gum camphor..... grs. ij.
Calomel..... grs. iij. to vj.
Sugar of milk..... grs. xv.
M.
Triturate very thoroughly.

The minute division of the medicines by trituration, I regard as very important. Here the sugar of milk is preferred to common loaf sugar, though the latter will answer. All the ingredients, when thus treated, will diffuse themselves readily, and will be extensively and speedily applied to and will readily act upon the stomach; while, if the opium and other articles be given in pill or coarser powder, they will be much more liable to be rejected before they have time to act; or if retained, their effects will be more slow and cumulative, and that of the opium may be too profound at a later period, when a powerful narcotism will be liable to be fatal.

If the treatment be commenced at a *very* early period in the second stage, and the circulation and respiration are still comparatively good, a quarter of a grain of morphine may be added to the first dose of the above powder. If there be evidence of matters upon the stomach not rejected, or if there be much cramp and retching, without the power of free emesis, an emetic dose of salt and mustard, or of sulph. of zinc, may precede the administration of the powder, and in that case the temporary calm after vomiting must be seized upon to give the powder. When the vomiting is spontaneous, the calm succeeding it is the most favorable moment for administering a dose. When the dry cups come off, they must either be reapplied, or the regions of the stomach and bowels must be covered with a strong sinapism. Sinapisms may also be applied to the extremities. If the first powder be rejected before it has had time to make an impression or to be absorbed, another should be immediately given, omitting the morphine, however, in the second dose, if the first was retained as long as ten or fifteen minutes, or if there is evidence of any portion of it having been retained; and after the second dose, it is not usually safe to add morphine to the two grains of opium, however frequent the vomiting may be. These powders may then be continued, sometimes varying the proportions by increasing the calomel and diminishing the opium, repeated once in from *one to three hours*, according to the severity of the symptoms, *until either the discharges are arrested, a perceptible degree of anodyne and narcotic influence is produced, or the blue stage occurs.* After one or two doses of the powder are given, and the vomiting has somewhat abated, and especially if the treatment had commenced at a later period of the disease, three or four grain doses of quinine should be administered once in one, two,

or three hours, until a scruple, or half a drachm, or more has been given. Should the discharges be arrested or very materially abated, as they usually are after a short time under this treatment, the stomach will be in a condition to retain other articles, and other indications besides that of arresting the discharges can be attended to. Should a considerable degree of narcotism be present, a strong infusion of coffee must be given liberally, and continued until the symptom is no longer sufficient to excite uneasiness. Should there be much depression, carbonate of ammonia may be added to the quinine, or given by itself, and should the surface be dark, with considerable depression of the vital powers, common salt and the flour of mustard, in doses of from ten to fifteen grains each, may be given once in from one to two hours. At the same time, a few spoonfuls of chicken broth or beef tea, with rice water well salted, may be given quite frequently, say every half hour. In the meantime, some fifteen to thirty or more grains of calomel have probably been given in the powders, and if so, no more will usually be required; but if rice water discharges still occasionally continue, five or six grain doses of this mineral may be continued without the opium, or with a quantity of it so small as not to be incompatible with the safety of the patient. The extent to which the opium may be safely carried cannot be defined, and must be carefully judged of in each case by all the lights which close observation and experience can afford. If the treatment be commenced later in the disease than we have been supposing, opium must be used more sparingly, and as the point at which treatment has commenced advances toward or into the blue and collapsed stages, less must be used, until none can, with safety or a prospect of success, be given. It is quite possible that the addition of atropine to the opium or mor-

phine may so modify its action as to render its use safe at a later stage of the disease, or in larger quantities; but of this I cannot speak from personal experience. When I treated Cholera the antagonism of opium and belladonna, or the modifying influence of the one upon the other, was not as now understood. If experience shall prove that the addition of atropine to an opiate will diminish or prevent its injurious narcotic effect without impairing its action in arresting the vomiting and purging, an improvement will have been made in the treatment of this disease.

Acetate of lead, in from two to four grain doses, may sometimes, perhaps, be beneficially given alternately with opium, calomel, and camphor powders, especially if the purging be out of proportion to the vomiting. But the stomach has certain capacities for the enduring of medicines, beyond which it cannot be plied with impunity. We cannot pour promiscuously into that organ, when irritated as in this disease, every article for which there seems to be an indication; and according to my observation, when acetate of lead, by the stomach, has been added to the treatment just described, the effect has not *usually* been so satisfactory as without it. In the condition, however, above referred to, when the purging is more severe than the vomiting, and continues after a partial calm has been effected by anodynes—or in the latter and lower stages of the disease, when this exhausting discharge continues—the effect of *enemata* of the lead, given as directed when describing the treatment of the premonitory stage, with such quantities of laudanum as may be borne, can scarcely be too highly praised. Tannin may be used as a substitute for the lead, is often quite as effectual, and, not unfrequently, is borne better by the stomach when used in that way. I have not unfrequently combined tannin with quinine, where

the latter article was indicated, and purging was present, without producing unpleasant effects on the stomach, and with a manifest impression upon the purging.

The above course of treatment, when commenced *before the blue stage has thoroughly set in*, will, according to my observations, in a very large proportion of cases, I should say in fair constitutions in more than nine cases out of ten, succeed in arresting the disease and procuring a favorable reaction. The after treatment should be simple.

I am aware that this statement of the success of this treatment is much more favorable than is usually found in the standard works respecting any mode of treating this formidable disease. For this reason the statement is made with some degree of hesitation, and not without due reflection. But a careful review of my own experience fully justifies it. It will be observed that the statement is not that nine out of ten of the cases of Cholera, as usually met with in practice, can by any means be saved; for frequently the disease, when the physician is first called, will be so far advanced as to be beyond the reach of any treatment; and occasionally a case will be so rapid and severe as to resist the most prompt and timely measures; but in ordinary cases, in persons of fair constitution, the premonitory diarrhœa occuring and the full attack developing in the usual manner, if the treatment be commenced before the blue stage has supervened, and be followed up with promptness and skill, an exceedingly large proportion of cases will recover. I can readily believe that in Dr. Taylor's experience in the British Army in India, where patients could be attended to as soon as attacked, and all proper appliances were at hand, ninety-four per cent. of recoveries took place as he reports.

If the bowels are not open after twenty-four or thirty-six

hours from the period of reaction, a gentle laxative of castor oil with the addition of small quantities of oil of turpentine and laudanum, or an aperient of some of the preparations of rhubarb, in divided doses, may be given. If the stomach seems loaded with bile, as it not unfrequently is at this period, a gentle emetic of salt and mustard will sometimes procure great relief. If the urinary secretion is not soon restored, or indeed in anticipation that it may not be, when the stomach and bowels become quieted, spts. nit. dulc. may be given in half teaspoonful doses in water, frequently repeated, or other diuretics may be given. Bland nourishment and drinks may be allowed, and the patient kept quiet. Sometimes gentle tonics may be useful.

In some rare instances, after not very severe cases of Cholera, but rather more frequently after the graver cases, the kidneys fail entirely to perform their functions, and the patient dies comatose from the poison of urea in the blood. Death usually occurs in from twenty-four to forty-eight hours after reaction; and, according to my observation, when the suppression of the secretion is complete, and comatose symptoms strongly resembling those of an overdose of opium supervene, no means within my knowledge will, as a rule, avert the fatal result. I have tried various stimulating diuretics, electricity, counter-irritation over the kidneys, and cathartics, but with little effect.

Where mercurials have been pretty freely used and alcoholic dosing has been avoided, it is seldom that severe congestions and inflammations of the brain and other organs occur after attacks which have not passed into the collapsed stage. Whenever these cases do occur, however, treatment must be conducted on general principles, bearing in mind that though there be inflammation, it occurs in a system

much debilitated by a severe disease. If the brain and spinal marrow and their envelopes be the seat of the disease, blisters, mercurials, and iodide of potassium would be indicated. If the stomach and bowels be the seat of the inflammation, blisters, a few minute mercurial doses, with small doses of morphine, followed, perhaps, by a mild laxative of castor oil, and this succeeded by the following mixture, will be well:

℞. Oil of Turpentine,
Tinct. of Opium.....āā f ʒijss
Gum Arabic,
Sugar.....āā ʒss
Camphor water.....f ʒijss
M.

For an emulsion. A teaspoonful once in three or four hours.

These secondary symptoms are varied and sometimes protracted, requiring a variety of management, often embracing ultimately a general tonic course.

But cases of Cholera are frequently not seen until they are far advanced into the cold or blue stage, or have actually passed into the collapsed condition.

While the pulse remains at the wrist there is sufficient hope to demand strenuous efforts, and even after it has disappeared, patients occasionally recover. The practitioner of close observation, of acute discernment, and of much experience in Cholera, will be able almost at a glance to determine the probable fate of his patient; for there is a discernible point, beyond which if he pass, all the chances are against his recovery.

If the condition borders upon the full collapsed or asphyxiated state, opium, as has already been stated and repeated, must not be given, or only in very small quantities. If the purging still continues, an enema of a solu-

tion of acetate of lead (fifteen or twenty grains), with perhaps a teaspoonful of laudanum, may be used and repeated, with or without the laudanum, as the circumstances may require. The cold affusion, or the rubbing in ice, may here be tried, followed by warm frictions, sinapisms, and warm blankets. The fullest inspirations of the freshest air must be insisted upon, and quinine, warm coffee, and carbonate of ammonia, two or three grains of the latter, and the same amount of the quinine, once in an hour or two, alternated with doses of from ten to fifteen grains each of salt and mustard, may be given, not omitting the frequent administration of chicken or beef tea, well salted.

The chlorate of potash would here be suggested as possibly supplying oxygen to the blood, and improving the condition in other respects; and quinine, if not well borne or appropriated by the stomach, may be tried *hypodermically*. The hypodermic use of quinine in these semi-collapsed conditions has perhaps not been sufficiently tested by actual experience to establish its value, and it cannot be expected that this or any other remedy will often be successful when the asphyxiated condition has reached a certain stage; but from the known effects of quinine in other conditions, I think it worthy of farther trial in this.

Dry Cupping along the spine and in other situations is also worthy of trial—is apparently often very useful.

It is quite the custom of some to give Calomel in this condition, and very large and repeated doses have been advised. I can see no good reason for such enormous doses, and yet some of the most remarkable recoveries from profound collapse I have ever witnessed have been after such doses had been given. I would, however, give a few grains once in an hour or two, unless a sufficient quantity of the medicine had been previously given and retained, not so

much with reference to any immediate effect, as with the hope, should the vital powers be kept up for a sufficient time, that a change might be made in the secretions, and that the cholera discharges might not return. Whether Calomel acts by checking the action of microbes, or by its impressions upon the functions of the system, I cannot say; but of this, from observation, I feel quite sure, that those cholera patients who take it are more likely to recover than those who do not. I am also quite sure, whatever may be the explanation, that those who take calomel are much more likely to have colored—darkish, greenish, or yellow—discharges from the bowels than those who do not; and that when such discharges occur, relapses into the cholera condition very seldom take place; but when the discharges continue colorless, the patients are infinitely less liable to react and recover. These are the substantial reasons why I so urge the use of this agent, and they seem to me sufficient.

The statement of Koch that the rice-water or gruely discharges, and the presence of the comma-bacilli have a relation to each other is worthy of consideration in this connection.

The use of opium in Cholera, so essential for the arresting of the discharges, and yet so liable when freely used to interfere with the function of respiration and produce other injurious effects, especially in the later stages of the disease, is of the utmost interest to the physician who expects to meet with this affection, as the chief element of his skill in treating the disease will consist in his judgment and tact in the administration of this article. There is, on the one hand, the Scylla of allowing the intense irritation and profuse discharges to so alter the proportions of the constituents of the blood and exhaust the patient as to carry

him beyond hope, and, on the other hand, the Charybdis of too great narcotism, interfering with respiration and other functions to an extent equally dangerous. It requires skill and tact to steer between these rocks of destruction, and, in treating Cholera, this passage must be made.

Of the treatment of the fully collapsed state I have little to say. I have seen a few such cases recover—that is, cases where the pulse could not be felt at the wrist, and where the loss of voice, the blue and shrunken condition of the surface, the extreme sunken and lustreless eye, and the slow laborious breathing, corresponded with the arrested condition of the arterial circulation—but these are exceptions so rare that the influence of treatment is not ascertained.

As already stated, some of the most remarkable recoveries of this kind I have witnessed have been after large and repeated doses of calomel, but whether these doses had anything to do with the recovery I am by no means certain. I have seen a few cases of almost equally marvelous recoveries where very little treatment was attempted. It is in these cases that the intra-venous injections may be tried.

In describing the treatment of the active or vomiting stage of Cholera, it was mentioned that drinks should be avoided, excepting in teaspoonful doses, or quantities just sufficient to moisten the mouth and throat, and the subject is again introduced here in order to make it more prominent. Notwithstanding the advice of some authors, that drinks should be allowed to be freely taken, and especially that ice may be taken *ad libitum*, such liberty is totally incompatible with the course of treatment upon which I depend. The thirst is so intense and so little assuaged by drinking, that enormous quantities of fluid would be repeatedly swallowed if allowed; and the stomach would be filled

and emptied in very rapid succession. The effect of this upon the retention of medicine within the stomach and its action upon that organ is very obvious. Diffusing a few grains of opium or other drugs in some quarts of water, and rejecting the whole from the stomach in a few minutes or seconds, is obviously a process of little utility so far as medication is concerned. The objection to free drinking, and it is a fatal objection if anything is to be done by stomach medication, is that while fluids in any considerable quantities are taken into the stomach, *vomiting will continue*, and medicines will not be retained.

A teaspoonful of ice-water or a small piece of ice may be taken frequently, and will accomplish about all that is possible in quenching thirst, and this will not defeat other important measures. So important do I consider this point of restricting drink, that I would not take the responsibility of a case—would abandon a patient whose friends would not enforce the restriction, where vomiting or the danger of vomiting was present. I speak of the action of friends, for the impulse to drink is so intense, and the indifference to consequences so great, that no ordinary cholera patient can be depended upon to restrain himself.

Time is so essential in the treatment of Cholera, that it is very important that every practitioner have about his person several articles of medicine; and particularly if the powders of opium, camphor, calomel, and sugar, which I have recommended, be used, they should be carefully prepared, of good materials, thoroughly triturated, and put up in packets accurately weighed. In a large practice much time and many lives may be saved by such precaution. The delay in sending to a drug store, and the uncertainty of a minute trituration and careful preparation of the medcine, might defeat the best intended efforts, and be the cause of the sacrifice of many lives.

It cannot be too often repeated, or at any rate too strongly impressed, that success in the treatment of Cholera will depend upon its early commencement, and upon the promptness and discrimination with which the remedies are applied. To know how far to go with the opium, judging from the appearance and condition of the patient, and the effect of the remedy produced, is the most important and the most difficult point; but in the application of any of the agents, much discretion is demanded.

The views of the treatment of this disease which I have ventured so positively to state, were, in their main features, formed from my experience years ago, and have been elsewhere in substance expressed. In examining anew the literature of the subject as I have now done, it has seemed to me that the treatment which most nearly approaches to that which I have advised has been attended with the best reported results.

But I do not presume to affirm that this course with all its details is the only successful mode of treating the disease, or that it cannot be improved upon. I simply say that after considerable experience, much observation of other methods, and of the use of similar remedies in other forms and combinations, the treatment I have detailed is the one upon which I depend, and with results in many hundreds of cases much more favorable than I had supposed possible.

The method of administering morphine by dropping it dry, far back upon the tongue, I have long been in the habit of resorting to when the stomach was inclined to reject medicine, and where the morphine was indicated, and have found it in many cases quite as efficient as by hypodermic injection. But the powder of opium, camphor, and calomel, finely triturated with hard sugar, the particles of each ingredient thus intimately united with those of the

others, readily diffused as it will be in a teaspoonful of water and taken into the stomach, followed by a teaspoonful more of water—taken into the organ specially to be acted upon—and particularly if thus introduced immediately after an act of vomiting, has been more satisfactory in its effects than any other remedy with which I have had experience. By the heat of the stomach the triturated camphor is speedily vaporized, the whole compound seems speedily brought in contact with its surface, and the impression which it makes is more speedy, decided, and permanent than that of anything else I have seen tried.

I do not doubt that morphine and atropine used hypodermically, in the proportion of one quarter of a grain of the former to 1-120 of a grain of the latter, will often answer an excellent purpose, but I should question much its efficacy as compared with the powder in arresting the vomiting and purging of Cholera. In any event, if in arresting the vomiting and purging with the opium compound, too much opium narcosis was induced, in addition to the coffee and quinine, and perhaps as a substitute for them, I should now try the effects of atropine hypodermically. I should also try the effect of quinine hypodermically in perfect solution with an acid, where I thought quinine indicated, and where the stomach would not retain it, though I have never tried this method in Cholera. With these exceptions, I should adhere to the plan in all its details which I have proposed, unless something better, or at least as good, was demonstrated to me. Such demonstration I have not had, and doubt whether I shall have, even should further observation in the treatment of the disease come in my way.

The fact is not overlooked that diseases, however specific in their causes and characters, are modified in many of their features, in their severity and in the action of remedies

upon them, by local circumstances, and by some prevailing influence not well understood, which give certain types to the affections. Cholera, however, seems more uniform in its type than most other epidemic diseases, but it may vary at different times and in different places, and it is quite possible that future experience in other cholera epidemics, or in different localities, would modify my views as to the selection and the efficiency of remedies. But if the disease as it may hereafter appear does not differ in its features from those presented during the three years of its prevalence in Chicago, referred to, similar results from treatment would confidently be expected to follow.

But the greatest desideratum in the treatment of Cholera has not been attained. This is some means which shall answer an indication more radical than those to which our attention has been directed, viz., that of directly and certainly neutralizing the cholera poison.

The investigations of Pasteur, of Koch, of Kline, and of their numerous co-laborers are directed chiefly to the discovery of that poison, and when it is demonstrated we may hope for the further discovery of some means of destroying it or preventing its effects. The present state of pathological and therapeutical science certainly points in the direction of the discovery and application of antidotes to specific poisons, and though in the case of Cholera it is at present only a pointing, we may hope in the future for definite realizations.

Already we know that Cholera originates and extensively prevails only where hygienic conditions are bad—where *filth* abounds—and so far as we can correct these conditions, and can remove this filth, we have the disease within our control; and if the hopeful views taken of the treatment be correct, we need not look upon it as the mysterious, the in-

evitable, and the utterly terrible scourge which from its first authenticated appearance it has been so generally considered.

PART SECOND.

DISEASES ALLIED TO ASIATIC CHOLERA.

The affections that most resemble Asiatic Cholera in their clinical history are accompanied with sanguineous determination to the mucous membrane of the alimentary canal, with free discharges or fluxes from its surface; and when they continue for a sufficient length of time an inflammatory condition of that membrane is likely to be developed.

In Epidemic Cholera we have found this fluxion and tendency to an inflammatory condition to exist, and this has been found to be more general and the inflammation to occur at an earlier period of the disease, by the late researches of Dr. Koch.

The causes of Cholera and choleroid affections, whatever they may be, and however various, all produce special lesion of function, and generally of structure, of the alimentary mucous membrane, particularly that of the intestines; and the similarity of these functional and structural changes constitutes the alliance of these affections.

The agency of a specific poison in the form of *microbes* producing epidemic Cholera, is based upon sufficient evi-

dence to be regarded as satisfactory if not perfectly conclusive; but there is not the same amount of evidence that specific poisons, especially that microbes are concerned in the production of the choleroid affections. Some of these, at least, are generally regarded as produced by peculiar *zymotic* influences, and it is believed that these influences are important factors in this connection. Diarrhœas accompanied with irritation and inflammation of the intestinal mucous membrane are often excited by exposure to filthy emanations when no other special influence can be traced; and the cause of typhoid fever, whatever it may be, is well known to produce a characteristic inflammation of Peyer's glands and adjoining portions of the mucous membrane.

Cholera Morbus, (or, as it is sometimes called, *Cholera Nostra*,) *Cholera Infantum*, and other particular forms of gastro-intestinal irritation, fluxion, and inflammation often occur under circumstances suggesting if not proving a specific zymotic cause, though other influences are capable of producing similar results, and often combine with an apparent specific cause in producing these diseases.

The particular affections which will be treated of in the remainder of these pages are, *Serous* (Zymotic) *Diarrhœa*, *Cholera Morbus* or *Cholera Nostra*, and *Cholera Infantum*.

All of these diseases might be included under the general designation of Irritation, Fluxion, and Inflammation of the Alimentary Canal, but they require to be considered separately and in their several relations.

These affections, though distinguishable from each other, possess so much in common that they may with propriety be treated of under the same general head.

By *Serous Diarrhœa*, as the term is used in this connection, is understood an irritated and fluxionary condition of the mucous membrane of the intestines, with a free secre-

tion of watery fluid from its surface, giving rise to frequent, thin, and copious discharges from the bowels, accompanied usually with more or less pain, by thirst, by rapid emaciation and loss of strength, by coldness of the surface in some cases at first, but when continued for some days, it is usually accompanied with a degree of feverish excitement, though the extremities may continue to be cool. Occasionally there is feverishness from the beginning. This feverishness when present commonly assumes a remittent type.

The form of diarrhœa here indicated chiefly prevails in our climate in the months of July, August and September, and is more likely to occur in seasons of great heat and a still atmosphere. Attacks of it are more abundant after a wave of heat which has continued night and day for several days together, and it prevails more in cities and large towns than in open country situations.

In its severer forms and more abrupt attacks it is apt to be accompanied with vomiting of a more or less serous fluid often mingled with bile, thus assuming the form, or merging into the condition, called *Cholera Morbus.*

When occurring in children under two or three years of age, it often assumes a state of much severity and danger known as *Cholera Infantum.* This diarrhœal affection in its different grades is much more common with children under six or eight years than with adults, but it may occur at any period of life.

It is often designated by the term "Summer Complaint," and is, perhaps, more prevalent in the cities and towns of the United States than in those of Europe. With us, it is more frequently found between the 31st and 42d degrees or parallels of latitude than beyond these limits, and oftener east than west of the Rocky mountains.

In this region there is a very great range of temperature

between the coldest days of winter and the greatest heat of summer; this range varying in different years 24° to nearly 60° C. (75° to 140° F.), and there is a very high average temperature in most places within this belt for two and sometimes three months in the summer. This great contrast in temperature seems to be among the causes of the affection, and for reasons which will presently be discussed.

There are other forms of diarrhœa produced by a variety of causes, and accompanied by various conditions, and some of these causes concur in the production of the disease under consideration. The term diarrhœa is applied to any state in which there are too profuse, too frequent, and too liquid intestinal evacuations. In some there are evident structural changes in the intestines. These are called *organic*. In others, no such structural changes are apparent. These are called *functional*. In some cases the diarrhœa depends upon the presence of some other disease, or recognized pathological state, of which the diarrhœa is a symptom. These are called *symptomatic*. In other cases, the diarrhœa is the primary and chief morbid condition. These are called *idiopathic*.

The various symptomatic diarrhœas we have not space here even to enumerate.

There are several varieties of the idiopathic class dependent upon different causes and accompanied by varying phenomena.

The contents of the small intestines are generally liquid or semi-fluid and pass into the large intestines in that state. Here the fluid to a large extent is normally absorbed, but if the peristaltic motion of the intestines is increased so that the retention of the matters in the large intestines does not take place, the discharges are more or less fluid. In most cases of diarrhœa there is increased effusion into the

intestines increasing the liquidity of the discharges. Anything which will either increase peristaltic action or glandular or intestinal secretion may produce diarrhœa. Congestion of the intestines from suppressed action of the surface, the irritation of improper or undigested articles of food, of various medicines or poisons, or of perverted secretions may cause diarrhœa. In many cases relief is obtained by the discharges and the diarrhœa itself, if not excessive, is beneficial by removing an injurious cause.

Diarrhœa is sometimes produced by impressions upon the nervous system, even by mental emotions, as by fear or pity, and by a variety of other influences.

A glance at these various facts will enable us the better to understand the special affections we have to describe.

It has already been mentioned that these "summer complaints" are much more prevalent and much more severe among children than adults. Indeed in our cities they are the chief source of infant mortality; and when we take into account that one-third of the human race perish before reaching the fifth year of life, that a much larger proportion of those that are born and reared in our cities and large towns die before that age, and that a very large proportion of them succumb to these bowel affections—this serous summer diarrhœa, cholera morbus, and cholera infantum—the importance of this subject will at once be appreciated. It is indeed more important though less alarming than Asiatic Cholera, as it is perennial and produces its annual harvest of death.

The leading *phenomena* of this serous diarrhœal affection have been mentioned in the definition of it already given. The *Clinical History* requires to be further sketched.

All the cases are not alike in their particular symptoms and course, and they occur both in children and adults. In

some cases, not the most common but the most serious and alarming, the patient after, perhaps, some preliminary indisposition is suddenly attacked with copious vomiting and purging of a serous fluid, at first the discharges from the stomach are mingled with the remains of food and those from the bowels with fecal matter, but after a few evacuations all become entirely thin, sometimes tinged with yellow or green, while in other cases they are almost as transparent as the discharges of Asiatic Cholera.

Very soon the countenance is shrunken and pale, though sometimes bluish, the eyes are sunken, the pulse frequent and small, the extremities cold and shriveled; cramping pains are often felt, fits of tossing restlessness are observed, great thirst is experienced, and in young children collapse and a fatal termination may be reached in from six to twenty-four hours.

In adult persons, or more vigorous children, or where the disease is less violent, in a few hours—from six to twelve—the discharges become less frequent and certainly less copious, the vomiting may be limited to the rejection of drinks when a considerable quantity is taken, and the discharges from the bowels may continue frequent, but they become small, and may be accompanied by considerable straining. In the case of adults, however, under proper treatment the symptoms usually almost completely subside in a few hours, a gentle reaction takes place, and little else than a feeling of languor and a degree of emaciation remains, from which, however, recovery is soon complete. With young children, speedy recovery is much less likely to take place. A diarrhœa continues, but little food is taken, or if swallowed is not assimilated; emaciation goes on, great debility ensues, the fontanelles, if open, are depressed; the child often lies with his eyes partly open—

in a stupid state; but sometimes there is much restlessness, with rolling of the head and tossing of the hands, and frequent moaning in a husky voice. In a large proportion of cases thus lingering, a degree of feverish reaction occurs. Vomiting no longer takes place, unless the stomach is too much loaded; but the diarrhœa continues, with small, often slimy, and slightly bloody discharges. Sometimes the discharges are more abundant and liquid, often greenish and irritating, and they may be expelled with an explosive force. In these cases a full development of muco-enteritis, or entero-colitis occurs, continuing for variable periods and with various results. There may be a gradual subsidence of the symptoms and a slow recovery, or there may be exhaustion, sinking, and death.

In another class of cases, more numerous, the disease commences with evacuations from the bowels, at first more or less fecal, but soon becoming watery, but with little or no vomiting, without much pain, and with no external heat, and no tenderness.

The discharges from the bowels may not continue simply watery, but may vary in color and consistency, and in the frequency of their occurrence.

They are apt at first to be free, and thus rapidly reduce the strength, causing the skin to be blanched, cool and shrunken, and the blood to be deprived of much of its serum, when the discharges become less free, possibly less frequent, and they are mixed with varying quantities of mucus. Febrile symptoms now appear in most cases, assuming more or less of a remitting type, the surface heat being irregularly distributed over the body. Sometimes the discharges have only a slight mawkish odor, while at others they are extremely offensive. The urine is scanty when the intestinal discharges are free. The food is apt to pass through the

alimentary canal but little changed, and is clearly recognized in the stools. Many cases, especially if left without efficient treatment, go on in this way for some weeks, the patient gradually becoming emaciated, assuming the appearance of age; the discharges often diminishing for a time and then increasing with an explosive force, until at length the patient becomes semi-comatose or morbidly vigilant from cerebral anæmia, and sinks and dies from exhaustion.

In nearly all adults, however, and in a large proportion of children, under proper management, hygienic and medical, after the disease has continued from a few days to a few weeks improvement in the symptoms takes place, the diarrhœa diminishes and at length subsides, the appetite becomes active and the power of digestion improved, convalescence takes place, the flesh and strength are gradually restored and the condition of health is resumed. In some cases more or less diarrhœa with offensive discharges continues a long time after the stomach has largely recovered its tone, the mesenteric glands become enlarged, the abdomen prominent, contrasting with the general emaciation; and a condition formerly called *Tabes Mesenterica* is assumed. This may continue for many months and terminate in gradual recovery or a lingering death. The appetite during all this may be good, even voracious, and the stomach digestion fair. In other cases still of this "summer complaint," with the commencement of the vomiting and purging, which vary as to moderation or violence, distinct febrile symptoms occur. In these cases there is more fretfulness, more pain, more tenderness of the abdomen, and in short more evidence of muco-enteritis as the chief pathological state. When the inflammation is chiefly in the small intestines the discharges are diarrhœal, but more or less mucoid, often much colored and offensive, but rather moderate in

quantity. When the lower part of the colon and the rectum are the chief seat of the inflammation, the discharges are more dysenteric—small, frequent, mucous and bloody—and accompanied with tenesmus.

Some of these cases of well marked muco-enteritis from the onset, occurring in adults or older children, are mild in comparison with other cases. There is pain of moderate severity, most about the umbilicus, but with more free discharges than in the disease as it occurs from accidental causes and in cooler weather, or at other times than after a heated summer term. Otherwise the symptoms do not differ materially from those of ordinary muco-enteritis.

In other cases the symptoms are more severe and the course of the disease is more protracted, though with symptoms scarcely differing in kind from those of ordinary or accidental muco-enteritis.

In other cases still, though the febrile and inflammatory symptoms are earlier manifested, the discharges are more *choleroid*, and they do not differ materially in other respects from those cases described as Cholera Morbus or Cholera Nostra, or in children as Cholera Infantum.

In still other cases more typhoidal symptoms occur, but the serous character of the discharges is marked, and in this and some other particulars the influence of a heated term is perceptible.

These different varieties of "summer complaints" have many features in common and shade off into each other in a manner that prevents lines of demarkation between them from being strictly drawn. It is often difficult to say how much structural lesion has occurred. As already stated there is a determination or fluxion of blood to the mucous membrane in all the cases of summer diarrhœa, especially in the first stage.

It would be interesting to trace minutely the anatomical changes, discovered after death, that occur at different stages of the disease, but it must answer our present purpose to state that evidences of irritation, inflammation, and their results are found in the intestines resembling those in Asiatic Cholera as observed by Koch and others, showing in the Morbid Anatomy as well as in the symptomatic phenomena the alliance between Malignant Cholera and these affections. These resemblances are so marked as to have brought some investigators to the conclusion that they are all varieties of the same general disease, and dependent upon similar causes acting with different degrees of intensity. But different causes often produce similar results, and there are too many facts showing the specific character of Asiatic Cholera to allow of doubt.

Etiology. The *causation* of these forms of summer disease is a matter of much interest. In discussing this subject too exclusive views are apt to be taken. There is doubtless a combination of various influences in the production of the results.

The geographical distribution of these affections and the season of the year in which they occur indicate the influence of meteorological conditions, and prove them to be among the chief factors in causation. Of these conditions *temperature* seems to be the most important.

Careful recorded observations were made for a series of years in several cities of the West, and a close correspondence was demonstrated between continuous high temperature for days and weeks and the prevalence of these diseases. Whenever a wave of high atmospheric heat continued day and night for more than five days an outburst of summer diarrhœa and cholera infantum was the result. It was particularly noted that high temperature for a single

day or for several days with cool nights was not followed by a particular increase of the disease, but when the heat was continuous and especially when at the same time winds were absent, with consequent impairment of ventilation, attacks and relapses were numerous. If high temperature and stagnation of air continued for two weeks or more great mortality among children resulted.

Other causes, such as bad food, improper milk supply, the change of weaning, the irritation of teething, over crowding, imperfect sewerage, and any form of filth, materially increase the amount and fatality of the disease.

What part *bacteria* may have played in causation, operating without or within the system, it is impossible at present to determine. No proofs of contagion have been discovered and the evidences of specific infection are not conclusive. A particular zymotic influence in these cases is exceedingly probable, but differing from the specific poison of Asiatic Cholera. Many of the conditions favoring the occurrence and spread of the disease are, however, similar, illustrating as well as their phenomena the relation they have to each other.

The heat, doubtless, operates both directly upon the body, and indirectly upon its surroundings in producing its effects. In its direct action upon the body it expands the tissues and diminishes their cohesion, and otherwise changes their molecular affinities, producing greater derangements in those unaccustomed to high temperature for larger portions of the year. The heat also increases perspiration and induces a loss of the saline ingredients in the blood, and this may diminish its capacity for receiving and retaining oxygen; and by the rarefaction of the air there is less oxygen in a given bulk inspired, less oxidation takes place in the system, less of the effete matter is consumed, and less purification of the system takes place.

But heat favors the production of bacteria and increases putrefactive changes, and effete matters within the system favor the lodgment and action of bacteria there.

These considerations go far towards explaining the influence of a "heated term" in promoting these diseases. We should not, however, lose sight of the influence of anything which irritates the mucous membrane of the stomach and bowels in precipitating attacks.

From this view of the subject the practical lessons in reference to the *prevention* of these diseases are readily inferred.

It is simply stating a truism to say that in all diseases prophylaxis consists in the avoidance, the removal, or the counteracting of the causes.

The meteorological conditions, the heat of summer we cannot control. We can, however, lessen the temperature of the body by bathing and producing artificial currents of air about it. We can improve ventilation and diminish heat by various natural and artificial means; we can diminish and remove filth; we can regulate the diet and give the best possible; we can mitigate the irritation of teething by scarifying the gums when they are swollen and inflamed; we can take the children into the open parks, upon the rivers, or other breathing places of cities; and above all in efficacy, we can take them into the country, away from the heated brick walls, the stone pavements, the sewer gases, and crowd-filth of the cities, and give them in the country, among the mountains or by the sea-side, cool nights, pure air, the light of heaven, proper exercise, pure water and wholesome food, and we can give the food with system and regularity.

The details under these heads readily suggest themselves to the physiologist and hygienist, as every physician is now supposed to be. Even the masses of intelligent people not

connected with the medical profession are supposed to be acquainted with the leading principles of hygiene; but it is sad to know how many people are still ignorant of its first principles, or indifferent to them; and how many not so ignorant fail to put their knowledge into proper practice. Self-indulgence in their own persons, the force of wrong habits, and the want of proper discipline and care in the government of children and youth, are so appallingly frequent as to produce distrust and uneasiness in the minds of philanthropists, and to throw a deep shade of gloom over the prospects of our country and the race. These remarks are of general application, and do not refer exclusively to the diseases we are discussing. The habitual indulgence in narcotics—alcohol, tobacco, and opium—is impairing the prospects of the race through personal and hereditary influences; and the neglect of other hygienic laws in reference to other than choleroid diseases is producing an amount of mortality, inefficiency, and suffering, appreciated only by those who have carefully observed and studied the subject.

It is by no means unreasonable to conclude that the occasional visitations of Asiatic Cholera are the means in the long run of saving many lives, by forcibly calling the attention of the profession and the people to hygienic rules, the neglect of which leads to a constant loss of life and health, which in the aggregate is infinitely greater than that produced by occasional advents of malignant cholera.

The same general means, a description of which was presented from so many authoritative sources when treating of Asiatic Cholera, are applicable to the prevention of *choleroid affections*, and indeed of all infectious and epidemic or endemic diseases.

The *special pathology* with reference to indications of treatment of serous Diarrhœa, Cholera Morbus, and Cholera

Infantum, requires a brief notice. The causes we have discussed as producing these diseases tend to the production of a lowered vitality of the whole system, to deranged action of the organic nerves, to the accumulation of effete matter in the body, and especially to an increase of irritability of the mucous membrane of the alimentary canal. The vital affinities are disturbed and the tonicity of the whole vascular system is lowered.

The morbid excitability and lowered tonicity of the mucous membrane favor a rapid influx of blood to that membrane and a correspondingly rapid effusion or exudation of serum derived from the blood and poured into the alimentary tube. The material of the diarrhœa is thus furnished, and the reflex excitement of the muscular coat results in the free discharges. Any irritating material, such as improper or undigested and fermenting food passed from the stomach, the possible presence of bacteria, and a variety of other impressions made upon the membrane directly, or upon it through reflex action from other parts of the body, increase the afflux and the discharge, and the primary phenomena of the disease are induced. The loss of the serum of the blood with the saline ingredients produces other results, as in the case of Asiatic Cholera. Other glandular secretions, salivary, urinary and hepatic, are often diminished or at least prevented; the blood, thick and deprived of some of its important elements, circulates with less freedom in the capillaries and the larger vessels, its oxygenation is greatly impaired, and a train of the phenomena of the disease, primary and secondary, is produced. The inflammatory lesions of the intestines which follow, give rise to feverish symptoms, with their consequences, and the morbid circle is complete.

When the vomiting is so active and persistent as to pre-

vent the fluid from being retained and absorbed, so as to supply in any considerable degree the place of the fluid lost from the blood, collapse and death may speedily follow. These are the immediate dangers of Cholera Morbus and Cholera Infantum. They are similar to, though not so great as, the danger in Cholera Asphyxia. This last remark respecting diminished danger is particularly applicable to Cholera Morbus in the adult, while in Cholera Infantum the less controllable character of the symptoms and the less power of endurance of the young child render this a very dangerous form of disease. The mortality in this is by no means small.

When, however, the discharges can be controlled, reaction may speedily take place, liquid nourishment may readily supply the losses of the blood serum, and comparative health may be soon restored. But in many cases, after the vomiting is checked and the diarrhœa abated, and reaction in the general tissues and functions has occurred, the lesions of the intestine are left. Large patches are denuded of their epithelium, hemorrhagic infarction may have taken place, a low inflammatory condition is excited, feverishness is induced, the diarrhœa is continued, but with less profuse discharges; and the continued heat, or other causes, may bring an increase or continuance of the symptoms, and the child may linger and slowly recover, or succumb to the disease.

The *Prognosis* in Cholera Infantum and the severer forms of serous diarrhœa in children is always grave, though many recover; while in the summer diarrhœa and Cholera Morbus of previously healthy adults, under proper treatment, the prognosis is very favorable. The cases almost invariably recover, and generally quite speedily.

Occasionally, however, in adults the vomiting and purg-

ing go so far that fatal collapse occurs, or if reaction takes place, capillary circulation may fail in the brain and the patient die comatose, or the kidneys may fail to resume their functions and the patient die from uræmic poisoning, as after attacks of malignant Cholera. Farther resemblance is here traced between Cholera Morbus and the latter disease.

TREATMENT.

From the foregoing account of these diseases we derive several indications of treatment; and as the symptoms and pathological conditions so much resemble those that are present in Asiatic Cholera, it is not surprising that the indications and the means of fulfilling them are very similar to those presented in that disease.

The indication first in time and in importance is to allay the morbid irritability of the mucous membrane of the alimentary canal, and arrest the profuse discharges, whether they are by vomiting and purging or by purging alone. There is then also an indication for restoring proper nervous influence, especially vaso-motor, and as well for restoring the general tonicity and proper affinities and functions of the system; and where there are lesions of the intestines, congestive, inflammatory, ulcerative, or necrotic, there is an indication to modify and overcome those conditions.

For accomplishing these purposes various remedies may be required, and the most careful hygienic management, the regulation of diet, drinks, and ventilation, the furnishing of pure, fresh air, often a change of locality, and the giving of tonics, the use of bathing and other restorative measures must always receive atttention.

As the different particular forms of these diseases will require modifications of treatment, it will be well to consider the measures for each leading form separately.

And *first*, the *Treatment* of ordinary attacks of *Cholera Morbus*, or *English or American Cholera* in the *adult*. If an adolescent or an adult is attacked with active vomiting and purging, especially if any irritating ingesta have been taken, a draft of warm water may be given and the stomach well washed out. When it is presumed that all irritating matters are removed, a decided opiate should at once be given, and its retention and effect may be aided by a sinapism applied over the upper part of the abdomen. The form of opiate and the manner of giving it are of some consequence. In ordinary cases nothing will be more convenient and efficient than dropping dry, far back upon the tongue, from a quarter to half a grain of a salt of morphia, and the taking of a small spoonful of water immediately after. This will be almost necessarily retained, and may be all that will be required for promptly arresting the symptoms. If, however, they continue, the dose may be repeated in an hour, possibly less or more, though the quantity should be varied according to the effects observed. The object is to bring the patient under a decided anodyne influence, to diminish the irritability of the gastric and intestinal membrane, and arrest the discharges. Care must be taken not to produce too profound narcotism, especially in adolescent and younger persons, and in those entirely unaccustomed to any form of narcotics. Opium in other forms may answer the indication about as well, and especially two grains of opium and two or three of camphor, thoroughly triturated with dry sugar, dropped into a teaspoonful of water and taken, and a spoonful of water given after it, will answer an admirable purpose. A few grains of calomel may be added to such a mixture, if thought necessary to modify the secretions or for any other purpose.

If all the doses are persistently vomited when adminis-

tered, by the stomach, a drachm or two of laudanum or its equivalent of an aqueous solution of opium or morphine may be used with a little starch or other vehicle by enema. It should be given immediately after an evacuation and its discharge resisted. In administering by the mouth, by far the best time is immediately after vomiting; and the time of repeating the doses and their size must be left to the discretion of the physician. Large doses will usually be well borne, and their repetition will often be required.

If the methods of administration described fail by reason of the persistent vomiting and purging, morphine may be used hypodermically either without or with the addition of atropine. A quarter of a grain in perfect solution alone, or the same with 1–120 of a grain of atropine, would be a proper dose; and the same or smaller doses may be repeated as required. The withholding of drinks, except in quantities just sufficient to moisten the passages, is almost as necessary here as in Asiatic Cholera, and for the same reason. A large quantity is sure to be rejected, and is likely to bring up with it the medicines administered. As an exception, I have known a free drink of *hot* water—as hot as could be borne—to arrest the vomiting at once and permanently.

If a case of sporadic or non-specific cholera has been allowed to progress until a degree of actual collapse has occurred, and with cramps in the extremities, opiates must be promptly but cautiously given if the vomiting and purging still continue, and then restorative measures must be used. Stomachic stimulants—ginger, mustard, spices, hot coffee, hot saline drinks, and friction are indicated; perhaps bromides and quinine; and, in short, the remedies advised in the blue stage of Asiatic Cholera may be required.

If, however, the opiate treatment is commenced before

such an extreme condition is reached, the arrest of the disease is almost certain.

The discharges controlled, the subsequent treatment is simple. Care as to diet may be all that will be required.

Attacks of vomiting and purging, almost identical with those described, sometimes occur in malarial fevers. The treatment for controlling the immediate symptoms will not differ from that in other cases; but full anti-malarial doses of *quinine* must be given to prevent a return of similar symptoms with the next paroxysm of the fever.

Sometimes cases are seen of only occasional vomiting, but more persistent diarrhœa, the discharges being of a gruelly consistence and of a light slaty color, with some fever, a heavily coated, pasty tongue and much suffering and depression. These cases most readily yield to moderate but repeated doses of morphine, with fractional doses of calomel and ipecacuanha.

The *Treatment* of the *serous summer diarrhœa of adults, and particularly of children, is next to be considered.*

In these cases, commencing with more moderate discharges than in the case of Cholera Morbus and well developed Cholera Infantum, there is not the same urgent necessity for speedily arresting the discharges, as there is not the same danger of the loss of the fluid and saline portions of the blood. There are apt to be improper ingesta, undigested food, or morbid secretions in the alimentary canal, which may need to be carried away.

There is also a *condition* to be removed as well as a diarrhœa to be checked, an inflammatory state is threatened or developed, and the causative indication must be followed here as in other diseases, and the cause is not simple.

In the milder forms of intestinal irritation and catarrh,

not depending mainly upon summer heat but more upon improper ingesta, simple treatment, in many cases, will alone be required. In many such cases, the diarrhœa excited will lead to the removal of the irritating causes, the free exudation will unload the vessels and relieve the fluxion, and the disease will thus cure itself. The food, however, should be suspended, or only the lightest kinds be taken; mucilaginous drinks may be advised or some simple tisane given hot; a cataplasm may be applied to the abdomen, or a tepid compress; and if there be much irritation without free evacuations, a laxative, such as a Seidlitz powder, a moderate dose of Citrate of Magnesia, or perhaps of castor oil, may be given; to which latter may be added a few drops of spts. of camphor, or half a teaspoonful of paregoric. After proper evacuations have occurred (and these are generally, or often at least, quite sufficient without the administration of the laxative), if the irritation and diarrhœa continue an opiate should be given and repeated from time to time, if required to allay irritation and check the discharges. Various preparations and combinations are advised by different writers, but all with an opiate as the basis. Many recommend the addition of dilute sulphuric acid, but my experience has not given me as much confidence in that remedy as is expressed by others.

In many of these cases the secretions from the liver and other glands, including those of the mucous membrane of the stomach and bowels, are perverted in different ways, and some small doses of mercurials in combination with soda will often, I am sure, be of service in modifying favorably wrong actions. A grain or less of calomel, or a grain of blue mass, or a few grains of mercurialized chalk may be given to an adult, either with or without some opiate, and repeated as may be required.

If the discharges should be decidedly checked by these means while intestinal commotion and pain remain, a very mild laxative, such as the syrup of Rhuburb, Castor Oil, or even a few small saline doses may be given. The operation of any of these may be followed by opiates, often beneficially combined with astringents and tonics, especially in cases where the discharges are watery and little or no fever or tenderness are present. Tonic doses of quinine often do much good combined with the anodynes; and whenever there is suspicion of a malarious influence, full antimalarial doses should be promptly given, but not long continued.

In some cases, and especially where fermenting or decomposing changes take place in the food, small doses of Carbolic Acid or Creosote may be added to the other treatment required.

More direct astringents are useful in many cases, especially after the disease has continued a few days.

Tannic acid is the chief active principle in the vegetable astringents, and it may be used in its natural combinations in those astringents, or by itself, or in various artificial combinations.

We find good natural combinations in geranium maculatum (spotted crane's bill), in matico, in hamamelis Virginica (witch-hazel), in coto bark, and in other vegetable substances. The coto bark has lately been much used and much praised. Ten or twelve minims of the fluid extract of the coto bark with a drachm of paregoric is a good mixture. This quantity, properly diluted, is to be given to an adult, once in from three to six hours. An *emulsion of oil of turpentine and laudanum* will be applicable to many cases, especially when they become sub-acute. The following combination will be proper:

℞ Oil of Turpentine.....ʒiij
Tincture of Opium.....ʒiij
Gum Acacia, pulverized, and White Sugar, of each.....ℨss
Camphor Water.....ʒiij

These ingredients, mixed and made into a thoroughly prepared emulsion, may be given to an adult in doses of a teaspoonful from three to five times a day. To this mixture half a drachm or a little more of carbolic acid may be added in preparing the emulsion, especially in cases where the discharges are offensive.

Several mineral astringents are sometimes found very useful. The sub-nitrate or the oxide of bismuth, combined with finely pulverized cinnamon, the astringent preparations of iron, in the more protracted and debilitated cases, such as the liquor ferri ternitratis, will often serve an excellent purpose. This may be alternated with anodynes or other medicines as may be demanded.

As a tonic to the intestines and to the general system, strychnine has obtained, and I think deserves, a favorable reputation. Given in proper doses it sometimes succeeds in the more chronic cases when other means fail.

In some protracted cases, especially where chronic muco-enteritis is the prominent condition, the nitrate of silver will be found very beneficial. It may be given either by the mouth or by enema, in the latter method when there are ulcerations of the lower bowels.

In all cases the diet should receive the utmost care. Its staple should, in most cases, be milk with which is mingled some very thoroughly cooked farinaceous substance. Generally the milk should be scalded, and often one-quarter or one-third of its bulk of lime water may be added with advantage. Well prepared beef tea, in which some nice crackers are crumbed, may be alternated with the milk and

farinaceous preparations, and sometimes a small amount of very digestible solid food may be well borne. Individual experience in each case should have influence in determining the amount and kind of food to be allowed; but too many experiments should not be tried, and a systematic plan of diet should be followed.

A change from the locality in which the disease has occurred, especially from the city to the country, will sometimes be essential, and will generally be followed by improvement.

But the disease is chiefly among Infants or Young Children and with them we find much the severest and most dangerous forms, and it is with them that by far the greatest difficulty of management is experienced. It is easy to say, the principles of treatment with children and adults are the same, and that similar medicines should be used, adapting the doses to the age of the child. This, however, while true, gives a very inadequate idea of the difficulties of managing these cases, and of securing for them the best results. Infants are very susceptible to medicinal impressions, but they do not respond in exactly the same manner to the action of some remedies, especially to opium, which is so important an agent in these cases.

An infant may be profoundly narcotized with opium, without having the discharges arrested. This is by no means as likely to be the case with adults. Then their generally high degree of susceptibility renders them more responsive to morbid impressions and influences, and in many of them the power of endurance is very feeble.

Another difficulty, and a very serious one, consists in finding for them suitable food. The natural food of an infant is a healthy mother's milk. For this there is no perfect substitute, and this healthy mother's milk is not always

to be obtained. Indeed, in a large city in either extreme of society, it may be said to be seldom obtainable. The poor mother's often have insufficient food, and much more frequently that of a bad quality, unskillfully prepared. The rich may select the best articles in the market, and suppose they have skillful cooks; but even artistic cooks do not always prepare the most wholesome dishes; and the domestic and personal habits of society in every grade are very far from being the most hygienically correct. The raw whiskey or gin and the beer and cider of the poor and the dissolute, and the no less injurious wines and *liqueurs* and brandy and Bourbon of the wealthy and respectable are not yet banished from daily use. The excessive and injurious use of coffee and tea among the women of all ranks is by no means a myth; and the frequent use of various narcotics to induce sleep, or relieve neuralgias caused perhaps by the very indulgence in them, impairs the health and deteriorates the milk of many mothers. The foul air breathed by the squalid mother may be endured by *her*, but the bad food she produces for her *nursing infant*, added to the same foul air it is forced to breathe, may be altogether too much for its feeble endurance.

Considering all these and many other facts that might be mentioned, the great infant mortality in the cities cannot surprise us. It is the penalty of violated physical laws, public and personal, and must be endured until these laws are obeyed.

But what are we to do for the *Infant* attacked with "summer diarrhœa," tending towards or merging into Cholera Infantum?

In looking over the directions, given in the text-books and the special monographs, as to treatment, often vague and seldom expressed with much confidence, the student cannot

be greatly encouraged in the prospect of subduing this disease, and the general city practitioner who has had experience may sigh for some comfortable specialty to which he may retire.

But these infants must receive attention, and skill in their management is of great importance. A nursing infant, or a recently weaned child, or, indeed, any child under five or six years of age, whose home is in a great, hot, crowded, and filthy city, if beginning to droop, or if manifesting any symptoms of the "summer complaint," between the middle of June and the first of September, should at once be taken to some open, healthy situation in the country, or at the sea shore, where it will have pure air, refreshing breezes, cool nights, and freedom to be much of the day out of doors. If receiving its food from its mother's breast, or from a wet nurse, that mother or nurse should live simply but well, and should accompany the child in its enjoyment of the open air. If the child be weaned, or if it takes in part artificial food, that should be selected with care. It should have an abundance of fresh, pure air.

The clothing should be adapted to the temperature, and to the exposure, and so arranged as to produce no restraint, and of a quality to protect from sudden changes.

If the child, while in the city, has an actual attack of the disease, if not too ill to forbid removal, it should be taken at once to a country or seaside situation.

But all parents cannot take their children into the country. If remaining in the city they should be taken daily to the parks, or upon the water, or where the purest air possible can be obtained. Exposures which may seem hazardous will often be followed by great improvement.

As heat operating directly upon the system is so important a factor in the production of this class of diseases,

especially in children, any means for effectually reducing the temperature in apartments would be of the greatest service.

Many city and village residences are furnished with hot air flues and registers, connected with furnaces for supplying warmth in winter by heated air. It has been suggested, and the plan seems feasible, that these flues and registers may be connected with refrigerators for supplying cool air in the "heated term" of summer. A power fan would perhaps be required to force the cool air into apartments, and a proper degree of coolness of the air might be produced by its being taken from a deep cellar, or by passing it through sprays of water, or through rooms containing quantities of ice, or chilled by chemical refrigerating processes. Thus the temperature of apartments which children and others occupy could be controlled. It is possible that in the near future comfort can be secured in many homes, suffering relieved, sickness prevented or cured, and life preserved.

The very first and most important duty when the physician is called to a case of summer diarrhœa in a child, is to inquire into the *diet* and general surroundings, and to give special directions respecting them. If in a nursing child, should the nurse be changed? In a majority of cases in common life this cannot be done, and often it should not be. This must be left to the possibilities of the case and the discretion of the physician.

If the child is not nursing, or the mother's milk evidently disagrees, what food should be advised? Here it is impossible to lay down positive rules. But certainly as a general rule, *milk*, good, fresh milk, from a healthy, properly cared for cow, is the basis. Its amount of dilution, whether or not by lime water, whether scalded with *thoroughly*

cooked farinaceous substances mingled, are matters to be determined by experience in each particular case. Sometimes good freshly prepared beef extract, partly digested artificially, will be advisable. In some cases, especially in older children, a portion of solid food will agree better. Tender beef or mutton, pounded to a jelly and freed from fascia by scraping, salted and given raw or but slightly cooked, will often agree well. Perhaps pepsin and pancreatin may be added to some foods with benefit; and various laboratory preparations are advised; but fresh milk and fresh meat are as a rule preferable when attainable.

As to quantity, time of administering, etc., the physician must direct. The importance of clean nursing bottles, and all vessels containing the milk and other foods, is now well understood.

In the treatment by *medicines* of summer diarrhœa in children, great caution and discrimination is required. The delicacy and impressibility of children must be considered, and their greater proportional susceptibility to the narcotic effects of opiates must be borne in mind. The difference in the strength of laudanum and paregoric should be impressed upon mothers and nurses, and opiate medicines should be prescibed in diluted forms to diminish the danger of accidents from over doses.

To allay the morbid irritation of the stomach and bowels and arrest the debilitating discharges is an important indication, and for fulfilling it opium and its preparations are the most efficient and most certainly called for, notwithstanding the danger of narcotism from their use.

A majority of practical physicians, certainly of the past, I think of the present, and I do not doubt of the future, have been, are, and will be of the opinion that some preparation of mercury may be added to, or alternated with, the opiates

with advantage. Its mode of producing its beneficial effects is not so clear, but it changes the conditions of the mucous membrane of the digestive tube and of the associated glandular organs. Some think its beneficial effects are due to its action as an anti-putrefactive agent, or by its checking the activity of bacteria. That the bichloride, into which form, it is supposed, other mercurials are slowly changed in the system, is exceedingly destructive to microbes is now well known. But whether it does good by acting on the living tissues of the body or the contents of the organs, this agent seems to be of use in these cases, and children usually bear it well. Calomel, blue mass, or mercurialized chalk, in doses of a grain or often much less, with an opiate, repeated according to the urgency of the symptoms until relief is obtained or until an anodyne, and gentle narcotic effect is manifested, is more likely to control the symptoms in a majority of cases than any other remedy. Ipecacuanha in minute doses, and alkalies in freer quantities may often be added with advantage.

The general principles of treatment are essentially the same in children and adults, the chief differences being in reference to care in the use of opium, to the matter of diet, and to the importance of leaving a city. The young practitioner should be advised that he is not to expect the same success with young children as with adults.

It should not be forgotten that from a protracted diarrhœa children are liable to fall into a state of stupor or *coma vigil* from cerebral anæmia and exhaustion resembling the latter stage of meningitis with effusion. This has been called *pseudo* hydrocephalus, and the appearances are false, the case requiring supporting measures.

The principles of *treatment* in *Cholera Infantum* are the same as those given in the case of Cholera Morbus in

adults; and all that has been stated about removal from a large town to the sea-shore or country, about diet and regimen, about exposure out of doors to the open air and sunlight, is as applicable here as in cases of summer diarrhœa in children, and if possible more important. In an active attack of Cholera Infantum when the vomiting and purging threatens to produce speedy collapse, as in the case of Asiatic Cholera, the most urgent indication is to arrest the discharges, and this is to be attempted by means similar to those advised in that disease, adapting the doses to the age and susceptibility of the child. There is, however, a *morbid state* to be corrected, and with reference to this I can but agree with Drs. Henry Hartshorn, G. B. Wood, Niemeyer, Jacobi and many others, that calomel in small doses does good, especially in the early stages of the disease. It should be finely triturated with sugar, and small doses of camphor may be combined. The bichloride of mercury has been, by some, advised in doses of the one hundred and fiftieth or one-hundredth of a grain, but experience has not been large with it in these cases.

Here too, as in Asiatic Cholera and Cholera Morbus, I believe quinine may be used with great benefit in many cases. Dr. A. A. Smith, of New York, uses quinine and morphine hypodermically, and there are the same reasons for its use here as in Asiatic Cholera. If a malarial influence is present there is a double indication for its use. Children as a rule bear it well.

The bromides have also their advocates in these cases, and there are reasons to believe them useful.

Bathing has been used it is thought with benefit. The warm bath tranquilizes, and the cool, and even cold bath, after Ziemssen's method of gradually reducing the temperature of it, is advised by Dr. Hartshorn and others. Chap-

man's ice bags to the spine, and enemas of cool water have also been advised; and mild mustard or spice plasters over the abdomen have their advocates.

Another means for arresting the vomiting and purging alluded to when treating of Asiatic Cholera, on the authority of an English physician, which must be comparatively harmless, consists in applying a blister over the course of the left pneumogastric nerve as near as possible to its origin behind the angle of the jaw. Speedy effects are attributed to it, and in a disease so desperate it seems worthy of trial. It will not interfere with other means.

In conditions of collapse, stimulants such as warm coffee, aromatic teas, ammonia and saline solutions, if the stomach will bear them, or warm chicken broth with a little mustard or pepper added, and above all moderate and repeated doses of quinine will be called for.

The injection of water, with, perhaps, the physiological proportions of salines for blood serum, into the tissues might be tried, where the watery discharges from the stomach and bowels have been great.

When the violent symptoms are controlled and reaction is induced, a condition of inflammation of the mucous membrane with accompanying diarrhœa is likely to be left, requiring the management applicable to the condition of the summer diarrhœas already discussed.

In lingering cases various astringents may come to be useful, both vegetable and mineral, before enumerated; and in the acute stage of vomiting and purging, acetate of lead with acetate of morphine may sometimes be given internally, and more efficiently still as an enema, when watery purging continues after the vomiting has ceased.

Nitrate of silver, by enema, has been much used in the chronic cases, and is most efficient when the lower bowels

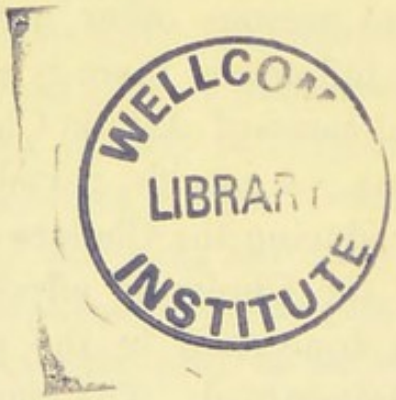
are ulcerated. If the child is held in a position with its hips elevated and a very flexible catheter is introduced into the bowel, it may be carried into the parts affected, and a sixth of a grain, more or less, in an ounce or two of water be injected through the catheter sometimes with excellent effects. The turpentine emulsion, previously mentioned, is often applicable in these as in so many other cases of sub-acute and chronic inflammations of the mucous membrane of the intestines.

In slow convalesence from Cholera Infantum great care must be taken in regard to diet and other hygienic conditions. Changes of air, salt water bathing, and the use of tonics, are among the means of restoration.

I have now given an account, but much less full and minute than the account of epidemic Cholera, of those affections which most resemble it. The resemblance is not confined to the symptoms but extends to the pathological lesions and to the causes concerned in their production. Heat and filth concur in the production of both, but heat has more to do in producing the Choleroid affections, especially Cholera Infantum, and filth, perhaps, plays a greater part in the Epidemic Cholera. Attacks of both are excited by improper ingesta and various other unhygienic conditions. But back of these influences there is a wide difference between the essential cause of Asiatic Cholera and any of the Choleroid affections. A specific, portable, migrating poison is concerned in producing the Cholera and the same poison does not produce the Choleroid affections. Whether any specific poison is concerned in the production of these is not positively determined. The general profession concur in speaking of them as zymotic diseases, and this term implies the existence of a material cause operating as a ferment. Full and precise knowledge on this subject, as

upon many others in the profession, awaits future developments.

However various the morbid influences impressing the organism, a similarity of processes is produced in disease. There are, indeed, certain relationships between all vital actions, physiological and pathological, and the more of them we trace—the nearer we approach to a unity of living conditions and actions—the nearer we shall come to the most ultimate truth.



ERRATUM.

For *returned*, in fifth line from top of page 75, read *retarded*.

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