hot water, and freely sprinkled over the surface with oil of turpentine, acts the same as a mustard paper. It is also a very useful injection (15 gm., in a litre or less of warm soapsuds, and stirred in while being administered). Internally, as above indicated, it may be given in doses of from three to ten drops.

Turpentine itself is not much employed in this country, but may be given for chronic diarrhœa, ulceration of the bowels, chronic rheumatic joints, sciatica, etc., as well as in leucorrhœa and gonorrhœa, under conditions indicating copaiba, over which it probably has no advantages; it may be made into pills and a gram or two be given at a time.

Resin possesses but little activity. It is employed only externally and occasionally.

PREPARATIONS.—Of turpentine there is no official preparation unless the oil and the resin might be so considered. Of the oil we have the *Linimentum Terebinthinæ* or *Turpentine Liniment*, of 65 parts of resin cerate dissolved in 35 parts of the oil. This is a very irritating application. *Resin Cerate* (*Ceratum Resinæ*, U. S.) is made of 35 parts of resin, 15 of yellow wax, and 50 of lard. *Resin Plaster* (*Emplastrum Resinæ*, U. S.) is made of 14 parts of resin, 80 of lead plaster, and 6 of yellow wax. *Cantharides Cerate* (*Ceratum Cantharidis*, U. S.) contains eighteen per cent. of rosin and fifteen per cent. of oil of turpentine.

ALLIED PLANTS AND PRODUCTS.—The genus *Pinus* is the most important of its family and comprises about seventy living species, distributed through the cooler regions of the earth. Turpentines are found to some extent in all species, and they agree closely in their general properties. Similar substances, some of them known commercially as turpentines, are found in related genera. *Venice Turpentine* is the product of *Larix Larix* (L.) Karst. (*Pinus Larix* L.; *Larix Europæa* D.C.) of southern Europe. *Strassburg turpentine* is obtained from *Abies Picea* (L.), Lyons (*Pinus Picea* L.), the European Silver or Strassburg pine. *Pitch*, *Canada* and *Burgundy*, as well as their turpentines, have been considered under those titles. *Tar*, *cade*, and *juniper oils* have also been duly considered. All agree in their general composition and properties with the subject of this article.

Besides these, a number of oleoresins derived from other families (copaiba, Chian turpentine, etc.) are commercial and medicinal products of similar nature.

W. P. Bolles.

TUSCAN SPRINGS or **LICK SPRINGS.**—Tehama County, California.

POST-OFFICE.—Red Bluff. Hotels and cottages.

The Tuscan Springs, about fifty in number, are located about eight miles northwest of Red Bluff, two hundred miles north of San Francisco and one hundred and thirty-five miles north of Sacramento. They cover an area of about ten acres, and are situated at an elevation of 900 feet above the sea-level. No complete analysis seems to have been made, but the waters resemble in medicinal properties those of the Kentucky Blue Lick Springs. A partial analysis of the Red Spring water was made by Dr. F. W. Hatch a number of years ago. It contains: Sulphuric acid,* hydrochloric acid, lime, sodium chloride (20.72 grains per United States gallon), lithia, iodine (4.50 grains per United States gallon), carbonic acid, iron bicarbonate, potassium chloride, magnesia, alumina. Temperature of water, 78° to 80° F.

The White and Black Springs are also in use, but they have not been analyzed. Most, if not all, of the springs contain sulphureted hydrogen in considerable quantities. The temperature of the springs varies from 67° to 94° F. Their action is tonic and alterative, laxative or cathartic, according to the amount taken. Ample facilities for bathing are furnished to guests. There is also a plunge bath thirty by sixty feet, four feet deep at one end, and thirteen feet at the other. The waters have considerable reputation on the Pacific coast in the treatment of syphilitic skin affections, scrofula, rheumatism, liver and kidney troubles. They are used commercially, having a considerable sale on the coast.

James K. Crook.

* Probably in combination.—J. K. C.

TUSCARORA LITHIA SPRING.—Juniata County, Pennsylvania.

POST-OFFICE.—McCoysville.

We are informed by Mr. W. A. Middleton, mineralogist, of Harrisburg, that this valuable lithia water was discovered by prospectors a few years since while boring for oil. The spring flows about four hundred gallons per hour, and is heavily charged with carbonic acid gas. It contains the following solids: Potassium bicarbonate, calcium bicarbonate, lithium bicarbonate, magnesium bicarbonate, magnesium sulphate, sodium sulphate, silica, alumina. The water is of the alkaline class, and is free from nitrates and nitrites. As far as can be learned, the spring is not yet fully developed as a resort, but the water is sold.

James K. Crook.

TUSSILAGO. See *Coltsfoot.*

TUSSOL—antipyrin mandelate, antipyrin phenyl-glycolate, $C_{11}H_{12}N_2O.C_6H_5.CHOHCOOH$—is a salt of antipyrin which is especially recommended in the treatment of whooping-cough. To a baby four weeks old Kennedy gives 0.03 gm. (gr. ss.) twice a day, and to a child of seven years 0.2 gm. (gr. iij.) four times a day. Rehn and Blum speak of its efficiency in pertussis, notable change in the cough ensuing in from three to ten days after beginning the treatment.

W. A. Bastedo.

TYPHOID FEVER.—(τῦφος, smoke; secondarily, stupor.) (Synonyms: English, *Enteric Fever;* German, *Abdominaltyphus;* French, *Dothiénentérie* or *Dothiénenthérite*, or *Fièvre Typhoïde;* Italian, *Tifo Enterico;* Spanish, *Fiebre Continua, Tifo.*)

HISTORY.—There can be no doubt that this disease has prevailed extensively from very remote periods, but its authentic history, like that of so many other infectious diseases, is of quite recent date. Indeed, for this there are especially good reasons in regard to typhoid fever, for the intestinal lesions are the essential and distinguishing characteristics of the disease, and these would be described carefully only after frequent autopsies. Ingenious attempts have been made to associate passages in the works of Hippocrates with this disease, but such have hardly carried conviction to others than their originators. Typhoid fever, as we know it, is not distinctly recognizable in any of these descriptions, and it is not until the seventeenth century that the clinical conditions ending in death, and followed by autopsies revealing intestinal lesions, are to be found in medical literature.

Spigelius, Lancisi, Baglivi in Italy; Friedrich Hoffmann in Germany; Willis, Sydenham, and Huxham in England, all described cases of typhoid fever with such exactness as to leave no doubt of the identity of the disease. Morgagni in France, in the eighteenth century, gave a particularly clear delineation of the course of the disease, and of the intestinal lesions. It still remained, however, for the nineteenth century to define its distinguishing characteristics, and to differentiate typhoid fever from all other diseases.

The Germans are disposed to attribute priority of recognition and determination of the distinctions between typhoid and typhus fevers to Hildenbrand, of Vienna, who published a treatise on "Contagious Typhus" in 1811 (translated into English by Dr. S. D. Gross in 1829). It is true that he distinguished between "contagious typhus" and what he calls "originary typhus," but his ideas about his "originary" typhus were extremely misty, and I think the impartial reader of his treatise will find much difficulty in identifying it with typhoid, although the "contagious" disease answers fairly well to typhus fever.

Bretonneau, Petit and Serres, Louis and Chomel in France, during the first thirty years of this century, did more, by their careful observations at the bedside and

their patient labors in the autopsy room, to elucidate the symptoms and course of the disease, to connect these with the pathological lesions, and to place the whole in the clear light by which we regard this very important disease to-day, than any or all of their predecessors. Even after the publication of their observations a good deal of confusion prevailed for another ten years between typhoid and typhus fevers, the one being more common in France, the other in England, the symptoms being by no means very dissimilar in exceptional cases, or at least sufficiently alike to throw doubt upon the recently promulgated pathology.

This doubt it was the privilege of American pupils of Louis to be instrumental in dispelling. James Jackson, Jr., of Boston, published in 1830, 1833, 1834, personal observations confirming the occurrence of intestinal lesions as the result of typhoid fever. Gerhard, of Philadelphia, in 1835, reported cases of typhus fever occurring during an epidemic at the Philadelphia Almshouse, which marked out plainly the characteristics of that disease; and in 1837, in association with Pennock, Gerhard established clearly the fact that typhoid and typhus were distinct diseases. This was further brought out the following year (1838) in Paris, and in 1840 in this country, by George C. Shattuck, of Boston, as the result of observations in the London Fever Hospital, at the request of and following the teaching of Louis. Stillé, of Philadelphia, who had previously been under Gerhard at the Philadelphia Hospital during the typhus epidemic, and who was in Paris at the same time with Shattuck, was also instrumental in establishing before the Société Médicale d'Observation the anatomical and clinical distinctions between the two diseases.

As a result of these and subsequent studies and reports, the non-identity of typhoid and typhus fever was early recognized and accepted in the United States—earlier and more generally than in England. Dr. A. P. Stewart, of Glasgow, who, after studying fevers in the Fever Hospital of that place, resorted to Paris for the same purpose, accurately described the chief features of these two diseases before one of the Paris medical societies, in 1840, and was the first of his countrymen who did so. It was not, however, until ten years later (1849–51) that a general recognition of the quality of the two diseases, of their specific characteristics, was enforced in Great Britain by the authority of Sir William Jenner. Since that time typhoid fever has been everywhere accepted as a distinct morbid entity, and all difference of opinion as to its special characteristics may be said to have disappeared.

ETIOLOGY.—No sooner were the problems of the semeiology and pathology settled, and the conclusions generally accepted, than the equally important question of the etiology of typhoid fever took their place, and a discussion arose which lasted thirty years. The medical world divided into two parties: (*a*) those who held that typhoid fever is not only a distinct disease, but a specific disease having a specific poison, which is only produced by itself, and only reproduces itself; (*b*) those who though acknowledging its distinct symptomatology and pathology, still held that it at times arises autochthonously or spontaneously; that mere filth, or according to some who embraced this view, even depressing emotions which derange the digestion, may give rise to these special results. These two theories were propounded and actively supported by Drs. Budd and Murchison, respectively, and from the year 1850 were largely identified with their names. Both of these theories were of practical benefit, for it was largely due to the efforts of Murchison that the foundations of modern hygiene were instituted, and the influence of Budd was felt both in the care of the patient and his excreta and in the incentive to determine the specific poison. As early as 1871 attempts were made to identify definite organisms as constantly occurring with the disease, but not until 1880 was the germ discovered by Eberth, which has since been found to answer the requirements of a specific organism.

The Eberth-Gaffky bacillus, or bacillus typhosus, was of constant occurrence in typhoid fever and absent in health. It was finally isolated, and after much experimentation grown in pure culture. Owing to the apparent insusceptibility of animals to the disease all attempts at inoculation of animals with typhoid have been unsuccessful, though lately Remlinger has claimed to have caused the disease in rabbits, but his work has not yet been confirmed. The organism has, however, been accepted. Its viability in the human body, before and after death, and its duration in different media, liquid and solid, under varying conditions of heat and cold, have been more or less definitely determined:

It is a short, thick rod, about three times as long as wide, and with rounded ends. The length equals one-third the diameter of a red blood corpuscle. It is somewhat variable under different conditions, and may be thicker or thinner according to circumstances, and may become arranged end to end, forming threads. In hanging drop it has motility due to numerous flagella, which may be seen by careful staining. The other characteristics and growth under different conditions belong to bacteriology and need not be discussed here. It is of practical importance, however, to know that these bacilli may live indefinitely under favoring circumstances, and they have been shown experimentally to exist as long as three months in milk, water, and in a dead body, and five and one half months in soil, and to resist freezing, though they succumb quickly to a temperature of 167° F. The practical value of these facts will appear.

By this discovery of the bacillus typhosus by Eberth in 1880 the etiology has been placed upon a definite basis.

Predisposing Causes.—Age. This is the most important of the predisposing causes. It is essentially a disease of youth, the great majority of cases occurring between fifteen and thirty years of age, and this holds true in general of all countries. Statistics on this and other points are generally made up from hospital patients, but would probably not vary much as to age if applied to those treated at home. Murchison deals with the largest figures, extending over a period of twenty-three years at the London Fever Hospital. He states that persons under thirty years of age are more than four times as liable to typhoid fever as persons over thirty. Of 5,911 cases admitted to the London Fever Hospital, between the years 1848–70 (twenty-three years), 56.70 per cent., more than one-half, were between fifteen and thirty years of age; 28.58 per cent., more than one-fourth, were under fifteen; 13.30 per cent. were over thirty; while only 1 in 71 cases exceeded fifty. The contrast between typhoid and typhus fevers in this respect is shown by the same tables, only 24.87 of the typhoid cases being over twenty-five years of age during a period of years when 50.66 per cent. of the typhus cases were over that age.

For five years preceding 1870 in Berlin, Zuelzer reports the following table of cases of typhoid among every 10,000 inhabitants of all classes:

From 8 to 10 years of age.....	18	From 35 to 40 years of age.....	13
" 10 to 15 " " "	22	" 40 to 45 " " "	16
" 15 to 20 " " "	32	" 45 to 50 " " "	13
" 20 to 25 " " "	31	" 50 to 55 " " "	27
" 25 to 30 " " "	20	" 55 to 60 " " "	7
" 30 to 35 " " "	14	" 60 to 65 " " "	10

This table gives the usual ratio up to thirty years, but betrays some singular discrepancies in the later years. Liebermeister found that seventy-seven per cent. of the typhoid patients in the hospital at Basle, from 1865 to 1870—a period of five years—were between fifteen and thirty years of age; and Fiedler reported that in Dresden eighty-one per cent. of all the typhoid patients were between those ages.

The average age of 291 cases which occurred at the Massachusetts General Hospital was about twenty-two years. Other statistics in this country are of the same tenor.

It should not be forgotten that typhoid fever does occasionally occur in the aged, and by no means infrequently in the very young. Undoubted cases in infants under a year old are on record. In fact, recent investi-

gation tends to show that typhoid fever in infants is much more common than is generally acknowledged. Even in the fœtus undoubted cases of typhoid fever have been recognized. In these cases the mothers were suffering from the disease, and the infection probably took place through injury or infarct in the placenta, which was in some cases demonstrable. Some of these fœtal cases near term had fever, diarrhœa, and positive Widal reaction, and some showed at autopsy ulcerated Peyer's patches, enlarged spleen, and typhoid bacilli were found in the organs. A considerable number of cases of very probable typhoid fever in the first, second, and third years of life has also been collected. Griffith and Ostheimer have collected 139 cases in the first year, 187 in the second, and 325 in the third. Many of these cases had positive Widal reaction, and in some typhoid bacilli were found post mortem. The symptoms often are so little marked in the very young that the nature of the trouble is liable to be overlooked. Subsequent immunity to exposure, it is fair to suppose, is sometimes due to an early unrecognized attack. The susceptibility is greatest between the ages of fifteen and twenty-five; next between ten and fifteen; and next between twenty-five and thirty.

Sex: If guided by hospital statistics, one would conclude that the disease is somewhat more common among men than among women. On the other hand, men are more likely to resort to hospital treatment, and the difference may perhaps be explained in this way. As a fact, either sex is probably about equally liable.

Locality: Typhoid fever is no respecter of locality, although having its places of predilection. It prevails alike in cities, in towns, in villages, in hamlets, and in solitary houses; among the poor and the well-to-do; on high and on low ground; over a sandy or over a clayey soil. It is, perhaps, of all infectious diseases, the most constantly to be found, under the greatest variety of conditions.

Seasons of the year: In all countries of the northern temperate zone the last six months of the year, from July to December, are those in which typhoid fever is most prevalent, and in the southern temperate zone the corresponding months, from February to July, are similarly prominent. September, October, and November are three months in which the largest number of cases occur, as shown by tables from various localities.

A statement of the deaths from typhoid occurring in Basle during fifty years gives the following for the different months. January, 192; February, 143; March, 137; April, 121; May, 160; June, 169; July, 186; August, 202; September, 237; October, 237; November, 236; December, 193.

Murchison's 5,988 cases at the London Fever Hospital, during twenty-three years, were distributed through the different months as follows: January, 433; February, 306; March, 318; April, 209; May, 232; June, 335; July, 434; August, 721; September, 803; October, 839; November, 819; December, 539—27.7 per cent. of the entire number were admitted in the two months of October and November, and only 7.3 per cent. in the two months of April and May.

Of 621 cases treated at the Pennsylvania Hospital during ten years, 89 were admitted during spring, 259 during summer, 182 during autumn, and 91 during winter. So marked is the prevalence of typhoid in the months of September, October, and November that it is often spoken of popularly as "fall" or "autumnal" fever. Owing to exceptional causes, epidemics may occur at other seasons of the year. In the older cities the disease has a tendency to become endemic, and to last through the winter months.

Notwithstanding that typhoid fever is more prevalent in the autumn months, statistics show that the mortality is much greater in the first quarter or first half of the calendar year. The reason of this greater mortality in the spring is probably not that the infection is more virulent at that season, but that human vitality is probably lower, and fatal complications are more frequent. The fallacy of statistics must also be remembered, and the fact that there are so many mild cases in the autumn would naturally lower the mortality rate.

Moisture and temperature, level of ground water: These do not seem to have any constant relation to the prevalence of typhoid. It is found to be active during and after both cold and hot seasons, dry and damp weather, although it is said that a warm, dry summer favors abundant typhoid in the autumn. Murchison regards warmth, with moisture and but little rain, as the most favorable combination of circumstances. Von Pettenkofer and Buhl succeeded in establishing a relation between low ground water and increasing typhoid for a time at Munich, but this does not hold good for other places and other countries. Such a connection is far from being invariable for every year and for all places. Wet seasons as well as dry, are followed by, and coincide with, abundant typhoid. In Berlin it has been shown that the inhabitants most exposed to the influences of the ground air are not those most affected by the disease.

In this connection Sedgwick's and Winslow's very recent and thorough statistical studies on seasonal variations in temperature and on the prevalence of typhoid fever in various countries deserve notice. These investigators have brought together statistics of the monthly variations in temperature and in the prevalence of typhoid fever for thirty communities, representing four continents and both hemispheres, and a very wide range of climate. While not asserting that the typhoid bacillus multiplies in the environment during the summer months of a temperate climate, they do consider that it is the absence of the destructive influence of cold, rather than any stimulating influence of heat, which permits the rise culminating in the autumnal maximum. They postulate their conception of the probable mechanism of the seasonal changes as follows:

The bacteriology and etiology of typhoid fever both indicate that its causal agents cannot be abundant in the environment during the colder season of the year. The germs of the disease are carried over the winter in the bodies of a few patients, and perhaps in vaults or other deposits of organic matter where they are protected from the severity of the season. The number of persons who receive infection from the discharge of these winter cases will depend, other things being equal, upon the length of time during which the bacteria cast in these discharges into the environment remain alive and virulent. The length of the period during which the microbes live will depend largely upon the general temperature; as the season grows milder, more and more of each crop of germs sent at random into the outer world will survive long enough to gain entry to a human being and bear fruit. The process will be cumulative. Each case will cause more secondary cases; and each of the latter will have a still more extensive opportunity for widespread damage. In our opinion the most reasonable explanation of the seasonal variations of typhoid fever is a direct effect of temperature upon the persistence in nature of germs which proceed from previous victims of the disease.

Individual idiosyncrasy plays a part as a predisposing cause in this as in other infectious disorders. Some persons and some families seem proof against the poison, even in an active form, while others contract the disease upon slight provocation. An inherited predisposition has sometimes been suspected as reappearing through several generations. Notwithstanding the immunity usually conferred by one attack, some persons have been known to pass through several distinct attacks at different periods. Phthisis, pregnancy, and lactation have been supposed to confer some degree of immunity, but this is doubtful.

The robust are quite as likely to be attacked as the feeble, and in the opinion of some are even more prone. Intemperance, fatigue, and mental emotions can only be admitted as predisposing causes very indirectly.

Exciting Causes.—Since the identification of the specific micro-organism causing the definite disease, typhoid fever, the etiology in relation to exciting causes has to do principally with the mode of entrance of the bacilli into the human economy.

Because the bacilli are capable of resisting drying to a certain extent, and may therefore be blown about in the air, the possibility that they may gain entrance through the respiratory organs cannot be ruled out, though this is probably infrequent, and even then some of the organisms could also be swallowed. Dr. Eduardo Germano concludes from experiments that typhoid bacilli cannot resist thorough drying, and therefore cannot be transmitted by air currents through dust to man. Undoubtedly the commonest mode of entry is by ingestion. Formerly it was supposed that water was the only vehicle of practical importance. That it was frequently the means of infection was so satisfactorily proved and is so generally recognized that it need only be mentioned, and space need not be occupied by the now familiar details of convincing instances, the latest and one of the most unfortunate of which is that at Ithaca, N. Y., the home of a university supporting scientific departments and a medical school.

It may not, however, be generally realized, even by physicians, who recognize typhoid fever as largely a water-borne disease, that the death rate from typhoid fever has declined steadily in direct ratio to the introduction of well-managed public water supplies, or to what extent this has taken place. Massachusetts may be taken as an example, for in that State the provision for public water supplies has reached its highest development in this country—over ninety per cent. of the population being now supplied with water under public control. The number of deaths from typhoid fever in Massachusetts in 1901 was smaller than in any single year since the beginning of registration in 1842, and at that time the population of the whole State was about equivalent to that of Boston and its suburbs today. The death-rate percentage from this disease in 1901 in thirty-three Massachusetts cities was only one-fourth of what it was in these same cities thirty years ago. In 1865 only twenty-five per cent. of the population used public water, and the death rate from typhoid at that time was 92.9 per 100,000 inhabitants. In 1875 forty-one per cent. of the population had public water and the death rate had decreased to 80 per 100,000. In 1901 over ninety per cent. of the people were supplied from public water systems, and the death rate from typhoid had fallen to 19.5 per 100,000 inhabitants.

Milk.—Epidemics due to milk have also been thoroughly traced. Sometimes the infected milk has been contaminated by polluted water which was used in washing the vessels or in diluting the milk. In some cases the milk was directly infected by those who were sick or assisting in the care of the sick and at the same time doing dairy work.

Kober recently has tabulated 195 epidemics of milk-typhoid. In 148 of these epidemics there is evidence of the disease having prevailed at the farm or dairy; in 67 instances it is probable that the infection reached the milk by soakage of the germs into the well water, with which the utensils were washed, and in 16 instances the intentional dilution with polluted water is a matter of evidence. More recently butter, fruit, fresh vegetables, and salads, which may have been moistened with infected water, have been shown to be the starting-points of epidemics.

Oysters and Shell Fish.—Shell fish are another source of infection, especially oysters which have been fed or fattened in contaminated beds. In 1894, at Wesleyan College in Middletown, Conn., many students who ate raw oysters were affected with typhoid fever, while those who ate them cooked escaped. It was found that the oysters had been temporarily kept in fresh water contaminated by sewage containing also the discharges of typhoid patients. This outbreak was worked out with much care by H. W. Conn, professor of biology at Wesleyan, for the seventeenth annual report of the Connecticut State Board of Health. The details are very convincing, and leave no reasonable doubt as to the relation of cause and effect between the oysters and the typhoid fever. Other authentic cases have been published, and in some instances the typhoid bacilli have been found in the oysters. As a rule, undoubtedly, the oyster or mollusk is simply a common carrier, the passive, indifferent vehicle or intermediary between the contaminated water and the human organism. It has been demonstrated (Foote) that typhoid cultures introduced within the shells of oysters and kept at 57° F. give active organisms at the end of a month.

Drs. Morny and Bulstrode have presented elaborate reports on the relation of shell fish and oysters to disease to the French Government and to the English Local Government Board respectively.

Dr. Fraser, medical officer of health of Portsmouth, England, where outbreaks of typhoid fever traceable to oysters have occurred, suggests the following propositions[1] as essential to establish proof against the oyster:

1. That the oysters had been eaten at such a date previous to the onset of the disease as would be consistent with what we know as to the time typhoid fever takes to develop in man.

2. That there was no other condition common to all or a large proportion of the cases which could be regarded as playing a causal part in the disease.

3. That the oysters had not only been exposed to sewage contamination, but that this sewage actually contained the specific infection of typhoid fever.

Ice.—Ice has at times been suspected and accused of harboring and conveying the typhoid-fever poison. Sedgwick and Winslow have recently published very elaborate investigations and experiments as to the effect of cold upon the bacilli of typhoid fever. Without going into details, their conclusions may be briefly stated, both because they are the result of careful work and because they are reassuring. Moreover, they harmonize with previous work done by the Massachusetts State Board of Health. Exceptionally, artificial ice made from impure water and used quickly after manufacture may conceivably be a menace to the public health. In the same way natural ice, if increased in thickness by cutting holes and flooding, and if served within a week or two, might allow sufficient of the virus to persist to excite the disease. Yet such instances must be very exceptional; and the general result of human experience, the absence of epidemics of typhoid fever traced conclusively to ice, the fact that cities like New York, and Lowell and Lawrence in Massachusetts, have used the ice of polluted streams, and have yet maintained low death rates from typhoid fever, all tend to support the conclusion that natural ice can very rarely be a vehicle of typhoid fever.

The following are the conclusions of the Massachusetts State Board of Health on this subject as given in its annual report for 1889:

"While clear ice from polluted sources may contain so small a percentage of the impurities of the source that it may not be regarded as injurious to health, the snow ice and any ice, however clear, that may have been formed by flooding, is likely to contain so large a percentage of the impurities of the source, and with these impurities some of the disease germs that may be in the source, that the board feels bound to warn the public against using ice for domestic purposes that is obtained from a source polluted by sewage beyond that which would be allowable in a drinking-water stream or pond; and that, in general, it is much safer to use for drinking-water and for placing in contact with food that portion of the ice that is clear."

In 1898 and 1901 the Boston Board of Health conducted, through Dr. H. W. Hill, investigations of the Boston ice supply with especial reference to danger from typhoid fever.

The conclusions arrived at practically accord with those of the State Board and with those of Sedgwick and

[1] Brit. Food Journ., January, 1903, p. 4.

Winslow, and are thus summed up: "On theoretical grounds the danger of infection from ice is very small. Practically, and under the conditions of the present Boston supply, danger of infection through natural or artificial ice is almost *nil*. . . . Careful search of the records has shown that but one presumably authentic case of transmission of typhoid fever through ice is on record. The fact that there is such a case shows the possibility of such infection; the fact that there is only one shows its extreme rarity."

Notwithstanding the experiments and conclusions of the authorities previously quoted, Drs. Hutchings and Wheeler of the St. Lawrence State Hospital at Ogdensburg, N. Y., have since, and very recently, reported an epidemic of typhoid fever due to infected, clear ice which involved thirty-nine inmates of that institution. It is scarcely possible to impugn the accuracy of the details or the conclusions of this report.

Flies.—That flies may carry the contagion is proved by finding the bacilli on different parts of their bodies, but

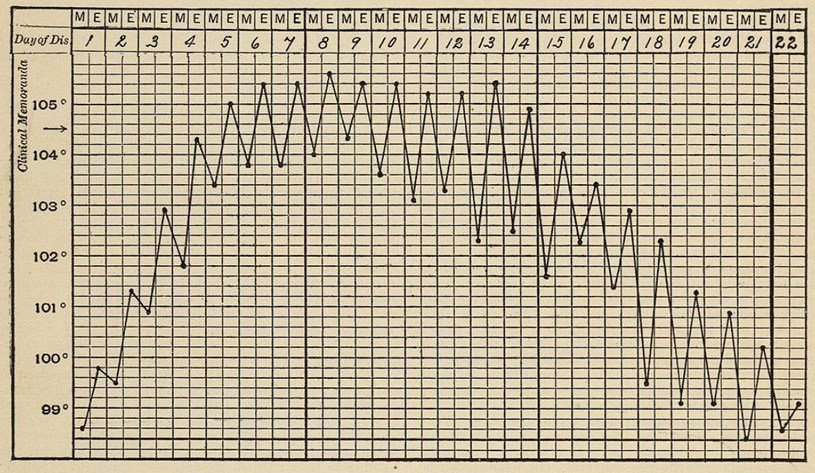

FIG. 4806.—Temperature in a Typical Mild Case of Typhoid Fever from First Day of Attack. (After Wunderlich.)

whether in sufficient quantity to be of grave importance in the dissemination of typhoid fever in civil life is still a somewhat open question. That sporadic cases have such an origin probably must be admitted, and this may have some influence upon the seasonal variations of typhoid.

All of these modes of infection have their practical importance in teaching the care of the patient and the prevention of the spread of the disease. Contamination of any article of food by those caring for typhoid patients is a constant source of danger, which, however, can generally be prevented by caution.

COURSE OF THE DISEASE.—*Incubation.*—The period of incubation, as with other infectious diseases, is a variable one, and probably depends as much on the susceptibility of the individual, as shown in idiosyncrasy or constitutional condition, as on the concentration and activity of the poison. From hospital patients it is difficult to draw any conclusions of value, either as to the period of incubation or as to the duration of the disease. But cases have been recorded in which there is little room for error as to the time of invasion, and from which maximum, minimum, and average periods may be fixed in a general way. Cases of less than a week's incubation are open to suspicion, and those reported instances in which immediate illness has followed the sudden opening of drains, etc., are probably, in their inception at least, due to septic or miasmatic poisoning. On the other hand, the instances of very long incubations, over four weeks, are but little better authenticated. The number of cases with a period of incubation not included between ten days and three weeks is probably small.

During this period the patient is able, as a rule, to pursue his ordinary occupations, though generally with less vigor, and there is apt to be diminished appetite.

Period of Invasion.—This stage begins with the first feelings of malaise, which are often accompanied by a chill or chills. There are headache, dulness, and listlessness, general soreness and chilliness, sometimes epistaxis, often diarrhœa, sometimes moderate abdominal tympanites, with tenderness and gurgling in the right iliac fossa, and the tongue presents a thin, whitish coat, not extending to the tip and edges, which may be rather red. All or only some of these symptoms may be present, but are hardly pathognomonic, as many of them may be present in the early stage of other febrile affections. In the temperature, however, we find an important aid to diagnosis.

If, in addition to the above systemic symptoms, the temperature rises step-like steadily from day to day, and from morning to evening, and reaches from 103° to 104° F. by the fourth day, there will be less reason to hesitate as to the diagnosis. By this time the fæcal discharges will begin to exhibit the characteristic light-yellow color and pea-soup consistence. By the end of the first week the temperature will have reached the maximum point which it is likely to hold during the disease, and the *stage of invasion* may be considered to be at an end.

Second Week.—From the end of the first week the temperature pursues a fairly steady course from the highest point, rising from morning, to evening, and falling from evening to morning, from 1° to 2.5° F., the chart developing the characteristic zigzag appearance; the countenance becomes more dull; the eyes more suffused; the face more flushed; the tongue more coated; the intestinal discharges thinner and more frequent; the abdomi-

nal tenderness and tympanites more marked; the skin drier, congested, and showing evidence of paresis of the vaso-motor nerves in the ready production of Trousseau's *taches cérébrales;* both skin and breath exhale a peculiar odor; the pulse increases in frequency—rising, perhaps, from between 80 and 100 to between 100 and 120—and is more in proportion to the temperature; the characteristic rose spots—small pink papules the size of a pin's head, slightly elevated above the surface and disappearing upon pressure—present themselves upon the abdomen and back; scattered sibilant râles are heard over the chest; the splenic area is enlarged; the urine is diminished in quantity, high-colored, slightly albuminous; a mild form of delirium or of coma vigil is developed. With these conditions the end of the second week will be reached.

Third Week.—At this stage the remissions in temperature from evening to morning will begin to be somewhat more marked, and the morning temperatures a little lower from day to day; the pulse and respirations, however, keep up their former frequency and may be even more rapid; the pulse is softer and weaker, and is apt to exhibit a slight dicrotism, due to the diminished tension of the arterial walls; the tongue is dry, brown down the centre and red at the tip and edges; the teeth are covered with sordes. The frequency of the alvine discharges presently begins to diminish, and the consistency to improve. The patient, however, exhibits the exhausting effect of the disease more than in the previous week; he lies generally upon his back, and presents a dull, stupid appearance, from which he can usually be easily roused; muscular tremor is shown upon attempts to move; speech and the protrusion of the tongue are attended with slowness and hesitation; a smart tap upon one of the large muscles is followed by a swelling due to the contraction of the degenerated muscular fibres; the heart sounds are feeble; the emaciation is pronounced; the rose spots begin to disappear. This brings the disease to the end of the third week.

Fourth Week.—About the end of the third week, or within a few days thereafter, the temperature will touch normal in the morning, although there will be a difference of from 2° to 4° F. between the morning and evening temperatures; the pulse and respirations will diminish in frequency, the former falling from between 120 and 100 to between 100 and 80, at the same time improving in character; the sibilant râles in the lungs and the signs of hypostatic congestion—if such have existed—will gradually disappear; the tongue will begin to clear and to become moist at the tip and edges; the dejections, from having been five or six in the twenty-four hours, and perhaps at times passed in bed involuntarily, will not occur oftener than once or twice in that time, or even in forty-eight hours; they will also begin to be more formed. The signs of nervous exhaustion are less striking, and the patient begins to enjoy hours of quiet, natural sleep.

By the end of the fourth week further progress is made in this direction; the temperature varies but little from normal either morning or evening; the pulse finds the level of health; the tongue is clean and moist, and the patient may be fairly pronounced a convalescent.

Such is the course of a typical case of typhoid fever of average severity, treated on the so-called "expectant" plan, ending in recovery; but individual cases vary from this in an infinite number of ways. In fact, there is no disease presenting a more diversified picture clinically. Any of the above symptoms may be exaggerated or absent altogether. The patient may not take to his bed at all, as in the so-called ambulatory typhoid; the period of convalescence may supervene rapidly upon a febrile course of not more than ten days or two weeks; and, on the other hand, instead of terminating in three weeks the pyrexia may continue for five or six weeks, or even much longer, and that without any genuine relapse. Some authorities used to explain these variations in duration by the statement that we have in typhoid two forms of fever to deal with—a primary, due to the infection of the

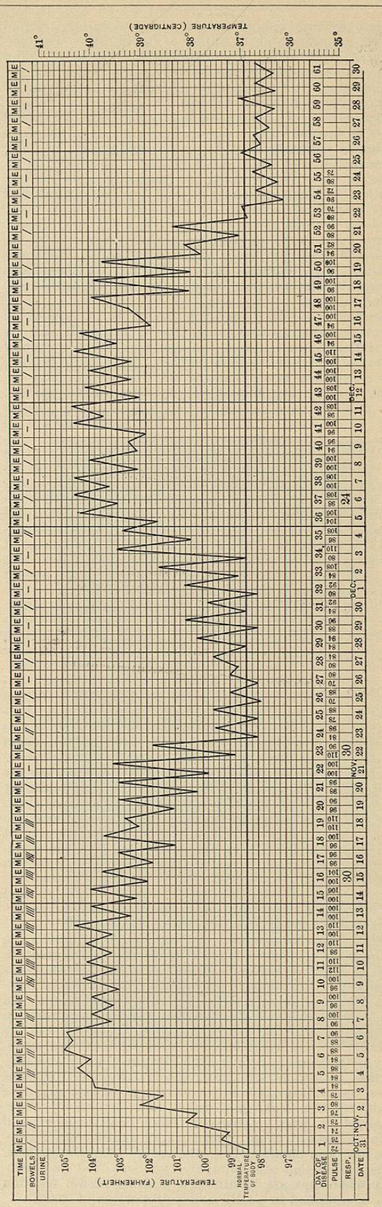

FIG. 4807.—Temperature in a Somewhat More Severe Case of the Disease, with Relapse. (From the author's own experience.)