

of replacing in the system the materials required by the secretion of milk, viz., fats and the various forms of albumin. Salts or salines should not be used largely as food or medicine, nor should articles containing strong-smelling oils. Milk is particularly good as food, while alcoholics should be avoided, unless, perhaps, a small quantity of beer for women who have always been accustomed to it in their own country.

Further details on wet-nursing may be found in the treatises on obstetrics and pediatrics. Among the works mentioned below I would call particular attention to those of Rotch and Holt.

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WHANN ALKALINE LITHIA SPRINGS.—Venango County, Pennsylvania.

These springs issue from the rocky bluffs 200 feet above the Allegheny River, at a spot which commands a fine view of the charming little city of Franklin. Their high altitude and spacious woodland surroundings preclude the dangers of surface contamination. The outflow is abundant and the water clear, bright, and sparkling. Its temperature at the springs is 50° F. all the year round. The following analysis was made by Merck & Co., chemists, of New York, in 1899:

One United States gallon contains (solids): Lithium chloride, gr. 3.68; sodium chloride, gr. 3.77; calcium carbonate, gr. 3.09; magnesium carbonate, gr. 0.75; magnesium sulphate, gr. 1.17; sodium sulphate, gr. 0.16; potassium sulphate, gr. 0.30; aluminum sulphate, gr. 0.07; silica, gr. 0.69. Total solids, 13.68 grains. Total residue by evaporation, gr. 15.09; organic matter and loss on ignition, gr. 3.68; carbon dioxide, free, gr. 1.37; nitrites and nitrates, traces.

The analysis shows a light alkaline-saline water which on habitual use ought to possess useful properties as an antacid, diuretic, and possibly laxative. It has been highly praised by physicians, who have become acquainted with its use, in rheumatism, gout, dyspepsia, and gastro-intestinal disorders, and in the uric-acid diathesis.

James K. Crook.

WHEAL. See *Urticaria*.

WHIP-WORM. See *Nematoda*.

WHITE SULPHUR SPRINGS.—Scott County, Iowa.

POST-OFFICE.—White Sulphur. Hotel destroyed by fire in 1893.

The waters of these springs are now used commercially. The following analysis was made by Emory Rush, of Buffalo, N. Y. One United States gallon contains (solids): Sodium chloride, gr. 92.79; calcium chloride, gr. 33.56; magnesium chloride, gr. 23.26; sodium bicarbonate, gr. 40.57; iron bicarbonate, gr. 27.37; potassium sulphate, gr. 6.13; sodium phosphate, gr. 5; silica, gr. 30.56; magnesium sulphate, gr. 16.23; carbonic acid (by weight), gr. 31.57. Total solids upon evaporation, 307.04 grains. Temperature, 56° F.

James K. Crook.

WHITE SULPHUR SPRINGS, LOUISIANA.—Catahoula Parish, Louisiana.

POST-OFFICE.—White Sulphur Springs. Hotel.

ACCESS.—The springs are reached by way of Alexan-

dria, La., on the St. Louis, Iron Mountain and Southern, and the Southern Pacific Railroad, or by way of Pollock Station, on the Iron Mountain Railroad. The location is in a hilly country, covered with pines. The springs are four in number, and, according to Mr. G. W. Bethards, of the Railroad Hotel, their combined flow is about thirty thousand gallons per minute. Like many other enterprises in the South, the resort lacks capital for its improvement. No analysis has been made, but the water has been used with apparent benefit in rheumatism, dyspepsia, Bright's disease, and debility.

James K. Crook.

WHITE SULPHUR SPRINGS, MONTANA.—Meagher County, Montana.

POST-OFFICE.—White Sulphur Springs. Hotel.

ACCESS.—By Northern Pacific Railroad to Townsend, thence by stage or private conveyance to the springs. They may also be reached by stage from Helena, seventy-five miles distant.

The springs are located at an elevation of 5,012 feet above the sea-level, in a valley seventy-five miles long by ten or fifteen wide, watered by numerous streams where trout and other fish are abundant. Game is also plentiful in the surrounding mountains. An analysis by R. B. Riggs, of the United States Geological Survey, in 1885, showed the presence of the carbonates of sodium, calcium, and magnesium, sulphate of sodium, chlorides of sodium and potassium, silica, and a trace of sulphureted hydrogen. The water is of the alkaline-saline-thermal type. The temperature of the water varies from 95° F. to 125° F. It is recommended for affections of the liver, for skin diseases, and for syphilis.

James K. Crook.

WHITLOW. See *Hands and Fingers, etc.*

WHOOPIING-COUGH is a specific infectious disease characterized by paroxysmal attacks of coughing followed by deep inspiratory efforts, which, owing to a spasmodic contraction of the glottis, have a loud crowing or whooping sound.

SYNONYMS.—Whooping-cough, hooping-cough, pertussis, Keuchhusten (Ger.), coqueluche (Fr.), pertosse (Ital.), Kikhosta (Swed.), chincough, kindcough, kink-cough, kinkkaust, Kinghost, Stickhusten, Krampfhusen, Blauer-husten, Hühnerweh, Eselhusten, Rehhusten; toux convulsive ou quinteuse ou bleue, maladie cuculaire, paroxysmes quintes, architoux des enfants; tussis ferina, seu convulsiva, seu strangulans, seu quinta, seu stomachalis; anhela clamosa, seu strangulans, seu de lassans, seu suffocans, seu amphemerina, seu tussiculosa, seu spasmodica, seu asinina, seu canina, seu perennis, seu clangosa, seu puerilis; tussis epidemica puerorum; bronchitis convulsiva, bronchocephalitis, pneusis pertussis; orthopnoea tussiculosa, seu clangosa, etc.; morbus cucullus, seu cucullaris; encullus; bex convulsiva, seu theriodes; bechorthopnoea.

HISTORY.—It is generally admitted that whooping-cough was unknown to the ancients, as no description of the disease is to be found in the writings of Hippocrates, Galen, or Avicenna.

The first account we have of the disease is by Baillou or Ballonius, a Frenchman, in 1578. He called it *quintes* or *quintana*, as the paroxysms of coughing were supposed to occur at intervals of five hours. Schenck, of Grafenberg, described the disease some years later. In England there was no definite account of whooping-cough till 1667, when Willis gave a very clear description of it under the name of *tussis puerorum convulsiva*; he was followed later by the famous Sydenham. Ettmüller, in Germany, and Lieutaud, in France, also published short accounts of the disease in the seventeenth century, at which time it occurred apparently only in small epidemics, although Willis speaks of its frequent occurrence among children and of the considerable mortality caused by it.

The first entry in the London mortality returns of a

death from this disease, under the name of chincough, is in the year 1668.

Throughout the eighteenth century whooping-cough rapidly increased and became widely diffused, as numerous descriptions of epidemics attest. In Sweden, from the year 1749 to the year 1764, over 43,000 children were said to have succumbed to this disease. In England, Germany, the Netherlands, Switzerland, Italy, and America, numerous epidemics prevailed.

At the present time whooping-cough not only occurs epidemically throughout Europe and America, but in nearly all the large cities and towns it has become endemic, so that cases are almost continuously occurring. In England, out of a total mortality of 510,315 in 1876, 10,556, or nearly two per cent., were due to this disease. In 1880 the proportion of deaths from whooping-cough in England was 2.59 per cent. Biermer says "whooping-cough has become a disease of all races and climates."

SYMPTOMATOLOGY.—Whooping-cough has been divided into three stages, which are more or less distinctive in various cases, and which pass more or less gradually from one to the other. These are, first, the catarrhal or prodromal stage; second, the paroxysmal or spasmodic stage; third, the stage of decline.

The catarrhal stage begins as a catarrh of the upper respiratory tract, and resembles an ordinary cold, from which, indeed, it cannot as a rule be distinguished, and it is often necessary to wait for the second stage before a definite diagnosis can be made. The prevalence of whooping-cough in the neighborhood or the history of exposure puts the physician on his guard. The symptoms in this stage are an ordinary cough, usually rather severe, and with a tendency to become paroxysmal, more or less coryza, with sneezing, and sometimes slight watering of the eyes, due to a mild conjunctivitis. An elevation of temperature occurs in this stage, which, although slight, is generally greater than in ordinary bronchitis, and is regarded by Flint, therefore, as an idiopathic or essential fever, as distinguished from a symptomatic one. Hensch, however, considers this idea of an essential fever to be erroneous.

The duration of the first stage is generally ten days or two weeks, but it varies markedly. The younger the child, the shorter is the first stage. Besides the factor of age, the severity of the attack also influences the duration of the prodromal stage. Thus the more severe the attack the shorter the first stage is likely to be; and, on the other hand, in mild cases the first stage may be lengthened to three or four weeks, or even in some cases may terminate without passing into the second stage, the diagnosis in these exceptionally mild cases being made by the existence at the same time of well-marked cases in other members of the same household.

The second stage, into which the first gradually or at times abruptly glides, is characterized by paroxysms of rapidly repeated forcible expiratory efforts or coughs, followed by a deep inspiration, which, owing to the spasmodic contraction of the muscles of the larynx causing a narrowing of the rima glottidis, has a loud and peculiar crowing or whooping sound, from which the name of the disease is derived. The little patient is generally conscious of an impending attack, becomes restless, and awakes from sleep, or, if at play, drops its toys with an expression of apprehension, and often appears to make every effort to suppress the approaching paroxysm. The pulse and respirations become more rapid, and when the coughing begins the child seeks to grasp its mother or some firm object for support. The respiratory efforts, from five to twenty in number, follow each other in rapid succession, terminating in a deep-drawn inspiration or whoop, and, after a rapid repetition of the series two or three times, there generally occurs the expulsion of a thick, glairy, tenacious mucus, and often the vomiting of the contents of the stomach, after which the child sinks back exhausted, but, if in a good condition, soon resumes its play as if nothing had happened. The urine and feces are not infrequently expelled involuntarily in young children, owing to the violent action

of the diaphragm and abdominal muscles. Older children, who are able to describe their sensations, and adults speak of a feeling of heaviness or oppression in the chest, and of an increasing tickling sensation in the throat, or the sensation of a foreign body in that region, which lead them to expect a paroxysm. A tickling in the nose or, in some cases, the feeling of nausea is also sometimes described by the sufferers as presaging an attack. The spasm of the glottis, and therefore inspiratory whoop, is more marked when the expiratory efforts have been violent and have followed each other in rapid succession.

During the expiratory efforts the pulmonary circulation is impeded, and a backing up of blood in the right side of the heart occurs, with resulting venous stasis. The veins of the neck become distended, the face reddened, and, finally, from the interference with respiration, cyanotic. The eyes stand out and are suffused with tears, the loose connective tissue about the eyes is puffy with infiltrated serum, and in severe paroxysms hemorrhages may take place from the nose or mouth, or subconjunctival ecchymoses may appear. The tongue in infants and young children is generally violently protruded from the mouth, the frenum and lower surface scraping against the gums or teeth. The child often makes clutches at its throat and face, and endeavors to relieve itself by pulling the mucus from its mouth. In these attempts the infant, with its poorly co-ordinated movements, will sometimes scratch its neck and face, or the mucous membrane of the mouth.

After the paroxysm the cyanosis is succeeded by pallor, the distended blood-vessels empty themselves, but the puffiness about the eyes, due to the infiltrated serum, often remains as a characteristic feature. Sometimes the child is covered with a cold sweat after the paroxysm.

The duration and severity of the paroxysms may be so slight that many of these symptoms are lacking, and the expiratory efforts may be only one or two in number. On the other hand, the attack may last one or even two minutes, consisting of a number of series of expiratory efforts, causing marked cyanosis and distress, and leaving the patient in a very exhausted condition. The number of paroxysms in twenty-four hours also varies very much, from two or three in very mild cases to fifty or even a hundred in the more severe examples. A characteristic feature of whooping-cough, and one that is almost always present, is the fact that the paroxysms are more common at night than during the daytime. In the waking hours any emotional excitement is apt to bring on the cough; hence this is frequently observed during the visit of the physician. A fit of crying is almost sure to be interrupted by a paroxysm of cough, which, by substituting a greater evil, effectually removes the original cause of the tears from the mind of the little patient. In a similar way, with several children in a room all suffering from this disease, the occurrence of a paroxysm in one is apt to be followed by the same thing in the others—the so-called paroxysm from imitation.

The fever, which may have been present in the first stage, is now generally absent, although an occasional temperature of 101° or 102° F. in the evening is not at all uncommon. A continuously elevated temperature, on the other hand, would at once point to some complication.

Vomiting following the paroxysm may be so frequent as seriously to interfere with the nutrition of the patient. In these cases the stomach becomes so sensitive that a very slight cough may be followed by the evacuation of the entire contents of the stomach; whereas in earlier periods of the same case or in milder cases vomiting occurs only after violent paroxysms. The general condition of the patient during the intervals between the attacks, supposing there are no complications, remains good if the course of the disease is mild; but if severe, the patient becomes much emaciated and debilitated.

The duration of the second stage varies very much, but averages from four to eight weeks, and gradually merges into the third stage, or stage of decline, when the cough has become less frequent and has ceased to

be spasmodic. This stage lasts generally two or three weeks, but is apt to be interrupted and prolonged by returns of the old paroxysmal cough. In fact, for a year or two after an attack of whooping-cough, an ordinary bronchitis is apt to take on the spasmodic character of the former disease.

When uninfluenced by treatment, therefore, whooping-cough runs a course of from two to three months. A duration of less than six weeks is uncommon, while one of more than three months is unfortunately less so. An average of ten weeks, as stated by West, is probably as accurate an estimate as can be given.

The physical examination in an interval between paroxysms of cough will show, in uncomplicated cases, more or less emaciation and anemia dependent on the severity of the attack, possibly slight puffiness of the face, especially about the eyes, and in some cases an excoriation or ulcer on the frenum linguae, with perhaps a slight bronchitis. In mild cases of whooping-cough there may be an entire absence of these signs, and the child may appear to be in perfect health during the intervals of the cough.

Sugar is occasionally found in the urine. Dolan found traces in fourteen out of fifty cases examined on this point. Albumin may also occasionally be found.

COMPLICATIONS.—The principal complications of whooping-cough may be divided into three classes: first, those due to an increase or extension of the mild inflammation of the air passages, which probably accompanies all cases of whooping-cough; secondly, complications due directly or indirectly to the paroxysm of coughing; and thirdly, accidental complications.

Bronchitis, although generally present in whooping-cough, is always, even in its mildest form, considered a complication by some authors. This bronchitis may increase and involve the smaller capillary tubes, especially in debilitated children and where the hygienic surroundings are poor, and result in bronchopneumonia. This is the most serious complication and is largely responsible for the mortality. With the presence of bronchopneumonia the little patient can ill bear the paroxysms of cough, but these fortunately, as a rule, become less severe at this time, so that false hopes are thereby excited.

Of the complications due to the violent paroxysms of cough may be mentioned pulmonary vesicular emphysema. Its diagnosis during life is often impossible, but the condition is frequently seen at post-mortem examinations, especially in the upper lobes of the lungs.

A more extreme condition rarely occurs, namely, rupture of the air cells, giving rise to interlobular emphysema. In these cases the air is sometimes forced into the loose connective tissue of the neck or even of the entire body.

According to Strümpell, a lobular emphysema may sometimes persist as a chronic state after recovery from whooping-cough.

Another group of complications that may result from violent paroxysms of coughing are hemorrhages. Epistaxis is the most frequent form, and may in some cases be so severe as greatly to enfeeble the patient or even to prove fatal. The next most common source of hemorrhage is the mouth, either from the ulcer or abrasion under the tongue, produced by friction against the lower incisors, or from the dry and cracked lips which are rubbed or picked by the little patient, or from the gums, tongue, pharynx, or indeed from any part of the buccal cavity. If stomatitis exist, the facility for bleeding is of course increased. In cases of bleeding from the mouth, the mucus, which is churned about in the mouth before it is expelled, becomes of course blood-stained, or the patient even spits out pure blood, if the hemorrhage is sufficiently free. This alarms the parents much more than a copious epistaxis would do, and they send for the doctor at once, thinking the child is coughing up blood from the lungs. True hæmoptysis, however, is very rare in children under ten years of age, and even in tuberculous cases is seldom seen at such an early age.

Subconjunctival hemorrhages are not uncommon and

give no pain, neither do they interfere with vision. They are almost diagnostic of this disease, as they are rarely seen in children from other causes, trauma of course being excluded. A conjunctival hemorrhage is rare. Trousseau reports a case in which it gave the appearance of tears of blood. Vision may be partially or totally obscured by hemorrhage into the retina. Blindness in whooping-cough has been found in some cases to be due to ischaemia retinae. Exophthalmus from hemorrhage behind the ball has been observed, also subluxation of the lens due to partial rupture of the zonula Zinnii in a fit of coughing.

Otorrhagia is very rare, and is due to the rupture of the membrana tympani by the air being violently forced up the Eustachian tube during coughing, or by the rupture of the vessels of the external auditory canal, which have been altered by an acute or chronic inflammation.

Subcutaneous hemorrhages, or ecchymoses, occasionally occur.

Hemorrhages of the brain or meninges, as is natural to infer, occur from the same causes as hemorrhages elsewhere, although they are rare and are of very serious and often fatal import. The history is usually that of a severe paroxysm of cough, followed by paralysis and loss of sensation in various parts, often a hemiplegia with unconsciousness and convulsive movements. The symptoms may gradually increase in severity, pointing to a slowly progressing hemorrhage. Very serious and ominous symptoms may be followed by complete recovery, so that the physician must not hurriedly give a fatal prognosis.

Convulsions in whooping-cough are, however, often due simply to the general reflex disturbance, owing to the high state of tension of the nervous system in children; but cerebral or spinal congestion, resulting solely from the cough, may be, and frequently is, a cause of the convulsions.

Hernia of the bowels and prolapsus ani are not infrequently seen, resulting from the strong expiratory efforts; and, rarely, the rupture of the rectus abdominis with the formation of a large tumor.

ETIOLOGY.—The infectious nature of this disease demands a living organism as the causative agent, and observers all over the world have been busy on this problem.

Deichler, in 1886, found always present in the sputa of whooping-cough patients an amoeba-like protozoon. This has been confirmed more lately by Kinloff, and again by Behla, but the importance of this organism in the etiology of the disease may perhaps be doubted.

Afanassieff, in 1887, found in the sputa short, rod-like bacteria of 0.6 to 2.2 μ in size, from which he obtained pure cultures, and states that this bacillus—"Bacillus tussis convulsivæ"—is distinctive from any previously described bacterium. With the pure culture he made eighteen experiments on animals by injecting it into the trachea or lungs, by which he produced in all cases symptoms of whooping-cough. On post-mortem examination of these cases he states that these bacteria were found on the mucous membrane of the bronchi, trachea, and nose, and he also found the same germ on the mucous membrane of the respiratory passages of children who died of whooping-cough.

Since then Ritter, Zusch, Czaplewski and Hensel, and Koplik have all isolated and studied a bacillus which is perhaps identical with that first described by Afanassieff.

Czaplewski and Hensel worked out a method which did not fail to show this characteristic bacillus in every case. They described the bacillus as being oval with rounded ends, which sometimes stain more deeply than the centre, giving the appearance of a diplococcus.

Whooping-cough is contagious during its whole course, especially during the first or catarrhal stage. It is least contagious during the third stage, or stage of decline, and its contagiousness may cease while the cough, which is then due to a simple bronchitis, still continues. The contagiousness may even cease before the whooping has stopped, for this latter may be kept up simply as a nervous habit. So-called relapses, where the spasmodic

attacks return during mild bronchial catarrhs acquired shortly after the whooping-cough has ceased, are generally to be explained in the same way, and are therefore not contagious. One attack of the disease secures immunity from it for the future, yet two or more distinct attacks of the disease in the same individual may sometimes, though rarely, occur.

Whooping-cough is very rarely carried by a third person or by the medium of clothing. Roger gives an instance of a boy sick for a long time with typhoid fever, never in contact with a case of whooping-cough, and yet developing that disease. The father and the doctor were the only ones who saw the patient, and therefore one of these must have acted as the medium for conveying the poison of the disease. I have recently seen a case in which the evidence of transmission by a third person was very clear. Clothing stained with sputa, it would seem, might easily convey the disease, although facts on this point are lacking. It is probable that the poison does not long survive outside of the body.

Like all contagious diseases whooping-cough prevails at times epidemically, and sporadic cases are to be traced to some previous case. Most large towns and cities are never entirely free from the contagion of this disease and cases exist at all times; or, in other words, whooping-cough is there naturalized or endemic. After a year of unusually great prevalence of whooping-cough in any large town or city, the number of cases in the following year is generally much less, a fact easily explained, as there are comparatively few children who are not protected by having suffered from the disease the year before.

The period of incubation varies considerably, but is generally from four to ten days in length.

Whooping-cough may occur in the new-born infant and in the aged, but is most common between the ages of one and five years.

In fact, owing to the almost universal prevalence of whooping-cough, very few children escape the disease, and this fact sufficiently accounts for its infrequency in adult life.

There are a few cases recorded in which the infant was born with the disease, the fetus being infected in the uterus from the mother who was suffering with the disease.

As to the season of the year, one would expect to find whooping-cough more prevalent in the winter, owing to the greater chances of infection by aggregation of children in schools, and the imperfect ventilation that prevails in this season as compared with the summer. Hirsch, however, has shown that the seasons have no influence on the spread of this disease.

PATHOLOGY.—Post-mortem examinations in cases of whooping-cough almost invariably show the morbid anatomy of some complication, as death from the disease alone is almost unknown. In the latter case we would find evidence of slight catarrh of the air passages, so slight and superficial as to be scarcely noticed. Examinations during life by means of the laryngoscope give us the most satisfactory knowledge of the pathological changes, and these studies have been made by observers, partly on themselves while suffering from an attack of whooping-cough, and also on others. The most elaborate and complete observations of Meyer Hüni and von Herff are in the main similar. They found a superficial inflammation or catarrh of the mucous membrane, from the nose and pharynx to the bifurcation of the trachea. The inflammation was found most marked on the posterior wall of the larynx, on the arytenoid cartilages and those of Santorini and Wrisberg, and especially in the interarytenoid region, and also on the under surface of the epiglottis. The vocal cords were intact. The posterior wall of the larynx, as high as the vocal cords, constituted the so-called "cough region"; that is to say, irritation of this part by flecks of mucus, or artificially by a laryngeal probe, as shown by von Herff, always brought on a violent paroxysm of cough. A similar but less intense one was produced by irritating the lower

surface of the epiglottis, while touching other parts of the larynx never brought on a true paroxysm. Flecks of mucus were seen by these observers to bring on a paroxysm of coughing, when they reached the opening of the glottis, which continued till they were expelled. During the violent inspirations the incoming air draws down the partially coughed-up bronchial secretion, renewing the irritation, and again bringing on a paroxysm, and the series ceases only on the complete expulsion of the mucus, or until, through exhaustion, the irritability is dulled. Meyer Hüni thinks that there is also probably another "cough region" at the bifurcation of the trachea.

Rosbach's observations, however, differ entirely from these, for he found the pharynx, larynx, and upper two-thirds of the trachea normal, without either redness or swelling of the mucous membrane. A catarrh of the larger bronchi, however, he considered a part of the disease, and just before a paroxysm he saw bubbles of mucus coming up from the lower part of the trachea.

Besides the superficial catarrh, involving more or less of the upper air passages in mild cases of whooping-cough, pathological changes are absent. The ulcer sometimes found under the tongue was at one time thought to be the specific lesion of whooping-cough, but is now recognized to be due to the friction of the tongue against the lower incisors, when it is violently thrust out in a paroxysm of coughing.

DIAGNOSIS.—During the first stage the diagnosis of whooping-cough is impossible in the majority of cases. The history of exposure to the contagion of whooping-cough, in a patient not protected by a previous attack, should make the physician suspicious of this disease when he finds a cough with few or no signs of bronchitis, especially if there be an elevation of temperature out of proportion to the severity of the bronchitis. During the prevalence of an epidemic, all cases of cough not due to any well-recognized cause, in children unprotected by a previous attack, should always arouse the suspicions of the physician, and the possibility of the disease should be mentioned to the parents, so that they may be on the lookout for the whoop. Whooping is, indeed, the characteristic symptom of the disease, but is not heard till the second stage has been reached, and when this is well marked the diagnosis is easily made. The visit of the physician often excites the child so that a paroxysm is induced, making the diagnosis plain. Pressing on the larynx or the root of the tongue, or on the vagus nerve at the base of the neck, or making the child cry, may be resorted to for diagnostic purposes to bring on a paroxysm of coughing.

In infants under six months of age, and in very mild cases in older children, the diagnostic whoop is often absent. Here we must depend on the history of exposure to contagion, on the history of a quiescent or incubative stage, and on that of a prodromal catarrhal stage; on the paroxysmal character of the cough, generally more frequent at night; on the congestion of the face during the paroxysm, the expectoration of the characteristic glairy, tenacious mucus, and the vomiting of the contents of the stomach. Whooping-cough is, indeed, the only disease in infants in which there occurs actual expectoration of abundant mucus.

The appearance of the child in the intervals between the paroxysms is almost diagnostic in cases in which the course of the disease is severe. In these cases we find pallor, more or less emaciation, puffiness under the eyes, congestion of the conjunctivæ, and, in a certain proportion of the cases, abrasions or ulcerations of the frenum linguae. Subconjunctival ecchymoses in children are almost pathognomonic of whooping-cough, as they are rarely seen in them from any other cause excepting traumatism.

In many cases it is a very difficult matter to decide whether a patient has whooping-cough or merely a bronchitis with copious secretion of mucus, causing suffocative or spasmodic attacks of coughing. Here we must carefully consider all the points mentioned above, and treat doubtful cases as cases of the disease until the diag-

nosis is clear, isolating them as much as possible, and refusing to admit them to the open wards of hospitals or other institutions.

Recently Meunier has pointed out a method for early diagnosis, namely, the constant leucocytosis which he has found in this disease, one that far exceeds the leucocytosis found in other febrile affections of the respiratory tract. The leucocytosis begins early, before the appearance of the typical paroxysms, and averages 25,000, reaching later as high as 40,000. Fröhlich found that the leucocytosis kept pace with the number of kinks. Wanstall has not confirmed these statements, he finds, however, an increased percentage of lymphocytes, at least equalling or exceeding that of the polynuclear neutrophilic cells, which he considers of diagnostic importance.

A method for certain early diagnosis of whooping-cough would be of the greatest practical service.

PROGNOSIS.—The prognosis in whooping-cough is very favorable if the general health of the patient is good and there be no complications. The occurrence of the latter, moreover, is largely dependent on the former, for the stronger the patient the less liable is he to complications, and death, in the absence of complications, rarely occurs.

Of the complications which cause death, by far the most common is lobular or broncho-pneumonia. The little patient may also die from exhaustion and malnutrition induced by the protracted course of the disease, the disturbed sleep, exhausting attacks of coughing, and starvation owing to the frequent vomiting. Hemorrhages from mucous membranes add greatly to the debility, and may in themselves prove fatal. Owing to the feeble state induced by these causes, the prognosis in intercurrent diseases is made much more unfavorable.

The prognosis in those already weakened by chronic disease or by previous acute disease is also more unfavorable; especially is this the case if the acute disease has left the bronchial mucous membrane impaired, as in the case of measles, for the patient is then more liable to complicating bronchitis which may eventuate in a severe broncho-pneumonia and death. Broncho-pneumonia is, indeed, the final act in a large proportion of the fatal cases of whooping-cough.

Convulsions are always of unfavorable import, whether they be due to the reflex irritability, to congestion and oedema of the brain, or to cerebral hemorrhage.

The age of the patient influences the prognosis very much; for the older the children the better able are they to withstand the exhausting effects of the disease, and the less liable are they to complications.

In adults the disease runs, as a rule, a moderate course, and the prognosis is good unless other unfavorable conditions exist. In the aged we again return to the feeble state similar to childhood, when resistance to disease is impaired, and here the prognosis may become unfavorable.

In Basle, according to Hagenbach, the mortality by ages, during eleven years, was as follows: Under one year, 26.8 per cent.; one to two years, 13.8 per cent.; two to five years, 3 per cent.; five to ten years, 1.8 per cent.; ten to fifteen years, 1.8 per cent. Biermer estimates that 31 per cent. of the fatal cases of whooping-cough occur in the first year of life.

As to sex, the prognosis is slightly more unfavorable for females than for males.

Dolan states that whooping-cough causes one-fourth of the annual mortality among children under five years in London.

In the United States, according to the census of 1880, the list of deaths from infectious diseases is as follows:

	Under five years.	At all ages.
Deaths from diphtheria.....	19,854	38,143
Deaths from whooping-cough....	10,313	11,064
Deaths from scarlet fever.....	10,142	16,388
Deaths from measles.....	5,481	8,072

The United States census of 1880 also shows a greater proportion of deaths in the rural districts (16.9) than in the large cities (9.7), and, in the regions where a distinction of color was made, a much greater proportion among the colored (33), than among the whites (14.3).

The census also shows the largest proportion of deaths to the total mortality to occur in the Appalachian region, comprising portions of Virginia, West Virginia, Kentucky, Tennessee, and Alabama, and on the Southern Atlantic coast, from the mouth of the Chesapeake Bay to the northern boundary of Florida, including both Carolinas and Georgia. The smallest number of deaths occurred in New England, New York, and Pennsylvania, the proportion there being under ten in one thousand deaths from known causes.

According to the United States Census of 1860, 1870, and 1880, comprising 17,939 cases, the greatest mortality from whooping-cough occurred in March, April, and May, and the least in October, November, and December.

TREATMENT.—As in all diseases which are prevalent, which are obstinate to treatment, and which run a definite course and get well of themselves, there are numerous plans of treatment for whooping-cough, and numerous remedies have from time to time been recommended by different men. These remedies have had for themselves longer or shorter periods of popularity, and many are forgotten. The literature of this subject is very large. It is unfortunate that many forms of treatment are recommended and become popular on insufficient foundation—a small number of cases reported, general impressions without careful record of cases, and lastly, disregard of the fact that the disease tends to recovery untreated.

Another source of error lies in the fact that whooping-cough varies very greatly in its severity, some cases even without treatment running a mild course with but few daily paroxysms. This variability is not taken into account, and it is very rare to find it stated at what stage treatment was begun. It is evident that there is a time in every case of whooping-cough when the administration of any drug will give apparently favorable results, simply because the disease is improving of itself. This natural improvement is sometimes very rapid without any treatment.

As the disease is a long and debilitating one it is plain that all drugs that interfere with the appetite, that disturb the digestion, or that depress the heart should be carefully avoided. It is far better to depend on hygienic treatment alone than to do harm in these ways, and render the patient more liable to complications.

The patient should be placed under the most favorable hygienic conditions, particular attention being given to good ventilation when the child is in the house. In favorable weather the patient should be out of doors as much as possible, and arrangements should be made, if possible, in summer for the child to sleep either in a tent or on a piazza or balcony. The diminution in the number of paroxysms while the child is in the open air is always very marked. The bedroom windows should be widely opened, the patient protected by screens from draughts, and an open fire kept going in the room if the weather is cold.

Sea-bathing, with care and moderation, in certain cases, or salt baths in the room, are of value, if they are followed by a warm and pleasant reaction of the skin. This reaction will be aided by rubbing the skin with a coarse towel. A change from the city to the country or seashore is often useful, but the danger of imparting the disease to others, and starting an epidemic in a new place, should always be considered. A mild moist atmosphere, by acting favorably on the laryngeal and bronchial inflammation, mitigates the disease. This can be obtained artificially by means of an atomizer, steam spray, or steam kettle, or by wet cloths hung about the room.

The diet should be carefully attended to; it should be very nourishing and easily digestible, and, if there is a tendency to vomit, food should be given frequently and in small quantities. The times of feeding should be arranged with reference to the paroxysms; thus, as

cough and vomiting are apt to occur in the morning on waking, it is better to wait for an hour or so till this has passed. At evening the child not infrequently has a paroxysm as soon as he is put to bed; hence, supper should be given at least an hour before bedtime, so that it will have a chance to be digested and not vomited. During the day food should be given after a paroxysm of coughing and vomiting, with the hope that it will be digested before the next attack.

The severity of the paroxysms may be mitigated by turning the child on its face with the head low, and detaching the mucus from the mouth with the finger, a practice which is commonly followed among the lower classes. The pressure of the hand over the eyes gives relief by preventing the strain upon them.

The number of drugs used is legion, and it is necessary to speak here of only the more important. Belladonna is one of the more popular antispasmodic drugs. It diminishes not only the hyperesthesia and muscular spasm, but also the hypersecretion of mucus in the air passages. It is generally well borne by children, and should be given first in small doses, the dose being gradually increased till physiological effects appear. The medicine may then be given in smaller doses or omitted for a while. It is often given combined with the bromides.

Cocaine, from its marked local anæsthetic effect on mucous membranes, has naturally been used in the treatment of whooping-cough. It has been applied in solution by a brush to the larynx and pharynx, or sprayed into the throat by an atomizer, or by inhalation of its vapor. Cocaine should, however, be used with great caution and in very weak solution. Alarming symptoms have resulted from a few sprayings with a four-per-cent. solution in infants.

Cochineal and grindelia robusta have had reputations, and are still believed in by some. Dried chestnut leaves steeped in the form of a tea can be given safely to young children, and often appear to give surprisingly good results.

Antiseptic drugs are given internally by the mouth or rectum in whooping-cough, or applied locally by means of inhalation of atomized solutions or of gases; by applications of solutions to the pharynx, larynx, or nose, by means of brushes or swabs; by applications to the nose and pharynx by syringing; or, lastly, by the insufflation of fine powders into the nose, pharynx, or larynx.

One of the oldest forms of antiseptic treatment is the breathing of the air in the purifying room of gas-houses, a method, according to Roger, first used by Dr. Desmarteis in 1859. Five or six years after this, this method became very popular, but it is at the present time but little used.

Among volatile antiseptic drugs given by inhalation may be mentioned turpentine, eucalyptus, pinus sylvestris, cresolin, thymol, and carbolic acid. These may be poured on boiling water, and the head held over the vessel, or they may be evaporated on water boiling over a lamp in a room. The objection to this method is that it is apt to interfere with free ventilation. Cases of poisoning from carbolic acid and cresolin have been reported.

Mohn has reported cases of whooping-cough cured, "as if by enchantment," by the use of sulphur fumigations. The child is dressed in clean clothes and sent from its room, which is closed and fumigated with burning sulphur for five hours in the morning. After the room is aired, the child sleeps there at night. One trial is generally sufficient for a cure. These observations have been confirmed by some and found valueless by others.

Quinine is deserving of more extended notice and its beneficial results were summed up in the Medical Congress of 1887 by Binz as follows:

First. That whooping-cough can be shortened and made mild by quinine (giving as many decigrams in twenty-four hours as the child has years).

Second. The prognosis is more favorable the earlier the treatment is begun.

Third. That the hydrochlorate of quinine given by the

mouth is the best, the sulphate of quinine the next best form.

Laryngeal insufflations of quinine in the form of a fine powder were first used by Letzerich, one of the earliest investigators of the parasitic origin of whooping-cough, and the results reported by him and other observers have been very satisfactory.

Nasal insufflations of quinine have the advantage of greater simplicity of manipulation, and can easily be given by the parents—a very important consideration, for in a large class of patients daily visits of the physician in whooping-cough are out of the question. They are also less disagreeable to the patient, in fact can be given without in the least disturbing him.

Powdered benzoin, boric acid alone or mixed with roasted coffee, iodoform, tannin, and salicylic acid have also been used in nasal insufflations.

Resorcin is a drug which has been largely used by Dr. Moncorvo, of Rio Janeiro, in the treatment of this disease, and reference is here made to his important and elaborate monograph on the subject. He applies a one- or two-per-cent. aqueous solution of the drug with a brush or probang to the opening of the glottis daily, and with good results. The advantages of resorcin over many other antiseptics are its slight or agreeable taste, almost no odor, and its feeble toxic or caustic action. Moncorvo says that children object to the first application, but afterward submit with great docility.

Asaprol in a one-per-cent. solution applied to the larynx has been favorably reported, as has also a spray of peroxide of hydrogen 1 part, water 10 parts, and glycerin 1.5 parts. Menthol in liquid vaseline has also been used. The objection to all sprays and applications to the larynx is the difficulty of carrying them out in children and the liability to bring on gagging and vomiting.

Oxygen and ozone have also been used as inhalations. Antipyrin has been used very largely in whooping-cough, notwithstanding its well-known depressant effects, and favorable results are reported by several able observers. Cases of injury from cardiac depression are also recorded, and it seems doubtful whether it is well to run the risk of the unfavorable effects of this drug.

Bromoform has been largely used of late, and appears to act better than most other drugs in diminishing the frequency and the severity of the paroxysms of whooping-cough. It should never be given in an emulsion, as, unless the bottle is thoroughly shaken, it will settle to the bottom and the last few doses cause serious or fatal results. It is best dropped on sugar, the dose being about one drop for each year of age, given every four hours.

Another still more recent drug of great value in whooping-cough is heroin. This can be given to a child three years old in doses of gr. $\frac{1}{4}$ three or four times daily, and it certainly has considerable effect in quieting the paroxysms, although in some cases it is of but little value.

Of late, various compounds with suggestive names have been used with varying success. The interpretation of these names follows:

- Antitussin* = difluorphenyl.
- Pertussin* = saccharated extract of thyme.
- Antispasmin* = a combination of one molecule of narcotin sodium with three of salicylate of sodium.
- Tussol* = amygdalic acid and antipyrin.

PROPHYLAXIS.—The only means we have for the prevention of the spread of whooping-cough is isolation of the patient.

Isolation in the case of the exanthemata is easily practised on account of the short duration of these diseases, and the fact that the patient is confined to bed. In whooping-cough, however, we have a disease whose period of contagiousness may continue over two months, during which the patient is able to be about the house and go out of doors. It is a disease which is usually not recognized, and for which the physician is not called till a week or two have elapsed, during which the other members of the household, and probably of the school, are exposed to contagion. Hence isolation is rarely prac-