

eral resistance and thus adds to the labor of the heart, while at the same time it favors venous congestion by lessening the capacity of the arterial system. Its use is admissible when cardiac arrhythmia is present, but it should always be guarded by an arterial dilator. Alcoholic stimulation may be required almost from the first, particularly in those patients who are addicted to its use. It is indicated when the pulse is small and thready, or when there is persistent delirium in an alcoholic subject. When under its use the temperature shows a reduction, and the pulse loses in frequency and gains in volume, we may be sure that the alcohol is doing good. It should not, however, be given in such quantity that its odor remains persistently in the breath.

The pulmonary circulation may require to be relieved by dividing the blood more equally between the arteries and the veins. This is accomplished by the use of arterial dilators. Of these sodium nitrite in doses of two grains every two hours gives the most satisfactory and even result. It can be supplemented by nitroglycerin as occasion demands. The indication for arterial dilators is found in a small and creeping pulse with failing pulmonary second sound and a tendency to cyanosis. In cases presenting these conditions in an extreme degree venesection followed by saline infusion will sometimes prove singularly beneficial.

Compensation for loss of respiratory surface may be secured to some extent by inhalations of oxygen. These should be resorted to whenever the respirations exceed forty per minute, and they may be made continuous if the condition persists.

For the reduction of excessive temperature cold sponging and an ice-cap to the head are the most available means. When the fever produces extreme jactitation, tending to nervous exhaustion, the coal-tar preparations may be employed very cautiously and for brief periods.

For the relief of pain hypodermic injections of morphine are by far the best means at our command. They are efficient, and at the same time, by slowing and deepening the respiration, they improve the circulation in the affected part. They are to be used with care, however, and their frequent repetition is to be avoided. Hot poultices on the one hand, and ice-bags on the other, are preferred by many, and are fairly efficient. In mild cases dry cups or sinapisms may suffice.

The feeding of the patient requires close attention. The tendency is to feed too highly. The conditions present are very unfavorable to digestion, and undigested food in the alimentary canal gives rise to flatulent distention and greater embarrassment of respiration, besides being a burden rather than a help to the vital power already overtaxed.

A concentrated fluid food that will not readily ferment is to be given, but in no greater quantity than can be easily digested and assimilated.

An abundance of fresh air from first to last is indispensable, and anxiety lest this should cause the patient to take cold should be dismissed. "Antiseptic precautions" should be adopted.

Serum therapy has not yet established its claim to be adopted, though the prospect for the future is somewhat encouraging.

Andrew Heernance Smith.

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PNEUMONIA OF INFANTS.—The acute pneumonia of infants may assume one of two distinct types—either that of an acute lobar pneumonia or that of an acute bronchopneumonia or lobular pneumonia. The former type, which is less common than the other, is caused by the pneumococcus, develops as a primary disease, has an acute onset, runs a short course, is characterized by a continuous high temperature, ends by crisis, and allows a good prognosis. The other type of pneumonia is the most common disease of infancy, is usually secondary, may be caused by one of several micro-organisms, is variable in onset, runs an indefinite course with irregular temperature, ends by lysis, and allows a less favorable prognosis—that is, one which depends largely on the disease to which it is secondary.

LOBAR PNEUMONIA.

Infantile lobar pneumonia—croupous pneumonia; Fr., *La pneumonie franche*; Ger., *Primäre genuine Pneumonie*—corresponds in some measure to the lobar pneumonia of adults, but it allows a more favorable prognosis. Lobar pneumonia is an acute disease of short duration, characterized by inflammation and hepatization of a certain area of lung tissue, and is caused by the pneumococcus.

ETIOLOGY.—The disease is almost always primary. Although it is less common before the third year, it may occur in early infancy. In fact, cases have been reported in which the disease developed before the birth of the child.

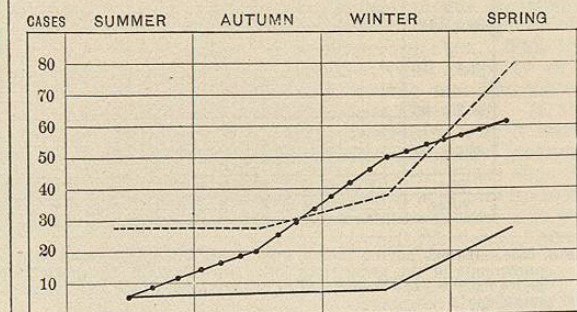


FIG. 3835.—Chart Showing the Frequency of Lobar Pneumonia in Infants and Children at Different Seasons. — Cases reported by Dr. Holt; — Cases reported by Dr. Comby; — Cases reported by Drs. Northrup and Freeman.

cur in early infancy. In fact, cases have been reported in which the disease developed before the birth of the child.

All statistics seem to agree that boys are more frequently affected with the disease than girls, the general ratio being 60 per cent. boys and 40 per cent. girls. Comby reports that in 172 cases seen by him 105 were in boys and 67 in girls. Of 44 cases reported by Henoch 24 were in boys and 20 in girls. Holt reports 60 per cent. of his cases as occurring in boys. Rilliet and Barthez, out of 408 cases, report 221 in boys and 187 in girls. Of 42 cases at the Foundling and Nursery and Child's hospitals in New York 25 were in boys and 17 in girls, or 60 per cent. in boys and 40 per cent. in girls.

SEASON.—This disease is seen most often in the spring. The accompanying chart (Fig. 3835), constructed from data by Comby and Holt and the authors of this paper, shows the frequency of lobar pneumonia, in children, in New York and Paris at different seasons. Exposure to cold, traumatism, contagion, and previous poor health have been mentioned as occasional etiological factors; but if they do play any part in the production of this disease, except by lowering the resistance, this must be true only in rare instances. The micro-organism regularly found in the sputum and in the lesion, and occasionally in the blood, is the micrococcus lanceolatus or pneumococcus of Fränkel. Various other bacteria may be associated with the pneumococcus.

PATHOLOGY.—The focus of the disease may be located in various parts of the lung, but certain lobes are more often affected than others. Holt finds that the left lower lobe is the one most often affected, the next in order being the right upper and the right lower. Comby, on the other hand, finds that the right upper lobe is much more frequently affected, the next in order being the left upper and the left lower. Monti, who has had a large experience with the disease in Vienna, considers that the right upper lobe is much more often involved than the left, and the left lower much more often than the right. The cases collected by the present writers show that the right upper, the right lower, and the left lower lobes are about equally often affected, while the left upper lobe is the least apt to be involved. The exact figures of relative frequency are as follows:

	Right upper.	Right lower.	Left upper.	Left lower.
Holt	2	3	..	1
Comby	1	..	2	3
Ashby	2	1
Northrup and Freeman ..	2	3	..	1

So far as its general characters are concerned, the lesion of lobar pneumonia in children corresponds to that in adults. It will therefore not be necessary to describe them here in detail (see article on *Pneumonia, Lobar*, by Dr. A. H. Smith). The disease is an acute exudative inflammation of the lung, in the course of which the air spaces become filled with red and white blood cells, serum, and fibrin. At the same time there is developed

a toxæmia from the absorption of the poisons which are produced in the lungs. The lesions are not usually in the same state of development in all parts of the involved lung tissue at the same time, for while one area is in the

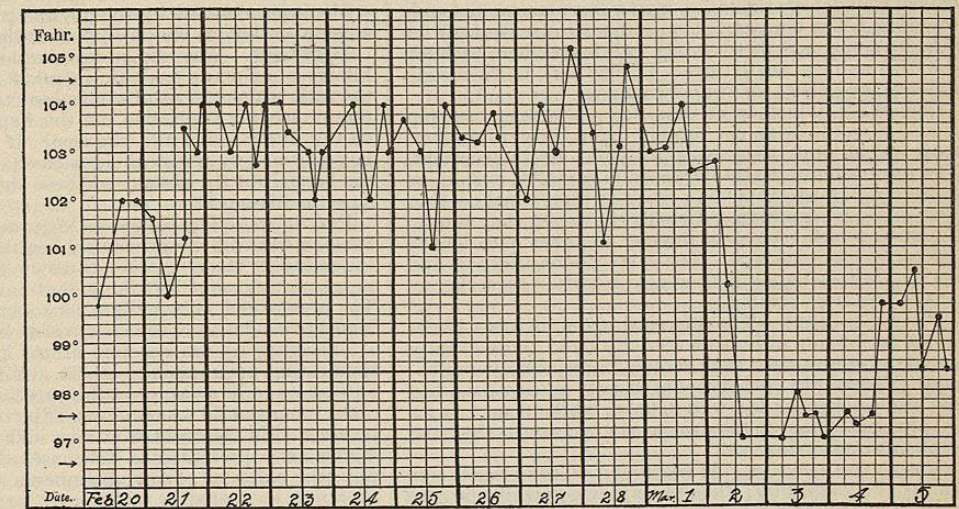


FIG. 3836.—Temperature Chart of a Case of Lobar Pneumonia in a Baby of Nine Months.

condition of red hepatization, a neighboring area may show gray hepatization.

Resolution does not always take place. The products may persist and become organized, or they may break down and form an abscess, or, finally, a necrotic process may ensue and gangrene manifest itself. In the lobar pneumonia of infants, however, these terminations are less often observed than they are in adults.

Pleurisy, with the development of fibrin only, or with a plastic exudate, or with pus, may accompany the pneumonia. A bronchitis is usually present. Pericarditis, endocarditis, and meningitis occasionally occur.

No sputum is, as a rule, expectorated by infants, all that is coughed up is swallowed. We have found that the sputum may best be obtained for microscopic examination by washing out the stomach half an hour after the child awakes and before food is given. Where this fails sometimes titillating the pharynx causes cough and ejection of small masses of mucus.

A leucocytosis appears at the beginning of the disease, and increases in intensity, disappearing as the temperature drops.

SYMPTOMS.—There is no incubation stage in the lobar pneumonia of infancy. The baby becomes suddenly very severely ill. It usually vomits and has a rapid rise of temperature. Convulsions may occur with the onset, especially in infants that have rachitis. Chills are rarely seen with the onset of the pneumonia of infancy. The child becomes dull and apathetic. With the rise of temperature the pulse rate is increased, while the respiration is increased out of proportion to the pulse rate. Thus the ratio of respiration to pulse, which normally should be one to four, approximates that of one to three. The child develops a short dry cough, and is apt to have an expiratory grunt. The alæ nasi expand with each inspiration. The child's face is usually flushed and the skin dry. The severity of the attack may usually be judged from the degree of elevation of the temperature. Cerebral symptoms often accompany the disease. Convulsions are occasionally seen, while stiffness of the back of the neck, stupor, and delirium are often present.

The typical temperature chart of the lobar pneumonia of infancy shows a rapid rise of temperature to about 104° F., slight morning remissions and evening exacerbations continuing for less than a week, and the disease ending by crisis. Such a chart is shown in Fig. 3836; it

represents the variations in temperature observed in a child nine months old while passing through an attack of lobar pneumonia. In other cases the remissions are more pronounced, the charts resembling more nearly those of bronchopneumonia, but differing in the fact that the disease now under consideration runs a short course and ends by crisis. The temperature continues to be elevated for about a week, and then usually falls somewhere between the fifth and the tenth days. It may fall on the second day or may persist for fully two weeks.

The pulse, which is at first full and strong, varying from 120 to 160 beats per minute, later becomes weaker, more rapid, and sometimes irregular or intermittent. The respirations are also increased in rapidity, even more so than the pulse; they may reach as high a rate as 40 or 60 or even 80 per minute. Usually, however, they bear to the pulse a ratio of one to three or at times one of even one to two and one-half. The inspirations are short and the expirations long and accompanied often by a characteristic grunt or groan.

PHYSICAL SIGNS.—The physical signs of lobar pneumonia in infancy differ so materially from those usually found in adults that they should be especially emphasized. These physical signs are usually late in appearing and are less regular and well defined, while in some cases no physical signs at all can be elicited until after the temperature has dropped.

Many cases show, at the beginning of the attack, evidences of congestion; these being recognizable in the form of slight dulness on percussion and diminished respiratory murmur, at times quite pronounced. In many of the cases neither of these signs is present, but on carefully going over the chest there will be found a small area where subcrepitant or crepitant râles will appear at the end of a deep inspiration. In other cases the first sign will be a small area of high-pitched breathing, which may or may not have the true bronchial character. In whichever of these manners the signs first appear, other of the usual signs of lobar pneumonia in the adult are gradually added, so that in most cases, before the end of the week, the chest will present, in some particular area, a group of characteristic signs, the most important of which are dulness on percussion, bronchial breathing and bronchial voice sounds, and increased vocal fremitus. In some cases the disease manifests the characteristic onset and range of temperature, the ratio of the respiration to the pulse is as one to three, the alæ nasi are dilated, and the expiration groan is present, and yet no signs of consolidation can be made out in the chest. However, the signs in the chest are not essential for the establishment of the diagnosis in any given case provided there be present the group of symptoms just enumerated. In some cases the chest signs will first make their appearance at the time when the temperature falls. Again, in other cases, while there may be no definite signs of consolidation, percussion over the area situated below the clavicle may elicit an exaggerated or tympanic percussion note, a sign which is believed by Comby to be of great value as indicating an involvement of the pleura or lung on that side.

COMPLICATIONS.—The most frequent complication is a general bronchitis, which may be the result of an infection with other micro-organisms than the pneumococcus. This complication may cause a greater daily variation in the temperature than is usually seen.

Next in point of frequency are the pleural lesions. At autopsies of these cases a dry pleurisy over the consolidated area—is usually seen. In six or eight per cent. of these cases some exudate of a fluid or plastic character may form in the pleural cavity. When this is marked it forms a thick layer of fibro-purulent exudate of a yellowish color and shaggy appearance, accompanied by more or less purulent fluid. The character of this exudate in children is important, for in some cases it is thrown out in considerable amount, and yet only a small portion of it is free fluid. This small quantity, however, is sufficient to yield the physical signs of the presence of fluid

in the pleural cavity and consequently to justify puncturing the chest wall with a needle. But the operation, under these circumstances, is very apt to prove unsuccessful, owing to the fact that the needle becomes occluded by the thick exudate.

Meningitis caused by the pneumococcus may occur as a complication, as may also pericarditis.

DIAGNOSIS.—The diagnosis should be based on the history of an acute onset in the midst of good health, on the ratio which the respirations bear to the pulse rate, on the prolonged expiration, on the expiratory grunt, and on the dilatation of the alæ nasi. If the diagnosis can be confirmed by physical signs on examination so much the better, but the absence of these signs need not invalidate the diagnosis.

PROGNOSIS.—The prognosis in primary uncomplicated lobar pneumonia in previously healthy infants is good, the mortality varying from three to five per cent. The prognosis is graver in children that have not been robust. The presence of only a slight leucocytosis is believed by Monti to render the prognosis worse.

TREATMENT.—On account of the possibility of communicating pneumonia to others, and for the good of the patient as well, a large, well-lighted and ventilated and quiet room should be obtained. But one person should be allowed in the room at a time. The number of cases which have presented at the onset the symptoms and physical signs of lobar pneumonia, but which have promptly recovered, is sufficiently large to warrant the belief that it is sometimes possible to abort the disease provided the efforts directed to the attainment of this object are made sufficiently early. Such treatment should consist in the administration of a single fairly large dose of calomel, the use of active counter-irritation by mustard paste, applied either over the whole thorax or simply over the suspected area, and the stimulation of the patient with strychnine. If no amelioration occurs within twenty-four hours after this treatment is begun, one may assume that the disease will run its course.

The medication, after the disease has once become established, should, as a rule, be directed either to the gastro-enteric tract or to the heart. Expectorants are rarely indicated. The tendency to constipation and tympanites, which is apt to embarrass the patient by interfering with the descent of the diaphragm, may usually be best treated by rhubarb or by a combination of rhubarb and soda. Heart stimulants are usually indicated early, and of these strychnine is the most valuable; it should be given in rather large doses, gr. $\frac{1}{16}$ to gr. $\frac{1}{8}$ every three or four hours. When the extremities are cold nitroglycerin is useful. Alcoholic stimulants should be reserved as a later resource. Among the antipyretics the use of water will be found to be most effective. Sponging with equal parts of alcohol and water has a moderate antipyretic action, and later, if it should be found necessary, a cold pack or a cool bath may be given. Of the antipyretic drugs only phenacetin should be given. In order to secure a sedative effect a very small dose (0.15 gm or gr. $\frac{1}{4}$) of codeine or from five to ten drops of paregoric may be administered. Oxygen (by inhalation) is one of the most valuable stimulants, especially in the treatment of very young babies who take medicine badly by the stomach.

BRONCHOPNEUMONIA.

Bronchopneumonia—Lobular pneumonia; Capillary bronchitis; Fr., *Broncho-pneumonie*; Ger., *Bronchopneumonie*—is an acute disease of indefinite duration, which is characterized by a capillary bronchitis and by peribronchial areas of consolidation, and which may be caused by one or more of several micro-organisms.

ETIOLOGY.—This disease is the form of primary pneumonia most commonly found during the first two years of life, and at the same time it is the ordinary form of secondary pneumonia encountered throughout childhood. It is very common in infancy and early childhood; and at the autopsies in the New York Foundling Hospital it is a rare event not to find the evidences of more or less

bronchopneumonia. The disease occurs most frequently during the first year of life and much less frequently with each succeeding year up to the fifth. After this age it is not a common disease. In the majority of cases the disease develops during the winter season; but this statement is more true of bronchopneumonia than of the lobar variety, for cases of the former disease in infants are seen also at other seasons of the year. Another important fact is, that bronchopneumonia rarely attacks infants who have previously been in good health. It often occurs in those who have had a preceding acute attack of chronic gastric or intestinal disorder. Rickets and hereditary syphilis predispose to the disease. The following acute diseases which are apt to precede bronchopneumonia are arranged in the order of frequency: measles, whooping-cough, diphtheria, influenza, ileocolitis, and scarlet fever. Furthermore, the environment has a good deal to do with the frequency of this disease. Thus, for example, it occurs with special frequency among the occupants of the tenements and hospitals, and among those who live in the crowded and poor sections of the cities, as has been well shown, so far as Boston is concerned, by Morrill.⁸ Finally, exposure to cold, which is by the laity considered all-important, is undoubtedly occasionally an active factor, but the history of a sufficient exposure of this sort is rarely elicited. Experimental researches in the lower animals have shown that cooling of the body does predispose to infection with the pneumococcus.²

So far as the bacteriology of the disease is concerned, it has been distinctly determined that there are several varieties of micro-organisms which may be actively concerned in the production of bronchopneumonia. These bacteria are also often found in the upper air passages of healthy persons, and become active agents in the production of bronchopneumonia when the organism has become depressed by a previous disorder or by a severe exposure to cold or fatigue. One or several varieties of these bacteria may be present. The pneumococcus is the organism most frequently found, while the streptococcus and the staphylococcus are often present. Darrier,³ in 1885, found in four cases of bronchopneumonia complicating diphtheria the streptococcus either alone or associated with the Loeffler bacillus. Prudden and Northrup,⁴ in 1889, after an extensive study of the bronchopneumonia of diphtheria in infants, also found that the streptococcus was the usual cause. Netter⁵ studied bacteriologically 42 cases of bronchopneumonia. In 25 only one organism was found, and in 17 more than one. As regards the 25 with only one variety of micro-organism, it was found that the pneumococcus was present in 10 cases, the streptococcus in 8 cases, the staphylococcus in 5 cases, and Friedländer's bacillus in 2 cases. As regards the 17 with more than one variety, it was found that the pneumococcus and the staphylococcus were present in 1 case; the pneumococcus and streptococcus in 3 cases; the pneumococcus, streptococcus, and staphylococcus in 2 cases; the streptococcus and staphylococcus in 5 cases; the streptococcus and Friedländer's bacillus in 3 cases; the pneumococcus, streptococcus, and staphylococcus in 2 cases; and the pneumococcus and Friedländer's bacillus in one case. Munier⁶ in 10 cases, without any diagnostic signs of influenza, found the Pfeiffer bacillus alone or associated with other organisms. In 5 cases he found Pfeiffer's bacillus alone; in 2 cases with the pneumococcus; and in 3 cases with other undetermined organisms. Wollstein,⁷ quoted by Holt, studied 33 cases, 19 of which were primary and 14 secondary. She found the pneumococcus alone in 17 of the primary cases, with the streptococcus in 7, and with the staphylococcus in 1. Holt found the streptococcus alone in 1, and the staphylococcus alone in 1. He found that the pneumococcus was present in 11 out of the 14 secondary cases. It was alone in two cases; it was associated with the streptococcus in 1 case; with the staphylococcus in 2 cases; with the tubercle bacillus in 2 cases; with the tubercle bacillus and the streptococcus in 2 cases; and with the tubercle bacillus and the staphylococcus in 2

cases. The streptococcus was alone in 1 case; it was associated with the staphylococcus in 1 case, and with the tubercle bacillus in 1 case.

ANATOMICAL CHARACTERISTICS OF THE LUNG IN INFANCY.—Before we consider the pathology of the bronchopneumonia of infancy, it may be well to speak briefly of the anatomy of the lung in infancy, for this is undoubtedly a determining factor in the preponderance of the bronchial form of pneumonia at this age.

In infants the bronchi are larger and more numerous and thus form a much larger proportion of the lung tissue than is the case in adults. In infants, therefore, the alveoli represent a much smaller proportion of the lung as a whole. This is particularly marked during the first two years of life. The connective tissue is present in greater abundance and binds the different elements together very loosely. As a result the blood-vessels are loosely held and easily become distended and encroach on the alveoli. These characteristics of the lung of infancy persist to some extent until the fifth year, after which period it may be considered to have assumed the adult type.

PATHOLOGY.—The lesions of the bronchopneumonia of infancy are to be found most often in the posterior portions of both lungs, generally of the lower lobes, but extending frequently to the posterior portions of the upper lobes. In bronchopneumonia we have usually a tracheitis, a bronchitis, a capillary bronchitis, and a pneumonitis, the inflammation starting in the upper air passages and travelling downward until the lung tissue is involved. The inflammation may extend downward slowly, several days elapsing before the pneumonia is developed; or, in severe infections in subjects with little resistance, the disease may extend so rapidly that signs of pneumonia are noticed simultaneously with the indications of inflammation of the upper air passages. Upon examining, at the autopsy, the lungs of an infant who has had bronchopneumonia, one often finds evidence of some pleurisy over the pneumonic area; perhaps only a dull, lustreless appearance, or a little exudate on the surface, and, in rarer cases, a fibro-purulent exudate. On section of the lung, if it be an early case, the involved area will be found, usually in both lungs, to be dark red in color and resistant to the touch. Other areas of congestion will show the dark red color, but will offer little resistance. The cut surfaces will also have for the most part a dark red color. Small white areas, of the size of a pin's head, are due to the filling of small bronchi with muco-purulent material which may be pressed out. The larger white areas which are found at a later period of the disease, are due to lobules undergoing gray hepatization. In a section of a lung of a child where the bronchopneumonia has advanced still farther in its course, one often finds all stages of the process in different adjacent lobules, so that instead of having a general condition of red or gray hepatization one notices a mottled appearance. The exudate which forms the consolidation consists of serum, epithelial cells, red blood cells, fibrin, and polymorphonuclear leucocytes. There is, however, as a rule, less fibrin, and the leucocytes are fewer than in lobar pneumonia.

Among the other lesions which are sometimes observed in these cases may be mentioned the following: atelectasis, hemorrhages, emphysema, and gangrene. Atelectasis may occur in areas supplied by bronchi which have become plugged with mucus that forms a valve, allowing the air to pass out but not to enter. Hemorrhages may occur in other areas, so that, on examination with the microscope, the air passages are found filled with red blood corpuscles. A vesicular emphysema may also occur, especially in the anterior portions of the lungs. Both vesicular and interstitial pneumonia are frequently found associated with the bronchopneumonia of whooping-cough. Finally, gangrene of a portion of the involved lung is occasionally found at autopsy.

In addition to the pulmonary lesions already described, the bronchial lymph nodes are commonly found to be enlarged from cellular hyperplasia. Occasionally, on

cutting such nodes, tuberculous lobules are discovered, although no tuberculosis is found elsewhere.

TERMINATIONS OF THE DISEASE.—Resolution may take place by cell degeneration and absorption at any stage in the process. This, however, takes place irregularly, and, while certain lobules are undergoing resolution, others may show an advancing lesion. In the place of complete resolution, chronic bronchopneumonia may establish itself, especially in feeble babies, who will thus be left with patches of marked bronchopneumonia which may persist for weeks or months. These areas undergo interstitial changes with dilatation of the bronchi, and sometimes with the formation of cavities which are filled with muco-purulent material. At times these cavities represent veritable abscesses. Finally, death may occur at any stage of the bronchopneumonia.

SYMPTOMS.—In the bronchopneumonia of infants both the symptoms and the course vary greatly, as might be expected when the conditions are considered; for the term bronchopneumonia is applied to a disease that may be caused by any one or more of several micro-organisms, and that may develop either as a primary affection or as a secondary phenomenon in the course of some other severe disease. If, in addition, we take into consideration the varying resistance of the subjects, the extreme irregularity of the course of this disease will appear perfectly natural.

Of the different symptoms which accompany a bronchopneumonia *fever* is one of the earliest noticed, and it is very rarely preceded by a chill. This fever usually rises to 102° and sometimes to 104° F. and then falls, rising again as high as or higher than the highest point previously reached. Thus it continues with exacerbations, followed by marked remissions usually of from two to four degrees. The exacerbation of temperature usually occurs in the afternoon or evening. The temperature lasts one, two, or three weeks, or longer. Only twenty-five per cent. of the cases defervesce within the first week. When the disease runs a long course, there are often observed intervals during which the temperature, for a day or two, will run much lower, rising again with the invasion of new lung tissue. The fever usually ends by lysis.

A *cough* is commonly present from the first. It is ordinarily a dry, short, hacking cough, but at times it is paroxysmal in character and may be almost incessant. Later in the disease the cough may disappear, owing to a loss of reflex activity in the air passages. The cough often persists after the other symptoms of the pneumonia have disappeared. Inasmuch as babies swallow all the material which they cough up, we cannot examine the sputum unless we take special measures for obtaining it.

As the disease advances the *respirations* become rapid, rising usually to from 40 to 80 a minute, and sometimes higher. Respirations above 80 should make one suspicious of pulmonary complication, but usually they are over 40. They vary from 40 to 60 ordinarily, but may reach 100 or more in severe cases. The rhythm of the respiration is also disturbed. The pause, which normally takes place after expiration is completed, is done away with and a pause takes place after inspiration. The child quickly draws its breath, holds it, and then with an explosive grunting sound, expires, and without pause again inspires. The expiration is prolonged and loud. The expiratory grunt is a very characteristic symptom of pneumonia in infancy. Another disturbance of rhythm is that known as Cheyne-Stokes respiration; this disturbance occurs in severe cases. Temporary suspension of respiration also occurs in the very sick. It may last as long as two minutes and be spontaneously resumed. Evidence of respiratory embarrassment is also found in the sinking in of the intercostal spaces and the dilatation of the *ala nasi* with each inspiration, in severe capillary bronchitis. Cyanosis is another symptom which often develops in severe cases of capillary bronchitis.

The *pulse* is accelerated with the onset of the disease, and in an ordinary case will soon reach the rate of 150 a minute. It is usually full at first, but later, and espe-

cially in the severe cases, it becomes more rapid and weak.

A most important diagnostic sign of bronchopneumonia is to be found in the *ratio which the respirations bear to the pulse*. This is usually altered from the normal ratio of one to four to a ratio approximating one to three; that is, in an ordinary case the respirations will number about 40 or 50 and the pulse beats from 120 to 150 to the minute. Such a respiration-pulse ratio should at once direct attention to the thorax, which should be very carefully examined for evidence of pulmonary disease.

Pain is not a symptom of any importance in the bronchopneumonia of infancy. There is usually some soreness in the chest, but these little patients do not, commonly, suffer from acute pain.

So far as *cerebral symptoms* are concerned, the onset of bronchopneumonia in infancy is usually characterized by a condition of apathy. The patients are said to be "dopey"; they are markedly prostrated, indifferent to their surroundings, and want only to be left undisturbed. Convulsions at the onset are rare; they occur only in very severe cases, in children with marked rachitis, and in those of poor previous condition. Delirium and stupor often develop. The *tache cérébrale* and Kernig's sign may sometimes be elicited.

Various *gastro-enteric symptoms* are commonly associated with a bronchopneumonia. Thus, for example, anorexia usually occurs at the onset of the attack, while thirst may supervene at a later stage. The tongue is sure to become coated, and in a certain number of cases the disease begins with marked gastro-enteric symptoms, vomiting, abdominal pain, diarrhoea, and tympanites—symptoms which may lead to a false diagnosis, or at least to overlooking the pulmonary condition.

PHYSICAL SIGNS.—The physical signs vary as much as do the symptoms. Some cases, which in other respects are following a typical course, may at no time give physical signs; that is, the disease fails to produce marked changes in any part of the lungs adjacent to the thoracic wall. In other cases local physical signs will be elicited only when the temperature falls, while in still other cases one gets marked signs of consolidation from the beginning of the disease.

Inspection reveals the fact that the respiration is rapid, irregular, and variable in its rhythm; it also perhaps shows the existence of a certain degree of cyanosis.

Palpation is of less value in infants than it is in adults, owing in part to the fact that the lesion usually is bilateral and in part to the fact that it often fails to yield good evidence of the existence of consolidation.

Percussion also gives valuable information less often in infants than it does in adults. It must be practised with care and with the employment of very little force; one finger will suffice for the actual percussing, and the examiner should make a light, sharp stroke by quickly withdrawing the finger. The revelation, by means of percussion, of a very slight dullness, especially if it is associated with a sense of resistance, points to congestion and consolidation, while a marked degree of dullness should raise a suspicion that fluid is present, and this conjecture should lead to the employment of auscultation as a means of differentiating between these conditions.

It is by *auscultation* that the first evidence of local pulmonary involvement is usually elicited, and it is upon auscultation that one must especially rely for locating the bronchopneumonia in infancy. In these little subjects the ear should not be relied on alone, but a stethoscope with a small opening should also be used. If the baby is emaciated, a flexible rubber chest-piece may be necessary. Auscultation gives information as to the presence of râles, the duration of the expiration as compared with the inspiration, and the pitch of the breathing. Since in bronchopneumonia there is an inflammation of both large and small bronchi, and often a pleuritic inflammation as well, all varieties of râles may be heard. The coarse, low-pitched, sonorous râles, which have their origin in the large bronchi, are usually present.

Areas of subcrepitant or crepitant râles, audible at the end of an inspiratory effort, are carefully to be looked for, since they are usually the first physical sign found by which one can locate the bronchopneumonia in infancy. It is not sufficient to listen carefully over the chest of a sleeping or quiet child for this sign, but effort must be made to secure deep inspiration. If the child coughs, the coughing will be followed by satisfactory inspiration, but often it is necessary to make the baby cry. It is during crying that the most satisfactory examination of the baby's chest may be made, for it elicits both deep inspiration and voice sounds which may be difficult to get by other means. If the pneumonia is sufficiently developed one may get a prolongation of expiration, and high-pitched or bronchial breathing.

In some cases the first local physical sign will be diminished breathing, which may be associated with dullness over the same area. Dullness and diminished breathing, although often due to congestion, should always suggest the possibility of fluid being present. If these signs are due to congestion, they should soon change to high-pitched breathing with râles; if they are due to fluid, they should persist and become more marked.

The location of the heart apex should always be definitely made out, as a displaced apex often determines the presence of fluid in cases in which other signs would seem to point to consolidation of the lungs.

COURSE OF THE DISEASE.—The bronchopneumonia of infancy usually begins with an abrupt onset, characterized by considerable fever and a condition of apathy. The child is evidently seriously ill. It coughs, breathes rapidly, and with each expiration is apt to groan or grunt. Dyspnoea develops, and sometimes cyanosis. The *ala nasi* dilate with inspiration. The fever persists for from one to three weeks, finally ending by lysis. As the disease progresses, the prostration becomes more marked, the pulse more rapid, and the extremities, nose, and ears often become cold. The respirations become very rapid, and delirium or stupor may develop; gastric or intestinal symptoms also often occur.

The disease may manifest itself under one or the other of three different types: the acute congestive type (or capillary bronchitis), the latent type, and the persistent type. The first of these, the *acute congestive type*, may be primary or secondary, and occurs most often in young infants. They become suddenly severely ill, and breathe with great difficulty and very rapidly (70 to 80); there is high fever (104° to 106° F.); and the pulse is rapid (180 to 200). Death often occurs in from twelve hours to three days. Some of these cases will end in recovery in the course of a few days. By the expression *latent type* is meant a bronchopneumonia which is found in cachectic and marasmic infants, who may have neither fever, nor cough, nor dyspnoea. It is a hypostatic pneumonia, which gives little evidence of its presence during life, and is often first discovered at autopsy. The *persistent type* of bronchopneumonia is seen in children who are in poor condition at the time when they are taken ill; it also often develops after whooping-cough. In these cases the disease usually runs a moderately severe course for from two to three weeks, and then, instead of defervescing and undergoing resolution, it continues for some time to manifest a moderate degree of feverishness and the physical signs of persisting consolidation. These patients are apt gradually to become weaker and die, although some of them may recover after a long period.

In addition to the three types briefly outlined above, it is permissible to establish—in accordance with certain characteristics that belong to the secondary bronchopneumonias following the different acute infectious diseases—other less important groups. For example, one group may comprise those cases in which a *bronchopneumonia develops in the course of an attack of measles or scarlet fever*. In this group the pneumonia begins either when the eruption is at its height or not until after the temperature has fallen to normal. In the latter event the temperature does not remain at this low point but soon rises several degrees, and evidences of the pneu-

monia begin to manifest themselves. But whether the pulmonary complication develops at this later stage of the original disease or whether it develops at the time when the eruption is at its height, the prevailing character of the pneumonia is in either case likely to be severe; indeed, the disease often assumes a congestive character. The *bronchopneumonia of whooping-cough* constitutes another group. This develops usually during or at the end of the paroxysmal period. The onset is more gradual and less severe than it is in the preceding group, and the fever usually is moderate. The disease develops in children who are much depleted by the whooping-cough, and it runs a long, subacute course. Finally, in the third group may be placed the *bronchopneumonia of diphtheria*. In this group of cases the disease again manifests itself commonly in a severe form like that which characterizes the bronchopneumonia of measles and scarlet fever. It usually develops early in the attack of diphtheria.

Bronchopneumonia also develops in connection with other diseases. Thus, for example, it sometimes occurs in a fairly severe form in the course of an *influenza*. When it occurs in connection with an *ileo-colitis* it usually develops at a time when the baby has been much weakened by the primary disease, and it then assumes a type similar to that seen in whooping-cough.

COMPLICATIONS.—The one very common complication of bronchopneumonia—the one for which diligent search should be made daily, in order that it may not be overlooked—is *empyema*. This occurs in a considerable number of cases, and requires a prompt evacuation of the fluid whenever the baby suffers severely from its presence. Evidence of fluid is usually first found behind or in the post-axillary line; less frequently it is found in front. Diminished breathing sounds and marked dullness on percussion are usually the first local signs. Another occasional complication is *purulent meningitis*, which is caused by the same micro-organism that produces the lung consolidation. *Pericarditis* is also sometimes encountered, but usually in connection with empyema. On the other hand, in all the cases of bronchopneumonia which have been seen by the writers in the New York Foundling Hospital, the complication of an *endocarditis*, except when associated with pericarditis, has not once been observed. Finally, in a certain number of cases, *tuberculosis* may constitute a complication of the bronchopneumonia. In these cases the trouble may sometimes be attributed to the breaking down of an old cheesy bronchial lymph node.

DIAGNOSIS.—The early diagnostic signs are the abrupt onset, the presence of fever and of a certain degree of apathy, the disturbed respiration-pulse ratio, and the discovery, by auscultation, of the existence of râles in the chest. To these signs may be added, at least for some of the cases, the following: some dullness on percussion, a high-pitched respiratory murmur, and broncho-vesicular respiration. Many of these signs may be absent, especially in the subacute form of the disease as it occurs in weak infants or as a complication of whooping-cough.

The differential diagnosis from lobar pneumonia is based on the following points: Most of the cases of bronchopneumonia are secondary, and when the disease is primary in its nature it occurs usually in infants under two years of age. The signs develop more gradually in this disease than in lobar pneumonia. Furthermore, the remissions of temperature are more marked than they are in the latter disease, and the return to normal takes place by lysis rather than by crisis. Finally, the course of the disease, unlike that of lobar pneumonia, is very irregular. In order to distinguish the disease from fluid in the chest, when there are signs pointing to the latter condition, it often becomes necessary to resort to an exploratory puncture in order to determine the truth. In making such a puncture it must be remembered that the fluid is often thick, so that a negative result from the use of a small needle means nothing. A large needle should always be introduced in an aseptic manner.

PROGNOSIS.—The prognosis in the lobular form of pneumonia in infancy is always very serious. It is mod-

ified by several factors. In the first place, the younger the child the more serious the outlook. Pneumonia in an infant under one year justifies a very serious prognosis. The condition of the child's health before the attack is another important factor. The better the health of the baby when taken ill with the bronchopneumonia the better the prognosis. The environment of the child also modifies the prognosis. Usually cases do much better under good surroundings, with isolation, quiet, and plenty of air—i.e., under such conditions as may be found among the wealthy classes—than they do in the tenements and hospitals.

Primary bronchopneumonia usually allows a much better prognosis than does that which develops in the course of some severe disease; for the outlook in secondary pneumonia varies with the disease which it complicates. Thus, in many of the cases of pneumonia complicating diphtheria the patients die, and the mortality of the disease, when it develops in the course of whooping-cough, is always very high (fifty to one hundred per cent.). The bronchopneumonia of measles is usually of a severe form, but, notwithstanding this fact, the mortality is somewhat lower than it is in the secondary pneumonias of diphtheria and whooping-cough (thirty-three to one hundred per cent.). In the influenza cases the mortality is more favorable.

TREATMENT.—A study of this disease emphasizes the importance of watching very carefully all children who are affected with colds, influenza, bronchitis, and the other primary diseases which bronchopneumonia is apt to complicate. Of still more importance is the careful watching of the digestion of babies and the prompt modification of the diet when necessary.

The direct treatment is entirely symptomatic, and the general hygiene, nursing, and feeding are usually of far more importance than the medicinal treatment. A baby with bronchopneumonia should be placed in a large quiet room with plenty of light and a southern exposure. The room should be ventilated from out of doors and not from other rooms in the house. Some moisture in the room will make the patient more comfortable, and this may be obtained by boiling water in a kettle. But one person should be allowed in the room at a time, and the same care should be observed to avoid disturbing the patient that is exercised in the case of a nervous adult.

The diet should consist of milk or modified milk, or milk with barley water, or oatmeal gruel. If the milk is not well digested, it may be given only after it has first been peptonized. If but little is taken at a time, the feeding may be done at intervals of one or two hours. With the onset three modes of treatment should be actively tried in an effort to abort the disease. These are: purgation, counter-irritation, and stimulation. For the attainment of the first of these objects, calomel is altogether the most satisfactory drug. For a baby under one year of age one-tenth of a grain may be given every half-hour until from four to ten doses shall have been given. If this medication fails to move the bowels, castor oil, in doses of one or two drachms, should be administered. Counter-irritation over the affected area, or, if this cannot be determined, over the whole chest in front and behind, may be made with mustard paste. The operation should be repeated at intervals until a marked redness of the skin is produced. Stimulation with strychnine in fairly large doses (from gr. $\frac{1}{100}$ to gr. $\frac{1}{50}$) every four to eight hours, according to the age of the child, may be resorted to temporarily. This treatment, which may be kept up until the physiological effects of the drug are obtained, will aid the organism in its effort to overcome the disease. Afterward the remedy may be administered with advantage in smaller doses throughout the entire course of the disease. The counter-irritation may also be repeated with benefit from time to time. Stimulation should be used when needed. Nitroglycerin is of especial value when the extremities become cold, and it should be given in a dose of gr. $\frac{1}{100}$ every four hours. At the same time hot-water bags should be applied to the feet. The administration of

alcohol internally may usually be reserved for severe cases, since it is a drug that is often badly borne by babies. It may be given in the form of whiskey diluted with from eight to ten parts of water and sweetened; champagne and sweet wine may also be administered. Oxygen is a most valuable aid in the treatment of this disease, and it may be given at frequent intervals or constantly, and should be delivered from the pipe held close to the child's mouth.

The gastro-enteric tract must be carefully watched, as marked tympanites, which interferes with respiration by restricting the descent of the diaphragm, is a frequent and very serious complication in many cases. A mixture of rhubarb and soda, or of rhubarb and soda with bismuth, or an occasional dose of castor oil, will often relieve this symptom, but at times the introduction of a stomach tube or rectal tube is needed for evacuating the gas. Counter-irritation and hot fomentations applied to the abdomen are also useful. The employment of pneumonia jackets and of poultices, as a routine treatment of the bronchopneumonia of children, has been given up. Both of these tend to increase the temperature of a child already suffering from fever, and they limit the expansion of the chest. A woollen shirt provides a sufficient protection to the chest.

Antipyretic treatment is needed in the severe cases, and should be resorted to if the child is bearing the fever badly, even if the latter is not very high. Stupor, delirium, or great restlessness calls for antipyretic treatment. A temperature of over 103° F. is usually an indication for antipyretic treatment. There is no disease in which the thermometer is of so little service as a guide as it is in infantile bronchopneumonia. It is the child's general condition that furnishes the best indications for treatment.

Bathing furnishes the best means at our disposal for reducing temperature. Sponging with equal parts of warm water and alcohol may be used for slight fever and restlessness, but the most efficient and simplest method is to place the infant in a bath. The bath may have a temperature of from 80° to 90° F., and the baby may be kept in it for five or ten minutes. It is usually well to stimulate the baby before putting it in the bath. The bath may be repeated as often as indicated by the temperature.

The coal-tar derivatives should never be used as antipyretics for infants. Expectorants are very rarely needed in the treatment of this disease. Ipecac is probably the most efficient, but, if used, it should be given in small doses. Of sedatives, a warm bath is usually the only one needed. If the cough is constant and interferes with rest, and if it is not relieved by a bath, five-drop doses of paregoric may be given every three or four hours.

In protracted cases and during convalescence, the internal administration of creosote, or guaiacol and cod-liver oil, or of some iron preparation may be of advantage, while counter-irritation may be made by painting the chest with Churchill's tincture of iodine, or by the use of the Paquelin cautery. *William P. Northrup.*

Rouland Godfrey Freeman.

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PNEUMOPERICARDIUM. See *Pericardium, Diseases of.*

PODOPHYLLUM.—U. S. P., *Mandrake, May-apple.* The dried rhizome of *Podophyllum peltatum* L. (fam. *Berberidaceae*).

This striking and beautiful plant is found in the greatest abundance in rich soil throughout the eastern and central portions of North America, except the far north.

The drug is mostly collected in the Ohio valley and the mountains southward. The very long and much branched rhizomes form a network a few inches beneath the surface of the soil, and produce large beds of the

very peculiar foliage of the plant, which is herbaceous, about a foot high, and of the appearance shown in the accompanying illustration. The leaves are thin and somewhat shining, about a foot broad, the flower beautifully white and waxy, and about two inches broad. The sterile stems terminate in a circular, centrally attached leaf, which is similarly lobed, and presents the appearance of an umbrella, whence the plant is often called umbrella plant, whereas the form of those of the flowering stems have given it the name of duck's foot. The fruit is a yellow, sweet, and edible berry, about as large as a pigeon's egg, and is known as May, hog, Devil's, or Indian apple, also as wild or ground lemon.

The younger portions of the rhizome, after being dried, are dark-colored, thin, and shriveled, and are deficient in medicinal property. The drug is thus described:

Of horizontal growth and indefinite length, occurring in irregular pieces; cylindrical, flattened from above, consisting of joints about 5–10 cm. (2–4 in.) long, the internodes 2–8 mm. ($\frac{1}{2}$ – $\frac{1}{4}$ in.) thick, the nodes about twice as broad; yellowish-brown to dark brown, the darker pieces usually longitudinally wrinkled, the lighter ones nearly smooth, the nodes marked above by broad cup-shaped scars and underneath by whitish, short stumps of the brittle roots; fracture short and sharp, whitish to pale brown, resinous in the best drug, marked by a loose circle of very short yellow wood wedges surrounding a large pith; nearly inodorous; taste sweetish and bitter, becoming acrid.

The active portion of the drug resides in its three to five per cent. of resinous matter, which is associated with much starch, a very little gallic acid, and small amounts of fixed oil, gum, etc. The resin is a somewhat complex mixture, but is an official substance and is very largely employed under the name *Podophyllin*. It is highly subject to adulteration, more than fifty per cent. of adulterant having been reported in it; hence, the official description should receive close attention. It is prepared by exhausting the powdered drug with alcohol, concentrating the filtrate by evaporation, and pouring it into water acidulated with a little hydrochloric acid, when the resin is precipitated. It is afterward dried and powdered. The resin is described as follows in the pharmacopœia:

"An amorphous powder, varying in color from grayish-white to pale greenish-yellow or yellowish-green, turning darker when exposed to a heat over 35° C. (95° F.); having a slight, peculiar odor, and a peculiar, faintly bitter taste. Permanent in the air."

Its alcoholic solution has a faintly acid reaction. Soluble in alcohol in all proportions; ether dissolves fifteen to twenty per cent. of it; boiling water dissolves about eighty per cent., and deposits most of it again on cooling, the remaining, clear aqueous solution having a bitter taste, and turning brown on the addition of ferric chloride T.S.

Resin of podophyllum is also soluble in potassium or sodium hydrate T.S., forming a deep yellow liquid, which gradually becomes darker, and from which the resin is reprecipitated by acids. It should yield not more than 0.5 per cent. of ash.

Resin of podophyllum has the following composition:

The most of it is resinous *Podophyllin Acid*, which is brown, and soluble in alcohol and chloroform, not in water, ether, or petroleum ether, and is inert. Of *Podophyllotoxin* (C₂₃H₂O₆ + 2H₂O) there is apparently a very small amount (about one-fourth of one per cent. of the weight of the rhizome), the larger amounts reported by various observers being probably impure. It is best obtained by extracting the drug with pure chloroform, and this extract with pure ether, then precipitating with petroleum benzine. Pure podophyllotoxin usually occurs as a white, amorphous, bitter, slightly acid powder, or in crystals soluble in ether, chloroform, hot water, and diluted alcohol. This pure substance is very difficult to obtain, being usually contaminated with the isomeric *Picropodophyllin*, which is readily formed from podophyllotoxin by the action of alkalis, and is much less active than the latter. *Picropodophyllin* occurs in bitter crystals, soluble in alcohol, not in water. Podophyllotoxin is also very apt to be contaminated with podophyllin acid, with the yellow coloring matter *podophylloquercetin*, and with fat.

ACTION AND USE.—Podophyllum or its resin is locally irritant, the dust occasioned by powdering the drug causing redness and smarting of the skin and inflammation of the conjunctivæ. It has also been known to produce, upon the perspiring skin, ulcers which have been mistaken for chancroids. It is an irritant cathartic, whether introduced into the bowels or stomach, given subcutaneously, or absorbed from a raw surface. It is a very slow-acting medicine, requiring from twelve to fifteen hours before its effects begin, but it is also rather persistent and thorough, and in full doses is followed by numerous watery stools. Gripping pains are frequent accompaniments, and vomiting and persistent diarrhœa may follow if the dose is very large. After poisonous amounts the above symptoms are exaggerated, and inflammation and ulceration of the intestines, bloody stools, great prostration, stupor, and death may follow. The action upon man and the lower animals is essentially the same. It is supposed to stimulate the liver, and is very extensively given with a view to this effect, in the digestive disturbances called popularly

"biliousness," but probably, as we now know of nearly all so-called cholagogues, it does not increase the production of bile, but merely favors its dejection.

Moderate doses of podophyllotoxin given to man produce the same effects as podophyllum itself, with perhaps less pain and less tendency to vomiting. *Picropodophyllin* acts like the above, but less violently, in consequence,

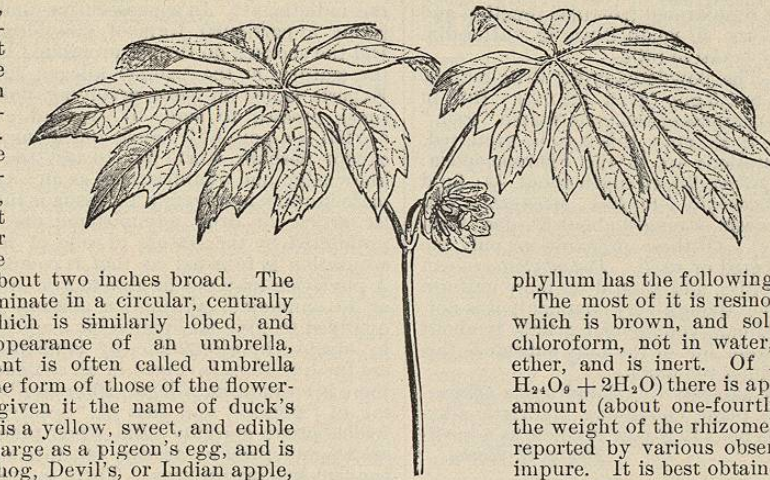


FIG. 3837.—Podophyllum; Flowering Plant. (Ballou.)

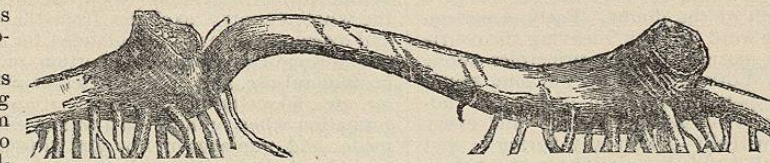


FIG. 3838.—Rhizome and Bases of Roots of Podophyllum.