the Bolivian Andes, and probably in Peru, at an elevation of 4,000 to 6,000 feet, the belt inhabited by the cinchona and coca plants. It is said to grow also in southeastern Brazil, but this is doubtless a distinct species. Several other species are collected and sold for it. The following is the description of the plant:

Fig. 3333.—Leaf of Matico Plant. (Baillon.)

Leaf from 12 to 20 cm. (5 to 8 inches) in length, very shortly and stoutly petioled, oblong-lanceolate, with obliquely cordate base, its lobes rounded, and a long acuminate, acute summit; margin entire or obsoletely crenate; bullate above, finely cancellate underneath, the veins densely brownish-hairy; odor faint; taste aromatic, pungent and bitterish. The flower spikes, which are frequently present, are about a fourth of an inch in diameter and two-thirds as long as the leaves. This distinguishes it from a spurious species often sold for it, the leaves being decidedly shorter and relatively broader and the spikes only about half as long and relatively thicker.

Matico contains from two to three per cent. of an essential oil, which is distilled for the market. It is yellowish-brown, of characteristic odor, and has a specific gravity of about .93. Its important constituent is the stearopten, which has been called "matico camphor" ($C_{15}H_{26}O$). The oil of the flowers is similar but has a specific gravity of 1.13. With the oil, there is considerable resin and tannin, and an amaroid, as well as *artanthic acid*.

The essential oil is a powerful abdominal stimulant, contracting the vessels in serous diarrhœa and in intestinal hemorrhage, in which action it is aided by the tannin. It has also been used locally as a hæmostatic, and as an ordinary vulnerary. It also possesses the ordinary properties of a bitter tonic. Its chief use, especially in France, has been as a substitute for cubeb and copaiba in the treatment of gonorrhœa and cystitis, but it is inferior to them, especially to the latter. We have official the fluid extract, dose 2 to 6 c.c. (fl. ʒ ss.–iss.), and a ten-per-cent. tincture, made with diluted alcohol, the best use of which is as a stomachic, in doses of ʒ ss.–i. *Henry H. Rusby.*

MATZOÖN. See *Milk*.

McCALLISTER'S SODA SPRINGS.—Jackson County, Oregon.

Post-Office.—Lake Creek. Camping grounds.

Access.—Viâ Southern Pacific Railroad to Central Point; thence by private conveyance over a fair wagon-road twenty-five miles east to springs

McCallister's Springs are located in a picturesque mountain region, 5,400 feet above the level of the sea. This region is noted for its pure, dry atmosphere and its freedom from miasmatic diseases. The springs are two in number, and flow about 120 gallons per hour each. The water has not yet been analyzed. We are informed by Mr. J. G. McCallister, the proprietor, that the waters have a wide reputation among the residents of the surrounding country in the treatment of chronic malarial poisoning. It is said that malaria is unknown in the neighborhood, and almost every person suffering from fever and ague is relieved after a few days' stay at the springs. We may easily believe, however, that these good results are at least partially due to the bracing mountain air of the neighborhood. The place is much resorted to by dyspeptics and rheumatic patients. The water is always cold, and is said to possess excellent properties as a tonic and appetizant.

James K. Crook.

MEASLES.—(Synonyms: Morbilli, Rubeola; Ger., *Masern, Flecken;* Fr., *Rougeole;* It., *Rosalia;* Sp., *Sarampion.*)

Definition.—Measles is an eruptive contagious fever. It is characterized by a period of incubation, of invasion, of eruption, and of decline. Its peculiar symptoms are manifested upon the skin and mucous membranes. It is highly contagious and, as a rule, attacks an individual but once.

History.—There is no evidence that measles was recognized as a distinct disease before the time of Rhazes (A.D. 900). Although this writer described measles and smallpox together, he probably appreciated their differences. Late in the tenth century Avicenna described measles, but it was not until the close of the seventeenth century that this malady and scarlatina were definitely determined to be separate affections, when Sydenham and Morton (1670–74) declared the latter to be a disease *sui generis*. Thenceforth descriptions of measles became more clearly defined, and to-day its literature is very voluminous. The origin of measles is buried in obscurity. At present its distribution is almost world-wide; only the remotest corners of the earth have remained exempt from its ravages. It appeared in America soon after the arrival of the first settlers, and advanced steadily with the pioneers of civilization. It did not reach Oregon until 1829, or California and Hudson's Bay Territory until 1846. Greenland, as late as 1864, had not been invaded by it.[1]

Clinical History.—*Typical Course.*—Stage of Incubation. Although it has been asserted by Vogel and others that for several days after infection the contagious principle remains absolutely quiescent, it must be concluded that an attack of measles begins at the moment when its specific influence is brought to bear upon the body of its recipient. Though not demonstrable and, certainly, so far as our present methods of research enable us to determine, quite without immediate appreciable results, this influence continues and grows until it acquires a force capable of upsetting the equilibrium of the economy and of initiating characteristic symptoms. The interval included between the date of infection and that of the outbreak of symptoms is called the *period* or *stage of incubation*. This period varies between seven and twenty-one days; very rarely it may be more brief than seven days, or prolonged beyond twenty-one days. Panum, whose opportunities for observation, during an epidemic of measles in the Faroë Islands, were unusually good, determined that the eruption occurred thirteen or fourteen days after infection. This would give a period of incubation of from nine to ten days. Girard,[2] in one hundred and eight cases of measles, determined that the exanthem appeared in from thirteen to sixteen days, never earlier, never later; in only three cases was it as late as the sixteenth day. This would correspond to an incubative period of from nine to twelve days. Chomel taught that the eruption may appear as early as seven days after infection, and in many cases may not appear until after fifteen days. The results of inoculation of unprotected individuals, with the tears and catarrhal secretions of persons affected with measles, are, as might be supposed, somewhat different. The inoculations practised at Edinburgh, in 1758, by Home, with the blood of infected persons, have been repeated with blood, tears, mucus, epidermic scales, etc., by different experimenters, with varying results. Katona failed in only seven per cent. of eleven hundred and twenty-two inoculations.[3] Prodromal symptoms began in his cases on the seventh day. The difficulty of discovering the exact time of infection necessarily renders the determination of the duration of the stage of incubation very uncertain. Many instances of apparently protracted incubation are to be explained by the fact that the individual became infected only after repeated exposures. It may be concluded that most cases develop prodromal symptoms on the ninth or tenth day after infection. These will rarely appear on the seventh or eighth day, somewhat more frequently on the eleventh or twelfth day, and only exceptionally, after more prolonged intervals or earlier than the seventh day.

Stage of Invasion.—This stage may begin abruptly with fever, or it may be ushered in by gradually developing evidences of disturbed nutrition. Anorexia, nausea, headache, general malaise, shiverings may accompany or follow symptoms of conjunctival, nasal, and bronchial catarrh, during which the fever will become manifest. Although it has often been claimed that vague signs of disorder accompany the incubative stage, it is usual for the invasion to be marked by a sudden onset of fever, in which, during the first day, a temperature of from 39.1° C. to 40° C. (102° to 104° F.) will be attained. Wunderlich has shown that this preliminary elevation of temperature "allows us to forecast the subsequently occurring elevations with very great probability, since these, on an average, are wont to exceed the height of the initial rise by about 0.8° to 1° C. (1.5° to 1.8° F.), and only exceed this a trifle even when most extreme."[4] Catarrhal symptoms develop almost immediately; indeed, the implication of the mucous membranes is the characteristic feature of this stage. The mucous membranes of the eyes, nose, and throat, of the larynx, trachea, and bronchial tubes, and sometimes of the digestive organs, become almost simultaneously affected. The conjunctivæ are injected and reddened, a free discharge of tears follows, shortly succeeded by a scanty muco-purulent formation about the tarsal borders, which is more free in scrofulous persons. More or less photophobia will be developed. Monti has drawn attention to the small red spots visible along the ciliary border. The eyelids become somewhat reddened and swollen. Köningsten has declared the conjunctival hyperæmia to be a specific effect of the measles contagium, and not simply catarrhal. Sneezing and snuffling, which are often the first symptoms observed, indicate hyperæmia and inflammation of the nasal mucous membrane. A thin watery discharge from the nose is also present. After a day or two this becomes muco-purulent. The membrane is seen to be reddened, and inspired air excites a painful, burning sensation. Cough denotes the involvement of the respiratory tract, and is intense, usually, in proportion to the severity of the attack. It is at first dry and troublesome, but afterward becomes associated with secretion. Croupy cough and respiration sometimes occur and denote swelling of the tracheal and laryngeal mucous membrane. Rarely, œdema of the glottis may suddenly develop and threaten life, or call for tracheotomy. Nausea, vomiting, and total loss of appetite indicate perturbation of the gastric mucous membrane, and the frequent appearance of diarrhœa denotes the occurrence of intestinal catarrh. The buccal cavity does not usually show pronounced alterations. The tongue quickly becomes coated with a thin whitish fur, through which the papillæ penetrate. From the first there are often pain and difficulty of swallowing, and the faucial mucous membrane assumes a more vivid coloring; and by the end of the second day careful inspection will detect small blotches of irregular outline and deepened color upon the hard and soft palate. Girard asserts that a punctate redness is visible on the palate from four to six days before the eruption. Due attention has only of late been given to the condition of the mucous membrane in this stage. The posterior wall of the pharynx is more intensely reddened than the arch of the palate. From twelve to twenty-four hours before the appearance of the cutaneous eruption, an eruption invades the palatal mucous membrane. The efflorescences are irregular, varying in size from that of a pinhead to that of a hemp seed or a lentil, and are isolated or confluent. They are sometimes papular. These lesions grow pale after from twelve to twenty-four hours. The buccal mucous membrane is sometimes similarly affected; that of the tongue, however, is never invaded.[5] While the eruption is most copious upon the soft palate and uvula, it has been observed upon the general visible surface of the respiratory and digestive tracts, and its existence at this time justifies the opinion expressed by Hardaway and others, that it would be better to designate the period of its development as the stage of the "exanthem of the mucous membrane." The throat is felt by the patient to be dry, and the cough, which constantly grows in intensity, may have a metallic ring and may be accompanied by decided hoarseness. Sibilant and sonorous, and, occasionally, subcrepitant râles, may already betray bronchitis. Not infrequently the symptoms become complicated with epistaxis, which rarely becomes alarming. Nervous agitation may now be extreme, or the child may remain dull, inattentive, or somnolent. Convulsions not very rarely appear, but, when observed thus early in the disease, are not often of grave augury.

The fever, which may have developed with the symptoms described, or may have preceded them, becomes in a few hours quite intense, in severe cases attaining a temperature of from 39° to 40° C. (102.4° to 104° F.). An exceptional case is reported by Hunter (*British Medical Journal*, 1898, i., p. 1134) where the fever, which was 107° F. before the rash appeared, after four days rose to 110° F., was accompanied by unconsciousness and followed by convulsions; the patient, a child, was treated with the cold pack and recovered. Vomiting and severe frontal headache often accompany the fever. The child will be fretful and peevish, or may remain drowsy and apathetic. All the symptoms enumerated may be of an exceedingly mild character, may even escape observation, or they may rapidly develop a high degree of intensity. Once developed, they continue unabated until the end of the second or beginning of the third day, when in most cases there will be a sudden amelioration. Indeed, fever may quite disappear, and delusive hopes of an immediate recovery may be entertained. The child will regain some of its gayety of manner and will play about the room at times. The catarrhal symptoms, however, will in most cases persist, though with diminished vigor. This period of apparent improvement is very deceptive, but by careful consideration of all concomitant phenomena, the experienced attendant will learn to avoid error. During the third day the fever will increase and remain unabated, while the appearance of the cutaneous eruption will usher in the next stage. The high temperature of the stage of invasion is not again equalled until the acme of the disease, which occurs toward the close of the second day of the eruption. Careful consideration of the symptoms, of the course of the fever, of the development of the catarrh, the coughing and sneezing, the lachrymation, the injection of the conjunctivæ, and especially of the efflorescences upon the faucial mucous membrane, will often justify a very confident surmise as to the true nature of the disorder before the cutaneous eruption appears.

Koplik's Sign.—Dr. Koplik, of New York,[2] has recently (1896) drawn attention to "buccal spots" of characteristic appearance and much diagnostic value. These are now generally known as "Koplik's Spots," or "Koplik's Sign," and the account here offered is taken from his writings. "Scant attention has been given to the most important elements of the eruption as it appears on the mucous membrane of the inside of the cheeks and on that of the lips. A thorough understanding of the eruption on the buccal mucous membrane will aid in separating an invading measles from a mass of eruptions resembling measles which appear on the skin in infancy and childhood. Any positive sign of the invasion of any infectious or contagious disease is a step to proper isolation and prophylactic hygiene.

"If we look in the mouth at this period (first twenty-four to forty-eight hours of the invasion), we see a redness of the fauces; perhaps, not in all cases, a few spots on the soft palate. On the buccal mucous membrane

and the inside of the lips, we invariably see a distinct eruption. It consists of small, irregular spots, of a bright red color. In the centre of each spot there is noted, in strong daylight, a minute bluish-white speck. These red spots, with accompanying specks of a bluish-white color, are absolutely pathognomonic of beginning measles, and when seen can be relied upon as the forerunner of the skin eruption. . . . No one has, to my knowledge, called attention to the pathognomonic nature of these small bluish-white specks, and their background of red, irregular-shaped spots. They cannot be mistaken for sprue, because they are not as large nor as white as sprue spots. These specks of bluish-white, surrounded by a red area, are seen on the buccal mucous membrane and on the inside of the lips, not on the soft or hard palate. Sometimes only a few red spots, with the central bluish point, may exist, six or more, and in marked cases they may cover the whole inside of the buccal mucous membrane. If these bluish-white specks, on a red spotted background, are at the height of their development, they never become white opaque as in sprue, and in this respect, when once seen, are diagnostic, nor do they ever coalesce to become plaque-like in form. They retain the punctate character. I have noted and demonstrated these spots on the buccal mucous membrane when the other symptoms were so slight that physicians have doubted the diagnosis. I have been invariably confirmed in my diagnosis by the subsequent appearance of the skin eruption.

"The eruption just described is of the greatest value at the very outset of the disease, *the invasion*. As the skin eruption begins to appear and spreads, the eruption on the mucous membrane becomes diffuse, and the characters of a discrete eruption disappear and lose themselves in an intense general redness. When the skin eruption is at the efflorescence, the eruption on the buccal mucous membrane has lost the characters of a discrete spotting and has become a diffuse red background with innumerable bluish-white specks scattered on its surface. The buccal eruption begins to fade even while the skin exanthema is at its height, or at least while it is running a late course. The mucous membrane retrogrades to the normal appearances long before the eruption on the skin has disappeared. This being the case, it will be seen that the buccal eruption is of the greatest diagnostic value at the outset of the disease, *before* the appearance of the skin eruption and at the outset and height of the skin eruption." These spots are sometimes referred to in English medical literature as Filatow's spots.

Stage of Eruption.—It rarely happens that the eruption is discovered on one in whom premonitory symptoms have not been observed. In such cases inquiry will often elicit the fact that for some days previously the child had not been in his accustomed health, though attracting no special attention. A slight cough, a mild coryza, a conjunctival irritation can be recollected.

In the great majority of cases the eruption begins to appear on the fourth day of the disease, when the fever and general catarrhal symptoms are approaching their height. It is first seen on the forehead, temples, and cheeks as pale red spots, appreciable to the eye, but not to the touch. These spots rapidly increase in number and in intensity of color, and include the face, head, neck, breast, shoulders, and trunk. By the fifth day, or second day of the eruption, in ordinary cases, the face becomes swollen and more or less covered with an eruption that has now acquired a raspberry-red color, and a configuration and distribution of peculiar character. The spots are now quite perceptible to the finger and sometimes decidedly papular, so that at times the hard, shotty papules of beginning smallpox eruption are simulated. This resemblance quickly disappears and the papule becomes surrounded by a red areola of small size, the whole spot not exceeding the size of a flake of bran. These spots tend to group themselves into crescentic shapes, or segments of circles, the general distribution of which varies considerably in intensity. At other times the spots will present a soft, almost uniformly elevated surface that may not suggest a papular eruption. They have an irregular outline and are surrounded by normal, unaltered skin, except where the eruption becomes confluent, as upon the cheeks in ordinary cases, or over more diffused areas in severe ones, or at the site of some pre-existing hyperæmia, as that from the irritation of a sinapism or other stimulating application. When confluent the eruption shows a dusky red surface, elevated, and more or less infiltrated.

During the fifth day the eruption extends along the trunk and upper extremities, but does not develop upon the legs until the sixth day. Here it is usually not nearly so intense either in extent or in coloration. The groups of macules are much less numerous, and their color is paler. The general symptoms will have continued with unabated vigor. If diarrhœa have not already been present during the prodromal stage, it is now very apt to occur, and may prove very annoying. The temperature remains unabated, reaching its acme at the height of the eruption. The catarrhal symptoms persist, the secretions often becoming muco-purulent. At this period vesicles the size of a hemp seed may appear at the mucous follicles of the buccal cavity, in the middle of a macule or papule. Sibilant, sonorous, and subcrepitant râles indicate the extent of bronchitis present. The maximal temperature is attained from the end of the fourth to the sixth day of the disorder (earlier in mild cases than in severe ones), and continues for from one and a half to two days, when there is a sudden diminution of fever and a rapid mitigation of all the symptoms.

At the height of the eruption, the finger pressed upon a spot causes the redness to disappear and to be replaced by a pale yellow color, which rapidly gives place to the returning hyperæmia. With the reduction of temperature the eruption begins to pale, and by the eighth day will have become quite indistinct, and the swelling of the face and neck will have, in great part, disappeared. With defervescence, which usually begins in the night, the eruption rapidly fades, first in those parts first invaded, so that by the ninth day the only traces to be found are pale-yellow spots, which will not entirely disappear upon pressure. Occasionally, when the eruption is at its height, a number of tiny, pin-point vesicles may develop more or less abundantly. They are not of importance, and commonly depend upon excessive temperature of the room or too heavy bed-clothing. At other times the eruption becomes hemorrhagic and assumes a petechial character, strongly suggestive of the exanthem of typhus fever. This condition is usually seen upon the extremities, but may involve the eruption over the whole body. The spots assume a more livid coloration, and are not affected by pressure. No especial significance is to be attached to this form of eruption, the course being favorable, though for many days after the active symptoms of the disease have ended the surface remains mottled with the dark spots. As the intensity of the eruption is usually proportionate to the severity of the fever, in milder cases the cutaneous lesions are more scattered and of less vivid coloration; and in the mildest cases fever, catarrh, and exanthem may be hardly appreciable, the eruption especially being pale, scattered, and limited almost entirely to the face, neck, and superior portion of the trunk.

Throughout the attack the tongue remains moist and thinly coated with a whitish fur. This coating is not stripped off as in scarlet fever, nor does the tongue become dry and brownish, and cracked as in typhoid fever, unless complications of grave character supervene. After defervescence, it soon reacquires its normal appearance. Even at the height of the eruption, the tongue usually remains red at its borders. General enlargements of the lymphatic glands are often observed. The submaxillary and anterior cervical glands are most markedly swollen. The urine is reduced in quantity, is strongly acid, and of high specific gravity. Occasionally, and especially early during the prodromal stage, retention of urine may be noted. At other times there is great irritability of the bladder, with frequent micturition and pain. Albuminuria will rarely occur, but may almost always be attributed to the febrile condition, and not to specific influence.

The eruption is most characteristic in those of fair complexion, though it always retains its peculiar features even in the darker individuals of the white races. In dark-skinned races, however, it becomes much modified, principally, of course, in its coloring. In negroes and those of mixed African descent, the characteristic color disappears in proportion to the intensity of the normal cutaneous pigmentation. The eruption, in losing its vividness, seems to acquire a more pronounced papular character, and the summits of the tiny papules often appear, by contrast, of a whitish, translucent color, from the exudation into them. Through the black skin the hyperæmic redness will be obscurely visible. The true nature of the eruption will usually be recognized without difficulty by its distribution, the œdema of the face, the concomitant fever and catarrhal symptoms, and the eruption upon the mucous membrane.

Stage of Decline.—Though the fever and eruption rapidly disappear, it is not until after several days that the catarrhal symptoms subside. As these become less urgent the appetite gradually returns, the various functions become restored, the strength and spirits increase, and the patient, though feeble, enters upon convalescence. This *stage of decline* terminates with a scanty desquamation. This begins about the tenth or eleventh day, and after mild cases may be almost imperceptible. Usually it appears, especially about the forehead and cheeks, as an exfoliation of fine, branny, epidermic scales, quite unlike the desquamation of scarlatina. After a few days it is completed, and health becomes re-established. Careful search is often necessary to detect this desquamation upon the body and limbs.

Atypical Course.—Very many cases depart from the typical course, as described, in one or more respects; indeed, the general characters of the malady may be irregular. The initiatory symptoms of the stage of invasion may be so insignificant as entirely to escape observation, when it may appear that the eruption abruptly ushers in the disease. Cases of this kind are not very uncommon. On the other hand, the stage of invasion may be prolonged until the sixth or seventh day. Here, however, appearances are apt to be misleading, as in cases in which the specific process develops during an attack of simple coryza or bronchitis. The eruption may be very long delayed by pre-existing internal disorders of more or less gravity—pulmonary phthisis, acute or chronic visceral inflammations, etc.—when the whole course of the disease is apt to be irregular. The stage of eruption may even be wanting. In such cases, a correct diagnosis depends rather upon etiological considerations than upon specificity of symptoms; occurring sporadically, these cannot be identified. But it occasionally happens, in families, boarding-schools, asylums, etc., where measles prevails, that children unprotected by a previous attack and exposed to the contagion, in due time develop all the symptoms of measles except the eruption, and upon recovery remain protected from future attacks. Such forms are designated as *morbilli sine exanthemate*. When, on the other hand, the eruption occurs without a well-marked or recognized catarrhal stage, and without the development of catarrhal symptoms during its course, similar diagnostic difficulties arise, and one is only justified in recognizing *morbilli sine catarrho* in the presence of unquestionable conditions. Indeed, there are those who claim that unless catarrhal symptoms are present, a diagnosis of measles cannot be maintained. In these forms the course is usually mild. Rarely, a very interesting departure from a typical course is the appearance of a rash almost simultaneously with the outbreak of the stage of invasion. This is usually observed, upon the morning of the second day, upon the cheeks, forehead, temples, neck, etc. At first it is like the ordinary measles rash in shape and distribution, but in color it is pale. With the mitigation of symptoms that occurs by the close of the second day, it ceases to develop, and may even recede partially and remain as pale, pinkish blotches, until the regular rash appears and supplants it. Such cases present generally no other abnormality of course. Irregular distribution of the rash is not very infrequently met with. It may invade the trunk alone, or may spare the lower extremities, or it may not appear in the order described. These are unimportant modifications and of themselves add no gravity to the prognosis.

As in mild cases the rash may be pale, scanty, and not well developed, so in severe ones it may be confluent, brilliant, and abundant; at times it may be livid, and the patches may coalesce into more or less extensive areas of eruption over the trunk and limbs, as well as upon the face. These patches feel elevated and infiltrated. Here and there tracts of unaltered skin will be sharply circumscribed by them. Pressure upon these dark, livid patches will generally cause them to grow pale; but there may be occasionally observed evidences of hemorrhagic exudation in the increased lividity of the patches, and in the fact that they are uninfluenced by pressure. The eruption may assume a petechial character strongly suggestive of the exanthem of typhus fever. The hemorrhagic spots often correspond closely to the eruptive lesions in configuration and extent, and remain for many days after the activity of the malady is passed. This condition is developed early, and may involve the entire area of eruption. It cannot be assigned to any recognizable cause, and, indeed, is not of serious augury. During convalescence these hemorrhagic spots slowly undergo the changes of extravasated blood pigment, and disappear within a week or two. This variety should not be confounded with that severe and extremely fatal form of measles known as "black measles," or "malignant hemorrhagic measles," which is fortunately very rare, and which more especially attacks persons with bad hygienic surroundings, such as soldiers in camps, convicts, children crowded into badly constructed asylums, etc.; also those exhausted by intemperance, want, exposure, and similar influences. Here all the symptoms differ from those of the form just described, in which, although the petechial character of the eruption is marked, there is always the corresponding, associated intravascular hyperæmia of the eruptive lesions. These differ altogether from the purplish and blackish ecchymoses of malignant measles. It has even been asserted that the pigmentation in them is not due to extravasated blood, but to the decomposition of red blood cells exuded in a purely inflammatory process. In malignant or "black measles," the symptoms of profound systemic intoxication are associated with the irregularly distributed rash, which is never perfectly developed. At first appearing possibly in the regular way, its abnormal course is soon declared. The eruption ceases to develop, and the lesions already present fade away or change into ecchymotic spots, which may correspond to the size of the primary lesion or assume linear or irregular shapes, and involve larger tracts of skin. These ecchymoses are most abundant and largest upon the trunk and on its most dependent parts, though they may appear anywhere. Signs of failure of circulation, quick and feeble pulse, coldness and lividity of the extremities, delirium, stupor, and subsultus tendinum develop. Hemorrhages may occur into and upon mucous and serous membranes, and death follow early from profound toxæmia. Malignant measles may run a very rapid course, as is especially the case in some epidemics.[6] Convalescence, however, may be established, but will usually prove tedious.

The course of measles may be made abnormal by the existence of acute or chronic disease at the time of infection. Here much alteration in the features of the exanthem may be noted. The prodromal stage may be unusually protracted, or the eruption may be imperfectly developed, both as to intensity and in distribution; or the mucous membrane may have to bear the brunt of the attack; at other times the attack seems to receive a sudden check. The eruption fades, and is succeeded by great pallor. Such sudden arrest is usually due to an intercurrent malady, and will be more suitably considered

with the complications of measles. It has already been said that convulsions occurring at the outset of the disease are not especially ominous. If, however, they occur repeatedly, or during the later stages of the disease, they are of grave augury, and often precede or accompany complications that may lead to a fatal issue. In rare instances the eruption is unduly prolonged; it has been known to persist as late as the tenth day.

Diagnosis.—Although the nature of the disease may very often be conjectured during the prodromal stage, it is only during the eruptive stage that the diagnosis of measles can be definitely determined. See, however, Koplik's sign, *supra*. Meunier, in 1898, reported that during the incubation period of measles there was constantly observed a loss of body weight, and that this loss in weight was quite independent of any other cause. In a series of thirty cases, given by Meunier, there was an average loss of 310 gm. (about ten ounces), the maximum being 700 gm. (about twenty-two ounces), and the minimum 90 gm. (nearly three ounces) (*Gaz. hebd. de Méd. et de Chirurgie*, 1898, p. 529). In typical cases the combination of fever, eruption, and catarrh of the mucous surfaces affords characteristic and easily recognizable features, when considered along with the history and course of the malady. During the prodromal stage the symptoms may be mistaken for those of simple coryza or of bronchial catarrh. Indeed, they are often identical with these, and to this extent can cause no confusion. They may be suspected to depend upon the contagion of measles, if they develop in one who is known to have been exposed to it, or if during the second or third day the eruption upon the soft palate is observed. If, however, the fever and catarrh persist after the fourth day without an eruption, measles may be excluded nearly always. Upon the appearance of the eruption, measles may be confounded with Rötheln or German measles, scarlatina, typhus fever, and in its earliest stages with varicella and variola. It will also be necessary to exclude drug eruptions, such as those from copaiba, quinine, etc. The diagnosis between measles and Rötheln presents many difficulties. It is true that recent writers describe Rötheln as having well-marked characteristics; but it must be observed that many do not agree as to the exact history and symptomatology of this affection. This want of agreement makes it difficult to determine the standard of Rötheln for comparison. The diagnosis must rest upon a general consideration of all the symptoms. In Rötheln the prodromal stage only exceptionally exceeds twenty-four hours; it often is less than twelve hours. In many cases Rötheln is afebrile throughout, and in most cases it is barely febrile. Upon this point, however, there is no consensus of opinion, some authors describing epidemics of Rötheln in which fever of great intensity prevailed.[7] Cheadle even claims as a distinguishing mark of the affection "a higher range of temperature and its longer persistence" than in ordinary measles.[8] The catarrhal symptoms in both affections differ only in intensity. The faucial mucous membrane in Rötheln shows a diffused redness rather than the flecked eruption of measles. Enlargement of the cervical glands has been noted as of constant occurrence in Rötheln, but it is likewise very often observed in measles. The eruption of Rötheln is pale red, rather than dark red, as in measles, while the patches are more circular and less discrete, and with less irregular borders. It is also more rapid in its course, and is but rarely followed by desquamation. It should be remembered, however, that upon no symptoms of Rötheln, as distinct from those of measles, have writers agreed, and that no case of the disease presents features sharply defined from those of measles. Up to the present time, therefore, one is not justified in diagnosticating Rötheln in any isolated case, unless the patient has already had measles or has been exposed to the influence of a prevailing epidemic of the former disease.

Of the other eruptive fevers, scarlatina is most like measles. Usually, however, the diagnosis is easily made. In scarlet fever the eruption appears by the second day. The fever is accompanied by sore throat, more or less severe, with intense redness of the faucial mucous membrane. The eruption is of a bright scarlet color, and more regularly diffused; the papules are much finer. In well-marked cases there is a universal redness. In measles the eruption is of a dusky red and arranged in circumscribed patches with intervening healthy surfaces. At times the measles eruption becomes almost universally confluent. The darker coloration is, however, still maintained, and the surface is distinctly infiltrated and elevated, giving to the hand a sensation of roughness. Moreover, there will always be areas of less intense eruption, where the characteristic arrangement may be recognized. Rarely, scarlatina develops a discrete eruption closely simulating that of measles. The patches will then be of larger superficial area, of a brighter color, and less infiltrated. There will nearly always be present concomitant symptoms that should dissipate doubt. After the first few days the tongue, in scarlatina, develops the characteristic strawberry appearance, whereas in measles the tongue remains coated throughout. The eruption of scarlatina is accompanied by a more or less intense itching, that is usually absent in measles. The fever of scarlatina persists for some days after the eruption has attained its height, while in measles the completion of the eruption is marked by almost immediate defervescence. The desquamation of scarlet fever is composed of large, sometimes of enormous, flakes of epidermis, while that of measles is branny and not abundant. In scarlatina the faucial mucous membrane is inflamed, sometimes diphtheritic; in measles there is catarrh of the whole respiratory tract. Finally, measles is not followed by dropsy and nephritis, which are so often observed after scarlatina.

During the first twenty-four hours the smallpox eruption may resemble that of measles, but its papular, shotty character soon reveals it. Varicella, or chickenpox, may also at first resemble measles, but its vesicular eruption quickly develops. The eruption of typhus fever is often perplexingly like that of measles. Doubt, however, is apt to arise only when the former affection is known to prevail, or where the conditions favorable to its development are present. The typhus eruption is especially like that of measles where the distribution is normal, but where extravasation gives a petechial character. Such cases of measles can be recognized through their concomitant symptoms. Bronchial catarrh is present in both. In typhus the nasal catarrh is absent, as is also the conjunctivitis, though the eyes may be injected. The eruption on the face is also absent or scanty. The course of the fever is also different in the two affections, the typhus exanthema not appearing until the seventh day.

A peculiar eruption following the ingestion of copaiba offers points of great similarity to that of measles, though at times it equally resembles that of smallpox. The resemblance is heightened by the catarrh of the conjunctival, nasal, faucial, and bronchial mucous membrane, and by the existence of fever. In the copaiba eruption the incubative period is lacking, and the rash, brighter red from the first, while exhibiting many patches indistinguishable from those of measles, develops many lenticular papules totally dissimilar. At scattered points vesicles will almost always be observed. Simple roseola is less intensely colored and is more fugacious than measles; it is without prodromal stage or catarrhal symptoms, and is usually afebrile. Moreover, many cases of what was formerly called roseola must now be relegated to the domain of Rötheln. Erythematous eruptions from quinine and other drugs somewhat resemble the measles rash; but they differ widely in most other respects. Erythema papulatum may also resemble measles, but its seats of election, the face, the forearms, the dorsal surfaces of the hands and of the feet, along with its afebrile course and general history, will serve to distinguish it.

Complications.—The course of measles may be made irregular by complications; or, occurring in persons already suffering from other diseases measles may itself

become the complicating affection. Disorders complicating measles may be simply the results of intensification of morbid processes characteristic of the disease, or they may be intercurrent. By far the most important are those involving the mucous membranes. "A high grade of purulent conjunctivitis may develop, and even false membranes may form upon the lids. True diphtheritic inflammation is not unknown. Purulent infiltration of the cornea and keratomalacia may be observed, but iritis occurs only secondarily."[9] Thomas has reported, as a sequela of measles, paresis of accommodation and, in consequence of this, strabismus. Rarely, the nasal mucous membrane may undergo excessive inflammation. Stomatitis is more often developed, and may range from ordinary catarrh to ulcerative and even gangrenous inflammation. True *cancrum oris*, or *noma*, is more apt to occur as a sequela. In stomatitis the mucous membrane becomes highly injected. The tongue is thickly coated with a whitish fur, and has a sodden look. The gums are spongy and swollen, and often bleeding at their borders. Superficial ulcerations appear upon the buccal mucous membrane, and aphthous deposits accumulate. Saliva is copiously discharged, and fetor of the breath becomes pronounced. The sublingual and submaxillary glands often become greatly enlarged and tender. Much distress is often experienced, and mastication becomes almost impossible. The stomatitis usually outlasts the measles and subsides in a week or ten days. More profound and gangrenous ulcerations form extreme degrees of these inflammations. *Per se* the stomatitis would not be of much account; but it is of great importance from the fact that the inflamed mucous membrane may become the seat of secondary infection, notably diphtheria. The more severe grades of pharyngitis only rarely complicate measles. *Diphtheritis faucium*, however, is not very uncommon. It usually leads to a fatal termination. Laryngeal and tracheal symptoms may at times acquire undue prominence, usually from catarrhal inflammation of a high grade. In such cases the voice, cough, and respiration become "croupy." Œdema of the glottis has been known to occur, and rarely may be so severe as to terminate life by asphyxia. True laryngeal diphtheria is also a recognized and very fatal complication of measles.

Bronchitis can be considered a complication only when it assumes a rôle more important than the essential disease. Severe bronchitis is quite common, and very often persists for some time after the eruption has disappeared. Serious results are not apt to ensue, but occasionally it may become grave more or less rapidly, or become suddenly intensified in badly nourished children, or in those not properly looked after. In such cases the fever is unduly prolonged, and the symptoms become those of ordinary acute bronchitis. A much more formidable complication is capillary bronchitis. Usually occurring during the decline of measles, it protracts the febrile movement while the eruption pursues its regular course, or, as more frequently occurs, prematurely fades with more or less abruptness; the life of the patient being thrown into imminent peril. This affection is most dangerous, both from its own intensity and from its tendency to develop atelectasis pulmonum and catarrhal or lobular pneumonia. Whether arising in this manner or not, lobular pneumonia is the most common of the graver complications of measles, and is responsible for the greater number of deaths from the disease.* It occurs mostly in badly nourished, delicate children, and in those who have been unduly exposed during the attack. Nevertheless, pneumonia often develops, in consequence of some individual predisposition, in those whose hygienic surroundings are perfect; and it cannot be denied that the contagious principle at times exerts a special morbific influence upon the pulmonary parenchyma, as is shown in the greater prevalence of complicating pneumonia in some epidemics than in others. Catarrhal pneumonia may appear at any stage of measles, in patients of any age, and at any period of an epidemic. It is more apt to occur, however, in those under five years of age, in children of poor parents, and at the height of an epidemic. Catarrhal pneumonia, complicating measles, does not necessarily greatly increase the gravity of the attack. It is probably, in more or less restricted extent, a very common concomitant of measles, and in many cases in which fever is protracted beyond the usual period, with persistence of symptoms of bronchitis, limited areas of lobular inflammation are present. The severity of the attack will be proportionate to the severity and extent of the pneumonia, which usually invades both lungs irregularly, beginning at the bases. There will always be present bronchitis, the symptoms of which are so prominent that the pneumonic symptoms may be very obscure. Crepitant râles, with slight dulness and bronchial breathing, may nearly always be detected during the attack. Dyspnœa is often decided, and there is greater tendency toward cyanosis than in lobar pneumonia. The sputa are generally catarrhal in character. The inflammation tends, in favorable cases, to terminate slowly, by lysis, possibly only after several weeks. When catarrhal pneumonia is the only complication, most cases end in recovery; but when it is but one of a number of complications, or occurs during a severe and abnormal attack of measles, the result is much more often fatal. Many cases of pulmonary tuberculosis after measles develop from an unresolved catarrhal pneumonia.

Lobar or croupous pneumonia is also a recognized complication of measles, but is of less grave import than the catarrhal form. It occurs abruptly, is not necessarily associated with extensive catarrh, and presents the characteristic symptoms. By many writers acute tuberculosis is described as a complication of measles. It should be classed among its sequelæ, though it doubtless very often dates back to the beginning of the attack. The intestinal catarrh that often becomes developed during measles sometimes becomes intensified, and to the diarrhœa there are added the symptoms of a more or less severe enteritis. Bloody, mucous stools, voided with tenesmus and the other signs of colitis, will at times be observed. These cases, however, usually end in recovery. It should be noted that in many of these cases the rash is not pronounced and sometimes fades, while the diarrhœa is very severe; so that a diagnosis of diarrhœa is often made, and the measles overlooked. Acute nephritis may also be a direct consequence of measles.[10] When convulsions appear during the course of measles after the development of the rash, they generally mark the supervention of some grave complication, and are thus of very evil augury. They may accompany pneumonia, enteritis, even meningitis. Inflammation of the middle ear of a catarrhal character, extending from the pharynx along the Eustachian tube, may occasion temporary deafness; or it may be intense, with severe pain, and followed by perforation of the tympanum. Permanent deafness may, but usually does not, result from this. Occasional and rare complications are gangrene of various parts, dropsy, various inflammations, hemorrhages, etc.

A much controverted question is that of the coexistence of measles with other eruptive fevers. Although Hebra denied the simultaneous presence of two of the exanthemata, many writers make positive assertions to the contrary. Thomas[11] says "measles can appear during the course of variola, scarlet fever, and varicella, and *vice versa*," and quotes Laverani as claiming that mumps attacked by preference patients suffering with measles, and Kesteren, who saw a girl attacked by measles while suffering from typhoid fever. Barthez and Rilliet also assert that two specific eruptive fevers may coexist. Blacke,[12] Steiner, Monti, Körber[13] report observations of the simultaneous existence of measles and other eruptive fevers, viz., scarlet fever, variola, and varicella. Traube,[14] Fischl,[15] Stiller, Trechmeister, and others report similar cases. There is, indeed, no reason why two specific morbid principles may not exert their peculiar pathogenic influences at the same time upon an individual.

* Pott reported as causes of death in 24 cases: pneumonia, 17 times; capillary bronchitis, 4 times; croup, 3 times (Jahrb. f. Heilk., vol. xiv., p. 331).