

bound around the shoulder and body or by an adhesive plaster strip supporting the elbow and crossing itself over the point of fracture.

5. *Fractures of the Coracoid Process.*—These are very rare and are usually combined with some other fracture or dislocation in the vicinity. The fracture is usually near the base of the process, and results most commonly from direct violence, although muscular contraction has been known to produce it.

The chief symptoms are local swelling, ecchymosis, abnormal mobility, and crepitus. Pain can be elicited by flexion of the forearm in a supinated position, as this brings the short head of the biceps muscle into action.

The treatment consists in immobilization of the arm in a flexed position by means of a Velpeau bandage.

Benjamin T. Tilton.

SCARLET FEVER.—Synonyms: *Scarlatina* (English and Italian); *Scharlach* (German); *Scarlatine* (French); *Escarlatina* (Spanish).

DEFINITION.—Scarlet fever is an eruptive contagious fever. Its incubative period is brief, rarely less than twenty-four hours, usually lasting for from four to six days, and not often exceeding this duration. This period is succeeded by a period of invasion, which is ushered in by fever, usually of considerable intensity, and by sore throat. A scarlet eruption begins to appear before the end of the second day, and marks the end of the prodromal, and the beginning of the eruptive, period. The eruption rapidly becomes general, and the tongue becomes stripped of its coating and assumes a raspberry-red color. The eruption slowly fades after the first few days. The fever persists until the sixth, seventh, or eighth day, or longer. As the eruption fades, desquamation begins and continues for from eight to fourteen days or more. It is peculiar in being lamellar, sometimes occurring in very large shreds and exfoliations. During the attack, and for weeks subsequently, there is an especial predisposition to renal inflammation. Scarlet fever attacks children more especially. It usually affects an individual but once.

HISTORY.—Scarlet fever is probably a disease of very ancient origin, though until three centuries ago medical writers had not recognized it; indeed, definite knowledge of it as a specific, independent affection dates back hardly two hundred years, although as early as 1589 an epidemic, which we now presume to have been scarlet fever, was described as having occurred in Sicily in 1543 (Paulus Restiva).¹ It was not until 1676 that Sydenham definitely separated this malady, as "*febris scarlatina*," from measles, and gave it an established position. The observations of writers had already been leading them toward similar views, and within a few years scarlatina became recognized all over Europe. Although its place of origin can never be known, it is probably of European birth; for it is a remarkable fact that scarlet fever has never succeeded in gaining a firm foothold in Asia or Africa. According to Hirsch, in whose most valuable work these facts have been recorded, the coast of Asia Minor is the only Asiatic district which is frequently visited with scarlatina in its severe forms. In nearly all other parts of Asia it occurs not at all, or only sporadically. Wernich, in 1871, declared the disease to be quite unknown there. In Africa, Hirsch states that it is only in Algiers and in the Azores that it is at all common. Following the carefully recorded data of Hirsch, scarlet fever appeared first in America, in New England, in 1735. It extended as far south as Philadelphia in 1746, and penetrated to Ohio in 1791. Not until 1851 was it seen in California. In 1830 it began to be generally observed in South America. In the West Indies it was first observed in 1802, in Martinique, as a mild epidemic. Greenland has heretofore escaped with but a solitary case. Australia and Polynesia appear to have escaped until 1848. In the Polynesian islands, except Tahiti, scarlatina has not been known. It is unquestionable that scarlet fever has never occurred in some localities only because the inhabitants have not been exposed to its influence; but

there can be no doubt that in other countries influences prevail that oppose the development of the disease. Whether these are climatic or racial, or due to other causes, is at present unknown. The American Indian is not exempt from its ravages, nor can any different degree of susceptibility be observed in the negro race in the United States. Frick,² however, noted a somewhat more pronounced tendency in the negro to scarlet fever.

In the epidemic in Baltimore, between the years 1850 and 1854, of every ten thousand inhabitants 13.8 whites and 10.8 negroes died. This would indicate a relatively greater predisposition in the negro, as in the total population the whites were largely in the majority. Frick's observations were too limited to secure an unhesitating acceptance of his conclusions. It must be noted, however, that in this country the negro is rarely of unmixed African descent. He may have inherited from white progenitors some of their especial liabilities to disease. Drake and others have shown that scarlet fever prevails less in the Southern than in the Northern States. It is also probably true that the disease is more frequent in cold than in hot countries. Yet it cannot be determined that the differences depend upon temperature; Greenland has remained without an epidemic, while Algiers has experienced them frequently. In 1873-75 a severe epidemic of scarlet fever appeared in the Farø Islands, among people who for at least fifty-seven years, and possibly never before, had not been exposed to scarlet fever.³ The study of this epidemic, to which reference will frequently be made, gives one interesting data as to the natural course of the disease in a community in which each individual may reasonably be presumed to have been exposed, and in which immunity, due to previous attacks, can be excluded.

FREQUENCY OF EPIDEMICS.—Scarlet fever at once shows differences from smallpox and measles in not sweeping over localities in great periodic waves. It may, it is true, sometimes invade very wide areas of territory with astonishing rapidity, but the intervals between epidemics are often very great. Without obeying any well-defined periodic law, measles is often known to prevail with noticeable violence every third or fourth year, frequently disappearing completely in the interim; so, too, smallpox usually exhibits unwonted activity at intervals of from five to ten years, or as soon as popular neglect of vaccination renders a large portion of a community susceptible to it. It is not thus with scarlatina. Hirsch has collected very valuable information upon this point. At Münster fifty years elapsed without the disease appearing. At Ulm there was only one small epidemic in seventeen years. At Tuttingen scarlet fever had not been seen for thirty-five years previous to the epidemic of 1862-63. A number of writers, however, have observed an epidemic cycle in scarlet fever. Thus Fleischmann,⁴ at St. Joseph's Hospital, in Vienna, observed one of four years. In Dresden, according to Gerhart, there is an epidemic cycle of from four to five years; in Munich, according to Ranke, one of three years. On the other hand, scarlet fever often prevails sporadically for a long time in a locality, finally to disappear or to spread suddenly far and wide. Mayr⁵ states that in Vienna the register shows that scarlatina has never absolutely died out in fifty years. Scarlet fever is remarkable in the varying intensity of cases occurring during a given epidemic, and in the differing severity of epidemics. At one time it was regarded as an insignificant disorder, almost never proving perilous to life. Even now epidemics of an exceedingly mild type are frequent. Graves has told how, between 1800 and 1834, whenever scarlet fever prevailed in Dublin, it was so uniformly mild that medical men attributed the bad results of their predecessors to improper methods of treatment, and flattered themselves upon their superior skill, until a change in type brought their death rate quite up to that of former times.

ETIOLOGY.—There is presumptive evidence that scarlatina is due to a specific micro-organism, but the direct and positive proof is so far lacking. Authorities admit

the constant presence of the streptococcus, which may be the direct cause of the inflammatory lesions of the mouth and pharynx, cervical lymph nodes, and probably of the secondary complications, as the heart, kidneys, and other tissues. It is possible that a streptococcus is the specific organism. With the streptococcus, the staphylococcus pyogenes aureus and the pneumococcus are frequently associated. In the light of our present knowledge it is impossible to state whether the toxins which undoubtedly are present are due to the activity of these secondary organisms or to some specific cause.

Class,¹⁶ in a recent paper on the subject, has described a diplococcus, discovered by him, which he believes to be the primary infectious cause of scarlatina. He finds it invariably present in the throat secretions, blood, and scales. He differentiates it from the other micro-organisms because it produces in the pig a disease closely resembling scarlatina, because the blood of patients convalescent from scarlet fever inhibits the growth of the organism, and because it produces nephritis in guinea-pigs. He also shows that a guinea-pig injected with the blood of a patient convalescent from scarlatina may be protected from the pathogenic action of his diplococcus. The coccus in question closely resembles the staphylococcus albus. It is very sensitive to environment and at times is so modified in form as to appear as a diplococcus, a streptococcus, or a streptobacillus, the three forms sometimes being present in the same culture. Its size varies from that of a small point just to be distinguished by a one-twelfth oil-immersion lens to a coccus one-third of the diameter of a red blood corpuscle, as seen in old cultures. For routine work cultures are made in the same way as in diphtheria. It is impossible at present to state the importance of this organism in the diagnosis of scarlatina. The results of animal experimentation are not, however, conclusive.

Recent bacteriological investigations by Pearce⁸⁰ and others have not added materially to our knowledge of the specific primary cause of the disease. While we may assume the exciting cause of the disease to be an as yet undetermined germ, in the presence of which alone scarlatina is possible, the question of the predisposing causes is a much wider one and demands careful consideration.

Predisposing Conditions.—There is a widespread impression that scarlet fever prevails more especially during the fall and winter months. There is, indeed, some difference in favor of these seasons, but by no means to the extent that is generally supposed. Hirsch has tabulated the records of 435 epidemics. These prevailed 178 times in the winter, 157 times in spring, 173 times in summer, and 213 times in autumn. The same relative prevalence is shown in his tables of deaths from scarlatina. Of more than 55,000 deaths from scarlet fever in London, from 1838 to 1853, 32.1 per cent. occurred in autumn, 25.2 per cent. in summer, 24.6 per cent. in winter, 22.1 per cent. in spring. These figures, however, cannot be accepted with perfect confidence, as they must have been influenced by the mildness or severity of the several epidemics. Hirsch's data show also the season of prevalence and the severity of type for two hundred and sixty-five epidemics.

Of 77 winter epidemics	42.2 per cent. were mild. 55.8 per cent. were severe.
Of 50 spring epidemics	54.0 per cent. were mild. 46.0 per cent. were severe.
Of 66 summer epidemics	45.5 per cent. were mild. 54.0 per cent. were severe.
Of 72 autumn epidemics	48.6 per cent. were mild. 51.4 per cent. were severe.

The maxima of malignancy fall in winter and summer; but, as Hirsch remarks, the difference is unimportant. It may be concluded, however, that in the spring epidemics are usually less frequent and milder.

Scarlet fever is chiefly observed in young persons, because older people are generally protected by a former attack. Nevertheless, adults who have never had scarlet fever are less liable to take it than children similarly circumstanced. This is not attributable to differences of age, but to feeble individual susceptibility, which prob-

ably held as well during the childhood of these persons. The greatest susceptibility appears to exist between the ages of three and six years. Nearly four-fifths of all cases occur in the first ten years of life. In McCollom's table of 1,000 cases of scarlet fever treated in the contagious wards of the Boston City Hospital,⁷⁷ 50 per cent. of all cases occurred between two and six years, 78 per cent. in the first ten years, and 90 per cent. before the age of twenty years. It is certain that a not very small percentage of persons successfully resist exposure to the scarlet-fever contagion throughout life. In the epidemic at Thorshavn, Farø Islands, in 1873-75, from a total population of 930 inhabitants, comprising all ages and not protected by a previous attack against scarlatina, only 38.3 per cent. was infected by scarlet fever. Holt is authority for the statement that not more than one-half of the children exposed take the disease. While, then, it is not difficult to understand why adults seldom take scarlet fever, it is more difficult to account for feeble predisposition observed during the early months of life. Infants less than a year old are rarely attacked, and often escape even when exposed directly and frequently. They do not, however, possess absolute immunity; indeed, scarlatina during fetal life has been reported. Leale observed such a case, as did also Tourtural. Thomas records several cases occurring in the practice of others. Veit noted scarlet fever in a child fourteen days of age. Numerous similar observations, more or less trustworthy, have been recorded. On the other hand, Murchison saw two new-born infants remain healthy while their mothers suffered from scarlet fever. New-born children are so subject to cutaneous and other disorders that may readily be mistaken for scarlatina, that we may well demand the most definite testimony. Scientific exactness should require that a new-born child must be proven either to have served as the medium of contagion for others, or to have developed characteristic symptoms in the midst of predisposing surroundings. Both sexes are equally susceptible to infection.

The predisposition to scarlet fever is much less universal than that to measles and smallpox. While the two latter diseases will almost certainly attack all unprotected persons exposed to their contagion, scarlet fever often leaves unscathed persons who have been brought into the most intimate personal relations with it. In the epidemic at Thorshavn referred to above, only 38.3 per cent. of the total population proved to be susceptible to scarlatina, whereas in the same population in an epidemic of measles in 1875, 99 per cent. of those not protected by a previous attack was shown to be susceptible to measles. It is consequently much easier to practise isolation with the hope of success. However, the immunity possessed by an individual, as shown by repeated exposures, may not prove perpetual, and well-marked, even fatal, scarlatina may follow a final exposure. A degree of immunity from scarlatina is sometimes exhibited in families, the members of which escape altogether, or have only light attacks. Unfortunately, on the other hand, a decided family predisposition to the disease is occasionally encountered, one member after another falling a victim to its virulence.

Careful observation has failed to show that predisposition to scarlet fever is especially favored by the nature of the soil or the state of the weather; neither can it be proven that the type of the disease is especially influenced by any ordinary surroundings, further than that conditions of life prejudicial to the maintenance of good health diminish the powers of resistance to the onset of the disease. It is important to remember that in the absence of the contagious principle no degree of filth, deprivation, dampness, bad ventilation or drainage, or exposure, no matter how injurious to general healthfulness, can serve as the starting-point for scarlet fever. Indeed, it is remarkable, considering the bad hygienic environment of the poorer classes, that between them and the rich there should be so small a difference in the degree of predisposition to, and in the relative mortality from, scarlatina.

Mode of Infection.—To develop scarlatina an individual

must, of necessity, receive into his body the *materies morbi* derived from one who has, or who has had, the disease. In all cases the contagion must be communicated by the air, or in solids or fluids received into the body. It is probable that physical contact occurs but rarely between infected and unprotected persons, and that when it does occur, the danger of infection is due rather to the increased liability of intercepting emanations from the body. Scarlet fever appears to be not contagious at the very beginning. In this respect it differs markedly from smallpox and measles. In the prodromal stage the contagion is probably not set free as readily as at a later period. Girard, however, has asserted that it is contagious only on the first day. This hardly needs a refutation. Longhurst⁵ also claims that it is most contagious during the pre-eruptive stage, and not at all during desquamation. These and similar opinions of individuals are negated by the almost universal experience of observers. Scarlet fever develops its highest properties of contagion during its period of eruption, and, still unlike measles, retains its contagiousness until desquamation is far advanced. Two children, at the Netherfields Institution at Liverpool, were believed to have been centres of contagion six and a half weeks after the beginning of their illness.⁶ Cameron⁷ reports a case in which, nearly nine weeks after the beginning of her own attack, a child communicated the disease to her sister by contact. It seems probable that the power of communicating scarlet fever is retained, gradually diminishing in intensity, until the end of desquamation, which may not be completed for six, eight, even ten weeks. Thomas mentions cases in which children, even after the completion of desquamation, while suffering from scarlatinal dropsy, probably served as centres of contagion. The agency of the atmosphere as a contagion-bearer does not seem to extend beyond a few yards. Thus, it often happens that the disease does not spread beyond the sick-room, provided mediate contact can be avoided. Possibly the contagion is of too great gravity to be wafted for any distance. Yet it is certainly, under certain conditions, very tenacious of life, and may be conveyed long distances and preserve its properties for prolonged periods. It has often been carried by a healthy person, who has been exposed to the malady, to persons at a distance. There are authentic accounts of physicians, nurses, attendants, and visitors serving thus to carry infection. Such unfortunate occurrences are not very common, and probably happen only when the carrier of contagion passes directly from the sick-bed to the unprotected person, without due regard to the proper disinfection of the person and clothing. A pernicious custom is the habit of putting on over-clothing and wraps over the dress in which the patient has been visited without proper exposure to the free circulation of fresh air. The tenacity with which the contagion clings to inanimate substances is most remarkable. Articles of clothing, bed-linen, furniture, wall-paper, hangings, and the like, frequently serve to communicate the disease, and often after almost incredibly long intervals. Richardson gives an example of this. Four children lived with their parents in a thatched cottage. One child was taken with scarlet fever, and the others were sent away. After three weeks one of these was permitted to return. It took the disease on the first day and died. The walls of the cottage were now cleaned and whitewashed; everything was thoroughly scrubbed, and all wearing apparel was washed or destroyed. After four months another child returned. The next day he was seized with the disease and died. Here the thatch was thought to have retained the contagion. The germs of the disease may be shut up in a letter and conveyed a long distance. Woollen clothing, put away and brought out after many months, pillows, cushions, toys, books, have all been known to preserve the contagion in full vigor. The dissemination of the virus in the atmosphere has been stated to be very limited, but the same cannot be said so confidently concerning the agency of fluids. The spread of scarlet fever has never been directly traced to the water-

supply, but there is abundant reason to attribute its occasional extension to the medium of milk. Thomas quotes two examples of this. One, reported by Bell, leaves it an open question whether the milk, its receptacle, or the boy who carried it, was the medium. The other came under the observation of Taylor, who noticed "that one of the first severe cases which initiated an epidemic occurred in the house of a milkman whose wife milked the cows, the milk being supplied to about twelve families in the city. In six of these scarlatina occurred in rapid succession, at a time when the disease was not epidemic, and without any communication having taken place between those who were affected and the person who brought the milk. It is very probable that in this instance the milk was the carrier of the contagion, as, previous to its distribution, it had stood in a kitchen which had been used as a hospital for scarlatina patients." More recently, Airy, in eighteen families, consisting of thirty-five persons, reported twenty-four of these sick with scarlatina within thirty-six hours. Every one of these patients received milk from the same source. Neighbors who had milk from other sources were not attacked. It was found that a person who milked the cows lived with a child in full desquamation from scarlatina. Several observations of this kind make it hardly doubtful that milk may serve as the vehicle for the scarlatina virus, and that it, indeed, may be considered a favorable culture-fluid for it. But until recently it has not appeared that the virus-bearing milk received its contamination otherwise than through human sources. Later investigations seem to throw much light upon the possible origin of scarlatina in man, and upon one of the paths for its dissemination previously unrecognized. An outbreak of scarlatina among persons who received their milk supply from a dairy in Hendon, in England, in 1885, seemed to be traceable directly to a disease of the cow. The cows of this farm were affected with a peculiar affection, among the symptoms of which were a shedding of the hair and the formation of vesicles and ulcers upon the teats and udders. The nature of the disease in this case is, however, doubtful. Crookshank held that it was cowpox and had nothing to do with scarlet fever. In 1900, Kober⁸¹ collected records of 99 epidemics of scarlet fever, and of these there was scarlet fever at the farm or dairy in 68; in 17, employees themselves were infected, and in 10 they acted as nurses; in 6, persons connected with the dairy either lodged in or had visited infected houses; in 2, infection was brought by cans or bottles from the houses of patients suffering from scarlet fever; in 3, the milk was stored near or in the sick-room; in 1 case milk utensils were wiped with an infected cloth. The existence of scarlet fever in animals has been claimed by such authorities as Salmon and Peters; other writers maintain that the disease is not identical with scarlatina as seen in man. In this connection it is an important fact that inoculation of cows, especially when in milk, with the virus of scarlatina, results in the production of definite symptoms.

The scarlatinal virus gains access to the blood through the respiratory tract, and is also conveyed in solid and liquid food to the stomach, whence it is absorbed. Though it is unlikely that absorption can occur through the sound skin, the disease is said to have been inoculated by artificial deposition of contagion-bearing material upon the abraded cutis. Miguel d'Amobise claimed to have inoculated children successfully with blood taken from scarlatinous patches. Stoel and Harwood have been reported as having conducted successful inoculations. On the other hand, Petit-Radel failed in his experiments. New observations upon this point are required. The contagion probably resides in the epidermis, and becomes diffused as this is exfoliated; also in the buccal and faucial mucous membranes, and probably in the secretions, in the lymph, and in the blood. In the absence of reliable inoculation experiments we have no fixed knowledge upon these points.

Incubation.—Scarlet fever has a shorter and much less definite period of incubation than the other eruptive

fevers. In determining the interval between infection and the outbreak of symptoms, it is much easier to reach correct conclusions when the fever has followed a single exposure than when the exposures have been repeated or prolonged. There is abundant evidence to show that the period of incubation may be less than twenty-four hours. On the other hand, it has been claimed that four or five weeks may elapse before the disease manifests itself. Most cases of scarlatina have an incubation period of from four to seven days. Even this wide limit, differing markedly from that of the other eruptive fevers, is subject to very many exceptions, and the literature teems with examples of scarlet fever developing a few hours after exposure, or only after many days, even weeks. Murchison believed the incubation period to be more often less than forty-eight hours in duration. The shortest authentic stage of incubation was in the case of Richardson, who after auscultating a scarlet-fever patient immediately became nauseated and chilly. He was conveyed home in the carriage of a friend, and dated an attack of scarlatina from that hour. Incubative periods of not more than twenty-four hours have been reported by many writers.⁸ In 20 cases Dukes found the duration to vary from one to nine days, in 10 cases it was less than five days. Murchison reported, in the Transactions of the Clinical Society,⁹ the incubative periods of 75 cases, none of which exceeded ten days. He considered a person safe from contagion who is not attacked within a week after exposure. Thomas¹⁰ thinks that from four to seven days is the most frequent interval; Kaposi considers it to be about eight days; Gee thinks that seven days are rarely exceeded; Lewis Smith, that it is ordinarily less than six days. Longer intervals, however, are not infrequently noted. In one case, Hagenbach¹¹ determined it to be eleven days; in another, fourteen days. Intervals of twelve days or more have been recorded by Veit, Paasch, Böning, Lewis Smith, and others. From the rather untrustworthy results of inoculation, seven days would seem to have been the incubative period. Barthez and Rilliet, Gee, and others thought they had observed cases in which the incubative period covered several weeks, and, indeed, in delicate children, especially those with rachitis or with one of the neuroses, it may be much prolonged (Mayr). Holt¹² has collected 113 cases scattered through medical literature, occurring under circumstances which made it possible to determine the exact length of the incubation. The periods of incubation in these cases were as follows:

Cases.	Cases.
Twenty-four hours or less... 6	Eight days..... 2
Two days..... 15	Nine days..... 5
Three days..... 28	Eleven days..... 1
Four days..... 25	Fourteen days..... 1
Five days..... 6	Twenty-one days..... 1
Six days..... 15	
Seven days..... 8	Total..... 113

There is a growing belief that the incubation of scarlet fever lasts less than six days, and, without attempting to be more accurate, we accept that as the common duration. It is very often less than this, and but very seldom more. In this, as in most other features, scarlet fever shows great variability, and, if the term be allowable, a capriciousness contrasting strongly with the behavior of other specific fevers.

Symptoms: Period of Incubation.—For convenience of description it will be proper to describe scarlatina as following an *ordinary* or *mild*, and a *graver*, course. The course is very often irregular, from the absence of characteristic symptoms, or from the undue prominence of one or several of them, or from the presence of complications. In fact, scarlet fever may vary from an insignificant, even an unappreciable, disturbance of health, to a malady pursuing its fatal course with lightning-like rapidity; and although the type of the prevailing epidemic may be mild, severe, or malignant, individual cases can only in a measure conform to the standard, from which they will invariably differ to a greater or less extent.

Milder Forms.—At the end of incubation the active

symptoms of scarlet fever usually develop suddenly; rarely they appear more gradually. In most cases fever is the first symptom observed. In larger children and adults an initiatory chill is often noted. Convulsions may occur at the outset; usually, however, they usher in graver forms of the affection. The fever develops during the night, or during the day the child loses its playfulness and in a few hours is found to have a high temperature, in most cases not exceeding 103° F. (39.5° C.), but occasionally reaching 104° to 105° F. (40° to 40.8° C.). At the same time the pulse will be full and frequent, beating from 120 to 140 times in the minute very commonly. The rapidly rising temperature and great acceleration of pulse are characteristic, and under favoring conditions should excite suspicions of scarlatina. The face becomes flushed, the eyes bright and injected. There is much thirst, but almost complete anorexia. Nausea and vomiting are so frequent that J. Lewis Smith attaches some diagnostic importance to the symptom. Of 214 patients it was present in 162. Jenner thought that severe vomiting is apt to precede severe throat symptoms. Diarrhœa sometimes occurs, especially in graver cases. The tongue may be only slightly coated; frequently it is covered with a white, creamy fur, but remains red at the edges. Already the little patient complains of sore throat (indeed this may be the first symptom to attract attention), and upon inspection the mucous membrane of the pharynx will be found to be swollen and dry, and of a bright or dusky-red hue, and often spotted with small areas of dusky redness. At this stage no curdy nor diphtheritic deposit will be observed. The nasal mucous membrane sometimes participates in the hyperæmia, and a nasal catarrh is induced. There will now be difficulty in deglutition, and already there may be some enlargement of the submaxillary and cervical lymph nodes. There are often headache and also delirium, sometimes of an active kind. As the fever increases in severity the patient becomes dull, listless, and drowsy, and various symptoms of cerebral disorder are common in graver cases. In very many cases, however, all the symptoms will be mild. There may be little fever, no noticeable disturbance of the various functions, not even sore throat. Beyond slight peevishness and irritability the child may not seem to be unwell. In not a few cases there may be no prodromal period at all, the eruption first attracting notice. During the prodromal stage the urine is rather scanty, acid, and high-colored. According to Gee, the urine is diminished in quantity; urea is not necessarily increased; chloride of sodium is diminished, sometimes decidedly, the diminution generally ceasing suddenly on the fourth, fifth, or sixth day; phosphoric acid, at first normal, is notably diminished on the fourth or fifth day, remaining for four days from one-third to one-half the normal quantity, and then returning to the healthy standard; uric acid is greatly diminished on the second and third days, becoming excessive on the fifth day, and then normal. Even at the earliest observation albuminuria may be noted. Böning, who denies a prodromal stage, and always encounters the eruption on the first day simultaneously with the chill, has found blood corpuscles, renal epithelium, and albumin in the urine from the very start. The respiratory movements quicken in proportion to the rapidity of the pulse. Nearly all cases will begin to show the eruption within twenty-four hours, many within twelve hours, a few during the second day. When the eruption appears later, an abnormal or unusually severe form of the disease often follows.

Stage of Eruption.—The eruption first appears upon the sides of the face, upon the neck and submaxillary region, and on the front of the chest, in the clavicular region, as small, pale-red points, closely aggregated, although at first discrete, and very slightly elevated. It rapidly extends over the chest (where it becomes most intense), and over the upper and lower extremities, and attains its full distribution by the end of the second day, acquiring a bright red or scarlet color. It occasionally happens that the eruption begins on other parts than

those mentioned, or may never become general. Rarely it spreads more slowly, even fading in some localities before the lower extremities are invaded. It is especially apt to affect the flexures of the joints. In mild cases the spots remain discrete over most of the body, and may resemble a fine "prickly heat," densely arranged and of minute size. At times the eruption consists of dark-red points, surrounding hair follicles, separated from each other by less intensely red areas (Henoch). In cases of greater intensity it is coalescent almost universally, and presents a continuous brilliant scarlet surface, like the shell of a boiled crab or lobster. The intensity of coloration varies somewhat, even in the same patient, depending much upon the degree of heat; becoming paler when the surface is cooled, more scarlet when this is protected by heavy covering, etc. It is, however, not perfectly smooth, but shows the tiny papules upon the reddened base, and communicates to the hand passed over it a sensation of roughness and of dry and pungent heat. Upon the legs and arms the eruption very often becomes more scattered, assuming the form of separate tiny points; rarely it is distributed over distinct areas of the trunk and extremities, with intervals of faintly erythematous redness (scarlatina variegata). This form, however, is apt to appear in severe complicated cases. At the same time it must be remembered that, unlike measles, scarlet fever affects the face less than other parts. Never very intensely developed over the forehead, temples, or chin, the eruption entirely spares an area around the mouth, including the upper and lower lips and some distance beyond the angles of the mouth, and often extending upward to include the nose. This area contrasts with the surrounding parts by its remarkable pallor. It has been asserted that the cheeks are also spared by the eruption. This is not true. The cheeks do not show the pointed redness of the early eruption elsewhere, but at once assume a scarlet or crimson redness that is deeper than the color induced by fever. The lips are often dry and cracked, and may bleed. The face becomes considerably swollen, especially in the loose tissue about the orbits. The ears are also swollen and of a bright red color. The eruption does not spare the scalp. Upon the backs of the hands and feet the eruption is discrete, and is arranged in groups the size of a lentil, while upon the palmar surfaces of the hands and fingers, and upon the soles of the feet, a bright, diffused redness, with swelling, is seen. At times the eruption will be partial, developing upon the trunk alone, or on the extremities, or in isolated patches about the body. These cases may not be abnormal in other respects. The skin over the joints is especially prone to be affected. The lesions may be more or less disseminated spots, varying from the size of a pin head to that of the finger nail, or a half-dollar, or even larger. It has been asserted that the eruption constantly consists of a papulated rash upon a reddened base, even when universally diffused. This is not invariably so, and one may encounter a smooth, uniform redness inappreciable to the touch. Where the eruption is very intense, small hemorrhagic spots or petechiae may appear. When thus occurring, their occasional presence is not of serious importance. In warm weather especially, and in children too warmly covered with bedclothes, the surface, particularly of the neck, chest, and belly, is sometimes plentifully sprinkled with an eruption of sudamina. In some epidemics these are more often observed than in others. It is not impossible that the "miliary fevers" that formerly occasionally prevailed in Europe were in reality forms of scarlatina. Mayr has said that the eruption of scarlet fever often spares the skin of paralyzed limbs; but Kaposi asserts that it may be unusually intense upon these parts. In dark-skinned races the eruption undergoes some modifications, which are greatest in those of full negro blood. In mulattoes and negroes it becomes often exceedingly difficult to distinguish the eruption. Of course the scarlet color is absent, a tinge of red will often struggle through the darkly pigmented skin, especially of the cheeks and abdomen. The true character of the eruption may often be revealed by a finely papular condition, the

tiny papules of the size of a pin-point being made apparent by their acuminated summits, which give, against the dark background, a resemblance to a sprinkling of the surface with a fine dust. The hand passed over them can perceive the little asperities. These are closely aggregated. In many cases it is impossible to recognize the eruption, and the diagnosis must rest upon the concomitant symptoms, which will not be peculiarly modified.

While the eruption—which attains its height by the end of forty-eight hours in mild cases, later in severe ones—is developing, the other symptoms become pronounced. The faucial mucous membrane is uniformly redder, or occasionally shows numerous red macules; the uvula, tonsils, and buccal mucosa deglutition increases. As the eruption reaches its height, the tongue parts with its coating in patches, exposing areas of intense redness. By the third day it acquires a uniformly brilliant red color, with enlarged papillae scattered numerous over its general surface, and presents the characteristic "strawberry" or "raspberry" appearance. Exceptionally this exfoliation of the lingual epithelium does not occur, and the creamy deposit persists. In many mild cases there is slight nasal catarrh, with a thin discharge from the nostrils. A muco-purulent discharge from the nostrils is associated with the throat complications of the graver forms.

During this period the fever continues to increase until the completion of the eruption, or the prodromal temperature remains unchanged. In the type of cases we are considering 105° F. (40.5° C.) is not often exceeded. Should the fever continue to increase after the third day, grave solicitude as to the result will be justifiable. The other symptoms continue with undiminished vigor—digestive disorder, nausea, vomiting, complete anorexia, rarely diarrhoea, persist. The skin burns or itches more or less intensely. Nervous symptoms, restlessness, stupor, headache, delirium, usually diminish, but may continue unabated; or active delirium may occur. Convulsions at this time are very ominous. The sore throat becomes distressing, and the cervical and submaxillary glands enlarge and become painful. Bronchial and pulmonary inflammations occur only as complications. After the fourth or fifth day nearly all of these symptoms cease to increase, and it becomes evident, *ceteris paribus*, that the course of the disease is to be favorable. The eruption, after persisting in full development for a day or two, becomes duller and slowly fades, first in the parts earliest affected, latest from the back of the hands. The color, which at first completely faded, now leaves a yellowish stain when the finger compresses the skin. It is not, however, until after four, five, or six days, that the skin loses its scarlet color. This may last longer. Jenner¹² has known it to persist for from fourteen to sixteen days. The fever slowly declines, until it ceases about the sixth, seventh, or eighth day, or later, and not before the eruption has entirely disappeared. Sometimes, from unknown reasons, it persists for days after all local symptoms have ceased to be active. On the other hand, fever, in some very mild cases, will hardly be noticed, or will endure but a few hours. The throat manifestations, or the superintention of complications, may protract the fever for many days. The sore throat, unlike the other symptoms, often fails to show signs of amelioration after the height of the eruption. The swelling and redness may increase, and white or yellowish curdy deposits form upon the tonsils and uvula, or the posterior wall of the pharynx may be bathed in a thick muco-purulent discharge from the posterior nares. True diphtheritic membrane is not apt to form in these cases, but the neighboring lymph nodes may become highly inflamed and suppurate. It is probable that renal catarrh and nephritis occur more frequently during this period than is commonly supposed. The character of the urine is subject to considerable variation. At the beginning of the disease it has the appearance of the ordinary febrile urine or of a severe active hyperæmia. It is not usual for an

acute nephritis to develop in the early stages of scarlet fever, but is most common in the second or third week. It may develop after the mildest forms of infection, and the greatest care should be (even when convalescence is well advanced) to guard against this serious complication. Frerichs, Reinhardt, Eisenschitz, Böning, Begbie, Newbigging, Holder, and others, consider the renal symptoms to be essential in scarlatina. This is, however, not true. Thomas¹³ practised microscopic examinations of the urine in twenty-five of eighty patients, and in twenty of these daily. In the prodromal and eruptive stages he found slight albuminuria only rarely and transitorily. Decided alterations in the renal tract were most uncommon. Mild catarrh was more often seen. Only the more severe forms he considered to depend upon a specific scarlatinal influence. Fleischmann,¹⁴ in 472 cases of scarlatina, reported dropsy during the first week in 9 cases. Not enough, certainly, to bear out the sweeping assertions just quoted, but sufficient to direct attention constantly to the condition of the kidneys in scarlatina.

Many cases of mild scarlatina fail to exhibit all the symptoms enumerated. The prodromal stage may be absent, sore throat may be insignificant or absent throughout. The tongue may never assume the "strawberry" appearance. The fever may be of feeble intensity. Finally, the rash may be faint and not widely distributed. It may be limited to a few reddish or pinkish punctate spots upon the neck or chest; or it may affect only the flanks or the flexures of the joints; or it may be so transitory as to escape observation or to be noted only during a few hours; or, finally, it may fall altogether to appear. On the other hand, sore throat may be the only active evidence of the disease. Cases that have been exposed to the contagion sometimes develop sore throat only. These may subsequently become dropsical from nephritis, or they may desquamate more or less abundantly, or even communicate scarlet fever to others. An interesting feature is a tendency, often shown by those exposed to contagion, to suffer from a mild attack of pharyngitis after every exposure. Many physicians, nurses, etc., experience this. Finally, the eruption may fail to appear, knowledge that scarlatina was present being acquired through the occurrence of desquamation or dropsy. Cases of this kind have been designated "*scarlatina sine exanthemate*." They are not so very rare. At other times the eruption is so indeterminate in appearance that, in the absence of accompanying symptoms, it is impossible to speak positively of its character.

Stage of Desquamation.—After the fading of the eruption the patient passes into the stage of desquamation. This is an immediate result of the eruption. Desquamation begins usually upon the neck, and continues for from eight to fourteen days, but not infrequently for four, six, or even eight weeks or more. Usually not earlier than the sixth day of the disease it is noticed upon the neck and face, and quickly extends over the whole surface, and may even occur upon parts not visited by the eruption. Upon the face and neck the scales are mostly fine, but coarser than those following measles. From other parts the epidermis peels in great shreds. On the hands and feet the lamellæ are always large, and sometimes from these members the cuticle is removed in masses resembling a glove or slipper. Desquamation endures longest where the epidermis is thickest, often for weeks; that newly formed exfoliating repeatedly. The hair and nails are sometimes shed after scarlet fever. Desquamation is at times observed in those who have had no eruption, or at least one of very circumscribed extent. With the completion of desquamation the disease may be said to have run its course. Great care, however, must be exercised for some weeks to protect the patient from the effects of complications and from the sequelæ to which the disease has made him liable. With the fading of the eruption, the cessation of fever, and the beginning of desquamation, general improvement takes place. The tongue gradually resumes its normal appearance or for a time becomes again coated; the sore throat diminishes; the various functions are properly

performed; appetite and strength return. Desquamation may, however, be sometimes delayed. The local use of oils and ointments during the eruption tends to make the desquamation less free. The occurrence of dropsy, dependent upon the development of an acute nephritis, sometimes defers the beginning of desquamation, and this may not become abundant until after the dropsy has subsided. Contagion has spread from desquamation beginning in this manner, after isolation has been abandoned as no longer necessary. In rare cases desquamation can hardly be said to occur at all. Even in mild cases, in winter, the patient should not be permitted to leave his bed until the end of the third week, or to leave his chamber until the completion of desquamation. In midsummer it is usually not advisable to insist upon confinement to bed for so long a period. Cases which run the apparently mild course just described are by no means free from danger, as they are often accompanied or followed by local pathological processes which, while they may not be essential symptoms of scarlet fever, are especially prone to affect those suffering from it. Such lesions will be considered among the complications and sequelæ of scarlatina.

Graver Forms.—Every case of scarlatina is dangerous. In those following the type just described the peril arises from processes that are not essential to the disease. Such forms pass, by insensible gradations, into those where life is imperilled by the greater or less intensity of characteristic phenomena. The graver forms of scarlatina may not differ in their initiatory symptoms from those already described. In most cases the severity of the disease is in great measure dependent upon lesions in the throat, while, as a rule, the eruption shows a more general distribution and a more intense coloration. The prodromal symptoms do not differ in kind from those of milder types, but are more severe. Vomiting is more apt to occur, and nervous symptoms to become prominent. Headache, jactitation, and delirium become more marked, or the patient grows petulant, drowsy, and stupid. Convulsions also may occur. Fever attains great intensity at the very outset, reaching 40° to 42° C. (104° to 106° F.), the latter temperature always denoting extreme danger. There is already sore throat, with difficult deglutition and with swelling and deep redness of the faucial mucous membrane, which by the third day, in the less severe cases, shows curdy deposits scattered over the tonsils. These deposits do not involve the mucous membrane, and may generally be detached by a mop or a brush. They are quite like the exudation of ordinary catarrhal pharyngitis. After the third or fourth day, under conditions of constantly increasing fever and general distress, in some cases, diphtheritic exudation begins to show itself over the tonsils and soft palate and posterior wall of the pharynx. It is an interesting point of difference between primary and scarlatinal diphtheria that the latter never begins to appear before the third or fourth day, after which date it is sufficiently common. Fleischmann reported diphtheria 168 times in 472 observations. The diphtheritic deposit is first developed on the lateral portion of the tonsils, except in those rapidly fatal cases in which the whole pharynx seems to be simultaneously involved. The patches are of a whitish or grayish-white color, and involve the mucous membrane sometimes to a considerable depth and superficial extent. At times the diphtheritic membrane rapidly spreads in a continuous sheet over the fauces, extending forward into the buccal cavity and into the posterior nares. In the latter case, a fatal termination is almost inevitable. Heubner¹⁵ asserts that those cases in which the entire mucous membrane, from the root of the tongue to the esophageal and tracheal orifices, is covered with the membrane, prove fatal within twenty-four or forty-eight hours, without exception. Here the membrane is sharply margined against the dusky-red mucous membrane, and within a few hours the slough shows signs of separation and develops a gangrenous odor. In these cases the membrane hardly ever travels down into the trachea. Bretonneau has made a positive assertion that this does