

and susceptibility restored by any protracted stay outside of the yellow-fever zone. This process of hardening against the reception of yellow fever is called *acclimation*. It is not by personal contact that the disease is communicated—in other words, it is not a contagious* but an infectious disease, and it is not against individuals that quarantine restrictions should be enforced, but against articles of clothing, bedding, or the like, or against all fomites. The condition of the individual opposes or favors the reception of the poison. Besides all those conditions which favor or retard the spread of the poison above mentioned, must be stated the habits of the individual. All excesses in drinking or venery either help the reception of the poison or increase the virulence of its action in the body. All depressing moral emotions, especially fear, act unfavorably.

Pathological Anatomy.—Not much wasting of the body is observed, and the *post-mortem* rigidity is usually well marked. The color of the skin is light or dark yellow, a change which appears to be never wanting in genuine cases. The skin is also stained by hæmorrhagic extravasation, ecchymoses, vesicular eruptions, and gangrenous vesications at points where irritating applications had been made. The dura mater is often yellow, the sinuses engorged, the vessels of the pia congested, rarely hæmorrhage in the subarachnoid spaces or bloody serum, the cerebrum not abnormal, the ventricles containing a little serum, very rarely bloody serum, and similar conditions in the spinal canal, there being nowhere in these organs any evidences of inflammation.† On the other hand, inflammation of the spinal arachnoid in the lumbar and sacral regions has been reported, but the constancy of such lesions must be regarded as doubtful. The changes which have been observed in the cœliac and hepatic plexuses, and which consist in an inflammation of the neurilemma, must also be considered as of doubtful significance.‡ More or less congestion of the lungs, chiefly hypostatic, is usual, and the bronchial mucous membrane presents the usual appearance of passive congestion. The sac of the pericardium contains more or less serum, as a rule, and it is rarely bloody. Purpuric spots are occasionally seen on the pericardium, endocardium, and on the surface of the heart itself. The muscular tissue of the heart may be unchanged, but it is very often more or less softened by granular degeneration. Various changes observed in the composition of the blood are described, but thus far nothing peculiar to yellow fever has

* This question is most elaborately treated by La Roche ("Yellow Fever," vol. ii), who finds the arguments against contagion stronger than those in favor.

† Lyons, *op. cit.*, Appendix, "Pathological Anatomy of the Yellow Fever of Lisbon," 1857.

‡ The official commissions appointed to investigate the nature of yellow fever have not contributed any new facts, or made any discoveries that help us to a better knowledge of the disease.

been discovered. It is true, Dr. Joseph G. Richardson, of Philadelphia, supposed he had found a peculiar bacterium, which he described as *bacterium sanguinis*, in the blood, but other competent observers have been unable to confirm his observations. A rapid crenation of the red-blood corpuscles has been noted by Dr. Schmidt,* of New Orleans, which he regards as a retrogressive change probably not peculiar to yellow fever. No alterations have been observed in the white blood-corpuscles, although there seemed to be some slight increase in their relative proportion. The most characteristic of the morbid alterations of yellow fever are those of the liver and other abdominal organs. In the Lisbon epidemic, in the epidemics of this country, and elsewhere, the liver has always been remarkably altered. Externally, it most usually presents a fawn-yellow, or buff-color, which is pretty uniform throughout the whole organ, although here and there may be patches of a deeper color. Various shades of the above-described tint are observed in some cases and in different epidemics, because the degree to which the alteration has attained differs somewhat; but when the ordinary liver-brown color is present, on minute examination, the liver is found to be altered in the usual way. The change taking place in the liver consists of a fatty infiltration, and a fatty degeneration of the protoplasm of the hepatic cells. In an advanced case, the hepatic cells are smothered in a mass of fat-cells and granules. More or less coloration of the cells about the radicles of the blood-vessels with blood and bile-pigments is to be seen. The stomach-veins are deeply engorged. This engorgement may be general or partial, and if partial the mucous membrane about the cardiac extremity is chiefly affected. Patches of vascularity, punctiform congestion, ecchymoses, and purpuric spots, have been observed in different cases. The epithelium is usually intact. More or less "coffee-ground" matter, or dark, coffee-colored liquid, containing coffee-grounds mixed with it, is found in the stomach. The black vomit consists chiefly of blood and epithelium; the blood-corpuscles are deprived of their hæmoglobin, which is separate; and the rest is made up of white corpuscles, epithelial cells, and *débris*. The spores and fully developed yeast-plants (*Torula cerevisice*) are found in the vomited matters, and other fungi quickly develop in them on standing. The mucous membrane of the small intestine presents the same deep congestion as that of the stomach. In more than one third of the cases in the Lisbon epidemic there was present in the intestine extravasated blood in various stages of the alterations produced by the intestinal juices, and which presented an inky blackness, a reddish-brown or a bloody tint. In quantity the extravasation was sufficient to distend the small intestine in some instances, and was generally considerable. The glandular apparatus of the small intestine has been usually represented as intact in

* "New York Medical Journal," February, 1879.

all the various epidemics. No characteristic changes take place in the spleen. The kidneys are rarely normal. A considerable hyperæmia of these organs seems to be nearly constantly present. The epithelium of the tubules undergoes granular degeneration, and this takes place both with the straight and convoluted tubes. Fatty degeneration follows in those cases where death has been long enough postponed to give the necessary time. The urine undergoes important alterations. The uric acid and urea diminish and ultimately disappear, and are replaced by leucin and tyrosin, while albumen appears, at first in a mere trace, but increasing in amount. The urine also assumes a deep color from the quantity of blood-pigment and bile-pigment present in it, and is denser and more viscid (Vidaillet*). Schmidt calls attention to changes in the supra-renal capsules, but they do not seem to be different from the appearances observed in numerous maladies.

Symptoms.—First Stage.—The period of incubation varies within wide limits, if conclusions are drawn from exceptional cases.† Usually, from the period of exposure to and reception of the disease-germ, from one to three days will elapse. The disease begins in two modes—one with prodromic symptoms or gradually, and the other very suddenly. Soon after the reception of the poison, in many subjects, there ensue impaired appetite, a feeling of debility, headache, muscular pains, for two or three days, when the disease sets in with a chill, or a feeling of chilliness followed by fever. In other cases there are no prodromal or premonitory symptoms, and the patient is seized apparently while in full health, walking, at work, asleep, with a chill, sometimes a severe rigor, and the fever comes on immediately. Very rarely have been witnessed in recent epidemics those formidable cases in which the patients in apparently full health were stricken as it were with a heavy bar on the back, falling at once into a condition of profound prostration, and dying collapsed in a few hours. These cases were known as *coup de barre*, or stroke of the bar, because of the intense violence of the sudden pain in the back and loins. In every epidemic, however, there are cases characterized by profound blood-poisoning and rapid termination in collapse. These variations will be mentioned presently. Now we are concerned with the ordinary course of the disease. The fever rises rapidly and reaches its maximum on the evening of the first or second day (103°, 104°, 105°). According to the tracings of Faget, as given by Sternberg,‡ “in sixteen the acme is reached on the first day; in twenty-three during the first two days”—the whole number of observations being twenty-six. The onset of the

* “Archives Générales de Médecine,” November, 1869.

† La Roche, “Yellow Fever,” vol. i, p. 511, Philadelphia, 1855.

‡ “On the Nature and Duration of Yellow Fever, as shown by Graphic Temperature Charts of Typical Cases, etc.,” “The American Journal of the Medical Sciences,” July, 1875, p. 99. By Dr. George M. Sternberg, U. S. Army.

disease causes great disquiet, and the victims are restless and disheartened. The face appears anxious and flushed; the eyes moist and bright, and the conjunctivæ injected. There are decided headache, throbbing of the temples, general muscular pains, but especially severe and depressing pains in the back and loins, which in their worst form constitute the dreadful *coup de barre*. Early in the disease, and, according to some, before the outbreak, a peculiar odor is perceived, and by many is regarded as distinctive of yellow fever. The odor is rather cadaveric and diffusible, but much that is asserted in regard to it seems to the author very apocryphal. The tongue is heavily coated with a thick, whitish fur, and is red at the tip and edges, the swollen papillæ projecting above the surface. The palate mucous membrane becomes red and œdematous. The stomach is from the first irritable; the epigastrium is tender to the touch; cold drinks are taken with great avidity, excite pain, and are rejected with a good deal of painful retching at first; and the stomach is equally intolerant of all kinds of food. Sometimes there is diarrhœa, but usually the bowels are constipated. The vomited matters at this early stage consist of particles of food, mucus, and bile, and flocculi of brownish or chocolate colored material—the forerunner of the dreaded black vomit. The stools are pasty and grayish, but constipated. The urine lessens in quantity, darkens in color, and distinct traces of albumen are now discovered in it. The pulse is rapid, strong, with high tension in some cases, weak and dicrotic in others, and the pulsations range from 90 to 120. When the temperature reaches its maximum, usually on the second day, it begins to decline by lysis, a remission occurring about the fourth day, terminating the first stage. In the mildest cases the remission occurs on the second day, and it may be postponed to the sixth day or longer. During the period of maximum temperature and the first stage, besides the symptoms already mentioned, there may be considerable restlessness and active delirium, the patient being kept in bed with difficulty, or the delirium may present the appearance of *delirium tremens*—an active, busy, and trembling delirium. At this stage there may begin to appear a jaundiced tint of the skin; the urine may contain bile-pigment, the stools having a clay-color, which is, however, not usual. There may also occur hæmorrhages from the nose, from the gums, and also from the stomach; but it is only in the severe cases that these hæmorrhages occur so early, and hence they are of evil augury.

Second Stage.—The decline of temperature which marks the end of the first stage may proceed to a complete intermission. In all of the cases collected by Sternberg, “a complete intermission, or nearly so, was found on the morning of the third day.” According to others, Haenish for example, there is not a complete defervescence—only a remission—in a majority of the cases. With the decline in temperature there occurs a most favorable change in the condition of the

patient. The delirium subsides, the pains cease, the stomach may become quiet, some critical evacuation, as a sweat, an attack of diarrhœa, or an epistaxis, may occur, and convalescence be at once established. Instead, however, of these favorable symptoms the delirium may persist, the irritability of the stomach may increase, albumen, if it has not been in the urine, may now appear, the pulse may become weak, and the condition of the patient may grow rapidly worse, notwithstanding the marked defervescence and the relief to the symptoms which may at first be caused by the remission. The period of time occupied by the remission varies considerably, and is from one to four days.

Third Stage.—The remission disappears and the temperature rises again, but not so rapidly as during the first stage, the maximum of about 104° being reached on the second day. If the active delirium persists, the patient becomes unmanageable, refuses food and drink, the leg-muscles are thrown into violent cramps, jaundice deepens, black vomit comes on, the pulse fails at the wrist, and death closes the scene suddenly in the midst of violent delirium. In much the largest proportion of cases, the mind is unclouded, and the moral state that of complete apathy and indifference. The strength rapidly declines, and the pulse is small, weak, and irregular. The jaundice passes from the characteristic lemon-color to a deep mahogany, and hæmorrhages pour out from the various mucous surfaces and from the skin; the nose bleeds, and blood is vomited, passed by stool, and less often expectorated. The gums are soft, spongy, and bleed with a touch, and rarely the ears bleed. The most striking and characteristic phenomenon is the hæmorrhage into the stomach and the return of the blood in the form of "black vomit." Even during the first stage, small flocculi, of a chocolate-color and composed of altered blood, are seen in the vomited matters, but the "coffee-grounds" do not appear usually until the second, or stage of remission, and often indeed not until the third stage. The urine constantly lessens in amount; the urea disappears; blood-pigment distills through in large quantity; the albumen increases, and very soon, in some cases, entire suppression occurs. Under these circumstances, somnolence, stupor, and ultimately coma supervene. Partial convulsions, hiccough, and Cheyne-Stokes breathing are often observed in these uræmic cases. The temperature also greatly declines toward the end—to 100° even; and it is a curious fact that the action of the heart continues for a time after the respiration and pulse at the wrist have ceased. If the case take a favorable turn during the third stage, the temperature descends to normal very abruptly, and an improvement in the condition of the patient at once occurs. The vomiting stops, and a little aliment may be taken; the kidneys act freely, the circulation improves, and very gradually convalescence is established.

Course, Duration, and Termination.—There are several forms of

yellow fever, which differ sufficiently to require some special consideration. Many divisions have been made, but in the following forms are comprehended the most important varieties—the algid, the sthenic, the hæmorrhagic, the purpuric, the typhous (Lyons). The purpuric form is, however, only the hæmorrhagic modified. Excluding this, we have four varieties of the disease, capable of ready clinical distinction. The *algid form* occurs in subjects debilitated by want and misery. The surface is cold, the face sunken and of a livid hue, the extremities blue, cold, and shrunken, the skin covered with purpuric patches, the pulse small and feeble, the temperature in the axilla at 96° Fahr. Such symptoms are not present merely at the outset, but continue to the end. Black vomit occurs early, and the hæmorrhages take place from all the mucous surfaces. In the *sthenic form*, the opposite conditions prevail. The robust, at the prime of life, are the subjects. High fever, severe headache and lumbar pain, delirium of an active kind, early jaundice, having the lemon-tint, and less of the black vomit, are the most characteristic features of this form. In the *hæmorrhagic form*, the peculiarity consists in profuse and simultaneous discharges of blood, effused at various points. Black vomit and intestinal hæmorrhage, uterine and renal hæmorrhage, simultaneous bleeding from the eyes, nose, ears, and mouth, and effusion of blood from any accidental abrasion, give to this form a distinct individuality. In the *typhous form* are presented symptoms which ally these cases to other typhous processes. They are characterized by stupor, prostration, sunken countenance, suffused eyes, dorsal decubitus, low-muttering delirium, in addition to the usual and ordinary symptoms of the disease. The mortality from yellow fever is largely influenced by the type of the prevailing epidemic, and also by the local conditions, and by the form of the seizure, whether algid, hæmorrhagic, sthenic, or typhous. It necessarily varies much, and between such wide limits as from fifteen to eighty per cent. More men die than women and children. The habits of the individual as to temperance enter seriously into the prognosis, since the mortality among spirit-drinkers is very high. All circumstances which act to depress the vital forces increase the severity of an attack. The early occurrence of black vomit and suppression of urine are very ominous symptoms.

Diagnosis.—The only disease with which yellow fever is likely to be confounded is remittent fever with jaundice. The distinction rests on the temperature line and the occurrence of black vomit. The remissions of malarial fever are quotidian or tertian, and the fever of the first stage of yellow fever is continued until the defervescence. Nothing like black vomit occurs in malarial fever; while remittent fever is promptly broken up by efficient doses of quinine, this remedy has no influence on yellow fever. Again, remittent fever prevails much more widely than yellow fever. It is only within the yellow-fever zone

that a question of differentiation can arise. When an epidemic influence is at work, there can be no difficulty in the diagnosis after the first cases have appeared.

Treatment.—It is good practice to begin the treatment by a mercurial purgative; a half-grain of calomel two or three times on the first day, followed by a warm-water enema. All drastic cathartics should be avoided, owing to the irritable state of the stomach. If the pain in the back and loins is very severe, one twelfth of a grain of morphine should be administered hypodermatically, and repeated according to circumstances. For the irritable stomach, there are two most efficient remedies, carbolic acid, and lime-water with milk—a fourth of a grain of carbolic acid in some mint-water every two hours, and a tablespoonful of lime-water and milk, equal parts, every two hours, so that these remedies will be taken in alternation every hour. Ice should be kept in the mouth and small pieces swallowed, but care is necessary to avoid distention of the stomach. For the epigastric tenderness, mustard should be applied, and, if the patient is vigorous and the reaction sthenic, leeches or cups should be used. During the second stage, for the irritable stomach a little dry champagne is often very serviceable, as it is very grateful. Hydrocyanic acid, and especially chlorodyne, may also act well as sedatives to the stomach. If the fever is high, the skin hot and mordicant, the wet pack may be used with advantage, or the body may be sponged over and then rubbed with some animal fat, as lard or suet, several times a day. The temperature may be reduced further by the rectal injection of a scruple of quinine, but this agent should not be administered by the stomach, as it will surely excite vomiting. For the same reason all harsh and drastic or irritating medicines should be avoided. The delirium and obstinate wakefulness of some cases require morphine and atropine (the latter in small proportion) hypodermatically. When the delirium is active, the patient restless and difficult to control, the most efficient hypnotic and calmative is duboisine given subcutaneously ($\frac{1}{30}$ grain); Aitken suggests chlorodyne. As digestion is almost entirely suspended, it is useless to push beef-tea and milk when the stomach rejects everything. The best aliment is milk and lime-water, half and half, given in small quantity, not to exceed a tablespoonful every two hours. If curds are thrown up in hard masses, the quantity of milk is too great. Thin barley-water to which some milk is added, and then diluted with lime-water, is a suitable aliment. During the stage of convalescence, the utmost circumspection is necessary in giving aliments. The algid form of yellow fever requires stimulants from the beginning. In the hæmorrhagic form, small doses of turpentine and tincture of the chloride of iron should be given frequently. In the sthenic form, the wet pack, leeches, quinine, morphine, and duboisine, are the most appropriate remedies. In the typhous form, suitable aliment, wine, and the stronger stimulants are

required. Yellow-fever patients should be isolated. All of the dejections by vomit or stool should be at once disinfected. The room and halls should be fumigated with sulphurous acid. All articles of clothing and bedding about the patient should be destroyed, or put into boiling water and boiled before handling. Questions of quarantine are not included in the scope of this work.

DENGUE.

Definition.—*Dengue** is an acute febrile disease which prevails as an epidemic, and is characterized by two paroxysms of fever, with an intermission of variable duration between them, the first paroxysm being accompanied by high fever and joint swellings, and an eruption, the second subsiding suddenly with some critical evacuation. It is also called "break-bone fever," "dandy fever," "neuralgic fever," etc.

Causes.—There are close analogies between dengue and relapsing fever; indeed dengue is a relapsing fever. It occurs as an epidemic, and attacks a large part of the population among whom it appears. Apparently beginning on this continent, or in the West India Islands, it has spread to most of the warm countries of the globe, following the routes of human intercourse. Rush, one of the first to give an account of it, mentions it as occurring in Philadelphia in 1780. It is not generally regarded as contagious, although maintained to be by Dickson,† and some others. A peculiar condition of the atmosphere seems necessary, the epidemics occurring after prolonged high temperature (Dickson), or great heat and moisture combined (Aitken ‡). It has been observed in several epidemics that the attacks of dengue succeeded to epidemics of scarlet fever, of yellow fever, and of whooping-cough. The disease occurs in all ages and in both sexes, but the negro race seems to be, although not exempt, somewhat less susceptible, while the mulattoes are attacked equally with whites.

Symptoms, Course, Duration, and Termination.—There may or may not be a prodromal or preliminary stage. The period of incubation is in some instances "prodigiously brief" (Dickson), the attacks in any given household occurring so nearly simultaneously that all are sick at the same time. Toward the end of an epidemic the period which elapses after exposure may be lengthened to five, even to ten days. When the epidemic is at the maximum, the attack may follow exposure within a few hours and the disease occur promptly without any preliminary symptoms. When prodromes occur they consist of weariness, lassitude, headache, anorexia, a white tongue, and more or less general

* The word *dengue* is pronounced *dangay*.

† Fenner's "Southern Medical Reports," vol. ii, p. 384, "A History of the Epidemic Dengue as it prevailed in Charleston in the Summer of 1850."

‡ Reynolds's "System," vol. i, p. 98, American edition.

soreness of the body. Usually, however, the onset of the disease is sudden. The patient is taken in full health, often waked out of sleep, with intense headache, burning pain in the temples, backache, and severe aching of all the joints, including the fingers and toes. Sometimes the initial symptom is an acute pain in the knees, ankles, and wrists, the patient being seized while walking. General muscular stiffness follows, so that the affected members become useless, and any attempt to move the joints causes severe suffering. With the headache there is also great intolerance of light and sound. The face is flushed and hot; the tongue coated; a good deal of burning pain is felt in the abdomen; there are nausea and vomiting, during which a quantity of bilious matter comes up, and scarcely anything is retained; constipation persists; the action of the heart is rapid, the pulse strong, and beating at 140 or higher in children. Sometimes also, especially in children, there is delirium, and, in very young children, the onset of the disease may be marked by convulsions (Dickson). An exanthem of very variable character, but most frequently scarlatiniform, may appear, and hence the frequent confounding by the older authors of this disease with scarlatinal rheumatism. The duration of the first febrile stage is very variable, lasting from six hours to several days. It may cease rather suddenly with critical phenomena, or slowly by lysis. The decline of the fever is signaled by the disappearance of the eruption if it had existed, by the appearance of moisture on the skin, a profuse urinary discharge, an attack of diarrhœa, the stools being dark and offensive (Aitken), and by the subsidence of the headache and joint-pains. Usually, at the termination of the remission, the patient is in a condition of very considerable prostration, and, although much relieved, is unable to leave his bed. In other cases, the relief is so great and the strength so well preserved that the patient insists on getting up. The remission may not occur at all. In those cases the joint affection appears with, and the eruptions after, the first symptoms; the fever is continuous, and lasts from five to ten days, when it disappears with critical phenomena. It is by no means improbable that a distinct remission of short duration occurs, but escaped the observation of practitioners unprovided with the means of accurate investigation. The duration of the remission or intermission is not constant, and varies from a few hours to two or four days. During the period of remission there are more or less headache and soreness, and stiffness of the joints and muscles, notwithstanding a very great diminution in the severity of these symptoms; hence it may be concluded that the condition of the interval is rather that of remission than intermission. At the conclusion of this interval, whether of several hours' or two or four days' duration, the symptoms begin again: the fever rises, although not so high as during the first stage; the headache, some muscular soreness, but only occasionally the swollen,

red, and painful joints, are felt again; the tongue becomes coated anew, the appetite ceases, and more or less nausea, very rarely vomiting, is experienced. The distinctive peculiarity of the second period, however, is the occurrence of an exanthem—erythematous, roseola-like, rubeolous, lichenoid, etc. Usually, beginning as an efflorescence on the palms of the hand and soles of the feet, it spreads thence over the body. It is often accompanied by intense itching. The eruption may be distinctly localized to particular parts of the body. The duration of the eruption is variable, lasting from several hours to two or three days, and terminates by desquamation of the furfuraceous kind. The subsidence of the second stage is gradual, and the patients are left in a feeble state, requiring months for complete restoration. There may occur other relapses. The joints continue stiff and sore for a long time. It is not surprising that persons attacked with dengue should be much reduced. The fever, severe pains, loss of sleep, inability to take food, the critical evacuations, and the relapses, are sufficient to tax severely the vital resources of the most robust patient. It is never fatal in adults, and it is rarely that children die in convulsions. It is a disease without complications, and leaves behind no sequelæ. The whole duration of fully developed cases is about eight days, of which the first stage occupies three days, the intermission two days, and the last stage three days or nearly so, but the period of convalescence may be protracted over several weeks, because of the weakness, emaciation, and lingering joint swelling and pain, and relapses may several times take place, still further retarding recovery.

Treatment.—As dengue is a specific disease for which we have no specific remedy, it must be treated symptomatically, or in accordance with empirical observation. During several epidemics the use of emetics, carried to the point of free bilious evacuations, was followed by decided amelioration of all the symptoms. Next to the emetic in importance is an efficient but mild laxative. The substitution of more healthy evacuations for the greenish, tarry, offensive stools has also had a good effect on the progress of the disease. Anodynes are needed to relieve the severe pains. It is probable that salicylic acid will have a decided influence over the rheumatic symptoms, which are such prominent features of the malady. If salicylic acid or the salicylates fail, antipyretic doses of quinine should be tried. It is important to maintain free action of the organs of excretion; hence, if the pain is so severe as to demand the administration of morphine, the bowels should be kept open and the kidneys active. As the first stage terminates with some critical evacuation, often with a sweat, the behavior of nature may possibly be imitated and the paroxysms shortened by the administration of pilocarpine. The intolerable itching, so often present, may be allayed by sponging over the part a one per cent. solution of carbolic acid. The joint-pains and soreness of the muscles remain-