Paresis of the sympathetic centers from over excitation by high solar heat, long continued and suddenly withdrawn, etc., so-called malaria : its etiology, pathogenesis, pathology and treatment / by Charles T. Reber.

PARESIS

OF THE

SYMPATHETIC CENTERS

FROM OVER EXCITATION BY HIGH SOLAR HEAT, LONG CONTINUED AND SUDDENLY WITHDRAWN, ETC.

SO-CALLED MALARIA;

ITS ETIOLOGY, PATHOGENESIS, PATHOLOGY AND TREATMENT.

BY

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PREFACE.

The aim of this work, is to establish the truth in regard to the nature of the derangment of the human organism, usually described under the name "malarial or malarious diseases," "malaria," "palludal poisoning," and "marsh miasma." In order to accomplish this object, meteorological influences have, to some extent, been considered. The domains of Natural Philosphy, Chemistry and Physiology have also contributed a few of their precious facts, to assist in the elucidation of this extremely complex question. Want of time has prevented a fuller elaboration. Should this obstacle be removed, at some future period, and should the subject then seem to require it, a more complete presentation may be undertaken.

This work has been done amidst the perplexing cares of heavy professional duties.

The sense of the necessity of an investigation of the subject, is the result of thirty years personal experience and observation, in regions of country specially favoring the prevalence of the disease.

The liberal quotations, from several works of great merit, were deemed absolutely necessary in order to present the subject in the best and most impartial light.

Thirty years of practical experience has fully demonstrated an imperative need of a more advanced and scientific presentation of the etiology and pathogenesis of this disease.

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THERMAL PARESIS;

OR THE SO-CALLED MALARIA.

CHAPTER I.

SUGGESTIVE THOUGHTS.

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"In the elevation of temperature that takes place during a paroxysm of fever, however, it is not merely a matter of increased production of heat and diminished loss of heat, but we have to do with a modification or disturbance of the power that *regulates* the heat of the body, by which disturbance, according to Liebermeister, the average grade of temperature is raised to a higher point than is normal. This has given occasion to a belief in the existence of a special center presiding over the regulation of animal heat. Whether this is an excito-caloric or a moderating center, or whether it possesses a double character, this much seems to be certain, that in fevers, and especially in intermittent fevers, this nerve-center is so affected by the specific malarial poison that it is disturbed in its functions, either momentarily or for

some time, whereby intermissions and remissions are produced. A certain number of the manifestations that accompany the fever, headache, dizziness, malaise, violent trembling and convulsions, etc., are either likewise dependent on the direct influence of the malarial poison on the central nervous system, or must be regarded as results of the increased supply of heat in the body, and as the effect of the heated blood on those nerve regions."[1] I will only add what, indeed, every physician knows in regard to what is stated in the last clause above quoted, that the manifestations alluded to may be, and commonly are present, before any increased heat supply has taken place—prior to the fever.

1. Hertz, in Ziemssen, Vol. II, pp. 632–633.

CHAPTER II.

INVESTIGATIONS ON CONDUCTION OF HEAT.

"Why does not cold wood produce an action equal to that of the cold metal? Simply because the heat communicated to it is accumulated at its under surface; it cannot escape through the bad conducting wood as it escapes through the metal, and thus the quantity of heat withdrawn by the wood is less than that withdrawn by the copper. A similar effect is produced upon the human nerves. When you come into a cold room and lay your hand upon the fire-irons, the chimney-piece, the chairs and the carpet, in succession, they appear to be of different temperatures; the iron chills you more than the marble, the marble more than the wood, and so on. It is needless to say that the reverse takes place when we enter a hot room, that is to say, a room hotter than your own body. You would certainly suffer if you lay down upon a plate of metal in a Turkish bath; but you do not suffer when you lie down on a bench of wood. By preserving the body from contact with good conductors, very high temperature may be endured; eggs may be boiled and beefsteaks may be cooked by the heat of an apartment in which the bodies of living men sustain no injury. Blagden and Chantrey exposed themselves in ovens to tempera-

tures considerably higher than that of boiling water. Let us compare the condition of the two living human beings with that of two marble statues placed in the same oven. The statues gradually become hotter, until finally they assume the temperature of the air of the oven; the two men under the same circumstances do not similarly rise in temperature. If they did, the tissues of the body would be infallibly destroyed, the temperature which they endured being more than sufficient to stew the muscles in their own liquids. But, the fact is, that the heat of the blood is scarcely affected by any augmentation of the external heat. The heat, instead of being applied to increase the temperature of the body, is applied to change the aggregation of the body; it prepares the perspiration, forces it through the pores, and, in part, vaporizes it. Heat is here converted into potential energy; it is consumed in work. This is the waste-pipe, if I may use the term, through which the excess of heat overflows; and hence it is that, under the most varying conditions of climate, the temperature of the human blood is practically constant. The blood of the Laplander is sensibly as warm as that of the Hindoo; while an Englishman in sailing from the north pole to the south, finds his blood hardly heightened by his approach to the equator, and hardly diminished by his approach to the Antarctic pole.

When the communication of heat is gradual—as it always is when the body is surrounded by an imperfect conductor—the heat is consumed in the manner indi-

cated, as fast as it is supplied, but if the supply of heat be so quick, (as it would be in the case of contact with a good conductor) that the conversion into this harmless potential energy cannot be executed with sufficient rapidity, injury to the tissues is the result. Some people have professed to see, in this power of the living body to resist a high temperature, a conservative action peculiar to the vital force. No doubt, the actions of the animal organism are connected with what we call its vitality; but the action here referred to is the same kind as the melting of ice, or the vaporization of waters. It consists, simply, in the diversion of heat from the purpose of temperature to the performance of work."[1] The foregoing remarks on conduction of heat, etc., from a lecture by Sir John Tyndall, furnishes a beautiful and important statement of facts bearing on the subject of the effect of heat upon the living human body. But they are incomplete, and unreliable, because the action of the vital and nerve forces is ignored. The fact that perspiration and vaporization are actively engaged in cooling the body, and, so to say, insulating it from the heat of the surrounding air, while it is yet 20° F. below that of the body, has been ignored or overlooked; while the temperature of the air is below 98° F., there is, of course, no conduction of heat from it to the body; yet, as is well-known, there is profuse perspiration and vaporization, when even the temperature of the

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1. Tyndall. On Heat as a Mode of Motion.

air is still many degrees lower than that of the body. Perspiration and vaporization are, therefore, not the "waste-pipes" by which the body relieves itself of heat *communicated to it from the air*, since no heat has yet been thus communicated. The fact no doubt is, that perspiration and vaporization are, in the proper sense, vital processes, set in action in a reflex manner by the sense of heat imparted to the sentient nerves of the surface, and from thence transmitted to the sympathetic nerve-centers, stimulating or exciting them in such a manner as to cause perspiration and vaporization by means of the reflex activity of the vaso-motor nerves. Truly, as Mr. Tyndall says, "the flesh of the body would be stewed in its own liquids," if the heat to which men subject themselves were permitted to come in actual contact with their bodies. The force of this fact has not been fully appreciated. It is not that the air is not a good enough conductor to blister the skin if brought into actual contact at a temperature of 212° F. I have been in a Turkish bath heated to this degree, but perspiration and vaporization did not allow any air hot enough to blister to come in actual contact with the surface of my body. The truth no doubt is, that the excessive heat of the air is cooled, mainly, on the outside of the surfaces of the body, and is not "changed into potential energy in passing through it—is not applied to change the aggregation of the body." It is, therefore, not the application of heat to the nerve-centers that causes their excitation and subse-

quent exhaustion and paresis; the nerve-centers are excited chiefly by an impulse given upon the surface by excessive heat, and transmitted to them through the nerves. Consequently, the concluding statements quoted above do not embrace the whole truth, and are even in part erroneous, in assuming "that the action referred to is the same in kind as the melting of ice, etc.," and "that it consists *simply* in the diversion of heat from the purposes of temperature to the performance of work." There is a very active effort by the nervous system to protect the body against the entrance of heat (by means of surface moisture and vaporization), rather than for the purpose of changing or consuming heat in the body. It is incorrect to assume that the "perspiration is prepared, forced through the pores, and in part vaporized" by the heat communicated to the body from the surrounding air. All the heat requisite for these purposes is unquestionably furnished by the same process as that which evolves animal heat under ordinary circumstances. Nor can this process be suspended without deranging the function of nutrition, as it would result in impairing the healthful degree of oxidation required for normal tissue change, so that it becomes evident that the human body neither requires, nor can it safely permit, any considerable or even appreciable amount of heat to be communicated to it from the air. In a room heated to only 80° or 85° F., we feel quite uncomfortable, although this is a temperature considerably below the normal tempera-

ture of our bodies; the discomfort, no doubt, being due to the difficulty the body encounters in relieving itself of the amount of heat usually lost in the insensible perspiration and ordinary surface radiation.

In these considerations on the subject of conduction of heat, the quality of the living human body as a conductor does not seem to have been taken into account. It seems, however, to have been taken for granted that the heat was received by the body, else it would not have been necessary to account for its disappearance from the body, "converted into potential energy, it is consumed in work," is the language used. There is, however, no statement as to its conducting capacity.

Liquids are non-conductors even under ordinary circumstances, and if their particles are of extreme mobility, as in the circulating blood, its conducting power is surely not enhanced. In the surface capillaries it may also be likened to a spray, and in this condition its conducting power or power to receive heat must be entirely negative. Then, again, the innumerable thin partition walls of heterogeneous, mechanical or physical texture, moistened on all sides by the rapid blood-spray currents, must have an extremely low conducting capacity.

By placing a piece of asbestos on the hand, a red-hot ball of iron can be supported without inconvenience, in consequence of the bad conducting capacity of the asbestos, which is due to the especial texture of that substance. This being true of this fixed min-

eral silicate, what, indeed, shall be said of the integument of the human body (a heterogenous, elastic, mobile, vascular compound) as a conductor of heat, admirably fitted for vaporization and radiation of heat, but not at all so for its reception? But this is not all. The healthy, living human body makes an active vital defense against the introduction of heat.

"In fact, we are sure that elevation of temperature and relaxation of arteries cannot exist with any other than a paretic condition of the sympathetic. Taking first for consideration the ordinary low or asthenic fevers with which we are familiar, let us see how far we can account for their phenomena, on the assumption that the poisonous miasma has weakened the vaso-motor system, as well as the others. The increased temperature, the quick, but soft and weak pulse, the hyperæmias of various viscera, may all, according to the foregoing views, be regarded as natural results. The increased secretion of urea may be accounted for partly by the augmented chemical changes which take place in the mass of the blood (considered for the time as a solid tissue) uncontrolled by the sympathetic nerves, and partly by the increased amount of renal action depending on the same cause. (Oppler has shown that the kidneys actually form a considerable portion of the urea secreted.) The hypertrophy which affects the glandular solitariæ and agminatæ in typhoid may also be traced to the same nervous paresis, and may be regarded as

analogous to the enlarged spleen of ague or the goitre of Swiss malaria.

"To regard this hypertrophy as an attempt at elimination seems to me quite a mistake. It is no more to be considered such than the enlargement of the correlated mesentric glands is, which takes place at the same time. Both are similar structures, and both hypertrophy under the same conditions, viz.: hyperæmia and loss of nerve influence. The condition of the other systems in low fever quite corroborates our assumption as to the condition of the sympathetic. The quiet, muttering delirium, the unconsciousness or half unconsciousness, testify how the brain is enfeebled, while the down-sunken posture in bed, and the subsultus reveal the extreme muscular debility. The feebleness of the heart's action, and the softening of its texture, prove how the vital energy is depressed. The readiness of the skin to slough shows how its nutritive power is impaired. In certain cases it seems as if the sympathetic system was but little impaired, and the main stress of disease fell upon the cerebro-spinal. * * * It was very curious to see a patient with a skin of a natural temperature, a perfectly natural pulse, tranquil respiration, clear eyes, no headache, a soft and fallen abdomen, incoherent, or with a low muttering delirium, excessive subsultus, extreme debility.

"1st. The almost universal prevalence of these diseases in all parts of the world is a striking fact. Most intense and widespread in the tropics, where the ma-

larious influence sets its stamp on almost all morbid action, it prevails as far north as 62°. 2nd. The apparent absence of anything special or peculiar in the conditions which give rise to it. Moisture and warmth seem to be the efficient cause of this strange malignant influence. A soil, or even a rock, needs but to have been wet and to undergo drying to become a source of disease. Even drying wood is adequate to produce the miasm. I am aware that evidence has been collected to show that ferruginous soils are eminently prone to generate malaria, but it cannot, I think, be contended that this fatal quality is peculiar to this kind or to any. Rather, it seems like the fulfillment of the original curse pronounced on the ground for man's sake. Excess of water and complete dryness arrest the development of malaria, indicating plainly that the formation of the poison is somehow connected with the act of drying. 3rd. The obscure (but obvious) relation between malarious diseases, influenza and cholera, and the much greater prevalence of these disorders in some years than others. 4th. The very various diseases which malaria commonly produces, as fever, neuralgia and dysentery. These may stand as representatives of the chief kind of morbid action, showing how multiform may be the phenomena which spring from this origin. 5th. The especial predilection of malaria for the nervous system, and the vast, almost endless variety of disorders it is capable of generating through the intermedium of this system. This circumstance, and

the consequent tendency of ague to be associated with peculiar, anomalous and alarming symptoms, as in the so-called pernicious fevers, give a deep interest to the study of malarious affections. * * * It is quite clear, therefore, that a practitioner should be well acquainted with the manifold manifestations of malarious *intoxication* if he desire to meet the requirements of his day. It is by no means sufficient to know how to manage a tractable, well-behaved ague; we should be prepared for a variety of strange, anomalous and puzzling forms of disorder which will be sure to perplex us if we have no clue to guide us to comprehend them. This clue will be found (1st) in a knowlege of the laws of neuropathology as developed by Bernard and others; (2nd) in an acquaintance with the action of malarious influence on nervous tissues. * * * With regard to the second topic, it may be remarked that the phenomena from which we have to judge do not all present the same character. The contracted vessels and skin, and the rigors of the cold stage of ague, appear to evidence a stimulation of vaso and muscular motor nerves, while the increased temperature, the full pulse, the flushed surface, and the dilated vessels of the hot stage, all show the existence of a state of paralysis of nervous and muscular tissues.

"The diarrhœa, dysentery, splenic, hepatic or thyroidal enlargements which are so frequently produced by malaria, can only be interpreted as results of dilated and paralyzed arteries, and consequent excessive

flow of blood to an enfeebled tissue. In some cases, paralysis of some of the voluntary muscles has resulted from exposure to malaria. * * * The general conclusion from these facts clearly is that the action of malaria is mainly paralyzing, though its operation may sometimes *appear* to be stimulating. I say appear, for I am very much disposed to think that the stimulation is only apparent, and this for two reasons. First, the voluntary power is certainly weakened, and the quasi-spasmodic contraction may proceed much like those of chorea from a state of undue mobility and excitability of the nervous centers. Secondly, there is certainly, as I can testify from personal experience, a remarkable hyperæsthesia of the cutaneous nerves, which are far more sensitive to cold than in the healthy state. This hyperæsthesia as well as the motor disorder may result from paresis of the centers according to the general law, that power and excitability vary inversely. It is by no means improbable that the whole train of disorders may result from a primary vaso-motor nerve paresis, giving rise to increased heat of the blood, which then might produce at first an unhealthy irritation of the nervous centers, issuing sooner or later according to the quality of the nervous power in exhaustion and paralysis. It is well-known that increased heat of the blood is one of the earliest occurrences in fevers. However this may be, whether the spasmodic phenomena result from fevered blood, *or from the direct action of the poison*, there is no question that

the stimulation is of an unhealthy and injurious kind, and that we have in the co-existence of the apparently differing phenomena above mentioned another proof of the connection existing between spasm and paralysis. The result of the action of malaria may probably vary a good deal according to the idiosyncrasy of the individual, and according to the virulence of the poison itself. Just as to some persons a moderate dose of opium proves a powerful stimulant, while in others it causes more or less powerlessness, so it may be with malaria. Beyond any doubt the prolonged operation of malaria has a remarkably enfeebling and lowering effect on nerve power, both the cerebro-spinal and sympathetic systems."[1]

I deem it to be impossible to add anything to improve the demonstration of the importance of the subject. The fact that the cause of the disease produces its evil results by way of paresis of the nerve-centers is also demonstrated beyond question.

However, the statement "that excess of moisture, and complete dryness, arrest the development of malaria." is not universally true. (See Oldham, "What is Malaria"; Humboldt, "Narratives," chaps. xvi, xx and xxv, pp. 66, 67, 242 and 575; Tristram, "Travels in Sahara," 287; Davy, "Ionian Islands and Malta," 247; McKinnon, "Climatic Fevers," Reports, Royal Commission in India; Hertz, in

1. Clinical Observations on Functional Nervous Disorders. By C. Hanfield Jones. 1867. pp. 34–35.

Ziemssen's cyclop., Vol. II, pp, 564–584; Hammond's "Hygiene"). The paths pointed out for complete elucidation of this subject—"a knowledge of neurophysiology and neuropathology, and an acquaintance with the action of malarious influence on nerve tissue" cannot but lead to correct and beneficial results.

CHAPTER III.

INSOLATION AND REFRIGERATION.

Dr. Kirchner has recently carried out a series of experiments on animals with a view to gain an insight into the pathogenesis of the two allied processes, insolation and refrigeration. He deduces from them that the latter may be characterized as prostration of the vital forces, and, first of all, of respiration and circulation. The morphotic and chemical alteration of the blood resulting therefrom, particularly its impoverishment in oxygen, is the immediate cause of the derangements that directly threaten life. Warmth, on the other hand, acts an as irritant on the animal organism, and when in excess leads to exhaustion. This constitutes the essence of insolation. As in the case of refrigeration, the foundation of the symptoms is the exhaustion of the oxygen of the blood, which here too is the consequence of failing respiration and circulation. The appearance of rigidity during exposure, either to cold or heat, indicates excessive lack of oxygen in the blood. This rigidity is like the rigor mortis, an anæmic muscular tetanus. * * *

The deleterious action of extreme temperatures on the organism is heightened by other weakening influences which tend to impair the supply of oxygen and to exhaust the resisting power of the system.

Here must be mentioned particularly the misuse of alcohol. In addition to these acute effects of cold and heat, there are analogous chronic conditions, which must be ascribed to the gradual action of extreme temperatures in the organism. They are characterized by manifestations of anæmia and exhaustion, and their higher grades partly constitute the basis of the tropical and polar cachexia. It is still an open question whether any other specific diseases owe their origin to the influence of heat and cold. The fact that abdominal typhus occurs more frequently during the latter part of summer and towards the end of winter, has not yet been satisfactorily accounted for; and, as in many cases, no external source of infection can be discovered, it is, in fact, possible that the morphotic and chemical alterations of the blood and tissues, which have been proved to be the pathological effects of insolation and refrigeration, play at least a subsidiary role in the production of the infection.[1]

Dr. Kirchner mentions as the effect of refrigeration, "prostration of the vital forces, and first of all, respiration and circulation." If this does not mean depression or exhaustion of nerve power it is impossible to discover what it does mean. Warmth, he says, acts as an irritant on the animal organism, and when in excess leads to exhaustion, and that "this constitutes the essence of insolation." Then comes this contradictory sentence (which is probably a mistransla-

1. *Allg. Med. Cent. Zeit*, No. 47, 1878.

tion): "The foundation of the symptoms is the exhaustion of the oxygen of the blood, which is the consequence of failing respiration and circulation." He obviously intends to state that exhaustion of the vital (nerve) force results: (1) in impaired respiration and circulation, (2) deficient supply of oxygen to the blood. "The foundation of the symptoms," therefore, is the exhaustion of the vital (nerve) force, and not the exhaustion of oxygen of the blood, which evidently is but an effect.

There is a strange overlapping of what may be called the intermediate effects of the exhaustion produced by heat, passing at once from "insolation" to the "chronic cachexia." It is not at all likely that the stage of chronic cachexia can often be reached without previous disturbances occurring, sufficiently well marked to require attention; cases that reach this stage without active manifestation of disease are very rare exceptions to the general rule. Such can hardly be possible, since deficiency of oxygen in the blood means also excess of carbonic acid, which, when in very moderate excess, is a cardiac and respiratory stimulant, producing fever, and when in great excess, results inevitably in phenomena that could not be overlooked.

The so-called malarial diseases fill the omissions alluded to, between insolation and chronic tropical cachexia.

CHAPTER IV.

INTRODUCTORY REMARKS.

What do we know of things that we do not perceive by our senses? Let us imagine ourselves blind and deaf, and without the senses of smell and taste, possessed of a general sense of feeling only—what would we be able to learn? How much could we know of any subject? This is our condition in regard to heat—to it we are blind and deaf; neither do we smell or taste it. The opinion commonly held, that we can taste heat, is a mistaken one. We only feel it in the mouth, as on other parts or surfaces of the body. We call this sensation warmth or heat. It is only through a certain range of temperature that we know heat by our own sensations or feeling, as is well shown by the fact that a very hot object applied to the body, unrecognized by our special senses, may cause a sensation of extreme cold, or pain, and an extremely cold object may cause a sensation of burning or pain only.

We may as well admit, at once, that we know but little of heat by means of our senses—our perceptions—and that very nearly all that we know of its properties and power we have learned by observing its effects. The observation has been made, and proved by experiment, that heat causes or is changeable into

light, mechanical motion, chemical action, electricity and magnetism, and that it may be active, sensible, or at rest—latent.

These suggestions show the difficulties which are in the way of a full and correct knowledge of heat, and these difficulties are here only hinted at. To appreciate them fully it is necessary to study the subject of heat more in detail. It is necessary to investigate the subject of solar heat and its various phenomena, its source, quantity, effect, radiation, reflection, refraction, convection, conduction, etc. This leads us to the questions or facts of the dew point, rain, evaporation, frost, congelation, thermo-electricity, thermo-dynamics, specific heat or capacity for heat of different substances, or the same substance in different circumstances, and its effect upon vegetable and animal life and growth. These remarks are made with the design of calling attention to the interesting phenomena and astonishing effects of heat, which cannot be appreciated without a diligent study of the more recent works on physics and chemistry.

Our task is to ascertain the effect of solar heat upon the human body

In order to do this it is necessary to take into account the properties and influences of the atmospheric air, and the source, production and regulation of animal heat, and the absorbing, conducting and radiating power of the living human body, whose normal temperature is 98° F. Where does this heat come from,

how is it formed, how does it happen to be maintained under so many and so great differences in temperature of the surrounding atmosphere and other disturbing influences? We know that friction develops heat, consequently we account for a portion of the heat produced by muscular exercise and the friction of the currents of the swiftly circulating blood. We also know that combustion—chemical action—evolves heat, consequently we account for another and the chief portion of animal heat by the oxidation of the blood and tissues, and the innumerable chemical changes which take place in digestion and nutrition, as also in the removal of the worn out molecules of the tissues and the processes of the secretions.

Chemical action is no doubt the main source of animal heat. But what regulates this chemical action so as to produce just heat enough to maintain the temperature at 98°?—the standard of health—whether the temperature be 32° F. or even lower, or 100° F., or even higher. When the atmospheric temperature is below 98° F., the body, of course, loses heat by radiation and convection, which must be supplied by an increase in production. But what regulates the rate of the production? We are well aware that the sympathetic nerve centers regulate and preside over digestion, circulation, nutrition, secretion and respiration, but the fact of its regulating heat production has been very strangely overlooked or disregarded.

CHAPTER V.

HUMAN TEMPERATURE.

The question, How does the body maintain its normal temperature of 98° F., when the temperature of the surrounding atmospheric air is above it? is one of the most interesting and important in the whole range of physiology.[1] If it receives any of it (external heat), its temperature must rise unless the heat be changed into some other form of force. It is evidently a very bad conductor, else we should surely be destroyed upon going into a Turkish bath at 212° F., as is frequently done. But its safety depends mainly upon its defense by means of free perspiration and vaporization of water from its surface, thereby changing the excess of sensible heat into latent heat upon the surface before it has entered the body. This effort to protect itself is not always successful, as is seen in sunstroke.

When the surrounding temperature is far below 98° F., the normal point, there is increased activity in respiration, circulation and heat production; whenever the surrounding temperature is above the normal degree, there is an active effort, wonderful in its character, to protect itself from its injurious effects

1. Dalton's Physiology, p. 317.

mainly by free, copious perspiration covering the surface of the body with water in order that evaporation may convert some of the excessive sensible heat into latent heat, or some other form of force. Where resides the power presiding over these activities manifested in protecting the body against deficient or excessive outside temperature? H. C. Woods, Jr., says, in a center located higher than the pons varoli.[1]

That it resides somewhere in the centers of the sympathetic system there should no longer be any doubt. They (the temperature centers) are intimately associated with the vaso-motor centers. In the undue excitation of these temperature centers, unduly stimulated by the frequent calls upon them through the afferent nerves to maintain the normal temperature; the frequency and urgency of these calls suddenly changing from one to another condition, from hot to cold, and especially in the over-excitation by a high outside temperature, loaded with moisture, (thereby preventing free surface vaporization) their tone, potentiality, health, normal condition is altered, lowered; they become unduly irritable, and therein lies the fundamental cause of all diseases now known by the term malarial, as well as the fundamental cause of many other diseases not so well marked by a distinct rigor, etc.

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1. H. C. Woods, Therapeutics; Ott, on Action of Medicine. p. 42.

CHAPTER VI.

RELATION OF THE TEMPERATURE CENTERS TO THE VASO-MOTOR CENTERS.

That the temperature centers are closely associated with the vaso-motor centers is evident, from the fact that in diseases remarkable for disturbances in temperature, there is also a well marked derangement of the circulation, and this, in some instances, even before the distinctive disturbances in temperature take place. But then, in farther illustration and proof it is only necessary to keep in mind the fact that "*malarial*" diseases are not always marked by chills and fever, or either of these phenomena. We have organic affections of the spleen, derangements of various forms of the liver and stomach, intestines, mesenteric glands, diarrhœa, dysentery,catarrh, neuralgia, dropsy, asthma, paralysis, apoplexy, insanity, skin diseases, etc., unquestionably owing to the same "malarial" cause, yet without the distinctive chill and fever, and these diseases are all due to disturbances of the centers governing temperature, respiration, circulation and nutrition. Why the periodicity in the inter and remittent forms? It is now a well established fact that there are regular electrical and barometrical tidal waves, as well as irregular or accidental ones. There are also rythmic processes, or states in the

human system beside the obvious ones of the lungs, heart and arteries. There are also rythms in temperature and blood pressure, and tissue metamorphosis. Hence it is easy to comprehend that marked periodic or rythmic disturbances may occur in temperature and circulation.

Further proof lies in the fact that the cinchona alkaloids, giving tone and strength to the sympathetic centers, cure the "malarial" diseases. So to a greater or less degree of other substances that give tone to the sympathetic centers. They have more or less effect, as strychnia, opium, arsenic, iodine, etc., although none are equal to the cinchona alkaloids, just in proportion as they are not equal to these in *tonic* effect upon the sympathetic centers, as they are unequal to these in preventing *shock*, which is in reality a disturbance, an undue excitation of the sympathetic centers of temperature, respiration and circulation. Many and various direct exciting causes produce chill, followed by reaction (fever), but if the tone (potential energy) of the sympathetic centers is unimpaired, health is speedily restored. When, however, the potential energy of the sympathetic centers of temperature and circulation have been lowered by the undue and prolonged excitation of heat, especially solar heat, health is not established until those centers have been restored to their normal energy; which is never speedily accomplished, requiring both time and well-suited remedial and hygienic measures. In this fact lies the reason and necessity for a correct pathology.

If we deem, or suppose, the disease due to some noxious element floating in the blood, or fixed in the tissues, we are very apt to imagine, or believe, that we can neutralize it by administering a suitable antidote, and since 20 or 30 grains of a cinchona alkaloid frequently arrest chill and fever we conclude that to be the necessary and sufficient amount, and that quantity having been administered, we cease treatment.

If, however, instead of being guided by this erroneous view we act upon a knowledge of the fact that the disease is due to abnormal irritability and enfeeblement of the sympathetic centers, we cannot reasonably believe that it is possible to *cure* the disease in 24 hours, and that what we accomplish by 20 or 30 grains of quinine is simply a removal or a suppression (frequently only temporary) of its most prominent symptom; consequently we continue the treatment of the case by the administration of tonics and well-suited hygienic measures. From many years observation I am fully convinced that the old *material* notion of these diseases is fraught with mischief to both patient and physician, the patient suffering from frequent relapses and long-continued ill health, while the physician becomes distrustful of his science, and disgusted with his art. It is on this account that these thoughts have been put upon paper, with a full appreciation of the satisfaction that practice, based upon the view advanced, gives to both patient and practitioner.

CHAPTER VII.

REJECTION OF OBSOLETE TERMS.

In order, then, to remove and avoid the erroneous ideas resulting from the use of the word *malaria*, it will be advantageous to discard this term, and to adopt in its place the term *hyper-therma*, or excessive heat. For it is quite evident that the air, *per se*, has nothing to do with the production of the diseases now known as the malarial diseases.

If even the cause were some gaseous emanation from vegetable decomposition or other sources, a microscopic fungi, or any other material thing, the air would be only the vehicle, at most, and therefore should not be charged as the cause of so much evil. But more than this, it is altogether unscientific, since we *know* that *it* is not the cause. And since high solar heat is the only unusual thing, or element, which is always present where these diseases prevail, and since we know that they do not prevail without it, do we not, even therefrom, *know* that *it is*, at least, the chief cause of them? There are, no doubt, auxiliary causes (as also conditions counteracting its injurious effects), which modify or increase its disturbing powers, such as foul air in ill-ventilated rooms, unsuitable or badly-cooked food, over-work, and all other agencies which depress health. It is

supposed unnecessary to enter into a fuller consideration of the propriety of using terms that convey truthful as well as useful ideas. Accordingly, the term, hyper-therma, is adopted, not to convey the idea that a normal degree of heat is bad or injurious, but that a long-continued high solar heat, and the changes it undergoes, and the effects it produces, directly and indirectly, causes an abnormal irritability of the nerve-centers of the human body, which results in disease.

The decrease and the increase of the body temperature, the chill and the fever, the depressed and the accelerated heart's action, pulse and respiration; the coated tongue and anorexia; the constipation and diarrhœa or dysentery; the deranged urinary and biliary secretions; the headache, delirium, convulsions and coma; the derangement of the intellect, sensation and voluntary motion; the neuralgic pains; the functional and organic diseases of the liver, spleen, lungs, stomach, intestines and skin; anæmia, chlorosis, hydræmia are not the immediate result of excessive heat, but they are the immediate result of unduly irritable nerve-centers, whose office it is to govern temperature, circulation, respiration, nutrition, sensation, voluntary motion, etc.; and this abnormal irritability, or lack of potentiality of the nerve-centers, is undoubtedly the effect of excessive heat. The derangements above indicated have been said to be due to a specific poison present in the blood, or, perhaps, deposited among the tissues. If such were the

case, we can be certain that there would be a fixed period of incubation, and a regular course and termination in these diseases, as in small-pox, measles, scarlet fever, etc., and that they would be contagious and present definite pathological lesions, and that, once arrested, there would be no recurrence without exposure to the specific cause.

CHAPTER VIII.

ANIMAL TEMPERATURE; ITS RELATION TO HEALTH, ETC.

The vital processes of the human system are soon arrested by a body temperature of 92° and under, and 107° and over. Some birds have a normal temperature of 112° F. Horses and cattle have a lower temperature than man; frogs and reptiles have a temperature of about 56° F., lower still. The constituent elements, ultimate and proximate, and the arrangement of general structure of all the vertebrata, including man, are similar, or so slightly different that it is impossible thereby to explain their differences in body temperature. And we can conceive of no reasonable explanation, except by a difference in tone or potentiality of their nerve-centers. It has been said, in answer, that the body temperature is in proportion to the respiration and consumption of oxygen; and while this proximately true, it is not an explanation of the cause of the difference in temperature, but is simply presenting the same question in a different form, and the question then is, why do they breathe faster or slower, and consume a greater or smaller amount of oxygen than man? Normal, healthful digestion, absorption, circulation, nutrition and secretion can proceed only at the normal temperature of about 98° F. Consequently, this necessary

degree of heat generation demands as much combustion in cold as in warm weather. And in order to accomplish a certain amount of physical or intellectual labor, as much force production—combustion—is requisite in cold as in warm weather. But in cold weather, radiation of heat from the body is greater than in warm weather. Consequently, increased combustion takes place. It appears that a certain amount of radiation is favorable to health, since health is best maintained at a temperature of about 65° to 75° F., which is from 33° to 23° F. below that of the body. No doubt a considerable amount of heat is lost by radiation when the very best health exists. When, however, the temperature of the atmosphere approaches that of the body, the conditions of temperature and radiation favorable to health gradually disappear, and when it is equal to that of the body, or even higher, health is seriously jeopardized, because the necessary amount of radiation can hardly take place. The body, through the power of its sympathetic temperature governing centers, attempts to relieve itself of its surplus heat by perspiration and vaporization, by which processes a large amount of heat is made to disappear, and when the condition of the atmosphere is favorable to free vaporization and radiation, success usually attends these efforts; but when the atmosphere is already saturated with moisture, vaporization and radiation are so greatly interfered with that the nerve-centers, in their efforts to regulate the temperature, suffer over-excitation and

lose their tone in a manner similar and parallel to that which results from over-excitation of the centers of sight, hearing, intellection, etc., and finally fail to maintain the bodily temperature constant, disease in various forms, heretofore called malarial, becoming manifest.

It appears unnecessary to multiply words on these points.

1st. That the temperature of the body is governed by the sympathetic nerve-centers as a temperature center.

2d. That in order to the healthy performance of this function, those nerve-centers must possess a certain degree of tone potential energy).

3d. That long-continued high atmospheric temperature, especially when saturated with aqueous vapor, produces over-excitation of those heat governing nerve-centers, resulting in a depression of their normal potential energy.

4th. That the abnormal state of those centers is the cause of all the diseases for a long time past known by the term malarial, or malarious diseases.

CHAPTER IX.

REASONS FOR PROGRESS.

It has been imagined and proclaimed unnecessary to discover the true cause of these diseases, on the ground that the medical profession knows perfectly well how to treat and cure them. It must, however, be readily conceded that successful treatment, in prevention, especially, but also with a view to cure, depends, to a very great extent, upon a correct knowledge of the cause and pathology. And this knowledge enables us to understand the action of our remedies, to prescribe intelligently, judiciously, and with confidence and success. But above all, the satisfaction of knowing the truth is beyond price. How is it possible to endure, to go on and on, for centuries and ages, in ignorance on so important a subject, important in the highest degree, socially and financially, to millions of human beings?

But, it will be asked, what benefit will the knowledge that these diseases are caused by luminous solar heat, bring? Can these diseases thereby be avoided? A fitting answer would be this: How do you avoid injuring your retina—sense of sight? The answer should, and probably would be, by not over-straining it, especially in a bad light. Just so of the sympathetic temperature centers—avoid overstraining them,

especially in a bad solar heat. When the body is surrounded by an excessively heated atmosphere, the urgent mandate (figuratively speaking) goes out from the temperature-centers to the skin to protect and relieve the body from excessive heat by perspiration and vaporization. When, on the following night, with a clear sky and a dry atmosphere, radiation is going on very rapidly, so that the temperature has fallen from 30° to 50° or more, down to perhaps 40° F., the temperature-centers are sharply excited by the call from the surface of the body for more combustion—heat. These alternating and different excitations of the temperature-centers must be avoided if we would avoid the diseases heretofore known as the malarial diseases. The proper name for these diseases, based on pathological lesion, would be "*Paresis of the temperature or sympathetic centers.*"

Therefore, as a means of protection, it is necessary—

1st. To avoid excessive solar heat, and especially very active bodily exercise in such solar heat, lest thereby further overtaxing the temperature-centers.

2d. To avoid too rapid and too low cooling after having been subjected to high solar heat.

3d. To avoid excess and deficiency of food; especially the saccharine and fatty kinds, in improper quantity, and badly-cooked, or stale, or unripe foods, and impure drinking water.

4th. To wear suitable clothing—cooler in the daytime, warmer at night.

5th. Surface and underground drainage, to prevent too much aqueous vapor in the atmosphere, which hinders free radiation from the body; shade trees, etc.

These points it is particularly important to observe, but there are many minor ones that it is by no means safe to neglect—temperance in all things, cleanliness, bathing, well-ventilated, dry rooms, and, in short, all the conditions necessary to good general health.

CHAPTER X.

THE SYMPATHETIC CENTERS.

It may be advantageous to recall to mind a few points in regard to the sympathetic centers, and, perhaps, better, to the entire arrangement of the gray nerve-cells, their structure, of cell nuclei and prolongation or poles, dividing them into a-polar, uni-polar, bi-polar and multi-polar cells, situated in the ganglia of the great ganglionic chain from the brain to the coccyx, in the heart, the retina and other organs, and in great abundance in the spinal cord, medulla and brain, all connected and associated by means of the nerve-fibres into a harmonious sympathetic apparatus—the center and governor of circulation, respiration, calorification (temperature), digestion, assimilation, dissimilation, secretion, sensation, voluntary and involuntary motion, memory and intellect. With these facts in mind it is not difficult to comprehend how a derangement of its tone—potential energy—causes giddiness, syncope, delirium, neuralgia, stupor or coma, convulsions, paralysis, chills and fevers, diseases of the lungs, heart, liver, stomach and intestines, and skin, as well as the very dangerous so-called congestions.

To persons who have not resided in districts where this disease prevails, nor otherwise acquainted with

them, it might be interesting to see reliable reports of cases under these several heads. Since it would be of no particular advantage to them, not being concerned in their prevention or cure, it is deemed unnecessary to here present such reports. Enough such cases have appeared in the medical journals and been reported to medical societies. If collected and published, they would fill a large library, and satisfy the curiosity and scruples of the most obdurate skeptic. Those who have lived, and especially those who have practiced medicine in such districts, do not require verbal evidence of the occurrence of such cases. With them there remains no doubt.

CHAPTER XI.

THE HISTORY OF THE THEORY OF HEAT.

Hippocrates believed heat to be the cause of the diseases which afterwards came to be known by the designation "malarial." Many other careful, thoughtful, scientific men have held the same opinion, espepecially in the past fifty years. By whom the term malarial was first adopted is probably unknown. Not unlikely, however, by Galen, since he was decidedly materialistic in his views, and no one holding the opinion that heat is a material substance, would be at all inclined to accept the theory that the so-called malarial diseases are due to its effects. The fact, however, that heat is not a material substance [1] but a force, or mode of motion, changeable into other forms of force, is now so widely recognized and firmly established, that all theories based on the supposition of heat being a material substance must be abandoned. It may be humiliating to acknowledge that more correct ideas of heat and its effects were prevalent 2,200 years ago than are commonly held now, but such superior knowledge has shown that much idle boasting has been indulged in by men in modern times.

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1. Tyndall, Herschell, Fownes.

CHAPTER XII.

ANIMAL QUINOIDINE.

The substance or property discovered in man and animals by H. Bence Jones, and subsequently by Dr. Chalvet in wines and various foods, and therefore not properly named, may be an agent or condition necessary to a healthful condition of the sympathetic nerve-centers. This is rendered probable by the fact that it is present in the blood in much smaller proportion or even entirely absent in the so-called malarial diseases. It is not improbable that this substance or property is destroyed or so modified by heat—its fluorescence changed—that the nervous system becomes affected. In this may lie the secret of the beneficial effects of the cinchona alkaloids. But since fluorescence is evidently due to a peculiar molecular condition, and not to the nature of the atomic elements of certain organic compounds, it is quite probable that there is no such substance as "animal quinoidine,"—the peculiar molecular action of many substances, in certain conditions, having the effect of making non-luminous rays visible—fluorescent. Whether the molecular condition of the blood, or of some of its constituents, which gives rise to fluorescence, has any relation to the health and tone of the nervous system is a very interesting question, the solution of which

will probably throw much light on pathology and therapeutics.

Since the foregoing pages were written, Dr. Abel, of Lakewood, Illinois, has kindly furnished me with a copy of Dr. Oldham's book, entitled "What is Malaria?" The facts and incidents concerning the etiology of the so-called "malarial" diseases, presented in this unpretentious volume, utterly demolish the notions commonly entertained and very elaborately set forth in some of the text-books on the practice of medicine, both the vague "*malarial*" and the more definite "*marsh miasm*" theories. Indeed, so far as facts bearing on the etiology of these diseases can be of any service, this little volume covers the entire ground, and the deductions made from those facts are also invaluable, but perhaps they are hardly sufficiently definite to be readily apprehended and accepted by the reader. Dr. Oldham says, "No doubt, in those who have suffered from malarial fever and especially from repeated attacks, there is an impaired state of the *heat generating* powers, or in other words a diminished power to resist the effects of cold; and this condition it is which causes the great tendency to a recurrence of the complaint, on exposure to a very moderate degree of chill. This state, in most cases, passes off gradually as the health improves, after a longer or shorter residence in a healthy climate; but it occasionally remains for a very long time. It is then admitted, that a great sensibility to cold *predisposes to*, and that exposure to chill *causes*,

the so-called relapses of malarious fever. But, as I have already shown, *these are the very influences which produce the primary attack.* Thus, an impaired state of the heat generating power is produced by continued exposure to great heat and this renders the system highly sensitive to the effects of chill.

"Then, the seasons at which malaria is most prevalent, are those in which comparative cold succeeds rapidly to the greatest degree of heat, and in which the vital powers, depressed by the previous high temperature, are least able to resist the effects of the rapid alternations of heat and cold. Night is the most deadly time, and especially the latter part of it, when the animal powers are at the lowest, and when, from the general loss of heat by radiation, they are tried to their utmost to maintain the temperature of the body. In the situation in which malaria is most commonly met with, the already overtaxed heat producing powers have also to contend with the intensely chilling influence of damp. It is moreover found, that the measures which afford the greatest protection against the influence of malaria, are those which tend to preserve the body from violent alterations of temperature. *In short, it is clear that the cause of malarious fever is chill.*"

"Thus, each attack of intermittent or remittent fever, whether primary or secondary, arises from the operation of the same cause, and while the increased liability to recurrence after frequent or severe attacks is owing, not to the presence in the system of

any dormant poison, but merely to a depressed state of the heat producing powers, similar to that which is produced by continuous exposure to great heat."

Unfortunately Dr. Oldham weakens his position, and obscures his deductions, by asserting that "it is clear that the cause of malarious fevers is chill." By "chill" he means abstraction of heat from the body, producing a sensation of chilliness or cold. But since elimination of heat is a normal and constant act of the healthy body, a process necessary to the preservation of health, it is evident that there must be a prior disease—paretic condition of the sympathetic heat regulating temperature-centers—else the abstraction of heat could have no direct evil result. The loss of heat and sensation of chill, are no doubt excitants of the nerve-centers, and it can be readily perceived that this excitation increases the paresis already present, from over-excitation by solar heat, still further; but to say that "chill is the cause of malarious fevers," is confusing, and, to a considerable degree, incorrect. However, Dr. Oldham's work, taken as a whole, is probably as complete a demonstration of the *true etiology* of the so-called malarial fevers, as it is possible to produce or reasonable to desire.

The January, 1879, number of the *St. Louis Medical and Surgical Journal* has just come to hand this morning, in which I find a synopsis of a paper on "Sunstroke," by Dr. C. H. Hughes, in which he presents a truly scientific view of the pathology and

etiology of that disease, and which confirms, admirably, the views herein advanced in regard to the so-called malarious diseases. In the same number I find, also, a charming paper by Dr. Trader, of Sedalia, Mo., on "Our Surroundings," in which he handles and exhibits ores, dug from a veritable "Comstock," abounding in the richest and most precious scientific facts, bearing on the etiology of these diseases. I had intended to notice, in a more especial manner, the views of some of the authors of standard text-books on the practice of medicine, as Aitken, Tanner, Roberts, Watson, Niemeyer, Hertz, in Ziemssen, Dunglison, Wood and Flint, but cannot do so now for want of time and space; neither can I comprehend any real necessity for it, nor benefit to be derived therefrom, since it would be impossible to give their views *in extenso*, and an incomplete or partial presentation of their views of the subject is not deemed advisable. I may add, however, that I think it would be advantageous to those who have not recently or specially examined this subject, to study carefully the views of all the authors named; for their views are not all alike; and to compare them impartially in the light of recently discovered facts in the physiology of the nervous system with those herein presented. From the theories presented, it becomes apparent that the views on the subject have been in a transition state—undergoing development for some time past.

In an article by Dr. Littell, published in the trans-

actions of the American Medical Society for 1866, are given some very valuable and irresistible facts and arguments against the old and crude theories of "malaria," and against the narrow facts and immature views of Lancisi in favor of his theories on marsh miasm. I would be glad to embody some of Dr. Littell's facts and conclusions, but cannot for want of time. I will, however, add that in my opinion his paper is well worth a careful reading. Its conclusions have not been accepted for very obvious reasons; yet they are really very nearly correct, so far as they relate to endemic malarial diseases. Had he not so seriously confounded electricity with solar heat and nerve force, and had he not been so extravagant as to claim that even the contagious diseases (some of which are known to have a specific cause) are due to electricity, his interesting paper would have had greater influence. The similarity between solar heat, electricity, and nerve force, is certainly very striking, and that heat is convertible into electricity, and *vice versa*, is an established truth; but the same cannot be said as to electricity and nerve force, nor as to heat and nerve force, for, although there is a remarkable idendity in their effects in certain conditions, it were futile to claim that they are identical in nature and source. Whether any part, or at most any appreciable part, of the excessive solar heat which destroys the potential energy of the nerve-centers, is converted into electricity when it disappears as sensible heat, upon the surface of the body, is a question of very difficult solution, and probably of no practical importance, in relation to the so-called malarial diseases.

CHAPTER XIII.

PREDISPOSING AND EXCITING, AND SPECIAL EXCITING CAUSES.

In order to give additional clearness to the subject of the etiology of these diseases, it may be well to make a division of their causation into *predisposing and exciting*, and *special exciting* causes. Such distinctions are probably mainly applicable only to intermittent, remittent and malarial typhoid fevers, and diarrhœa and dysentery. At any rate, these forms of the thermal diseases are more frequently precipitated, or excited into their characteristic phenomena by special causes (such as a damp chilling air or wind, mental and bodily fatigue, sudden over-exertion, indigestible food, menstruation, and so on), than the thermal cachexia. Many attacks of these diseases occur, in which no special exciting cause can be discovered, fairly considered, having any influence in the causation of the disease, the whole cause being solar and radiant heat. In such cases, heat is at once the predisposing and exciting cause. But there are many attacks the outbreak of which are clearly traceable to a special exciting cause, such as those before named; and it is these that are included under the phrase, "special exciting causes." I will illustrate the subject in this

way: A man undertakes to walk a certain distance without food or rest; he becomes gradually exhausted, and if the distance be too great he falls down from sheer exhaustion, it being the whole cause of his fall, predisposing and exciting. But if on his journey he meet with unexpected obstacles, hills, mud, fences, for instance, he will fall the sooner, and these obstructions may properly be held as *special* exciting causes to his fall. In the thermal diseases we have frequent and numerous causes of this character. They are very well calculated to mislead us in our search for the true cause of these diseases, and are the main source of the confusion and misconception that has existed for so many years in the minds of the profession upon this subject; the whole field of professional vision having been occupied by the multitude of special exciting causes, the great chief cause, solar heat, underlying the whole subject, was seen but dimly, or not perceived at all.

CHAPTER XIV.

IRRITABILITY OF THE NERVOUS SYSTEM.

In the normal condition of man there is necessarily a certain standard degree of sensibility or irritability, or in other words, molecular activity of the nerve fibers and nerve cells. It is by this means (nerve excitability) that the human organism adapts itself to so many and varying circumstances, and defends and maintains itself against a multitude of pernicious influences from within and without. Unfortunately we have no means of much practical value of measuring the degree of this normal irritability. By means of the thermometer we have ascertained the fact that the normal degree of human temperature is 98° F. By means of the same instrument we also discover all variations from this standard normal degree; but we possess no means of detecting such characteristic conditions of the nervous system with any great measure of accuracy. It is true we can measure surface sensibility, and by means of electricity we obtain some idea of motor irritability, but for fullness of import and practical value, there is no comparison in this with what we learn of temperature by the thermometer.

We estimate the condition of the brain by its intellectual manifestations; that of the spinal cord by

its motor and reflex activity or irritability; but by what means shall we determine the degree of irritability, the tone—the potential energy of the sympathetic system—the great governor of the organic or vegetative functions? We can form only a vague and doubtful estimate of its conditions from the manner in which the organic functions are performed.

For our purpose it is unnecessary to refer to the excitability or special manifestations of excitation peculiar to the cerebrum, cerebellum and spinal cord, since we are concerned with phenomena which depend mainly upon the irritability and tone of the sympathetic. It is owing to this property of the sympathetic mainly, that the sensation of hunger arises when the body needs nourishment, and the senation of thirst when it is in want of water; that the pupil contracts when exposed to strong light; that the sense of dyspnœa arises when the blood is in want of oxygen and surcharged with carbonic acid; that the heart and arteries are caused to act so as to convey nutriment elements to the tissues; that the mouth "waters" at the sight or smell of savory articles of food; that the parotid pours forth an abundant secretion, of suitable quality, upon the placing of food in the mouth; that the secretion of gastric juice takes place when the food reaches the stomach; that the bile, pancreatic and intestinal secretions are poured out by presence of the food about the orifices of the ducts; that the peristaltic action of the intestines takes place; that the presence of unwholesome, irri-

tating or poisonous substances causes nausea, vomiting, diarrhœa, pain and general disturbance of the organism; that conception causes development of the uterus, mammæ, etc.; that irritation of the nipples causes increased flow of blood to the mammæ, increased secretion of milk and contraction of the uterus; that the introduction of a catheter may cause syncope; that the injection of fluids, even water into the peritoneal cavity, may cause death from syncope and shock; that the application of warmth or heat to the surface produces perspiration and thus protection against excess of heat.

To say that the functions of the cerebral, spinal and sympathetic are distinct and independent of each other would be entirely erroneous. There is a most complete and undistinguishable inter-communication and inter-dependence between these three anatomical divisions of the nervous system. Nor can any material difference in function be reasonably expected from structures so nearly identical in cellular, nuclear, granular and fibrous elements, differing mainly only in general arrangement and distribution. The purpose of the whole being the same—the growth and preservation of the human organism; the cerebrum to gain cognizance of surrounding objects, and to estimate its condition relative to those circumstances; the spinal system for purposes of action, locomotion, aggression, prehension, defense; the sympathetic for the internal economy—digestion, assimilation, nutrition, reproduction, temperature, etc.

CHAPTER XV.

ABNORMAL IRRITABILITY.

The normal irritability—tone—of the nervous system demands for its maintenance a certain amount and degree of excitation. If secluded from objects and conditions which act as healthful stimuli, it soon loses the properties which characterize it when in a normal condition. It cannot be deemed necessary to give illustrations of this fact. It is a fact patent to every intelligent mind. When, however, the stimulus is of a (1) pernicious character, or (2) too frequently repeated, or (3) excessive in amount and degree, or (4) too long continued, as (1) a narcotic or irritant or acro-narcotic poison, (2) light to the eye, electric shocks, etc., (3) heat or its absence—cold, (4) mental work, etc., the result is a depression or exhaustion of the normal irritability—a lowering of tone, a derangement of potential energy. This condition may be temporary, or may continue for some time, or may be permanent. The consequences of this depression or derangement of the normal irritability (paresis) of the sympathetic system can be readily enough educed from a knowledge of the conditions of the various physiological functions and processes controlled and maintained by what is usually termed healthful innervation.

It has been said that some of these processes (nutrition, for instance,) are not due to any special influence of the nervous system, since they take place in the plant. This is readily conceded as regards that function or process in the plant (in vegetable growth), but it is entirely incorrect as regards nutrition or any other function in the adult human organism.

For illustrations and examples of pathological conditions, primary and secondary, resulting from paresis of the sympathetic centers, the reader is referred to the article on "Symptoms and Pathology." (See also Carpenter's "Principles of Physiology," 464 to 468.)

CHAPTER XVI.

EXCITATION PARESIS.

Excitation of the nervous system, (1) by excessive heat, applied from without, (2) by too great retention of the heat generated normally in the body, and (3) by too rapid loss of animal heat by radiation and vaporization and convection, produces paresis or abnormal irritability of the sympathetic centers.

For illustrations we have (1) sunstroke (insolation), "ardent" fevers, nausea and vomiting, (2) syncope, neuralgia, headache, loss of appetite and the various derangements which are usually placed in the list, said to be due to living in overheated rooms, although such overheated rooms have temperatures scarcely as high as 80° F., and (3) chill, drowsiness, catarrhs, pneumonias, etc. (See Hanfield Jones, Clinical Obs., p. 33. Carpenter's Principles of Phys., 603-677.)[1]

Anæmia, hydræmia, chlorosis, inanition, etc., greatly favor the production of heat-paresis, etc., inducing this condition far more readily than when the system is in a healthy state. Excitation of the nervous sys-

1. The fact that the heat generating power is not equally energetic in all individuals, nor in the same individual at all periods of the year, nor of a single day, has so important a bearing on the question under consideration that it will be well not to lose sight of it. (Ibid 675-6. Dalton 304.)

tem by heat is modified in a very interesting manner, and to a great degree, by the amount of moisture, the degree of temperature and the quietness or mobility of the atmosphere. These facts are more strikingly apparent when presented in a condensed tabular form.

CHAPTER XVII.

CONDITION OF AIR—EFFECT.

Hot, dry still air—radiation rapid, vaporization free, convection low. Hot dry wind—radiation good, vaporization very free, convection free. Hot, moist still air—radiation very low, vaporization low, convection low. Hot moist wind—radiation low, vaporization low, convection low. Cold, dry still air—radiation good, vaporization very moderate, convection low. Cold dry wind—radiation fair, vaporization very low, convection good. Cold, moist still air—radiation very low, vaporization very low, convection good. Cold moist wind—radiation very low, vaporization zero, convection rapid, chilling.

This table furnishes the basis for a comparative idea of the effects of differences in degrees of heat, moisture and mobility of the atmosphere.[1]

After long continued high heat, the heat-generating power is found to be very feeble (see Carpenter's Principles, 676), which is due to the paresis or lowered irritability of the temperature centers. This is the explanation of chilliness so readily experienced upon even slight depression of temperature under those circumstances. The sensation of chill does not indi-

1. Tyndall, Heat as a Mode of Motion, 425-432.

cate, necessarily, a low temperature, for the same reason. It may be present when the temperature of the body is above the normal standard. This is a paradoxical phenomenon quite common in thermal paresis of the sympathetic.[1]

Sympathetic disturbances from sensory impressions are among the most complex yet interesting and important subjects. A tap upon the abdomen may dangerously interfere with the action of the heart. Pinching the skin is sufficient to kill some animals. Dysmenorrhœal pain will cause extreme lowering of the temperature.[2]

Anatomical structure and chemical characteristics of the skin have a modifying influence upon the reception of heat by the body and its escape therefrom. The thick, black, sooty, oily skin of the negro *transmits* heat much less readily, although it radiates external heat much more freely than the skin of the white man. It is almost entirely due to the peculiar structure and properties of the skin that the negro possesses a comparative degree of immunity, under certain circumstances, from thermal diseases.[3]

Degrees of dryness and moisture, as well as oiliness of the surface, exert an important modifying influence upon the action and effects of heat upon the skin and upon the organism generally.

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1. Hanfield Jones, Clinical Obs., 288. Erb in Ziemssen, xi., p 7.

2. Ott, Physiol. Action Medicine, 288.

3. Oldham, 73-77.

The influence of clothing in protecting the body from sudden accessions and from sudden losses of heat, is a very familiar matter, but its importance and philosophy are far too commonly disregarded.[1]

By enveloping themselves in thick wadded coats at sunset, certain tribes of India escape, almost entirely, the injurious influences of abstraction of heat and thereby avoid the so-called malarial diseases.[2]

1. Tyndall, Heat, etc., 202-3.
2. Oldham, What is Malaria? pp. 171-372.

CHAPTER XVIII.

EFFECT OF TOPOGRAPHY ON SOLAR HEAT AND THERMAL DISEASES.

A low, level marshy surface in a hot region, has been long known as extremely subject to the production of thermal (malarial) diseases. It is this circumstance that gave rise to the term marsh miasm, palludal poison, etc. Erroneous as the theories are on which these terms are based, and misleading as these terms are, nevertheless, it is true that a level, marshy, hot region is peculiarly liable to those diseases.[1]

This topography favors in various ways the injurious influences of heat, (1) by an enormously increased accumulation and radiation of solar heat, above that of a rolling, broken, and hilly region, especially if the latter is interspersed with bodies of deep water, (2) by a vast increase of moisture and aqueous vapor in the atmosphere, and in many other ways, that cause injurious effects, directly or indirectly.

The temperature of level regions is invariably much higher than that of broken, hilly or mountainous regions of the same latitude and altitude,—the character of the soil and currents of air being alike in both regions. The differences in surface topography

1. Ziemssen, vol. ii, 566. Oldham, 96-101.

are the main causes of inequalities of temperature at equal distances from the equator. Altitude has a marked influence upon temperature, but it is the broken character of the country that brings about increased altitude in many places, the valleys being as low as the "level regions" in question, the hills being higher.

Temperature does not always correspond with lines of latitude parallel with the equator, owing, in great measure, to the topography of the earth. Thermal (so-called malarial) diseases are governed by *isothermal* lines of latitude.

The rays of the sun strike a level surface, during the whole day, from the time of its rise to the moment of its disappearance below the horizon.

The daily period of sunshine is longer in a level than in a hilly or mountainous region, because there are no hills and mountains to project long evening and morning shadows. The rays fall more vertically on the one than on the other, and for a longer time each day.

Rays falling vertically upon a surface, have an immeasurably greater heating power than oblique rays, as is well known from the fact that the former are the cause of summer, the latter of winter.

Broken surfaces produce many changes in the angles of the rays in the course of a day, and considerable portions of such surfaces are even shaded for some time at one period or another, between sunrise and sunset. This produces many minor surface cur-

rents of air which have the effect of lowering and equalizing the temperature by means of convection.

It has been calculated that the total amount of solar heat received by the earth in a year, if distributed uniformly over the earth's surface, would be sufficient to liquefy a layer of ice 100 feet thick, and covering the whole earth, or would heat an ocean of soft water, surrounding the whole earth, 66 miles deep, from the temperature of melting ice to that of ebullition. But this calculation is based on the power of rays that are vertical, or nearly so. There can be no doubt, that if all the rays of the sun should fall vertically upon the whole surface of the earth, that is, if the surface of the earth were a uniform smooth sphere, like a ball, all its flora and fauna, and diseases would be widely different from those that exist now. The sudden increase in the prevalence of thermal disease which occurs at the beginining of autumn, is no doubt in part due to the cessation of vegetable growth and consequent cessation of consumption of solar heat, instead of being due to the supposed products of vegetable decomposition.[1]

Low level surfaces are said be especially productive of the malignant influence called "malaria," and that this influence is most active near the surface and at night after a very hot day. These observations are based on facts, and are not fancy. Toward morning of a clear night, after a hot day, the thermometer

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1. Tyndall and Sir John Herschel.

will be 10° and 12° and even 20° F. lower on the surface of the earth than four feet above the surface.[1]

Marshy surfaces, shallow ponds of water, etc., in hot localities, vaporize rapidly, and saturate the atmosphere with moisture, thus checking vaporization from the body during the heat of the day, but favoring the abstraction of heat by conduction and convection at night. In this manner over-excitation of the heat regulating centers of the body occurs, which finally results in exhaustion, altered irritability and paresis.

Deep bodies of water are not so readily heated, on account of the multitude and mobility of their particles; compare a thin sheet of water with the Atlantic ocean, which seldom attains a temperature of 70° F. A live swiftly running brook remains cool, while a sluggish, stagnant stream becomes hot and is evaporated.

The extreme amount or power of heat, in low, level regions, is shown in the exuberant vegetation. A portion of this heat is consumed in building up the immense quantities of vegetable fiber, severing the carbon from the carbonic acid in the atmosphere, and the hydrogen from water, which by their union form vegetable fiber, etc., storing up a vast quantity of heat (potential energy), that again becomes manifest when we use it as fuel and food. Without solar heat there would be no rain, no dew, no springs and rivers, no clouds, no glaciers, no snow, no winds, no hurri-

1. Tyndall, Wells, Fownes, on Dew Points, etc.

canes. Is it reasonable to contend that so powerful an agent does not also cause derangements of the human organism, and that such derangements must not necessarily be such as have heretofore been known as the malarial diseases?

CHAPTER XIX.

THE THEORIES OF DECOMPOSITION, FERMENTATION, ETC.

Vegetable decomposition, resulting in the formation of noxious gases, etc., may be an auxiliary in depressing the general health, but has no primal influence as a cause of these diseases. No doubt, there is also some evolution of heat, but it cannot be supposed to be sufficient to have any appreciable effect.

Cities built upon sites that were formerly swamps pestilent with so-called malarial poison, have a fair degree of health, and very little of the former diseases, because evaporation from shallow sheets of water has been arrested, and the angles of the sun's rays have been changed, so as entirely to change the character of the solar heat. Animal and vegetable decomposition goes on to perhaps even a greater degree than formerly. Undoubtedly there is more bad or impure air, than when the locality was a swamp, yet there are not "malarial" diseases. Louisville, Ky., is said to be an illustration.

It is however entirely useless to consider the subject of decomposition any further. The theory is no longer held, unless purely from habit.[1]

The theories of cryptogamic plants, algæ spores, etc.

1. Ziemssen, Wood, et al.

also belong to the speculation of the past; entertaining, brilliant and plausible, yet the miscroscope has demolished them.

A peculiar kind of fermentation has been held to be the cause of the thermal (so-called malarial) fevers. But since there are many diseases allied to those fevers (but without fever), and since the fevers named, often pass into those allied diseases, or *vice versa*, or alternate with one another, and since they occur in the same localities and at the same seasons, and are prevented and cured by the same means, they are evidently due to the same cause. Yet, fermentation is evidently not present in the allied diseases.

Fermentation properly considered, is characterized not only by the formation of carbonic acid and alcohol, or acetic acid or lactic acid, etc., but also, and especially by the development of a new growth of the fungous order. Any other chemical process is not properly fermentation, but should be termed decay when simple oxidation, or decomposition, or putrefaction takes place. In the living organism retrograde changes are continually proceeding, of the saccharine or fatty compounds, resulting in the formation of carbonic acid and water; and the retrograde metamorphosis of the albuminoid compounds resulting in the formation of the simpler ureides. This is, chemically, a decomposition and not a fermentation, and proceeds in health, although at a slower rate than in fever; but it takes place in other fevers as well as in the so-called malarial fevers, consequently it cannot be held

as the cause in the latter, and not of the former.

There have been no chemical compounds discovered in the so-called malarial diseases, whether accompanied by disturbance in temperature or not, that do not occur in the progress of other diseases.

Toxæmia, septicæmia, pyæmia, puerperal fever, etc., are, no doubt, owing to a special noxious element in the blood, but they are characterized by pathological conditions, products and results, utterly different from those of the "malarial" diseases. The two classes of diseases have nothing whatever in common, so far as their etiology is concerned, and must be held as different in nature as Asiatic cholera is from gastro-enteritis.

CHAPTER XX.

PATHOLOGY AND SYMPTOMS.

This branch of the subject is thus epitomized for the purpose of making its relation to the sympathetic centers more readily perceivable.

With a view to clearness, precision, and at the same time a reasonable degree of comprehensiveness, it is deemed best to present this subject under the various heads to which the derangements belong—such as those of innervation, circulation, nutrition, temperature, secretion, etc.

NEUROTIC DERANGEMENTS.

1st. Mental Disturbances.—Mental confusion, distaste and inability for mental effort, mental apathy, weakened memory, drowsiness, wild screams, curses and blows, dizziness, headache, syncope, delirium, stupor, coma, roaring in the ears, seeing sparks, intoxication, melancholy, hypochondriasis, psychical disturbances, hallucinations, maniacal attacks, sleeplessness, distressing dreams, irritability, periodic wakefulness.

2nd. Sensory Disturbances.—Headache, darting pain in the eyes; chilly, creeping sensations over the body; burning pain in the pharynx, œsophagus and over the region of the stomach; a feeling of lassitude

and exhaustion; vague, wandering pains, shooting pains in the limbs, pain in the back and in the back of the head; disturbance of visual accomodation; marked sensitiveness to changes in temperature; cramp-like sense of constriction in the region of the heart; photophobia; sensation of fullness and tension in the epigastrium; nausea, stale, bitter or metallic taste; sensitiveness to changes of temperature, sensation of heat and cold running over the body; complete loss of consciousness and sensibility; chill, and constriction of the chest; insensibility to the sharpest irritants; anxiety, oppression; sensitiveness in the region of liver and spleen of an intermittent character; neuralgias of many different nerves; angina, cardialgia, colic, gastralgia, etc.; anæsthesia of various nerves; micropia, macropia, amblyopia; night-blindness, photophobia, deafness, hyperæsthesia of the surfaces; hallucination of the sight, hearing and touch, etc.; sensation of numbness, formication, tickling or burning pain in the back and over the coccyx of a dragging character; in the joints, character of pain very various.

3rd. Motor Disturbances.—Twitching of the eyelids; disinclination or inability to move; intermittent paralysis of certain limbs; disturbance of speech; apathy; hiccough; shivering and rigor; trembling of the lips, chattering of the teeth; twitching of the muscles; contraction of muscular fibers of the skin, causing the cutis anseria, and a convulsive shuddering of

the whole body; convulsions; contracted, dilated and immovable pupils; hand clenched, jaws set, stiff-neck, body bent either backward or forward, unable to move or utter a sound; tremors, convulsions in single limbs; clonic and tonic spasms and hysteriform and chorea-like seizures; mutism, aphonia, stuttering, opisthotonos, emprosthotonos, pleurosthotonos; paresis in some one or more of the limbs, more rarely muscular contraction; paralysis of tongue and organs of deglutition; paralysis (partial and general), epileptic or tetanic spasms.

4TH. SYMPATHETIC DISTURBANCES.—Diminished appetite; disposition to stretch and yawn; profuse sweating; malaise; sighing; chill and fever; nausea and vomiting; palpitation of the heart; neuralgia of the vagus with yawning, stretching, dyspnœa, cough, etc.; cardialgia, beginning with a feeling of unpleasant oppression, which gradually increases until it amounts to a most severe pain, frequently accompanied by a scarcely perceptible pulse; cold extremities; great anxiety; eructations; vomiting and thirst; neurotic disturbances of the great splanchnics, resulting in colic, diarrhœa or constipation, and affections of the bladder, urethra and uterus. It is claimed that the typical cramp of the vessels supplying certain extremities has been observed; dilated pupils; coldness of the body, like that of marble; choleraic conditions of the body; colliquative sweats; insatiable thirst; great elevation of temperature; rapid tendency to col-

lapse; tenesmus; appetitite normal, diminished, lost entirely or voracious; involuntary evacuations of the bowels and bladder.

Disturbances of Respiration.—Respiration short and rapid, often anxious and sighing, accelerated and noisy; becomes freer and easy, stertorous; dyspnœa; breathing rapid, and stertorous and frothing; respiration is shallow, as slow as ten in a minute; dullness on percussion; increased vocal fremitus; crepitant ronchi; bronchial breathing and bronchophony; cough, dry cough, friction sounds; shortness of breath upon exercising; irregular sighing, respiration; respiration arrested in cases of apparent death; death with all the appearances of asphyxia.

Disturbances of Nutrition.—Inflammatory disturbances of nutrition, as coryza, bronchial catarrh, swelling of the tonsils, tongue, liver and spleen; various skin affections, as erysipelas, purpura, urticaria and pemphigus; iritis and ophthalmia, which may lead to atrophy of the globe; gastritis, peritonitis, pneumonia; bronchitis; inflammation of spleen and liver; grangrene, jaundice, parotitis; enlargement of liver and especially the spleen; gastric or intestinal catarrh; diarrhœa; dysentery; spleen and liver hard and sensitive; furuncles; renal diseases; amyloid and leucæmic conditions; tuberculosis; inflammation; thickening and ulceration of the intestinal glands; thickened capsule of the spleen.

DISTURBANCES OF TEMPERATURE.—Skin hot and dry; fever and apyrexia; fingers cold; temperature of the remote parts of the body below the normal standard; in the mouth, armpits and rectum, above; duration of stage of chill variable; the trunk becomes burning hot and the temperature of the periphery is elevated; nose stone cold; grows warm; burning heat diminishes; temperature rapidly sinks to the normal point; chilliness followed immediately by glowing heat, etc.; the fever paroxysm may betray itself by a periodical sweat, during which the thermometer will indicate a rise of temperature of from one to two degrees; hot stage lasting from twelve to thirty-six hours; chill and heat without sweat, interval of several hours between chill and heat, or between heat and sweat; chill following the heat and sweat, or beginning with heat, followed by chill, ending in sweat. If the anticipating or postponing process is frequently repeated it alters the rythm of the fever. In young children the skin grows cold; after a period of from ten minutes to an hour the hot stage follows incomplete forms in which the chill is lacking, and the hot stage with a very light sweat constitutes the attack. Cold stage ending in death without fever. In marked cases which run their course without fever, or with only partial febrile manifestations, and as a rule of about two hours duration, preceding or following or alternating with the ordinary intermittent form, or other forms, death may result from high temperature; fever may intermit or remit regularly or irregularly, or be

continuous. Algid intermittent; coldness of the surface, like that of marble; temperature in the mouth from 86° to 88° F. and that in the axilla 84°; attack begins with the usual chill; it is not until after the hot stage that the patients turns cold, while at the same time he complains of a burning heat within, and of thirst, and is covered with a cold sweat. Attack usually preceded by an ordinary intermittent, with imperfect reaction. Fever may be of sthenic, typhoid or adynamic character. Death in the cold stage without reaction. In the malarial cachexia never found the temperature elevated, *unless when it assumes an "intermittent or remittent or continuous type."*

Disturbances of Secretion.—Profuse sweating at night; mouth and gums dry; tongue and teeth often covered with a slimy coating; foul breath; constipation or diarrhœa; skin hot and dry; urine scanty, dark colored and turbid, with abundance of urea; commonly sweating after fever. The urine is usually increased in quantity, clear and watery, of low specific gravity, and without sediment, during the stage of chill. During the hot stage urine is scanty, red and of high specific gravity. In the sweating stage, urine is copious, of high specific gravity, rich in solid ingredients, and throws down a brickdust sediment of the urates; on moving about or making the least physical effort, he breaks into a sweat; urine is sometimes dark and throws down a brickdust deposit; chill and fever not followed by sweat, or chill lasts for a few

minutes and the patient breaks out in a profuse sweat, or there may be only a periodical sweat; irregular sweating stages; running of the nose; periodic diarrhœa; sweating may be more or less well marked. Skin hot and dry; mouth and tongue also dry, and often covered with a fuliginous coat; patient comes to himself in the midst of a profuse sweat; streaming perspiration; skin of the body is hot and dry; choleraic discharges from bowels, becoming more and more watery, and sometimes resembling bloody water; skin covered with a cold sweat; muco-bilious vomiting; greenish-yellow stools; urine free from albumen, but scanty, etc.; copious dejections from the bowels; first of a serous character, afterwards consisting of blood and mucus, or of pure blood; vomiting of a brownish or bloody fluid, while at the same time there are copious watery passages from the bowels; vomiting of bile and bilious diarrhœa; urine scant; deep red color from abundunce of biliary coloring matter; urine yellow, staining the linen; urine in great abundance, dark brown and rich in blood; increased secretion of saliva; urine excessively abundant, clear as water, low specific gravity, without abnormal constituents.

DERANGEMENT OF CIRCULATION.

1st. Cardiac Disturbances.—The impulse of the heart is augmented; carotids throb; pulse rises in frequency, action becomes extremely rapid and feeble; pulse may be normal; in certain cases the heart's ac-

tion is extremely variable both in size and frequency; pulse may be feeble though not frequent, irregularity of pulse finally terminating in paralysis of the heart; sometimes fast, sometimes slow, sometimes full; the pulse is irregular, often much retarded, is slow as forty in the minute, small and thready; again quite small, even becoming entirely unrecognizable, palpitation and blood murmurs in the heart.

2ND. ARTERIAL AND VENOUS DISTURBANCES.—Pulse regular, though small and frequent; carotids throb, pulse full and hard; now and then the pulse may become frequent, with imperfect intermissions; pulse small, scarcely to be counted; the pulse becomes softer, wave-like and regular, and diminished in frequency; distended jugular veins; external hyperæmia and swelling of the spleen; apoplexy of the spleen with rupture and escape of blood into the peritoneum, or gangrene of that organ; extravasation of blood in the spleen; congestion of the bowels, serious hemorrhage from the stomach and bowels, endangering the life of the patient or leading to deep fainting fits; murmuring to be heard in the neck; a venous congestion of the lungs and pulmonary hemorrhages; pulse small and rapid to 140; spleen enlarged, pulse sometimes extremely slow, accompanied by deep collapse; enormous swelling of the liver and spleen; epistaxis, hæmoptysis and hæmatemesis; carotids and fontanelles pulsate strongly; hemorrhage from the kidneys, intestines and uterus.

3D. CAPILLARY DISTURBANCES.—Skin shrunken and pale; eyes sunken, nose pointed, lips and nails blue, fingers white and cold; skin on them wrinkled and numb as if dead; the face becomes flushed; eyes red and fiery; grows warm; the natural turgescence of the skin returns; herpetic vesicles appear; the head is aglow, face red; œdema of the face, hands and feet; pale or livid countenance and lips; œdema of the lower extremities or of the mammæ; ascites and anasarca, iritis and ophthalmiæ; collapse; hyperæmia of the various tissues; hyperæmia of the bronchi; congestions of the lungs; infiltration of the lungs, congestion of the pleura; petechiæ; diarrhœa and dysentery; death from pigment embolism of the cerebral vessels; complexion pale and muddy; ecchymosis.

CHAPTER XXI.

TYPE—RYTHM—MODE—FORM.

In the text-books, the higher thermal (malarial) derangements are treated according to certain peculiar types, or other peculiar characteristics, frequently manifested. This manner of presenting them is practically useful for the purpose of discussing and impressing upon the mind their more prominent phenomena, rather than to convey a truthful and complete knowledge of their cause and nature.

That these peculiar, striking phenomena are mainly incidental, and by no means essential, features of the disease, will be apparent from the following interesting quotations from Hertz, in Ziemssen's Cyclopedia: "The entire paroxysm *generally* lasts from 4 to 12 hours, more rarely from 18 to 24, or even longer, 30 to 36. * * * Certain deviations from the course above indicated may occur, but they are of such a nature that while they modify the features of the disease they do not alter its essential character. There are cases, *usually* of the quotidian or tertian type, in which at a given hour of the day a slight feeling of chilliness is experienced, followed immediately by heat, etc., lasting for several hours, and *not* succeeded by sweat; or the chill lasts for a few minutes and the patient thereupon begins to sweat profusely; or chill

and heat may both be absent, and the fever paroxysm betrays itself only by a periodical sweat, etc. Such instances are not rare among people living in a malarious region, etc.

"They also occur as a species of relapse during recovery from fever. The intensity of the several stages may differ widely in the same individual in successive paroxysms, etc.

"Even in severe cases of *intermittent* fever some stages may be very short, or entirely lacking, etc. The disease may begin with the period of heat, the missing chill being replaced by some severe brain symptom, as d lirium, etc. Chill entirely absent, or consists of a slight shudder, and the hot stage lasts from 12 to 36 hours, often accompained by the gravest symptoms, followed by but slight sweating." He then decribes some instances of what he calls *febris dissecta*, and refers to some cases in which there is a "reversal of the order in which the stages follow one another," also to other irregular conditions which he describes under the name of *febris subintrans*. He then gives the quotidian, tertian and quartan types. "Such are the fevers which occur every fifth, sixth, seventh, eighth or even every thirteenth day." In addition to the simple types, double types may also occur. "Two paroxysms may appear daily, at different times of the day, and of different intensities (int. quotidian, duplicata), or one attack may appear daily, but of such form that the paroxysms of the first and third, and those of the second and fourth days, correspond with one another

as to time of day and intensity, presenting not the quotidian type of fevers, but two tertians combined, (int. tertiana duplicata)." He also refers to double quartans. This brings two successive fever days together and leaves every third day free. "To these may be added one more form, which is the semi-tertian intermittent, and consists of a quotidian and tertian combined, so that on the first and third days there are two attacks each, while on the second day there is but one." He then refers to the anticipating and postponing attacks: "If the anticipating or postponing process is frequently repeated, it alters the rythm of the fever; thus by anticipating, a quotidian is changed into a remittent or a subcontinued form, a tertain into a quotidian, and a quartan into a tertian. The reverse of all this being accomplished by postponing."

"In other and rarer instances, especially among persons who have suffered repeatedly from malarial disease, it is liable to show the greatest irregularity and variety in the occurrence and character of the paroxysms (*intermittens erratica*)."

Under the heading "masked fevers" he describes "attacks of disease, which, bearing the type of ordinary intermittent, present symptoms foreign to this malady, which ordinarily run their course *without fever*, etc. These *fevers* either appear as independent diseases in persons otherwise well, or they are associated with other forms of sickness, or they may precede or follow ordinary intermittent *fevers* or *alternate* with

the latter in the regular manner, so, for instance, that the first day shall present a regular attack of fever, the second the masked form, the third again the regular paroxysm, and so on, assuming the character of double tertian. They usually show themselves as typical neuralgias, etc. The character of the pain is very various; it may break forth suddenly in its fullest violence, or it may for several days give warning of its approach and gradually increase in intensity." He describes farther anomalous types and forms under the head of *masked fevers*. Then, the various, almost indescribable phenomena of "pernicious" attacks, and closes the "pathology" with malarial *cachexia* and the *remittent* and *continued* forms.

There is certainly no lack of symptoms and pathological conditions in these hyper-thermal diseases. They are so numerous and various in character as to produce, in the mind of a careless or inexperienced observer, confusion and bewilderment. The student of the old text-books, and diligent attendant of regular courses of lectures, cannot fail to be impressed with the idea that the different pathological conditions manifested are so many distinct diseases, produced by different causes, or by a different degree of activity of the same cause, or are owing to a greater or less degree of susceptibility of the individuals affected, and that the cause is some *organic or inorganic material substance*, or that the cause is *unknown*.

In the light of established facts, relating to the etiology and pathology of these derangements, the

theory of an organic or inorganic material substance (miasm or malaria) is entirely untenable.

The derangements produced by substances of this character, are recognizable by their well-defined and unvarying train of symptoms, courses and terminations; they are governed by certain immutable laws of their organization or nature, while the hyperthermal derangements disregard and contravene all laws of organic and inorganic material nature. This fact, which is incontestably established, but unfortunately sadly overlooked, is freely and fully apparen upon an attentive study of the verities of their pathology.

CHAPTER XXII.

DIAGNOSIS.

It is impossible to determine with certainty from the prodromal symptoms, whether a thermal or some other disease is impending. When a chill has occurred with or without the ordinary prodomata, followed by the stages of fever and sweat commonly manifested in the simpler intermittent forms, and succeeded by freedom from any special manifestations of disease, a diagnosis is easily made. Complications arising from derangements of the respiratory organs, chylopoietic viscera, kidneys and other organs, however, frequently obscure the character of cases that would otherwise be simple intermittent, so completely that what is simply a complication may be mistaken for the primal disease, or rather be regarded and treated as the only disease present. Physicians well acquainted and very familiar with the thermal diseases have but little dificulty in detecting the primal nature of the attack, but are in danger of erring in the opposite direction, that of overlooking or disregarding the complications entirely; so that the patient may succumb to the complications, while the practitioner is aiming all his efforts at the supposed chief enemy. The greatest danger from this source is in overlooking hepatitis, gastritis and nephritis. These precautionary remarks apply as

well to the remittent and continued forms as to the intermittent, but an oversight of the kind alluded to, or a failure to diagnose clear the complications as well as the primal disease, is more likely to be followed by disastrous results in the severer than in the milder forms. The graver the character of the primal attack the greater the probability of secondary complications and the greater the likelihood of overlooking the latter.

An uncomplecated case marked by a paroxysm of chill, fever and sweat, occurring every day, every second or every third day, is readily recognized, because of its well marked phenomena and frequent occurrence in hyperthermal regions of country. So, also, of uncomplicated cases in which there is no complete abatement of fever. If there is a regularly recurring exacerbation and decline of fever with or without a preceding chill or a succeeding sweat, there need be no hesitation in announcing the case to be one of thermal fever. But here the practitioner frequently finds himself in a dilemma; if he pronounce the case to be one of the remittent form he will often have cause to change his opinion before he gets through with it, and if he diagnose the case to be one of a continued form—typhoid—he will find himself in an equally unpleasant predicament. For a change in diagnosis in the progress of a case adds nothing to the reputation of a practitioner, nor to the standing and dignity of his profession. There is no means of distinguishing the more sthenic)remittent) from

the more asthenic (typhoid) forms in the first three or four days, unless by a careful, diligent use of the thermometer, by which the sthenic forms will show a more sudden—a shorter, but more rapid—exacerbation, a more uniform high-fever line, and a more rapid decline than the asthenic (typhoid). Even this test sometimes misleads. Herein lies the cause of so much variance in statistics. Some practitioners diagnosing nearly all cases of this character as "remittents," while others class them as "typhoids." It is quite a common thing to find practitioners "who *cure* nearly all *their* cases of "typhoid" or "typho-malarial" fever in from one to two weeks! The whole mystery lies in *their diagnosis.* The reason for it exists in the facts that it is safer and better for their reputation to cure typhoid fever inside of two weeks than to wrestle with a case of "remittent" for a period of four or five weeks, or longer.

The truth is, there is no distinguishable difference between these distinctively named conditions, but the difference in degree of severity. The distinctive names referred to have a mischievous effect, in imparting the idea that they are diseases of essentially different natures; and they also at least arouse a suspi cion that they result from different causes.

The most important matter, then, to determine in cases of continued fever, is the grade, whether sthenic or asthenic. If the exacerbation be prompt, the high-fever line well maintained, the decline well marked, accompanied with moisture of the surface, and if at

the same time a decided quieting of nervous disturbances, as headache, pain in the back and limbs, and restlessness takes place, the case is one of the more sthenic grade, and will prove more promptly amenable to treatment. If the reverse of these conditions be present, we are justified in considering the case to belong to the asthenic grade. At the outset, the condition of the tongue and urine give no indications of the grade. The former is usually more or less coated with a white or yellow-white coat, and the tip and borders more or less increased in redness. If the case be one of the asthenic grade the mouth and tongue will begin to show signs of dryness, usually as early as the first week, but may not until later, and if not suitably treated will increase in dryness, so that the tongue becomes hard, much impaired in its natural mobility, while its coat turns a darker color, until it sometimes is black. The urine is highly colored from the beginning, and as the case progresses usually becomes more and more scant. Cases in which the intellectual and sensory functions are much depressed, with a marked degree of stupor, are frequently obscured by the bladder being distended by long retained urine, which distention adds to the depression and irritability of the nervous system. There is nothing connected with the urine, nor in the manner of its secretion and evacuation, by which the thermal diseases can be known from many others, but its quantity, color, increase or decrease of normal constituents, presence of abnor-

mal ingredients, and the manner of its secretion and evacuation furnish important indications in regard to the form and grade and complication of each particular case. The same holds true in regard to the action of the bowels and the character of the dejections. There is in many cases a decided *bilious* condition of the stools in consequence of derangements of the hepatic and duodenal secretions; commonly the bowels are inclined to constipation, yet this symptom is of little value for purposes of diagnosis, as the opposite conditions may be present instead. From the symptoms alone present at any particular time, it would often be extremely difficult and sometimes even impossible to make a differential diagnosis between some cases of thermal fever, meningitis, hepatitis, gastritis, gastro-enteritis and nephritis. However, the symptoms in connection with the history of the case relative to residence, mode of living, occupation, previous condition of health, season of the year, etc., should invariably lead to a correct diagnosis.

Milk-sick is sometimes mistaken for a somewhat low form of thermal fever (remittent or typho-malarial). This has happened in the practice of gentlemen of fair attainments and many years' practice. Such oversights may be deemed inexcusable. Yet so long as no more definite and scientific knowledge in regard to the cause and nature of these diseases prevails, such blunders will continue to occur.

One of the most dangerous forms of thermal dis-

ease, dangerous because of the insidious manner of its attack, and the quietness and apathy of the patient, is that commonly known as congestive diarrhœa or dysentery. The attack comes on in many of these cases without any rigor; there is simply a sense of weakness and shortness of breath on making any exertion, followed by looseness of the bowels with thin watery discharges, sometimes more or less mixed with blood. After a few hours the attack abates and the patient feels, in many cases, about as well as before its advent. He will assume it to have been an attack of diarrhœa due to some indiscretion in diet, or to having taken a cold. But in a day or two, or three days, or in week there will be another and a severer attack lasting longer, but he may pass through this also, and again suppose himself well or getting well; but there comes another and probably a fatal relapse or attack. During the attack the patient complains but little, many times apparently because he has not enough energy to do so. He is lethargic, apathetic to a remarkable degree, in fact, in many cases, semi-unconscious, and is then in an extremely critical condition, being in danger of fatal syncope upon the slightest exertion. There may not be any marked depression of temperature, nor any appreciable rise after the attack, should it not prove fatal. In some of these the diarrhœa or dysentery is attended with pain, while in others it is as painless as in cholera. In the severer attacks, at least before death, more or less nausea and vomiting occurs.

It is highly important to remember that these diseases occur at all ages, from earliest infancy to extreme old age, and that in the very young, the delicate and the old, they do not present the usual and more distinctly marked features of cases occurring in vigorous adults. In the very young drowsiness, coma and convulsions, even when there is no rise of temperature, are commonly the chief symptoms. Feeble middle-aged persons, and the aged, are generally more subject to the masked forms of the disease.

Thermal paresis of the sympathetic centers seems capable to produce or rather to open the way for the production of almost every known patholgical condition, not due to some specific infectious or contagious cause. And it frequently modifies, to a very important extent, pathological conditions due to other causes.

It can scarcely be necessary or advantageous to discuss the diagnosis of the pernicious forms, and the thermal cachexia; because the former present features of so striking a character as to be readily discerned, unless perhaps from cases of poisoning from some narcotic or acronarcotic agent. The latter can hardly he mistaken for any other form of cachexia, especially when the history of the case is kept in view as a guide. Indeed, it is by this guide that all forms of the disease are to be examined, else there will be much doubt and hesitancy, and many grave mistakes. In hyper-thermal localities, cholera morbus and cholera infantum should be classed with the

thermal diseases. Thermal paresis of the sympathetic centers from excessive excitation by solar heat being the primary pathological condition, it is an important matter in its bearing upon successful treatment.

CHAPTER XXIII.

TREATMENT.

For the sake of convenience in setting forth the treatment of the thermal fevers, and all the other thermal diseases, there is a temptation to divide them into several forms and types, as has heretofore been the custom. But, as such divisions convey the idea, at last by inference, that they are essentially distinct diseases, and as all division of these diseases is based upon purely conventional or imaginary grounds, so far as their essential nature and cause is concerned, it is deemed preferable to give the treatment on broader grounds, based on general principles.

The chief pathological condition, the paretic and abnormally irritable condition of the sympathetic nervous system, is what needs to be kept most prominently in view. In some cases it may be a somewhat perplexing matter to decide whether this condition is due to disease of the nerve-centers primarily, or whether it is a secondary condition depending upon a diseased state of the blood. As a rule, all derangements of the blood, and of the functions of the various organs, as also structural changes, are results, effects, and not causes, of the disease. These secondary conditions, of course, modify the phenomena

present, and commonly require therapeutic, dietetic, and hygienic attention.

The most valuable and reliable medicinal agent in the treatnent of this multifarious disease is cinchona and its alkaloids, quinia, quinidia, cinchonidia and quinoidine. The three first named are those most generally in use, and of about equal value and power, although their actions, and the sensations they produce, are not exactly identical.

The action of quinia is more energetic upon the brain, as is evinced by greater cerebral disturbance, headache, photophobia, tinnitus aurium, deafness, etc., while that of cinchonidia is more energetic upon the spinal cord, as shown by tremors of the hands, etc., and is decidedly more energetic as a cardiac sedative, acting frequently so strongly as to cause dizziness and even syncope (when the patient assumes the erect position), from cerebral anæmia; with quinidia I have not had sufficient experience to state any specific differences in effect. Quinoidine has power equal to that of the others, but is not so well borne by the stomach and bowels, frequently causing nausea, vomiting and diarrhœa. Their powers to arrest the progress of thermal diseases (to restore tone to the paretic sympathetic centers) is decidedly superior to any other known agent. But their efficiency depends very greatly upon the manner in which they are prescribed. Agents so positive in their effects for good when properly administered may also be injurious when misapplied. The contraindications to their use,

then, are matters of the highest importance, and their disregard has cast a certain degree of reproach upon the profession. They should not be administered in the stage of chill with actual reduction of temperature. In cerebral and spinal irritations, hyperæmia or inflammation as shown by severe throbbing pain in the head and back, severe headache, with flushed face and injected conjuctiva, photophobia, great active restlessness and convulsions, they should be withheld until these conditions have been removed by other measures. Neither should they be administered when there is high irritation or inflammation of the stomach, as indicated by a red and swollen, or red and dry tongue, with great thirst, nausea or vomiting and tenderness upon pressure upon the epigastrium, and especially not in the form of a dry crystalline powder. In this form, dry crystalline powder, the cinchona alkaloids are obnoxious to many healthy stomachs. Whenever given in the form of powder, the crystals should first be broken as thoroughly as possible, by complete trituration, either alone or with the addition of pulverized extract glycyrrhiza or some other powder of this character. A very good plan is to triturate together the alkaloid, pulv. ipec., pulv. zingiber and pulv. ext. glycyrrhiza in proper proportions, depending somewhat upon the special conditions present. The conditions of the head, spinal cord and stomach mentioned as contraindicating the use of the cinchona alkaloids constitutes an objection to their use in every grade of the disease from the mild-

est, simplest intermittent to the most severe congestive or so-called "pernicious." They can be given to the youngest infant (although they are frequently not necessary in the very young), to the adult and the aged. The very young and the very old do not bear, neither do they require, so large proportional doses as adults.

From my own observation I must say that the alkaloids of cinchona have in certain cases the action of abortifacients, and contrary to the observations of some, that they all have this power alike. It is probably due to abnormal irritability of the cerebral and spinal reflex centers. That they have the power of exciting and strenghtening uterine contractions at full term in women who suffer from thermal paresis there can be no doubt.

The best form for the administration of the cinchona alkaloids is in combination with hydrobromic acid and syrup of licorice or some other suitable vehicle tending to disguise the taste. The hydrobromic acid influences in a very favorable manner the unpleasant effects upon the brain and spinal cord. It is unfortunate that there is no officinal preparation of this acid. It is therefore usually necessary to indicate in the prescription what preparation is desired—Fothergill's, Squibb's, or some other. No doubt in the coming revision of the pharmacopœia this subject will receive the necessary attention.

The dose of the cinchona alkaloid will, within certain limits, have to be regulated by the severity of

the case and the period of time open to its administration. From my experience I must say a five grain dose is the most suitable for an adult male patient. When there is sufficient time for the administration of the medicine in five grain doses at intervals of from two to four hours, to give from 20 to 60 grains before the recurrence of dangerous symptoms, this is the best method to adopt. It is safer, more permanent and less disagreeable in its effects. It is however sometimes necessary on account of want of time to prevent the recurrence of a dangerous attack, or owing to the urgent necessity of reducing a dangerously high temperature, to give larger doses. I have never given more than 30 grains of quinia or cinchonidia at one dose. Such doses often give rise to very well marked phenomena, such as sensory disturbances, depression of the circulation, fainting, hallucination, etc. Beyond these unpleasant manifestations I have not observed anything that should cause hesitancy in prescribing such doses when there is a clear indication therefor.

According to my experience, relapses occur more frequently after the administration of 30 grs. in one dose than after 30 grs. administered in six doses three hours apart. But the relapse is more commonly not in the form of the original attack, that is, an intermittent will manifest itself in its relapse as a frontal neuralgia or some other form of a periodic character, or be devoid of anything typical, but show itself as a jaundice or as anæmia. The use of the remedy should

be continued for a length of time, (even after the acute symptoms have abated) proportionate to the degree of paresis present, from one to four weeks. So long as the skin has not assumed its healthy hue and function, the tongue is not clear and of natural size, the appetite, digestion, assimilation and nutrition, tissue change and secretions not normal, and there is shortness of breath and an unusual sense of fatigue upon slight exertion, the alkaloid should be continued. During this stage of treatment, it is commonly advantageous to combine the alkaloid with other tonics, as iron and strychnia or arsenic, and with alteratives, or with diaphoretics, certain cathartics, and diuretics. Iron preparations are generally not well borne in large doses nor in concentrated form, under these circumstances. The tinc. of the chloride of iron must be given in small doses well diluted; so of the subcarbonate; solution of dialysed iron is a good preparation, usually well borne by the stomach. The syrup of the iodide is also a very useful preparation in 20 drops doses, well diluted.

The alkaloid in combination with fluid extract of eucalyptus globulus acts very well in the chronic catarrhal forms. Eucalyptus globulus, picrate of ammonia, the sulphites, as that of soda, tincture of iodine, arsenic, chloroform, opium, the bromides and a multitude of other agents have been announced as possessing equal specific power with that of the cinchona alkaloids. After a rather extensive experience I must place these agents in the list of auxiliaries.

Some of them have but a slight tonic effect upon the paretic nerve-centers, at least in the doses usually advised, while the others have no such effect at all; they act mainly upon the secondary pathological conditions and not upon the primary nerve center paresis, or if so, in an indirect and uncertain manner.

It may be well to remark, and to bear in mind, that the action of the cinchona alkaloids, and other agents also, no doubt, is frequently prevented or neutralized by the condition of the stomach or its contents, preventing its ready absorption, or, perhaps, even sometimes changing it in its chemical characteristics so as to effect its therapeutic value. I am impelled to make this statement from having observed a much more decided effect after the action of an emetic or cathartic than before. A somewhat acid state of the secretions of the stomach favors the action of the alkaloids; when this is not present it is advisable to give them in combination with an acid, as hydrobromic or sulphuric acid. The practice of giving them in combination with alkalies or the alkaline salts, as bromide and nitrate of potash, necessitates a larger quantity of the alkaloid.[1]

In all forms of this disease there are quite commonly present, conditions of the secretions of the skin, liver and kidneys, which seem to indicate the administration of diaphoretics, cholagogues and diuretics. It will, however, be found upon trial, that the

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1. H. C. Woods, Jr., Therapeutics, etc.

action of such agents will be very imperfect and unsatisfactory so long as the primary lesion of the sympathetic centers has not been removed. After the removal of this primary lesion by a sufficient quantity of the cinchona alkaloids, the organs and functions referred to, it will be discovered, have also regained their normal condition, and this will usually be first noticed in the perspiration.

A simple intermittent requires no other medicinal agent than a suitable quantity of one of the alkaloids named, given for a sufficient length of time. Complications must, of course, be treated in accordance with their indications. Dietetic and hygienic measures are of great importance, and should be strictly insisted upon in every case. It is an anomalous matter that patients cannot understand why they should suffer from relapses when they continue to expose themselves to the same conditions that gave rise to their first attacks. They are quite apt to imagine, very foolishly, that twenty or thirty grains should not only cure them but should keep them well for that year, at least, although they continue subject to the same influences as before the first attack.

In the somewhat severer cases, in which the fever abates, but does not disappear, the alkaloid requires to be used in the same manner, and will have an equally beneficial effect. It is generally necessary to continue its use for a longer period, until the exacerbation ceases to appear, and then for several days longer in smaller doses, or at longer intervals. In these

cases it is frequently useful to give a dose of hydrag. chol. mit., five to twenty grains at the outset, in the chill or exacerbation, to be followed in two or three hours by a saline cathartic, which must be repeated in two hours until free evacuation of the bowels has been secured. If the case is not seen until the remission has commenced the cinchona alkaloid should be administered at once, and given in full doses with the view of preventing another exacerbation. If not successful, the cathartic may be given during the following exacerbation, and when the remission sets in the alkaloid should be resumed. In these cases there frequently is much suffering from nausea and vomiting, and restlessness, especially during the stage of high fever. Cold water or cold acidulated water drinks with cool bathing of the head gives great relief. A small dose of morphia often produces a good effect. Bathing the surface of the body with water of a grateful temperature is of the utmost importance in all cases and at whatever stage, provided the surface is hot and dry, or either one or the other. The skin should under all circumstances be kept soft and moist, unless there is depression of temperature, whether the case be of the asthenic or sthenic grade. When there is obstinate vomiting or distressing nausea, effervescing powders given every half-hour or hour almost invariably give relief. Aromatic spirits of ammonia with peppermint water, also, frequently answer a very good purpose. Sinapisms may also be applied over the epigastrium, and in the event of a high grade of fever, cloths

wrung out of cold water may be thus applied. A distressing headache of a neuralgic character is often present in such cases, which, however, does not prohibit the use of the alkaloid, but on the contrary is benefitted by it. In this disease, and especially in the severer cases, active, irritating cathartics are injurious, frequently complicating the case with troublesome irritation and even inflammation of the stomach and bowels; old, hardened, drastic pills are especially contraindicated. The sulphates of magnesia, soda and potash, or the citrate of these bases, are the best preparations in all cases that are not greatly debilitated. In such, castor oil is the best, per orem, but in the extremely typhoid cases, if it becomes proper to move the bowels, it should be accomplished by means of enemata of castor oil emulsions.

If there is persistent deficiency in the sudoriferous and renal secretions, spir. etheris nitrosum or liq. ammonia acetatum should be given with the alkaloid. If the deficient secretions be accompained by much active restlessness and a high grade of fever, tinct. of gelsemium may be added to the article just named, or given alone[1]. When there is much dryness of the mucous surfaces, in the more sthenic cases, small doses of hyd. chlor. mit. can be prescribed with advantage, combined with suitable proportions of opium or pulv. ipecac. compound, when necessary to restrain the action of the bowels. The latter agent can also

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1. Ott, Physilog. Action of Med., etc.

frequently be given in combination with the alkaloid to promote perspiration and rest. The administration of twenty-grain doses of sodium sulphite four times daily almost invariably prevents dryness of the mouth and the browning and blackening of the coating of the tongue, and should be administered throughout the course of every case of any considerable degree of severity, and especially in cases of a low or typhoid character. Ten-drop doses, in emulsion, of oil of turpentine, given every three hours, is the promptest agent for the removal of a dry brown or black coat from the tongue. High irritability and inflammation of the stomach, however, forbid its use. The application of sinapisms or oil of turpentine over the abdomen should be persevered in during the whole course of the case, if there is any indication of enteric complication. In conditions of high or acute inflammatory action of the peritoneum, or intestines, cloths wrung out of cold water applied over the abdomen answers an excellent purpose. Hemorrhagic complications from the nose, mouth, stomach or intestines can be generally promptly controlled by the use of ergot, opium, acetate of lead, and persulphate of iron, etc. If the sodium sulphite is administered from the beginning of the case, hemorrhages seldom ensue. For diarrhœa, opium, lead acetate, tannic or gallic acid, meet all the requirements.

In cases of violent seizure and extreme depression of some or all of the vital functions, such as those

usually described under the terms "pernicious," congestive, algid, etc., the most useful and prompt agents are atropia and morphia administered hypodermically; of the former one-hundredth to one-sixtieth grain, and of the latter one-tenth to one-fourth grain in combination. This measure can be repeated every fifteen to thirty minutes. In the meanwhile other suitable measures can also be instituted, as diffusible stimulants, ammonia or alcoholic, artificial warmth and rubbing. In case of excessive heat, the cold water douche, or a cold water bath and in the event of not too great cerebral or spinal congestion, one of the cinchona alkaloids should be freely administered.

In all cases, unless there is an unmanageable complication present, the fever can be controlled within the limits of safety by means of free ventilation, bathing of the surface, cooling drinks and the proper administration of a cinchona alkaloid. These means should be diligently and judiciously employed until convalescence is fully established. A suitable diet is of importance and requires the strictest attention of the physician. Many cases have been permitted to perish for want of nourishment. Of course, in the acute stage at the onset of an attack, active feeding is not only not required, but would be a source of discomfort to the digestive organs of the patient. But when the active sthenic stage has passed, which is the case at an earlier period in the young, the feeble and the old, active and positive measures for the nourishment of the patient should be instituted. It must al-

ways, under such circumstances, be borne in mind that the patient is incompetent to determine what nourishment he requires. The appetite and sense of taste are lost or perverted. Nothing is palatable and he generally objects to taking nourishment of any kind. It is as necessary and important that others should determine when he shall take food, and what he shall take, as it is in regard to medicine. And after the case has continued for several days, food is as important an agent for his recovery as medicine, and often more so. The choice of the kind of food, and the period of its administration, can in no event, under such circumstances, be left to the patient. He is utterly incompetent to decide whether he needs food or not, or what should be its character. At times he may have a peculiar craving for special articles of food, which it is safe to indulge to a moderate extent, provided there is no well marked contraindication.

Iodine is useful in the treatment of the sequelæ and cachexia of whatever form, glandular enlargements, anæmia, etc. It should be given in the form of the compound tincture, or compound solution, or the syrup of iodide of iron; the condition of the stomach must be good, otherwise it will not be accepted. The use of iodine in the form of tincture, especially to be given in water, cannot be commended. During the past ten years, at least, it has however been published in numerous medical journal reports as a remedy in intermittent fever. The action of iodine as an alterative and tonic is no doubt useful in many cases of

this disease, yet it cannot, nor can any other agent be compared, for efficiency, with the cinchona alkaloids, as special tonics. Arsenic holds about the same rank as iodine, in regard to its worth as a remedy, in this disease.

The other agents naméd at the beginning of this article have more or less power for good if judiciously applied, but they do not compare in therapeutic value and range of applicability with the cinchona alkaloids. In fact, any agent, material or immaterial, capable of making or communicating a stimulating impulse upon the nerve-centers, produces more or less effect upon the disturbed innervation arising from the paretic condition of the sympathetic temperature and circulation regulating centers. Strychnia, as an excito-motor and stimulant of the cardiac and respiratory centers, is an agent of positive value.

In case of a continued fever, and in fact in all cases where there is dryness of the mouth and skin, deficient urinary secretion, jaborandi, in from 5 to 18 gr. doses every 3 or 4 hours, exerts a most excellent effect. Great enfeeblement of the cardiac systole is however a positive contraindication to its employment.

There are temporary conditions of feeble circulation, in many cases, that can be relieved by alcoholic stimulation, but the greatest indication for its use is in prolonged attacks resulting in inanition, feebleness of circulation and sleeplessness from cerebral anæmia.

Blood-letting, one of the first measures formerly had in mind for the management of the thermal fevers, is

not often neccessary, but in certain conditions of sudden high sthenic fever, with active congestion or inflammation of the brain, liver, stomach or other vital organ, threatening early disorganization or fatal lesion, it affords the most prompt and efficient means of averting grave consequences. In such conditions it has greater power to calm the abnormal irritability of the sympathetic nerve-centers than any known agent, and should be resorted to in a prompt and fearless manner. The blood should flow freely and copiously from a large orifice, otherwise no good may result therefrom. Conditions requiring blood-letting arise most commonly in cases described by the late Prof. J. K. Mitchell, under the name of the "summer remittents," by some called the" ardent fevers." They occur generally during the hottest months, and are characterized by violent disturbance of all nerve-centers, from the direct effect of excessive solar heat.

Thermal diseases, whether accompanied by aberrations in temperature or not, should not be treated without the intelligent use of the fever thermometer. It is impossible to form a reliable estimate or judgment of the character of the case without the information it affords. There is no other mode of ascertaining whether the temperature is within safe bounds and when to adopt measures for its reduction or elevation. When it indicates 96° or 105° F., there is urgent need of instituting suitable measures for its elevation or reduction, as continuance for any considerable number of hours of those degrees of temperature will bring about the gravest consequences.

During convalescence it is generally necessary to regulate the diet and to assist the impaired digestion. For the latter purpose pepsin and the various prepa

rations of this agent, and ingluvin, possess valuable properties. Their powers are enhanced in some cases by the addition of hydrochloric or lactic acid. Patients occasionally die from inanition, due to impairment of digestion and assimilation. Troublesome abscesses, especially of the parotid, are liable to occur. Their management must be based on general principles. They constitute a dangerous complication, yet are not necessarily fatal.

Nothing will be said on the subject of prognosis for the reason that this depends so greatly on the previous condition of the patient and the treatment—therapeutic, dietetic and hygienic. There is probably no other disease more certain of producing fatal results if left to itself, although often in a very indirect manner, nor is there another disease that is more amenable to treatment. The low or typhoid grades of fever continue for four or five weeks, under the best directed management, and a simple intermittent or simple paretic depression, may continue for years, if neglected, or until it brings about a fatal result by way of a pneumonia, an incurable disease of the liver, or phthisis. Occasionally the disturbances of one or more of the vital functions is so sudden, and violent, as to produce death before any measures can be brought to bear for the prevention of this result.

In order to overcome the paretic condition of the nerve-centers, whether there has been any marked disturbance of one or more of the vital functions of the system or not, it is sometimes necessary to abandon all active mental and physical work, and to bring to bear the invigorating influences of travel and change of climate.

CHAPTER XXIV.

LOCATION OF SICK ROOM, THE BED, THE LINEN, AND POSTURE OF THE PATIENT.

The first floor is generally unsuitable because of its proximity to the surface, especially if it has not a well ventilated, clean, dry basement or cellar underneath. The second story rooms of two-story houses are generally too hot during the middle of the day, unless well shaded and ventilated. A well ventilated room on the second story of a three or more storied house is the best. Unfortunately this is a matter not always subject to control.

The mattresses should be clean and pure, and thoroughly aired every second day. Feathers and other imperfect conductors, in cases of fevers, are to be condemned. Feather pillows under such circumstances are especially obnoxious. The patient's linen should be renewed daily.

The posture should be strictly attended to, in order to avoid hypostatic pneumonia and bedsores. He should be moved at least every hour, to prevent the injurious effects of gravitation and pressure, especially when the circulation has become much enfeebled. Chilling currents of air must also be guarded against under such circumstances.

CHAPTER XXV.

ONE OF THE CAUSES WHY NEW VIEWS ARE SO SLOWLY ACCEPTED.

The remarks upon "What can be learned without the aid of the special senses," at the beginning of this work, are the result of experience in the difficulties met with in attempts to convince the minds of men of erroneous ideas long entertained, and perhaps often repeated in thought and word. Under such circumstances the mind can hardly be convinced, unless by ocular demonstration. An idea long prevalent in the mind, whether erroneous or true, becomes almost as firmly fixed as though the impression had been made by actual sight of the object itself—a definite image having become very clearly and almost indelibly fixed in the mind.

Such as cannot efface the old "malarious" images unless by ocular demonstration, will go on in their search for a "material specific something," and will arrive at the end of their lives without having found it, as many generations of "blind men with good eyes" have done in the past. The search for, and belief in, a specific material cause of the thermal diseases, reminds me, forcibly, of the search of the ancient alchemists for the philospher's stone.

INDEX.

ERRATA.—On page 17, third line from bottom, read *glandulæ* for glandular; on p. 26, eleventh line, read *overleaping* for overlapping; on p. 56, twenty-first line, read *nutrient* for nutriment; on page 88, third line, read *clearly* for clear.