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AND

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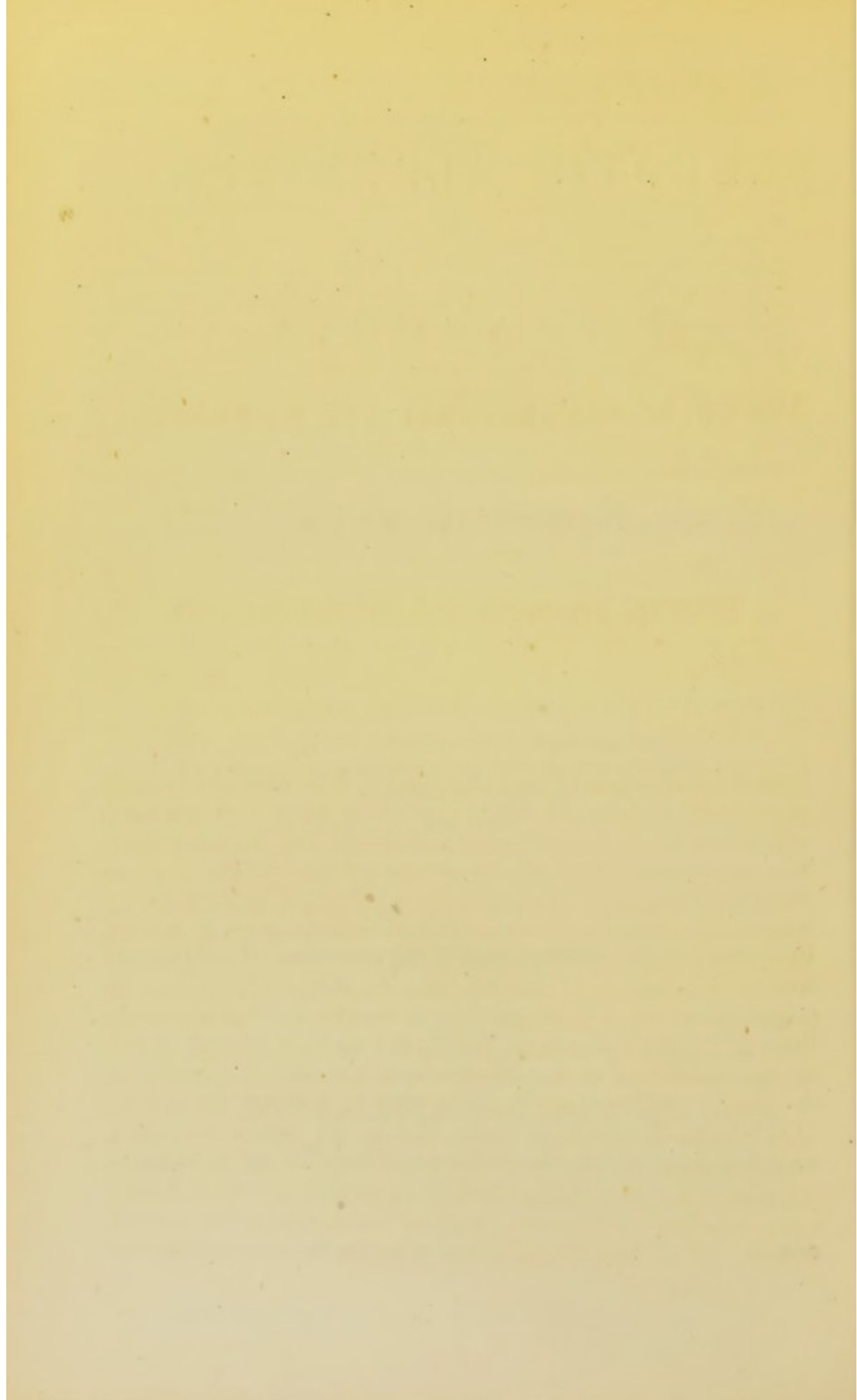
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ETC., ETC.

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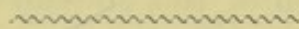
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ON
NEUROTIC ALBUMINURIA AND HÆMATURIA;

MORE ESPECIALLY IN RELATION TO

THERMIC NEUROSES AND TO TAKING COLD.



FOR several years past I have attempted to show what an important part morbid conditions of the nervous system play in both functional and structural diseases of organs and tissues, and, more especially, that most fundamental element of the nervous system of all its divisions, the trophic. And by the term trophic, I do not mean the vaso-motor system only, but use it in a wider meaning to indicate that larger system, which including the vaso-motor as a higher and special evolution of it, presides over the primary, vegetative, or organic processes of nutrition, so as to modify the chemical conditions of the blood corpuscles, lymph, and tissues in general, as well as the contraction of the blood-vessels and the distribution of the blood. And in these processes must be included not only all that happens chemically in plants, and in the tissues themselves, but also results such as the production of heat, of the *vis insita* of muscles, and of the various kinds of *vis nervosa*, all which depend upon bio-chemical processes that are regulated by the nervous system. Of all these the production of heat is the most fundamental

and essential, because without a due temperature vital processes cease, of whatever kind they be. Hence the universal influence of heat and cold in the causation of disease and in cure.

Amidst the various theories current, which are either humoral, anatomical, or mechanical, this neurotic element in causation is by some pathologists wholly omitted, or, if admitted by others, is imperfectly observed and understood. In renal diseases there is hardly any recognition of the influence of the nervous system in causation, although there is hardly a case in which that is not manifested. My friend, Dr. Warburton Begbie, has recently detailed instructive instances of neurotic albuminuria in connexion with the symptoms of Graves' disease,^a and I propose in this paper to show the connexion of the thermal portion of the trophic nervous system with transient albuminuria and hæmaturia, and in special reference to "taking cold."

It is one of the most instructive facts in the history of medicine that, while what is termed "taking cold" is so universally recognized as the most common of the general causes of disease, yet, from the neglect of trophic pathology, the theories of the process are so unsatisfactory that they have no systematic applications to practice. An illustration of this statement is afforded by the discussion at a meeting of the Clinical Society of London, when Dr. Geo. Johnson, well known for his valuable researches into the pathology and pathological anatomy of renal diseases, related to the Society cases in which temporary albuminuria had followed upon cold bathing. I shall shortly subjoin a note of these cases as illustrative of my subject, after having shown, by details of cases, the clinical relations of the condition known as rigors to both albuminuria and hæmaturia. I think the facts will prove that, in the process known as "taking cold," there is always a change induced in the trophic nervous system, both locally and generally, such, that one or other of a numerous group of trophic changes result in organs and tissues, and that this morbid and morbid change is one of the primary and most essential conditions of the process.

The first case of transient neurotic albuminuria with rigors occurred in a man who had been exposed to great atmospheric heat, and at the same time to malaria—a poison which, whatever may be its nature, induces a great variety of neuroses. In especial, those who have thus suffered in tropical climates not unfrequently have

^a Edin. Med. Journal, April, 1874.

such a change in the nerve-centres induced, that very slight exciting causes will induce a fit of rigors for years after they have returned home.

CASE I.—*Recurrent Chills and Ague-fits in a Man with Enlarged Spleen and a Syphilitic Bubo—Transient Albuminuria after a paroxysm—Neither that nor the Ague recurred during an attack of Variola.*

J. M., aged twenty-four, a joiner, of dark and sallow complexion and icteric tint, and of irregular habits of life, was admitted, on November 18th, 1873, into Ward III. of the Edinburgh Infirmary, under my care. I am indebted to one of my clinical clerks, Mr. McDiarmid, for a careful record of the case. J. M. had recently contracted syphilis, and had an ulcerating bubo in the right groin. He had had a blister applied over the region of the spleen, which organ was enlarged; a patch of dark pigmentation, corresponding to the shape and size of the blister, was observed in that region. He had also pleuritic friction on that side. When admitted he complained of pain on the left side, occasional attacks of ague, and general weakness. He stated that while out in Arkansas, about the end of last July, he had an attack of ague one very hot day, which was evidently ushered in by a slight sunstroke while on the top of a frame house. For at first he suddenly became giddy, and had a peculiar sensation in his head "as if the blood was all flowing to his ears," and everything seemed dim, and he could not hear for several minutes.

The paroxysms assumed a quotidian type, recurring about twelve o'clock daily for nearly two months. These commenced with a rigor, which lasted for half an hour, followed by the hot stage of two hours' duration, and terminating by profuse sweating. During his voyage home and since his arrival, he had had attacks of ague and chills at longer or shorter intervals. One of these occurred shortly after his admission. On 28th November, he felt much depressed and feverish, and had diarrhœa with much pain. Temp. 97.8° ; pulse 72; resp. 18; urine scanty (15 oz.), of a dark, reddish colour, sp. gr. 1026. On November 29, he sweat very much. Temp., at 1 p.m., 100.0° ; pulse 84; resp. 24. At 8 p.m. temp. 101.6° ; pulse 96; resp. 30. On the evening of the 30th November, at 7 o'clock (having had for three days previously more or less diarrhœa and profuse sweats), he complained of being very cold, saying the "chills" were coming on, and desired to be covered up

with blankets. There was not, however, any distinct rigor. His temperature in the axilla at this time was 103.6° . This state lasted nearly an hour, and the hot stage set in with a temperature of 104.2° , pulse 132, which terminated in about two hours by profuse sweating. Quinine was given to him, and there was no recurrence of the paroxysm; but, on the day after the chill, albumen was found in the urine to one-sixth, with a temperature of 100.6° , and pulse 108. On December 3rd, he had bilious vomiting and loose bloody stools, the albumen in the urine being still very considerable, with much mucus, but the temperature fell to 97.6° and pulse to 72. The next day the albumen was much less and phosphates were more abundant; and, finally, on the following day no albumen could be found.

Shortly after this the patient had a smart attack of varioloid, with pyrexia, but there were neither ague-fits nor albuminuria, and no eruption over the pigmented surface.

Here, then, is a case of temporary albuminuria coinciding with that condition as to the feeling of cold and to the physical effects of a lower temperature, which is experienced when the temperature of the skin is actually lowered, although in this case the temperature was really raised. It is reasonable to conclude, therefore, that it was not in this case a lower temperature of the surface which was the cause of that condition of the urinary organs upon which the albuminuria depended, *but some more general condition upon which both that condition, the higher temperature of the skin, and the phenomena termed rigors or chill, depend.* That more general condition can be shown, I think, by an analysis of the phenomena of rigors I shall shortly make, to be a neurosis of certain nerve-centres, which have the function of regulating the temperature of the body and maintaining it at its specific heat.

As to Hæmaturia with Albuminuria.—In the discussion referred to below, Dr. Hermann Weber mentioned a case of hæmaturia induced by cold. As there is much in common in certain cases between this disorder and albuminuria, I will detail a case of what I shall designate thermic and neurotic hæmaturia, which came under my observation, and which will further elucidate the relations of the thermal nerve-centres to the urinary organs.

CASE II.—*Paroxysmal Thermic Neuralgia with Hyperæsthesia and Thermic Palsy; Hemispinal Sensory Neurosis; Albuminuria, Hæmatinuria or Hæmaturia, with Purpuric Spots and Lividity.*

A physician, aged fifty-six, practising in London, well known for his literary and professional attainments, did me the honour to consult me, in August, 1871, for an obstinate hæmaturia, recurring paroxysmally under various conditions, but chiefly when labouring mentally, or when the atmospheric temperature was low. It seemed doubtful from his statements whether it was hæmaturia or hæmatinuria; but he had a paroxysm while under my observation, and I saw that he certainly then passed almost pure blood. There was also great hyperæsthesia of the bladder, and a muco-purulent discharge, so that although in previous paroxysms bloody tube-casts left no doubt it was renal, it was not improbable that blood also came either from the vesical mucous membrane or the prostatic ducts.

Much benefit had been got by full doses of quinine, and I suggested a change to arsenic; but, after hearing the facts, I concluded that it was a case of neurotic exhaustion, involving the thermal and other spinal centres; that all brain-work, anxiety, and the depressing effects of low temperature, would always induce paroxysms which would finally exhaust the patient; and that no cure was possible except by rest and relaxation in a warm climate. The patient, being necessarily reluctant to make so great a sacrifice, struggled on for two years longer, and then yielded to the inevitable. It is satisfactory to know that the change to a warmer climate has been beneficial. The case having been already published by Dr. Druitt,^a I subjoin the following summary of it, as there given:—

The patient, of a dark and somewhat bilious complexion, stated that he had enjoyed very good health, save that he was occasionally subject to bilious sick head-aches in early life, and, later, to symptoms which threatened gout. In the summer of 1866, being then fifty-one years of age, he underwent great mental and bodily fatigue during the cholera epidemic. In September of that year, whilst snatching a hasty holiday, he went, on a very wet day, to explore the ruins of Corfe Castle, and was walking or driving in wet clothes for the greater part of the day. On coming home he changed clothes, took a warm bath, and seemed no worse; but he had a very restless night, was sick when

^a Medical Times and Gazette, April 19th, 1873.

he got up early next morning to return to London, and was shivering, sick, and giddy during the whole journey. This was the beginning of the illness from which he subsequently suffered. On reaching home he was obliged to go to bed, on account of the feverishness and bilious vomiting, which lasted some days. On getting up, in an exceedingly weak and prostrate condition, he was suddenly seized with inflammation of a patch of veins, on the inner side of the right calf, ending in obliteration of the veins. This he hardly recovered from before the end of October, when it ceased, and has never returned; but the state of health which followed was extremely unsatisfactory.

The patient was incessantly told by his friends that he was of a singular dusky, earthy, colour, and the features "drawn." Although appetite and sleep were good, he felt languid, and under a cloud, but yet got through his ordinary work as usual. He was subject to numbness of the right foot, which was provoked by cold, but it would also come on if the foot were immersed in water a little too hot.

These results showed the influence of cutaneous temperature acting through the thermic nerves on the spinal cord, and the numbness showed that the sensory nerves and nerve-centres of the foot were involved. Subsequently he had also numbness of the left hand, but without coldness. These facts serve to show that, as to the seat of these sensations of numbness, it was spinal and unilateral—the decussating sensory nerves of the left hand being affected in the right hemicord. But as to the thermic centres, the affection was double, for certain morning paroxysms, shortly to be described, were accompanied with a cold, profuse, wet, sour, perspiration in the palms, while the body generally was dry. When there was no paroxysm, the backs of the hands, and the exterior sides of the limbs, perspired; the palmar sweats corresponding to one class of skin diseases, the dorsal to another class. Probably the volitional—*i.e.*, cerebral relations of the nerve-centres to the muscular system of the hand, determined these differences.

During the summer of 1867 he first noticed a very small quantity of dark sediment in the urine, but did not investigate its nature. Ever since the previous year it had been exceedingly high-coloured and abounding in lithates. In June of this year the patient had ague-fits on two consecutive days, in addition to five others at distant periods. These came on at 1 a.m. in each day with intense rigors, blueness, and vomiting, followed by intense

feverishness. In short, they were paroxysms of thermic spasm and neuralgia, as I shall shortly show. These he attributed to Cambridge sewer miasm.

The first attack of hæmaturia followed upon a paroxysm of this kind in September following. Being in Switzerland, he went to Grindelwald, where, on a coldish morning, in the midst of a clinging mist, he visited the Glacier, and went into the grotto cut out in the solid ice. Here he got very chilly, and, on his return to the hotel, had a most severe attack of rigors, with blueness of the hands. This gave way to a good draught of wine, and was succeeded by no feverishness as on former occasions; but it ushered in the most prominent feature of the case, as follows. The shivering lasted till about one o'clock. Early in the afternoon the patient started to return to Berne, which was reached in the evening. The bladder was habitually capacious, and free from irritability, so that no urine was voided between leaving Grindelwald and reaching Berne—when, to the patient's horror, on going early to bed, he passed a very large quantity as black as porter, and evidently containing a large quantity of blood-stuff. The patient was so alarmed at this that he slept ill, and rose in the night to pass more water to see what it was like. This was absolutely pale and natural looking; the bloody admixture had passed off as suddenly as it came.

The patient soon returned to England, and, during the autumn, was excessively weak and languid, being obliged to give up a good deal of his work, and to take more notice of the phenomena of his own bad health. It soon became evident that at every mid-day the urine displayed signs of some periodic disturbance; either a small quantity of blood, or of kidney epithelium, or of red, white, or pink colouring matter would appear in the urine passed between 10 a.m. and 2 to 4 p.m., whilst that passed in the evening and at night always was of its natural appearance. Great fatigue, aching in the loins, numbness of the legs, sense of brain-fatigue, and an earthy yellow complexion, accompanied the state of the urine.

On one occasion the patient had purpuric spots on the face, caused by putting his head out of the drawing-room window to speak to a passer-by. He was conscious of a scarcely noticeable chill; but this soon passed off, and as the afternoon was bright and fresh he went out about 2 o'clock for a drive. During the drive it was noticed that his face became curiously spotted with blue, just

like patches of incipient gangrene. And the same day the quantity of blood-stuff in the urine was greater than ever.

He came back to town in March 1868 and got through the summer with more or less misery. In fine warm weather, pretty well; but in cold and damp or easterly winds, the diurnal loss of blood-colour by the urine, and the morning fits of coldness of the feet, tended to be greater than ever, though kept at bay by quinine, as will be shown presently.

September 1868 was spent in delicious sunshine at Swanage, where the patient had good sleep, good appetite, abundance of air and exercise, and no return of any evil symptom, except once. He felt perfectly well, and quite fit for his ordinary work; but on his way home he spent a night or two at friends' houses, the weather became damp and cold, and by the time he reached London he was as bad as when he left it.

The next winter, 1868-9, was passed very dismally with a combination of symptoms, which may be summed up once for all, to avoid repetition. The sleep and appetite were good; the patient awoke feeling refreshed and well, but about 9 or 10 o'clock there came on, with horrid punctuality, a feeling of languor and depression; pulse down to 50-56; hands and feet painfully cold, wet, blue, and cramped like those of a cholera patient; great lassitude and indisposition for work. In the middle of the day, after luncheon and wine, the symptoms passed off, but the urine secreted during these hours and passed about 2 or 3 p.m., was excessively bloody. Under favourable conditions the bloody appearance passed off in the evening, and the urine passed at night was clear and natural. Few things could exceed the patient's misery; the painful coldness of the feet hindered all mental work; he would sit with his study-door bolted, with his boots and stockings off and blacking his soles in stripes by putting them against the bars of the grate, in the vain attempt to warm them.

The paroxysms of fever were accompanied by intense drowsiness and jaundice, with profuse excretion of bile, prodigious discharge of lithates, and great debility. The temperature in these attacks rose to 103°; what it was during the neuralgic paroxysms does not appear further than that, except during the fever fits, it was steadily at 98°·4, both in mouth and axilla. But it is probable that these were due to thermo-motor palsy, and that the temperature was much reduced, since it is stated that the whole heat-producing power of the economy, as well as the power of resisting cold, were singularly

deficient. Precisely at 9.30 every morning (except in hot or very fine weather) the feet became cold and blue. This coldness was of the intense and most painful sort, such as used to be felt by travellers outside a coach in cold weather, causing acute suffering attended with cramps, blueness, and a miserable wetness of the palms and soles, precisely like those of cholera patients. Equally distressing was the fact that in any brisk wind, even if not very cold, the moderate abstraction of heat from the skin would paralyse the capillaries; some part—it might be the end of the nose or the cheek—would become first pale and benumbed, then red, then purplish, and at last quite black. This occurred sometimes with and sometimes without a most unpleasant tingling. The patient, if walking out on a cold morning, would get the face so blue as to have it noticed by people in the street and by persons at whose house he called. Of reaction against cold there was no sign. If the hands or feet, or the face, were chilled at any time, the use of cold water followed by the briskest friction was of no avail to bring on a healthy and comfortable glow. Exposure of the skin in the morning would bring on a fit of coldness and numbness of one leg, but these effects were generally absent in the summer when the thermometer was above 70°. The singular lividity of the skin of the face always disappeared quickly if the patient came into a warm atmosphere; but for that, as well as for the coldness and lividity of the hands and feet, mere friction was of no use. The act of walking or standing on a wetted board-floor of a railway station was enough, at almost any time, to take away all sensation in the legs, and was followed by bloody urine. The patient always noticed that he was pretty well during a full moist mild south west wind, and usually better when the barometer was low.

The state of the nervous system influenced the production of the paroxysm. Numbness of the right foot and left hand (without coldness) were early and severe symptoms, although they ceased to be troublesome after a year or two. But mental worry and want of sleep, were the most efficient agents in bringing on discharge of blood with the urine. During the month that the patient spent at the sea-side, in 1865, the only return of his symptoms was on a day which he was obliged to devote to writing letters on a subject that caused a great deal of anxiety. If he were sitting, during the forenoon, warm and comfortable by the fire, and then moved to the table to begin anything like mental work, the feet became cold directly. Such an incident as being

cross-examined in a court of justice would bring on cold and numbness of the feet, followed by bloody urine. On the other hand, sleep was a supreme remedy. When going off into a comfortable nap, which the patient could do at will, a grateful warmth of the extremities succeeded painful coldness, and at no time did the hæmaturia occur while he was in bed, except on one occasion, when he was unable to sleep from anxiety.

The urine varied under varying circumstances; was most commonly acid; sp. gr. from 1026, more than once of 1022, now and then as low as 1014. During the paroxysm there were blood, bloody tube-casts, altered blood-corpuscles, and colouring matter of blood; was intensely albuminous, or had only a trace, or was altogether free, according to the stage of the paroxysm; sometimes renal epithelium; no sugar; urea deficient; uric acid for the most part normal.

I shall now give the details of a case of what would have been named hysterical rigors by some, if the phenomena had occurred in a woman, but which indicate a functional disorder of the cerebro-spinal nerve-centres, premonitory of insanity, and due in part to alcoholism. This case is not the less significant because the albuminuria was both transient and trifling in amount. I am indebted to my clinical resident, Dr. William Bourke, for a note of the details.

CASE III.—*Rigors and Transient Albuminuria in a Drunkard, with Hypochondriasis and Spinal Cephalic Neuroses.*

D. A., aged twenty-three, druggist's assistant, of dark complexion and with black hair, was admitted to the Royal Edinburgh Infirmary under my care, 23rd March, 1874, complaining of pain over the crown of the head, frontal head-ache, and feeling of numbness and tingling extending up the back of the neck to the occipital region.

Present ailment dates from the New Year (1874), about which time he was drinking hard, chiefly brandy. In consequence he had two attacks of *delirium tremens*, and since then has been complaining of severe coronal head-ache, as if a great weight was pressing on the vertex, with a feeling of giddiness and faintness at times. He also experienced a girding sensation around the head, as of a tight-fitting cap, with a feeling of numbness over the same region, extending down the back of the neck. Ever since he has also been getting very low-spirited and hypochondriacal, and

usually passes more or less restless nights. Two years ago, he lost the power of his left forearm and hand for a period of six weeks, after a drinking bout. He confesses to have lived a debauched life and to irregular habits, but denies sexual excess or syphilis.

After admission he not only complained of head-ache and all the other symptoms noted under history, but he had spectral illusions, and a feeling of tenderness localized to one spot on the vertex, a little to the left of the coronal suture, and which, when pressed upon, causes pain at the back of the throat. This spot is about the size of a shilling. He also complains of a feeling of numbness and pricking in the ring and little finger of the right hand, extending a short way up the forearm. The various sensibilities—to touch, pain, temperature, &c., are unaffected. Motor power both voluntary and reflex are normal; sleeps badly; head-ache, &c., often worse at night, and prevents sleep. Pupils are large, but contract well to the stimulus of light; the eyes are myopic with hyperæmia of optic discs; other special senses normal. He is generally morose, low-spirited, and desponding, and seldom associates much with the other patients.

On April 19th, between twelve and one o'clock, he was seized with severe rigors, followed by hot and sweating stages. Felt sick during the cold stage and inclined to vomit, and complained of severe pains in the back, and of frontal and coronal head-ache. He also felt great oppression on the vertex and against the eyeballs, as if forcing them inwards. The pains in the small of the back were unusually severe, and extended up to between the shoulder blades. During the hot stage, the pain increased, and he began to pass a considerable quantity of somewhat pale-coloured urine in the sweating stage. The cold stage lasted for about a quarter of an hour or twenty minutes, during which, although the patient felt cold, the thermometer stood at 102° . The hot stage lasted about half an hour or more, and the temperature was 104.2° . He felt hotter about the head and neck than elsewhere, and sweated most, he thinks, in these regions. Thermometer registered 101.2° in the sweating stage. Urine passed contained a trace of albumen, sp. gr. 1020; phosphates abundant, with epithelium, mucous cloud, &c. Bowels were confined; aperient ordered. Up to date of writing there was one recurrence of the fit.

The chief points of resemblance and difference in the three classes of cases detailed are very obvious. With differences as to the state of the kidneys, the cardinal points of resemblance are the

thermic phenomena known as rigors. To understand the pathology of rigors it is necessary to compare them with the results of cold; to definitely locate them; and to ascertain, if possible, the anatomical relations of the nervous system to the heating and cooling of the tissues locally, and of the organism in general. First, then, as to the physiology, as indicated by "taking cold." To indicate the relations of taking cold to albuminuria, I shall take an abstract of the cases communicated by Dr. Geo. Johnson to the Clinical Society of London already referred to, as given in the *British Med. Journal*, Vol. II. for 1873:—

"The first case was that of a medical student, aged twenty-two, who, about seven o'clock on the 18th June, after bathing for a quarter of an hour in the Marylebone bath, had a sense of fatigue and head-ache. Four hours after the bath the urine was tested and found albuminous. In the evening there was still a trace of albumen. The next day the urine was normal, and continued so until June 25th, when he again bathed. The bath was again followed by a head-ache, and in the course of the day the urine was found albuminous. From that date until July 17th every specimen of urine passed was tested, and albumen was present at some period of the day on all but five days. Since July 17th the urine has remained normal. The subject of these observations is in good health, and has never been seriously ill. The second case was that of a medical student, aged twenty-five, who one day in July bathed in the Lambeth bath for an hour. He felt no inconvenience. The urine passed an hour after the bath contained a sixth of albumen. The urine was not tested for three or four days, when it was found normal. The experiment has not been repeated. The third case was that of a medical student, aged twenty-three, who on three occasions found his urine normal before bathing in the sea in August and September; and on each occasion, after remaining in the water from a quarter to half an hour, found a moderate quantity of albumen in the urine. In a few hours this had disappeared. He felt no inconvenience from bathing. Four other students, after bathing from half an hour to an hour, and on one occasion for an hour and a half, found no albumen in the urine. The fourth case, a boy, aged sixteen, looking pale and feeling languid, was found to have albumen in the urine to the extent of one-eighth on June 25th. It was of pale colour and contained no casts. On September 23rd, when next seen, only a trace of albumen remained. On October 23rd the urine was quite normal. Until within a few days

of the time when the albuminuria was first discovered, he had been bathing almost daily in the sea, from half to three quarters of an hour at a time. He had felt fatigued and chilled, and on one occasion had vomited on coming out of the water. The only previous illness had been diphtheria, ten years before. The transient albuminuria was believed to have been caused by the repeated and prolonged immersion in cold water; and it was suggested that as acute Bright's disease is not unfrequently excited by exposure to cold and wet, there was danger lest the frequent recurrence of temporary albuminuria, the result of prolonged cold bathing, and the consequent repression of the cutaneous secretion, might lead to permanent mischief and the structural degeneration of the kidney."

So far as to albuminuria. In the discussion which followed, Dr. Hermann Weber related a case of hæmaturia from cold as follows:—

Coming lately to Grindelwald, Dr. H. Weber found a gentleman in bed with hæmaturia, of whom it was stated that, a few days previously, when greatly fatigued, he had fallen into a river, whence he had not walked, but had been carried home. He had sat for some time in his damp clothes, dined, and had then gone to bed. Three weeks afterwards the gentleman came to London. His urine was no longer bloody, although albuminous; the specific gravity was normal, and it contained nearly transparent casts of the tubes. The albumen remained for five or six weeks. Six months afterwards the gentleman was quite well. Probably, therefore, before the accident he had no albuminuria, otherwise it would not have disappeared so readily. Of four other cases under Dr. Weber's care, in whom albuminuria has ensued upon exposure to wet and cold, one was fatal; in one the albuminuria remained permanent; the two others recovered. Probably the two former had previous disease of the kidney, whilst the two latter had none.^a

Various opinions were expressed as to the order of causation in these cases. Dr. Greenhow thought that the symptoms were traceable to some defect of the nervous system. Dr. George Johnson, being a humoral pathologist, thought the albuminuria was probably due to the repression of the cutaneous secretion, and fortified his opinion by quoting experiments on rabbits, which had albuminuria after having had their skin deprived of hair and then varnished. These experiments hardly help, however, to an explanation, because it is by no means clear that rabbits and men are alike as to their cutaneous structures and functions, and because it

^a British Medical Journal, Vol. ii., 1873, p. 664.

is doubted whether the shaving and varnishing of these rabbits is at all analogous to human bathing. A well-written article in the *British Medical Journal* for December 20th, 1873, discusses the question of causation from a mechanical point of view. The writer maintains a hydrostatical theory, and argues that "a continuous application of cold to the surface of the skin must obviously have the effect of increasing the blood-pressure in internal organs; and this increased pressure on the walls of the Malpighian capillaries may determine a serous transudation through their walls." But he modifies his theory humorally for chronic cases of albuminuria. It is probable, he thinks, that the albuminuria which follows directly upon a prolonged cold bath, and passes away in a few hours, is due to this purely mechanical or hydrostatical cause; but when (as in one of Dr. Johnson's cases) the albuminuria continues for three weeks, and in another for three months, it seems more likely that the repression of the cutaneous secretion is the proximate cause of the albuminuria. The appearance of albumen in the urine of a rabbit whose skin has been covered by an impermeable varnish seemed to him a strictly analogous phenomenon. These views offer the most recent and best solution of the problems involved. Something in the argument may be admitted. For example, there can be little doubt that whatever may be the exciting causes in cases of this kind, there are local predisposing conditions affecting the kidneys in one or other of their structures. One of these may be the state of the nervous system locally; another of the blood-vessels; a third of the secretory structures. But the appearance of albumen in the urine of a shaven rabbit, when its skin has been covered by an impermeable varnish, cannot be admitted to be strictly analogous to that following on the use of a cold bath. Further, the occurrence of albuminuria at a temperature of 103.6° , as in Case I., negatives the repression theory of cold.

A brief examination of the phenomena resulting from too low temperature of the surface will suffice to show that we must widen greatly our sphere of inquiry. Two results follow accordingly as the withdrawal of heat acts locally or generally. If locally, there may be simply numbness and aching of the part, with dingy redness or blueness; or there may be death-like pallor, ending in chilblain, frost-bite, or death of the part. If the results be general, then the phenomena vary much according to the extent to which the temperature is lowered generally, and to the heat-producing power. Under ordinary circumstances, a person whose general

temperature is lowered sufficiently, as in a cold bath, or otherwise turns pale or even livid, the muscles of his jaws and limbs are thrown into short contractions so that his teeth chatter, and he shivers and shakes. At the same time certain muscular structures of the skin, of the hair-bulbs, and perhaps of the sweat-glands, contract, so that his skin gets rough as well as pale, and having been likened to the skin of a plucked goose, is termed the "goose-skin." But it is to be noted that the same kind of contraction occurs when a feeling of pain is experienced, and hence it is also termed horripilation (the Greek word *ρίγνέω*, whence rigors, means to be horrified as well as chilled.) That the muscles of the hair-structures are chiefly involved in this phenomenon is probable, because in lower animals fear and anger cause the hairs and their analogues, as quills, feathers, and crests, to be erected. So that there are contractions of this kind—1, from lower temperature; 2, in the paroxysm of an ague; 3, in fevers; 4, in suppurative inflammations; 5, in various neuroses; and, 6, in emotions. Hence, for a common source of origin of rigors we must look to some condition of the nervous system. And so with the heat and the sweats. As a clinical fact, the whole phenomena of a fit of ague are sometimes limited to a limb or to half the body. These can only be explained in like manner. That both heat and sweats and redness are neurotic in various other conditions is equally capable of proof. Examining the phenomena as they are connected in febrile rigors with the *feeling* of cold, and yet with higher temperature of the skin, it is worthy of special notice that the fact has been known for above a century. It was clearly stated by De Haen, a clinical professor at Vienna in his *Ratio Medendi* of date 1759–65. De Haen was a most accurate thermometric observer, but for nearly a century his valuable facts and observations of this kind have been lost to science and art, simply by that neglect which is so commonly the lot of too-advanced men. He particularly noted that in the case of a quotidian intermittent the patient complained most loudly of cold during the so-called cold stage, although the thermometer was everywhere at 104° , *while the complaints of cold diminished as the thermometer fell to 100° , 99° , and 98° .* The pulse during the cold stage was, as is usual, quick, small, and contracted. De Haen tested and objected to a mechanical theory then current, and since revived, I think, by Virchow, that the heat of fevers is due to the increased friction of the blood in the blood-vessels, and he used this case for that purpose; but at

the same time he seems to have been of opinion that the man was really cold internally, although not externally, which, indeed, may have been the case; and he says that his fever was not of that kind termed a *leipuria*, in which the patient is cold externally, yet thirsty and burning internally, and which is said to be fatal—such a condition, in fact, as we have in choleraic collapse.*

We can take advantage of modern psychological science to explain some of these conditions. The patient in a rigor, even when wrapped up, *feels* cold on the surface of the body, although he is hotter than natural, because his nerve-centres are in the same condition, morbidly, as if the temperature on the surface had been lowered. Hence we can conclude not only that the illusive feeling is a thermal or thermic neuralgia (for the painful sensations due to temperature can only be manifested as painful sensory neuroses in this way); but that lowering the temperature of the body, as by cold, induces such a centric neurosis, known normally as the pain of cold, and which neurosis causes not only the feeling of cold, but also the convulsive tremors of the jaws and limbs, the contraction of the muscles of the hair-bulbs, and the contraction of the vessels causing pallor. But if the lowering of temperature be not too long continued or too extreme, there is, as a result, increased heat production, so that thermogeny results as a reflex conservative act.

If now we differentiate the thermic nervous system, we can subdivide it into what are the analogues of the sensory and motor systems. The sensory will be the seat of neuralgia, as pains of heat and cold (*ardor* and *algor*); of hyperæsthesia, or neuralgic sensibility to changes in temperature; and of anæsthesia or loss of thermic

* Since writing the above I have had my attention called to a paper written by a Dr. Allvey, of date 1801, for a provincial medical society in England, on the employment of cold in typhus, and published in *The Practitioner* for April. The author precedes his observations "on the relative powers of heat and cold upon the sensations of the human body" by a few statements as to what cold is and what it causes. The gist of his paper is that the sensation of the patient is a good guide, in the use of cold therapeutically, as well as the thermometer. Thus, when cold sponging is to be used, "the heat of the surface must be steadily above what is natural, not the smallest sensation of chilliness or tendency to perspiration being present." And again:—In a "fever in many respects similar to the synochus of Cullen, in which the senses of hearing, taste, and feeling are throughout the disease uniformly acute, and the heat of the surface frequently up to 108°, with great restlessness, delirium, and incessant talking, the patient invariably shrinks from and is hurt by cold." As a practical fact, he affirms that in fevers of that kind the practice of employing cold therapeutically "in any form so as to prove inconvenient to the patient, has been found baneful, and ought to be abstained from altogether."

sensibility. Hyperæsthesia and a consecutive neuralgia characterized Case II. In addition to these thermic phenomena, there are the muscular aches and contractions which follow upon extreme cold. Rigors, from this point of view, constitute a central *thermic* or *thermal* neuralgia and spasm.^a As to the thermic motor system the excessive production of heat corresponds to motor spasms, and the abolished production and regulative power to motor palsy, as I could show more clearly if space allowed.

This view enables us to apply the facts of experience, as to neuralgia in general, to the elucidation of these thermic neuroses and their results. Thus, for example—first, just as in ordinary neuralgia there is the exalted sensibility to impressions termed hyperæsthesia, so in rigors, in the first stage of fevers, and in various local and general thermic neuroses there is exalted sensibility to cold, or an intolerance of heat, or of a higher temperature. And there may be this state of feeling with vascular spasm, quite irrespective of the temperature of the part affected, just as occurs in rigors. So that to conclude, because there is pallor, and the patient says he feels cold, that there is a state of coldness, is an error in method.

Even so experienced and accurate an observer as Dr. Brown-Séquard has, I think, omitted that precaution in discussing the pathology of a case of thermic hyperæsthesia and neuralgia.^b Contraction of the blood-vessels is not necessarily a cause of coldness, although as a reflex act it is a cause of cooling. In rigors and in other thermic neuroses there may be undue heat without the feeling of hotness, and contraction of the vessels to obviate the undue heat with the feeling of coldness. In Case II. there were both the feeling of coldness and a real lowering of temperature from thermic palsy, as indicated by the lividity of the surface.

Carefully observed facts, in short, dispose of the theory so generally held, as if it were an established fact, that abnormal coldness is due to, and therefore always follows on, vaso-motor spasm; and that abnormal heat is induced by vaso-motor palsy—in each case it being

^a There is some doubt as to the proper uses of these terms, but it appears to me that the word "thermal" should be restricted to indicate those morbid conditions which directly depend upon too high or too cold a temperature, or are due to heat and cold as immediate causes; while the word "thermic" should be used to denote the kind of affection which results from morbid conditions of the thermic nervous system, as the regulator of temperature.

^b Case of persistent reflex-contraction of the blood-vessels. Arch. of Scien. and Pract. Med., Vol. I. 1874.

assumed that the blood is the exclusive source of heat, and not the tissues, coincidentally, at least, with the blood. And this theory is a common source of fallacy, both in observation and treatment, for, since it is not the fact, as is proved by the phenomena of severe rigors, that there is necessarily diminished temperature with diminished circulation and pallor of the surface, so neither is there necessarily increased heat with increased blood supply and congestion. So that redness or flushing by no means necessarily implies, as is commonly thought, an increase of temperature. There must be various other conditions, for the laws of vital heat are complex. The state as to vital energy of the tissues themselves, their condition as to innervation, the state of nutrition of the blood and of the lymph, and the contractility of the lymphatics, as well as of the capillaries and arterioles, and of their condition as to innervation, are all factors in the causation of heat, and of these morbid local changes, of whatever kind, which depend upon states of nutrition and of temperature of parts. This is particularly the fact as to these tissue-changes known as inflammation and inflammatory, and congestive effusions and exudations; and which, even as to the lymph and the lymphatics, vary greatly under the terms scrofulous, rheumatic, gouty, syphilitic. But whatever the kind of change may be a certain specific temperature is necessary for vital activity, and any wide departure from this, either in excess or in defect, leads to various morbid changes and to death.

The relations of the blood-corpuscles to heat-production turn upon their being the vehicles and sources of oxygen, the chief element of combustion in combination with certain chemical compounds to which the colour of the blood is due, and of which carbon and iron are essential constituents. Now, a lower temperature of the tissues will diminish the vital energy of the corpuscles and capillaries, and hence, probably, the lividity of the surface when too cold. In Case II., since this too cold state, due to thermic palsy, was the probable cause of the extreme blueness observed, it is also probable that a like condition extended to the kidneys, causing hæmaturia. But a due consideration of this point would lead us into the pathology of purpura hæmorrhagica and purpuric fevers. All I would say now is, that there are certainly neurotic forms of purpura.

To understand the diastaltic action of the thermic nervous centres on the tissues, the blood-corpuscles, the capillaries and small vessels, and the sudoriparous glands, and the relation of these latter to the kidneys, it is necessary to apply the

laws of reflex action to heat-production. We can start from the fundamental fact that the body has to be maintained at a certain range of temperature by the conservative and regulative action of the nervous system; this range is the specific heat without which no natural activity can properly go on. Now, it is certain that this is maintained, not only in the body generally, but in particular portions and under varying thermal conditions of surrounding media, whether these tend to raise or to lower the temperature. If we inquire into the action of the regulative mechanism, we find that it varies according as the one or other contingency has to be met. If the surrounding medium abstract heat, then the incident excitatory thermic nerves excite the regulating thermic centres, so that a conservative reflex influence is exercised on the cooled part, heat is produced therein, and the specific heat maintained. On the other hand, if the surrounding medium add to the heat of the body, a conservative reflex influence is equally exercised, so that due cooling results. The chief means to the latter end seems to be an increased efflux of blood to the sudoriparous glands, so that the surface of the body is covered with water, and cooling results from evaporation. This does not, however, exclude a mechanism for cutting off the supply of oxygen and carbon from the blood-corpuscles to the tissues proper by contraction of the blood-vessels. When the production of heat is needed, the conservative process may be held to be exactly analogous to reflex motor acts; we need only to substitute motor energy as heat for motor energy as muscular contraction. There is no question here as to the contraction of the vessels, which is also a physical process, for we know that the abstraction of heat locally causes vascular contraction and pallor, while the addition of heat induces dilatation, redness, and increased vascular activity. Such result would also follow on the neurotic and conservative production of heat in tissues; so that it may well be doubted whether the results of experimental injury to the ganglia of the sympathetic system, or of lesion of the spinal cord are shown—first, in the dilatation of the vessels, and then in the production of heat. On the contrary, it is heat-production first, and then dilatation and vascular activity. Probably the same order of events occurs in muscular activity. The heat produced excites the activity of the circulation in the muscular tissue, but that is a result of the action of the *vis nervosa* on the muscular mechanism.

Carrying this analogy further it can also explain, in some degree, why in certain morbid states of the thermic nerve-centres there is

increased heat in the corresponding tissues; for just as violent muscular contractility, in the form of convulsions and spasms, results from certain morbid conditions of the musculo-motor system, so, also, in the thermic system. From this point of view all the phenomena of rigors, including heat-production, are spasmodic; inasmuch as there is not only spasmodic contraction of the vessels, but the hyperpyrexia is equivalent to spasm, too, as the analogue of convulsions. We may also extend the analogy to the *post-mortem* production of heat in certain diseases, as tetanus, yellow fever, and cholera; for in these in like manner, there are often *post-mortem* contractions not only of muscles, but of groups of muscles. And, lastly, just as there is a so-called "*vis insita*" in contractile tissues, so, also, in the tissues of plants and those of animals devoid of nerves and blood-vessels, there is a "*calor insita*" independently of blood and nerves. It follows, as a necessary conclusion from all this, that thermic changes will occur, both generally and locally, from diastaltic and reflex action of the thermic nerve-centres, together with the coincidents of redness, pallor, and sweats. In illustration of this principle I refer to one of my published lectures,* from which I subjoin an extract:—

"Numerous facts prove decussation of the thermic nerves. If one hand be made cold by being placed in iced cold water, the other becomes cold also; and this is not due to a general lowering of temperature, because that of the axilla and tongue remains unchanged. Cooling the hands or feet is an effectual method of causing a paretic urinary bladder to contract. Hemi-section of the medulla oblongata, or of the spinal cord on a level with the first cervical vertebra, is followed by increased heat on the same side of the head, hand, foot, wrist, and ankle, and on the opposite side of the trunk, thigh, arm, leg, and upper part of the forearm. Hence the conclusion that the thermic nerves of the abdominal parietes decussate either as soon as they enter, or when they leave the spinal cord. On hemi-section in the mid-cervical region, Schiff found the hand and lower part of the arm to be hotter on the same side as the section, but the shoulder and the rest of the limb to be hotter on the opposite side. Also the foot and ankle were found hotter on the same side, but the trunk, thigh, and leg hotter on the opposite side. These results of experiment appear to me very worthy of notice, because they explain various anomalies which I have

* On the Trophic Clinical Anatomy of the Cerebellum and Medulla Oblongata. Medical Times and Gazette, July 22nd, 1871.

observed clinically. A diagonal or circumscribed area of cutaneous inflammation may sometimes be seen in skin diseases similar to these spheres of heat-production. The law is also specially manifested in cases of diagonal dropsies and in wasting palsies, in which the same crossed morbid action is seen. In all these cases the centric disorder may be unilateral, although the results are shown in the upper portion of the limb, say on one side, and the lower portion in the other; for lesion in one half of the cord may affect the direct fibrils on that side, and the decussating fibrils entering in from the opposite side. It is probable that the decussations of the sensory nerves of the hands and feet are high up within the cranium, and not in the cord, as is the case with those of the upper arms and thighs; for, the former being tactile and executive instruments, must have both their special motor and sensory centres within the encephalon. It is for this reason that numbness, as well as motor palsy, beginning in both hands or in both feet, is a sign of intra-cranial centric disease. In like manner, symmetrical gout of the hands and symmetrical affections of the skin, like purpura and psoriasis palmaris, are associated with trophic nervous debility of centric origin. The hot palms in fever and in various neuroses, belong also to this class of symptoms. It is for this reason that the first return of moisture on the palms in cases of fever is so welcome. It indicates returning regulative action of the nerve-centres.

“Knowing these general principles of trophic clinical anatomy, we can be more practical in our researches, and more readily apply experimental facts. Claude Bernard found hemi-section of the spinal cord in the dorsal region to be followed by increased heat of the lower extremity of the same side, and diminished heat of that of the opposite side; so that a diseased kidney acting injuriously on the spinal cord on its own side (which it will do), might lower the temperature in the opposite side by acting on the decussating thermic-motor or executive fibrils going to that side, and at the same time cause an illusive sensation of heat there by acting on the sensory afferent fibrils. Sweats and rigors may also thus be induced. Irritation of the urethra will excite dangerous, because general, rigors; but then, like the cervix uteri, it is a unified organ, in virtue of the double decussation of its sensory fibrils, so that urethral irritation cannot be unilateral; nevertheless, creeping local chills and goose-skin do occur from localized centric or diastaltic action, such as those felt about the loins at the beginning of a ‘cold’ or of a fever.

“There are numerous morbid conditions which are plainly due to

this diastaltic action of diseased viscera. Thus, in unilateral pneumonia, and in tubercular phthisis chiefly affecting one lung, there is often a hot flush over the cheek of the same side. Sometimes one ear is hotter than the other in head affections, just as there is more venous congestion on one temple than on the other."

It is now possible to discuss humoral theories of repression from an intelligible point of view. When the surface of the body is chilled, what is or can be "repressed" or thrown back upon the kidneys? Obviously it must be something that the skin excretes in common with the kidneys. Now, the kidneys, besides the mineral constituents of urine, excrete water, azotized carbon as urea and uric acid and its salts, and oxidized carbons constituting the various urinary pigments. The first and last are skin excreta, but their relations are more complex than appears at first sight.

The regulative mechanism which the thermic nerve-centres constitute is chiefly occupied with the production of heat, because for the most part the surrounding media are at a lower temperature than the specific heat of the body. But there are conditions of climate, and of disease, and work, such as occur in great muscular activity and in fevers, in which the cooling of the body is the object aimed at. And this is chiefly attained by the method of evaporation, to which end the sudoriparous glands, as I have shown, are excited to pour out a watery fluid profusely as sweats. The relations of these glands to the kidneys are not exclusively, therefore, specific as to certain excreta, as the humoral pathologists affirm in their theories of repression, but include the amount of water to be excreted by the skin and the kidneys correlatively. Further, in regard to the excreta themselves, it must be remembered—1. That water may itself be an excretion, for the quantity in the blood is, like the heat of the body, a specific quantity, and if it be in excess must be excreted by either one organ or another. That this regulative function as to water is fulfilled by the kidneys is well established, and recent researches point to the Malpighian corpuscles as the excretory organs. If, then, it is water that is repressed, these structures will be affected. 2. The carbonaceous products which the kidneys excrete largely being the products of thermogeny, will be in relation to the heat produced. That this is so clinically is shown by the deep colour of the urine in acute rheumatism and other pyrexial diseases, and is well illustrated by the lithates and bilious vomiting in the pyrexial paroxysms of Case II. But, 3, it is questionable whether the relations of the skin to the kidneys extend beyond these carbonaceous products;

carbon pigment is excreted of various colours by the skin—blue, yellow, brown-black—but we rarely, if ever, find urea or uric acid. From this point of view we must take in both the liver and the lungs, in their relation to the kidneys, as excreting used-up carbon or oxidized carbon of varying composition.

The exhausting influence of a high atmospheric temperature upon both the skin and the kidneys may be more easily understood when we consider the relations of these organs to the need for water and for getting rid of superfluous carbon; but, more especially, as to the latter in inhabitants of temperate climes, when exposed to a high temperature, or when there is not habituation to extreme heat. That a high temperature influenced the origin of the thermic neuroses in Cases I. and II. is a leading fact in their histories; and that it had its influence on the bathers is not improbable. A continuously high temperature, from excessive muscular activity with profuse sweating, must have a like exhausting influence; and hence the readiness with which persons so situate “take cold,” and suffer from pyrexial diseases.

Illustrations of these views as to the position of the nervous system in thermogeny might, indeed, be extended to almost any length in elucidation of the causes of disease.

