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ON

HYSTERIA AND NEURASTHENIA.

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BY

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ALTHOUGH the expression "functional nervous diseases" is a bad one (for do not all diseases during life declare themselves by alteration of function?), yet it is a well established term and is of use and should therefore not be lightly discarded; for it includes those affections in which we know of no pathological anatomic change and in which we assume that there is either some dynamic abnormality in a statically normal nervous system, or else that a lesion, if such exists, cannot be found owing to imperfect methods of examination.

Only a few years ago this group was a large one and included Landry's paralysis, myasthenia gravis, Graves's disease, chorea, paralysis agitans, epilepsy, tetanus, tetany, paramyoclonus, convulsive tics, spasmodic torticollis, habit spasm, writers' cramp, tic-douloureux, migraine, hysteria, neurasthenia, hypochondriasis, and so on. But in many of these affections definite organic changes are now recognized, and in others, even including neurasthenia, it is easy to conceive either that changes exist or that normal reflexes have become disorganized.

I wish here to deal especially with hysteria and neurasthenia. It is often assumed that the great war added enormously to our knowledge of these conditions. Certainly it led an increased proportion of medical men to take an interest in them and to study them for the first time; and this was an excellent thing. But I am not alone amongst neurologists in saying that the war revealed no manifestation of these affections in any way new to us, and no system of dealing with them which had not already been practised by those engaged in that branch of medicine. The war added very greatly to the already existing prodigious mass of literature on hysteria, neurasthenia, and the psychoses; but this is not an unmixed blessing, for it has enormously complicated a somewhat intricate subject, and, worst of all, has led to the introduction of a totally unnecessary new terminology, gradually becoming almost a foreign tongue, and often, to me at any rate, incomprehensible. Some authors, in fact, seem to have lost themselves in a forest of words. Yet in spite of this there is often an inability to distinguish between two entirely different affections—hysteria and neurasthenia—and worse still to mix up neurasthenia with the early manifestations of insanity, with which as a rule there is no connexion.

HYSTERIA.

I will define hysteria as a purely mental condition without pathological anatomic change in which diseased manifestations are imagined and assumed; and the basis of the condition is a morbid craving for sympathy or notoriety, or both. Note that it must be a morbid craving and that it must be some diseased manifestation which is assumed. Many have a craving for notoriety which they try to obtain by writing to newspapers, speaking on all kinds of subjects at every opportunity, or dressing in bizarre clothing, and in some this craving so greatly influences their conduct as to make it morbid. But this is not hysteria, as it is not a simulation of disease. So with a craving for sympathy. This may be a very real and legitimate desire, as in the case of the sick or overworked wife neglected by her husband, which exhibits itself by depression or weeping. This is not hysteria; but if as a result of such craving for sympathy some disease manifestation is assumed, then the craving is morbid and it is hysteria. In neuropathic subjects this craving for sympathy may occur without any reasonable cause for sympathy to be given, as when a servant has

been rebuked ever so gently by a master, for some slight fault, and a hysterical convulsion has resulted.

It may be objected that such an assumption of a diseased condition is mere malingering. I admit that sometimes it may seem difficult to make a distinction, but it is really very wide, for I define malingering as the deliberate assumption of a diseased condition, the basis of the assumption not being a morbid craving for sympathy or notoriety, but a natural desire for personal and material gain. Malingering is most common amongst prisoners (including suspected persons awaiting trial), soldiers and sailors (especially on active service), and in persons claiming compensation for injuries. In my presidential address at the Neurological Section of the Royal Society of Medicine¹ I narrated several pairs of cases in which the manifestations were similar, one case of each pair, however, being hysteria, the parallel case malingering. Let me narrate two illustrative cases.

A nurse complained of intense pain in the spine, worse on movement, and pyrexia up to 102° F. was present. She was, of course, kept in bed, but repeated examinations revealed no cause for her trouble; the pain and irregular pyrexia continued for several weeks. I then became suspicious, took her temperature myself with two thermometers simultaneously, one in each axilla, and found the temperature normal. She recovered at once, knowing her deception had been found out. Now if this simulated illness was for the purpose of obtaining the sympathy of her attendants and fellow nurses she was a case of hysteria; but if merely to have a lazy and comfortable time in bed it was malingering.

A boy, aged 16, was brought to me suffering from total blindness which had come on rather suddenly while at a public school. No cause could be found for this in the eye itself. He had to be led about everywhere, and one of his schoolfellows had always to attend him. When he came to see me I at once noticed from his features that he was "taking stock" of me. I took him in another room away from his friends, spoke rather sharply to him, told him he could see perfectly well, and ordered him to return to the other room and walk freely about to show his friends he had recovered, and this he did. If this blindness was assumed to get off lessons, and especially if he had been found reading novels when alone, he was a malingerer; if to gain sympathy and notoriety amongst his fellows, it was hysteria.

Both in hysteria and malingering any disease may be imitated which the person has seen or heard of or read about, but never one of which the person has no previous knowledge; and the greater the knowledge of the disease the more close the resemblance will be, and the contrary. In both cases an audience is necessary; a hysterical person does not waste her substance "on the desert air." A hysterical person, and even a malingerer, will submit to all kinds of personal discomfort (even the amputation of a limb) to gain the object in view.

One fundamental difference between hysteria and neurasthenia is that the former is principally a matter of objective physical signs, the latter of subjective symptoms. The manifestations of hysteria, such as blindness, deafness, mutism, anaesthesia, loss of power, vomiting, raised temperature, and so on, can be observed and tested by others; those of neurasthenia all relate to altered feelings. But in hysteria and in malingering complaint is sometimes made of intense local pain, and it is impossible to test the truth.

As regards etiology, all persons are prone to hysteria, and it is sometimes seen in domesticated animals, such as horses and especially pet dogs craving for notice. Gilles de la Tourette² records several such cases. One was that of a terrier for whom his mistress got a bitch as a companion. The dog at once lost its gaiety and appetite, developed dysphagia, alteration of voice, and a progressive paraplegia without incontinence. It recovered as soon as the bitch was removed.

In neuropathic heredity this proneness is more likely to become manifest; in the well balanced person, in spite of all inducement, it will never occur. Almost no age is exempt; I have seen hysterical cerebellar reel in a boy of 7 years, and hysterical flatulence from deliberate air-swallowing in women over 60. It is, of course, commoner in women, but is also found in males (generally below the age of 20). The immediate causes of the condition manifesting itself are almost too numerous to mention: moral shocks, jealousy, insults, either real or imagined, disappointments, frights, and injuries; sometimes it occurs as a complication of real disease. But in every case, if thoroughly investigated, the basis is a craving for sympathy or

notoriety, or both. In compensation cases I have seen many instances in which the condition has been produced or made much worse either by supposed or real inattention to the person at the time of injury; or later on by someone depreciating the amount of the injury received or by offering a quite inadequate sum as compensation.

The signs and symptoms in hysteria are as numerous and varied as the imaginings of the patient; and may be manifested in acute attacks lasting an hour or some days and coming on periodically, or may be more chronic and last months or years.

Alterations of sensation may lead to complaints of localized pain, sometimes in the head or spine, either the whole spine or a localized area, in the breast, over the heart, and frequently in the abdomen. Hyperaesthesia is more common than the spontaneous pain just mentioned, and these tender zones may be on the top of the head, above or below the breast, at the iliac fossae or the vertebral spines, and pressure on such zones may start an acute hysterical seizure. More frequently loss of sensation is found, variously distributed, in one limb or part of a limb or both legs, but hemianaesthesia is more common; as a rule the areas said to be affected do not conform to the anatomical distribution of the sensory nerve roots. In a limb, for instance, the limit of anaesthesia is generally a horizontal line drawn round the limb either just above or below a joint. Affections of vision are common, either total blindness of one or both eyes, marked contraction of the fields of vision, abnormal alterations of field of colour vision (instead of the normal white, blue, red, green, it may be red, blue, white, green), or colours may not be recognized or may be called by wrong names. I have never seen a bilateral homonymous hemianopia in hysteria; it is a manifestation very unlikely to be known to a hysterical subject. There may be unilateral or bilateral deafness, loss of smell or taste; speech may be affected either as aphonia or mutism or be manifested by mere gibberish.

The motor manifestations may be general or partial convulsions, local contractures, various forms of tremor, paralyzes of various types, paraplegia, hemiplegia, or monoplegia. But close observation will reveal that in no case do they perfectly conform to the signs of similar affections due to organic disease; the "fit" is never a perfect epileptic fit, the spastic paralysis is never accompanied by the proper associated increased reflexes, nor the flaccid paralysis by wasting of muscles.

To put it shortly, the change, if any such exists, which produces such sensory or motor disturbances is not in any part of the brain or cord known to be directly connected with sensory or motor centres or tracts, but is a dynamic change in the highest cerebral cortex, a psychical change.

Visceral manifestations may affect the digestive system—*anorexia*, starvation, ravenous hunger, vomiting, flatulence from air-swallowing, meteorism (and pseudocyesis), colic, constipation. Other visceral affections may be constant cough, altered breathing, bringing up blood either by coughing or vomiting (such blood as a rule having been sucked from the gums or throat or injured tongue). About 1889, when resident in hospital, I was told that there was a girl in the surgical wards who was suffering from total loss of sensation and motion of the left arm, due to rupture of the brachial plexus from a fall against a pew in church. At the most earnest solicitations of her friends and herself, as the paralysed arm was a constant hindrance to her, it was arranged to amputate the arm at the shoulder-joint. The night before the operation I was asked to see her as she had vomited a pint of blood. She was transferred to the medical wards. The next morning, from the peculiar transparency of a thin film of the blood, I surmised it was being sucked from the gums, and on examination found this to be the case. Needless to say no operation was performed and she was discharged cured. Polyuria, dysuria, ischuria, and vaginismus are also seen.

I believe that many of the so-called trophic and vasomotor changes described in hysteria are not changes due to disease but are artificially produced. I refer to the bloody stigmata, the blisters, the gangrenes, the erythemata, and the

increased temperature. If suitable and full observation be made, such tricks for obtaining sympathy can always be found out. The "blue oedema" and "white oedema" if not artificial are, I think, real vasomotor changes unconnected with hysteria.

Although hysterical subjects may possibly sometimes suffer from a self-induced hypnosis or may apparently have no recollection of what has occurred during an acute attack, or may have a simulation of loss of memory of the whole life-history previous to a particular attack, these, to my mind, are no more real than a hysterical flaccid motor paralysis. It is most important also to remember that however unconscious a hysterical person appears to be, it is probably always a simulated unconsciousness; at any rate that is my personal experience. Indeed, I go further and maintain that, however unconscious hysterical subjects may appear to be, they are really intensely "wide awake" and are watching the observers as keenly as the observers are watching them. A psychic condition of the utmost importance in hysteria is hypersuggestibility; so marked a feature is it that Babinski has suggested the name "pithiatism" (*πειθω*, I persuade) for hysteria. I thoroughly agree with him that many of the manifestations seen, such as hemianaesthesia and various types of paralysis, have unconsciously been suggested to the patient by the medical examiner, and the more they appear to be the real thing the more they have been suggested.

It would take too long to consider the differential diagnosis of each hysterical manifestation; and indeed it is not necessary to do so. All that has to be remembered is that the hysterical simulation is never perfect and never fully conforms to the anatomy and physiology of the nervous system.

Treatment also must be dismissed in a few words. In very acute cases, such as a "fit," a sudden shock, such as a strong faradic current applied to the neck or a douche of cold water on the head, may cure at once.

A boy, aged 18, was brought into hospital one night in great haste, said to be suffering from hydrophobia; he was in convulsions and there was a vague history of a dog bite some weeks before. As I was the only man in hospital who had ever seen genuine hydrophobia, I was called up to see the patient. The convulsions were of the irregular bizarre hysterical type, and when I approached the boy he "barked" at me and tried to bite me. A strong faradic current applied suddenly to his neck promptly cured him.

But in chronic cases any such violent methods do the greatest harm; isolation from friends and relations is almost essential, and the doctor and nurse must sympathize with the patient, and go fully into the life-history to discover the reason why the morbid craving has arisen. In this way the patient comes to the conclusion that at last there is someone who understands her, and when once such confidence has been gained the medical man can without difficulty persuade the patient to a normal condition. Of course, the sympathy extended must be of the persuasive, encouraging, optimistic type, and not the coddling and pessimistic type which makes things worse.

NEURASTHENIA.

Neurasthenia may be defined as a disease of the nervous system without known pathological change in which there is a persistent weakness and irritability of nerve centres due to chronic overuse of neurones and manifested by purely subjective symptoms—that is, by altered feelings.

In health, fatigue is followed by a repose during which the cell is restored, and in animals the cell changes due to fatigue have been observed—the swelling of the cell body and dissolution of part of the chromophil substance, followed during repose by restoration in size and of the chromophil particles. But if fatigue is either too severe or too prolonged such restorative changes may not occur; and the altered cells become at first more irritable and more susceptible to fresh fatigue, and finally their function is lowered.

There is no common standard of fatigue for all men, a point beyond which fatigue must not go if an ordinary repose is to restore the used cell to the normal. But a sharp line must be drawn between the person with a neurotic heredity

and the average person with no such heredity. In the former, much more easily and much earlier in life, fatigue deleteriously affects the nerve cell in such a way as to make its recovery more difficult and to allow relapses to occur more easily during the rest of life. Thus hereditary neurasthenia as a rule has much more marked symptoms than acquired and is much more difficult to cure.

The immediate causes of neurasthenia are gross overwork, and especially worry. The dictionary definition of "to be worried" is "to be unduly anxious or troubled; to be in a state of solicitude, anxiety, disquietude or pain; to make one's self anxious or harassed; to fret," and inquiry in neurasthenic cases will always reveal one or more of these causes. Trauma, a frequent cause of neurasthenia, is generally one form of worry, sometimes started by shock.

Neurasthenia may affect either somatic sensations or psychic feelings. The symptoms of somatic neurasthenia are often due to increased irritability of nerve centres causing pains, not along definite nerve distributions, but in wide and somewhat indefinite areas. After listening to the tales of hundreds of neurasthenics it would almost seem as if their viscera had become as sensitive as their skins; they can apparently feel their brains working, their hearts beating, and their alimentary canals doing the work of digestion. Other symptoms seem to be due to a lowered irritability of nerve centres, as shown by lack of power of attention or by great bodily fatigue. Headache is exceedingly common and is constant when it occurs; it may be a feeling of weight on the vertex with dragging pains up the back of the neck, sometimes coming forward to the root of the nose or round to the temples, or is like a tight band round the head, or a tight skull-cap; sometimes the scalp is very irritable, at others the pain is across the brows and behind the eyes. Sometimes the pain is as if inside the brain, which is described as "stirred up" or "screwed up," as if something were moving in it; or at other times as if the head felt empty. Other painful sensations are found in the spine, either the whole spine or in some definite locality—spinal irritation—cervical, dorsal, lumbar, sacral, or coccygeal (coccygodynia); not infrequently pains radiate down the limbs or round the chest or abdomen, sometimes, indeed, in so definite a form that it may be difficult at first to exclude gross organic lesion; or there may be paraesthesiae (creepings, tinglings, burnings, etc., down the limbs); but real anaesthesia I have never met with.

Neuro-muscular asthenia is common, and is described as a feeling of lassitude and fatigue, often on waking in the morning, improving after a meal, and getting worse after any extra effort, mental or bodily.

The special senses may be affected. There may be "floating specks" in the vision, a feeling of burning in the eyeballs, an inability to read for more than a few minutes, a feeling of grit under the eyelids. There may be noises in the ears, continuous or pulsating, or distress caused by loud noises; vertigo sometimes occurs.

Each heart beat may be felt and may, indeed, be painful, and there may be tachycardia. Hyperaesthesia of the alimentary tract, if I may so describe it, is the cause of a very large number of symptoms—the irritable, or painful tongue, the irritable pharynx, pain and spasm of the oesophagus, discomfort and pain after food, eructations, flatulence, a sense of fullness, sometimes a loss of appetite with wasting; sometimes food is not taken because though hungry the patient fears the discomfort of food in the stomach; the tongue is often furred and flabby and there may be constipation; sometimes the symptoms relate more to the bowels than the stomach, the discomforts being then more in the middle or lower zones of the abdomen.

In the genital system there is often loss of sexual appetite, or sexual impotence; burning pains in the urethra, in the testicles, the spermatic cords, or the perineum.

A consideration of the cerebral symptoms will lead on to the psychic symptoms of so-called psychasthenia, much more common in heredity than in acquired neurasthenia. Many neurasthenics sleep quite well, but in others there is either intense insomnia or disturbed sleep; sometimes they cannot start to sleep, at other times they sleep at once, but only for

two or three hours, and are then awake for the rest of the night. Complaint is often made of loss of power of mental concentration, of inability to attend to business, of indifference to affairs in general with loss of memory for recent events; then come states of anxiety, mental depression, fear of going insane. The genuine neurasthenic very rarely goes insane, but some, especially those with a family history of insanity, do, and it must be remembered that some cases of genuine insanity (failure, as Mercier said, of adjustment of self to surroundings, which is manifested by disorder of conduct) actually start with purely neurasthenic symptoms. Then there is the irritability of temper, the intolerance of loud noises, the general impatience of the tired-out man. There are constant "doubtings," often about the most trivial circumstances, and these lead on to the many "phobias"—the fear of closed places, or wide open spaces, the fear of disease or of contamination by persons or objects, the fear that "something is going to happen."

Neurasthenia is often classified according to its prominent symptoms—cerebral, spinal, cerebro-spinal, dyspeptic, cardiac, genital, and so on.

The diagnosis is easy when the affection is widespread, but it may be difficult when the symptoms are confined to special organs, and it is in these cases that so many mistakes are made and in which so many useless and often very harmful operations are done. It would be interesting to know how many operations for gastric and duodenal ulcers, for gall stones, for appendicitis, for kidney trouble (including movable kidney), for gastropexy, for enteropexy, for ovarian and uterine affections, have been performed on people suffering from neurasthenia with no causative local affection of any of the organs mentioned. I have personally known some hundreds of such cases. These mistakes may often be avoided by taking a large view of the patient's condition and paying less attention to the symptoms complained of. When a patient comes to see me complaining of some altered sensation, the cause of which is somewhat doubtful, I encourage him to talk and then "sit tight," and if it is a neurasthenic it will not be long before a whole host of other complaints, not anatomically or physiologically connected with the original one, will be poured forth; and then further inquiry will give the cause as being some form of worry or stress. In all modesty I would suggest that in these doubtful cases it would be well if the surgeon before operating would ask the advice of his physician colleague.

The prognosis of neurasthenia depends on the type. The hereditary neurasthenic may improve from time to time, but will have relapses for many years, although as age advances they may lessen. The patient with acquired neurasthenia very frequently recovers; if the cause is recent recovery may be only a matter of a few weeks or months, but if of older date with constant repetitions of the cause it may be a matter of one or more years.

Treatment is extraordinarily difficult. Each case has to be dealt with on its merits. The cause must be sought out if possible and removed if possible; the full details of the patient's life and work must be investigated and altered if necessary; things must be explained to him in detail, and an explanation given of the cause of his various symptoms. Frequent interviews and long talks are often necessary, so that to deal satisfactorily with these patients is one of the most tedious and difficult tasks, involving the greatest patience and sympathy. Very frequently a total change of surroundings is necessary, and the choice of a suitable place is difficult. Some patients require total quiet, such as a lonely country or seaside resort miles from a station, some a sea voyage or foreign travel, others require the distractions of London, and others interesting occupation on a farm. It is very necessary to treat symptoms medicinally—the insomnia, the dyspepsia, the headache, and so on—and to build up the body tissues if they have unduly wasted.

Hypochondriasis.

Hypochondriasis is a condition so definite that it should be considered apart from neurasthenia. It is a psychical change so closely allied to insanity that if severe it is

inseparable from it. In it the patient does not merely complain of altered sensations and feelings, but has gone a stage further and translated these into terms of definite disease, from which he is certain he is suffering, and his conduct is modified accordingly. Many patients have an idea that they may have syphilis or cancer, or ulcer of the stomach, and consult their doctor on this account. But this in itself does not constitute hypochondriasis, for after adequate examination and explanation they may be convinced that their fears are groundless. It is the person with the fixed idea, unalterable by argument, that he has some definite disease and will not therefore take food, or only certain foods, and will not touch other persons for fear of contaminating them, or will not walk lest he suddenly drops down dead from heart disease, or who spends his time constantly examining some part of his body which he considers diseased, or constantly washes and changes his linen because he thinks he is verminous—that is the true hypochondriac. It is in some cases a truly terrible affection, and is often as incurable as a case of chronic delusional insanity.

Traumatic Neuroses.

It would take too long to discuss traumatic neuroses in all their aspects, complicated and increased as they have been by the Workmen's Compensation Act, but a few words are necessary. No signs or symptoms are found in these cases differing from those mentioned in my previous remarks. The manifestations may be those of malingering, of hysteria, of neurasthenia, of hypochondriasis, or even of true melancholia. The only peculiarity is that after trauma it sometimes happens that there is a mixture of hysteria and neurasthenia with some malingering. According to legal decisions hysteria and neurasthenia (including, of course, hypochondriasis and melancholia) are psychical or physical changes and have to be compensated. But malingering, being pure fraud, gets no compensation, and the great difficulty is to prove that the case is one of pure malingering. Sometimes the doctor can discover this himself, but at other times it can only be proved by outside evidence. For instance, a man after injury may have paraplegia, not organic, as it does not conform to this, but apparently hysterical. If, however, there is evidence that when not under observation so far as the man knows he is seen to walk and run in a perfectly normal manner he is an obvious fraud.

Psychical shock producing neurasthenia may occur without physical injury. A lady in a tramcar saw a following car approaching too rapidly and thought the guard would be killed, but beyond a very slight impact of the cars nothing happened. But the lady got out of the car in a state of fright, fainted, and was afterwards at home suffering from profound neurasthenia for weeks, and was given heavy damages at the assizes.

Again, a man is in very great danger owing to an alarming accident, say, of a falling crane crushing him to death; perhaps he escapes with a bruised foot which soon recovers, but he develops neurasthenia lasting many months. And it is not uncommon for some simple injury, say, of a finger, to be followed by hysterical paralysis of sensation and motion of the same arm. In these cases, although the original slight injury soon heals, compensation must be paid so long as the neurasthenia or hysteria persists.

Finally, I would say that although after trauma the neurasthenia is due to a molecular nerve change similar to those of an ordinary acquired neurasthenia from business worry which recovers perfectly in weeks or months, yet I think that in cases of more severe injury due to falls from heights or injuries to head, and also if the accident has been a very terrifying experience (such as being whirled round a revolving shaft), it is possible for the nervous molecular changes to be so intense that recovery never occurs, in spite of full compensation having been paid. The man is "never the same as he was," and occasionally passes into melancholia and sometimes commits suicide.

REFERENCES.

- ¹ *Lancet*, October 23rd, 1920. ² *Traité de l'Hystérie*, 1891, p. 123.

SOME APPLICATIONS OF PHYSIOLOGY TO MEDICINE.

III.—BLOOD PRESSURE AND HEART ACTION IN SLEEP AND DREAMS:

THEIR RELATION TO HAEMORRHAGES, ANGINA, AND SUDDEN DEATH.*

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THIS is an important, and in some of its aspects an almost unexplored, field of study, with an obvious bearing on many questions. Precise data on the subject are naturally somewhat difficult to obtain. The present paper contains some results of slowly accumulating observations carried on by the writer as opportunities presented themselves over a long series of years.

Changes in Normal Sleep.

The slowing of the pulse rate (noted by Galen) and the respiration during sleep has long been known to be accompanied by a lowering of bodily temperature, a great reduction in metabolic activity and heat production, depression of reflexes, diminished secretion, etc. There is general agreement as to a definite lowering of the systolic blood pressure, varying in different conditions and as recorded by different observers, but often amounting to 15 to 30 mm. Hg at the end of two hours' sleep; the pressure gradually rises in the later portion of the night's sleep. Greater reductions have been noted in persons with high pressures in the daytime. Thus some years ago Brooks and Carroll in 39 "hypertonic" subjects with an average systolic pressure of 204 mm. found a fall of 44 mm. after two hours' sleep; at the moment of waking it rose 22 mm. from the level present in sleep. More recently, in the last year or two, C. Müller in normal persons found the systolic pressure to be down to 94 mm. in men and 88 mm. in women during sleep, after a small dose of veronal. Blume, in men and women with moderate day pressures, recorded falls of 15 mm. and 21 mm. respectively, while in those with high day pressures the falls averaged 31 mm. and 39 mm. Much importance has been attached by some writers to this reduction of pressure; it has even been regarded, though on very insufficient grounds, as the determining cause of sleep.

It must be borne in mind that in the recumbent position a fall of aortic pressure would be necessary to prevent the pressure in the cerebral arteries from being higher in the horizontal than in the erect position—from the influence of gravity, the hydrostatic factor of the weight of the column of blood between the levels of the heart and the brain. Allowance for this factor in the recumbent posture cuts down the observed lowering of arterial pressure to a comparatively small amount, probably much too small to play the potent rôle that has been ascribed to it in the production of sleep. Further, the crude analogy of unconsciousness caused by an arrest or sudden great diminution in the blood supply to the brain cannot be regarded as valid when applied to the induction of the normal process of sleep.

Diminished vascularity of the brain substance during sleep has been described by various writers (Durham and others) on the ground of direct observations on exposed portions of the brain surface. A similar change has been inferred from the plethysmographic records obtained by Mosso and his followers, who found evidence of an increased volume of blood in the limbs (arm, etc.) during sleep, and assumed this to be attended by lessened vascularity of the brain, the converse conditions being present after awaking. But this hypothesis has to be revised in view of Leonard

*A communication on this subject was made to the International Physiological Congress at Edinburgh on July 26th, 1923. Part I of this series was published on January 13th, 1923 (p. 51), Part II on August 11th, 1923 (p. 215).