

**ARTICLE II.—Contributions to Rational Medicine.—Spasmodic Diseases.** By ALEXANDER WOOD, M.D., F.R.C.P., Lecturer on Practice of Medicine, etc., Edinburgh.

Is our treatment of spasmodic diseases rational? A serious question truly, and one which is well worthy of consideration. A practical question also of pressing importance. Judged by the frequency of spasmodic diseases, one which must often force itself on the attention of the practitioner. Judged by the insufficiency of our treatment of these diseases, one to which he is scarcely entitled to give a very decided answer in the affirmative. And yet your routine practitioner is the most obstinate of creatures, once give him an idea that a disease ought to be treated in a particular way—no matter why—and he will go on in this invariable method, never stopping to inquire whether after all it be a right one, and never startled from his dream of security by the small success, or even total failure of the means he most diligently employs. And your philosophical practitioner is somehow now-a-days far too much engaged about the adjuncts of medicine to bestow the attention which he ought on its practical bearings. He is too exclusively occupied with diagnosis, or with morbid anatomy, forgetting that the one is only a means to an end, and that the other is the product, not the essence of disease. I do not undervalue the vast advances which the *organicien*, whether anatomist or chemist, has made in medicine, but like all other good things, his study has its peculiar dangers. Something more is wanting in medicine than *mere* observation. If his be a laborious task who patiently examines minute structure, and acquaints us with the results; still more laborious and of a far higher order of mental elaboration is his, who, classifying the facts thus discovered, seeks to deduce from them practical laws. The tendency at present manifested to overestimate mere structural change, and to undervalue the vital laws which are equally important in the maintenance of life, and in the manifestation of disease, is bringing forth its legitimate fruit. A class of minds is springing up in our schools of a very material order—the scalpel, the microscope, or the chemical reagent, are with them omnipotent, and are looked to as the sole means of revealing the *arcana* of disease. They believe in nothing which is not demonstrable to their senses; they have a gross appreciation of what the eye can see, or the ear hear, or the hands handle, but by this faith and knowledge are to them limited, and vital laws are only recognised, in so far as they can be explained, by changes in physical properties. Neither the pure Materialist, nor the pure Vitalist is likely to be a successful practitioner. We must avail ourselves to the utmost extent of the information which each supplies, and estimate that information according to its more or less direct connection with practice.

What are called spasmodic diseases, have little to attract the mere materialist. Though alarming in their appearance, violent in their symptoms, and too often fatal in their results, they yet leave little trace after death. The muscles, in the action of which the principal symptoms display themselves, are little susceptible of those changes which, as the product of morbid action, so much delight the morbid anatomist, and are so often regarded by him as the very personification of the disease; and though there is little doubt that the inordinate motions which display themselves, are most usually the result of nervous influences, yet we are still unable to determine whether a change of nervous influence implies a change of nervous structure, and have hitherto failed to discover any modifications of their delicate fibrils at all capable of explaining the symptoms observed during life. In this dilemma, we have only one course to follow. It is a very safe one, and one which might with advantage be oftener pursued, even in those diseases where morbid anatomy can do most for us. It is to examine the natural action of the parts affected by disease in its various relations. These are chiefly muscle and nerve. We are too apt to regard spasmodic and nervous diseases as convertible terms, and to look upon the nervous system as that in which the derangement is exclusively seated. But is this the case? If it be, why does a spiculum of bone produce epilepsy in one case and not in another? Why is a wound followed by tetanus in one case and not in another? Why do acrid secretions in the bowels produce chorea in one patient and not in another? or why does the pressure of a tooth on the gum at one time cause the infant no inconvenience, and at another plunge it in violent convulsions? It is evident that the exciting cause is not all—a predisposition must exist, and where is this predisposition to be sought for? “In the nervous system” answers the routine practitioner. It may be so; the proposition is one that scarcely admits of dispute. Through it certainly most of the exciting causes operate, and, often with the rapidity of the lightning’s flash, transmit their direful effects to the whole flesh (muscular system) of the body. But are we to allow nothing to the muscle itself? Is it—the only constituent of the body which has an inherent power of motion—a mere passive instrument to be played upon at will by the nerves? All analogy forbids the supposition, and I am inclined to think that the predisposition to many spasmodic diseases exists in the muscle, while the exciting causes are chiefly to be sought for in the nerves.

Let us then endeavour to study the pathology of convulsive diseases in connection with the physiology of muscular action, arranging our ideas under the three following heads:—

- I. TERMINUS—*Effect.* Contractility. Its nature.
- II. MOTUS—*Power.* Agents exciting contractility.
- III. MODUS—*Manner.* How it is produced.

The advantages of such an arrangement will appear from the following considerations:—

*First*, Disease is never an entity—a separate existence—an individuality, which we can examine and analyse, and describe as we do a plant, or mineral, or animal ; but,

*Second*, Disease is in every case a modification of some vital action or series of actions, and these must be understood in their healthy condition before their alterations under disease can be comprehended.

Hence the necessity for the study of the *Modus*.

*Third*, All vital processes may be resolved into reactions occurring on the application of stimuli; each organ having a stimulus peculiar to itself. In disease the *Modus* or reaction is often normal, as regards the stimulus applied, but the stimulus itself is abnormal, and hence the reaction excessive. This can only be understood by a proper appreciation of the natural *Motus*.

*Fourth*, Disease is not an act but a work;—not a single operation but a complicated process. Why is this? Evidently because vitality manifests itself in a series of processes. Life, as a whole, is a series of processes, and each of these processes (functions) is a series too. Wheels within wheels. Touch a part of any one of these processes, so as to modify it, the effect will not be limited to the single action with which you have interfered, but will be transmitted through a long series, till it shows itself in some modification of the ultimate effect to which they are subservient.

Hence the *Terminus* demands study, and with it we shall commence. Analysis suits the subject better than synthesis.

## I. TERMINUS—EFFECT—MUSCULAR CONTRACTILITY.

### A. *Physiological Proem.*

**I. What it is.**—It is an endowment of muscle, as muscle—a *vis insita*—its own its independent function. Moreover, it is the property of living muscle, like all other vital properties—the more living the structure the more energetic the function.

**II. What it requires.**—1st, In its performance it exhausts nourishment; therefore in its performance it must demand nourishment. This it receives from the blood, and the blood in its turn obtains supplies by *nutrition*.

2d, Muscle also demands a vital stimulus—oxygen. This too the blood supplies by its red particles, and this the blood receives by *respiration*. Hence, where much muscular exertion is required, much blood is demanded, and that blood in a higher state of oxygenation. This is seen (*a*) in the individual, and (*b*) in classes of animals. *a.* In the individual, violent muscular exercise accelerates respiration, and subsequently demands an increase of food. *b.* In classes of animals we find that a direct relation subsists between muscular power, the quantity of blood sent to the muscles, and the degree of oxygenation of that blood. Thus animals may be arranged in this respect as in the following table :—

- |               |                |
|---------------|----------------|
| I. Birds.     | IV. Reptiles.  |
| II. Insects.  | V. Fish.       |
| III. Mammals. | VI. Crustacea. |

3d, The more strongly an animal, or part of an animal lives, the more readily it dies, *i. e.*, the more dependent it is on rapid nutrition, the more quickly does it perish when that nutrition is arrested. Stop the nutrition or respiration of an animal, and it will be found that muscular contractility disappears exactly according to the place it would hold in the foregoing table—birds losing the power soonest and crustacea last.

4th, The law of irritability, or that of re-action on a stimulant, is just the counterpart of the law of contractility, and, therefore, as has been well shown by Dr Marshall Hall, is inversely to the rapidity of the circulation, and of the respiration. The less blood and the less oxygen a muscle receives, the more easily is it excited to contraction. "Such is the irritability of the muscular fibre of the frog that it and the galvanic agency are mutual tests of each other."<sup>1</sup>

These four physiological laws will be found to have important pathological analogues, especially in reference to the predisposition to convulsive diseases.

### B. Pathological Deductions.

To keep a muscle healthy, it has been shown that it must have nourishment and oxygen from the blood, and that it is therefore dependent on nutrition for the one, and on respiration for the other. 1st, In almost every spasmodic disease, assimilation is interrupted. Take, for example, CHOREA.—"In the advanced period of the disease," says Dr Hamilton, "flaccidity and wasting away of the muscular flesh take place, the consequence of constant irritation, of abating appetite, and impaired digestion, the common attendants of protracted Chorea."<sup>2</sup> Or take LARYNGISMUS STRIDULUS. How commonly is it associated with impaired nutrition and with well marked derangements of the digestive organs, and how impotent do all drugs prove for its cure, unless associated with pure air, and carefully regulated diet. Or take SPASMODIC ASTHMA. "Of all the predisposing causes of asthma," says Dr Forbes, "dyspepsia in some of its forms or consequences is by far the most frequent. \* \* \* \* It is only, however, in what may be termed secondary dyspepsia, or that general disorder of the system which is often the consequence of long continued irritation of the chylotropic organs, that results of the kind now contemplated arise."<sup>3</sup> Or in INFANTILE CONVULSIONS. The opinion is gradually gaining ground, and has been prominently advocated by Dr W. L., Mauthner of Vienna, that convulsions comparatively seldom occur

<sup>1</sup> Bostock, quoted by Dr Marshall Hall.

<sup>2</sup> Observations on the Utility of Purgatives, p. 69.

<sup>3</sup> Cyclopaedia of Medicine. Article, "Asthma."

in children as the primary results of disorder of the nervous system, but are very frequently to be traced to an interruption between the nutrient parts and the parts nourished, inducing irritability of the muscles.<sup>1</sup> In corroboration of this opinion, we may cite the facts collected by M. Bouchut, which clearly shows that in ten out of eleven children who died at different periods after convulsive seizures, the brain presented no morbid appearance whatever.<sup>2</sup>

*2d.* Impeded respiration, and consequent deficiency of the red particles of the blood, is often associated with spasmodic diseases. How often is the bronchitis of infancy closed with convulsions ! and how frequently do we fail to detect any adequate cause for this in the state of the nervous centres ! "It goes to the head," we say, but where is our proof ? It goes to the blood would perhaps be a more satisfactory exclamation. Again, a careful examination of the Parliamentary reports on the state of large towns, serves to show that the habitual inhalation of the impure air of these localities arrests the muscular development, and gives a greater liability to spasmodic diseases.

*3d.* The third physiological law went to show that the more rapid the nutrition, the more sudden the exhaustion consequent on its arrest. All muscular action demands nutrition, and as the supply is not constant it is soon exhausted, which explains (*a*), the excessive exhaustion produced by all spasmodic seizures, and (*b*) the great and sudden collapse by which the paroxysm is so often followed. And perhaps also (*c*) the enormous appetite which we often see in convulsive diseases after the attack, as, for example, epilepsy.

*4th.* The fourth law showed that the irritability of a muscle was inversely as its contractility—that as its strength declined, its irritability increased. From this, several pathological inferences may be deduced—(*a*). Why muscular weakness should predispose to convulsive disease—(*b*). Why convulsive diseases should be especially frequent in the young—(*c*). Why losses of blood and anaemia generally, should so often give rise to convulsive affections—(*d*). Why the frequency of convulsive seizures, and therefore the severity of the disease, is not a sign of the patient's strength but of his weakness.

### C. Etiological Deductions.

I limit the inquiry, of course, to predispositions. Laws 1 and 2 teach us the effects of mal-nutrition, impure air, and diseases of respiration, in producing convulsions. Law 3 explains why full health wards off convulsive diseases, but renders them more fatal when they do occur. Law 4 explains how excessive losses of blood and weakness generally, serve to induce convulsive diseases, and how in persons of lax muscular fibre, spasmodic affections are liable to occur on the application of very slight irritants.

<sup>1</sup> See Br. and For. Med. Rev. Vol. xxi. p. 391.

<sup>2</sup> Man. Prat des Malad. des Nouveaux Nés, etc., etc. Par E. Bouchut. Paris, 1845.

### D. Therapeutical Considerations.

These, of course, are restricted to the subject of prophylaxis.

*1st.* The impaired nutrition suggests the propriety of attention to the digestive organs in all cases of anticipated spasmodic seizure. *2d.* The state of the red particles, the carriers of oxygen, explains the action of the salts of iron so successful in some of these diseases in the hands of Elliotson and others; the researches of Andral and Gavarret having shown that by their use the red particles of the blood are increased. It also teaches us the value of change of air. *3d.* We learn from this law how cautious we should be in the use of the lancet in diseases whose danger often seems to consist in the rapidity with which they exhaust the nutritive supply, and the advantage of pouring in nutriment as fast as it can be assimilated in all cases where this exhaustive process is at work. *4th.* A knowledge of the existence of increased irritability, and of its augmentation as the exhaustion of the disease proceeds, should make us very carefully guard our patients against every source of irritation, whether mental or corporeal. From it we also learn the importance of exercise, the great strengthener of muscular fibre, in the intervals between spasmodic seizures. "The epileptic," says Dr Cheyne, ought to be trained so as to be in good wind, or, in other words, his muscles ought to be in a state of the utmost strength and firmness. If we permit ourselves to take a lesson from empirics, we may surely avail ourselves of such information as may be derived from a brotherhood at least as respectable, namely, the "gentlemen of the fancy," as they are called, or we may have epileptics trained as the *athletæ* in ancient times."<sup>1</sup> I shall attempt to reduce this to a Table:—

	Physiological.	Pathological.	Etiological.	Therapeutical.
1.	Dependence on nutrition.	Connection with mal-assimilation.	Effect of indigestion.	Attention to diet.
2.	Do. do. on oxygen.	Do. with diseases of respiration.	Do. of impure air.	Use of iron. Change of air.
3.	Power exhausted in proportion to the amount of nutriment demanded.	Speedy exhaustion and hunger by which attack often followed.	Full health wards off attacks, but makes them more dangerous.	Caution in depletion. Attention to prevent exhaustion.
4.	Irritability increases as strength (contractility) declines.	Why so often associated with weakness, and occurring in the young.	Why arise after losses of blood, and in persons of lax fibre.	Avoid all irritation during paroxysm. Importance of exercise in the interval.

### II.—MOTUS POWER.—AGENTS EXCITING CONTRACTILITY.

In the first division of the subject it has been attempted to show, that whatever may be the exciting causes of spasmodic disease, to effect the production of one of these diseases, a peculiar state of the muscular system must exist; and that as these three—muscle, blood, nerve—

<sup>1</sup> Cyclop. of Practical Medicine—art. Epilepsy.

concur in the production of healthy muscular action, so are they equally concerned in that which is diseased. Passing then from the consideration of the predisponent, and taking a survey of the exciting causes, the first thing with which we are struck, is the vast variety and apparently opposing character of these. Some of these causes are mechanical, some chemical, some vital, and another class mental, and this affords a groundwork for division. But again, when we have grouped these causes under the several heads so indicated, it may be observed, that those ranged under each head admit of a two-fold division, according to the nature of its action. They must all act by modifying the vitality of the tissue to which their operation is directed. It is the office of one class to exalt, and of another to depress, that vitality, which serves as a foundation for another division of each class into stimulants and sedatives. These terms are not used with reference to the effect of the agents on the vascular system; primarily, they seem to affect the nervous tissue, though subsequently through it they affect the contractility of the heart, and thus the circulation at large.

Our further investigations into the modus will be facilitated by a tabular arrangement of these ascertained excitants of spasm.

Mechanical....	Stimulant.....	{ a. Insolation. b. Tumours or spicula. c. Chronic alterations. d. Electricity (in small doses). e. Shock from violent injuries, etc. f. Electricity (in large doses). g. Loss of blood.
	Sedative.....	
Chemical .....	Stimulant— in small doses.	{ a. Alcohol, ether, chloroform. b. Strychnia, brucea, etc. c. Lead, arsenic, mercury. d. Opium, camphor, etc. e. Aconite, hyoscyamus, prussic acid. f. Belladonna, stramonium, tobacco. g. Digitalis, antimony, ipecacuan.
	Sedative— in large doses.	
Vital .....	Sedative .....	{ a. Gout and rheumatism. b. Ischuria renalis. c. Bright's disease. d. Cholera. e. Puerperal convulsions.
	Urea in blood—	
Mental.....	Sedative .....	{ a. Emotions. b. Emotions. c. Volition. d. Imagination. e. Imitation.
	Neutral.....	
	Stimulant.....	

### III.—MODUS—HOW THEY ACT—OPERATION OF CAUSES.

#### *A Physiological Proem.*

Examining the foregoing table, it will be found that, except the vital agents, which are all sedative, each of the other divisions is

divisible into two classes—stimulants and sedatives. Is it possible to explain the manner in which these operate by a consideration of physiological laws? The attempt must at least be made.

1st. *What is an Irritant?*—The consideration of this is a necessary prelude to that of exciting causes. Every agent, external or internal, mechanical or chemical, corporeal or mental, which, when applied in any way to the living body, directly or indirectly affects its vital actions, is an irritant. Each organ has its own irritants, modifying its own vital actions. Some irritants are general, increasing the vitality of the whole system.

2d. *Re-action on the Application of an Irritant.*—Every organ in a healthy condition has a certain amount of tone or power of action, which is modified by the application of the irritant. It has also the power of preserving the vital composition of its structure when disturbed by an external agent. The operation of the irritant is therefore followed,—first, by a change in the condition in the same way as in an inorganic body; and, secondly, by a return to its normal condition which is peculiar to the organised body.

3d. *Relation of Re-action to the Circulation.*—These changes are of a vital character, and imply therefore changes in the composition of the organ. To supply the combinations and decompositions which are caused by this exercise of vitality, oxygen and nutriment are demanded. We may illustrate this by the comparison of Richerand, who represents the vital actions as combustion requiring oxygen to unite with the burning body, and combustible matter to supply the flame, the whole resulting in the evolution of caloric. In the same way, when the vital force is consumed by increased action, a demand for vital nutriment is made, and an increased afflux of blood, and a more abundant conversion of blood into organised matter, takes place at the seat of the vital action. “Tiedemann remarks, that an organ in an excited state undergoes more rapid changes in its material composition, and therefore attracts more quickly, and in greater quantity, the blood, which alone is able to render an organ capable of increased vital action.”<sup>1</sup>

4th. *The kind of Re-action depends on the Function of the Organ.*—Every excitant, even the same, will produce motion when applied to a muscle; pain in a sentient nerve; the perception of light in the optic nerve; and of sound in the auditory nerve; hence we see why the vast number of excitants contained in the foregoing table produce the same effect. It is sufficient that they all act on muscle. The vital property of muscle is contractility; hence whatever agent alters the vitality produces contraction.

5th. *Contractility a Re-action, and how it is produced.*—Muscular contractility is a re-action, normal or abnormal, as the case may be. The excitor being some irritant—mechanical, chemical, vital, or mental, the part on which it operates being usually the peripheral distri-

<sup>1</sup> *Physiologie, tom. i., p. 326.*

bution of the sensitive nerves; the agent in its production, the spinal cord, acting on a peculiarly excitable condition of the muscle.

6th. *The Irritant may be either a Stimulant or Sedative—attempt to ascertain why both operate alike.*—An examination of the causes, as set down in the foregoing table, proves this; but it also proves what I believe to be of vast practical importance, that the great majority of the exciting causes are sedatives, and not stimulants, as is generally supposed. However opposed these two classes of agents may apparently be, and although they are usually regarded as antagonistic, yet it is a singular fact, that their secondary effects on the vital actions is very similar. By both, the relation between the energy of the organ and the nutritive supply is altered. By the one, the vital energy is increased, so that it is in the relation of *plus* to the nutrition. By the other, the vital energy is diminished, so that the nutrition is *plus* to it. But in the former case, after a short time, the nutritive supply becomes exhausted, and the vital energy becomes *minus*. The final result is thus the same; in both cases diminished vital energy, the nutritive material, however, being *minus* in the one and *plus* in the other. It is evident, then, that every excitant, whether stimulant or sedative, changes the relation of the part on which it acts to the blood.

7th. The locomotive actions (functions of the voluntary muscles) in health, are under the control of the will, and only incidentally affected by reflex agency. They are thus controlled by the cerebrum. On the other hand, the excito-motory phenomena are not connected with the will, and in fact are most perfectly manifested where the power of the cerebrum is interrupted, and that of the spinal system alone retained. Thus various experiments by Müller, Marshall Hall, and other physiologists, have shown, that when the power of the brain proper is suspended by narcotisation, or cut off by division, the animals so treated have their muscles thrown into violent convulsions by the very slightest irritant.

8th. Two sources of action, almost antagonistic, are thus seen, one mental—Spontaneity; the other corporeal—capability of being affected by stimulus, Receptivity; I say almost antagonistic, because, as the former declines, the action of the latter is manifested.

9th. Excito-motory phenomena are peculiarly easily produced in cold blooded animals, or in the young of warm blooded animals. In short, in those in which, as has been formerly shown, the irritability of the muscles is great, and their contractility, and therefore their dependence upon vital stimuli small.

10th. The spinal cord is the essential link between the centripetal impression conveyed by sensory fibres, and the centrifugal influence of the motor nerves. It may excite to action,—

- a.* By direct irritation.
- b.* By irritation of sensory fibres reflected through the cord on motor nerves.
- c.* By sympathy.

*B. Pathological Deductions.*

1st. Any agent which has power to modify the action of a muscle, either directly by application to its tissue, or indirectly through the nervous or vascular systems, may act as the excitant of disease in it. Of these two indirect channels, we are inclined to think that the nervous is the one through which the influence is most frequently conveyed. Indeed, even admitting all that has been alleged, in reference to the absorption of various poisons by the blood, it seems evident that the blood can only act as the channel of their conveyance, either to the nervous centres or to the affected muscles themselves. The whole phenomena of spasmodic diseases seem, however, to point to the nerves as the sources of the disordered action.

2d. The effect of the modification so produced displays itself by an attempt on the part of the organ affected to return to its normal state, and the manifestation of that attempt is convulsive motion.

3d. As the disturbing agent can only operate by affecting the vitality of the part,—that is, by altering the relation between it and its supply of nutriment and stimulation, so it produces disturbance of the circulation. This may be a cause as well as a consequence of the perturbation; for it is plain that a preternatural afflux of blood, either to the nervous centres or nervous peripheries, may itself act as an irritant, and prove the cause of the subsequent changes; or, on the other hand, the irritation, if persistent, must sooner or later affect the blood, and through it every organ depending on it for nutrition. To strengthen the weak and flabby flesh of an indolent patient, you insist on a due amount of exercise being taken. The vital energies being called into play, more of the sustaining element is demanded, and it is received; but the heart thus transmitting it is only a retail dealer; and it must call upon the manufacturers (digestive and respiratory organs) for an increased supply. This briskness of trade again demands increase of raw material. For this the appetite loudly calls; and thus throughout the whole body signs of renewed impetus are manifested. A picture the very reverse of this might be drawn of those cases in which the muscles, having acquired unnatural irritability, respond to the most trifling stimulus. Their tone is weakened, and the demand for the nutritive interchange increased; the supply, however, being deficient, the blood suffers, and thus every organ of the body, but especially the nervous system, becomes affected, and ultimately a painful state of nervous exhaustion, with muscular irritability, is produced. Sad examples of this kind must be familiar to every practitioner.

4th. The effect of any irritant being, as has already been shown, only to rouse the vital actions of the part to which it is applied, it is obvious that whichever of the irritants enumerated under the head of "Motus" be employed, its sole effect will be to produce muscular contractility more or less developed, either in degree or in extent. On the other hand, whatever curative agents we employ, if they

have any virtue at all, it can only be manifested by their acting as irritants also, and thus producing in healthy persons modifications of the vital force similar to those which induce disease. This accounts for all the supposed examples of the law "similia similibus curantur," which Hahnemann has so diligently culled from the writings of the orthodox school, many of which will be found to have reference to those very agents which have been discussed under the head of Motus.

5th. The nutritive interchange is so essential to all vital action, that it is modified by the slightest increase or diminution of functional activity in any organ. This is an important fact; for, *a*, It serves to show on what foundation the opinion of those rest who maintain, that all convulsive diseases arise from congestion, or the reverse. *b*, It often enables us to measure the amount of disturbance which exists. *c*, It shows us that, although congestion may be present, yet that, as that congestion is not the cause but the consequence, we are not to expect that its removal will effect a cure. *d*, It teaches us that that afflux of blood, in whatever way it may be produced, will of itself act as an irritant; and, *e*, It explains the force of the old Hippocratic maxim, "that convulsions arise from too much or too little blood in the cranium."

6th. Those experiments appear peculiarly interesting which show that, in order to the full manifestation of excito-motory phenomena, the connection between the cerebrum (organ of volition) and the spinal chord (organ of excito-motion) must be suspended. They also show how this mere suspension serves at once to make the body peculiarly susceptible of every unnatural irritation,—a fact which appears to explain the operation of many of those agents included in the table of the Motus. Does not this also show how, in the less severe spasmotic diseases,—hysteria, for example,—a powerful effort of the will may overcome the spasms?

7th. Another fact seems also brought out by the same experiments: that the ordinary sensibility of parts seems to be suspended prior to the manifestation of the excito-motory phenomena. This indeed, is involved in the interruption of the cerebral functions, with which what is called mental in sensation must, of course, be associated.

8th. While, however, it appears essential to the manifestation of these phenomena that volition and sensation should be suspended, it is equally evident that the mind occasionally performs the part of the irritant, as indeed is seen by reference to the mental causes of these diseases.

9th. It has also been shown, that these experiments took more effect on cold-blooded animals, or on the young of warm-blooded animals,—a fact which is easily explained by the greater irritability of their muscles, and which refers us back to what has already been said under the head of "Terminus," and brings into beautiful harmony the predisponent and the exciting causes of spasmotic diseases.

10th. It would thus appear that, when muscular irritability has been induced by any of the predispositions, it is only further necessary that volition and sensation should be temporarily suspended, in order that any irritant, however innocuous at other times, should throw the muscles into spasmodic action. It only remains, therefore, to complete this branch of the subject by showing that the agents enumerated in the table of motus have this effect. I confine this table at present to the sedatives:—

*Effect of the various Sedative Agents exciting Convulsions.*

AGENT.	EFFECT ON VOLITION.	EFFECT ON SENSATION.	AUTHORITY.
Shock from severe injuries. Electricity.	Impairs volition. Suspends it; coma.	Impairs sensation. Suspension of; insensibility.	Dr Alison ; Dr Copland. Dr Alison ; Dr Hartmann.
Loss of blood.	Functions of brain, consciousness suspended.	Ditto.	Dr Marshall Hall.
Alcohol, etc.	Depression of functions, especially those of external relation.	Insensibility.	Dr Christison.
Strychnia. Lead.	Stupor. Delirium, etc.	Stupor. Coma.	Dr Bally. Case of Dr Corbin, etc.
Arsenic. Opium, etc. Aconite.	Stupor. Suspension of volition. Muscular debility.	Insensibility. Ditto. Impaired sensibility.	Dr Dymock, etc. Dr Pereira. Dr Fleming.
Hyoscyamus. Prussic acid.	Paralysis. Extremities paralysed.	Insensibility. Extinguishes sensibility.	Dr Pereira. Dr A. T. Thomson.
Belladonna.	Placed on legs cannot stand.	Insensibility.	Dr Taylor.
Tobacco, Stramonium, etc. Digitalis, etc.	Paralyses the heart, etc.	Operates on the sensibility.	Dr A. T. Thomson.
Sedative emotions.	Diminished muscular power. Syncope.	Insensibility. Absence of Syncope.	Dr Pereira. Dr Alison ; Dr Carpenter.

11th. To sum up these observations on the Modus or manner in which the known exciting causes of spasmodic diseases operate, it is to be observed,—*a*, That the ascertained predispositions infer a state of the muscular system implying diminished contractility with increased irritability. *b*, That almost the entire exciting causes are sedative in their operation. *c*, That those causes which act as stimulants produce, like other stimulants of the nervous system,—*First*, a brief period of excitement; *Second*, a state of exhaustion, with excitability; *Thirdly*, a state of atonic exhaustion; and that it is not until the second or third of these effects have been produced, that the convul-

sions are displayed. *d*, That it is on the nerves of sensation chiefly that the sedatives operate.

12th. It may thus be assumed, that the best recognised causes of convulsive diseases act as sedatives; and by suspending volition and sensation, bring the patient into a state resembling that of the narcotised or decapitated animals in Dr M. Hall's experiments.

13th. That while common sensibility is thus blunted, there is a morbid susceptibility to those impressions which operate through the excito-motory system.

14th. It thus appears that the name exciting causes is scarcely properly applied to the majority of those which we have so termed; for their action only tends to bring the muscles under the operation of the excito-motory system, leaving it to other irritants to operate through it on the muscles. The channels by which these act we attempt to show in the following table, chiefly compiled from the valuable memoirs of Dr Marshall Hall:—

*Excito-Motory Origin of Convulsive Diseases.*

IRRITANT.	SEAT OF IRRITATION.	EFFECT.	DISEASE.
Ipecacuan vapour, cold air.	Muc. memb. of bronchi.	Contraction of bronchi.	Asthma.
Indigestible sub- stances.	Do. of stomach		
Effete matters.	Do. of bowels.		
Emetics. Rota- tory motion.	Brain.	Contraction of stomach and abdominal muscles.	Vomiting.
Irritation. Do. Do.	Of fauces. Of stomach and bowels. Of uterus.		
Poison in blood.	Brain.	Conv. of vol. mus- cles, especially of throat.	Hydrophobia.
Do.	Do.	Do.	Convulsions.
Irritation. Indigestible matter Effete matter.	Muc. memb. of gums. Do. of stomach. Do. of intestines.	Conv. of glottis, dia- phragm, etc., mus- cles of hand & foot	Laryngismus stridulus.
Injury. Irritation.	Incident nerve. Brain.	General spasms. Contraction of sphincters.	Tetanus.

*C. Therapeutical Considerations.*

If the foregoing conclusions are admitted, they show our present treatment to be sadly irrational, and furnish important indications for its improvement. But, indeed, whether admitted or not, the

treatment ordinarily pursued is so very contradictory as to prove, that it at least cannot be right. In the severer convulsive diseases, as tetanus and hydrophobia, wine, brandy, and opium,—stimulants,—are conjoined with the cold affusion or cold bath,—sedatives. Opium in small doses, which as a stimulant and soothing remedy might prove useful, is counteracted by tobacco, a sedative, or by irritating and depressing purgatives. We are told to administer the most violent purgatives in these diseases, and are encouraged to persevere in their employment to an enormous extent, by the hope of eventually obtaining from the bowels an assortment of strange and heterogeneous matters.

In these diseases, where the violent muscular effort demands a large supply of blood, and where the want of that supply increases the irritability of the system, we are taught to bleed, beginning with from thirty to forty ounces, and repeating it if need be. What end can blood-letting possibly subserve, unless in those exceptional cases, to be afterwards specially considered, where urea exists in that fluid? There is no morbid matter in the circulating fluid which bleeding can remove! There is no inflammation which it can subdue! On the contrary, that terrible muscular action, like a consuming fire, is draining away the nutriment of the system even faster than your relentless lancet, and when the supply is exhausted the flickering taper will expire.

Or, in the case of an unhappy infant,—ill thriven, ill fed,—who has imbibed irritability of constitution with the milk of a gay, luxurious, self-indulgent, and nervous mother, and who has had that irritability confirmed by a long course of ill-regulated management,—why will you, when the irritation of a tooth has proved the cause of convulsions, not rest satisfied with removing the immediate pressure, and then set about improving the general system, in which the real danger lies, but apply cold to a head where no symptom of congestion or inflammation is to be found, harrow the gums with daily scarifications, and administer a powerful purgative, glorying in the expulsion of depraved secretions, which only indicate the impaired state of nutrition, and the necessity for a very opposite kind of treatment?

But enough of these comments. Let me very humbly but very earnestly solicit the attention of my professional brethren to the following therapeutical considerations, based on the physiology and pathology of spasmodic affections:—

1st. The importance of great attention to a proper supply of nutriment and of air in all circumstances where either hereditary tendency or other circumstances are likely to develop convulsive diseases. Trismus nascentium is epidemic in the West Indies, from the absurd way in which infants are there treated. The same disease was banished from the Dublin Lying-in Hospital by proper attention to ventilation and cleanliness.

Laryngismus stridulus is never so satisfactorily treated as by change

of air. The mortality of tetanus in our naval stations in the West Indies has been very much reduced, mainly, according to Dr Dickson, by improved hygiene.—(*Med.-Chir. Trans.*, vol. vii. p. 765.)

2d. Let us divest our minds of the idea that it is necessary to treat the fit in any of these diseases. It is only a part of a train of morbid phenomena, and though the part most striking to the bystander, ought not to make the same impression on the intelligent physician. No one now thinks of treating the fit, either in epilepsy or in chorea, and why should we think it necessary in tetanus or hydrophobia?

3d. Is it not worthy of consideration whether the obstinate constipation in tetanus and lead poisoning may not be a spasm of the muscular coat of the intestines analogous to that of the voluntary muscles, and, like it, not to be overcome by brute force (*i. e.*, purgatives)? Certain it is, that in lead Colic the finger, introduced into the rectum, is held by the sphincter as by a vice, and pressed tightly upon by the gut, and that this pressure returns at each paroxysm.<sup>1</sup> Certain it is also, that the retraction and hardness of the abdomen, associated by Merat<sup>2</sup> with that internal constriction, is found also to exist in tetanus, though I am not aware that any one has ever explored the internal state of the bowel in that disease. It may be necessary to remove the morbid secretions in the bowels, though every intelligent physician will have to balance the amount of irritation produced by their presence with that caused by the drastic purgatives necessary for their removal. The spasm which retains them is the effect of the disease. It is to treat symptoms, to attack it alone; and when we succeed in overcoming the disease, the bowels will spontaneously relieve themselves. Tralles<sup>3</sup> found opium succeed in a case of ileus where purgatives had failed. I have seen the same. Lentilius<sup>4</sup> has confirmed this; and in a severe form of colic, Bonn<sup>5</sup> became convinced by experience that it was the most powerful remedy.

4th. The most efficient and the most frequent agents in the production of these diseases are sedatives. Blood-letting is a most powerful sedative, and if carried to any extent in a healthy person produces convulsions. Is blood-letting, then, a suitable remedy in these affections? In chorea it was formerly practised, and is now abandoned from the injurious effects which it produced. In delirium tremens and hysteria, its use has also been given up. In epilepsy it is rarely used by intelligent physicians, except to meet the requirements of secondary affections; and if we still retain its employment in the more severe convulsive diseases, it is probably only because their rapid course and frequently fatal issue makes it very difficult for us to ascertain the effect of any treatment.

<sup>1</sup> Tanquerel—*Traité des Maladies de Plomb.*, etc., p. 210.

<sup>2</sup> *Traité de la Colique Métallique.*   <sup>3</sup> *Opii. Usus et Abusus*, sect. 2. p. 260.

<sup>4</sup> *Eph. Mat. Cur.*, dec 3, ann. 1, p. 131.

<sup>5</sup> *De Officio Medici.*

5th. In one class of convulsive diseases blood-letting seems, in the present state of our knowledge, to be indispensable. Where urea exists in the blood and produces convulsions, it must either be expelled or counteracted. We scarcely know how to accomplish the latter indication, and therefore are driven back on the former; but, even while seeking by blood-letting to get rid of the urea which is mixed with that fluid, we must never forget that it "both acts on the nervous system as a narcotic poison and impoverishes the blood, inducing degeneration of the tissues;"<sup>1</sup> and that, therefore, while we take blood to remove the poison, we must do our utmost to replace the nutriment which we are unavoidably compelled to abstract along with it.

6th. Our views on this subject would become more definite and precise, could we avoid imagining that spasm implies augmented strength. It is not easy for us, when seeing the violent agitation of the system which prevails, to divest our minds of the idea of great power being developed, but the same remarks apply to mania, in which disease, thanks to the exertions of Dr W. A. F. Browne,<sup>2</sup> general depletion, tartar emetic, brisk cathartics, and ice to the shaved scalp, are no longer in such vogue as they once were.

If such are the objections to the routine practice, what course ought to be pursued? It is easier to point out error than to demonstrate truth. But I venture to suggest,—

7th. That sedatives should be cautiously used. Chloroform and cold affusion have each proved fatal in delirium tremens.

8th. That every effort should be made to put into the system as much nourishment as it is capable of beneficially employing.

9th. But, if there is any faith to be placed in antipathic treatment, it is to stimulants we must most trust.

10th. It is worth observing, that most of those chemical agents which produce convulsions, acting, as has been already said, in large doses as sedatives, do in small doses act as stimulants.

11th. We find also, that where the minor spasms, as cramp, have been excited by irritation of the peripheral distribution of one class of nerves, as those of the mucous lining of the bowels, they are often relieved by irritation of the peripheral distribution of another class of nerves, as by friction on the skin.

12th. The cerebral functions, more especially volition and sensation, being much in abeyance, any stimuli, whether mental or physical, by which they can be excited, should be freely given. It was on this principle that Boerhaave prevented the recurrence of epileptic attacks, by directing a red-hot iron to be applied to any who might be seized.<sup>3</sup>

13th. The extreme sensitiveness to all irritations which exists

<sup>1</sup> Williams' Principles of Medicine, p. 150. <sup>2</sup> Monthly Journal, 1841, p. 75.

<sup>3</sup> Falconer on the Influence of the Passions, p. 100.

whenever the Spinal predominates over the Cerebral system, suggests the propriety of enforcing the most absolute quiet, and preventing the access of all bodily and mental stimuli. In tetanus and hydrophobia the creaking of a shoe, the slamming of a door, the sight or even the thought of water, or the gentlest zephyr playing on the surface of the body, excites a fit. Hence Armstrong tells us, that in tetanus those patients recover best who get little active treatment, but are nursed, as it were, through the fit.<sup>1</sup>

14th. And if sources of irritation ought to be prevented, those actually existing ought to be removed, but never by irritants which are more powerful than themselves. This surely gives sufficient latitude to the most devoted admirer of the gum lancet, the bolus, or the bag and pipe, while it suggests to him a little caution in these somewhat coarse though most popular remedies.

15th. And lastly, if I have not succeeded in pointing out any one remedy which stimulates the cerebral without exciting the spinal system, it is because few, if any, such are known. It is a subject of investigation well worth attention. And if no particular plan of treatment has been announced, which can be unhesitatingly recommended, I am perfectly satisfied if I have created any doubt as to the course which at present is too unhesitatingly followed. I think, at least, something has been done to show how much more constitutional these affections are than is usually supposed, and thus to open up new plans for prevention, if not for cure. And if in acute mania, in puerperal insanity, in delirium tremens, in chorea, in laryngismus, and may I add in epilepsy also, empiricism or the influence of authority has induced us to abandon antiphlogistic treatment and to adopt stimulant and soothing remedies, I do not despair of a sounder pathology soon prevailing in regard to this whole class of affections, and of the discovery yet being made, that they are much more amenable to treatment than has hitherto been supposed.

### ARTICLE III.—*Illustrations of Thoracic Aneurism, with Remarks.*

By W. T. GAIRDNER, M.D., Assistant-Physician and Superintendent of Morbid Anatomy in the Royal Infirmary of Edinburgh.

At a meeting of the Medico-Chirurgical Society, in June 1851, I brought forward a case of aneurism of the aorta. (reported in the "Monthly Journal of Medical Science" for August, pp. 137 and 184), in which, as in some other published cases, the symptoms were almost exclusively referred to the larynx; spasmodic dyspnœa with stridulous respiration forming a complication so serious as apparently to warrant the operation of tracheotomy. Although, owing to the objections of the patient, the operation was delayed till too late to be

<sup>1</sup> Lectures, edited by T. G. Thomson, p. 572.