

put to the violence of this deadly struggle by bleeding. We saw the man recover from the moment of the bleeding. You may have heard him declare that the bleeding was the saving of his life—though you need not perhaps take any great account of a patient's opinion on such a point. You have seen all this. Well, gentlemen, I trust I have a sufficient sense of the fearful amount of fallacies which beset our medical reasoning—of what Dr. Barclay calls our "medical errors"—I believe I have a sufficient dread of the proverbially reigning confusion in our ideas of the *post hoc* and the *propter hoc* in matters therapeutical. But I think a man must be sceptical indeed, beyond all bounds of reason and common sense (if we may invoke that sense here), who refuses to connect effect with causation, the consequence with the antecedent, the cure of the disease with the venesection, in the cases I have to-day brought under your notice. And this one other word let me add suggestively, What other remedy do you know of under the sun which is capable of producing off-hand, then and there, such great results in such formidable disease?

## Original Communications.

### ON VITAL FORCES.

By JAMES RHODES, Esq., Glossop.

WITHOUT much preface, I intend to state my views upon the question of the origin of the motor or vital force in the living organism.

I am not aware that any more appropriate term can be given to designate this subject than physico-vital dynamics.

It is no less true for the human system than for the external universe, that *no force can be lost or destroyed*, and that *no force can increase in any degree that which exists*. When a force or power of motion has once ceased to act in one particular manner—as *vis viva*, or mechanical force, light, heat, or electricity—it becomes transformed into some of the other forms of force, according to the relation which the surrounding parts possess in influencing the conversion. A good instance of this fact is mentioned by Professor Grove, in his work on the *Correlation of Physical Forces* (page 58).

I shall attempt to trace out the changes or conversion of forces which take place in the human system.

Without doubt, the prime moving force in all Nature is that which started worlds into existence—a First Cause, producing the law of gravitation in the heavenly bodies, and called by Mayer, Tyndall, and others, *vis viva*. Now, when this *vis viva* becomes arrested, an *equivalent* proportion of heat is produced; and the discovery of its equivalent may hereafter give us a key whereby we may estimate the value of any of the chemical agencies acting in the human economy.

The mechanical equivalent of heat is equal to 772 foot-pounds for 1° Fahr, and was discovered by Mayer, a German of our profession, and by Joule of Manchester, whose labours were carried on independently and without the knowledge of each other.

The leading philosophers now consider that one main force now exists. It is not my intention to dispute this important point, but it will be necessary to coincide with them. Yet the most uninitiated

can ask, How can there be variety of forms out of one force? According to the more advanced philosophers, there exists a grand central force, round which systems of worlds revolve; and the light which emanates from the central bodies or suns of these systems is created by the very force which causes the revolution of the earth round our sun. It is not necessary here to enter fully into the subject of forces as they exist in external Nature, but the same laws apply to them in the human being; and I shall simply state the order and relationship which they possess to each other.

A gravitative force is established by the Great Unknown, which force is called *vis viva*. It is now discovered that a body falling to the earth will produce a certain equivalent of heat by the gravitative or moving force, which by this means becomes arrested and changed.

The following is an outline of the order in which I propose to consider this subject.

1. A close relationship exists between chemical force and the force of gravitation; and, under certain conditions, each of these produces heat and electricity—the former, the voltaic form; and the latter, frictional electricity.

2. A correlation between heat, light, and electricity is found to exist in the world around us; and it remains to be shown how these are connected and related in the living body.

3. It is not too much to expect that, as science advances, the total value of all these may be ascertained. The voluntary principle of man cannot create more force than is produced by the changes effected by the oxidising or chemical process in the system; otherwise exhaustion would be unknown, and sleep would be dispensed with.

4. There is the same correlation of forces in the human body, and these take their origin from simple motion, or *vis viva*; the attractive force existing in carbon, hydrogen, oxygen, phosphorus, etc., becoming converted into heat and nerve-force. These two are correlated, just as are heat and electricity. I do not consider that electricity and nerve-force present exactly the same phenomena; yet they are closely related, and almost identical.

5. I hope to show that heat and nerve-force are produced from the same origin; and that heat is not essentially, if at all, converted into nerve-force, as stated by Dr. Richardson; but that they are distinct at their origin, and that the nerve-centres are supplied with their force through afferent nerves—*i. e.*, cerebro-spinal and sympathetic—as well as that generated within the brain itself. This nerve-force becomes expended, as in walking, through the motor nerves, and it is, *à priori*, likely to be conveyed along the afferent nerves just in the same amount; but, without a knowledge of these facts, it would be difficult to understand how or why.

I think the results of the following experiments sufficiently prove the origin of nerve-force.

Most of the readers of the JOURNAL are conversant with the experiments of M. C. Bernard upon the sympathetic nerves, whereby he made known the facts of their "calorific and vascular" influence. When a branch of the sympathetic nerve is divided, the vessels are paralysed, and no longer oppose active resistance to the pressure of the blood; they become expanded, from loss of the contractile power of the capillaries, and a suspension of nerve-current to and from the capillaries.

The fact of an exaltation of temperature to 6° or 8° cent. indicates that what is lost in the non-production of nerve-force is converted into heat, or the *plus* heat is equal to the *minus* nerve-force lost, as shown by the loss of contractile force of the capillaries of

the part. I consider that the nerve-force generated in the healthy capillaries is conducted to the nerve-centres and ganglia; and that some of this force is returned to produce contraction of the capillaries, whilst the rest is applied in voluntary and involuntary purposes of life.

This view is greatly supported by the experiment of ligature of the femoral artery, and section of the sympathetic nerve on the same limb. We now find a reduction of temperature, with diminished sensation; whereas, in the former experiment, we find exaltation of temperature and sensibility.

The immediate effects of closure of a large artery by ligature or embolus are well known; viz., coldness and diminished sensibility of the limb. I cannot agree with Dr. Richardson in considering heat added to the body as altogether sufficient to keep up the functions or vitality of a part or organ. If such were the case, heat applied to a limb, as in the above experiment (of ligature), would restore its sensibility. If the heat applied were converted into nerve-force, the sensibility of the limb would be restored to its former condition by such addition before the renewal of circulation in the part takes place by collateral means. But we know that sensibility does not return until the collateral circulation has become established; and, therefore, that the afferent nerve-force of the part which is essential to carry an impression (as a prick or burn) to the brain is supplied when the limb is re-supplied with fresh blood to its capillaries.

Dr. Richardson, in his communication on the "Physics of Disease", appears to object to the term nerve-force and muscular force. In all cases, those terms are the best which convey to the mind a clear idea of an object or thing, although this may be able to assume numerous forms under varying conditions; as by the terms steam, vapour, rain, snow, hail, or ice, we signify the various forms assumed by water. In the same manner, it is just as correct to speak of nerve-force and muscular force, since we understand that these are correlated or changed into each other; and so it would be convenient to give a dozen other names, if force within the body assumed as many characters. Therefore, it is quite proper to give generic terms when force is made to assume its peculiar generic characters.

In speaking of the action of light falling upon the retina, sound upon the tympanum, and the chemical influence of touch, he says: "The motion of the body, in all that pertains to its own power of action, is through heat." I have elsewhere shown that heat is not converted into nerve-force. If it were converted, we should not hear of the exhaustion produced by extreme heat. We all know of the prostration produced in the body by the great heats of summer, and the strength of body evinced on a winter's day.

No doubt it is a beautiful and wise arrangement, that the two forces arise together; for the sense of touch is increased with the increased temperature of the skin. Yet heat, light, and sound do not constitute true nerve-force; they are excitants; they are received upon the skin, eye, and ear, and produce corresponding impressions on the brain. We know that people die from excessive heat. The dial in electric telegraph operations is moved by the commutator; and a corresponding movement is noted at the other end of the wire or station. It is the force generated in the battery which is used up in the production of messages; so, in the system, it is the impression of a commutator, so to speak, upon the skin, or any impression received by any of the special nerves of sense, which is conveyed by the force which is in continuous formation, and is impressed

upon the brain. It is impossible to see how the prick of a pin can impart force to a muscle. No doubt it causes an expenditure of force by the muscular contraction which follows through reflex action. If a pin could generate force, a stout cudgel well applied to an animal would be an economical substitute for hay and corn.

I have thus shown that heat and nerve-force have their own distinguishing characters at their origin. I also consider that there is developed at least the same amount of heat, in proportion to the mass of matter in the brain, as occurs in other highly vascular parts of the body. A proof of this is shown when the bulb of a small thermometer is introduced into an animal's brain. If the sympathetic nerve in the neck is divided (Donders's experiment), the temperature of that side of the head, and also the brain, is increased in like manner; thus showing the correlation of that force which is generated in the brain, and heat.

In the number of the BRITISH MEDICAL JOURNAL for September 17th, 1864, a few remarks occur. M. Pontevéz states, that the hot and red skin is produced by relaxation of the blood-vessels, just as it is produced after division of the sympathetic. The cause of this increased temperature can readily be understood by reference to statements before made; and the only remaining means likely to produce increased temperature are, increased friction by greater blood-current, and by increased combustion by great admission of more blood into the capillaries of the part. Now, by the discoveries of the mechanical value of heat, and of the known quantity of heat evolved by combustion of carbon and hydrogen (the former by Favre and Silbermann, and the latter by Grassi), we have a ready means to estimate the amount of heat capable of being produced by both these means. To give the figures in proof of this would take up much space.

When the half of the spinal cord in the lumbar region is divided, increased sensibility of the limb ensues; and this strongly convinces me that this increased sensibility of the limb, or increased afferent nerve-force, becomes collected, and the limb highly charged with this force, derived from the peripheral extremity of the nerves.

To conclude this brief account: I consider that the sympathetic and sensitive nerves are supplied at their peripheral or afferent extremities with their peculiar functions and forces. Their functions are to receive impressions, as touch, vision, hearing, smell, and taste. And these two classes of nerves are here connected by ganglionic nerve-cells. The derivation of the nerve-force supplied to the nerves of special sense, and the function produced in each of these, will be, in my opinion, as follows. The nerve-force generated by chemico-vital action in the capillaries within the eye is conveyed to the retina by the expanded layer of ganglionic nerve-cells which are found spread upon its surface; and hence, light falling upon the retina, the sensation of an image is conveyed to the brain by the force generated, not in the nerve-centre, but in the eye. This instance will serve to explain what is effected in the other organs of special sense.

It is an established law in physiology, that the development and functional activity of an organ is in direct ratio to the abundance of arterial blood which is sent to it. This is seen by the excited condition of the pneumogastric nerve during digestion, when the amount of blood to the stomach is much increased. The opposite condition is seen when part or organ is deprived of its arterial blood. Thus the functions of the brain are checked when all the arteries which go to it are tied, and return again

when blood enters one of them. Instances are recorded of fetuses born without brains and with only rudimentary spinal cords, and yet whose hearts have continued to act.

### CASE OF TRANSMISSION OF SECONDARY SYPHILIS: WITH REMARKS.

By THOMAS SKINNER, M.D., Liverpool.

[Communicated to the Medical Institution of Liverpool, April 14, 1864.]

ON the 20th of September, 1861, I was consulted by a lady in reference to her first confinement. She was suffering from pruritus vulvæ, arising from a simple non-specific herpetic eruption on the vulva, which was cured in a week or two by diet and simple tonics, directed to improve the digestive organs. On the 4th of February following, she miscarried of a viable child, which, although seemingly healthy, died within a fortnight of its birth. The mother has had no return of the vaginal or vulvar irritation up to the present moment, and has enjoyed better health during all that time than has been her lot for some years before.

On the 3rd of July, 1862, she again conceived, went the full time of gestation without a single abnormal symptom, and was delivered of a rather puny-looking female child on the 10th of April, 1863. Within a week after birth, the child exhibited unmistakable signs of hereditary syphilis in an exaggerated form. On both hips, and around the anus and vulva, there was a florid red eruption, in rounded patches of various size and extent, each patch being raised above the level of the surrounding skin; and on the worst and most florid parts an ichorous discharge issued, which seemed to inoculate the sound skin, greatly extending thereby the diseased surface. Over the whole of the body a roseolar rash appeared, covered more or less with minutes scales, unaccompanied with itching. The whole of the mucous membrane of the mouth, lips, gums, fauces, and nostrils, became excoriated. The lips and gums, particularly the angles of the mouth, bled on the slightest touch; and they were always moist with a muco-serous exudation from the broken surfaces. Aphthous deposits were visible every where, but chiefly on the tongue and buccal mucous membrane. The child began to emaciate rapidly; and the mother's milk disappeared, apparently from grief at seeing her infant in such a frightfully diseased condition; so that we were driven to the alternative of substituting a wet-nurse. A strong healthy wet-nurse was obtained; the child was put upon grey powder; the diseased mucous and cutaneous surfaces were dressed thrice daily with a weak solution of the acid nitrate of mercury; and in three weeks the child was free from any appearance of disease; but, as it was still weak and delicate, I sent it, with the nurse and father and mother, to the coast of North Wales, where it thrived well, and remained quite well for a month, when a slight threatening of the eruption reappeared on the hips and vulva, with at the same time ozæna. A few more powders of chalk and mercury, and applying the lotion of the acid nitrate locally, again removed all trace of the disease within a week. The child has been weaned, and is now thriving better than ever, being both fat and plump.

So much for the disease in the child. But how did it come by it? As I have already stated, the mother never manifested a trace of syphilis, either locally or constitutionally, during either of her pregnancies; and from the 20th of February, 1862, until the present date, she has never had any discharge, sore, or other local disturbance of the genito-urinary organs.

I at once suspected the husband; and I told him of my suspicions, when he candidly confessed that he had contracted the disease by a primary sore on the penis eight years ago; but, as he had undergone a thorough salivation on more than one occasion, he thought the poison had been eradicated from his system. On making further inquiries about his present state of health, I found that he was still the subject of constitutional syphilis. The form in which it now manifested itself was that of chronic syphilitic ulceration of the tongue, coming and going, not yielding to ordinary tonics. I examined the ulcers; and, judging from their characteristic ash-coloured surface, combined with the fact that they had come and gone for eight years independent of external causes, I have no doubt in my own mind that the husband was the cause of the disease in the child. He has since been cured to all appearance by iodide of iron, baths of nitro-muriatic acid, and an occasional mercurial purgative.

Having now accounted for the disease in the child, let us turn to the wet-nurse. The child had not been a week at the breast when, with one of its nails, it injured or broke the skin a little below the nipple. Every care was taken of this broken surface, by means of cleanliness, etc.; but I fear they were too late of adoption, and that some of the saliva or the secretion from the excoriated lips of the child inoculated the wound. The wound did not heal kindly: more or less of a suppurative tendency showed itself. It healed with simple dressing within a week or ten days; and the woman went with the family to the coast, and remained out of my supervision for about four weeks. On her return, she was covered from head to foot with a roseolar rash, the same as I observed in the child a few days after its birth. On the back of the neck, and on other parts, the peculiar copper-coloured eruption of secondary syphilis was present; but I was very unwilling to believe it. Partly at my own request, and partly as it was the wish of the family, a second opinion was taken. The physician who met me was one who has had a very large experience of syphilis, and he at once pronounced it a genuine syphilitic eruption; in fact, he pronounced it so even before he had heard the history of the case; and I believe he was perfectly right. The wet-nurse was immediately put upon a course of mercurial purgatives, which removed all trace of the disease in about six weeks, without affecting the breast-milk otherwise than by increasing the quantity of the secretion. At this date, she remains perfectly free from any trace of the disease.

REMARKS. I am fully aware that, so far as the profession as a body is concerned, we are far from being unanimous as regards the question of the possibility of the transmission of secondary or constitutional syphilis. My object in bringing this case before you is to strengthen our belief not only in the possibility, but in the certainty of such transmission; as also that we may see how deeply we are interested in the subject in a legal sense, as regards the general management of such cases.

The case I consider quite equal to an *experimentum crucis*; and I feel perfectly confident that every avenue leading to deception or mistake has been strictly guarded. I can vouch for it that, during these two years, neither locally nor constitutionally has the mother ever manifested any appearance of a primary syphilitic sore or sores; and far less has she shown any symptom at all approaching to constitutional syphilis. I can also testify that, during the same period, she never was treated with any anti-syphilitic agent. If you ask me how the mother escaped contagion, I answer that I know not. All that I can say is, that this case is not the only one