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By Whom, all things; for Whom, all things.

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CONTEMPORARY PHILOSOPHY: MIND AND BRAIN.

IN the last number of this REVIEW I stated that philosophy is at this present time running strongly in two directions: one towards historical and critical discussions, and the other towards the physiology of the brain and nerves. Having pointed out the defects of an exclusively historical method, which may take us away from the observation of the operations of the human mind, I am now to follow the other and far more powerful stream, and inquire whither it is conducting our young men.

Physiological psychology is at present collecting around it a keen feeling of interest in Germany and in England. In the former we have Lotze, Wundt, and a host of others, physicians and metaphysicians. In England we have Carpenter and Bain, Maudsley and Ferrier, making observations and experiments; and Spencer constructing his bold but premature generalizations. The real fruit gathered is not yet a sufficient payment of the labor expended. Rash hypotheses have been formed by one man, to be taken down by his neighbor. A strong determination has been shown by not a few to account for all mental action by brain action. But out of the researches there will issue a record of important facts, which in due time may be coordinated into laws. This REVIEW cannot be employed in a more important work, in an age in which materialism is making such lofty pretensions, than in exposing and restraining rash speculations and expounding and encouraging real discoveries.

Within the last few years we have had two excellent works published in Britain on the relation of brain to mind.

Carpenter's "Mental Physiology."—This is a very interesting work, full of information collected from a variety of

quarters. The author wishes to save himself from materialism. On the ground of consciousness he stands up for a will, and this a free will above the bodily organization. "In reducing," he says, "the thinking man to the level of 'a puppet that moves according as its strings are pulled,' the materialistic philosopher places himself in complete antagonism to the positive conviction—which, like that of the existence of an external world, is felt by every right-minded man who does not trouble himself by speculating upon the matter—that *he really does possess a self-determining power* which can rise above all the promptings of suggestion, and can, *within certain limits*, mould external circumstances to its own requirements, instead of being completely subjugated by them." He adds, emphatically, "that we have exactly the same evidence of this *self-determining power within ourselves* that we have of the existence of a material world outside ourselves" (p. 5). But it is surely worthy of being inquired whether, as he has felt himself bound to call in will, to which he gives a high and controlling place, he should not have associated with it other mental exercises, intellectual and moral, such as our judgments and our convictions as to right and wrong. We have exactly the same evidence of the existence of reason and conscience as we have of will. Meanwhile Carpenter has been severely criticised by the school of Bain, both in France (in the *Revue Philosophique*) and in England, who find it easy on their principles to account for volition by the prevailing desire, which, in the last resort, is the prevailing sensation wrought up into higher forms by association.

The theory on which he proceeds in accounting for our intellectual ideas (he scarcely refers to our moral ideas) is a very superficial and unsatisfactory one. An *impression* (a very misleading word, brought into philosophy by Hume) travels upward to the sensorium, where it gives rise to a sensation. "The change there induced being propagated onward to the cerebrum, becomes the occasion [another vague word] of further changes in its cortical substance, the downward reflection of whose results to the sensorium gives rise to the formation of an idea. If with this idea any pleasurable or painful *feelings* should be associated, it assumes the character of an *emotion*, and, either as a simple or as an emotional idea, it becomes the stimulus to further cere-

bral changes, which, when we become conscious of them, we call intellectual operations" (p. 123). This is a "free and easy way" of generating the thoughts and sentiments of which we are conscious. A boy, we may suppose, strikes his mother. An impression of this rises in our sensorium, goes up to the gray matter in the periphery of the brain, comes down as an idea, which is of the unkindness of the boy, of his wickedness and evil-desert!! We see what oversights the highest of these physiologists commit. What a gap between an action in a soft, pulpy substance, the brain, and the judgments pronounced as to truth and error, and the ideas of merit and demerit!

Ferrier's "Functions of the Brain."—This work is of a more special character than Carpenter's. Much consideration is given to the effects, especially the psychological effects, as on the senses, by lesions or injuries of the brain, and the mutilations of particular parts. But the work is especially valuable, as detailing a great many experiments wrought on such animals as pigeons, rabbits, dogs, and monkeys, which had been rendered insensible by chloroform. He had been anticipated in these by certain German physiologists, such as Fritsch and Hitzig, who had published the results some years before Ferrier had begun, or at least made known, his researches. I am not able to allot to each man his share of merit in the observations and in the results reached. It is certain that Prof. Ferrier has himself conducted very important experiments, and has detailed them in a convenient and connected form. Priority is due to the two Germans referred to, but credit to all the three, and to others. I am anxious simply to obtain the ascertained results, and I leave to others the work of distributing the due amount of merit to each investigator. We shall find difficulty enough in determining the points which are to be regarded as fully established.

The experiments were made by the application of an electrical current to the cortical substance of the cerebrum and other ganglionic centres in the brain. They seem to have been conducted with care. There are difficulties involved in the process, and doubts may be thrown on the certainty of some of the conclusions. The chloroform which renders the frame insensible to pain may produce other effects of a disturbing character, and modify in some cases the action of the part experi-

mented on. Further, the injuries inflicted on parts and the mutilations may spread to contiguous regions, and render it difficult to settle what is the precise seat of the affection produced. The experiments will doubtless be repeated, with variations, and the whole will be tested by critics; and in the end we shall have a valuable body of well-established and acknowledged truths. Already some points have been rendered highly probable. I propose to lay before the readers of the REVIEW some of the more important conclusions of Prof. Ferrier, to dwell on those which bear on mental action, and show how little they favor materialism.

Nobody imagines that the bones or muscles of the body can produce thought or feeling. It is the cerebro-spinal mass alone that can be supposed to have any psychological qualities. Let us examine it, beginning with the spinal column and mounting up to the cerebral hemispheres.

The *Spinal Column* is composed of white matter, which is fibrous, and of gray matter in the centre, which is cellular. It gives off along the backbone thirty-one pairs of nerves, which are combined in knots or ganglia, which exhibit reflex action. The anterior in the pairs are Motor (designated A M); the posterior, Sensor (P S). The Sensor nerve, which is afferent, being stimulated, transmits an action to the centre, and there goes out in motion along the Motor nerve, which is efferent. Now there is no evidence of there being mental action of any kind in the cord or in the nerves. Mr. Lewes, it is true, speaks of there being unconscious mental action. I doubt much whether there is such a thing as unconscious thinking or feeling. From its very nature, we cannot be conscious—that is, directly cognizant of it. It cannot explain any thing which cannot be accounted for otherwise (supposed unconscious acts are simply acts which have passed so rapidly that they are not remembered) by known and acknowledged principles. There is no proof of there being mind in the motions of the ganglia. There is, no doubt, intelligence implied in the very delicate mechanism by which reflex action is produced, but it is that of the Being who fashioned and arranged the whole. The movements are not directly under the control of the will. Professor Ferrier maintains that there is no sensation in the backbone or its appendages. All

the parts above may be removed without destroying the proper action of the parts. So far, then, we have no trace of mental action, of will, or judgment, or emotion, nor even of sensation.

Going upward, the spinal cord expands into the *Medulla Oblongata* (Fig. I., L). Here we have a centre of co-ordination of a more complex character. It is concerned in the processes

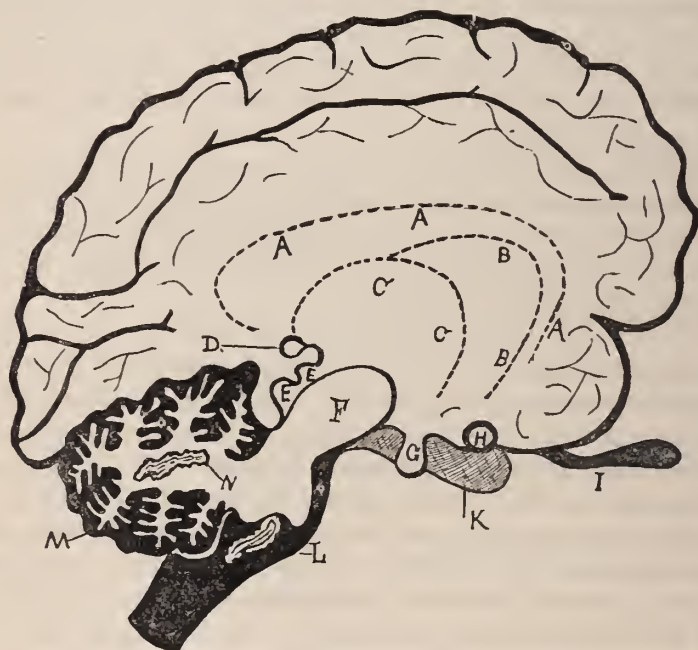


FIG. I.—THE ARRANGEMENT OF THE PARTS OF THE BRAIN.¹

The Corpus Callosum (A), the Corpus Striatum (B), and the Optic Thalamus (C), are shown in dotted outline. D, Pineal body; E, Corpora Quadrigemina; F, Crus Cerebri; G, Pituitary body; H, Optic nerve; I, Olfactory bulb; K, Exterior Hippocampal region, and region of the Subiculum Cornu Ammonis; L, Medulla; M, Cerebellum; N, Corpus Dentatum.

by which infants suck and swallow, and is supposed to be exercised in the production of articulate speech. The co-ordination of respiratory movements is one of the chief functions of the organs.

“It is farther a centre of the reflex manifestation of facial expression, and some other forms of what is usually regarded as emotional expressions. Vulpian has shown that if a young rat be deprived of all the encephalic centres

¹ The two figures were drawn by G. T. G. Ricketts, M.D.

above the medulla, and if then the toes are pinched, not only may reflex movements of the limbs be produced, but also a cry as of pain may be elicited. This is capable of frequent repetition. If now the medulla oblongata be destroyed, pinching of the toes will cause the reflex movements of the limbs as before; but no cry will be elicited. The cry in this case is a pure reflex phenomenon, and is easily accounted for, when it is remembered that a cry is only a modified expiration, and that the medulla oblongata is the co-ordinating centre of the respiratory movements."

I call special attention to the circumstance that the cry as of pain is no evidence of pain being felt. Our author says:

"If all the centres above the medulla be removed, life may continue, the respiratory movements may go on with their accustomed rhythm, the heart may continue to beat, and the circulation be maintained; the animal may swallow if food be introduced into the mouth, may react to impressions made on its sensory nerves, withdrawing its limbs, or making an irregular spring if pinched, or even utter a cry as if in pain, and yet will be merely a non-sentient, non-intelligent reflex mechanism."

Rising higher, we come to the *Mesencephalic Centres* (Corpora Quadrigemina), (Fig. I., E E). These are the seat of more complex and special co-ordinations, involving very wonderful adaptations, and the reflex expression of emotion produced by the action of the special senses. Carpenter regards the mesencephale as the *sensorium commune*, or seat of sensation, and the source of what is called sensori-motor, or consensual action—such as sneezing, which is not dependent on the will, and cannot be produced directly by a volition; but which is felt, and is so, our author maintains, because the act reaches a sensory centre in the brain. He does not allow that this action has in itself any sensation; and he asserts that the plaintive cry elicited by pinching the foot of a rabbit may be merely a reflex phenomenon, not depending on any true sense of pain, and that the leap to the side which the brainless frog makes so as to avoid an obstacle may be merely the resultant of two simultaneous impressions, the one on its foot, and the other on its retina.

The *Cerebellum* (Fig. I., M) was regarded by the phrenologists as the centre of sexual appetite, but this view is not confirmed by accurate research. Our author doubts whether, as is often asserted of late years, it is the special centre of co-ordinated action. Ferrier allots to it the function of equilibration, which

is paralyzed when the organ is totally destroyed, and may issue in falling or rotatory motion, according to the part affected when it is diseased. He maintains that neither sensation nor voluntary motion need be affected by disorder in the cerebellum.

This may be the proper place to call attention to a process which takes place in the *Pons Varolii* and *Crura Cerebri* (Fig. I., F). There is a decussation or crossing of the various sensory (so-called) and motor parts. Above this, destruction of one side causes paralysis of motion and sensation, not on the same, but on the opposite side.

The *Crura Cerebri* pass into two great ganglia situated at the base of the brain, where they are inclosed and concealed by the cerebral hemispheres. These are believed to perform very important offices in connecting the brain proper with the organs that lie farther down.

The *Corpora Striata* (Fig. I., B), it is agreed, have motor functions. Destructive lesions of this organ in man, in dogs, and other animals, produce hemiplegia of the opposite side, owing to the decussation just spoken of. Sensation meanwhile remains unaffected.

There is a considerable diversity of opinion as to the functions of the *Thalama Optici* (Fig. I., C). Carpenter regards them as playing an important part in the sensori-motor tract, and speaks of fibres as ascending from the sensorium to the cortical layer of the cerebrum, which is thereby sensorially stimulated or affected. Ferrier writes somewhat hesitatingly. There are undoubtedly cases in which injuries of the optic thalamus have been associated with diminution or abolition of sensation in touch, sight, hearing, taste, and smell, in one form or other, on the opposite side of the body. He holds that the thalamus contains the sensory paths of all the nerves of sensation which take their origin below the crura cerebri. The sensor and motor paths seem to unite about this place, and lesions of different parts of the thalamus seem to produce somewhat different effects. The motor tract has become completely separated from the sensor in the corpora striata. He holds it to be physically impossible that sensation should continue after the total destruction of the optic thalami.

But our author insists once more on the fact that mere reac-

tions to sensory or rather afferent actions are not indications of true sensations. He maintains that up to this place, up to the thalami optici and corpora striata, there is no evidence of will or even of sensation. This declaration, however, is to be taken along with the very important doctrine, that movements at first requiring true volitional effort "tend to become automatic by repetition; and the less varied and complex the movements, the more speedily does the automatic organization become established." He reaches the conclusion that "the corpora striata are the centres in which these habitual or automatic movements become organized," and that "the optic thalami play the same subordinate rôle to the sensory centres."

So far as we have yet gone, there is no proof of any mental act, nor even of sensation. Cut off the cerebral hemispheres from above, and there may be many movements as adaptive as if they had been done by the animal's will and intelligence, but there is, after all, no feeling and no purpose. Our author holds that "it has been conclusively demonstrated that in man the consciousness of sensory impressions, or true sensation, is a function of the cerebral hemispheres." I believe he has gone far to establish this most important truth in opposition to those who, like Carpenter, find the tract of sensation at the base of the brain.

His definition of sensation is approximately correct: "It is the consciousness of an impression." I do not like the word "impression." I believe that "affection" would be better. But he is surely right in saying that in sensation there is consciousness, or an immediate mental act, and this, I may add, a cognitive act; it is the knowledge of an affection of the body. He maintains resolutely that "sensation is a function of the higher, that is, cerebral centres," and quotes Flourens, who was of opinion that "sensation proper was abolished by the removal of the cerebral hemispheres."

Our author goes farther than this: he thinks he can localize, in the gray matter which composes the cortex or periphery of the brain, the centres of the various senses. At this point he is opposed by many eminent physiologists. His experiments will require to be repeated, and his conclusions tested by competent men, before they can be regarded as fully established. But he

seems to me to have proven his positions provisionally and approximately. I use this guarded language because I believe that, while the senses have to do with the centres allocated to them, there may be need of more investigation to determine the precise function of the centres. It is surely quite conceivable that the

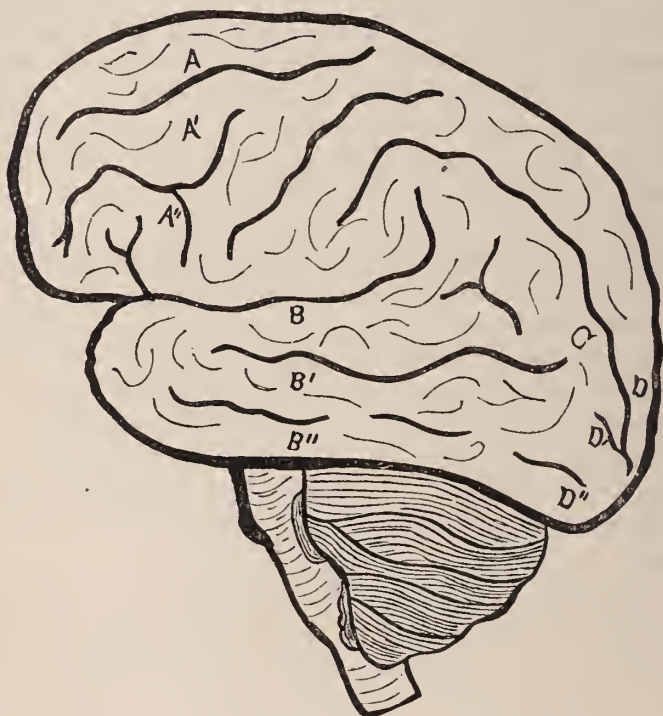


FIG. II.—LATERAL VIEW OF THE BRAIN OF MAN (LEFT SIDE).

- A, Superior frontal convolution ; A', Middle frontal convolution ; A'', Inferior frontal convolution.
 B, First temporo-sphenoidal convolution ; B', Second temporo-sphenoidal convolution ; B'', Third temporo-sphenoidal convolution.
 C, Gyrus angularis.
 D, First occipital convolution ; D', Second occipital convolution ; D'', Third occipital convolution.

sensation which is so diffused in the lower animals may become differentiated and localized, in the higher animals and in man, in special cerebral organs, which, however, it may perhaps have to be added, are not so differentiated as not to be mixed up with other functions.

We may begin with the *Organic Sensations* or *Visceral Sensa-*

tions. The cerebral centres of these are supposed to be in the occipital lobes (Fig. II., D, D', D"). Cut off these, and the animal continues to see, hear, touch, taste, and smell as before, and can walk, run, jump, and use its limbs with perfect power and co-ordination. But the relish and the appetite for food are gone. It has to be added that thirst, which is a tactile sensation, may remain. But place food before the animal, and it has no inclination to taste it. The occipital lobes are thus the centre of those visceral affections, which, as healthy or morbid, do so affect our vague feelings of well or ill feeling, which are apt to constitute no inconsiderable portion of our happiness or unhappiness, and make our temperament and our tempers placid or irritable.

Touch is represented as having its centre in the hippocampal region (Fig. I., K). "Destructive lesions of this region abolish tactile sensation on the opposite side of the body. When the right hippocampal region is destroyed, sight and hearing are unimpaired. But cutaneous stimulation, by pricking, pinching, or pungent heat, sufficient to cause lively manifestations of sensation, when applied to the right side of the body, failed in general to elicit any reaction whatever on the left side, whether face, or hand, or foot."

Smell and *Taste* are supposed to have their centres, not easily distinguishable, in the subiculum cornu ammonis (Fig. I., K, anterior portion). "Irritation of the subiculum, in the monkey, cat, dog, and rabbit, was attended by similar phenomena in all—viz., a peculiar torsion of the lip and partial closure of the nostril on the same side. This is evidently the outward expression or reflex indication of the excitation of subjective olfactory sensations of an intense character."

Sight has its cerebral centre in the gyrus angularis (Fig. II., C). It seems that the eye, with all its coats and humors, and the retina and the optic nerve, might be all entire and in a healthy state, and yet there be no vision whatever. In order to sight, the action must go up to the cerebral centre. "Destruction of the angular gyrus on one side causes blindness in the opposite eye. The loss of vision is complete, but is not permanent, if the angular gyrus of the opposite hemisphere remains intact, compensation rapidly taking place, so that vision is again possi-

ble with either eye as before. On destruction of the angular gyrus in both hemispheres, the loss of vision is complete and permanent."

Hearing has its centre in the superior temporo-sphenoidal convolution (Fig. II., B). In the experiments conducted, it was found that when these were not destroyed, the other senses, such as touch, taste, smell, and sight, were not impaired; but in the experiments there was no response to the usual forms of auditory stimuli. The animal was perfectly awake, and looking around, but was quite unmoved by loud calling, whistling, and knocking.

Our author speaks much more loosely and hesitatingly about the *Frontal Lobes* of the brain. Their functions have not been determined either by the method of electrical excitation or that of destruction:

"Removal or destruction by the cautery of the anterior frontal lobes is not followed by any definite physiological results. The animals retain their appetites and instincts, and are capable of exhibiting emotional feeling. The sensory faculties—sight, hearing, touch, and smell—remain unimpaired. The powers of voluntary motion are retained in their integrity."

We know for certain that the frontal lobes have a connection with motor ganglia, as the corpus striatum and motor tracts. It is probable, he thinks, that they may be specially the seat or centre of higher intellectual acts, as phrenologists maintain; but he gives no proof, and does not profess to have any. He is able, however, to allot to them a very important function, what he calls "inhibition:"

"Though not actually motor, they are inhibitory motor, and expend their energy in inducing internal changes in the centres of actual motor execution."

"The removal of the frontal lobes causes no motor paralysis or other physiological effects, but causes a form of mental degradation, which may be reduced in ultimate analysis to the loss of the faculty of attention. The powers of attention and concentration of thought are, further, small and imperfect in idiots, with defective development of the frontal lobes; and disease of the frontal lobes is more especially characteristic of dementia, or general mental degradation. The frontal regions which correspond to the non-excitabile regions of the brain of the monkey are small or rudimentary in the lower animals, and their intelligence and powers of reflective thought correspond. The develop-

ment of the frontal lobes is greatest in man, with the highest intellectual powers; and taking one man with another, the greatest intellectual power is characteristic of the one with the greatest frontal development."

This is all he is able to say—I believe all that any man is able to say at this present time. Let us suppose, then, that the frontal lobes have a special motor power, and act downward on the inferior organs; it has occurred to me that we might thereby partially explain those curious mental phenomena which have been described, without his endeavoring to give any *rationale* of them, by Sir Henry Holland, in his "Chapters on Mental Physiology." He lays it down as a rule, that if the consciousness—or, as I would rather say, the attention—be directed forcibly or habitually to any organ, that organ is affected. We are thinking of an organ; we have some sort of idea of it—say of our mouth or stomach—and some project defined or undefined regarding it. There will be some action downward upon that organ. If we think of the saliva in our mouth, the secretion of the glands is increased, and the quantity becomes more abundant. I have often been annoyed by this peculiarity in visiting persons laboring under infectious disease. Having been advised by my physician not to swallow my spittle in such circumstances, I have found my mouth filled with saliva in consequence of the very attempts to restrain it. "The organs," says Dr. Holland, "are variously subject to the same influence. The act of swallowing, for instance, becomes manifestly embarrassed, and is made more difficult by the attention fixed on it when the morsel to be swallowed comes into contact with the part." "The act of articulation in its various forms is as obviously subject to the influence we are describing, and especially where there exists already some impediment in the function. This is curiously illustrated in many cases of stammering, and also in paralytic cases, where the organs of speech are affected by the disease." Turning to other parts of the frame, we find the same accomplished physician saying: "A similar concentration of consciousness in the region of the stomach creates in these parts a sense of weight, oppression, or other less definite uneasiness, and whenever the stomach is full, appears greatly to disturb the digestion of the food." "The

symptoms of the dyspeptic patient are doubtless much aggravated by the constant and earnest direction of his mind to the digestive organs and the functions going on in them. Feelings of nausea may be produced or greatly increased in this way, and are often suddenly relieved by the attention being directed to other objects." I remember of having sea-sickness cured on the instant, when, on stepping on deck, I found that the vessel was in danger of sinking, and as I looked abroad on a scene in which the howling of the storm and the flashing of the lightning completely carried away my attention from my agitated stomach.

Other portions of our frame, usually supposed to be less susceptible, feel the same influence. I remember being suddenly pushed forward on one occasion on a very high platform to address an assembly below. As I looked down through the boards, I felt as if I might fall, and suddenly, through the attention being directed towards them, I found my limbs shaking and my steps tottering. Had this state of mind continued, I would probably have dropped down on the platform; but fortunately I had to address the crowd, and my attention being thus drawn off myself, I had not finished the first sentence till I found my limbs as calm and firm as if I had stood on the solid earth.

Dr. Holland says that different parts or textures are differently affected by the consciousness thus directed to them, either from diversity in the organs themselves, or from some obscure inequality in the exercise of the power. In some cases the influence is a happy one; more frequently it is a deranging one. I have observed that the influence is for good when it is intended by the Author of our nature that the will should be directed to the organ, but that in other cases it is followed by a disturbing effect. Thus, so far as our senses are concerned, it is evidently intended that we should voluntarily exercise and direct them. In such cases, the influence is for good. "No one can direct his consciousness to the organs of seeing, hearing, or even of taste, without becoming aware of certain changes in their state from the mind thus by effort applied to them. It is even possible, as learnt by experiment, to give a different intensity to the impressions received from one or other eye, or even by the agency of the mind severally upon

these parts. And explanation of the improvement of the senses by exercise may readily be found in the habitual repetition of this mental action, and its effects on the physical condition of the organs—in conformity with the more general law, that any frequently repeated action of a part invites more of blood and nervous power into it, adding, unless there be excess of action, to its power and capacity." In all cases in which nature (by which I mean God acting by natural agents) can carry on the process without any effort of our will, the morbid brooding upon the organ has a tendency to disturb its functions. The conceited intermeddling with the operations which God carries on has always the effect of injuring and deranging them.

And this leads me to remark, that this peculiarity of our nature may be made a means either of producing or of curing disease. It is a common saying that many a disease proceeds from imagination. This is a literal truth. The hypochondriac imagines that he has disease in the heart or stomach; he is led in consequence to think much of these organs, and he thus produces the very malady of which he was afraid. On the other hand, disease has in some cases been cured through the same law of our constitution. A friend of mine, an eminent medical practitioner, assures me that he has at times effected a cure in the following way: He tells the patient that the malady under which he is laboring requires the application of a blister; he prepares the blister and sends it to the house of the sick man, with instructions that if he is not better by a certain time, say by evening, it must be applied. The patient meanwhile has the pleasant reflection before him of this application; this keeps the attention fixed on the part, and, strange as it may seem, the fear of the blister has the same stimulating effect as the actual use of it, and before the set hour has arrived, the part is not unfrequently so improved as to render the actual application unnecessary. The cure effected by Dr. Beddoes has often been quoted. He was about to try the effect of electricity upon a paralytic, and before doing so inserted a thermometer under his tongue, simply in order to ascertain the heat of his body. The patient assumed that the thermometer was to be the means of cure, and became so much better after the first few minutes that the electric shock was not given, and he recovered

simply by the daily use of the thermometer. Doubtless the cures effected by homœopathic globules and by magnetic influences and mesmeric passes have been much indebted to this process. It is believed that even organic diseases may at times be cured in this way. "The idea," says Müller, "that a structural defect will certainly be removed by a certain act, increases the organic action of the part, and sometimes produces a cure. Hence the cure of warts by what is called sympathy, *si fabula vera.*" We are accustomed to say that we owe these diseases and these cures to imagination; but this explanation is far too loose: the truth is, we owe them to that curious law according to which the attention of the mind directed to an organ affects the functions of that organ.

To this same property we owe, in part, certain of the influences wielded by the mesmerist. We say in part, for there is another law at work. The mesmerist must first of all acquire a power over the law of thought of the person mesmerized. This can also be explained, but it is away from our present purpose, as it arises from laws to a great extent mental. But it falls within our present topic to show that when the mesmerizer has got this control, all the rest follows according to the law now expounded. He wishes, let us suppose, to deprive the party under his influence of the use of a particular organ, say of the power of moving his arm or limb, or of opening his lips. He has only by hints, by pointing, by passes, to direct the attention of the person strongly to these parts of the frame, and a derangement is produced similar to that in my limbs when I looked down through the boards of the high platform, and all healthy and steady action becomes impossible.

I regret that I cannot dwell longer on these interesting topics on which so little has been ascertained in time past, but where I am convinced not a little may be ascertained in time to come, by careful observation. I have said enough, I trust, to point out in what way investigation should be conducted. Inquiry into this subject has not always been prosecuted in a careful spirit. Every one knows that in this dark and cloudy region, which intervenes between the two territories of mind and matter, we meet with some of the profoundest mysteries of our nature. Here we fall in with sleep, dotage,

somnambulism, insanity—topics on which little or no light has been thrown. In the mists and clouds which forever brood over this dark gulf, a thousand errors have been lurking. In this border territory there is a continual warfare going on. But the very mystery which attaches to them is ever tempting persons of ardent curiosity and little caution, of strong fancy and weak judgment, to penetrate into these depths, and to speculate far beyond what they are entitled to do, on the principles of a rigid induction. In particular, we find the mesmerist displaying his phantasmagoria in this darkened room, to the astonishment of the vulgar. I acknowledge that the mesmerist has certain curious and important facts that he is playing with. It is vain to deny that there is a singular set of psychological and physiological phenomena which may, for want of a better name, be called Mesmeric. I am convinced, indeed, that there is no truth whatever in the doctrine of Clairvoyance; I am sure that not only has no satisfactory proof been advanced in its behalf, but that it has been disproven by the tests to which it has been put. But it cannot be denied that, both in health and in disease, mind and body are often in very curious states, and these states can be produced and operated upon by artificial means. But it has commonly been the business of the practisers of mesmerism not to throw light on these topics, but rather to perplex them, their ambition being not so much to explain these phenomena as to excite our surprise by representing them as more wonderful than they really are; and in accomplishing this end, some have been found guilty of not a little studious concealment—nay, of not a little trickery and deceit. Of all persons they seem to be the most unfitted to clear up this most difficult subject, and to put it upon a scientific basis. But we trust that the very wonder which they have excited, and the abuse which they have made of positive facts, will stir up others, qualified for the task, to make the attempt to probe these questions to the bottom. The result of this will be that the wonders which so strike the vulgar will very much diminish, and finally disappear, but only to disclose other wonders which will fill the intelligent mind at once with admiration and awe, as intimately connected at once with the strength and weakness of that nature of ours, which combines in itself the great-

est strength and the greatest weakness. "In wonder," says Coleridge, "all philosophy began, in wonder it ends, and admiration fills up the interspace. But the first wonder is the offspring of ignorance, the last is the parent of adoration. The first is the birth-throe of our knowledge, the last is its euthanasia and apotheosis."

I have now to call attention to another and higher function of the brain. The cerebrum, we have seen, contains centres of sensation and locomotion—the mind through them has a perception of forms, colors, smells, sounds, and tastes, and has power over the organs. But these centres give us not only our primary perceptions: they are necessary to the reproduction of them in idea when the objects are absent—to what Carpenter and the physiologists, following James Mill, call ideations, but I would rather call *phantasms*; a phrase taken from Aristotle, which (with phantasy, the faculty of which phantasm is the product) some of us are anxious to revive. I have taught this doctrine, as many of my pupils may remember, for more than a quarter of a century. The view is sanctioned by Bain and by Ferrier. To explain what is meant: whatever be the organ by which we see (it used to be thought the optic thalamus, it is now believed to be the angular gyrus), that same organ is required in order to our being able to recall it in image when it is absent. Thus, if the centre of vision be the gyrus, a healthy state of that organism is needed, not only in order to see the object, say the Falls of Niagara, but to recall them. It is the same with all the other senses. In order to image visceral sensations, the occipital lobes must be in exercise; in order to remember sounds, we need the temporo-sphenoidal; and in order to recall tastes and odors, the subiculum. I hold that in both cases, both in the perceptions and in the reproduced ideas, the mind does the work, produces the perceptions and the ideas; but in both it needs an organ, and this organ is the same in both operations. By this law we can explain so far certain curious facts.

I shall suppose that we are cherishing a very strong mental affection—this may so affect the organism that we feel as if we saw the object before us. We may thus account for some of the most curious phenomena of our compound nature. Sir

Isaac Newton, having been employed in looking upon the sun in a looking-glass, brought his eyes to such a pass that he could look upon no large object without seeing the sun before him. If he but thought upon the sun, he presently saw his picture, though he was in the dark. In order to be rid of this unpleasant sensation, he shut himself up for three or four days in a dark chamber, and so far recovered from them; but for months after, the spectrum of the sun began to return as often as he began to meditate upon the phenomena, even though he lay in bed at midnight, with his curtains drawn. Years after, he thought that he could make the phantasm return by "the power of his fancy." Here we have an evident reaction of mind and matter. The bodily organism gives the mental image, and the thinking of the object—the fancy of it—calls up the bodily image. By the help of this same principle, we can account for the experience of Goethe. "When I closed my eyes," says he, "and depressed my head, I could cause the image of a flower to appear in the middle of the field of vision; this flower did not for a moment retain its first form, but unfolded itself, and developed from its interior new flowers, formed of colored, or, sometimes, green leaves. These were not natural flowers, but of fantastic forms, although symmetrical as the rosettes of sculptors. I was unable to fix any one form, but the development of new flowers continued as long as I desired it, without any variation in the rapidity of the changes. The same thing occurred when I figured to myself a variegated disk. The colored figures upon it underwent constant changes, which extended progressively from the centre towards the periphery, exactly like the changes in the modern kaleidoscope." The physiologist Müller represents himself as frequently seeing different figures in the field of vision when he lay quietly down to sleep. Müller had no voluntary power over either the production of these images or their changes of form. Goethe, on the contrary, was able to give the type for the phantasm, and then the different variations ensued on it, as it seemed, independent of the will, though with regularity and symmetry. "This difference," says Müller, "accorded well with the characters of our minds, of which the one had all the creative power of the poet, while the other was engaged in the investigation of the actual phenomena of nature."

This curious power is not possessed by all ; it seems, indeed, to be confined to comparatively few. Some of those who possess it can exercise it at any time, others only at particular times. I have sometimes thought that it is a power to be feared rather than coveted.

This same principle may explain many cases of spectral illusions. When dreams are very vivid, the person actually sees the scene as he suddenly opens his eyes upon awaking. "A friend of mine," says Sir Benjamin Brodie,¹ "on awaking in the morning saw standing at the foot of his bed a figure in a sort of Persian dress. It was as plainly to be seen and as distinct as the chairs and tables in the room, so that my friend was on the point of going up to it, that he might ascertain what, or rather who, it was. Looking, however, steadfastly at it, he observed that although the figure was as plain as possible, the door behind it was plainly to be seen also, and presently the figure disappeared. Considering the matter afterwards, he recollected that he had had a dream in which the Persian figure played a conspicuous part." Most persons must have fallen in with the cases of children awakening out of sleep, and incapable of distinguishing between the imaginary scenes of which they had been dreaming, and the actual objects before them.

There is but a step between these and spectral illusions actually believed in, and even that intermediate space is filled up with cases in which spectres are seen without being believed in. "The case of a gentleman," says Dr. Abercrombie,² "has been communicated to me, who has been all his life affected by the appearance of spectral figures. To such an extent does this peculiarity exist, that, if he meets a friend in the street, he cannot at first satisfy himself whether he really sees the individual or a spectral figure. By close attention he can remark a difference between them, in the outline of the real figure being more distinctly defined than that of the spectral. But in general he takes means for correcting his visual impression by touching the figure, or by listening to the sound of his footsteps. He has also the power of calling up spectral figures at

¹ "Psychological Inquiries," p. 79.

² "Intellectual Powers," p. 277.

his will, by directing his attention steadily to the conception of his own mind, and this may either consist of a figure or a scene which he has seen, or it may be a composition created by his imagination. But though he has the power of producing the illusion, he has no power of banishing it; and when he has called up any particular spectral figure or scene, he never can say how long it may haunt him. The gentleman is in the prime of life, of sound mind, in good health, and engaged in business."

A somewhat similar case has come within my own experience. A lady of my acquaintance had had her nerves dreadfully shattered in consequence of a fall, and for years after she was haunted with dark and disagreeable thoughts. These were usually confined to the mind, but at times they were bodied in external images. She was a person of naturally a strong mind, and never for one instant believed in the reality of the spectres. I was called in to administer to her the consolations of religion, which, in such afflicting circumstances, were found to be unspeakably precious.

Here, then, we have cases of a mental conception so affecting some portion of the sensory organism that the person feels as if he saw the object. After much the same manner, sounds have been heard. Dr. Holland mentions the case of a lady, advanced in years, and much devoted to music through life, who unceasingly heard musical sounds or airs. Of the tunes thus impressing her with a sort of a reality, some were familiar to her, others altogether new combinations. The struggle between the voluntary power conscious of the delusion and the physical sensations offered many curious facts. A particular air could generally be brought on by the will, but not dismissed again except by a strong effort to take up another. The same author tells us of a person who for a time believed in and acted upon the reality of illusive sounds and conversations, but afterwards came to know that they were imaginary, partly by his never discovering any person in the places whence the voices had come, chiefly by finding himself able on trial to suggest the words which were thus seemingly uttered by some one external to himself. Dr. Holland adds there was for the most part some obvious foundation in the thoughts or feelings at the time for the phrases

which seemed to reach the ear from without. From all this it appears very clear to me that there was an action of the mental conception upon the organism, putting it in very much the same state as the external sound does. I am convinced that similar phenomena occur in regard to the other senses, and that there are illusory touches, tastes, and odors produced by mental anticipations or images.

We have a case of illusory smells recorded in the *Life of Chalmers*: "A party of ministers had met at the manse (of Kilconquhar), where a number of them were to remain all night, and among the rest Mr. Gray, against whom some slight pique, on account of a real or assumed literary superiority, was entertained. The question as to the relative power of the imagination and senses was raised, and the argument rose high, Mr. Gray alone taking the side of the senses, and all the others the side of the imagination. The combatants parted for the night; Mr. Gray, by retiring first, giving his adversaries the opportunity of concocting the trick by which they made his own act contradict his argument. It was the custom at that time to wear wigs, which were given to the servant at night to be powdered for the next day. When Mr. Gray, with his freshly-powdered wig, came down next morning to the breakfast-room, he found it unoccupied. It was not till one of his brethren joined him, who, on approaching, gave very distinct but not very agreeable indications, that a most offensive odor was issuing from the wig. Trying his own senses, Mr. Gray could detect nothing amiss, but laughed at his friend for his folly. Now, however, a second friend came in, who declared immediately on entering that there was a very strong smell of brimstone in the room, and laid it at once and unhesitatingly to the wig. The laugh subsided, but still, after a second trial, Mr. Gray could find nothing amiss. But a third friend came in, and a fourth, and a fifth, all fixing the alleged offence upon the wig, till, his own senses overcome at last, and the victory given to his adversaries, Mr. Gray flung the harmless wig indignantly away, exclaiming, 'Why, the fellow has put brimstone on the wig.'" (*Life*, I., p. 192.)

There is scarcely any perceptible line between some of these cases and those in which the illusion is complete. In the case of many persons who see spectres, there is first a bodily disorder

ganization, acting on the mind in the way of calling up certain ideas, and then this idea producing a particular state of the organism which gives a bodily shape to the idea. In other cases, the phenomenon originates within, and proceeds from a dominant idea, so strong and vivid as to affect the corresponding part of the organism. Give us only such a vivid conception, and an organism disordered by it or by other causes, and we can now account for the spectres which have been seen both by sane men and by lunatics. We can explain in this way the vision said to have been seen by Brutus before the battle of Philippi; the sad prognostications in his mind must have created it. Thus, too, are we to account for the ghosts which have haunted the conscience-stricken murderer until he delivered himself into the hands of justice. To the same cause we are to refer the authenticated cases of second-sight; persons of moodish and morbid minds and disordered stomachs and brains are ever seeing spectral images, and when no fact corresponds to them, they are forgotten almost as easily as dreams; whereas when there are, as there will be at times, coincidences in real life, the vision is remembered, related, and declared to be a prophecy. Some have supposed that it is in this way that we are to account for Swedenborg's constant intercourse with the external world: by his high intellectual and spiritual conceptions he could make Moses and Elias and Paul appear before him as easily as Goethe, by his poetical fancy and through his botanical predilections, could surround himself with visions of opening flowers.

It is easy to conceive that when the person has become deranged, that these spectral illusions should be more frequent and exercise a greater control over his mind. For, in the first place, derangement often, if not always, proceeds from a diseased brain—diseased in the way we have been speaking of, and such a brain must be peculiarly susceptible of producing illusive scenes; and, in the second place, the mind thus distracted is less capable of distinguishing between truth and fiction. The disordered mind and the disordered brain conspire to construct an imaginary world, in the midst of which the person lives and moves, conversing with those around him and listening to their conversation, acting and being acted on, and experiencing feel-

ings of joy or of sorrow, according to the nature of the circumstances in which he is placed. And in all this there may only be the disorganization of powers of body and mind, which are usually good and beneficent, just as in bodily disease there is simply the disorder of organs which, when in health, are the chief source of our activity and physical enjoyment.

Returning to the frontal region of the brain, we find that a very special function belongs to one of the lobes—to the third frontal convolution (Fig. II., A"). M. Broca has shown that this is the *Organ of Speech*. A lesion of it produces what is called aphasia. The person is quite capable of appreciating the meaning of words uttered in his hearing. But

“the word spoken, though it calls up the idea or meaning, cannot call up the word itself actually or in idea, owing to the centres of word execution and word ideation being destroyed. The appreciation of the meaning of spoken words is readily accounted for by the fact that in the process of education an association is formed directly between certain sounds and certain objects of sense simultaneously with, if not antecedent to, the formation of the cohesive associations between these sounds and certain acts of articulation. The cohesion or association between sound and meaning remains unimpaired in aphasia; it is the cohesion between sound and articulation which is broken by removal of the organic factor of the organic nexus.” “Some can neither speak nor write; some can write, but cannot speak; some can write their names, but cannot write any thing else; all can comprehend spoken language, many can comprehend written language; others not at all, or only imperfectly.”

Aphasia seems to be confined to the left side, and our author ingeniously accounts for this:

“The loss of speech, actually or in idea, from destruction of the centres of articulation is not more difficult of explanation, on the principles laid down in this chapter, than the loss of sight, presentatively or representatively, from destruction of the angular gyri. That which constitutes the apparent difficulty is the explanation of speechlessness without motor paralysis from unilateral lesion of the centres of articulation in the left hemisphere. This difficulty is explicable on the principles laid down in reference to motor acquisitions in general. As the right side of the body is more immediately concerned in volitional motor acts, so the education is principally in the motor centres of the left hemisphere [owing to the decussation of nerves spoken of above], and these centres are more especially the organic bases of motor acquisitions. The left articulatory centres, as has been argued by more than one observer, preponderate over the right in the initiation of motor acts of articulation. They are, therefore, more

especially the organic bases of the memory of articulations, and of their revival in idea. The destruction of the left articulatory centres removes the motor line of the cohesions which have been formed by long education between the centres of hearing and sight, and between the centres of ideation in general."

Thus far I have been writing chiefly of the cerebral centres of the senses. But it seems that the concurrence of the motor centres is required in order to our forming ideas in which the object is represented as acting and being in motion. Prof. Bain fondly dwells on this circumstance, and it is thus described by Ferrier:

"Our idea of a circle is a combination of an ideal colored outline with an ideal circular sweep of the eyeballs, or it may be of the tactile impressions coinciding with an ideal circumduction of the arm or hand, or perhaps with both these factors combined. The same elements enter in all varieties of form or shape of which we are capable of forming an idea. Our ideas of distance, weight, resistance, all involve not merely sensory factors, but these combined with muscular movements. To revive any of these ideas is to revive both the sensory and motor elements of their composition; and we tend in ideation to repeat the actual movements which were concerned in the primary act of cognition." "We have thus a sensory memory and a motor memory, sensory ideas and motor ideas; sensory ideas being revived sensations, motor ideas being revived or ideal movements. Ideal movements form a no less important element in our mental processes than ideally revived sensations." He adds, "There is practically no limit to the number of associated combinations of sensory and motor elements. Sensory centres form organic associations with other sensory centres, motor centres with motor centres, sensory centres simple and in complex association with simple or complex associations of motor centres."

This doctrine may be adopted provisionally and as an hypothesis. We cannot have an idea of a sensible object without the concurrence of the sense centres, or of an object in motion without an action of the motor centres. We need a sense centre to have an idea of a carriage, and of a motor centre to picture it as moving; and I have to add, of the language centre to speak of it. Every one knows and feels and acknowledges that the mind is so far dependent on the brain. The account I have now given, taken so far from Ferrier, but not wrought by him into a theory, may perhaps enable us to form a more intelligible idea of it than we ever had before. It shows us what brain action can do, but it also shows what it cannot do. We see how the perception of bodily objects and the recalling of

them require the co-action of brain organs, both of these processes implying consciousness, being in fact mental, and not cerebral. We see how the mind must be hindered in all its operations when certain centres of the brain are injured or are out of their normal connection—when the sensor centres, for instance, do not act with the motor. Deprive any one of the power of picturing forms, and colors, and odors, and tastes, and sounds, and touches, and motions, and of using symbols for several or all of these, and we see how repressed the mind would be. The views of the sensible qualities of objects being mixed up and confused, the persons would inevitably fall into mistakes in their judgments, and reasonings proceeding on inadequate notions and false premises; and in the end the very moral convictions proceeding on the erroneous representations might be perverted. We can understand how, on the brain being disorganized, the old man should lose his memory and forget names. I believe that very many of the well-known peculiarities of dotage—its incapacity and its delusions—can be thus accounted for. Certain of the organs are working abnormally, and raising up perverted pictures, whereas others are decayed and inoperative; and thus the man is without the means of forming a correct judgment. All this may be, without his having lost his true mental capacity of understanding, moral discernment, and affection, which are ready to work in this world when the hindrances are removed, or in the other world when a spiritual body is provided.

So far as sense perceptions and sense ideations are concerned, the maxim of the Stoic philosophy (not of Aristotle, as our author says) may be true: “Nihil est in intellectu quod non prius fuerit in sensu.” But there is nothing whatever in these observations or experiments to show that it is true of our higher ideas—of mind, of consciousness, of thought, of moral excellence, of justice, of merit and demerit, of infinity. Prof. Ferrier is not justified, even in appearance, in the conclusion he draws, that in these cerebral actions “we have the basis of all intellectual and volitional acquisitions.” For in all this we have only sensor and motor affections of the body, and sense perceptions and reproductions of sense perceptions in the mind. As yet, we have none of the higher manifestations of mind—no

judgment, no reasoning, no idea of perfection, no determination to make sacrifices, to do good and resist evil. To produce these, we must call on higher attributes of mind, and these observations furnish no proof whatever that these require special cerebral centres.

So far, then, as physiological observation and experiments have gone, they do not show, or even seem to show, that brain action can produce or explain mental action. After all, the old account seems the correct one—that the brain is the organ of the mind, its functions being instrumental and subsidiary. It is believed that in lower organisms the brain matter is in a diffused state; that the sensation is a *sensus vagus*, and that the locomotion has very loose ends. In higher animals it becomes centred in little brains, and these become more and more specialized as we ascend the scale, and they are differentiated to the greatest extent in man. But there is no absolute proof that in the end they accomplish a higher purpose in kind—they certainly do so in degree and in intensity—than they did at the beginning. They may, for all that these experiments show, be merely organs of sensation and locomotion, original and revived. It is difficult to prove a negative, and I do not affirm that the brain can have no other functions than these. But if there be others, let it be proven that there are; and what is still more important, let it be shown scientifically what they can do, and this will bring out what they cannot do.

In meeting materialism, we are on impregnable ground when we show first that mind and matter are made known to us by different organs—the one by self-consciousness, the other by the senses; and, secondly, that they are made known as possessing very different attributes, the one being characterized by thought and feeling, the other by extension and resistance. Prof. Ferrier is far too wise and too candid to affirm that brain action can account for mental action. He says, "No purely physiological investigation can explain the phenomena of consciousness." "We may succeed in determining the exact nature of the molecular changes which occur in the brain when a sensation is experienced, but this will not bring us one whit nearer the explanation of the nature of that which constitutes the sensation. The one is objective and the other subjective, and

neither can be expressed in terms of the other." I am sorry to find him, after he has made these admissions, following Bain, and declaring that "the physical changes and the psychological modifications are the objective and subjective sides of a double-faced unity; and that mental operations in the last analysis must be merely the subjective side of sensory and motor substrata." The word "side," as applied to mind, has and can have no meaning. Tyndall, in that wild careering lecture which he delivered lately at Birmingham, and in which he lets us see where his philosophy (if philosophy it can be called) must end, has forcibly stated this: "It is no explanation to say that the objective and subjective effects are two sides of one and the same phenomenon. Why should the phenomenon have two sides? This is the very core of the difficulty. There are plenty of molecular motions which do not exhibit this two-sidedness. Does water think or feel when it forms into frost ferns upon a window-pane? If not, why should the molecular motion of the brain be yoked to this mysterious companion—consciousness?" The word "side" so applied is at best metaphorical, and has a misleading tendency, as implying that mind has shape. We can understand that our body has a side, but cannot have the dimmest idea of a meditation or a sentiment being a side or having a side.

It has been shown by physiologists that you may destroy any one organ of the brain without affecting the integrity of the mind. It has been proven that you may take away a whole hemisphere of the brain without the mind losing its inherent capacity. We have all seen that while the body and its organs are dissolving into the dust from which they have sprung, the mind may be as active and as intelligent as ever, and may catch glimpses more vivid and exalted than ever it had before of the world opening on its view.

JAMES MCCOSH.