for femoral aneurism of one leg, and the other for popliteal aneurism of the other limb; a case of paraffin epithelioma (admitted); a case of enlarged gluteal bursa; a case of fracture of the sternum; a case of fibrous polypus; a case of ostitis of jaw; a case of old fracture of the cervical vertebræ and subsequent recovery; a case of hæmaturia from bleeding from kidney; a case of dislocation of a rib; a case of double inguinal hernia with double femoral hernia. There have been two cases of bites inflicted by women, and several of wounds of joints inflicted by human teeth, shown during the session.

Part Second.

REVIEWS.

The Relations of Mind and Brain. By HENRY CALDERWOOD, LL.D., Professor of Moral Philosophy, University of Edinburgh. London: Macmillan & Co.: 1879.

SECOND NOTICE.

IN his next chapter (VI.) Dr Calderwood takes an interesting and important retrospect of the ground already gone over. There are points in the summary with which we cannot agree; but this review threatens to reach such undue dimensions that we must withhold what we had written. There is a great risk of being tempted to theorize in studying the automico-physiological experiment of Dr Burdon Sanderson, although it seems favourable to our views, but we forbear. All the more, when we see how Professor Bain (who is on our side also) and Dr Calderwood proceed to compute the entire number of cells in the cerebrum, and whether or not they will suffice for both the acquisition and the retention of knowledge. Allowance is even made in the computation for some impressions being so evanescent as to admit of storing-room for subsequent impressions stronger and more permanent. Such speculations are surely too mechanical and quite beside the question. We cannot explain the mysterious contact of mind with matter. The connexion is *unthinkable*, and beyond our ken in all its aspects.

The author discusses in his next chapter (VII.) the subject of "Personal Experience as connected with Sensation," in his usual able manner. It has no special bearing, however, on the subject we are discussing.

Chapter VIII. deserves and will repay careful perusal. There are portions of it with which we cannot agree, but to consider them in detail would be only to re-traverse ground which we have already passed over repeatedly in the foregoing criticisms.

"Retentiveness of Acquisition—Memory" is the title of the next

chapter (IX.). This subject of memory is one which must necessarily perplex those philosophers who cannot allow that the higher exhibitions of mental power are dependent on the physical organism. In saying this, however, we disclaim *materialism* or *somatism*, or whatever these terms express. We hold the absolute distinction betwixt soul and body. We only reiterate the opinion or belief already expressed, that in the present system of things brain is necessary for the manifestations of mind, for the intelligent acquisition of knowledge, and for the retention of it. Here is the way in which Dr Calderwood deals with the subject:—

“*There is a physical acquisition resulting in physical aptitudes.* There is no artistic attainment which does not illustrate this. In every such case there is a real attainment, a retentiveness of something acquired. The seat of the acquisition is partly in the nerve-system, partly in the muscular, and is definitely restricted to the portion of the organism concerned in the form of activity.” The muscles employed increase in development and strength and aptitude. Dr Calderwood admits that there is also a degree of increase in *sensibility* as well as in the efficiency of the motor apparatus. “But,” he adds, “the illustration of retentiveness supplied by the sensory apparatus is much more restricted, and, as I took occasion at an earlier stage (p. 55) to remark, such increased sensibility, acquired and retained, involves much more than sensibility. It really much more illustrates an acquisition by means of intellectual activity.” Is there not here a virtual recognition of what we have been aiming at? You cannot draw a line betwixt the consciousness of sensation and the higher operations of intelligence. They differ only in degree, not in nature. The scent of a bean-field is remembered. In some minds, and these often the more highly endowed, it recalls a great deal more—the circumstances under which it was first perceived, the scenes of early days, old friendships, and a crowd of other associations. The same mind or soul which experienced the sensation is stirred in many lines of thought and sentiment. But our author says that such acquisitions as sensation affords are “acquisitions without choice and without any effort save what is common to all animal life from birth, in the reception of food, with the amount of sensory and motor activity involved in the search for it. But in the higher phase of activity now under consideration it is a new order of food which is sought,—food for a higher life,—and the conditions of acquisition and retention are changed.”

We grant that the conditions of acquisition may often differ in the two cases, but not invariably, because the higher knowledge is sometimes without choice, and the lower acquisitions—that is to say, of sensation—are sometimes the result of voluntary search. We deny that the conditions of retention are changed. There seems to be no essential difference betwixt the retention or memory of sensations and the retention or memory of the higher exercises of the

mind. The latter, if once matters of consciousness, may be recalled in accordance with what psychologists call "laws of memory,"—by simple or relative suggestion, by similarity or contrast. So may smells and sights and sounds, if they have previously been matters of consciousness.

One man whose faculties are specially strong in a certain line of thought will remember with comparative ease the knowledge which he has acquired in that direction; while another man who has no tendency towards such studies and attainments is unable or unwilling to pursue them, and therefore has a very limited store of them in his mind, and few associations enabling him to recall them if he wished to do so. These considerations raise a question which those who think with Dr Calderwood must find very perplexing. If the mind is independent of the vesicular structure of the cerebrum, how do we account for the infinite varieties of mental faculties and proclivities which men exhibit? What leads one mind to deal with questions of psychology, and to have real pleasure in so doing, when possibly it may be comparatively helpless in the ordinary affairs of life? How is it that another man, with a large cerebrum, who *ought*, if the sensori-motor arrangement really monopolizes the convolutions of gray substance, to show his power in bodily activity and muscular exertion, has, as we often see, no tendency towards outdoor sports, gymnastic exercises, and handicraft, but exhibits an utter inaptitude for such pursuits? These questions might be multiplied almost indefinitely. The phrenological system, which Dr Calderwood never mentions in the course of his elaborate book, may have some weak points, but it is certainly strong on the subject of memory. It recognises no separate organ of memory. Every faculty, intellectual or moral, has its own memory. The more amply developed and active, the more tenaciously will its acquisitions and experience be retained and recalled when needed. Large organs of *causality* and *comparison* meeting together must assert themselves, whether in peasant or peer, although the modes and occasions of that assertion may be very different, and the manifestations of their presence will inevitably be stored up and ready for use when occasions offer. A well-developed organ of *ideality* will in the same way make its existence known sooner or later, either in the tastes, in the language of the individual, or, it may be, in his power of invention, if he possesses an aptitude for practical activity, in handicraft or the arts. But the point we wish to emphasize is this—that the memory exhibited by the individual will mainly display itself in the sphere of those cerebral organs which are in his case exceptionally strong and predominant. Before passing from this matter, we ask, but only by the way, How happens it in the case of the lower animals—notably the dog and horse—if the sensori-motor system monopolizes their cerebrum, that they so often remember persons, localities, and events with manifest indications of associated sentiment, such as devoted attachment, courage, fear,

self-sacrifice, throwing into abeyance for the time all their natural and habitual tendencies?

Do not all these considerations point to the conclusion that the soul or mind, the *ego*, both in man and beast, acts through a bodily organ, so that, as we can connect muscular action with certain organic structures, designated sensori-motor, in like manner we are warranted, justified, in connecting higher manifestations of the same *ego*—call it mind, or soul, or $\psi\upsilon\chi\eta$ —with other portions of the same nervous structure for which we have discovered no adequate function?

We have already adverted in an incidental manner to the difference of opinion betwixt Professor Bain and Dr Calderwood as to the sufficiency of storing-room in the gray matter of the cerebrum for mental acquisitions. Dr Calderwood, who finds other work in connexion with sensori-motor action, maintains that there is no adequate room; Professor Bain holds that there is. "Non nostrum tantas componere lites." We can say no more than that the question appears to be irrelevant, if it is supposed to have any bearing on the function of the cerebrum.

A very interesting and carefully written chapter (X.) follows, on the "Use of Speech." It is well worthy of the reader's attention, but we shall pass it over as not bearing very directly on our main topic of discussion.

The next chapter (XI.) is occupied with "Action and Reaction of Body and Mind," and is virtually a re-statement of views already brought before the reader in various aspects:—

"Organism accomplishes much without the aid of mind; immediately, mind accomplishes, with the aid of the body, much for which organism itself is insufficient; and in advance of this, mind, by a reflective process, reaches a knowledge unattainable by sensory apparatus and the largest stores of nerve energy." There is something here, as it appears to us, like begging the question at issue.

"We are familiar with the fact that *a disturbed bodily condition is an effectual hindrance to the action of intelligence.*

"Though disorder of the digestive organs involves disturbance of brain, it does not therefore follow that the stomach can perform the functions of the brain." Certainly not. "And just so, though the disorder of brain involves disturbance of mental action, it does not follow that the brain can perform the functions of the mind." The statement of this proposition is surely very incorrect. The things compared have no correspondence with each other. Disturbance of the stomach, the organ of nutrition, affects the healthy action of the brain, a part of the organism. To suppose that the stomach in its healthy condition can perform the functions of the brain is *absurd*; but to suppose that disorder of the brain should involve disturbance of mental action is not only not absurd, but in the highest degree probable: otherwise what is the meaning of Dr Calderwood's long and elaborate argument with which we have been engaged in the preceding pages?

We may quote the concluding paragraph:—"These two facts stand indubitable: disturbance of bodily functions can retard intellectual action. Thought, with its attendant emotion, can lower or quicken the vitality of the physical organism. As correlated facts they are strongly confirmatory of the position that there are in human nature two forms of existence acting and reacting upon each other."

We need not say that we thoroughly agree with the author in this last position. The difference between us consists as to the function of the *cerebrum*. He holds—contrary, as we think, to the analogy of the sensori-motor system—that the mind or soul is outside of the brain, even in this world of sense; we hold that here and now the soul acts and manifests itself through the organism of the brain, although when that organism is dissolved into its chemical constituents the soul remains untrammelled and perfect, and suited for the new surroundings to which its Author may summon it. We hold by the Christian doctrines, and wish to show that the attainments of physiology and psychology are in harmony both with each other and with them.

Weariness, Sleep, and Unconsciousness are treated of at length in Chapter XII.

"There is no 'manual labour' which is not at every moment of its continuance 'real brain work,' as the preceding investigations have amply illustrated. The commonest work of the hands cannot be done without a draft upon the nerve energy supplied by the brain. All human labour is brain work, and all the work done by the lower animals in the service of man is also brain work." We know what is implied in these statements.

"To avoid needless complications, it is desirable to enumerate the forms of brain action which must be considered as generally attending on the more ordinary mental exercises. They may be briefly stated thus: (1.) Action of the special senses and of the special tactile sense; (2.) Action of the muscles concerned in the management of these senses, and specially of the organs of sight; (3.) Co-ordination of sensory and motor apparatus required for use of the senses; (4.) Action of sensory centres consequent on use of the imagination (p. 273), in part a renewal of sensory impressions, or a movement of the sensory cells consequent upon stimulus which imagination supplies; (5.) Sensory and motor action consequent upon the stimulus coming from mental emotion, such as weeping, facial expression of sadness or sympathy." "With these facts before us we can reach some conclusions as to the weariness attending on mental activity."

"First, there is large use of both sensory and motor apparatus in connexion with all the ordinary forms of intellectual activity." Dr Calderwood illustrates this in a very successful and happy manner by the experience of public speakers.

"Second, all thought proceeds, to a large extent, by use of language,

and thus seems to involve activity of the cells concerned with the acquisition and use of language and speech." This head is also illustrated with much ingenuity and accuracy of thought; and it is shown, we think, conclusively, that all the exercises already mentioned are sufficient to account for *some* of the weariness attendant on ordinary exercise of thought, especially if there be in addition a demand for dexterity of manipulation, as in writing, engraving, drawing, painting, or mechanical contrivance. We use the word *some*. Dr Calderwood thinks *all* the weariness is so explained.

"Third, concentrated thought makes a severer demand on all the forms of brain action connected with ordinary thought, and so quickens and increases the exhaustion of nerve energy." Dr Calderwood accounts for this by "the deliberate and well-sustained guard put upon the senses that they may not prove hindrances to us."

"As all nerve action involves weariness, with demand for nourishment and rest, we are naturally led to consider the *phenomena of sleep* as these are concerned with the relations of mind and brain."

"Sleep implies rest primarily and specially to the sensory and motor systems, and through these to the general muscular system." "Of the special senses, the sense of sight, the most restless and active of all during waking hours, has the fullest advantage from slumber."

The *phenomena of dreaming* constitute "a department of inquiry beset," as Dr Calderwood remarks, "with special difficulty, but it is of obvious importance as bearing on the general problem."

How are we to explain the phenomena of dreaming if "mental phenomena imply the action of a higher nature distinct from the body, though existing in closest union with it"? This is Dr Calderwood's mode of stating the case. Would it not bring it out more explicitly if we put it in this form: As the sensorimotor system is manifestly often imperfectly at rest during sleep, are not dreams just what we might expect when other portions of the gray matter of the brain are in an analogous condition of imperfect sleep? How does the high nature generate the strange and fantastic phenomena of dreaming, if it is so distinct from the organic structures? Sleep ought to be the time, surely, for *its* clearest, truest, and most real work. "Some have maintained that our dreams are all connected either with the period when we are sinking to rest or with the period when we begin to wake; but any extended observation of others in profound sleep will contradict such a view." We believe, however, that most persons who have seriously attended to the subject hold the opinion that dreams occur chiefly either at the commencement or near the close of sound sleep. This is more a question to be determined by individual consciousness than by the observation of others. Such observation is hardly possible without affecting the condition of the sleeper.

Various points, such as the following, are illustrated very in-

structively by the author, but they do not bear specially on the question at issue. We quote the headings, and advise our readers to study the illustrative observations for themselves.

"1. *While the senses are sealed in slumber, the imagination is often occupied with a representation of scenes and occurrences such as recognised by the senses.*

"2. *There is power of persistent determination and intelligent appreciation of previously formed purpose, influencing the sleeper from the beginning to the close of his slumbers.*

"3. *There are many examples of concentrated intellectual action during sleep.*"

We shall only hazard one remark upon these statements of admitted and well-known facts. They all indicate imperfect repose of mind, one or more faculties awake and active while the majority are at rest, the peculiar mental proclivities of the individual being at the same time apparent.

The subject of *unconsciousness* next claims attention. There is no progress made under this head in our author's argument, and little need be said in the way of criticism. Some good cases are given in illustration of somnambulism or sleep-walking. Dr Calderwood describes it neatly and concisely when he says, "In somnambulism there is actual performance of what is contemplated during the dreaming state. Is not this the difference between dreaming and somnambulism, that the dreamer appears in some measure to recognise that he is sleeping, whereas the somnambulist does not?" The subjects of *trance* and *mesmeric sleep* are referred to briefly at the end of the chapter.

We have now reached the subject of "Brain Disorders," which ought specially to test any theory as to the relations of mind and brain—Chapter XIII. pp. 362-410.

We are met at the very outset by the following sentence, which startles by its apparent inconsistency with all that has gone before. We rub our eyes, and feel that we must have been doing our author injustice by gross misrepresentation of his views:—"As it is admitted that the brain is the organ of mind,—and *this is expressly maintained by those who hold the distinct nature and higher functions of mind*,—all disorder or disease of brain must present facts of importance towards constructing a theory of the relations of mind and brain." We subscribe to this most cordially, but wonder how Dr Calderwood will clear his ground after so remarkable an admission.

Can anything be put more clearly than what follows? "No oculist would disregard the statement of a patient who mentioned that he often saw luminous appearances floating before him. No aurist would treat slightly the statement, made in consultation, that the patient experienced uneasiness and inability to understand what was said when words were spoken loudly. And, on precisely analogous grounds, the physician dealing with morbid conditions of brain must mark and classify evidence as to the feelings, dis-

positions, and thoughts of his patients which have a distinct value for his purpose, if only they are accurately interpreted."

Our author proceeds to consider the forms of brain disorder under three heads. When the weight of a human brain is below 30 ounces, there is feebleness of mind and feebleness of body. "Undeveloped brain implies an undeveloped physical condition; such a condition implies the impairment or loss of many of the appliances which contribute to intellectual development." "We come to the question, To what extent is imbecility accounted for by imperfect development of brain? At an early stage of this inquiry we have seen that neither is size of brain nor weight a sure test of brain power. Much depends on quality of the nerve-cells and convolutions of the gray matter. But it is beyond doubt that there is a limit beneath which there is imbecility. Below 30 ounces in weight or below 17 inches in circumference of cranium uniformly implies imbecility."

Attach as much influence as we may to a defective sensori-motor system, and amplify as much as is consistent with strict accuracy the results of painstaking instruction and judicious physical management of idiots, the great fact remains that their mental manifestations correspond very closely with characters of their brain.

The subject of insanity next comes to be treated of; and as it is often very difficult to explain such mental disorders by undoubted and conspicuous morbid appearances found after death in the brain, Dr Calderwood evidently regards this as a strong link in his chain of reasoning. We cannot afford space for discussing the subject in detail, because our review is already too long, but we shall content ourselves with a few general remarks.

The minute pathology of the brain can only be investigated in a small proportion of such cases, because many recover under treatment. But in fatal cases the morbid appearances are either so marked that no hesitation can exist regarding them, or, where the mental disorder has been of long standing, there will be indications of more or less chronic disease. In the comparatively rare cases of death at an early period from other maladies, the absence of morbid appearances is no proof that these did not exist in the form of hyperæmia in certain parts during life. This enables us to explain the great variety of symptoms which mental disorders exhibit. Some portions of the brain may be in a temporary morbid condition while others continue healthy. The intellect may continue clear, while the imagination, the emotions, the animal propensities are unduly active, whether the morbid changes be functional or organic, temporary or permanent. We are at a loss to conceive how, under the theory of Dr Calderwood, that the mind is outside of the brain, so to speak, the endless modifications of insanity can be accounted for. Of course, in the treatment of what are called mental diseases no sensible physician will forget that both mind and body require

his careful attention, for they act and react upon one another. But surely Dr Calderwood does not suppose that disease begins in the mind. If so, he seems to beg the question at issue.

Our author attaches much importance to the admitted fact "that brain disease may exist to a large extent without experience of uneasiness or indications of mental restraint or aberration." We admit this so far as uneasiness can be trusted; but as to a hemisphere of the brain being destroyed without mental restraint, the statement is incredible. Few persons are competent to speak *ex cathedra* on such a point. In a case such as that of the late distinguished Sir William Hamilton, who, though paralytic on one side for some years, retained his exceptionally strong powers of reflection, we cannot doubt that the disease was confined to the basal ganglion and the sensori-motor tracts; but when told of established disease in one hemisphere unaccompanied by mental impairment, or that one hemisphere did the work of both, common sense revolts from such statements. We agree with Dr Crichton Browne's suggestive remark, "It is astonishing how little real thinking will suffice to carry a well-trained man through an average day or month of an average year."

Dr Calderwood remarks, and we cordially agree with him, "that all treatment of the insane includes a moral element as well as a physical." This is, we think, perfectly consistent with the views we advocate. If a portion of the cerebrum is unduly active,—say hyperæmic, if you will,—what is so fitted to give it rest as occupying the mind in different directions, so that other portions of the brain may be brought into action? How is this to be effected? By a combination of moral and physical treatment, by change of scene, by new surroundings, by strenuous employment of the sensori-motor system in locomotion, in out-door exercise, in handicrafts of various kinds. This is the plan adopted by all intelligent physicians, and it seems quite in accordance with our view as to the relations of mind and brain.

A few words on violent injuries to the brain. The well-known "American crowbar case" is given at large and commented on very fairly. To us it seems to confirm all our views in the most explicit and striking manner. Dr Harlow, who gives a history of the case, says, "The equilibrium or balance, so to speak, between his intellectual faculties and animal propensities seems to have been destroyed." "A child in his intellectual capacity and manifestations, he has the animal passions of a strong man. Previous to his injury (he survived it twelve years and a half), though untrained in the schools, he possessed a well-balanced mind, and was looked upon by those who knew him as a shrewd, sharp, business man, very energetic and persistent in executing all his plans of operation. In this regard his mind was radically changed, so decidedly that his friends and acquaintances said he was 'no longer Gage.'"

Dr Calderwood remarks, "A breach of the controlling power

resulted from the injury to the frontal region; but there is evidence of comparatively little inroad on the intelligence proper." In this connexion it is desirable, also, to keep in view the fact that the activity of the intellectual powers has been associated with the *posterior region* in the brain. On this point Dr Bastian presents his testimony in the following form:—"Various reasons led me some years ago to the conclusion, which, however opposed it may be to generally received opinions, has since been strengthened by observations made independently in different directions and by different persons." The present writer may mention, in passing, that many years ago the late Professor Goodsir told him that he had come to the conviction that the hindhead has fully as much to do with intellectual work as the forehead, and that he felt that his own strength lay there. These may not be the precise words, but they convey his meaning. It is important to note, also, that Gall, Spurzheim, and Combe place the organ of *concentrativeness*, the power of close mental application, in that region of the brain.

Dr Calderwood frequently adverts to what he conceives to be a generally received opinion, that "the governing power belongs to the frontal region." We do not know how this impression has arisen. All this, however, about the occipital region is irrelevant to the case of Gage. The injury to the frontal portion of his cerebrum was quite in accordance with the mental impairment which he seems to have undergone.

Before leaving this part of the subject we may advert to a remark which our author makes in furtherance of his contention: "Intelligent self-control may avert insanity." This is a quite possible, but a rare experience. Everything, in our opinion, will depend on the cerebral region which happens to be in danger, and the regions which are acting healthily. Dr Maudsley says, "In the wise development of the control of the will over the thoughts and feelings there is a power in ourselves which makes strongly for sanity." Dr Calderwood, never losing sight for a moment of his ruling idea, adds, "Such wise development of the control of the will as is here commended belongs to the normal life of man whether he be educated or uneducated; but in saying this it is granted that there is a personal control superior to brain action, and which may keep ascendancy in midst of the disturbing experiences of a disordered brain. This declaration, confirmed as it is by a large body of evidence, and brought into application by the physician in his treatment of sufferers, affords definite and very express testimony to the superiority of mind over brain."

We hold as strongly as our author does the superiority of mind over brain; but what we contend for is this, that some minds, be they essentially inferior or not, are restricted, hampered, cabined, so to speak, in their action by the inferiority or want of ordinary balance of the *cerebrum* with which the Creator hath, meanwhile, furnished them. Such people are usually placed at a great dis-

advantage for exercising wise control on the part of their will. A man of intellectual and cultivated mind may have warnings that he is overworking his brain, and may, instructed by the experience of others, have sufficient self-command to limit his studies in due time, and so avert insanity or a mental breakdown. A drunkard or a licentious person, in whom the animal propensities engross an undue proportion of his *cerebrum*, is in a more helpless and hopeless condition. The higher powers have from the beginning been relatively weak, so far as brain is concerned, and how can they be expected to take the command when ill-health and temporal misfortune come upon him? He is now virtually left a prey to his lower tendencies. His intellect may for a little be roused and quickened by the visit, for example, of an intelligent and sympathizing friend, but the intercourse is no sooner at an end than the animal propensities resume their sway.

The penultimate chapter (XIV.) is devoted to "The Higher Forms of Mental Activity."

After a few preliminary statements, the author says, "It is apparent that there are three departments of higher thought which are capable of being regarded as rigidly distinct, while they afford common tests of the power of human intelligence. If this last consideration be kept in view, it will be seen that we have a common field of testimony before us, even while we distinguish three departments of inquiry. Though some show an aptness for only one of these regions of thought, and special interest in it, all have some share in the thought that belongs to the three. There is no mind which does not experience an influence from the scientific, the moral, and the religious, or at least the speculative thought of the race."

1. "*The purely intellectual department of thought.*"

"Our problem is this: Can such ranges of thought be regarded as functions of nerve tissue, and explained under the laws of nerve action?"

"From examination of the lower orders of activity we have found that comparison,—recollection of the results of past comparisons,—inference, and volition are all characteristic of man, and cannot be accounted for under the laws of nerve energy. This being true, still less can the higher powers of intellectual activity be so explained, and the more obvious does it become that mind is a superior order of existence, performing work unapproachable under the laws of nerve action."

Of course, if Dr Calderwood has already proved what he believes he has done, the conclusions drawn in the last sentence must be admitted. We deny, however, that he has succeeded in his previous contention, and therefore cannot admit what he now affirms. Nay, more, believing that what he calls the lower orders of activity—comparison, recollection of the results of past comparisons, inference, and volition—are all referable to the vesicular substance of

the brain, we are prepared to refer the higher manifestations of mental activity to the same source. We object to the phrase "laws of nerve action" as inaccurate, and therefore apt to mislead inquirers. Nerves are merely the conductors of force, sensory or motor. The better form of expression in this argument would be, "*vesicular structure, or gray matter of the cerebral convolutions.*"

A very able and suggestive passage follows (pp. 415-422), which cannot fail to interest the reader, and will, we think, illustrate the views we have been advocating on the "Relations of Mind and Brain." We quote a sentence from Dr Bastian, occurring in the passage referred to, which calls for a few remarks: "From these considerations it follows that we may have presented to us for examination two brains equal in size and weight, equal also, so far as can be ascertained, in the number and depth of convolutions,—that is to say, in the extent of the gray matter,—the latter being also similar in its minute structure, and yet one may represent great intellectual power, the other quite an opposite condition."

In short, Dr Bastian means to assert that two brains *apparently identical* may be connected with very different mental powers. The supposition is out of the question, contrary to reason. Granting, however, that two such brains have been met with, and that the mental history of the individuals to whom they belonged answers to the supposition, there is an element to be taken into account which the doctor has overlooked. The organs which in the aggregate weigh the same may separately exist in different proportions in the two brains. One may exhibit large *causality* and small *imagination*; one may have *large causality* and proportionately small *concentrativeness*; one may have *large desire of applause*, the other *little desire of applause* to urge him to intellectual efforts. In short, mere weight, or depth of convolution, or fulness of intellectual regions, are insufficient to warrant our conclusions. These must be formed on a general and careful survey. We use the *phrenological* terms for the sake of convenience. We do not homologate all the details of that system; we merely indicate our opinion that the investigations of Ferrier and others on the brains of the lower animals may yet be supplemented by careful observations of the more *salient* and obvious features of the human cranium, and by connecting pathological appearances after death with the cautious record of symptoms during life.

"Concentration of thought, not as the result of impression from without, but as the result of personal determination within, is not to be accounted for under the known laws of brain action."

How can we account for the remarkable difference between individuals as regards this power of concentrating thought? With some it is a strong faculty, showing itself even in childhood; with others it is virtually absent through life. Doubtless we have mind acting in both cases; but in the one mind finds a fitting cerebral organ for its purpose, in the other that organ is proportionally small and inactive.

2. "*Thought as concerned with the regulation of personal life.*"

"It is as a thinker that man shows his superiority in the direction of his conduct. He reflects upon what ought to be, decides for himself the question of personal duty, and acts in accordance with a rule of life standing out before his mind as a rational law of activity which he must apply for himself."

This is quite the thing to say from a chair of ethics, but does it meet the questions we are discussing? Some children have no tendency to tell an untruth, others lie from their earliest years. Some are benevolent from the beginning, others as conspicuously selfish. Some are brave, others timid. Some have strong wills, others are pliable and easily guided. Lessons addressed to their reflective faculties will be found quite out of place and useless. We have an explanation of all this in the phenomena of brain development; and we wonder how philosophers who have once got the hint that such an explanation is available, and all the more when they have become conversant with other departments of the anatomy and physiology of the nervous system, do not grasp it thankfully as an important key to many psychical difficulties. Dr Calderwood calls us somatists to avoid the sterner word materialists, but it is not necessary to disclaim again the imputation that we regard brain as the *source* of mind. It is merely the limiting condition under which mind manifests itself. This is our reply to the following challenge: "No attempt at scientific explanation has yet been submitted from the side of the somatists, and we may reasonably claim that the defenders of the theory that thought is a function of brain offer their defence at such a testing point."

3. "*Thought as concerned with the absolute Being and His government of the universe.*"

Conceptions of the invisible, the infinite, the divine, do exist in the world, and they have exerted a wide influence in the history of the human race. That this is simple statement of fact cannot be denied—the fact must somehow be explained. The question is, Can a physiological explanation be offered?

To those who believe in divine revelation and in the history contained in the Book of Genesis, this is an unnecessary question. There can have been no period in the history of our race without an idea of God existing in some form, and tradition has never, and will never, allow it to die out. But there is a physiological side, too, from which the question may be regarded by those who believe in brain as the organ through which mind acts both intellectually and morally. The same arguments are applicable to the still higher department with which we are now called to deal. If one portion of the brain has to do with intellect, if another portion has to do with the emotions and moral sentiments, is it unreasonable to infer that another portion still has to do with religious ideas? In whatever way the idea of God arose originally, it seems to be universal in the families of men; yet it is a notable experience

that men in all lands differ as widely from each other in the degree of reverence entertained, or at least manifested, by them as they do in any other manifestations either of intellect or of moral sentiment. It is only reasonable to infer, if we admit separate organs in the cerebrum at all, that these differences in the amount of reverence depend on varieties in the development of the organ corresponding with the sentiment. Right or wrong, the phrenologists have assigned a particular region of the *cerebrum* to this sentiment of veneration for superiors, whether human or divine. No observer of his fellows can fail to note the remarkable disparity which exists in this respect among individuals, even among children. Here is still another secret which the key already mentioned might enable psychologists to unlock. It would appear that even among the lowest and most degraded races, who may never have heard a tradition as to the existence of a God, there are beliefs and expectations quite as reasonable as those held by the ancient Greeks and Romans, with all their culture and high civilisation, so that we are inclined to dissent entirely from the view indicated by Dr Calderwood in the following sentence, p. 438:—"If such belief and expectations are compatible with the lowest forms of uncivilized life and with an utter absence of education, the fact presents a serious difficulty for a theory which assigns all human activity to brain action alone and makes the degree of brain development the test of mental power." Does not the universal religious feeling, dark and debased as it often is, point to an organ of *veneration* in all human brains? Mere mental power or brain development does not afford an adequate explanation; for the mentally weak are often more reverential than those who are counted strong and wise. It is an organ of the brain common to all, but varying in its relative proportions.

This natural and universal tendency to venerate, with all its varieties of intensity, is, as we suggest, probably connected with a cerebral organ, and may therefore be independent of tradition. But whether this be the case or not, it renders possible the acceptance of divine revelation on the subject. Did the idea not exist originally, there would be no soil in which it might germinate. A great preacher, taking the traditionary view exclusively, has well said, "Even in the depths of heathen ignorance and darkness God has never left himself without a witness; the primitive traditional revelation is not quite obliterated; there is still some gleam of light that may fit the eye for bearing more—some element of good that may be seized and turned to account."

We have not wittingly misstated or overlooked any stage of the argument which we have been criticising, but we feel that the extent of the ground traversed and our fear of fatiguing our readers may have rendered the result unsatisfactory.

After all, the real difference betwixt Dr Calderwood's view and our own consists in this, that he cannot admit that the higher

qualities of mind require the instrumentality of organic structure for their manifestation. That they do require it appears to us beyond reasonable doubt, and this has been our contention from beginning to end of this essay.

A few points still demand consideration before drawing to a conclusion.

In an early page, to which hitherto we have made no reference, there is a very interesting table, presenting some results of an inquiry into the weight of the human brain, as illustrated by the cases of a number of eminent men.

Let it be noted that the average weight, according to Professor Turner, of the adult European male brain is 49 to 50 ounces, that of the female being about 5 ounces less. Here follows a list of brains considerably above the average:—

	Age.	Ounces.
Cuvier, Naturalist, . . .	(63)	64·5
Abercrombie, Physician, . . .	(64)	63
Goodsir, Anatomist, . . .	(53)	57·5
Spurzheim, Physician, . . .	(56)	55·06
J. Y. Simpson, Physician, . . .	(59)	54
De Morny, Statesman, . . .	(50)	53·6
Daniel Webster, Statesman, . . .	(70)	53·5
Campbell, Lord Chancellor, . . .	(80)	53·5
Agassiz, Naturalist, . . .	(66)	53·4
Chalmers, Theologian and Preacher, . . .	(67)	53
Fuchs, Physiologist, . . .	(52)	52·9
Gauss, Mathematician, . . .	(78)	52·6
Jeffrey, Judge and Critic, . . .	(76)	51·8
Babbage, Mathematician, . . .	(79)	49·5

The ages are mentioned because, in the case of old men in the list, some allowance must be made for senile atrophy. In Lord Jeffrey's case, moreover, the cerebellum, which weighed $6\frac{1}{2}$ ounces, was not included in the 51·8.

Evidently there is much to be learned from this table. We cannot account for the weight of these brains by the bulk required for mere *sensori-motor* functions. Granting that all of these men *might* have been athletes or eminent in handicraft and artistic occupations, these were not the lines in which they principally exhibited their brain power. We happen to know also that, besides being exceptionally heavy, one or two of the brains in the list were remarkable for the number and depth of their convolutions. Are these not facts which, taken together, warrant an *a priori* presumption that mental power and brain development, *ceteris paribus*, go together? Let us state the question thus: The mind, the soul, the Ego, in the case of these illustrious men, was provided from the hand of God with a powerful instrument with which it could work, while other minds—shall we say as powerful—were provided with brains of inferior bulk, form, and quality, not suited for the splendid

intellectual manifestations which made their brethren so conspicuous. This explanation may be called *somatic*, but is certainly not materialistic in the ordinary acceptation.

Another remark still remains to be made. Some men with well-balanced brains, intellectual and moral, are "a law unto themselves," and are not tempted in the way that others often are, who have come into the world with brains more scantily or less symmetrically developed; but transgressions of the moral law on their part, when they do happen, are proportionally aggravated and sinful. Let all be thankful that, whatever be our natural disparities, we have a *thoroughly remedial and divine provision* offered to us by Him who constituted us as we are.

Recent experimental investigations in physiology have done much towards elucidating the *sensori-motor* functions of the brain. These experiments, however, in all probability cannot be carried much farther even in the lower animals, and the way is obviously closed against such experiments on man. Much may be effected in future, as we have already said, by carefully observing and recording mental manifestations in connexion with accidental injuries and morbid changes of the brain; but we would suggest that farther progress might be made in the same direction were young anatomists and physiologists to apply their minds to a calm, unprejudiced inquiry into the real merits of the opinions promulgated by Gall, Spurzheim, and Combe. The two former were more than phrenologists, they were scientific anatomists.

Our knowledge of human structure leads us to think that some of their statements were hasty, premature, and over-sanguine, and there are certain regions of the skull, notably in the lower frontal portion, the examination of which must in all cases be made under great, perhaps insuperable, difficulties; but still we feel confident that some of the wider conclusions of these enthusiastic men were essentially sound, and will be confirmed by careful, kindly study and accurate measurements. The distinction drawn by them between the *knowing* and *reflecting* organs will stand investigation; their allocation, also, of the *moral sentiments*, at least the more conspicuous, will probably be confirmed; and we have a strong impression that the *occipital* region, as already indicated, has much to do with a steady, concentrated application of the mental powers, giving force and effectiveness to them all, and thereby securing retentiveness and vivid precision of memory.

Let this line of observation be taken up *con amore* by some fresh young minds, who, having mastered anatomy and physiology in their newest forms, and having obtained at the same time an adequate acquaintance with psychology, are anxious to explore fields of knowledge still comparatively hidden, and beyond doubt some valuable results will reward their labour.

[This review, written in 1879, has been delayed by unavoidable circumstances.]