that may throw him on his back, than the possible date of the one death that must come, and of which the time is to him personally—in spite of libraries full of statistics—utterly unknown and uncertain. We join, therefore, in the demand for a registration of sickness that has not a fatal end, as well as for a more effective registration even of the births and of the causes of deaths themselves. Let us have lists of the killed, and of the wounded too.”—(*All the Year Round*, No. 86, pp. 227, 228.)

In Newcastle, where so much has been effected with such care and pains by the Medical Society and Dr. Philipson, it is needless for me to enlarge on the advantage of an official registration of all sickness attended at the public expense. The best methods of obtaining so essential an addition to our knowledge of the extent and causes of disease, will probably be discussed by the Section; and I hope that the Association will adopt such measures on the subject as may aid those who are endeavouring to obtain from the legislature an organisation of skilled officers of health, to whom would be committed the compilation of the proposed register of sickness in every district. Great as have been the results of voluntary effort in this place—still more remarkable the completeness of these records in Manchester and Salford for the last ten years (thanks to Dr. Ransome and other earnest workers)—it is, I believe, generally admitted, that a national machinery is indispensable to the permanence and universality of the work, and that the fitness and efficiency of that machinery depend on the course which Parliament may take in future sanitary legislation.

INTRODUCTORY ADDRESS

DELIVERED IN

THE SECTION OF PSYCHOLOGY,

*At the Annual Meeting of the British Medical Association,
in Newcastle-upon-Tyne, August 1870.*

By THOMAS LAYCOCK, M.D.,

Professor of Physic in the University of Edinburgh; President of the Section.

HOW FAR CAN THE RELATIONS OF BODY AND MIND BE INVESTIGATED SCIENTIFICALLY AND PRACTICALLY?

I CANNOT but offer my congratulations to the Association that the Council has completed your scheme for the advancement of medicine by the initiation of a Section of Psychology. The title, too, is of happy omen; for that which is usually called medical psychology is the only science worthy the largely comprehensive name of the science of the soul of man. A true psychology must deal with the varying states of consciousness in their immediate relations to the organisation, and not apart therefrom, as is common with the speculative psychologist.

Now it is at the outset an important question to determine how far it is possible, and by what method, to understand these relations of body and mind, so that psychological medicine may have a solid scientific foundation. It is customary with uneducated and unscientific persons to affirm that they are too mysterious for scientific investigation. There is a natural conclusion from the popular doctrine that the mind or soul exists and acts under certain circumstances independent of the body. Nor is this opinion restricted to the uneducated; it is the *ignava ratio*, or idle reason, which some metaphysicians give for neglecting the study of cerebral anatomy and physiology. Yet professedly scientific investigations are attempted in accordance with the popular doctrine, and the results are “spiritualism” with all its follies. Now, a truly scientific psychology not only excludes the popular doctrine from its researches, but distinctly adopts the contrary thereto; its starting-point being the fundamental fact of experience that no change in the human mind or the consciousness, of whatever kind, can or does take place without a coincident change in the living encephalic tissue. If this be true, as a fact of experience, to its fullest extent of the statement, it follows that a true psychological science can have no other foundation than that fact, and that all systems of mental philosophy and of medical psychology which discard inquiry into these necessary relations of body and mind are *ipso facto* vicious in method, and must lead to errors in both theory and practice. There are two extremes of modern philosophers, however, the physicists and the metaphysicians, who, while they admit the truth of the fundamental fact of scientific psychology, agree in opinion with the uneducated as to the inscrutable and mysterious nature of the relations of consciousness and organisation. Hence, also, necessarily follows their opinion that, for want of a competent method of inquiry, the fundamental fact must always be barren

of scientific results, and psychological medicine be nothing more at the best than an enlightened empiricism. It is a great advance that all the best modern psychologists and metaphysicians admit that this fundamental fact is true generally; they have not quite given up the idea of a separate existence of mind or soul, the basis of the old methods of inquiry; but they affirm no more than that the mind, for anything we know or can find out, may and does act independently of organisation. To this view of the matter there can be no objection on the part of the scientific inquirer, who strictly limits his researches, of whatever kind, to what is cognisable either by the senses or the understanding—in Baconian phrase, “*re vel mente*”. The question between the two schools of mental science or philosophy is thus fundamentally a question of method, and that depends upon the answer to the question—Are the relations of body and mind so mysterious as to be inscrutable by scientific research, or ought the method of inquiry common to all the natural sciences be applied to them and a rank materialism established?

Starting, then, from the fundamental fact, it is clear that the objects of research are essentially those molecular changes in the encephalon, termed cerebro-mental, which inseparably coincide with the varying states of consciousness of the living man. Since these encephalic changes are vital, it necessarily follows that the changes of the states of consciousness termed, generally, mental faculties, powers or energies, must be inseparably connected with the causes of the vital changes considered as vital properties, energies, or forces. This proposition which a true mental science affirms, speculative philosophy denies, and opprobriously terms it materialism; while theology professedly orthodox, echoes the change. It cannot be denied that this opprobrious disparagement of scientific inquiry has greatly retarded the development of psychological science. Is it then, justifiable? By no means; on the contrary, the doctrine of the inseparable connection between life and soul is taught by Holy Scripture and by the great metaphysical creed of the Church, that of St. Athanasius. The fact is indeed adopted as a simple truth in that creed to explain a true mystery, when it says—“For as the reasonable soul and flesh is one man, so God and man is one Christ.” Also, in Genesis, we are told that it was only after the Lord God had breathed into man’s nostrils the breath of life—a divine emanation, be it observed, that he became a *living* soul. It is very lamentable to note how often ignorant persons, professing to be orthodox, blaspheme, I may truly say, the true Scripture doctrine of human nature by discarding from their thoughts that life which, coming direct from God, is holy and sacred.

Turning, now, to a consideration of the method to be followed, let us scan more minutely what we have to investigate. It is obvious that our fundamental fact of experience requires to classify phenomena, which are the various states of consciousness from the highest efforts of the intellect to the simplest feeling of bodily pain and pleasure. This had been done in some degree by the philosophical schools; what we have to insist on is, that they all shall be considered as fundamentally of one kind, for the feeling of bodily pain is just as much of the soul of man as the highest sentiments of humanity. These phenomena of consciousness we will designate mental or psychal. Next come those which we term vital; and, in this generalisation we must include all vital phenomena, from those which coincide with the manifestations of the highest intellect, to the characteristics of the simplest organism or protoplasm. But, thirdly, there is an important school of physicists who maintain that life is only a manifestation of the physical or molecular forces of matter. To understand this question better, it will be useful to determine what we mean by certain terms. Now, the highest manifestation of the human consciousness is the knowing adaptation of means to ends, as reason; the means can be finally resolved with the application of energy to ends, or, as I would prefer to say, motor energy. We necessarily thus discriminate between the means and their use; now, that which directs their use is termed mind. Here, therefore, are two other kinds of phenomena, those due to the physical motor or molecular energies, and those which are metaphysical or intellectual, which belong to the “pure reason” of philosophy, and which differ from the psychal in this, that they do not imply necessarily any feeling or emotion of the soul. Now, this “pure reason” is identified by philosophy with the great intelligent First Cause, and except as manifested in us is inscrutable, and cannot be separated from the mental or psychal. We have three classes of phenomena, therefore, and three causes of these named forces or energies; viz., the psychal or mental, the vital, and the physical. What, then, are their practical relations to each other?

Physical force or energy is necessary to all mental work. The potential energy of the brain is the greatest of all the known kinds of vital energy or tension, and requires a large supply of blood to maintain it. Few members of this Association can have failed to

be interested in the admirable researches of Dr. Haughton in this direction, who has shown that five hours of cerebral activity or mental work are equal, as to expenditure of energy, to about ten hours of merely muscular activity. The relative proportions may not be exactly made out, but this uncertainty does not affect the conclusion to be drawn; which is, that much more force, as motion, is used in mental than in bodily activity in the same time. Here, then, is an eminently practical and scientific fact, worth acres of speculative writing.

Two obvious and unavoidable conclusions follow; firstly, that the molecular changes which coincide with vital and mental activity may all be resolved into motion; and, secondly, that there is an accumulation or conservation of motor energy in the brain or the organ of mind. This coincides generally with what the physicists teach us as to molecular motions in ponderable matter in general, whether it be living or dead.

But the question thence arises, In what respect does this cerebral energy differ from the purely physical? The brain is ponderable matter, and has therefore gravity; and both heat and chemical affinity are essential to all its molecular motions whatever. But it is equally certain that these motions of living matter in relation with consciousness must not only differ from the chemical motions of inorganic molecules, but be of such a kind as to coincide and correspond with all states of consciousness. What, then, is the cause of these differences in molecular motions of inorganic and organic matter? Now, if we take the proper characteristic of the mental forces or energies, it is that of conservation and distribution of potential energy with adaptation to ends—"the pure reason"; consequently, it is in this characteristic of adaptation that the vital energies resemble mind or the psychical energies, and both differ from the physical. In like manner, the kinds of chemical motions of the molecules of living and organised matter must differ from those of dead and unorganised matter. For the results of those motions consist not merely in the chemical compositions and decompositions by which vital energies and forces are accumulated and manifested, and which occur in unorganised matter, nor even in motions of organs and limbs, which may also be, and are often, due to physical forces, such as elasticity and contractibility, but in the results which follow upon these energies in adaptation to ends. Hence it is that we cannot exclude this fundamental characteristic of adaptation to ends from our definition of life and its forces: so that adaptivity, if I may be permitted to name this characteristic, is as much a peculiar property of living matter as gravity is of ponderable matter.

If, then, the vital and physical molecular forces be identical, as is maintained by certain physicists, it legitimately follows, on the one hand, that the property of adaptivity—the special characteristic of the vital molecular force—is also the property of the physical molecular force; and on the other, that, since the vital and mental energies are inseparably connected, the mental forces are equally inseparably connected with the physical. But these physicists prefer to deride the principle of adaptivity (which is the foundation of teleology), and to declare with the metaphysicists that the inseparable connexion of body and mind is an unfathomable mystery. As a fact of experience, it is, however, no more mysterious than that inseparable union of matter and force which constitutes weight or gravity. However simple the idea may appear to modern physicists, it is not two centuries since one of the greatest philosophers of the day, Leibnitz, remarked: "I am a great friend of experimental philosophy; but Newton deviates much from it when he pretends that all matter is heavy, or that each particle of matter attracts every other particle." (*Life of Sir Isaac Newton*, by Sir David Brewster, vol. ii, p. 60.) The history of this as well as of all other departments of science proves that mystery and ignorance are synonymous terms, and that all possible knowledge is open to the human mind, if a right method be adopted. It also shows that methods are right and fertile in results in proportion as they are founded on broad general principles—fertile as well in correcting the error and ignorance veiled under the term mystery, as in advancing knowledge. Newton himself probably never dreamt that his great discoveries in physics would enable Adams and Leverrier, more than a century later, to find in the irregularities of motion of a known planet proofs not only of the existence, but of the place of existence, of another planet hitherto invisible because of its position on the extreme limits of the solar system. I say nothing of the wonderful application of Newton's researches to the spectro-analysis of the sun and the most distant bodies moving in the universe of space; these are still *sub judice*. That the attempt is made, is enough for my purpose, which is to show that the more comprehensive the general truth, the more widely applicable is it to the discovery of the order of Nature. Consequently, if it can be shown, as to adaptivity, that it is coextensive with gravity and the molecular force, we ought to avail ourselves of the fact to elucidate the connexion between mind and body.

As an illustration of this part of the method which I propose, let us examine the relations of adaptivity to gravity, as manifested in the motions of the celestial bodies, which move so harmoniously through space. I need not stop to prove that our own planetary system is stable, and that this end is attained by the motions of its constituent elements. What is of present interest is the fact that the particular direction of their motions—viz., from west to east—is essential to stability, and is so clearly an adaptation of their motions to ends, that they could only be due to an intelligent cause of the adaptation. The existing system is, in truth, one of so many other possible arrangements of the constituent masses of matter (which, for the sake of elucidation, may be considered relatively to each other as molecules), without attaining such a perfect result, that Laplace calculated, by the calculus of probabilities, the chances in favour of the motions being directed by an intelligent First Cause to be above four millions to one, and two millions of times more certain than that the sun will rise again to-morrow. Such a fact is conclusive as to the principle I have laid down; viz., that the direction and rapidity of the motions of molecules moving to ends is comprised in the idea of adaptivity. It is in this respect that chemical affinity, considered as a cause of arrangement of molecules, takes its place in the series of adaptive energies known as vital.

The fact of adaptivity to ends being thus established as inseparably connected with particular kinds of motions of masses and molecules, we next naturally inquire into the cause and intent of the adaptations. If we are unable in thought to separate motion from its cause considered as force, we are not less unable to separate adaptivity from its cause considered as Mind or Intelligence. In fact, the direct presentation to the human mind of all energies and forces is in the first instance as none other than an adapting energy; it is only by a knowledge of the external world that we are able to realise the operation of motor and subordinate energies. I know it is affirmed by certain cerebral physiologists that every man is conscious that he thinks by means of at least his head, if not by his brains; but it must be remembered that from a like datum of consciousness Plato and other ancient philosophers made the heart the seat of the emotions, so that the hypothesis influences language to this day. This direct presentation to the consciousness as immediate knowledge of the cause of adaptation to ends is the true fundamental fact. As such, it was the basis of all the old cosmical philosophies, however varied, and with Plato and others gave rise to the hypothesis of an *anima mundi*, or soul of the universe. So also, being the foundation of all natural religion, as a direct intuition of a cause in nature adapting to ends, it has been operative in the human mind from the most remote antiquity, in shaping religious beliefs, being manifested even in pre-historic times. Hence it was that the earliest inquirers were led to worship dead men, and to find multitudinous spiritual beings present where we now only recognise the forces of nature directed by one God to beneficent ends. Undoubtedly, this direct intuition, being the sole primary knowledge of energy as mind, is the strongest scientific proof of a spiritual element in man and nature.

Seeing, then, that what is common to all energy is motion, and that what differentiates motions due to mental and vital energies from those due to merely physical forces is the quality of adaptivity or coadaptation to ends by varying the direction and rapidity of molecular motions, in what respect is there a difference as to the accumulation and conservation of energy? The law is this: that adaptivity is more and more manifested, and potential energy or tension increased, in proportion as living organisms are evolved in form and function—being least in the lowest, greatest in the highest. Now, this is to say that the vital and mental energies are under the great biological law of evolution from the general to the special. Looking at these questions from this point of view, we see at once how chemical affinity is separable from all the other physical molecular forces, since it is the only one of which we can predicate evolution. Abundant facts prove that, whether it be manifested in organic or in inorganic matter, complexity of chemical composition correlates increase of potential energy or tension, as represented by molecular weight, in ascending series. Thus the molecular weight of hæmoglobin, composed of 54.2 carbon, 21.5 oxygen, 16.0 nitrogen, 7.2 hydrogen, 0.42 iron, and 0.7 sulphur, equals 13,280. Another illustration of this doctrine is the relation of certain compounds to the chemical affinities of brain-constituents; as, for example, the different effects of the methyl series of compounds with increase of the carbon-molecule in evolutionary series, of which chloral is one, as has been so beautifully shown by Dr. B. W. Richardson. The difference which one atom of water makes is shown by the different effects of morphia and apomorphia, which latter has one atom of water less than morphia, and is not a hypnotic or sedative, but an active emetic. The influence of chemical compounds on the higher states of consciousness has been well shown by experiments with the organic nitrites. "These agents" (the organic nitrites), writes Dr. B. W. Richardson, "against

our wills, act through precisely the same means and in precisely the same manner as do the more obscure because more refined influences which excite daily in us what we call emotions. An act which shall call forth a blush, an act which shall call forth the pallor of terror, which shall produce involuntary secretion, which shall make the heart beat with an intensity that is painfully felt—all and any of these acts, which would be called psychical, have their precise analogues in the actions of the organic nitrites." (*Report of the British Association for the Advancement of Science*, 1869, p. 409.)

I will only allude to one other series of phenomena in connexion with this subject, but one of singular interest and novelty. The question has often been asked, What is the nature of the so-called impressions made on the senses, and through these on the encephalic nerve-centres, when the varying states of consciousness arise in connexion with external impressions? We can well understand that they must be finally reducible to waves of motion or of energy, but waves in *affinity* (I use the term advisedly) with the molecules which constitute each nerve of sense in the first instance, and next with those of the connected nerve-centres. Nothing is more striking than the apparatus of the senses, provided in so great variety in different organisms, for intensifying this motion of impressions—multipliers exceeding far in nicety of construction the most perfect of the very ingenious apparatus used by physicists. I forbear entering further upon this deeply interesting field of research. What I have said is enough for my purpose, which is to show that, so far from the relations of body and mind being too mysterious for investigation, it is a simple fact that the phenomena can be brought within the range of molecular physics and experimental research.

I have said nothing of the vast collateral range of inquiry opened out by bringing psychology into the circle of the biological sciences. As to this and other lines of psychological research, I would only remark that, while they are inexhaustible, they have hardly been entered upon by psychologists. Another generation, however, will see profound changes in all the sciences which deal with human nature. The proper foundation of them all being the great science of life, or biology, and that being the essential foundation of both scientific and practical medicine, it is clear how large a part the profession must play in the future development of those sciences which aim at the social advancement of man. Its influence will be exercised through psychology, which, as now defined, touches on ethnology, anthropology, morals, education, the public health, and all questions included under social and political economy.

INVENTIONS, &c.,

IN

MEDICINE, SURGERY, DIETETICS, AND THE ALLIED SCIENCES.

FREEZING AND VENTILATING MACHINE.

A NEW freezing and ventilating machine, of remarkable ingenuity and promise, invented by Franz Mulhausen, Esq., Civil Engineer, of Brunswick, Germany, is on view at the Ice Works, Emerson Street, Southwark. In the construction of this machine, the cold is produced by the mechanical expansion of atmospheric air. It produces, when in operation, any desired degree of cold, freezes water without the use of any chemical agents, and will effectually cool and ventilate any apartment or building, on whatever scale, large or small. In hospitals, especially in tropical climates, where the production of ice and the cooling of the air is often a matter of great urgency, and always of great value; in theatres and workshops, and in our new Indian barracks, such a machine will be of infinite value. The London theatres can hardly afford to be without it. The labour of one man, with a small five-horse motor power machine, will produce 100 pounds of ice an hour, and cool 15,000 cubic feet of air from thirty to fifty degrees below Reaumur. The production of pure ice, for the purpose of cooling our drinking-water and furnishing a cheap mode of replenishing our domestic refrigerating safes during the hot season, will be a great addition to the sum of comfort in London life. Cheap ice will be especially a great boon to the hospital and sick-room. Nothing is so refreshing for the parched lips of the sick man. If it were not so costly as it now is, ice would be very largely used in all hospitals, and would be an infinite boon to the sick.

NOTICE.

THE ANNUAL SUBSCRIPTIONS TO THE BRITISH MEDICAL ASSOCIATION FOR THE YEAR 1870 BECAME DUE ON THE 1ST DAY OF JANUARY LAST: and it is a matter of essential importance to the working of the Association, that all which still remain unpaid, should be paid promptly.—Members of Branches, and all others who usually receive circulars at the beginning of the year from the local Secretaries, are urgently requested therefore TO PAY THEIR SUBSCRIPTIONS FORTHWITH TO THE LOCAL SECRETARIES.—All other members should pay their Subscriptions without delay to the General Secretary, T. WATKIN WILLIAMS, Esq., 13, Newhall Street, Birmingham.

Gentlemen wishing to become members of the Association are requested to apply to the General Secretary, to the Branch Secretaries, or at the office of the JOURNAL, when forms of application and the rules of admission will be forwarded.

BRITISH MEDICAL JOURNAL.

SATURDAY, AUGUST 27TH, 1870.

THE ASSOCIATION AS CHAMPION OF MEDICAL REFORM.

A HIGHLY important debate on medical reform occurred at the Newcastle meeting. It was not wanting in any of the circumstances which could give it interest and dignity. On the one hand were five members of the Medical Council who were known to entertain opinions not altogether favourable to the course pursued by the Association and its Committee in insisting on direct representation as a *sine quâ non* of medical reform. On the other hand there were the members of the Direct Representation Committee and the officers of the Association, who have so insisted throughout the year, at a great sacrifice of labour and time, and at the cost of repeated visits to London and persistent representations to the members of the legislature and the Government. Very early in the meeting it became evident that this most important subject was largely occupying the minds of some of the members. Dr. Stokes and Dr. Paget, to whom was entrusted the task of proposing the well-merited vote of thanks to Dr. Chadwick for his exertions on behalf of the Association, and for the admirable manner in which he has filled the office of annual President, recalled to mind that no small part of the President's duties had arisen in connexion with the demand of the Association for the direct representation of the profession in the General Medical Council; and that, in pressing that claim on the Government and the House, Dr. Chadwick had taken part in the decision that those acting for the Association would rather see the Bill withdrawn for this session than passed without provision for the direct representation which they were instructed to demand. This led them at once into a digression on medical reform at the outset of the meeting; and both this digression and the cheers which greeted the warm allusion to it by Dr. Chadwick in replying to the vote of thanks, showed that there was a general and deep interest in the topics thus introduced, and that a spirited debate might be expected.

The report of the Committee on Direct Representation having been read and its adoption proposed, it was printed for deliberate consideration: and, on the following day, the final discussion on it took place.

Issue was joined very fully and fairly; and the debate, which was one of great moment, was sustained with marked ability. Let us add, for the information of the Medical Council, that the speakers were limited to ten minutes each; that it is tolerably certain that they put forward within that space of time all the arguments which really bore upon the point at issue; and that, while many things were repeated, it does not appear that any material arguments were omitted. The discussion lasted nearly two hours. There is not the least reason to suppose that it would have led to any other result if it had lasted a week. The main facts and arguments were placed in a perfectly clear light by those who have been the acknowledged leaders of the two classes of