the man is mad"? Are there not many, who, biassed by some theory, or influenced by too sensitive feelings, would rejoice to have such plausible facts to allege in justification of their statement?

Justice, then, to the public, and justice to the insane, demand that a competent Board, having its constitution defined by statute, should be appointed, to meet the varied cases which are occurring constantly in our criminal courts, and I respectfully urge its adoption upon the attention of the public and the legislature. It is not only special cases, like to the one which has immediately evoked this paper, which demand such an arrangement in our criminal procedure, but the grave question of crime itself demands to be investigated upon psychological principles. Law and medicine have been long antagonistic upon this question, and the populace, unfamiliar with the phenomena of mental disease and with the mutual sympathy of mind and organization, has sustained the former, and smiled with incredulity on the statements of the most trustworthy observers among the latter, as it smiled in a former age at the statements of Copernicus and Kepler in respect to the movements of the celestial bodies—but, "*E pur se muove*"—and the time will come when truths, now despised, shall be as generally accepted as is the axiom of the earth's revolution.

Memory and the Brain. By the Rev. W. G. Davies, Chaplain of the Joint Lunatic Asylum, Abergavenny.

Memory is an attractive theme, and one on which it is important that just views should prevail. It seems, however, that there is too much inexactness in the views which are commonly entertained about memory. It is generally supposed to be a repository, or something analogous to a tablet, which receives or retains impressions. Now, these notions, when the facts of the case are minutely investigated, fall short, in many respects, of the truth. This may be partly accounted for by the difficulty which, at first, invariably exists to find words to express mental operations, for men, at the outset, are forced to use, in an analogical sense, words already associated with physical phenomena, in order to designate those of mind. When, therefore, we speak of memory as a receptacle of impressions, after the manner of a tablet, we may perhaps mean no more than this, that there is some kind of analogy between memory and a tablet. Allowing that there is truth in what is here stated, it nevertheless seems that the words which are usually chosen to describe the phe-

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nomena of memory, are intended to convey the idea that knowledge exists in the mind in a latent condition, that it resides there even when it is not manifest in the form of consciousness or cognition, and to deny this will be deemed a grave error by some, and, indeed, present a paradoxical air to all. But let us examine the facts of the case.

Where is the seat of memory? In the present state of our knowledge, no inference seems so conclusive as that which indicates that it is located in the brain. But how is knowledge retained by the brain? Say that the cellular neurine of the brain receives and preserves certain impressions. But an impression, if it be anything of a pictorial nature, specially presupposes something as its recipient, and one recipient cannot retain more than one impression. Besides, what is there in a vanished cognition to retain? While a cognition is experienced there is, of course, a retention of it, but when the cognition is not a cognition, what is there left for the brain to store up?* On such a hypothesis also, the capacity of the brain for retaining knowledge must be limited, and the wonder of the villagers in Goldsmith's famous poem was not in the least out of place. I am fully aware that I am here propounding a theory of memory, which no longer obtains among intelligent psychologists, and that by impression must be meant simply an effect of some sort produced upon the brain, and possessed of a certain degree of persistence; still it will not be throwing words away, if what has now been stated help to introduce more clearly to the reader, the view which is here about to be taken of this topic.

It seems at present to be generally known, by those who make a study of mental science, and more especially by those who devote themselves to the study and alleviation of pathological conditions of the human mind, that every manifestation of thought and feeling depends upon cerebral action. When there is no cerebral action there is no thought, no feeling, no recollection. "The activity of the vesicular neurine of the brain," says Dr. Bucknill, "is the occasion of all these capabilities. The little cells are the agents of all that is called mind, of all our sensations, thoughts, and desires; and the growth and renovation of these cells are the most ultimate

* The various theories which have attempted to account for it by traces or impressions in the sensorium, are obviously too unphilosophical to deserve a particular refutation. 'Elements of the Philosophy of the Human Mind,' chap. vi, sect. i, Dugald Stewart.

Our ideas being nothing but actual perceptions in the mind, which cease to be any thing when there is no perception of them, this laying up of our ideas in the repository of the memory, signifies no more but this, that the mind has a power, in many cases, to revive perceptions which it has once had, with this additional perception annexed to them, that it has had them before. And in this sense it is that our ideas are said to be in our memories, when indeed they are nowhere, but only there is an ability in the mind when it will to revive them again. Locke's 'Essay,' Book ii, chap. x, sect. 2.

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conditions of mind with which we are acquainted."* And again, "Not a thrill of sensation can occur, not a flashing thought, or a passing feeling can take place without changes in the living organism, much less can diseased sensation, thought, or feeling, occur without such changes."† "The existence of any pathological state in the organ of mind will interrupt the functions of that organ and produce a greater or less amount of disease of mind, that is, of insanity." Presuming, then, that it is more likely to be right than otherwise, to state that every act of mind depends upon cerebral action, I consider that memory, in so far as it is a latent power, is no more than an aptitude developed and established by practice, in the vesicular neurine of the brain, to repeat certain actions as the antecedents of thought. Thus considered, there is no more limit to the brain in the reproduction of thought, than there is to the hands in the reproduction of movements. There are those, however, who to this view will object, that the mind, independently of the brain, is the repository of knowledge. The obvious reply to this objection is, that apart from its manifestations as consciousness, we cannot frame a notion of mind. Mind out of operation is to us a perfect incogitable. Man's sole acquaintance is with its operations. Since, therefore, we know nothing of mind as a substance (*substans*), we are also incapable of knowing how it is a repository of knowledge. It is not here denied that it is not such a repository, but what is stated is, that to man the means of knowing this is not given. To say, therefore, that memory is a power which the mind possesses of treasuring up knowledge, is a statement which conveys no new information, and yet cannot be made more explicit. The only explanation which it is possible for us to gain of memory, considered as a latent power, is a physiological one. Memory in operation can be analysed exclusively by the psychologist, the reflective observer; but memory, as a latent power, can only be explained by the physiologist, the outward observer.

Some philosophers, with a view of showing the independence of the mind upon the body, maintain that it is never at rest, that it is, in its very essence, an activity. The evidence which is procurable on this point seems, however, as Dr. Laycock has shown, to indicate the contrary. As to the theological aspect of the question, it is the same whether the soul, in this life, be regarded as dependent on the body, or the contrary; all that is required being, as Bishop Butler argues, in his 'Analogy of Religion,' that the soul at death, after the manner of the development of the chrysalis into the butterfly, should enter a higher state of existence. That there are some men who never seem to themselves to sleep without dreaming, is likely enough, because we know that the mind may be brought by over-

* 'Psychological Medicine,' p. 351.
† Ibid. p. 356.

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work into a state of excitement which is hostile to unbroken repose. If, however, the majority of men were canvassed on this point, there can be little reason to doubt that their testimony would be to the effect that during sleep they enjoyed, with few exceptions, calm and unbroken repose. One eminent metaphysician, Sir William Hamilton, who held the ceaseless activity of the mind, and thought he discovered this in his own case, was a man who accomplished such a vast amount of head-work as to astonish most people; and that in doing this he overtaxed even his gigantic intellect, and brought his brain into a state of unhealthy excitement, may be inferred from the fact that some years before his death he fell a victim to paralysis. If mental effort necessitates cerebral action, as in the opinion of the most advanced medical psychologists it does, incessant activity of mind would over-tax the brain, and induce derangement of its functions. "Exertion of the brain," says Dr. Bucknill, "if kept within due limits is followed by a state of repose peculiar to itself; but carried beyond these limits, the excitement of its function, while it produces rapid exhaustion of power, also renders the organ incapable of such repose and renovation. Over-work produces exhaustion accompanied by excitement, which continues the over-work, and accelerates the exhaustion."—'Psychological Medicine.'

The theory of memory herein embraced is gathered from the following facts. It is observable that our moving organs acquire, by repeated efforts, a facility, either to retain certain positions, as the turning out of the feet, or to reproduce certain movements. There appears to be a neuro-muscular, as well as a purely mental retentiveness. The drill of the recruit, the execution of the musician, handicraft proficiency, sleight of hand, do not simply involve mental adhesiveness, but also neuro-muscular adhesiveness. This is clearly seen in those voluntary movements which, by constant repetition, become automatic, that is, such as to dispense with the continuous guidance of the mind. Now here we have a kind of adhesiveness which is open to observation, and it is found to be a readiness gained by repetition, in the neuro-muscular system, to retain certain positions, or to execute certain movements. And since we thus know one kind of retentiveness, we are naturally prone to think of another kind, in the light of that with which we are familiar. This tendency, however, must be controlled by evidence. Due account must be taken of the differences between the phenomena to be explained, for these differences may be so great as to invalidate any inference drawn from the known to the unknown case. Still when these differences are fully taken into account, we cannot fail, at once, to perceive that there is, at least, a striking analogy between the memory of the mind, and what we may figuratively call the memory of the moving organs. And this analogy affords sufficient *primâ facie* evidence to

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justify further inquiry. Starting, then, with the presumption that both neuro-muscular and mental retentiveness come under the same law, further evidence of this is sought, and it has to be discovered, in the first place, that mental manifestation involves cerebral action, which is shown by the following facts. It is ascertained that intense thought or excitement is attended with a more rapid circulation of blood to the brain, that a feeling of fatigue follows such thought or excitement, and that the secretion from the kidneys, after such an occurrence, exhibits an increased waste of nervous tissue; that diseased states of the brain interrupt its normal working, and produce a greater or less amount of mental aberration, thus manifestly showing the dependence of rational thought on the legitimate action of a healthy organ, and of mental derangement on the faulty action of a diseased organ; and, finally, that pressure on the brain is followed by loss of consciousness, and manifestly because cerebral action is by this means obstructed. What do these facts severally, and *à fortiori*, collectively indicate, but that mental manifestation is invariably preceded by action of the brain?

We have, in the second place, to show that memory, like manual skill, *e. g.*, is perfected by repetition. This, however is so well known, that to mention it is enough. Having then shown that memory involves cerebral action, and is developed and established by repetition, we are able to infer that both neuro-muscular and mental adhesiveness come under the same law. As the one is, an aptitude, developed by repeated efforts, to reproduce certain actions, so is the other.

From the foregoing remarks, it must be seen, that an act of memory is something like a repetition of the process by which we first gain the knowledge of an object. Mr. Bain puts the question, "What is the manner of occupation of the brain with a resuscitated feeling of resistance, a smell or a sound? There is only one answer, so far as I can see. The renewed feeling occupies the very same parts, and in the same manner, as the original feeling, and no other parts, nor in any other manner that can be assigned."—('The Senses and the Intellect,' p. 333.) There must, however, be a marked distinction between memory and perception, else how are they so clearly distinguished by all sane men? An act of perception, I have called * a bi-une fact, because it is invariably a synthesis of cognition and object. Take away either of these elements, and you annihilate perception, the bi-une fact, cognition *plus* object. Now an act of memory is not a bi-une fact. In it the only constituent of perception, which is reproduced, is the cognition. As the former is composed of cognition *plus* object, so the latter is simply cognition *minus* object.

* 'Consciousness the Standard of Truth, or Peerings into the Logic of the Future,' p. 27.

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This view is not in accordance with that which Mr. Bain takes of the subject, who says, no currents, no mind. According to him "a stimulus, or sensation, acting on the brain, exhausts itself in the production of a number of transmitted currents or influences; while the stimulus is alive these continue, and when these have ceased the impression is exhausted. The revival of the impression is the setting on of the current anew, &c."* Mr. Bain holds that recollection is a revival of the original action of the brain and nerves, and that it is always a current action. Undoubtedly an act of memory is a revival, in some sense, of the original operation, a revival that is, of the cognitive element of perception, but it does not go so far as to be a renewal of the current action which attended the original process. For instance, the afferent nerves convey a message to the centre of cognition, then the efferent, perchance, convey a message from this centre to the locomotive organs of the body. Now if this process has to be reproduced every time we call it to mind, it is quite clear that the initiative cannot be taken, as in the first instance, at the peripheral extremity of the afferent nerves, but at the centre, where these have their origin. Are we to suppose that in each act of memory, and, indeed, of thought, the current is reversed in the centripetal nerves, and that a message is despatched from the brain to their peripheral terminations? Such a supposition is entirely opposed to the evidence of consciousness or experience, and appears, from the liability incurred of confounding in-going with out-going currents, to involve a complete derangement of our sensational system. For according to this view, how should we be able to distinguish recollection from perceiving, except it were by the greater faintness of the former? And if recollection happened to be unusually vivid, even this mark of distinction would be lost.

In the case of the efferent nerves, it must be allowed that this objection does not bear with equal force against Mr. Bain's theory. Nevertheless, even as to these, the evidence for a current action does not seem to justify the confidence with which Mr. Bain affirms its existence. Who, for instance, can fail to see that there is a difference, other than that of degree, between mental articulation of words when one reads or thinks, and the actual, audible articulation of them? Who can fail to see that there is a difference in kind between one's mere thoughts of dancing, running, or leaping, and one's performance of these acts themselves? It must, however, be conceded that in such instances there is something like an effort made to put the muscular system in motion, accompanied by a counter effort to arrest such motion, or something of the kind, especially in instances of great mental effort in such directions. There is, however, the unmistakeable fact of arrested motion, and this check must occur in the mental centre. Consequently, in such cases there

* 'The Senses and the Intellect,' p. 61,

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can be no current of nerve-force in the centrifugal nerves. This is a very important fact, when we consider, that it constitutes the difference between perception and memory.

To show that recollection may be carried on without the aid of the efferent nerves, simply by the vesicular neurine of the brain, I adduce the following quotations. "Experiment and observation, in our opinion, prove beyond doubt that the seat, not only of the intellectual, but also of the instinctive functions of the brain, is the convolutions of the cerebrum proper."* Here nothing is said of the necessity of the fibrous or conducting portion of the brain to the exercise of thought. But as still more to the purpose, the following words may be adduced: "It is sufficiently proved that the medullary substance of the brain, forming so large a portion of its mass, is merely a conducting medium. Pathological conditions may exist in this white substance in the cerebellum, the corpora striata, and thalami, without affecting the mental functions. Sensation and motion will be affected, but judgment, memory, and emotion may be left intact."† Circumscribed effusion of the blood in the white substance of the brain often produces loss of mental functions, when it first takes place, from the pressure which it exerts on the gray matter of the convolutions. But when the mischief occasioned by this pressure has been removed, by the adaptation of the blood in the cerebral vessels to the contents and capacity of the cranium, the powers of mind return, while those of motion remain injured, until the integrity of the torn substance is restored."‡ From these passages it appears that the convoluted hemispheres can act independently of the nerves of motion, and, indeed, of the whole medullary substance, that is, without necessitating that current action in the centrifugal nerves, which takes place when the articulating organs, *e. g.*, are put in motion. For is it credible that any current, however slight, can pass to these, while they remain perfectly at rest? In opposition to Mr. Bain, then, I cannot avoid the conviction that we do mentally repeat words without the co-operation of the efferent nerves, which communicate with the articulating and vocal organs, and, consequently, without "feeling the twitter of these organs just about to speak out."

While holding this position, I must not neglect to state, that in the case of the mental emotions there is an apparent exception to what has now been maintained. Among the emotions of the mind, there is a great aptitude for being called into activity by the mere recollection of the circumstance which originally excited them. Our emotions, however, be it observed, are not resuscitations of former emotions, but are regarded as fresh and fresh every time that the remembrance of the exciting circumstance stimulates them into

* Bucknill, 'Psychhlogical Medicine,' p. 353. † Ibid., p. 354.
‡ Ibid., p. 354.

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action. Emotion has no memory, is not self-conscious, but forms an object of perception, and need not be remembered, the emotion itself being so readily excited.

It may not now prove uninteresting, were we to apply the view of memory here embraced to account for the loss of memory as the first failure of mind in dementia, as well as in old age.

In dementia it seems that owing to a diseased condition, the brain fails to act with its customary power and facility. And the reason why memory is the first to fail is because it comes into existence subsequently to, and as a result of, the originating powers of the intellect; and consequently is stimulated into action less strongly than these, which so long as a related object is presented to them, and they have not wholly been destroyed, are constrained to act. Every one must see that if a man who is not wholly demented, has his hand squeezed, he must perceive it, although he may be in a state to forget, in a few seconds afterwards, that it was squeezed. Memory, for this reason, should also be the first to fail, it is, physiologically considered, a revival of a former cerebral action, and if that action be weak, the possibility of its renewal will be proportionately lessened, and perhaps be null. Moreover, since memory is a consequence of the originating faculties, or, as Mr. Morell says, a *residuum*, it must either be prior to, or contemporaneous with, them in decay.

In old age, memory fails, because the brain, in common with the whole organic system, decays. Loss of memory is a result, of course, of this decay, in the same manner as it is of disease in dementia, cerebral action does not take place with its former rapidity, ease, and force. The events of youth are remembered, while recent events make no stay in the memory, because the former events produced a strong effect upon the mind when it was in its prime, because they so frequently formed the subject of thought and conversation during many years of life, and consequently have been, by repetition, so firmly established that it would be as easy for a Chelsea pensioner to forget his drill, as for a man to forget such events. It is clear therefore that the incidents which befell a man in the youth and maturity of his life will be remembered, when the senile mind has lost its capacity for recollecting recent occurrences.

It is recorded that some persons during fever have remembered things which they had long forgotten. This is a strange phenomenon, but may, perhaps, be thus accounted for. When the brain is in a diseased state of activity, certain cerebral actions get reproduced, which but for that abnormal violence of action would be incapable of revival, because disuse had so greatly weakened the tendency to it. It is well known that some persons during mania manifest a brilliancy of intellect without a parallel in their previous sane state. The porter, who when drunk left a package in a certain

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place, but when he became sober, forgot where he had left it; and only remembered the place when he again transgressed, may be viewed as exhibiting a phenomenon similar to that exhibited by some persons during fever. In the stupidity arising from excess of drink, he deposits the package in a certain place, and the act, owing to his stupid condition, leaves but a slight effect upon his memory, so slight that when he gets sober, he cannot recall the act, but not so slight that when the brain is next stimulated to increased activity by drink, he fully remembers the place in which the package was left.

An attempt has been made during the foregoing remarks to elucidate memory from a physiological point of view, and it has been seen that, regarded as a latent power, it is not competent for us to explain memory in any other way. From this investigation, however, it clearly appears that physiology has no other explanation of mental facts to yield than this, namely, that each act of mind is preceded by action of some sort in the vesicular neurine of the brain. But how cerebral action is followed by thought, we probably shall never know. We must rest content with the knowledge that such is the fact, and remember that, in this life, we know but in part. "How any combination of cells," says Dr. Bucknill, "can be attended by processes of thought is to us inconceivable, but it is not more inconceivable than that similar combinations should result in the phenomena of life, or that a combination of atoms should result in the movements of the solar system. All that we can say is that the cerebral cell and gravitating atom are creatures of the almighty Creator, acting in obedience to laws impressed upon them by his fiat—laws whose phenomena we can trace, but whose ultimate nature we cannot understand." It must always be felt that there is a wide chasm between the activity of the brain-cells and thought, when we attempt to get the former to throw light upon the latter. To say, for instance, that cerebral action is thought, is just as if we were to say that fire applied to the hand is pain, or that the mere vibration of a tense string is sound, to which it bears no resemblance. We can never therefore expect to gain an analysis of thought by means of the anatomy and physiology of the brain. In the analysis of mind, thought is both the agent analysing, and the immediate object analysed. While, however, cerebral action affords little light in the investigation of mental processes, it seems quite possible that a knowledge of the laws of thought may throw considerable light on the nature of the brain's working. For example, differentiation in thought would seem to require a corresponding differentiation in the cerebral activity which invariably accompanies thought. And this differentiation in brain-action requires that different portions of the brain be set apart for the performance of special functions. This principle I can here, however, simply

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allude to, for I must hurry on to notice memory as an active power.

Memory, as is well known, operates in the manner set forth by the laws of association. But, as I have elsewhere* endeavoured to show, the laws of association, that is indeed, the laws of memory in operation, are derived from those primary operations which originate knowledge. The law of contiguity, the first law of association, is derived from perception, the first originating faculty; and the law of similarity, the second law of association, is derived from conception, the second originating faculty. The most important law in connection with memory is the law of similarity, which describes the mode in which conception operates. When the mind recalls a fact, or repeats a thought, there springs up a consciousness of identity between that recollection or thought and a previous act of mind; and it is this knowledge of identity between past and present acts of consciousness which constitutes recollection. Were thoughts to crowd ever so rapidly into the mind, still we should have no remembrance of having experienced them before, were it not that conception recognises their identity with previous thoughts. Indeed we should not be able to keep any thought for the shortest period before the mind, because this implies a thread of consciousness; that is, the consciousness of the identity of the present thought with the thoughts immediately preceding. Thus, to constitute the continuance of a thought in the mind for any, even the least time, the identity of a^1 with a^2, a^3, &c., must be cognised, and this is an operation of memory, which therefore, is principally the function of that faculty which apprehends resemblance among objects, namely, conception.

But remembrance also largely results from different mental modes suggesting each other. Thus, an earthquake may suggest internal fire, and that Vesuvius, and that, Herculaneum and Pompeii. And this is the usual way in which facts are recalled to mind. We must not, however, lose sight of the fact that no renewed knowledge of an earthquake would be possible, were it not that we recognised the identity of that knowledge with, or at least its similarity to, our previous thoughts of one. Neither could we think of internal fire, Vesuvius, Pompeii, and Herculaneum, did we not recognise the identity of our previous thoughts immediate and remote with our present thoughts of them.

The distinction between identity and similarity as just used is this:—When, according to the law of contiguity, a mental mode suggests a different mental mode, as for instance, when the thought of night suggests that of stars, if the different mental mode suggested be regarded as identical with a past mode, such suggestion is an act of memory; but if the different mental mode suggested be

* 'Psychological Journal,' Oct., 1862.

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regarded as simply similar to a past mode, such suggestion is an act of bringing a particular instance under a concept or general notion, and is more properly called conceiving or thinking than remembering. Of course, memory is involved in this act, because a concept, to have any existence, must be viewed as identical with itself in its immediate and remote manifestations. Every intellectual operation presupposes memory, because no thought which has not some degree of persistence is possible; and this persistence is the effect of retention, or in physiological language, of the continuance of a cerebral movement. What, however, is commonly called remembrance is an act in which a present thought of an object is known as identical with the original thought or cognition roused by that object. When our thoughts are not regarded as coinciding with past perceptions, in such a manner as to be exact reproductions of the cognitive element of the latter, but are simply a revival of a general view of such perceptions, and of none of them in particular, the mind is then said to operate through concepts, there is no appeal to memory proper. When, as in a work of fiction which is meant to be life-like, we imagine events, we then closely imitate the action of memory, we relate the events as if they were identical with what had come under our observation. If we think through the medium of concepts, we abstract the attention from those minute and unimportant circumstances which must be attended to when we are called upon to exercise remembrance.

Mr. Herbert Spencer gives an account of memory which is highly instructive but somewhat at variance with that afforded in this article. He says that remembrance begins where the purely automatic actions of the nervous system terminate, and that an act of memory tends by repetition to become automatic, and then, in the common acceptation of the word, ceases to be remembrance at all. "This truth that memory comes into existence when the connections among psychical states cease to be perfectly automatic, is in complete harmony with the obverse truth, illustrated in all our experience, that as fast as the connections of psychical states we form in memory become, by constant repetition, automatic, they cease to be part of memory. We do not speak of ourselves as remembering those relations which have become organically or almost organically registered; we remember those relations only of which the registration is not yet absolute. No one remembers that the object at which he is looking has an opposite side; or that a certain modification of the visual impression implies a certain distance; or that a certain motion of the legs will move him forwards; or that the thing which he sees moving about is a living animal. It would be a misuse of language were we to ask another whether he remembered that the sun shines, that fire burns, that iron is hard, and that ice is cold. Though on hearing the voice of some unseen person

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slightly known to us, we speak of ourselves as recollecting to whom the voice belongs; we do not use the same expression respecting the voices of those living in the same house with us. And similarly, though when a child the reader's knowledge of the meanings of these successive words, was at first a memory of the meanings he had heard given to them; yet now their several meanings are present to him without any such mental process as that which we call remembrance."*

There is much truth in the above quotation, but I think that maturer consideration would lead Mr. Spencer to modify his views on this subject. It has been seen that memory involves action in the vesicular neurine of the brain, but now the question occurs, can such action take place without revealing itself in the form of consciousness? For if it is possible for memory to become automatic, there must be action in the brain-cells without the attendant result, the manifestation of mind. It seems to me that this never occurs, for is it credible that cell-action in the brain should disclose itself in the form of consciousness as the rule or intention of its working, and then sometimes cease to do so? Does the organ of vision ever act when we do not see, or the organ of hearing when we do not hear? The action of these organs even when they are deranged, and when there is no external object to excite them, reveals itself as seeing and hearing. "The little cells," says Dr. Bucknill, "are the agents of all that is called mind." Since therefore the cells are the agents of mind, the intention of their action evidently is to make mind conscious, *i. e.*, perceiving, conceiving, remembering, reasoning, emotional, and desiring. In proof of the theory of unconscious cerebral action, that is, in more exact terms, of vesicular activity, less its consequent consciousness, I can discover no evidence. The mental phenomenon which this theory is intended to explain can be otherwise accounted for, and it is only after the failure of all other explanations of the phenomenon in question, that the explanation which this theory affords is admissible. But let us state the case more fully. When we study a given subject for some time, and then perhaps, owing to mental exhaustion, abstain for a season from doing so, it is found, upon resuming our attention to the subject, that it has in the meanwhile assumed a more orderly and defined character. How is this to be accounted for? Some psychologists make it the effect of unconscious cerebral action, that is, properly speaking, of cerebral action unaccompanied by consciousness. But how are we to know that such action has taken place if it has not revealed itself? We know it, it is said, by the result. Our knowledge, without any exercise of thought, has reached a more advanced stage, consequently the brain must have been working without disclosing the fact. The objection, however,

* Spencer's 'Principles of Psychology,' p. 551.

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to this explanation arises from the fact that cell-action in the brain is the invariable antecedent of consciousness or knowing, and since cell-action thus discloses itself, the supposition that it also takes place when it does not thus disclose itself, can only be allowed in the absence of an explanation more in keeping with the facts of the mental world. Which is the most natural presumption in this case? This, that when there is no revealing of thought there is no cell-action in the brain. The explanation therefore which is most in agreement with this presumption is this, namely, that the phenomenon under consideration results from the greater persistence and obtrusiveness of the more oft-repeated, than of the less oft-repeated thoughts. For those ideas which have been in existence the greatest number of times will be the best retained. Now let us suppose that after studying a subject, the various ideas arising from it are in a confused order; and let 100 represent the thoughts most frequently repeated, and 1 the thought once occurring. Say, then, that the thoughts occupy, at first, the following confused order:— 90, 50, 70, 100, 40, 10, 1, 30, 80, 20, 60. It is evident that the thoughts, in proportion to the frequency of their repetition, will tend, by a sort of mental gravitation, to assume the following order: 100, 90, 80, 70, 60, 50, 40, &c., the ideas represented by the smaller numbers perhaps dying away completely, while those represented by the larger numbers may also have lost something, and that in the ratio of their less frequent renewal. Now the very tendency of the ideas thus to adjust themselves, or their aptitude, in proportion to their frequency, to become fundamental, and the readiest to be recalled to mind, is sufficient to account for the phenomenon in question, and is far more conformable with the psychological principle, that the activity of the vesicular neurine of the brain is the occasion, not to say the origin, of every manifestation of mind.

It may, perhaps, be urged against the foregoing view that it has very long ago been known that mental operations take place unconsciously. For instance, it is still a debated question as to what takes place in a simple act of reasoning, some logicians maintaining that the syllogism is the type of all reasoning, and some denying this. If we were conscious of the reasoning process, there would not be this difference of opinion. Reasoning takes place, and most men only know its result. Any objection, however, drawn from this source is easily got rid of. We have no *reflective* consciousness of mental processes, till such time as, by diligent reflex observation, we have found out their nature; that is, in short, we know nothing till we know it. But to say this is a very different thing indeed from saying that cell-action in the brain takes place without the attendance of consciousness of any kind. We require to have a clear understanding of the difference which there is between reflective consciousness and direct consciousness. We cannot observe a rose

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without being conscious, and without being aware that we are observing the rose, but we are almost certain to be examining the rose without thinking in the least of the mental process which is going on, that is, without any exercise of reflective consciousness. The objection here noticed then is of no avail against the doctrine that cell-action in the brain is invariably followed by consciousness.

We may also express the law which we are considering in another way. There are in thought two extremes, the one of resemblance, the other of difference. The former is represented by the *summum genus*, the latter by proper names. The former is the extreme of generality; the latter, of individuality or uniqueness. Now memory, since it is developed and established mainly by repetition, has its principal abode in the region of the general, and is more at home with the more general than the less general. Hence it follows that ideas will fall in, and be retained in proportion to the rank which they hold as genera or common notions.

In the examination of this subject, due importance must also be given to the fact, that when a subject of study which, from mental fatigue, had for a time been set aside, is again resumed, the mind has recovered from its prostration, and is capable of viewing the subject with renewed vigour. Then, to use a metaphor, the eye was dim, and the landscape obscured by mist; now the eye is keen, and so clear is the air, the hills seem close at hand. Besides, during the interval in which the mind has been resting, many ideas in connection with the supposed subject would spring up spontaneously, and lead to unsought trains of thought which would deepen one's familiarity with it.

As favouring the view herein advocated in opposition to the theory of cerebral action without consciousness, I may also point to the fact, that mental force is in proportion to the energetic action of the vesicular neurine of the brain, violent activity of cell being attended by unusual mental power, and feeble activity of cell being attended by a feeble display of mind. This fact shows, according to the law of concomitant variations, that when consciousness is null, so also must cell-action be null. Besides, what conclusion are we to draw from the fact of cerebral fatigue, if the brain is prone to continue in action, although from sheer exhaustion the mind ceases to operate in a certain direction? Couple with this the tendency of the brain when overworked to become excited, the excitement continuing the overwork until the brain becomes deranged. If mind, therefore, as pathological conditions of the cerebrum chiefly indicate, cannot operate without the agency of the brain-cells, the converse seems to be equally evident, namely, that these cells cannot act without a consequent display of consciousness. For instance, the organ of vision cannot act without seeing, the organ of hearing, without hearing, the organ of smell, without smelling, the organ of taste, without tasting,

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the organ of touch, without actual sensations, and the moving organs, without moving. Can the organs of emotion act without a manifestation of emotion? No one has supposed that they can. Then why should they suppose that the organs of thought can act without thinking? If it is to account for the phenomenon under consideration, that can be elucidated in a manner more in conformity with the facts of the physiology, psychology, and pathology of the mind. I really fail then to see what evidence, of a conclusive character, there is to support the theory of so-called unconscious cerebral action. In holding this opinion, I do not for a single moment overlook the fact, that there is an automatic action of the moving organs. For no one can possibly doubt that after long practice, such movements as those concerned in eating, walking, talking, and many others, can take place without the constant direction and superintendence of the mind, and consequently, be it observed, without involving action in the vesicular neurine of the brain.

But how, in accordance with this view, can we explain the fact mentioned by Mr. Spencer, namely, "that no one remembers that the object at which he is looking has an opposite side." Well, if a person does not remember this fact, he must either perceive it, or infer it. But he does not perceive it, because the opposite side is out of sight. Does he then infer it? This we have to ascertain. As soon as the object is looked at, the thought of the opposite side is instantaneously present. Were an appreciable interval to elapse, from the moment when we first looked at the object, until the moment when we thought of its opposite side, we should be remembering that it had this side. When no such interval elapses there is, says Mr. Spencer, no remembrance. But there is no difference in kind between the two cases. It is true that when recollection has become perfect, the presentation of some of the qualities of an object to perception so instantaneously summons its remaining qualities before the mind, that it seems as if we had a simultaneous perception of them all. Such, however, is not the case, for when, for example, we subject our visual perceptions to a strict examination, we discover that one thing suggests another, as in an act of memory, but so instantaneously and perfectly that it escapes detection. But shall we say that, on this account, it is automatic, that it is a cerebral action unattended by consciousness? I certainly think not. What is the difference between the two cases? An appreciable interval, and an inappreciable interval, between the existence of the suggesting and the suggested. A lad is asked a question in history, and after taking some time to think, he gives the correct answer. This is remembering with difficulty. He is asked another question, and he gives the answer immediately. This is remembering with ease. A certain word is uttered in his hearing, and the meaning instantaneously flashes into his mind. This, according to Mr. Spencer, is not an act

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of memory, but an automatic operation. But why automatic? Because the interval alluded to is not perceivable. But to fail to perceive that which is not perceivable does not involve automatic action, but no action at all. An inappreciable interval is to the mind as no interval, and where the mind does not operate, it is presumed that there is no action in the brain-cells, and where there is no cerebral action, of course, there is no automatic cerebral action. With the difference here pointed out then, a visual perception, as to its suggestions, is so much like an ordinary operation of memory that, philosophically speaking, it is at least not incorrect to say that one *does* remember that the object at which he is looking has an opposite side. It must, however, be conceded that such language is not in accordance with common parlance, but to appeal to a popular tribunal for the meaning which words shall bear in scientific nomenclature, is to appeal from a higher tribunal to a lower. Were we to defer to popular judgment in fixing the exact meaning of the word memory, this word would have to represent the very crudest view of the subject treated of in this article. According to the most popular notion of seeing, instead of having to infer that rays passed from an object to the eye, we should have to infer that nerve-fibrils passed from the eye to the object.

But now, if there is so much reason for saying that we remember that an object has an opposite side, what correctness is there in the usual statement that we infer the existence of this opposite side? Are these two statements opposed to each other? Nay, they are quite compatible. Both remembrance and inference come under the head suggestion; but in inference, the suggestion is unavoidable, and not dependent on repetition, whereas in remembrance it is not unavoidable, and does depend on repetition. An act of inference, however, not to mention that all thought involves memory, is remembered every time that it occurs again to the mind as identical with its former presentation. When Cheselden, a young man who was couched for cataract, had once seen that a certain object had an opposite side, he could not afterwards avoid concluding, by an act of spontaneous or implicit induction, that it had such a side. This would occur to his mind as necessarily as it occurs to the mind of every one, after the first trial, that fire burns; but this would also involve remembrance. On the other hand, there was no inference concerned, when, seeing the cat, he could not call to mind whether the animal's name was cat or not, and could not decide till he laid hold of the creature, for then he knew from his sense of touch that it was the cat. This was simply a case of an object suggesting its name. And the suggestion not being unavoidable, and being dependent on repetition, it did not infallibly occur to the young man that the animal he saw was puss. The higher mental operations presuppose the lower. The consequence is that there can be remembrance without inference, but no inference without remembrance.

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