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AUTOMATIC CEREBRATION AS RELATED TO  
CEREBRAL LOCALIZATIONS.

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Of late years the attempt to explain certain forms or varieties of intellectual phenomena, usually described as unconscious cerebration, has not been happy in its results. Certain physiologists have not hesitated to invoke the well known laws of reflex action as the most plausible method of unraveling a group of mental actions which are of a most delicate and highly intricate order, acts, indeed, purely voluntary, whose spontaneity is entirely opposed to mere automaticity; acts pointing to the existence of an intelligent and immaterial principle, acting upon matter, and utilizing the brain as a medium for the exercise of its functions. These new theorists hold that centripetal impressions, or physical sensations, emanating from the external world, hence purely eccentric in their essence, become concentrated, and by a new physiological process or adaptation, which they assume to understand, are animalized; spiritualized or quintessenced, so to speak, in the ganglia known as the optic thalami—afterwards, propelled therefrom towards certain assumed definite

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centers in the cortical portion of the brain, where they constitute the basis or material nidus of the purely psychological sphere, which is only stimulated into action by incentives coming from without. In other words, purely external impressions, or the so-called sensations, are the *starting point* of all true cerebation. Our voluntary motions, our conversations, our thoughts or ideo-motor movements, which are sources of invention, and so many causes of the various practical adaptations of modern life and social intercourse to the sciences and arts; all such movements are only so many reactions of material sensibility, mere reflex phenomena; concretions, which subjected to a peculiar molecular action of certain cortical cells, and having a common extraneous starting point, do not develop any, but purely material actions and reactions of certain definite types.

To reflect, therefore, is to deliver one's self up to the automatic action of cerebral cells, which, by mutual reactions and inter-associations, eliminate psychical force which is, therefore, originated, controlled and preserved by certain chemico-molecular, or vital disturbances of their static equilibrium. This force is thus discharged or disgorged and, like all purely material displays of functional activity, is only gauged and regulated by the physiological activities of the particular portions of the the cerebral organism to which they appertain. Under these same circumstances memory merely represents a certain primordial property of nervous element. All the processes of intellectuality are performed in a blind, unconscious, irresistible manner. Automatic activity reigns supreme, and thereby becomes the sole force which rules and orders the intellectual operations.

It is thus that new relations are produced, that our daily reminiscences are preserved; *this influence* always present, always active, manifesting and occasioning a spontaneity in our ideas, words and acts, becomes more

and more indicative of the vitality of the cerebral regions whence it springs. To believe that thought can originate spontaneously in the brain is an error, it already appertains or is incorporated in certain territories of the cortical substance which constitute the seat of its presence, and need only to be placed in automatic vibration for its external manifestation or expression. Such are the conclusions which we are to be indoctrinated with, as if contemporaneous physiology would blindly and resignedly subscribe to this manifest abdication in favor of materialism.

Where heretofore we have believed in the existence of a soul, voluntary movement, free judgment, action impressed with the divine seal of intelligence, or the energetic manifestation of personal liberty, the inspiration of genius, acts of heroism, we have all along been mistaken—alas! such were only automatic, blind reactions, unconscious even of their own fatality. No matter how marvelous such psychic functions have appeared, they were only reflex phenomena perfected in the brain, where the materials, which were received under the guise of mere impressions of physical sensibility, became elaborated and accumulated by phosphorescent reactions and vibrations, which at the proper time were awakened to be automatically ejected, or thrust externally, resuming and blending the harmonic modalities, infinitely varied, and which were heretofore falsely interpreted as expressive of the voice, so to speak, of the human soul.

Such, in a few words, is the doctrine, of reflex cerebral action or of unconscious cerebration. Some more recent workers in this field claim to have ascertained that the optic thalami are the *special laboratory* which receive and purify all the impressions of purely physical sensibility, during the early stage of their voyage in the

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nervous apparatus; they assert that the basal ganglia form essentially the central regions which constitute, as it were, a system of conjunction of the entire cerebral mass. All physical impressions are arrested there, elaborated there, animalized there, subjected to a metabolic action, and rendered more assimilable before passing to the cortical layers where they finally become incorporated as an integral part of the organism.

The first impression we experience in the presence of these audacious attempts at localization, is one of utter astonishment. The mysterious organism of the brain, the most mysterious of all in the human economy, which for centuries has defied the sagacity and explorations of the most skillful investigators and serious workers, like the ancient Sphynx's enigmas has perpetually defied us, and refused to divulge the secrets of its intricate and complicated structure. What has been ascertained to-day is but too often lost to-morrow, and the labyrinth of perplexities involved in the study of this organ, still, to a great extent, prevents the successful exploration of its mysterious constitution and functions. In refutation of these assertions and presumptive conclusions, it seems to us that the anatomical proofs are, as yet, absolutely incapable of carrying conviction. The existence of connections which reunite certain portions of the thalami optici with definite regions of the cortical portions, with the peripheral apparatus of the senses, with the sensitive fibres in general, is still to a great extent contestable and doubtful. Huguenin (of Zurich,) among others, formally declares that the sensitive fibres emanating from the cord are not distributed to the cerebral ganglia, (optic thalami, corpora striata, lenticular nucleus,) but passing through a grey mass *behind* these ganglia go directly and without interruption towards the cortical regions,

taking part in the spreading out of the white substance. Even if the anatomical proof were established it would possess but a subaltern value. The physiological ground of the argument can only be sustained by a consideration of the experimental results attained in the localization of cerebral functions by Fritsch and Hitzig, Fournier, and particularly by Ferrier. Notwithstanding the confidence and great deference due these gentlemen, on account of the high order of their indisputable scientific attainments, it is nevertheless impossible to overlook the fact that the method of interstitial injections and electrization are open to numerous fallacies, as proven by Brown-Séquard who says:

Whatever may be the truth about that special point, there are several decided obstacles to admitting the conclusions which have been drawn from these experiments; one of these is that the parts, through the galvanization of which these movements are caused, are the will centers for such movements. In the first place, these supposed centers are not situated in homologous parts in different animals, cats and dogs for example, a fact which evidently is a fatal objection to the theory. In the second place, these centers do not differ in size in the same proportion with the muscular matter to which they correspond; one small muscle, for example—the orbicularis oculi—which in bulk is certainly not even the hundredth part of the mass of muscles of the anterior limb, has a center (pointed out by Fritsch and Hitzig,) which, according to my experiments, is five or six times (in the dog) as large as the center for the muscles of the anterior limb, so that the center for the orbicularis is, proportionately to the mass supposed to be moved by it, five or six hundred times as large as it should be. In the third place, according to Ferrier's researches, we find that instead of one center the orbicularis has three in dogs and cats, and that the sterno-cleido-masticoideus has from three to five centers, and that these various centers for one muscle are wide apart one from the other.

Besides, Vulpian has injected the chemically inert lycopodium powder into the cerebral circulation, with the effect of choking up the vessels of the cortex cerebri, whereby we should expect that the function of this organ would be destroyed; nevertheless, by galvanizing it, Vulpian succeeded in obtaining the muscular move-

ments so often referred to, almost as distinctly after, as before the operation.

Hitzig has found that the destruction of these supposed centers causes a paralysis of the parts which are moved when galvanism is applied to those centers. This sometimes occurs, it is true; but sometimes it does not, and when it occurs it is not permanent. In one case, one of the best observers of our times, Prof. Rouget, after producing paralysis of the anterior limb, by destruction of the cortical center of the opposite side of the brain, found that when the similar center on the other side of the brain was destroyed, there was (instead of a paralysis of the anterior limb yet free,) the cessation of the paralysis produced by the first lesion.

\* \* \* Another important fact is, that if we take away not only the pretended psycho-motor center of a limb, but besides that part, a good deal of the surrounding substance of the same half of the brain, we frequently find that there is no paralysis appearing. If Hitzig's views were correct we should then have a more extensive paralysis than there is in his experiments, as not only several of the supposed psycho-motor centers are taken away, but also the intervening parts of the brain, which several writers have considered as being vicariously able to replace the missing centers. I know that it may be said that the other half of the brain then performs the motor function of the injured half. But what becomes of this explanation *in extremis*, when we find that the simultaneous ablation of the pretended psycho-motor centers on the two sides is not followed by paralysis? The celebrated experiment of Flourens, consisting in slicing away the two halves of the brain from their anterior parts towards the pons Varolii has long ago shown that a great deal of the substance of the cerebral lobes can be taken away without the appearance of paralysis. \* \* \* *It is clear that if a paralysis can appear on the side of the injury to, or a disease of the brain, we are not to look upon it as an effect of a loss of function of a supposed motor center.*

Caustic liquids inserted into the depths of the cranial substance must cause injury when diffused; their destructive action is complicated with many divers accidents, particularly the reactionary inflammation excited around the limits of the focus of the injection, which fact will invalidate precise and rigorous conclusions. The same may be said of the effects of electrical stimuli,

which are probably reflected to the basal ganglia by diffusion. I moreover believe that the great majority of physiologists are in accord, in consequence of the want of sufficient constancy in the results of the experiments, in asserting that the problem has not yet been solved and that new researches are necessary to elucidate the subject.

It may not, here, be amiss to review some of the opinions of laborers in this special field of science. Nothnagel, whose recent researches upon the encephalon have attracted universal attention, holds that the only phenomenon which he ascertained to exist after the destruction of the optic thalami in animals, was an abnormal position of the extremities. Longet has taught that the disorganization of the latter ganglia in living animals is not accompanied with destruction of vision, and so thoroughly did his experiments develop this fact, that it might well be claimed, as he maintains, that the name which the ancient anatomists imposed upon these bodies, of thalami optici, might be relinquished in consequence of their non-association with visual functions, and great obscurity still attaches itself to our appreciation of their physiological interpretation. Without much embarrassment these adverse citations of authorities might be multiplied, the inevitable consequence of which would be to compel us to confess our ignorance of the subject, so far at least as the appropriate and specific workings of these ganglia are concerned.

Messrs. Render and Gombault, in a remarkable study of cerebral localizations state that:

As far as the optic thalami are concerned, a result seems established at the present time, a negative result it is true, which nevertheless, possesses a real importance. Their excitation provokes no phenomena of movement, *nor painful sensation*. Their destruction provokes neither motor paralysis nor loss of sensibility.

Now let us consider for a few moments the lessons furnished by the study of clinical medicine, as the evidence collated therefrom is more than sufficient to establish our position, Vulpian says:

That the experimental lesions of the optic thalami do not weaken sensibility which survives even after their ablation. Moreover the pathological changes in the thalami optici do not seem to have any special influence upon sensibility. I have seen a sufficiently large number of lesions (hæmorrhage and softening) of the optic thalami; I have given a very special attention to the examination of this point physiologically and pathologically, and for me there is no doubt that these lesions, when they are well limited to the optic thalami, and are not accompanied by other lesions, are not able to determine the least diminution of sensibility, and when sensibility is slightly weakened, it is no more so, than happens in certain lesions of the corpora striata. The lesions of the optic thalami especially cause paralysis of motion. This result is often observed in man.

I am well aware that certain contradictory results can be invoked at this juncture, notably in the experiments of Crichton Browne, as well as those of Türk and Waters, but where can any doctrine be found which has not been subjected to a parallel ordeal. Let us now consider some other facts. According to not a few of the defenders of the doctrine we are criticising, the sensitive impressions emanating from the optic thalami, will not be directed and disseminated indifferently in the cortical portions, but on the contrary, each particular order of impressions will be distributed into a special area of the periphery of the organ; in other words, each peripheral vibration discovers in the nervous centers a sympathetic vibration, so to speak, from adjoining portions in immediate opposition, or in active association and confederation with the centripetal vibration. To better establish this proposition of the arrangement of impressions in dis-



tinct zones of the cortical substance, three arguments are resorted to.

*First*; the anatomy of the brain, whence results the existence of the direct connections between certain portions of the optic thalami and certain districts of the convolutions. In refutation of this assumption, however, I may refer to previous criticisms, namely, that the very minute anatomy of the brain is more or less *sub judice*, and the present status of the question, especially, as regards the direction of the fibers and their conjunctions and distributions, is to be more thoroughly and definitely ascertained, requiring us to receive all positive assertions in this connection *cum grano salis*. Suppose, moreover, that anatomy did reveal to us positively, and with mathematical precision, the direction that a certain impression follows in the brain, and the particular portion which furnishes a limit to its further progression in a circumscribed portion of the convolution; how can we feel assured that this identical impression may not be afforded every latitude for diffusion and dissemination, and that even before being perceived it may be widely spread in an indefinite manner in the vast expanse of the encephalic cortical? Are our methods of investigation sufficiently subtle, accurate and mathematical to definitely determine this very important matter?

*The second proof*, often quoted by the advocates of this theory is that experimental physiology, and especially the experiments of Flourens, prove that upon living animals successive layers of cerebral substance may be methodically removed, with the result of an accompanying loss to these animals of the faculty of appreciating visual or auditory impressions. To us, for reasons developed elsewhere, it seems that experimental physiology has not proven the proposition. Flourens, more-

over, far from accepts or endorses the doctrine of brain segmentation in affected districts, for the reception of impressions of a different character—on the contrary he held, to use his own words, that :

1. A portion quite extensive of the cerebral lobes can be removed either in front, behind, above, or at the side without their functions being abolished. A restricted portion of these lobes, *therefore*, suffices for the exercise of their functions.

2. Just in proportion to the removal, will all the functions become suspended and gradually extinguished, beyond a certain limit they will become entirely abolished. The cerebral lobes therefore co-operate in their totality for the perfect and entire exercise of their functions.

3. Finally, as soon as perception is lost, all functions are ; as soon as one faculty disappears all disappear. There is not, therefore, a different seat for the different faculties nor for the different perceptions.

Again, he says:

When a perception returns all return ; when one faculty reappears all reappear.

Farther on in making more general deductions he affirms :

1. That the cerebral lobes are the exclusive seat of the perceptions and volition.

2. All these perceptions and volition occupy the same seat in the organ ; only the faculty of perceiving, of conceiving, of wishing, constitute a faculty essentially *one*.

3. The third and last argument is the citation of the curious, interesting, but incomplete experiments of Schiff's upon the elevation of the temperature of nerves and nervous centers following sensorial irritations.

A few quotations from Schiff himself will however cause us to invalidate the broad conclusions drawn by our antagonists, Schiff says:

It follows from these experiments, that, as a general thing a sensible excitation acts upon *both* hemispheres in an almost equal manner.

Again, he says:

We believe that we are able to affirm that sensible excitations act upon *all* the parts of the cerebral hemisphere.

It is true that we do find in Schiff's work the following declaration.

From what we have demonstrated it seems that it is always the temperature of the *median* zone (of each hemisphere) which surpasses that of the other zones. It would therefore appear that sensible impressions, although reacting upon the entire brain, exercise a more marked influence upon the *middle* portion of the hemispheres, and if the internal portion is compared with the external portion, the first will be found more active at the moment of a sensible excitation of the body.

If we are to accept the conclusions of these gentlemen, we are to believe that our notions of personality and moral responsibility, properly speaking, the development of our ideas, our acts of judgment and will, all the operations of our psycho-intellectual sphere, derive their origin from the pure *sensibilities* of nervous elements. In reply to such deductions and without noticing certain views recently maintained by some distinguished modern writers, regarding the mode of production of the phenomena of intellectuality wherever grey nervous matter is found, whether in the brain or spinal cord, I will content myself with recalling the fact which seems to have been overlooked and is pregnant with importance, namely, that, with ordinary care and circumspection, one must perceive without difficulty a profound difference, one quite unmistakable between spinal and cerebral functional activity. What will we ascertain in the analytical scrutiny of reflex phenomena? After the retardation of a minute fraction of a second, motion succeeds without an appreciable interval, the action of a stimulant, the presence or existence of which is absolutely required ; its evolution is inevitable,

blind and oftentimes unconscious. *Nolens volens* we ourselves aid its explosion or transition, it seizes possession of our muscles with a grip of iron—and with sovereign and indisputable force it throws them into irresistible spasms—either of the mildest or most convulsive character, oftentimes fatal in results.

Do we find these characters in the pretended reflex cerebral phenomena, with which explanation our antagonists have dignified the evolution of the phenomena of intellectuality? That we do *not*, we have only to study the workings of our own internal consciousness to be convinced. Without any external stimulation, amidst the most profound silence from without, in the recollection of our respective senses, we are able to evoke with ease, or even capriciously, certain reminiscences connected with the far distant past, and immediately the *vestigia rerum* will make their appearance vivaciously, and yet saliently, before our attentive view. They are engulfed in the living tombs of our memories.

The faithful guardian we called the soul has preserved in its sanctuary the impression of past events, notwithstanding the destruction of nervous cells and accompanying retrograde metamorphoses of nervous matter. Thus, in a moment, are recalled into life, souvenirs of our early childhood, sentiments which were nearly buried in the obscurity and silence of by-gone years. With ease are refreshed our scientific labors and acquisitions which have been dormant, and have almost escaped our conscious interpretations. Yet we are desired to believe that such phenomena are but simple reflex operations, similar to those emanating from the ganglionic cells of the spinal marrow.

We may voluntarily continue to contemplate recalled associations, even when these are of the most immaterial nature as e. g., cause and effect; distinguish

even persons, things and places upon which we are wont to dwell and reflect; we may concentrate our minds with sympathy upon certain recollections, or, on the other hand, we may repel them with horror; or, as when certain remembrances naturally reproduce others which are analagous, associated or contemporaneous, we can immediately and decisively repress them, when we so desire, thus continuing uninterruptedly to follow and enjoy our more pleasurable recollections entirely at our discretion. In one word, our mind moves with a deliberation and liberty which rejects inevitably such aspersions of blind fatality as explanatory of its mode of action, and thereby precludes our contenting ourselves with a doctrine which is as repugnant to our feelings as it is insulting to our intelligence. Let us reflect, to develop this matter a little more *in extenso*, upon the analysis of a deliberate, premeditated and voluntary determination, which we are at perfect liberty either to execute or not as we judge best.

Having carefully weighed the motives and being in possession of the enjoyment of the most absolute freedom of action, as regards our decisions; having foreseen the consequences; having overcome all the impulses and incentives which incline us towards a certain line of action; yet, resisting our instincts, the force of habit perhaps, the influences of flesh and blood, we succeed in mastering ourselves by the exercise of firmness, and our personal will power. If in opposition to such a course we permit ourselves to glide along and yield to some unfortunate and reprehensible inclination, is there nothing but reflex transmissions of sensiferous impressions to explain the culmination and perfect elaboration of such high states of psychical development? Do such deliberate determinations admit of such an interpretation?

It is precisely in this manner, and dependent upon the issue of such internal conflicts and after the experience which such painful and prolonged struggles in the innermost depths of our consciousness afford, that the moral responsibility of our acts commences. In other words it is in this manner that either crime or virtue, merit or disgrace, derive their birth. Imagine for example a rock precipitated violently to the earth in blind obedience to the great law of gravitation, exercising discretion and liberty in order to arrest its flight. Shall we refer to the pure and brilliant conceptions which are eliminated from the intellectual domain, and which attaining their culmination represent that celestial ray, that superior illumination which we term genius? Are the heroic inspirations of Homer and Virgil, the admirable calculations of Newton, the splendid speculations of Descarte and of Leibnitz, the funeral orations of Bossuet, the immortal tragedies of Shakspeare and Racine, the *chefs d'œuvres* of Michael Angelo, of Raphael and of Rubens, the musical creations of Beethoven and of Myerbeer, the science of an Alexander Von Humboldt, the genius of Cæsar and Napoleon, the researches and sparkling scintillations of Harvey, Virchow, Trousseau, Ray, Esquirol and all the illustrious disciples of the great healing art; in a word, are all the literary, artistic, scientific, philosophical, medical, poetic, legal, rhetorical and theological treasures of the world, are we to *believe* that they all are only the mere reflex products of nervous action? Are such delicate and incalculably superior psychic developments and attainments purely and essentially reflex actions, strictly analagous to automatic actions of the spinal marrow?

Such assertions, therefore, are pure fictions which savor of puerility, pure hypotheses without adequate

proof; mere comparisons without even the foundation of arguments, mere figments of the fancy without authoritative corroboration, mere shadows which dissolve when a serious attempt is made to reach them, hiding behind their dark outlines the spectres of materialism and fatalism. Molecular vibrations could not evoke even simple perceptions, if behind their action a *principal* did not reside which receives, vivifies and distributes them, the same principal which sends forth, over the entire organism, life and movement, *mens agitans molem*. We fully admit that there are vibrations of matter which may permeate directly, influencing the innermost recesses of the soul; there are modifications so intimately associated, and so evanescent in character, that they may evade the scrutiny of the most careful observer and yet direct our inclinations and modify our actions with an almost overpowering force, and result in those irresistible yieldings those impulsive and impetuous monomaniacs which have so long attracted the attention of medical alienists and moralists. When the cerebral circulation is momentarily disturbed, when an epileptic wave passes over the nervous system, immediately the intellectual faculties are obscured, the moral sense blunted, and the most honorable, learned, prudent, reserved and discreet man commits acts which make us shudder with horror, notwithstanding that, at the same time, they disarm public opinion and retributive justice. Especially the presence of epilepsy produces psychic destruction, which is not unlike the ravages wrought by the fury of the tempest, the most dreadful confusion signals its presence, with at the same time an accompanying and absolute moral irresponsibility. Such exceptions, however, do not invalidate the rule, which attaches to man in his normal condition, the responsibility of his acts because he has received from his maker

the precious gift of liberty, which alone makes him capable of merit.

The repetition of a muscular act, which before the muscular sense was fully educated for a complex movement, was entirely under the control of the will, and thereby regulated in all its details, may finally become repeated automatically, it is true, and even in an almost absolutely unconscious manner. I am free even to admit of a sort of automaticity of cerebation and unconscious ideation, because during such states the annular protuberance and basal ganglia predominate in their action over the cortical layers, and many of the examples of Laycock and Carpenter are corroborative of the latter explanation only, depending as they do, not upon the cortical layers properly speaking, but upon the mesocephalon or spinal cord.

Ferrier himself, whilst stating that:

In man the shorter circle through the optic thalami and corpora striata does not appear sufficient for the interruption of the conscious circle through the hemispheres, by lesion of the cortical motor centers, produces paralysis of a very complete and enduring character. This goes far to show that even the most habitual or most automatic actions of man require the co-operation of the centers of conscious activity, a view which is taken and strongly argued by Dr. Ireland.\*

But (Ferrier continues) though the basal ganglia may not of themselves suffice for the execution of the habitual movements in man, there is every reason for believing that they do so to a large extent, from the fact that the performance of habitual actions exercises but little interference with the conscious activity of the hemispheres in other directions. We may express it thus, that in actions requiring conscious discrimination and voluntary effort, the larger circle of the hemispheres is involved, but that in the actions which have become habitual or automatic, the larger circle is greatly relieved by the organic nexus between impression and action, which has been established in the sensory and motor

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\*Can Unconscious Cerebration be Proved. *Journal of Mental Science*, October, 1875.



basal ganglia. The optic thalami and corpora striata form thus a sensori motor mechanism, according to the views of Dr. Carpenter. I would use the term, however, only in the given sense of afferent—efferent; it having been shown that sensation or consciousness of impressions, is not a function of the optic thalami. Hence the reaction between the optic thalami and the corpora striata being below the domain of consciousness, is outside the sphere of psychical activity, properly so-called.

In conclusion, therefore, it is wholly impossible for us to grant such an unheard of extension to an exceptional and subordinate factor, which we term unconsciousness; and we will continue to protest against the invasion of phosphorescence and automaticity, when placed upon the same level as intellectual and moral action.

Now, more than ever before, we feel assured that the immortal soul, the Divine spark animating the human organism, has not, as yet, been dethroned.\*

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\*For many of the inspirations of this paper we are indebted to Dr. Masoin's learned analysis of the subject in the *Revue des Questions Scientifiques*.