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PART 1.—ORIGINAL ARTICLES.

The Physical Conditions of Consciousness. By A. HERZEN, Professor of Physiology, Lausanne. *Translated by* DR. T. W. McDOWALL.

(*Concluded from p.* 53.)

IV.

Before approaching the next subject I wish to avoid the reproach of departing from the rules of the inductive method by drawing conclusions from the complex to the simple; that is to say, in this case, by applying to the lower centres a conclusion drawn from the observation of the higher centres, instead of proceeding in the opposite way. I am obliged to proceed in this manner by the very nature of the problem which really cannot be treated any other way. As we have to deal with the *subjectivity* of central phenomena it is impossible to seek its conditions when we have no direct means of proving its presence or absence. Now in respect to the subordinate centres we are reduced exclusively to objective observation, which in no way can teach us anything of the subjectivity of the changes which take place in them; therefore, whatever conjectures we may make in regard to the consciousness or unconsciousness of the motor reactions furnished by the lower centres, they can have only a certain degree of probability when we study these reactions by the aid of what subjective observation teaches us relative to the consciousness or unconsciousness of the cortical centres. It is because they have not followed this method that writers disagree so completely as to the presence or absence of subjectivity in the sensori-motor centres, and especially in the spinal cord. Let us begin with the latter.

Whereas some adopt the doctrine of Marshall Hall, ac-

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cording to which the activity of the cord is essentially *different* from that of the brain, absolutely unconscious and purely mechanical, Maudsley and Lewes maintain, on the contrary, that the activity of all the nervous centres is essentially *identical;* but, as we know, with this radical difference, that according to Maudsley consciousness is in every case an accessory phenomenon generally absent; whereas, according to Lewes, it is a necessary phenomenon, constantly present. The facts under discussion are the following:—

If we place a drop of the acid on the skin of the lumbar region of a decapitated frog we immediately see the foot on the corresponding side lifted to scratch and rub the spot irritated by the acid; if we repeat the experiment after having amputated the foot, the application of the acid puts the frog into an evident state of agitation, it makes fruitless efforts with the stump, hesitates, stops, seems to reflect, and ends by employing the *other* foot to wipe off the acid. Pflüger was so struck by this phenomenon that he attributed not only consciousness but even intelligence and will to the medullary reflexes. These opinions were adopted by Auerbach in Germany and Lewes in England. But since 1858 Schiff expressed himself opposed to this interpretation. He has the merit of having recognised, on the one hand, that the facts observed in man in consequence of traumatic lesions of the cord *do not permit us to conclude the unconsciousness of the spinal cord.* For in these cases the nervous communication between the cord and brain being interrupted, the latter can in no way perceive what takes place in the cord: it is exactly as though these two organs belonged to two individuals—the brain of Paul does not know what occurs in the cord of Peter. On the other hand, the visible reactions being the only objective sign which reveals to us the presence of a conscious sensation in any organism, except our own, *we have no right to refuse all trace of consciousness to the spinal cord.* But whatever may be the degree of consciousness it possesses, we can by the following reasoning refuse the property of intention and will to the spinal reactions; in fact, we give this name to movements of which we have an anticipated representation, of which we foresee the form, the energy, the succession, and the effect; but the spinal cord of a decapitated animal cannot have these representations, because the destruction of every sensory

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centre necessitates the abolition of the corresponding representations, and because decapitation is the simultaneous destruction of all these centres; the cord is therefore deprived of the psychical materials which, combined into a whole, confer on any given movement the special character which we indicate by the word voluntary. So true is this that we do not give this name to movements which, notwithstanding the integrity of the nervous centres, are accomplished in the absence of all this combination of representations, without prevision and without consciousness: we then call them automatic. I would further say: the examples of unconscious movements *accomplished by ourselves* seem to me the *only* facts favouring the possibility of any unconscious nervous reaction.

This reasoning is perfectly applicable to the sensori-motor centres; they are accessible to the multiplicity of impressions which the organism can receive from the external world by the organs of sense, and they consequently react by series or groups of movements to the series or groups of impressions which stimulate them. Thus, for example, a pigeon deprived of the hemispheres stands on the ground or perches on a stick, maintains its equilibrium when the stick is rotated, rises if placed on its back, flies if thrown into the air, and does not fall down after having flown, but perches on any object, and so on; in some favourable cases, it even ends by learning to eat and drink by itself; it then continues to live and behaves almost like a normal pigeon, the only difference being that it is more apathetic, that it manifests less initiativeness, that it seems to "want spontaneity," as A. Bain would say. Seeing that the analogy between sensori-motor and ideo-motor acts is much greater than that between the first and the spinal reactions, we may *a fortiori* conclude that the opinion is not maintainable according to which the activity of these centres is also unconscious.

Now what is the degree of consciousness which we can attribute to the spinal cord and to the sensori-motor ganglia? By *degree* I mean simultaneously the quantity and quality of consciousness, that is, its intensity and the psychical dignity of its contents.

On this subject accident has furnished me with information which I think important. During a certain period of my life I suffered from frequent syncope, and I had the opportunity of observing on myself the psychical phenomenology

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of the return to consciousness. During syncope there is absolute psychical non-existence, total absence of all consciousness; then one begins to have a vague, unlimited, infinite feeling, a feeling of *existence in general* without any delimitation of one's own individuality, without the least trace of any distinction between the ego and the non-ego: one is then "an organic part of nature," having the consciousness of the fact of one's existence, but having none of the fact of his organic unity; one has, in a word, an *impersonal* consciousness. This feeling may be agreeable if the syncope is not due to violent pain, and very disagreeable if it is: this is the only possible distinction: one feels that he is living and enjoying or living and suffering, without knowing why he enjoys or suffers and without knowing the seat of this sentiment. A great number of facts make it probable that in this phase of return to consciousness, the extremities may execute the spinal reflexes in response to tactile or painful irritations; although the cephalic centres are certainly still incapable of becoming active. As a result of this first observation I believe that the spinal marrow, suddenly separated from the cephalic centres by decapitation, is reduced to this elementary form of sensation, without any discrimination, without localisation, without knowledge of the different parts of the ego, or the ego itself, and accompanied only by a vague, diffuse, impersonal consciousness. Such no doubt is the only form of consciousness which we can admit in the minute beings which are wanting in special organs; it is also the only one which savants unanimously attribute to the newly-born child, before he has had time to learn, by the education of his senses and the association of impressions, the topography of the surface of his body, and to distinguish its different parts from one another and from the objects which do not belong to it. I think, consequently, that the spinal cord of a decapitated animal would react to any impression *indifferently* by any movement, perhaps by a series of irregular contractions of all the muscles (as it really often does in the newly-born), if it did not contain a great number of direct communications from the afferent to the efferent nerves, communications previously developed during the infinitely long evolution of living beings and become hereditary, or else acquired by the individual himself; but in every case *preformed*, that is to say, ready to re-act immediately in a given manner to a given irritation. I believe that in relatively simple cases, those in which the

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cord gives an immediate and limited reaction to a particular stimulus, by means of a preformed mechanism, the spinal consciousness is reduced to the minimum of intensity or to zero; because then the transmission of the stimulus is accomplished with the maximum of rapidity and facility by nervous paths perfectly adapted thereto; on the contrary, in relatively complicated cases, like that of the decapitated frog whose leg we amputate to oblige it to execute less automatic reactions, or like that of the tritons of Flourens whose posterior extremities, after total section of the cord, gradually *learned* to co-ordinate their irregular reaction with the movements of locomotion; in these cases, I say, the spinal consciousness attains its maximum of intensity, because in these cases the central elements offer a considerable resistance to the stimulus which, not finding a means of escape close at hand, radiates and produces an extended, profound and lasting disintegration up to the moment when it succeeds in making new paths duly adapted to the unusual circumstances; these paths once sufficiently elaborated, every act is accomplished more quickly, more easily, more automatically, less consciously.

But it must not be forgotten that we have always spoken of decapitated animals; in the normal animal it is not quite the same; if an excitation which affects the spinal cord is not immediately and *entirely* transmitted and discharged in the shape of automatic reaction, nothing obliges it to remain in the cord, and there to effect the adaptation of new central tracks; on the contrary, it passes directly to the cephalic centres; it thus follows that in the non-mutilated animal the spinal consciousness will *never* be called upon to manifest itself except in some exceptional cases, as that of animals who have no cephalic centres—the *amphioxus* for example. It is evident that in such animals the cord must accomplish all the functions devolving upon the nervous centres. But during the course of the evolution of living beings, the anterior portion of the cord undergoes an extraordinary development and becomes cephalic; the central attributes follow the same course; they gradually abandon the spinal centres which become more and more subordinate, and end by being only organs of transmission and of some definitely organised reflex acts: the central attributes gradually become the more and more exclusive privilege of the new cephalic organs which alone exhibit a complexity and specialisation of structure capable of corresponding to the more and more varied neces-

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sities of a more and more complicated organism. It follows that the spinal consciousness must be more intense in the inferior vertebrates and less intense in the superior: it must be at its maximum in the amphioxus and its minimum in man.

Let us now proceed to the sensori-motor centres at the base of the brain. I have already said that the observation of animals deprived of their cerebral lobes leads us, in the majority of cases, to the conclusion that the movements which they execute apparently without intelligence and without will, are yet not unconscious; on the contrary, analogy, and especially the arguments which we have quoted in support of spinal consciousness, oblige us to consider them as habitually conscious reactions. Maudsley himself, so inclined to deny consciousness wherever it is possible to deny it, and so disposed to consider animals as unconscious machines, is obliged to recognize, notwithstanding some contradictions to which I will refer later on, that in regard at least to the superior vertebrates the sensori-motor centres enjoy a certain degree of consciousness:—

> "For it may well be that organs which are only a little lower in dignity than the supreme cerebral centres, which are essential to the development of their function, and which are in such intimate functional relation with them throughout life that a functional separation appears to be a pure abstraction, do possess that property which is most highly, but not exclusively, developed in the higher centres"—("Physiology of Mind," p. 242).

For the same reason he grants them, though unwillingly, what he calls *a kind of sensory perception*, which he considers the germ or rudiment of *intellectual* perception, the exclusive privilege of the cortical centres. So it is no longer the *fact of consciousness* which is placed in doubt; we have to deal with a more subtile distinction, relative to the *quality* of the contents of consciousness. Let us see if the study of the further progress of return to consciousness after syncope permits us to determine this quality.

From the chaos of the first phase which is characterised, as you remember, by a confused, impersonal consciousness, without any trace of localisation, without discrimination of definite sensations, vague and obscure differences gradually take shape; one begins to see and hear; but, what is very curious, the sounds and colours seem to arise within one's self, without one having the least idea of their external origin;

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further, there is no connection between the different sounds and the different colours; each of these sensations is felt by itself; thence results an inexpressible confusion, accompanied by a complete stupefaction of the individual; at this moment the sensory centres have regained sensibility, but they are so only to the impressions which come *directly from the exterior*, each centre for itself. The intercentral reflex action is not yet re-established, the different sensations do not combine with one another; there thus results the total want of localisation, of distinction between the ego and the non-ego, and of projection beyond the origin of the impressions; one has *stupid* sensations, if I may express myself so, that is to say, sensations which, because they remain isolated, cannot be *known*, but only *felt*. Next follows the re-establishment of the intercentral reflexes; their activity fuses into what we call the sensorium commune; the different sensations begin to influence one another, and, consequently, to become reciprocally determinate, defined and localised; and there results the distinct appearance of the consciousness of *the unity* of the ego; but this consciousness is at first only an unintelligent feeling, which merely expresses the fact of the organic unity of the subject, and from which a clear notion of the relation of himself to his surroundings is still entirely absent. In this stage of awaking I clearly felt (p. 181-2) *I was myself*, and that my auditory and visual sensations came from objects which did not form a part of myself; but I did not understand what was happening, nor what had happened, why I was there, stretched on the ground or on a sofa, nor why the persons present surrounded me eagerly, unbuttoned my shirt, threw cold water on my face; that was because these are complex perceptions of a higher order, genuine intellectual perceptions resulting from the synergic action of the cortical centres; they can only, therefore, reappear with the complete re-establishment of these centres, which are the first to suffer and the last to recover their functional integrity. Later on, at a given moment, at the end of a variable but always appreciable interval, filled by the strange stupor already described, the cortical centres are suddenly re-established, their nutrition having resumed its normal course; at the same moment the mind is traversed, like a flash of lightning, by the following thought: "Ah, that was another fainting fit." From this moment intelligence is completely re-established, it seizes the complicated relations of the situation, and resumes the command which

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a temporary insufficiency of cerebral nutrition had deprived it of.

Now, what conclusions can we draw from these observations? In the first place it seems evident that the sensory centres, taken individually, can be conscious each in its particular mode of sensation, but only, as I have said, in a stupid manner, that is to say, without combination or correlation between the different sensations, consequently without their localisation—without projection of their origin beyond the ego—and, consequently, finally, without distinction between the ego and the non-ego. In the second place, it is evident that the sensory centres, combined in the *sensorium commune* (if not anatomically, at least functionally, as the mechanism of inter-central reflex action, of the synthesis of the different specific sensations of external origin, and of the internal induction of reflex sensations producing each other) may be conscious in an elementarily rational manner. Not only can they feel, but they can know that what feels is not what produces sensation; they can consequently have individual consciousness in its most elementary form, *i.e.*, as a mere sentiment of the unity of the ego, but cannot form a notion of the relations of this ego with what surrounds it, nor understand the circumstances in which it finds itself.

We see in all this a great analogy to what occurs in the spinal cord of a decapitated animal; very probably, in an animal deprived only of the cerebral hemispheres, the sensori-motor centres can at first accomplish only the acts, however complex they may seem to us, which are due to a preformed mechanism, hereditary or acquired; their reactions would consequently, in the majority of cases, be automatic, and slightly or not at all conscious. Just as the spinal cord in certain favourable cases, for example in the salamanders of Flourens, may learn to execute reactions which at first were impossible, so the sensori-motor centres learn in certain cases (to tell the truth, very rare ones, for example in the pigeons deprived of their hemispheres) to execute all the co-ordinate movements necessary for the maintenance of the life of the individual; and we cannot doubt that during the period of learning, their consciousness must be carried to the maximum intensity of which it is capable, to diminish afterwards gradually and in proportion as the new associations, by repetition and habit, adapt the nervous paths and render the intercentral transmission rapid and easy.

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On reflection you will see that I do not make an improper use of the word *learn;* it suffices, in fact, to recall the perfect analogy which exists between the genesis of a motor association and that of an association of ideas. In both cases we have to do with intercentral reflexes in process of organisation. Once organised they constitute a faculty; this faculty, by habit, may at last act unconsciously. The process is identical in both cases. Maudsley is quite right in insisting on this analogy; he draws the following parallel between the acquisition of a series or group of co-ordinate movements, and the acquisition of a series or group of reflex cortical sensations—that is to say, of ideas; ideas, like co-ordinate movements, are the "constitutional" result of the surroundings, exercise, education. The ideas of a child are, like his movements, instantaneous, undecided, transient, disorderly. Ideas, like movements, are combined in groups or series the more indissoluble the oftener they are exercised; once combined, they are not produced separately without difficulty, and indeed generally become absolutely inseparable. Ideas, like movements, become more and more easily evoked by exercise, and end by appearing unconsciously. Finally, ideas by being repeated several times running, fatigue the organs concerned in their production, exactly as too prolonged movements fatigue the muscles. The sensori-motor centres being capable of perfecting their motor reactions, should be capable also of perfecting their rudimentary intelligence; but it is probable that, as in the spinal cord, this intelligence, as well as the consciousness itself of the *sensorium commune*, is very rarely called upon to act in the normal animal, as, whenever all the energy of any stimulus is not immediately and automatically restored entirely to the external world in the form of muscular movement, it does not stop in the subordinate centres to force new paths, but goes directly to the cortex. This preponderance of the cortical centres corresponds with the zoological position of the animal, and, as it increases, those exceptional cases for which there exists no mechanism ready to act immediately, and which demand reflection, pass more and more to the exclusive domain of the cortical centres. It follows that Consciousness, Intelligence, and Will abandon more and more the subordinate centres, and concentrate themselves in the superior ones; consequently the activity of the sensori-motor centres has its maximum of Consciousness, Intelligence, and Will in the inferior vertebrates, or in the animals entirely,

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or almost entirely, deprived of cerebral hemispheres, and these faculties are, contrary to Maudsley's opinion, reduced to their minimum in the superior vertebrates, especially in man.

It is easily seen that the relation between consciousness and the functional disintegration of the nervous elements such as I have already indicated, holds good for the sensori-motor centres as well as for the cortical centres and the spinal cord. By neglecting this relation the clearest minds inevitably fall into contradiction.

We have seen that Maudsley considers the sensory centres as organs of a dignity almost equal to that of the cortical centres; elsewhere he says that the fact of animals artificially deprived of their hemispheres crying when irritated, does not prove that these animals *feel pain*, but only that *they cry as if they felt it.* To this I answer that Maudsley's reasoning proves still less that these animals *do not feel* pain, for cries, or any other external expression, are the only objective signs which reveal to us pain or any other internal sensation in any organism except our own; so that in all probability they indicate consciousness and not unconsciousness. We might as well doubt, in fact, that an animal in full possession of its hemispheres feels when it cries. In this case, as in the other, we have in favour of sensation only analogy. We might even doubt the consciousness of a man who says that he has a sensation, for, strictly speaking, each of us can decide the question only for himself, and can by no means have a *proof* that another individual feels anything. We can simply state that he *acts as though he feels,* and then remember that if we ourselves acted thus, we should do it in consequence of such and such sensations, and should finally conclude that probably the other individual had similar sensations. Still the analogy of one man to another is such that on this subject we have not the shadow of a doubt. Certainty diminishes, it is true, according as the organism is different from our own; it further diminishes if this organism is placed in abnormal conditions which permit it no longer to manifest all the reactions which it would manifest if it were not mutilated; but as long as there is any reaction, however imperfect or partial, we never can say with certainty that *nothing has been felt.* On the contrary, the only proof we have that any reflex reactions may occur unconsciously is furnished, I repeat, by subjective observation, which teaches *each of us individually* that certain reactions sometimes occur unconsciously in us.

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Further on, Maudsley questions if we ever have consciousness of a sensation unless it awakens a perception.

"It is doubtful whether we ever are conscious of a sensation without perceiving, whether, in fact, we can have consciousness of a pure sensation; when we say we feel it, we feel it in a particular part of the body; and what is that but to perform internally a sensori-motor act, and to recognise more or less clearly its *where*—in other words, to *perceive* it according to forms of space?"—("Physiology of Mind," p. 242).

So be it, but when we feel *without* saying it, without knowing that it is *we* who feel, nor what we feel, as happens in the second stage of awaking from syncope, have we not simple sensations with absence of all judgment? Besides, Maudsley himself destroys this argument by admitting, on the one hand, that a new-born child has sensations, although he does not localise them, and cannot do so, as everybody agrees, until after the lapse of some time; and, on the other hand, that the confused sensations which accompany the various organic activities are *felt*, although they do not produce *clear* consciousness in us, or a perception of the causes from which they originate.

"In respect of our organic feeling, we are, in reality, on a level with those humble animals that have a general sensibility without any organs for special discrimination and comparison; and if this were the only feeling which an individual had, he would probably not know that he was an *ego*"—("Physiology of Mind," p. 254).

This is certainly incontestable, and I have tried to show that this is really so in the first stage of awaking from syncope; but because the *notion of the ego* is then impossible it by no means follows that *impersonal* consciousness does not exist; Maudsley seems here to confound consciousness *of the ego* with consciousness *in general*. It is with the latter that we have to do at this moment, and we have seen that we cannot exclude its existence even in the spinal cord; still more must we admit it in the sensory centres, but in these centres it is no longer *quite indistinct* as in the spinal cord, which has no special organs for discrimination and comparison; it is differentiated, for to each sensory ganglion there corresponds a particular quality of sensation, a *specific* sensation. Further, owing to their mutual reflex relations these ganglia, functionally united in the "sensorium commune," possess all they require for *comparison and discrimination*, that is to say, not only for *unintelligent* and undetermined sensation, but for *elementary perception*, for a

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rudiment of intelligence, a first distinction between the ego and the non-ego, sufficient to establish at least the sentiment of the unity of the ego, in opposition to the plurality of external objects. Elsewhere Maudsley observes that, from the presence of a rudimentary intelligence in the sensory ganglia of inferior animals, we must by no means conclude that it is present in the sensory ganglia of man.

"On the contrary, it might be argued that as higher nervous centres are differentiated in the course of evolution, functions are localized in them which were more generally diffused in the lower animals; not otherwise than as the fore-limbs in man, which in the ape and some other animals serve both for grasping and walking, are specialized in structure and function as prehensile organs" (p. 24).

There is no doubt of this, and withdrawal of attributes and localisation of functions most certainly occur during the progress of evolution; indeed, evolution consists in this, and for this reason the higher an animal is placed in the zoological scale, and the more its cerebral hemispheres are developed, the less can we observe conscious psychical functions in its sensory centres; sensori-motor acts are in fact to a great extent automatic; we call them *instinctive.* For the same reason, in Man, consciousness and intelligence of the sensory centres are doubtless reduced to the minimum, exactly like those of the spinal cord; consciousness and, consequently, intelligence manifest themselves in those parts of the nervous system where there is still something to be done, which are not yet perfected mechanisms, and whose automatism leaves something to be desired; for they are, as we know, the subjective expression of one of the phases of the work of acquisition and organisation. Now to admit that consciousness has completely abandoned these centres, and has become the exclusive attribute of the cortical centres, we must first allow that all possible and imaginable sensori-motor acts are accomplished by means of a preformed mechanism, almost like the direct and immediate spinal reactions in the superior animals; but if it is probable that the spinal cord of these animals, through reacting in a uniform manner to uniform impressions, has arrived at the highest degree of unconscious mechanism, this is not at all probable for the sensory centres which are exposed to an infinite variety of impressions, not only from all the external influences likely to call into action the different forms of sensibility, but also from the inexhaustible stream of internal influences, acting upon

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each from all the others, and all being acted upon by the cerebral hemispheres. So that, except the few automatic acts which they accomplish in virtue of an organisation definitely acquired by the species or by the individual, they are every moment obliged to provide new adaptations, that is to say, to do what the hemispheres do, though doubtless in a much more restricted manner. It follows that if in the superior animals the spinal cord, in which reflex sensation does not exist, has been reduced by the preponderance of the cephalic centres to an unconscious and automatic organ, and especially to an organ of transmission, the sensory ganglia are not so easily deprived of their attributes as independent and conscious centres, for they are the seat of *reflex sensation,* through which the simple organic sensibility is transformed into genuine mental activity, or *psychicity;* so that it is incorrect to say, as Maudsley does, that there is *no demarcation* between the reflex actions of the cord and those of the sensori-motor centres; on the contrary, there is a *very marked* difference between them—a difference which does not exist between the reactions of the sensory centres and those of the hemispheres; in fact, in the first case, the transition is abrupt, whereas in the second it is gradual; in the first we pass from a *simple* to a *complex* mode of activity; in the second we only pass from a *complex* to a *more complex;* and the complication which appears in the sensory centres, *reflex sensation,* is really the rudimentary germ of intelligence, which may be thus defined: an increasing complexity of reflex cortical sensations produced under the influence of external impressions; so that the transition in this case does not imply any new mode of activity, and is accomplished without any appreciable line of demarcation between the less and the more complicated; which justifies this other assertion of Maudsley, that a separation between the sensory and cortical centres must appear as a pure abstraction.

The result of this paper may be summarised as follows:—

I. *In the spinal cord:* Elementary, impersonal, unintelligent consciousness; maximum in inferior animals, minimum in superior; in the latter in their normal state spinal consciousness is never called for, because all the reactions which are within the capacity of the cord are accomplished automatically, and because the stimuli, not finding in the cord any mechanism capable of discharging them, are directly transmitted to the cephalic centres. It is only in cases of experimental complications of conditions that this conscious-

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ness is awakened through the extended and profound disintegration which such complications produce; it disappears again according as new mechanisms are organised and consolidated.

II. *In the sensori-motor centres* (functionally co-operating as "sensorium et motorium communia"): Individual consciousness, rudimentary perception, germ of intelligence; intelligent and voluntary character of the reactions submitted to conditions identical with those governing the intensity of the spinal consciousness, but with this difference, that owing to the infinite variety of external and internal impressions which excite these centres to activity, the latter is not reduced to a completely automatic mechanism like the spinal cord, and consequently always participates more or less in the panæsthesia of the individual by contributing thereto its share of consciousness.

III. *In the cortical centres* (acting as "intellectorium commune"): Intelligent consciousness, clear notion of the relations of the individual to external objects, and of these objects to one another, whence results the intentional, really voluntary character of the reactions. Conduct is regulated by past, present, and future circumstances, such as the individual can foresee by means of the experience he has acquired; differing from the two former modes of consciousness, this one increases with the zoological status of the animal, and reaches its maximum in man. The intensity of this consciousness and the quality of its contents depend on the same conditions as those which regulate the consciousness of the sensori-motor and spinal centres.

IV. Lastly, *in the whole nervous system*, considered as the organ of the fundamental function of the whole life of relation, of *reflex action*—consciousness or unconsciousness of its activity, according to the physiological phase of this activity and according to the following law:—Consciousness is exclusively connected with the functional disintegration of the central nervous elements; its intensity is in direct proportion to this disintegration, and simultaneously in an inverse proportion to the facility with which each of its elements transmits to others the disintegration which affects it, and with which it returns to the phase of reintegration.

V.

I may be wrong, but it seems to me that this explanation, however incomplete it may be, proves that the physical law of consciousness which I propose is justified by facts, and

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applies equally to the action of the different nervous centres. Far be the thought from me that my law is a perfect and complete expression of the true state of things, but it seems to me that it is a better and more complete expression than any hitherto offered, for it embraces at the same time the most intensely-conscious and the most unconsciously-automatic activity. Besides, it forms a bond between the apparently irreconcilable opinions of Lewes and Maudsley, and this not by adopting the *juste milieu*, but by amalgamating the extremes in a conciliatory synthesis. Let us return for a moment to the opposition between these two eminent psychologists. Neither maintains an absolutely false thesis, but each exaggerates what there is of truth in the thesis which he maintains: Lewes, too much pre-occupied by the phase of cerebro-psychical disintegration, by the resistance of the central elements and by the difficulty of transmission, sees consciousness everywhere; Maudsley, too much pre-occupied by the cerebro-psychical reintegration, by the rapid action of the preformed mechanisms and by the facility of transmission, sees it nowhere. It follows that Maudsley thinks himself justified in enunciating this paradox: that man would not be a less perfect intellectual machine without consciousness than with it, and that Lewes is indignant at such an assertion:—

"To suppose that they pass from the psychical to the physical by frequent repetition would lead to the monstrous conclusion that when a real naturalist has, by laborious study, become so far acquainted with the specific marks of an animal or plant that he can recognise at a glance a particular species, or recognize from a single character the nature of the rest, the rapidity and certainty of this judgment proves it to be a mechanical, not a mental act. The intuition with which a mathematician sees the solution of a problem would then be a mechanical process, while the slow and bungling hesitation of the tyro in presence of the same problem would be a mental process: the perfection of the organism would thus result in its degradation to the level of a machine"—("The Physical Basis of Mind," p. 379, 1877).

I confess that in this I see no more a subject for indignation than in the fact that a musician, who has painfully learned the varied and delicate movements which he must execute, with a lively consciousness of each one during the period of learning, ends by playing the most difficult pieces without his movements, the mechanism of which is definitely organised, occupying his consciousness for a single moment; this is a necessary consequence of his progress and his "virtuosity," and without it he could never enjoy

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music nor afford pleasure to others by it. The same must hold good in relation to intellectual activity, and does so; in fact, *the conscious mental process betrays an imperfection of the cerebral organisation*, for it indicates, as Herbert Spencer has so well understood and expressed, the presence of a new, unusual activity, which deranges the equilibrium of the innate or previously-acquired automatism, and which does not find a preformed mechanism ready to discharge it. Active vibrations occur unconsciously until the moment when they meet central elements which resist their transmission, and then they become conscious; but if the same activity is repeated several times, if the resisting elements learn to transmit it without delay to other elements, the limit between the conscious and unconscious will *ipso facto* be displaced, thrown back: the conscious proceeds from the unconscious and returns to it; but consciousness does not thereby cease, it only goes elsewhere, and continues; as combinations of an inferior order escape from consciousness, combinations of a superior order occupy it. The reduction of the simpler psychical processes to automatism is the absolute condition of the mental development which would otherwise be impossible; a naturalist would never recognise a plant or an animal at the first glance, if he were obliged each time to have a vivid consciousness of each separate characteristic; the mathematician would not even conceive of the existence of the highest problems if he were obliged each time to have a clear consciousness of the multiplication table. It is thus with all our psychical acts. It follows, therefore, that the conscious mental process is the transitory phase of an inferior to a superior cerebral organisation; it expresses novelty, incertitude, hesitation, groping, astonishment, an imperfect association, an incomplete organisation, a want of promptitude and exactness in transmission, a loss of time in the production of reaction; it indicates that the nervous paths are not sufficiently cleared or distinctly enough traced to permit the stimulus to be transmitted without obstruction, whatever may be the final effect, reflex movements or reflex ideational sensations. It shows in short that physiology has not yet become morphology, and as soon as it does so it disappears. *But it does not disappear completely and absolutely*, it only disappears where the work of incarnation is finished, to proceed to some other region where this work has just begun; *for consciousness always and necessarily accompanies the clearing of the cerebral field, whilst it ignores the*

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rest unless there is some new combination to be formed. This is what has escaped Lewes and Maudsley, when the latter supposes that a man may be as good an intellectual machine without consciousness as with it, and when the former is indignant at the idea that the perfecting of the organ coincides with its degradation to the level of a machine. The reduction of the whole psychical activity to an unconscious automatism would be possible only if organic evolution had an unsurpassable limit, if all labour required to reach this limit had been completed, if nature had exhausted its resources and could no longer advance. But all our knowledge of the evolution of living beings tells us, on the contrary, that it has no limit. This is why the unconscious intellectual machine of Maudsley is just as impossible as Lewes's indignation is useless; for if the psychical processes which now are conscious become automatic to-morrow, far from losing all consciousness thereby, we should have a consciousness more vivid than ever, but its *contents* would be different; it would not abandon the psychical acts which it now accompanies and which seem to us very complex, until they had become simple to us, and in order to accompany more complex acts, more abstract ideations, acquisitions of a higher order. It would then accompany the formation of new intercentral communications in the cortical layers, the appearance of new layers on the convolutions, the elaboration of new convolutions in the hemispheres and perhaps the development of new cerebral organs. The race would then do what the individual now does, what in fact it has always done, but in another sphere of functions. The school-boy is conscious of the separate cyphers or the elementary operations which he must perform, but he has no idea of the higher mathematical problems; the student is no longer conscious of these elementary operations, they are accomplished instantaneously and automatically in his mind, but he is conscious of the more complex calculations and problems of arithmetic and algebra, which he is studying. He is ignorant, however, of the existence of the problems of higher mathematics, these are sealed books to him. Finally the mathematician executes, in the twinkling of an eye, unconsciously, the most complex calculations, manipulates formulæ as the pianist the keys of an instrument, and his consciousness is awakened only by the most difficult problems of higher mathematics; and according as the latter become familiar, habitual to him, according as he comprehends

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them easily and solves them rapidly, they occupy his consciousness less and less. It gradually abandons them, proceeding to their results, their consequences, their applications, to new combinations, to unknown questions—in other words, it manifests itself more and more *elsewhere*, where cerebro-psychical evolution trenches upon uncultivated regions, and the work of clearing begins, and there stakes out the roads of the future. It is conditional upon abandoning the simple, the acquired, that consciousness rises to the complex and goes forth to conquer the unknown.

Such is the cerebral or intellectual progress which has done so much in the past and which will do still more in the future, and which has no limits other than the evolutional plasticity possessed by a race or individual. Progress towards perfection necessarily stops when the conditions of further development no longer exist, but it necessarily continues where these conditions are found united. This is why, on the one hand, the animals considered as *inferior* by us, remain where they are; they have traversed the whole extent of the development compatible with their particular organisation, and the more simple the organo-psychical correspondence which they represent is, the more unintelligent and unconscious, *i.e.*, the more instinctive and automatic they are. This is why, on the other hand, of all the animals we call *superior*, man has been able to develope in such a surprising manner, that he has come to believe that he has nothing in common with them, and has thought himself justified in denying their relationship; they have exhausted the possibilities offered by their poorer organisation and are henceforth condemned to revolve in the circle of a more or less complete automatism, which he alone has been able to break and enlarge. And he has enlarged it so much that he has opened to himself an infinite horizon of new acquisitions more and more complex, where his conscious activity may exercise itself during endless periods without the risk of being reduced to a state of an intellectual automaton. Two conditions, however, might put an end to the proud *excelsior* of the human species; psychical progress must of necessity stop some day, either through an absolute boundary between the knowable and the unknowable, or through an equally absolute limit to the organic perfectibility of the human brain. In these two cases consciousness will, without doubt, finish by abandoning more and more the cerebral activity, which will gradually assume an instinctive, reflex, auto-

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matic, mechanical character. Notwithstanding the increasingly intense, forced, giddy and feverish work to which our race addicts itself, it is certain that long before this limit will be reached, the gradual cooling of our solar system will have put an end to the possibility of life on the surface of the globe. This prospect is not encouraging to the race, but it is not the less certain; to tell the truth, it affects us very little as individuals.

Shall we therefore say, *Après nous le déluge?* No, we will rather say, *Fais ce que dois, advienne que pourra!*

On Escapes, Liberty, Happiness, and "Unlocked Doors," as they affect Patients in Asylums. By J. A. CAMPBELL, M.D., F.R.S.E.

During the year ending 1883, I had rather an unusual number of escapes, and as two ended fatally from exposure, I thought it only fitting to glance over the escape-book and see the results of previous years. I may here mention that the two patients who died were dements, that one had been 17 years in Garland's Asylum, the other 15, that neither had shown a disposition to escape previously, that one died after two days' exposure, he having been found alive, and that the body of the other was found seven days after his escape; also that all means likely to be of avail in retaking these patients were made use of.

As I take it, our duty as medical officers of asylums stands in the following relations:—1st. To preserve, and to do all we can to lengthen the lives of our patients. 2nd. To promote recovery by all reasonable and legal means. 3rd. To do this in the most pleasant manner for our patients, and with the greatest regard for their comfort and happiness.

I am thoroughly aware that different opinions are held about the gravity or triviality of escapes. I have heard the views expressed that a good lot of escapes show a healthy state of an asylum, and that some people take too serious views about the loss of a patient by his own act or accident after his escape from the asylum. I think we must look at this from the point of view of the individual patient. We cannot afford, it is against the first tenets of our profession, to follow the example of nature in sacrificing the individual for the best interests of the race. We must not, we should not,

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