

PRINCIPLES
OF
HUMAN PHYSIOLOGY,

WITH THEIR CHIEF APPLICATIONS

TO

PSYCHOLOGY, PATHOLOGY, THERAPEUTICS, HYGIÈNE,
AND FORENSIC MEDICINE.

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and by which any irritation of the larynx is made to close the passage, so as to prevent the entrance of improper substances; whilst the superior laryngeal nerve also excites the muscles of expiration, so as to cause the violent ejection of a blast of air, by which the offending gas, fluid, or solid, may be carried-off. The effect of carbonic acid in causing spasmodic closure of the glottis, is well known; and affords a beautiful example of the protective office of this system of nerves. The mucous surface of the trachea and bronchi appears, from the experiments of Valentin, to be endowed with excitability, so that stimuli applied to it produce expiratory movements; and this evidently operates through the branches of the pneumogastric distributed upon the membrane. Here, as elsewhere, we find that a stimulus applied to the *surface* has a much more decided influence, than irritation of the *trunk* of the nerve supplying it.

305. The actions of *sighing*, *yawning*, *sobbing*, *laughing*, *coughing*, and *sneezing*, are nothing else than simple modifications of the ordinary movements of respiration, excited either by mental emotions, or by some stimulus originating in the respiratory organs themselves.—*Sighing* is nothing more than a very long-drawn inspiration, in which a larger quantity of air than usual is made to enter the lungs. This is continually taking place to a moderate degree; and we notice it particularly when the attention is relaxed, after having been fixed upon an object which has excited it strongly, and which has prevented our feeling the insufficiency of the ordinary movements of respiration. Hence this action is only occasionally connected with mental emotion.—*Yawning* is a still deeper inspiration, which is accompanied by a kind of spasmodic contraction of the muscles of the jaw, and also by a very great elevation of the ribs, in which the scapulae partake. The purely involuntary character of this movement is sometimes seen, in a remarkable manner, in cases of palsy; in which the patient cannot raise his shoulder by an effort of the will, but does so in the act of yawning. Nevertheless this act may be performed by the will, though not completely; and it is one that is particularly excited by an involuntary tendency to imitation, as every one must have experienced who has ever been in company with a set of yawners.—*Sobbing* is the consequence of a series of short convulsive contractions of the diaphragm; and it is usually accompanied by a closure of the glottis, so that no air really enters.—In *Hiccup*, the same convulsive respiratory movement occurs, and the glottis closes suddenly in the midst of it; the sound is occasioned by the impulse of the column of air in motion against the glottis.—In *Laughing*, a precisely reverse action takes place; the muscles of expiration are in convulsive movement, more or less violent, and send-out the breath in a series of jerks, the glottis being open. This sometimes goes-on, until the diaphragm is more arched, and the chest is more completely emptied of air, than it could be by an ordinary movement of expiration.—The act of *Crying*, though occasioned by a contrary emotion, is, so far as the respiration is concerned, very nearly the same as the last. Every one knows the effect of mixed emotions, in producing an expression of them which is “between a laugh and a cry.”—The greater part of the preceding movements seem to belong as much to the *consensual* or to the *emotional*, as to the *excito-motor* group of actions (§ 45); for whilst they are sometimes the result of peculiar states of the respiratory organs, or of the bodily system in general, they may also be called-forth by influences which operate directly through the senses, or which excite the emotions. Thus, whilst *Sighing* and *Yawning* often occur as simple results of deficient aeration, they may be brought-on,—the former by a depressed state of the feelings,—the latter by the mere sight of the act in another person. The actions of *Laughter* and *Crying* seem never to originate in the respiratory system; but to be always either expressions of the emotions, or simple results of sensations,—as when crying arises from the sense of pain,—and laughter from that of tickling. The origin of the act of *Hiccup* does not seem very clear; but the movement is probably of a purely-reflex nature.

accompanies most of them, it is not essential to them ; whilst those which are necessary to provide more *remotely* for its requirements, are for the most part committed to the guidance of his Reason. For the impressions which have been brought by the afferent nerves to his Sensorium, and which have there produced sensations, do not in general react at once upon the motor apparatus (as they do in those animals in which the Sensory Ganglia are the *highest* of the nervous centres), but usually transmit their influence upwards to the Cerebrum, through whose instrumentality they give rise to ideas and reasoning processes, which operate upon the motor apparatus either emotionally or volitionally. And it is for the most part only when this upward transmission is checked, either by the non-development or the functional inactivity of the Cerebrum, or by its complete occupation in some other train of action,—or, on the other hand, when the reflex action of the Sensory ganglia is called into play with unusual potency,—that we have any manifestations of the *sensori-motor* or *consensual* mode of operation in Man, that are at all comparable in variety or importance to those instinctive acts which are so remarkable in the lower animals (§ 459).

538. Still, sufficient evidence of the existence of this class of reflex movements may be drawn from observation of the actions of Man in his ordinary condition ; examples of it being furnished (as we have seen) by the closure of the eyes to a dazzling light, the start caused by a loud and unexpected sound, and the sneezing excited by sensory impressions on the Schneiderian membrane or on the Retina. To these may be added the vomiting produced by various sensory impressions, as the sight of a loathsome object, a disagreeable smell, a nauseous taste, or that peculiar feeling of want of support which gives rise to 'sea-sickness,' especially when combined with the sight of continually-shifting lines and surfaces, which itself in many individuals disposes to the same state ; the involuntary laughter which is excited by tickling, and also that which sometimes bursts-forth at the provocation of some sight or sound to which no ludicrous idea or emotion can be attached ; the yawning which is excited by an internal sensation of uneasiness (usually arising from deficient respiration), or by the sight or sound of the act as performed by another ; and those involuntary movements of the body and limbs, excited by uneasy sensations, (probably muscular) which are commonly designed as 'the fidgets.' When the reflex activity of the Sensory ganglia is more strongly excited, in consequence either of an unusual potency of the sensory impressions, or of an unusual excitability of this part of the nervous centres, a much greater variety of sensori-motor actions is witnessed. The powerful involuntary contraction of the orbicularis and of the muscles which roll the eyeball upwards and inwards, in cases of excessive irritability of the retina (§ 522), is one of the best examples of this kind ; but another very curious illustration is afforded by the involuntary abridgement of the excito-motor actions of respiration, when the performance of these is attended with pain,—the dependence of this abridgement upon the direct stimulus of sensation, rather than upon voluntary restraint, being obvious from the fact that it often presents itself on *one* side only, a limitation which the Will cannot imitate. Again, there are certain Convulsive disorders (Sect. 8) which appear to depend upon an undue excitability of these centres, the paroxysms being excited by impressions which act through the organs of sense, and are not thus operative unless the patient be conscious of them ; thus in Hydrophobia, we observe the immediate influence of the sight, sound or contact, of liquids, or of the slightest currents of air, in exciting muscular contractions ; and in many Hysterical subjects, the sight of a paroxysm in another individual is the most certain means of its induction in themselves. A remarkable case of this general exaltation of purely sensorial excitability has been recorded by Dr. Cowan ; who gives the following account of its phenomena, which can scarcely be referred to any other than this category. "The shadow of a bird crossing the window, though blind and bed-curtains are closed, the displacement of the smallest portion of the wick of a candle, the

we cannot raise or depress the larynx as a whole, nor move the thyroid cartilage upon the cricoid, nor separate or approximate the arytenoid cartilages, nor extend or relax the vocal ligaments, by simply *willing* to do so, however strongly. Yet we can readily do any or all these things, by an act of the Will exerted for a specific purpose. We conceive of a tone *to be* produced, and we *will* to produce it; a certain combination of the muscular actions of the larynx then takes place, in most exact accordance with one another; and the predetermined tone is the result. This anticipated or conceived sensation is the guide to the muscular movements, when as yet the utterance of the voice has not taken place; but whilst we are in the act of speaking or singing, the contractile actions are regulated by the present sensations derived from the sounds as they are produced.—It can scarcely but be admitted, then, that the Will does *not* directly govern the movements of the Larynx; but that these movements are immediately dependent upon some other agency.

548. Now what is true of the two preceding classes of actions, is equally true of all the rest of the so-called *voluntary* movements; for in each of them the power of the Will is really limited to the determination of the result; and the production of that result is entirely dependent upon the concurrence of a 'guiding sensation,' which is usually furnished by the very muscles that are called into action. It is obvious, therefore, that we have to seek for some intermediate agency, which *executes* the actions *determined* by the Will; and when the facts and probabilities already stated are duly considered, they tend strongly in favour of the idea, that even Voluntary movements are executed by the instrumentality of the Automatic apparatus, and that they differ only from the automatic or instinctive in the nature of the stimulus by which they are excited,—the determination of the Will here replacing, as the *exciting cause* of its action, the sensory impression which operates as such in the case of an instinctive movement, and which is still requisite for its guidance.

549. This view of the case derives a remarkable confirmation from the analysis of two classes of very familiar phenomena: the first consisting of cases in which movements that are ordinarily Automatic are performed by Voluntary determination, or simply in response to an Idea; the second consisting of those in which movements originally Voluntary come by habit to be Automatically performed.—Of the first class, the act of Coughing is a good example. This action, which is ordinarily automatic, may also be excited by a voluntary determination; such a determination, however, is directed to the *result*, rather than exercised in singling-out the different movements and then combining them in the necessary sequence; and the Will thus seems obviously to take the place of the laryngeal or tracheal irritation, as the *primum mobile* of the series, which, in its actual performance, is as automatic in the latter case as in the former. So, again, we know that many of the automatic movements which have been already referred-to as examples of the sensori-motor group (§ 538), and which the Will cannot call-forth, may be performed in response to *ideas* or *conceptions*, which are Cerebral states that seem to recall the same condition of the Sensorium as that which was originally excited by the Sensory impression. Thus it is well known that the act of Vomiting may be induced by the *remembrance* of some loathsome object or nauseous taste, which may have been excited by some act of 'suggestion;' and the author has known an instance in which a violent fit of sea-sickness was brought-on by the sight of a vessel tossed about at sea, which recalled the former experience of that state. So, the Hydrophobic paroxysm may be excited by the mention of the *name* of water, which of course calls up the idea; and a tendency to yawn is in like manner frequently induced by looking at a picture of yawners, or by speaking of the act, or by voluntarily commencing the act which may then be automatically completed.—The automatic performance of actions which were originally voluntary, has already been fully discussed (§ 540); and we have therefore only to remark here, that the fact very strongly supports the

science are based upon these fundamental intuitions of our nature, that they possess a firm hold upon our convictions as necessary truths.—“Closely connected with the Moral are the Religious intuitions of the soul; which are developed, more or less distinctly, amongst the earliest of our Human Sentiments, in that form of awe, veneration, and reverence, which is inspired by objects of sublimity, grandeur, vastness, and mystery.”—(Morell.) It is, by their appeal to these intuitive feelings of reverence, and to the Moral sentiment of goodness, that religious teachings make their first impression on the understanding, and lay the foundation for those more definite ideas of the Divine Being, towards which, in a higher phase of religious development, we direct our consciousness of dependence, and our desire of self-elevation; and which we invest intellectually with those attributes which represent our highest ideal of Power, Wisdom, and Goodness (§ 616)

609. The Moral and Religious intuitions are closely related to those forms of our *Emotional* sensibility, which, being no longer purely subjective, require as a condition of their existence that they shall relate to an external object. This is pre-eminently the case with all those which are termed ‘emotions of sympathy;’ thus, the perception of the pain or distress of another instinctively excites (except in individuals of a peculiarly unsympathetic temperament) a corresponding affection in the percipient mind, just as the sight of certain bodily movements (as yawning) tends to call forth the same movements in ourselves; and the opposite state of cheerfulness or mirth has a like tendency to affect those who are brought into contact with it, provided that there be nothing positively antagonistic in their own condition. But further, the perception of enjoyment calls-forth a respondent *gladness*; whilst the perception of suffering tends to excite in ourselves that feeling of sorrow which we term *pity*, and either of these feelings may be experienced, even when we do not ourselves share in the state of elevation or depression which excited them.—More closely connected with the foregoing than is commonly conceived, is that sense of the *humorous*, which attaches itself to certain manifestations of character presented to us in the actions of others; that *sympathy with Human nature* in which the former have their source, being the foundation of the latter also; and thus it happened that those writers who have the strongest power of exciting our sense of humour, are usually distinguished also by their mastery of the pathetic. To the sense of the humorous, that of the *ludicrous* is obviously related; but this, when excited by operations of the intellect, instead of by external objects, belongs to a different category (§ 619). The same may be said of the sense of *wonder*; which in its simplest form may be connected with our sense-perceptions, but which is more commonly experienced in regard to the ideas which they excite.—Another group of Emotional feelings belonging to the same category, is that which may receive the general designation of *Attractions* and *Repulsions*. These are the elementary states of those Emotions which involve a distinct *idea* of the object which attracts or repels, and which then assume the forms of *desires* and *aversions* (§ 619); but it is in this form that they seem to act in the lower animals and in young children, whose minds are not yet fully developed into the stage of ideational consciousness. The various terms *like* and *dislike*, *partiality* and *distaste*, *love* and *hatred*, which we use to signify the modes in which we ourselves feel affected by external objects, indicate the existence of this elementary form of emotional sensibility in connection with the perceptive consciousness.—There are other emotional states, some of them rising to the intensity of *passions*, which seem to belong to this category; but the examples already cited are sufficient to illustrate the doctrine here contended-for.

610. It is a characteristic peculiarity of all the modes of affection of the consciousness which have been now described, that, being the immediate experiences of the percipient mind, they cannot be expressed in language, or conveyed by any system of purposive signs to other minds; although the spontaneous expres-

709. In most forms of Monomania, however, there is more or less of disorder in the *Ideational* process, leading to the formation of positive *delusions* or *hallucinations*, that is to say, of fixed beliefs or 'dominant ideas,' which are palpably inconsistent with reality. These delusions are not attributable to original perversions of the reasoning process, but *arise out of* the perverted Emotional state. This gives-rise, in the first place, to a mis-interpretation of actual occurrences in accordance with the prevalent state of the feelings (§ 623); but when the disorder has lasted some time, ideas which have had their origin in the Imagination alone, and which it has at first presented under a very transient aspect, are habitually dwelt-upon in consequence of the interest with which they are invested, and at last become realities to the consciousness of the individual, simply because he has not brought them to the test of actual experience.¹ When the mind has

is merely the expression of the fact, that the consciousness of the performance of a certain act by one individual, gives-rise to a tendency to its performance by the other. Thus the excitement of the act of yawning by the sight or sound of it in another, is a simple phenomenon of *consensual* movement proceeding from an *exciting sensation*. And in like manner, the commission of suicide or homicide, after an occurrence of the same kind which has previously fixed itself strongly upon the attention, is an *ideo-motor* action, prompted by a *suggesting idea*. Thus, it is well known that after the suicide of Lord Castlereagh, a large number of persons destroyed themselves in a similar mode. Within a week after the "Pentonville Tragedy," in which a man cut the throats of his four children and then his own, there were two similar occurrences elsewhere. After the trial of Henriette Cornier for child-murder, which excited a considerable amount of public discussion on the question of homicidal insanity, Esquirol was consulted by numerous mothers, who were haunted by a propensity to destroy their offspring.—The following is a remarkable example of the *sudden* domination of a morbid impulse, to which no tendency seems to have been previously experienced, and which appears to have been altogether devoid of any emotional character. Dr. Oppenheim, of Hamburg, having received for dissection the body of a man who had committed suicide by cutting his throat, but who had done this in such a manner that his death did not take place until after an interval of great suffering, jokingly remarked to his attendant,—“If you have any fancy to cut your throat, don't do it in such a bungling way as this; a little more to the left here, and you will cut the carotid artery.” The individual to whom this dangerous advice was addressed, was a sober, steady man, with a family and a comfortable subsistence; he had never manifested the slightest tendency to suicide, and had no motive to commit it. Yet, strange to say, the sight of the corpse, and the observation made by Dr. O., suggested to his mind the idea of self-destruction; and this took such firm hold of him that he carried it into execution, fortunately, however, without duly profiting by the anatomical instructions he had received; for he did not cut the carotid, and recovered.

¹ The Author was led, several years since, to the formation of the view above enunciated with regard to the Emotional source of most if not all, the *delusions* of the Insane, by the careful observation of a case in which the gradual formation of such delusions could be traced, and in which the varying tenacity of their hold over the belief (which sometimes appeared disposed to get rid of them) corresponded exactly with varying degrees of intensity of the dominant emotion. Having been led, by his interest in this case, to make particular inquiries as to the point in question, among those whose experience of Insanity has been far more extensive than his own, he has obtained from them full confirmation of the view above expressed. Thus Dr. Skae remarks in the "Morningside Report" for 1853, that "nothing can be further from the truth than to believe that in every case of Insanity there must be some delusion, or some perturbation of the intellect. Of all the features of Insanity, *morbid impulses, emotions, and feelings*, and the *loss of control over them*, are the most essential and constant. Delusions, illusions, and hallucinations are, comparatively speaking, the accidental concomitants of the disease. The former, perhaps, invariably accompany the invasion of the disease; the latter are frequently only developed during its progress, and are sometimes never present at all."—It is not a little interesting, in this connexion, as well as in the additional relation which it indicates between Insanity and the various phases of Delirium, Dreaming, &c., that the *particular delusion* seems often to be suggested by accidental circumstances, the mind being previously under the influence of some morbid tendency which gave the *general direction* to the thoughts. Thus we find it mentioned in the "Morningside Report," for 1850, that the Queen's public visit to Scotland seemed to give a special direction to the ideas of several individuals who became insane at that period, the attack of insanity being itself in some instances traceable to the excitement induced by that event. One of the patients, who was affected with puerperal mania, believed that, in consequence of her confinement having taken place on such a

strange combinations, moreover, which they occasionally present, remarkably distinguish them from the more settled forms of the diseases which they simulate.¹ The clinical history of Hysteria, then, would lead us to suppose that the convulsive action depends rather upon some state of the blood which alters its relation to the nervous tissue as its exciting fluid, than upon any such change in the nutritive supply which it affords, as would induce a more permanent disorder in the system. Taking all the phenomena, however, into account, there seems much reason to think that a general excitability of the nervous system, such as is only an exaggeration of that which is characteristic of the female sex, is induced by some defect of Nutrition, comparatively permanent in its nature; whilst the particular forms of perverted action are determined either by some toxic agent in the blood, slight variations in which may give it a selective power for one part or another of the Nervous Centres, or by irritation of the peripheral nerves. Among the sources of imperfect nutrition, leading to undue excitability of the nervous system, and thus acting as a 'predisposing cause,' it seems probable that a gouty diathesis is one of the most frequent;² whilst among the 'exciting causes,' some irregular action of the sexual apparatus is among the most common, though it would not be correct to affirm, that disorder of the nutritive or secretory functions of the sexual system is essential to the production of the hysteric condition. The influence of Emotional states upon this condition (§ 710), is among the most remarkable features in the history of the disorder. There can be little doubt that habitual indulgence of the feelings, especially when these are of a painful kind, has a direct tendency to affect the nutrition of the nervous system; but

¹ Thus, the Author has known an obstinate case of Hysteric disorder, in which at one period attacks of the most complete Opisthotonos coexisted with perfect Coma; at another period, the Coma recurred alone; then, again, there was Trismus, lasting for five consecutive days, without any other spasmodic action or loss of sensibility; this sometimes alternated with fits of Yawning, in which the jaw was held open for half an hour together; at another period, the convulsions had more of the Epileptic character, the face being distorted, and the limbs agitated, concurrently with a state of Coma, but without laryngismus; with this alternated fits of Laryngismus, without insensibility, and occurring during the expiratory movement; whilst during the whole of this succession, there was Paralysis of the extensor muscles of both lower extremities, with paroxysms of the most violent and prolonged Cramp in one of them. The mental phenomena of this case were almost equally strange; for a state of almost Maniacal excitement often came-on suddenly, and ceased no less abruptly; and every form of Double Consciousness, from simple sleep-waking to an alternation of two very similar states of mental existence, presented itself during one long period of the disorder.—It is worth noting that in this case the exciting cause of the disorder lay in the disappointment of affections long cherished in secret; but the nutrition of the nervous system had been previously impaired by anxiety and excessive mental exertion. The first access of the disorder was kept-off by the influence of a very determined will; but when the malady had fully developed itself, it resisted every kind of treatment for four years. The catamenial discharge remained very scanty during the whole of that time, and was sometimes absent altogether; and the recurrence of the period was almost invariably marked by an aggravation of the spasmodic attacks, and frequently by pains resembling those of the first stage of labour. A slow and almost imperceptible improvement was taking-place, when circumstances occurred which gave a new turn to the feelings; a fresh attachment was formed, which was happily reciprocated; and from that time the cure rapidly advanced, the convulsive and paraplegic affections being speedily recovered-from, and nothing being left but dysmenorrhœa, which still continued to be occasionally accompanied by severe cramps, and sometimes by general convulsion, coma, &c. This was not altogether corrected, though improved, by marriage; and any emotional excitement of an unpleasant kind was sure to produce an additional aggravation. The state of the os uteri was then examined; and as it was found to be unduly contracted, cautious dilatation by sponge-tents was practised. This had the best results; the dysmenorrhœa soon abated; pregnancy supervened, and after a miscarriage (which seemed traceable to emotional excitement, coinciding with the monthly nîsus) a second pregnancy followed, which went-on to the full term; and no return of the spasmodic attacks has since occurred.—It is worthy of note that in this case there was an hereditary predisposition to Gout, which seemed once to manifest itself in a peculiar affection of the tissues about the wrist-joint, of a character rather gouty than rheumatic.

² See Dr. Laycock "On the Nervous Diseases of Women," pp. 161, et seq.