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Contributors

Warner, Francis, 1847-1926.
Doran, Alban H. G. 1849-1927
Royal College of Surgeons of England

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Visible Muscular conditions as Expressive of States of the Brain and Nerve-Centres

by

Francis Warner.

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VISIBLE MUSCULAR CONDITIONS AS EXPRESSIVE OF STATES OF THE BRAIN AND NERVE CENTRES.

BY FRANCIS WARNER, M.D. LOND., M.R.C.P.

Assistant Physician to the London Hospital, and to the East London Hospital for Children.

CHAPTER I.

COARSE or extensive paralyses, such as hemiplegia, paraplegia and other profound disturbances of the muscular system, have received much attention from clinical and pathological observers, and by the accumulation of their joint observations much knowledge has been gained as to the symptoms that result from lesion of certain portions of the brain. This should encourage us to observe in all cases the conditions of the muscles, knowing that the movements correspond to the states of certain nerve-centres, and looking upon such nerve-muscular conditions as indications or expressions of the states of those centres.

Epilepsies have been closely observed and accurately described, with the result of adding to our knowledge of brain conditions. Chorea, paralysis agitans, and the movements seen in athetosis, and disseminated sclerosis of the cord, were described as nerve-muscular conditions, and were empirically observed before their pathology was discovered. In these cases by studying the palsies, spasms, tremors, rhythmical and other forms of muscular action, we are enabled to gain some idea of the state of different portions of the brain and spinal cord. All expression of feeling is effected by muscular action, whether it be by words, by facial movement or gesture, move-

ments effected by voluntary muscles; or expression may be produced by dilatation of the pupil, erection of the hair, or disturbed action of the heart, these being due to the conditions of inorganic muscular fibres.

For these reasons I have been accustomed to look rather closely at the nerve-muscular condition of "nervous cases" when seeking definite signs by which to describe them, sure of the axiom (with certain exceptions, such as conditions of muscular irritability, and muscular disease) that movements depend upon nerve-muscular stimulus originating in nerve-centres.

Examples may easily be given showing how we commonly judge of the state of the nervous system by muscular conditions. Note the stooping attitude and spiritless gait of a tired man as compared with that of the same individual when rested and refreshed. Incipient intoxication is indicated by a reeling gait, unsteady hand, and muscular tremor. Expression may be indicated by the position of the head; it is seen firmly upright in defiance, drooping in shame; it is commonly held on one side in nervous women, and girls convalescent from chorea, the first example cited of an asymmetrical gesture. The artist's brush or pencil, the sculptor's modelling tool and chisel, the pianist's and violinist's finger-touch, indicate the training and actual condition of the working of his brain. The educated and refined singer trains and refines his whole mind, i.e. his brain, and is well aware that his "whole soul," as he may express it, comes out in the action of the muscles concerned in producing his song, and musical notes.

In the infant the condition of the nervous system is best recorded in terms of nerve-muscular phenomena. It laughs and is playful; reflex action is well marked when a finger is placed in the child's hand, or mouth. The eyes are moved and directed towards any object looked at; these are conditions of healthy action. It is well known that in the convulsive state the fists are often closed with the thumbs turned in.

All these examples of expression are nerve-muscular conditions; the movement, the attitude, the gait, result from states of the brain or spinal cord.

In the observations to be referred to, examples are chiefly

drawn from the ocular and facial muscles, and those of the upper extremity. Muscular movements in the eyeball are seen in the varying conditions of the pupil under the influence of light, and in the changes accompanying accommodation for near and distant vision.

In the iris we have a very sensitive and beautifully adjusted muscular mechanism, in connection with the third nerve of the brain and the sympathetic. The clinical study of this muscular organ and its indications were fully and carefully treated by Mr. Hutchinson in a paper in 'BRAIN,' Vol. I.

Movements produced by muscles outside the eye are seen in the act of directing the eyes in any given direction, these movements being so governed that the parallelism of the axes of the eyes is usually maintained; these co-ordinated movements being probably governed by some brain centre. In looking at objects about two inches from the face, these recti muscles outside the eyeball cause convergence of the axes of the eyeballs. To allow of such convergence, the simultaneous and equal contraction of the internal rectus muscle of each eye must be accompanied by the relaxation of the external recti; this complicated association of muscular conditions must be regulated by the nerve-centres. These movements are the normal.

We now pass on to consider departures from these normal conditions. I have shown that in deep anæsthesia from chloroform,[1] or in coma from alcoholism, or in the profound sleep of infants, the loss of associated movements of the eyes may be complete. If in an adult deeply under chloroform, the eyelids be gently raised, the pupils will be seen minutely contracted, often to a pin-point, the eyes having at the same time lost the parallelism of their axes. One eye may move upwards or outwards while the other remains quiet, or moves in a different direction, or at a different pace, thus causing a temporary and varying strabismus. Usually these movements are confined to the horizontal plane, less commonly the eyes assume a different level, one being in the horizontal plane, while the other is turned downwards. It is noteworthy that the average continuance of the eyes in the horizontal plane of

[1] See paper, 'Brit. Med. Journal,' March 10th, 1877.

the axes of the orbits, is in accordance with other examples of involuntary movements of the eyes, to be presently noted, e.g. nystagmus, and irregular jerking movements of the eyeballs. These movements I have frequently observed in the healthy subject, and seen that though they occurred thus irregularly while in coma, the action of the pupils and the co-ordination of the eye-movements were completely restored on recovering consciousness. In the profound sleep of an infant in its mother's arms the same loss of association of movements occurs, but at the moment of waking the pupils dilate, and co-ordination of movements is restored; the child must be profoundly asleep to allow of the eyelids being raised without awaking it.

Case I.—At the Children's Hospital, Birmingham, in 1876, I saw a girl three years of age the subject of permanent hemiplegic paralysis, following convulsions in infancy. She had never spoken, was constantly dribbling, and idiotic in manner. There was an occasional loss of the parallelism of the eyes; one would remain at rest, while the other wandered inwards or outwards; this was a chronic condition in the child, who was suffering from no acute disease. The symptom appeared due to the defective condition of the brain.

Case II.—Through the kindness of my friend Dr. Fletcher Beach, I had the opportunity in 1877 of seeing in the Clapton Asylum a microcephalic idiot of very low development, in whom the eyes almost habitually wandered about independently of one another.

In very weakly infants, not the known subjects of brain disease, the loss of associated movements may be very distinctly seen at times while awake and sucking at a bottle. In cases of meningitis, and other conditions of coarse brain disease, the same condition is sometimes seen.

Lastly, it is interesting to call to mind that in many of the lower animals there is the power of moving either eye separately and independently, so that that centre which co-ordinates the movements of the two eyes may be looked upon as a "later centre," i.e. one more recently developed in the ascent of Man. Probably some interesting and important points concerning the movements of the eyes might be

elucidated by considering them in connection with those of the lower vertebrata.

Nystagmus is a condition producing a rapid oscillation of the eyeballs; usually the parallelism of the axes of the eyes is maintained, and the movements are in most cases in the horizontal plane of the axes of the orbits. Occasionally the movements are vertical, as in the cases of two brothers with retinitis pigmentosa, frequently seen in the clinique at Moorfields about 1870.

These cases of vertical nystagmus are uncommon, so also I believe, it is unusual to have one eye only thus affected.

Case III.—Emily B., aged 4 years, was sister to an infant under my care at the East London Children's Hospital for congenital syphilis. When seen, nystagmus of the right eye was at once observed. There was inconstant vertical oscillation of the right eyeball, without any lateral movement; the movement was seen when the child looked at distant objects, not when looking at near objects; there was no nystagmus of the left eye. The pupils were equal; there was no strabismus. The normal movement of the eyes could be performed, together with the natural convergence for near vision. Ophthalmoscopic examination was impossible, on account of photophobia. There was good vision in both eyes; the child was intelligent.

Case IV.—In an infant which I had the opportunity of seeing at the London Hospital while she was under the care of Mr. Hutchinson, there was congenital nystagmus of both eyes; the rapidity of movement in the two eyes varied greatly, but it was impossible to count the oscillations. This would appear to indicate that the nerve-centres ruling either eye and regulating the tension of one rectus muscle when its opponent is relaxed, act more independently than in the normally developed brain, i.e. the centre whose office it is to co-ordinate the associated movements of the two eyeballs is feeble or absent in such a case, as it appears absent in some idiots, and paralysed (in healthy brains) in deep coma.

Case V.—William D. was the subject of right hemiplegia and presented syphilitic lesions in the soft palate, pharynx and bones, and there was atrophy of the right half of the tongue. There was no strabismus, and he could move the eyes in

any direction; when the eyes were directed in an extreme degree to either side horizontal oscillatory movements resulted, the lateral jerks reminding one of the more rapid oscillations of nystagmus, but these movements only occurred when the eyes were directed towards the right or left hand; no such oscillations resulted on looking upwards or downwards. Another noteworthy phenomenon concerning the muscles of the eyes is the fact of convergence for near vision: an additional example of movements in the horizontal plane of the axis of the orbits. This movement is well seen in a healthy individual by causing him to look at a distant object and observing the size of his pupils and the parallelism of his eyes, then causing him to look at his nose the eyes are seen to converge, directing their axes towards the object, at the same time the pupils contract.

Case VI.—Mr. Priestley Smith, in the Ophthalmic Hospital Reports, vol. viii. part ii., narrates the case of a lad in whom the lateral movements of the eyes were impaired. "Both eyes were fixedly turned towards the patient's right. The deviation, measured by prisms, equalled twenty degrees in each when looking at a distance. The head was kept turned towards the left to counteract the position of the eyes. An object was moved from right to left, and left to right in front of the patient. Neither eye could follow it to the smallest extent towards the left, but both, on the contrary, were capable of a very slight additional turning towards the right. This they performed, however, in a jerking manner, and at once returned to their former position. An object was then held at ten feet distance and rather towards the patient's right, so that his eyes could be fixed on it, and it was then made to approach his face. Both eyes steadily converged so as to remain fixed on the object until it was only five inches from the face. This involved a remarkable phenomenon, viz. the right eye, which had before refused to move before the left, now made a considerable excursion (about fifteen degrees) in that direction." In this highly interesting case collateral deviation of the eyes was marked, the power of convergence for near objects being retained.

Ferrier has shown[1] that there exists in the convolutions of

[1] 'Functions of the Brain,' p. 229.

the frontal region a brain centre, which when excited causes both eyes to turn away from the side excited; if on the contrary this centre be destroyed instead of excited, the corresponding centre in the other half of the brain, acting unopposed, turns both eyes towards the side of lesion. Such a lateral deviation of the eyes, parallelism of their axes being maintained, is a common condition in cases of hemispasm and in recent hemiplegia.

In health the greater number of ordinary movements of the eyes are probably in the horizontal plane of the axes of the orbits. Thus the movements of accommodation for near vision are in this plane, in nystagmus the oscillations are usually so, also the jerking movements in the Case V., and the involuntary movements with loss of parallelism seen in coma, are mostly horizontal. The facts point to the horizontal movements as the commonest, the least voluntary, and probably the least intellectual. The horizontal movements of the eyeballs do not involve movements of the eyelids by muscular action, i.e. the horizontal movements of the eyeballs do not cause simultaneous movements of the muscles of the eyelids, therefore I think horizontal movements the least intellectual. To turn to vertical movements of the eyes. Dr. Gowers has shown[1] that the movements of the lower eyelid constitute a simpler problem than those of the upper lid. The lower lid follows the movements of the eyeball upwards and downwards, but not very closely. No muscular mechanism exists which can cause the downward movements of the lower lid; such movement is produced by the movement of the eyeball acting mechanically upon the lower lid. The upper lid possesses a more complex mechanism. The descent of the lower lid on downward rotation of the globe is not due to the contraction of the orbicularis. Simultaneous with the descent of the upper lid in the downward movement of the eyeball, there must be a relaxation of the levator. In upward rotation of the eyeball, contraction of the levator is associated with that of the superior rectus. The association of the levator and superior rectus suggests that both are relaxed, or energised, in similar degree when the eyeball is moved upwards or downwards; in

[1] 'Med. Chir. Trans.' vols. i. and ii.

accordance with the law, which it is evident must obtain in all muscular actions, that the opponents of the muscles producing the movement are relaxed in exact proportion to the degree of movement produced. Thus in the upward vertical movements of the eyeballs, a more complex movement and especial muscles come into play.

Contrasting the horizontal with the vertical movements, we see that the former involve only movements of the recti muscles. Of movements of the eyeball in the vertical plane those in the downward direction involve contraction of the inferior rectus only, but at the same time the levator must be relaxed; this co-existent relaxation of the levator and contraction of the inferior rectus suggest that the downward movements are more intellectual than the horizontal. In upward movements the levator contracts synergically with the superior rectus, and the co-existent activity of the two muscles points to these as probably the most intellectual of all. This is again another point as to which it would be exceedingly interesting to know the teachings of comparative anatomy to see whether this power of upward turning of the eyeball, with elevation of the upper lid, be not a later developed power.

From direct observation it appears to me that intellectuality is represented by the movements of the eyeballs in their orbits. When an individual in looking at an object moves the eyes by the action of the recti muscles so as to direct them towards it, the movement is more intellectual than when the head is turned so as to direct the eyes in the required direction. A bright, healthy well-developed infant turns its eyes well in the orbits in looking about, not so a dull wasted child.

Again, intellectual people usually move the eyes in their orbits in looking at any object; the low and vulgar often move the head in the direction required. Here again is a question as to the meaning of which comparative anatomy might give some light.

In chorea we frequently see that although the eyes never lose their parallelism, they are often jerked about in a perfectly involuntary manner, and clearly without the patient desiring to look at the successive objects towards which the eyes are turned. It would appear that the brain-centre which governs

the co-ordinated movements of the eyes is never paralysed in chorea as in conditions of coma, but that it may be "choreic"; this centre then may be temporarily paralysed in healthy infants, or in healthy adults by chloroform; it may be absent in idiots; in weakly infants the slight disturbance of sucking (cerebral anæmia?) may paralyse for the time this centre; this centre is absent in many lower vertebrata.

In making observations on these associated movements of the eyes we are strongly reminded of Ferrier's experiments[1] on excitation of different portions of the cerebellum. I quote a few results. "Both eyes turn to the left or right in a horizontal plane"; "both eyes move straight downwards"; "both eyes move upwards and to the left"; "both eyes move upwards," &c. These results of experiments suggest that possibly it is the condition of these cerebellar centres that leads to the eye movements described and referred to.

We now come to the study of visible conditions of the facial muscles in expression of the state of the nerve-centres.

The method I have used in analysing the muscular condition of faces is as follows:—holding a piece of paper with one edge vertical, either half of the face is covered in turn, it is thus seen whether the face is symmetrical. Again, the face may be divided into three zones by holding the paper with one margin horizontal, leaving the forehead above the eyebrows uncovered; or the face below the lower margin of the orbit may alone be exposed, showing the mouth, most of the cheeks, and the alæ nasi; or again, the middle zone including the eyelids may be viewed alone.

Most of the more definite forms of expression by muscular action are symmetrical, and the face is no exception to this rule. Asymmetry of the face is not met with in many instances. It is seen in facial palsy, whether from disease of the portio dura of the seventh nerve, or from brain disease; it is also seen in the expression called sneering when a one-sided muscular action partially uncovers the canine tooth; and in winking. Occasionally in very nervous people a one-sided grimace may be seen. Other cases of asymmetry of the face may be seen, but are rare.

[1] Op. cit. p. 98.

Before proceeding to describe symmetrical conditions of the face illustrative of the subject under consideration, it may be well to consider what we see when we look at a face.

1. There is its *form*, outline, and the relative position of parts.

2. *Colour*, a condition of the surface which may be in part due to pigmentation of the skin and other conditions, as well as to the state of its circulation.

3. *Movement* of the parts of the face from tone, action, or relaxation of the muscles. It is with these conditions of the muscles that we are principally occupied.

Certain commonly marked lines in the face exist as the result of the puckerings produced by muscular action. In the frontal zone horizontal lines are produced by the action of the occipito-frontalis, and vertical lines are produced by the action of the corrugators. In the middle zone the most pronounced lines are the naso-labial grooves; we also specially here observe the lines of the upper and lower lips, and the positions of the angles of the mouth. The mouth may be widened, or one or both angles may be drawn upwards and outwards or downwards.

The attempt has been made to determine something of the intellectuality of the different facial muscles. The problem was commenced on the negative side by observing the conditions of the face in fifteen idiots. In conjunction with Dr. Fletcher Beach, of Darenth Asylum, I analysed each face according to the following form :—

General muscular condition	The action, or relaxation, of the muscles of the limbs and body generally, were noted.
Face	Facial aspect, and muscles in action or relaxation.
Upper zone	Frontal region, occipito-frontalis and corrugator.
Middle zone	Eyelids and orbicularis oculi.
Lower zone	Mouth muscles; muscles of nose; cheeks.

Summarising from such forms the muscles most often seen in meaningless action, the following results are obtained :—

Occipito-frontalis	11	Depressor anguli oris	5
Zygomas	8	Orbicularis oculi	3
Corrugator supercilii	7	Grief-muscle	2

With regard to the teaching of these figures, so far as these few cases go, it shows the frequency with which these muscles

respectively come into spontaneous action in a meaningless manner. This is perhaps some indication of the degree of their intellectual representation. Thus the grief-muscle and orbicularis oculi were much less frequently thrown into meaningless action than the occipito-frontalis and zygomatic, and probably these former are much more expressive of intellectuality than these latter.

In the above table the number 7 is put against the Corrugator; but this I think needs explanation; for from direct observation in healthy intellectual faces, I think that this muscle is one of the most intellectual. If, instead of putting one against the name of a muscle as it may be seen frequently in an action in a particular face, we put one or one half, according as its action is marked or only slightly indicated, on summarising these numbers we get for the occipito-frontalis 10·5, for the corrugator 5·0. This result indicates the slight action of the corrugators in the faces of idiots as compared with the occipito-frontalis.

Again, applying direct observation to the other side of the question, and noting which muscles are most frequently put in action in the faces of intellectual people in the expression of their mental states, I think that we see intellectuality most commonly expressed in the frontal and middle zones, and by the action of the corrugator and orbicularis oculi muscles.

Among out-patients it has frequently been possible from the muscular condition of the frontal region (principally increased tone or contraction of the corrugators), and depression of the angles of the mouth (dep. ang. oris) to accept the facial appearance as a physical sign of the "mental state" of intellectual suffering, and physical or organic suffering. On inquiry in such marked cases some painful condition and some source of anxiety or mental distress has almost invariably been found.

Much has been said[1] at various times about facial expression. I will not add thereto, but suggest that to describe such expressions in anatomical terms is a matter of physiological importance, as giving more exact indications of the nerve-centres.

[1] See Darwin on Expression of the Emotions; Bell on the Face; Camper, 1780; Bulwer, 1649.

Taking the face as a clinical region of observation, special points sometimes observable in the different zones may be described. When specially studying the faces of patients, the subjects of recurrent headaches,[1] and analysing them daily, my attention was particularly drawn to the middle zone.

It is not uncommon to observe that an individual "looks as if he had an headache." Analysing such faces, it soon became noticeable that there was a look of depression, heaviness, fulness about the eyes, especially about the under eyelid. It appeared that this expression must be due principally to the condition of the orbicularis palpebrarum. There was obviously no pitting on pressure, no œdema, and when the face is œdematous this relaxed look is not seen. Specially observing the orbicular muscle and the parts adjacent, there seemed to be a loss of tone in it; there was an appearance of fulness and flabbiness; the skin hung too loosely, with an increase in the number of folds; and, in place of falling against the lower eyelid neatly, as a convex surface, it fell more or less in a plane from the ciliary margin to the lower margin of the orbit. This condition is often seen best by looking at the patient's face in profile. It was often seen when the skin was healthy and elastic; and that it is due to the muscle seems demonstrated by the change produced if the patient can be induced to laugh, when the muscle is energised, recovers its tone, tucks in the skin well against the eyeball, and the expression of headache is lost for a time. It is not suggested that this muscular condition indicates only the states producing headache; it appears common in other states of depression.

It may be remarked that the eyeball is probably almost entirely lacking in expression. If a man wear a mask, showing the eyes only, there is no certain expression. It is the custom in some parts of Italy for men to beg in silence, wearing a loose garb, and hood covering the face, with holes showing the eyeballs only, and the absence of expression is marked.

Doubtless in rage we have the dilated pupil, and it contracts with accommodation for near vision; and the iris may also have a characteristic pigmentation; but, speaking generally, the eyeball almost lacks expression, and the special appear-

[1] 'Brain,' Part XI.; and Brit. Med. Journal, Dec. 6, 1879.

ances observed about the eye are due to conditions of the eyelids and the muscles which move them (the orbicularis and levator palpebræ), and in some degree to the muscles which move the eyeballs.

The orbicularis oculi is not solely supplied by the facial nerve, but has also some supply of nerves from the sympathetic.

It is likewise one of the muscles not greatly paralysed by facial palsy due to brain disease. Indeed in Bell's paralysis the eye can generally be closed.

Case VII.—In a case of congenital Bell's paralysis,[1] from ear disease, in an infant, accompanying hemiplegia on the opposite side, the eyelids on the side of paralysis were closed when the face was blown on. This muscle is much less paralysed than the zygomatic in cerebral facial palsy.

In the lower zone are many points of interests to be noted. With regard to the depression of the angles of the mouth in feelings of sorrow, I have frequently observed that when a mother has just lost her child there is a marked depression as from physical suffering.

Case VIII.—In the case of a mother speaking to me of the loss of her children four years previously, there was no depression of the angles of the mouth, but contraction of the corrugators; this would seem to point to the passing away in the course of years of the expression of mere physical suffering from the loss of her children, and the more permanent expression of intellectual suffering from the bereavement.

Case IX.—A woman came to see me as an out-patient, ill with the effects of distress at the loss of a son, aged 21 years, and married only three months. He had died of small-pox a month previously. Her aspect was emotional, she flushed much, and there was marked expression of distress, indicated principally in the frontal region by action of the corrugators, and slight contraction of the inner portion of the occipito-frontalis. The angles of the mouth were not depressed. The face appeared to indicate mental distress and anxiety rather than bodily suffering.

The compressores alæ nasi under ordinary circumstances and in dyspnœa act rhythmically, and synchronously with the

[1] 'Brain,' Part VIII.

respiratory movements, under the guidance of the respiratory centre. In slowly advancing death the alæ nasi may become paralysed, and so collapse on inspiration. Again, in chorea these muscles are often distinctly choreic, being jerked with the other facial muscles, thus seeming to indicate that they receive the choreic impulse from the facial centre, not from the respiratory, as they do not jerk synchronously with the other respiratory muscles.

Among asymmetrical conditions of the face the most marked are due to paralysis. Facial paralysis occurs from two principal causes—(1) lesion of the facial nerve; and (2) lesion of one side of the brain, attended with paralysis of the upper and lower extremity, and of the face on the opposite side. In the case of facial palsy due to brain disease, the muscles about the angle of the mouth are principally weakened. This is illustrated by the photograph of a man the subject of left hemiplegia. If either vertical half of the face be covered, it is evident we have an asymmetrical condition. If then we cover each zone in succession, and again look at each zone separately, we find the asymmetry is in the lower zone about the mouth; it consists in a falling of the left angle of the mouth from weakness of the muscles, which expand the mouth and draw its angle upwards and outwards.

This may be compared with a photograph of a case of Bell's paralysis on the right side, in which all the facial zones are affected in an asymmetrical manner, the muscles all being weakened on the same side.

In connection with the fact that brain disease causing one-sided facial paralysis affects the muscles about the angle of the mouth the most, we are reminded that the zygomatics are among the most frequently active muscles in the movements of the faces of idiots, as recorded in the table. These muscles are also sometimes seen acting very asymmetrically in very nervous people. A very moderate amount of brain disturbance appears to cause irregular action or weakening of these muscles.

Again we are reminded of Ferrier's[1] experiments. I quote the results of the excitation of points in the ascending frontal convolution: "(7) action of the zygomatics, by which the

[1] Op. cit. p. 143.

angle of the mouth is retracted and elevated." (8) "Elevation of the ala of the nose and upper lip, with depression of the lower lip, so as to expose the canine tooth on the opposite side."

Some points in favour of the clinical study of nerve-muscular conditions of the face are illustrated by the passive, expressionless face which may be woke up, "lighted up," be made to express "the whole soul in the face" simply by conditions of tension of the facial muscles resulting from the mental state. Thus often great and most pleasing beauty is seen in faces unattractive when at rest. Conversely some faces are beautiful in their passive condition, but lack expression and interest when in action from mental work; such women talk but little. Surely from these two considerations it is suggested that the passive form and colour of a face are qualities not as great, not as much mind-indicating, as the mobile expressions produced by muscular tension.

Possibly we may for a moment be allowed to step out of our groove and see how education, and thoughts and habits of thought, and feeling, implanted in the individual can and do produce an effect on the individual's higher nerve-centres, for certainly direct observation shows that these principles, these forces or modes of force, alter the facial expression.

Other conditions of the face expressing emotion have been described and illustrated by Darwin. If these expressions be due to muscular action, they must be due to the condition of the nerve-centres; and it is as indicating their conditions that they are of special interest in the pursuit of our special subject. The physiologist and practical physician are principally concerned with the human body as it now exists, and to them it is not a case of the emotion (feeling), causing expression, or the mind showing itself in the face, but rather a condition of the muscles of the face caused by the condition of nerve-centres, and indicating this condition.

Now, passing on to observations of the muscles of the upper extremity. Probably the most expressive muscles are those which move the fingers, i.e. those which produce the finer movements. These finer movements appear more to represent the brain conditions than do the coarser movements, e.g. those of the shoulder or elbow.

It is of course in the free or disengaged hand that we must look for examples illustrating the condition of the brain which governs it. If the muscles be employed in some definite act, such as holding an object, or in an act of manipulation such as sewing, then the movements are directed to accomplish the aim attempted, and are not simply indicative of the condition of the brain, as may be the case with the free hand when unconsciously expressing the mental condition by gesticulation. When, on the contrary, the hands are left free and disengaged, as the hand of the orator which unconsciously expresses by its position or movement the general mental state of the speaker, we have in this muscular movement an expression of the man's mind. It is as reasonable to look for the state of the mind to be expressed in the position and action of the hand engaged in definite voluntary, purposive acts, as to look in the face when the sun is shining full in the eyes, or the lips are engaged in eating, or moved with the other movements of dyspnœa. Still it is true that in either case the manner of performing the act may be indicative of the mental state, but the muscles of the face or hand are not engaged in expressing the mental state.

In Art at the present day we but seldom see the hands represented as disengaged; usually they are painted or sculptured holding some object, or resting on some part of the figure; such are hands engaged or resting from labour, or performing some act of toil, not engaged in expressing the action of the mind.[1]

I have spoken of the finer movements of the hand as the most expressive of the condition of the brain. Movements are spoken of as coarse when performed by large muscles, e.g. movements of the shoulder and hip-joint are coarser than those of the wrist and ankle. Fine movements are performed by smaller muscles, and are confined to small arcs, e.g. slight movements of the fingers; the smaller the arc through which the finger moves, the finer is its movement said to be.

The finer movements of the hand have been spoken of as most expressive of the condition of the brain; some reasons

[1] Examples of the disengaged hand are seen in the statues of Cain in the Pitti, Florence; the Venus de Medici; and the Diana, British Museum.

for this statement may now be given. 1. In hemiplegia from brain disease the finger movements are most damaged, and the latest to recover. 2. Finger movements are much more damaged by brain disease than by spinal disease.

It may be convenient to commence this study by the consideration of four principal positions of the hand, due to, and representative of the condition of nerve-centres. These may be easily described, and perhaps will be useful in describing conditions of departure therefrom.

In a former paper on "Recurrent Headaches in Children" I described the position of the "nervous hand."[1]

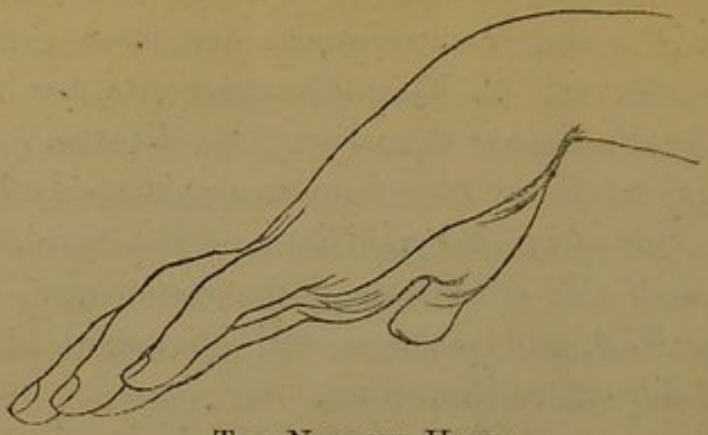
When a very nervous child, or one convalescent from chorea, holds out its hands in front, on a level with the shoulder, and with the fingers spread out, we commonly see this nervous hand. As the palms are turned down, the wrist droops slightly. The metacarpo-phalangeal joints are moderately extended, the first and second internodes being either flexed or kept straight. The thumb is simply extended backwards, and somewhat abducted from the fingers. This position is also maintained when the palms are turned upwards. In such cases there is very commonly finger-twitching, of which notice will be taken further on.

With regard to indications of states of the nerve-centres by states of the muscles, there appears to be evidence[2] that in opposite states of the nerve-centres the respective conditions of the muscles are in direct antithesis. Probably also the converse is true, that opposite conditions of the muscles indicate opposite conditions of the nerve-centres. Let us look at the antithesis of the "nervous hand." In applying this principle of antithesis, we must reverse each relative position of the phalanges and joints.

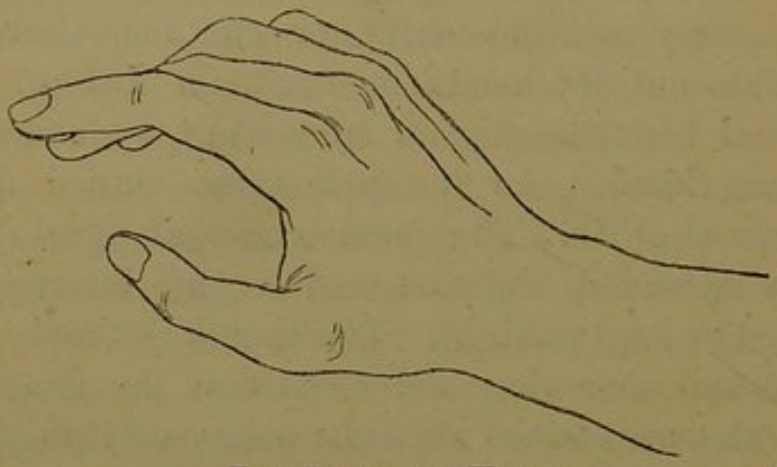
	The Nervous Hand.	*versus*	The Energetic Hand.
Wrist	flexed		extended.
Metacarpo-phalangeals	extended		flexed.
1st internodes	flexed		extended.
2nd internodes	flexed or ortho-extended		extended.
Thumb, metacarpo-phalangeal	extended.		flexed.
„ 1st internode	extended.		flexed.
Phalanges, relative position	slight abduction		abducted.

[1] 'Brain,' October 1880.

[2] See Darwin.



THE NERVOUS HAND.



THE ENERGETIC HAND.

THE HAND AT REST.

THE STRAIGHT HAND.

NOTE.—The hand should be represented as perfectly straight with the forearm.

Now we may inquire if this antithesis of the nervous hand be indicative of a condition of the nerve-centres the opposite of the "nervous condition." This position is represented in the Diana in the British Museum, and well corresponds with the general forcible attitude of the figure. In one point, however, this hand of the Diana differs from the exact antithesis of the nervous hand, in that the first and second internodes are flexed. The forcible character of this position of a free or disengaged hand is well seen in contrast with the nervous hand of the adjacent Venus; and it was in comparing these that I saw the one to be the antithesis of the other.

This energetic or powerful hand is probably in life seen only under certain mental conditions, or, as it is preferable to say, in certain conditions of the brain producing what we call mental states, such states of the mind giving energy and the feeling of strength. I do not know that it is to be seen as the result of any pathological condition of the brain. It is, I think, seen in forcible expressions of feeling; and in astonishment, as expressing which it is figured by Darwin.

The most natural position of the hand is doubtless that of rest, and here analysis shows all the joints in the position of flexion. The hand may be seen in perfect rest during sleep, or when the man is resting, engaged in quiet unexciting conversation. The following is the analysis:—

	The Hand in Rest.	*versus*	Hand in Fright.
Wrist	flexed		extended.
Metacarpo-phalangeals	flexed		ortho-extended.
1st internodes	flexed		ortho-extended.
2nd internodes	flexed		ortho-extended.
Thumb, metacarpo-phalangeal	flexed		ortho-extended.
„ 1st internode	flexed		extended.
Phalanges, relative position	abducted		abducted.

This analysis represents a hand in complete flexion and its antithesis a hand in general extension or ortho-extension. The term ortho-extension is used to imply that the joint is so far extended as to place both the bones constituting the joint in the same straight line. If extension be full or complete, the bones form an obtuse angle with one another.

CHAPTER II.

Some characteristic passive positions of the hand were described in the last chapter as types; one other position must now be referred to—the "ortho-extended hand." Here the axis of the metacarpal bones and of the digits are in the same plane with the bones of the forearm. This is the position in which a strong man naturally holds out his hand when requested to put it forward. This may be considered as the antithesis of the "hand at rest." It was seen in Case V. *a*, presently to be described, in the left hand, when he held out his hands, while the right (paralysed) hand assumed the "nervous position."

A healthy child when it runs in its play, or to meet a friend, commonly holds out its arms, the hands assuming the "energetic position"; and this, as the result of observation, is I think characteristic of a healthy nerve-muscular condition; healthful children in pictures by the best masters are often thus represented. When a child is in the state of convulsion, it is well known that usually the hand is closed with the thumb turned in upon the palm, the fingers being flexed around it. Such a position of the hand in a child when ill is very indicative of a state of the nervous system predisposed to convulsions.

Case X.—A child two years of age was admitted into Buxton Ward at the London Hospital, having had strong convulsions the day before. The child looked very ill, its eyes were sunken, the body generally was rigid. The position of both hands was alike; the wrist was slightly extended, the bones of the thumb ortho-extended, or slightly more extended

from the force with which its tip pressed against the last node of the index-finger. The metacarpo-phalangeal joints of the index and middle fingers slightly and equally flexed, the internodes remaining ortho-extended. The ring-finger rather more flexed than the middle one, separated from it, and the nodes slightly flexed. The little finger was in contact with the ring-finger, and assumed a similar position. I took a cast of the right hand, and the description at the same time. In a piece of sculpture exhibited at the Royal Academy two years ago a child's hands were represented so nearly in this character as to be very suggestive that the child was going off into fits.

The following cases may help to illustrate the advantage of studying common positions of the hand, that we may be able to detect others characteristic of weakness or disease.

Case V. *a.*—The notes of William D. have been already partially given; I now have to speak of the condition of his upper extremities. It has been said that he had been attacked with right hemiplegia; after a few months' treatment the condition of the arm improved, and the grasp of the hand became fairly good. In holding out both hands the left was straight with the forearm (ortho-extended), and the thumb straight with the fingers. In the right hand the wrist drooped a little, with slight extension of the metacarpo-phalangeal joints, and the thumb was extended—the nervous hand. There were some irregular and involuntary finger movements; these were chiefly flexor-extensor, occasionally slight abductor-adductor movements intervened, separating the digits. The muscular sense of this extremity was more interfered with than its muscular power.

Hemiplegia: involuntary movements of arm and face.

Case XI.—Arthur T., aged 10 years, came under my observation, May 1880, as the subject of a chronic left hemiplegic affection. His general health had been good, and the only probable cause of brain disease was found in the fact that his father is syphilitic. His left upper extremity was wanting in

muscular voluntary power and in muscular sense; certain involuntary movements of the hands and of the fingers were also observed. I now collect the notes describing the nerve-muscular condition of the hand. The left hand, when held out, assumed on the average the "nervous position"; not so the right, which was natural. A certain amount of involuntary movement of the fingers was seen; the middle finger moved the most; during the examination, and at other times when his fingers were curling up against his will, he would frequently use the right hand to straighten the fingers of the left. As to the kind of movement, it certainly was not voluntary, and on several occasions a similar movement was seen repeated. The dynamometer showed the power of the right hand as 47, against 36·5 on the left side.

I had often noticed that the boy looked much distressed when I examined the left arm, and this appeared not surprising considering that, with good bodily health, he was losing the use of the left arm, and at the same time there was family trouble from the father being out of work. Looking at the lad's face, one observed distinct over-muscular action in the upper zone, causing in the middle of the forehead transverse and vertical furrows, an appearance commonly resulting from the condition of brain associated with grief. For a long time I was deceived by this face, and thought the boy depressed, but later, on cross-questioning him, and inquiring of his mother, he appeared not only unconscious of these movements, but not to feel any mental distress. I was therefore compelled to regard the facial movements, which were suggestive of the expression of distress, as analogous to those of the fingers, which more resemble athetosis than any other phase of involuntary movement. The movements of the fingers were slow, involuntary, and unconscious; no child in chorea puts up his hand to straighten out the fingers which have curled up on the other hand. There were no general twitching movements, and those movements that did exist were not twitching in character. These points appear to indicate an analogy to athetosis, rather than to chorea, both in the hand and in the face.

Case XII.—*Hemiplegia, malingering.*—Charles Giles, a country-looking man, aged 29 years, was an in-patient at the London Hospital, December 1880. He was admitted for right hemiplegia with anæsthesia. Suspecting the man a malingerer, I carefully noted the following points. "The right upper extremity is held out well and firmly, on a level with the shoulder; it is apparently easily kept out, and well sustained, as no muscular tremor or twitching is seen. The hand droops vertically from the wrist, the joint being flexed at about a right angle, and all the digits in a straight line with the metacarpal bones." This drooping of the wrist, as if hanging dead at the end of an active arm, is a condition totally different from the more or less flexed position usually seen in hemiplegia. He represented an arm without tone in the extensors of the hand and digits, and without rigidity. The hemianæsthesia was easily disproved; the electro-contractility of the two extremities was equal; he was sometimes caught using the right hand, and finally ran away, having inquired as to the locality of another hospital.

Before passing away from the consideration of the upper extremity as an index of brain conditions, we must notice the more active conditions of muscular movement. Equally characteristic with the passive positions of the hands are the muscular movements of the fingers,—twitching, tremors, and rhythmical movements. These conditions have been more fully studied and described than the characteristic passive positions (postures), and they have long been considered as visible muscular conditions expressive of the states of the nerve centres. The varieties of finger-twitching may be described as:—

(1.) *Flexor-extensor;* the primary movement being that of flexion, followed by a secondary extensor movement. This may be seen in a variety of cases, and in particular is seen in what is called "picking the bedclothes" in the typhoid state preceding fully developed coma.

(2.) *Extensor-flexor;* the primary movement being that of extension, followed by a secondary flexor movement. This is common in the slighter forms of chorea and in nervous

children; such twitches usually constitute the subsultus tendinum so indicative of exhaustion in the course of typhoid fever.

(3.) *Abductor-adductor* twitches; the movements consisting in lateral separations of the fingers, followed by their being drawn together again.

As to "finger-twitching," the "nervous hand," and "the relaxed orbicularis oculi," the following statistics are from an analysis of 34 cases from my note-books of the East London Children's Hospital:—

Finger-twitchings in 19.—Twitchings alone	in	8	cases.
With the nervous hand . . .	„	8	„
With relaxed orbicularis . .	„	3	„
		19	„
The nervous hand in 19.—Nervous hand alone	„	7	„
With twitchings	„	8	„
With relaxed orbicularis . .	„	4	„
		19	„
Orbicularis relaxed in 10.—Orbicularis relaxed alone . .	„	3	„
With the nervous hand . . .	„	4	„
With twitchings	„	3	„
		10	„

As to the general character of this group of 34 nervous cases in which nerve-muscular signs were specially noted, no cases of known organic brain disease were included, and all were under 15 years of age. I have abstracted and summarised the diagnosis of the 19 cases in which the "nervous hand" was seen:—"Headaches," 6; "Neurotic temperament," 3; "Anæmia and headaches," 2; "Headache and somnambulism," 1; "Restless sleep," 1; "Laryngismus," 1; "A dull child with congenital ptosis," 1; "Old rickets," 1; "Debility," 2; "Slight chorea," 1. The cases of "finger-twitching" had the same general characters as those with the "nervous hand," therefore I do not further describe them.

As to the kinds of finger-twitching, the varieties were noted as follows:—Simple twitching, 9; flexor, and abductor-adductor, 5; flexor, 3; abductor-adductor, 1; extensor, and

abductor-adductor, 1. As shown in the tables above, the "nervous hand" was associated with "finger-twitches" in 8 cases.

In cases where the right and left hands were compared, we find a difference in 6 cases, always to the disadvantage of the left hand; it specially presented "the nervous position" in 4 cases, and finger-twitches were specially marked on the left side in 2 cases.

The cases with "relaxed orbicularis" were specially marked by recurrent headaches, some with optical illusions and scarlet zigzag forms.

In 2 cases herpes zoster occurred while under observation.

The various positions, and movements of the head upon the spine, now claim our attention in as far as they depend upon and indicate the condition of the nervous system.

If we describe two axes of the head: (1) Interparietal, passing from one side to the other above the ears; (2) Occipito-frontal, passing from the occipital protuberance behind to the centre of the forehead in front, we can by referring to the positions of the axes define all the positions and movements of the head.

A. *Flexion and extension*—i.e. bending forwards and backwards of the head. Here the occipito-frontal axis has its anterior or posterior extremity depressed, but there is no deviation to either side, and the two ears remain at the same level.

B. *Rotation*—i.e. rotation of the occipito-frontal axis in the horizontal plane, the head remaining erect, and the interparietal axis horizontal, without flexion or extension.

C. *Inclination*—i.e. depression of one or other extremity of the interparietal axis, in which case one ear is lower than the other. Inclination may occur without either flexion or rotation, but is commonly associated with both. Right inclination means depression of the right extremity of the interparietal axis; left inclination, depression of the left extremity.

By means of these three terms we can, I believe, define all the possible positions and movements of the head. No account

is here given of the alterations of the positions of the head due to movements of the cervical spine. Flexion and extension of the head are of frequent necessity and physiological import; rotation is frequently necessary to move the eyes towards an object looked at, or to direct the ear towards a source of sound.

Inclination is, I think, often of other significance; it often indicates weakness, it is more often seen in young girls and weakly persons than in strong men. Inclination, with rotation to the same side, with slight flexion, is a position of the head very commonly seen in choreic girls, and then often accompanies an awkward ill-balanced position of the spine.

Inclination of the head, with rotation to the opposite side, and slight extension, is indicated by Sir Charles Bell in his figure in Adoration. In seeking general information as to the signs of cerebral adequacy in an infant, that is, whether the infant has a good sound brain, probably capable of due development, we always notice whether it can hold its head up, whether it usually keeps it erect when sitting up. In drawings of babies, we often see them represented as weak, evidently incapable of holding the head erect, the artist representing the want of strength of infancy by personal weakness and debility; this may be seen on comparing certain modern paintings with some of Raphael's infants.

An example of abnormal position of the head is the extreme retraction often met with in infants in brain disturbance, and also in cases of epidemic cerebro-spinal meningitis in adults. In all cases it depends upon tonic spasm of the extensors of the head, and is of grave import as indicating brain disease.

Case XIII.—January 1879. George W., age 4 months; complaint was made that he was stiff and unable to move his head. Fourteen days previously he had been taken ill suddenly with slight feverishness, and in a few days he could not sit up, and he fell into the condition in which he was when seen. He could move his arms and legs, but his head was distinctly retracted, and any movement of the head caused evident pain; there was no tonic spasm except in the muscles which retract the head; he looked intelligent, and the abdomen was natural. The tonic spasm lessened in a

week and passed away in three weeks; he remained two months under observation and recovered completely.

Such cases of retracted head are not uncommon, I think most of them die; it seems certain that in all cases the spasm depends upon nerve stimulus.

A curious and, as far as I know, unexplained chronic movement of the head in flexion and extension is occasionally seen in infants; the head constantly nodding up and down—a similar rotatory movement sometimes occurs.

Case XIV.—Elizabeth C., age 11 months, appeared healthy and well, and there was no complaint made except as to the head movements. These movements had commenced about a month previous to the time of observation; at first the mother did not notice them much, and there were never any signs of pain or general disturbance, the limbs were in no way affected. The infant looked healthy and well: the head-movements were simply rotatory in character; they came on, lasting a few seconds, then passed off again, leaving the head quiet, with the power of natural movement; then again three or four lateral oscillations succeeded, apparently never any vertical ones. There were never any general convulsions; no cause was assignable, and there was no history of injury or exposure to cold. The case came under my care at the Children's Hospital, Birmingham, in 1876.

Case XV.—Margaret McC., aged 8 months, seen April 1, 1879. She was brought under observation on account of constant nodding movements of the head. The movements were simply in the vertical direction, extension and flexion, being a series of nodding movements; these had continued for three months. The head was not retracted, the sutures appeared normal; the ribs were slightly beaded. General health was good. The child continued under observation a month, the head-movements remaining unaffected; light appeared to increase the movements. These movements appeared somewhat analogous to those of nystagmus.

In cases of cerebral hæmorrhage, softening, tumour, and other coarse brain-disease, paralysis of one or more cranial nerves often forms a marked diagnostic symptom. As has already been said, facial paralysis from brain disease presents

certain characters distinguishing it from a lesion of the facial nerve. Ptosis and strabismus are not uncommon results of coarse brain disease; these facts teach us to look to the condition of the muscles supplied by the cranial nerves when examining the condition of the brain.

The first two cranial nerves are purely sensory, having no motor function; the third, fourth, and sixth supply the eye-muscles; of the movements of the eyes as indicating brain conditions much has been said already. The seventh nerve supplies the facial muscles, and its action has been discussed. There remain then for consideration the motor division of the fifth nerve (masticatory), the eighth, and the ninth.

Fifth nerve.—Tooth-grinding is produced by the action of the deeply-situated pterygoid muscles; champing of the jaws and trismus are produced by the masseter and temporal muscles; all these muscles are supplied by the fifth nerve, and it is to their condition that we must look for information as to the condition of the central origin of the nerve. Tooth-grinding when it has become a habit is indicated by the flattened condition of the tips or edges of the teeth which may be ground down—a sign that may be particularly seen in the incisors and canines. Ground teeth are very common in nervous children, such as those who suffer from recurrent headaches, restless sleep, somnambulism and finger-twitching. In lunatic asylums and wards for imbeciles it is very common to hear tooth-grinding on every side; in such cases tooth-grinding is a sign of central irritation of the fifth nerve; it is well to bear in mind that the sensory branches of this nerve supply the membranes of the brain and the external parts of the head.

Trismus is tonic contraction of the masseter and temporal muscles which close the jaws, and it is a common symptom in tetanus, epilepsy, and hysteria. Seeing that the slight disturbances occurring during sleep in many children caused the pterygoids to contract rhythmically, it is not surprising that grave disease should cause spasm of the other muscles supplied by the fifth nerve.

The ninth nerve is motor to the tongue, and this organ being a mass of muscular fibres running in various directions almost unsupported by bones, is very sensitive to changes in

the nerve-centres. In chorea the tongue is often jerked in and out in a manner quite characteristic of the disease; in other cases it is easily kept protruded, and its substance is seen to be in a condition of constant movement. Such irregular movement is very common in nervous children; a tremulous tongue is characteristic of alcoholism, and general paralysis of the insane. In hooping-cough we see tonic spasm of the tongue causing its violent protrusion, which is frequently so strong as to cut the frænum by stretching it over the lower incisors; the centre of the tongue is depressed, while its margins and tip are raised. Defective speech is not necessarily a lesion of the muscle of the tongue; but we can only know the condition of the centre of speech through its power to guide the muscles of the tongue and others used in speech.

Concerning the eighth pair of nerves, the distribution is partly to voluntary muscles, but the pneumogastric is distributed to many organs, and largely to organic muscular fibres; this fact brings us to the consideration that the tone or action of organic muscular tissue may indicate states of the nerve-centres. As the examples to be quoted are not cases of the visible action of muscles, they will only be enumerated. Palpitation may occur without disease of the heart, the action may be irregular, as the result of chorea or of coarse brain disease; the controlling action of the nerve over many glands and organs is probably due to its action upon the muscular walls of the vessels; there is also evidence that in asthma, bronchial spasm is due to irritation of the pneumogastric; in functional aphasia, the recurrent branches do not convey the due stimulus.

It is a matter of very common experience that children and adult patients "hold themselves awkwardly;" stoop, or otherwise give the spine and trunk an ill-balanced position, due to want of nerve-muscular energy, and characteristic of the condition of exhaustion and weakness. Doubtless there is much expression in a torso; in many cases a weakly condition is indicated by a stooping attitude, with a lolling over to one side. It is difficult to indicate in precise terms the positions and movements of the spine, and perhaps this is one reason why so little is known about the action of the muscles of the

back. In stooping, the spine may remain symmetrical, the bends of the column being only in the antero-posterior median plane, and not deviating laterally.

We may then distinguish symmetrical from asymmetrical positions and movements of the spine. Some further remarks will be made on this subject under the head of chorea.

As to the lower extremities, I have fewer observations to refer to than with the upper limbs. The gait and manner in walking may be characteristic of brain or cord disease. Conditions affecting the muscles of both lower extremities are usually dependent upon disease of the cord, and most of the signs by which spinal disease may be localised are derived from examination of the muscles of the legs. Cramp in the feet and legs is due to tonic spasm of the muscles, and probably is usually produced by overstraining of the muscles, or by indigestion, &c., i.e. it is not dependent directly upon the condition of the nerve-centres, and therefore is not to be taken as a direct index of their condition.

Reflex actions are used as means of localising and ascertaining the condition of nerve-centres. Here, again, visible muscular conditions are the indices; but on this subject no more will be said now, as it hardly comes within the scope of this paper.

As to the proximate cause of the passive positions or postures of extremities—the hand, the spine, the face, &c.—it is the relative tone of the muscles involved that brings this about; mainly the relative tone of the flexors and extensors; and this relative condition of tonicity results, it is believed, from the condition of activity of the nerve-centres corresponding. Hence it is probable that in observations of the involuntary postures, or passive positions of the limbs, hands and digits, we may find indices which we may record in cases indicating the relative tonicity of groups and sets of muscles, and the conditions of the corresponding nerve-centres.

No doubt the position of the limbs is simply the position of the bones, and this is simply the result of the relative activity of the muscles acting upon them; the action of muscles is the cause of the posture or movement, and the posture or movement indicate the action of the muscles, and so likewise the

action of the nerve-centres corresponding; therefore the postures may indicate the state of nerve-centres.

In describing postures it is probably worth while to attempt greater accuracy by indicating the angles of flexion and extension; adduction or abduction in the different joints. The condition of the hand in ortho-extension is that of a balance of the flexors and extensors; in the "hand at rest" the flexors have the best of it, and the amount of hypertonicity of the flexors may be indicated by giving the relative angles of flexion at the different joints, the less this angle the greater the hypertonicity of the flexors, i.e. the angle of flexion and the hypertonicity of the flexors are inversely proportional. In the ortho-extended hand there is no angle of flexion or extension.

The principle of antithesis is used by Darwin to explain certain forms of expression of the emotions, and I think that every physiologist must grant the muscular indications of emotion are due to the state of the nervous system, its structure and its activity. The dictum then involved in the assertion of this principle is that opposite conditions of muscular action indicate opposite states of the nerve-centres, and conversely, that opposite states of nerve-centres will cause opposite muscular conditions. The most natural opposite conditions of the nerve-centres are activity and inactivity, or activity and exhaustion. It is not only in the case of motor nerve-centres that the nerves become so exhausted that they cannot repeat their proper functions. The eye, after it has been fixed on one strong colour becomes incapable of perceiving that colour longer till it has been rested, but it may readily perceive the complementary colour; again, after having looked long at a bright light, a black spot only is seen when we look elsewhere. The following appear fair examples of antithetical postures.

1. The erect figure—the stooping figure.
2. The nervous hand—the energetic hand.
3. The hand at rest—the ortho-extended hand.
4. Orbicularis oculi relaxed—the orbicularis energised in laughter.

Chorea has in this essay been many times referred to,

because it is a condition of brain which we know only through the effect produced upon the muscles of the brain, and this condition affords abundant examples of various forms of nerve-muscular movement. It will then probably serve my purpose if I enumerate some of the principal muscles and groups of muscles that may be affected. In different cases very different groups of muscles may be affected, thus indicating the very different brain areas that may be choreic. It is suggested that in studying a case of chorea we should try and indicate the extent of brain affected by specially indicating the choreic area. The following points then should always be looked for —as present or absent in any case described—and the order of invasion of groups of muscles or their recovery should be observed:—

1. In examining a case to prove the fact of chorea it is very convenient first to look at one or both hands, held out free and disengaged. The kinds of movements of the hand and fingers have been dwelt upon and described.
2. The upper and lower extremities present the greatest mass of the choreic movements. It is important to note whether the finer or coarser movements be the most affected; the amount of involuntary movement, and the power of voluntary act that is left.
3. Hemiplegic varieties are common; the least mobile side may be much weakened, though not much moved.
4. The face. Varieties in this group of muscles have been discussed.
5. The soft palate may present marked movements of an irregular twitching kind, the levator-palati muscles working distinctly. I do not refer here to the dragging of the palate by the choreic twitchings of the tongue, but to the primary twitching of the palatine muscles. In some cases the levators are distinctly seen twitching upwards. This symptom is often absent in chorea, and when seen, I have observed that it has usually passed off early.
6. *Tongue* may be markedly jerked in and out. When

protruded, it may present much movement, but still be kept out a fairly long time.

7. Eyes. Upper eyelids often strongly retracted.
8. Head in the active stage is often moved much. During convalescence, and when the active movements have passed off, a lolling of the head to one side is common ; i.e. inclination with rotation to the same side, combined with slight flexion.
9. Spinal muscles and trunk are often affected, but how to describe their condition I do not know. The child often balances itself very ill, throwing the scapular and upper dorsal region too far back, and thrusting the pelvis too forward, the spine still remaining symmetrical. It has sometimes seemed to me that the awkward appearance was due to want of adaptability of the proper compensations in the movements of different muscles.
10. The respiratory muscles. These may be affected much or little; the alæ nasi muscles may be affected also.
11. The vascular centres. The heart's action is sometimes irregular.
12. Varieties.—Hemiplegic.
    Paralytic.
    Local chorea; in Nerves IX., V., &c.

The significance of the action of muscles as indicating brain conditions has long been dwelt upon by writers. Camper, who wrote in 1821, has shown how the Laocoon presents evidence as to how deeply the ancients had investigated the influence of pain as expressed in the figure and the muscles. In this group, "not merely does the face, but the arms, legs—in short, all the muscles of the body indicate anguish." Further on he quotes from the words of Paulo Somazzo's work, 'Dell' Arte della Pittura,' published 1531, in which he describes the influence of the passions upon the muscles of the face, and still more minutely the different postures and contortions of the body. Camper there complains that authors have usually either confined themselves to appearances, or have "reasoned metaphysically concerning the operations of the mind, without

attending to the physical causes of the changes produced by these operations, but in my opinion (that is, Camper's) speculations concerning the manner of the soul's working, or concerning the seat of the soul, are of no use to the artist. These belong to metaphysicians, who, by the way, lose themselves in a labyrinth of terms, or words with no definite meaning, without having in the least explained the action of this immortal principle upon the corporeal and mortal frame." Camper then proceeds to give examples of the conditions of the muscles as indicating conditions of the mind, and then says, "the observation deducible from these effects is, that in every emotion of the mind particular nerves are affected; consequently every painter ought to make himself acquainted with the construction and connection of the nerves productive of these changes."

John Bulwer in 1649 published his work entitled 'Significative Muscles of the Affections of the Mind.' He expresses his opinion that every motion of the mind is indicated by a corresponding motion of the muscles. This is the same idea as Camper expressed later, and as is now well known to physiologists, that all postures and movements are the result of changes in nerve-centres. To study the conditions of the mind it is necessary now, as in former times, that the positions and movements of the body should be largely observed. Bulwer says, "When we assent, affirme, yield, grant, vote, confirme, confesse, admit, allow, or approve of a thing, &c., we are wont to nod or bend our head forward, the naturall reason of which motion in these, seems an approving, which is made by the Imagination, seeing, or hearing, somewhat done or said which accordeth very well, and this power remaineth in the Braine or forehead part of the head where in the cell and Seat of the Imaginations lieth. When any of these things give it contentment, suddenly it moveth the same, and after it all the muscles of the Body." In all cases, after describing the expression of a state of mind, Bulwer endeavours to explain which muscles take part in the act.

If anything can aid our studies of man, the matter becomes of interest to several classes of writers, to all those who study the body of man as indicating the activities of this brain or

mind, and as giving the knowledge of the means whereby the idea of his mental states and feelings may be expressed. If the matters discussed in this essay are of use in this direction, they concern not only the physician, but also the artist.

It is the work of the painter and sculptor to express by form the conceptions he may conceive of the condition of men and women in certain conditions of mind, states of strength and weakness; expressions of mental and physical pain, states of rest or repose, feminine coyness and defiance; the poet has to describe all these things in words. Clearly, also, it is a mistake for conditions of the limbs characteristic of disease to be used in art as mere expressions of feeling, unless the feeling be the result of disease.

There is then in the subject before us, "the visible conditions of the muscles as expressive of the states of the nervous system," a field for observation and description in which the artist and the physician may work together, observing and analysing with as much exactness as may be, the mode by which the varying conditions of the brain and mind are indicated to our eye, and may therefore be described by words, or by drawing or sculpture. We must study man in all aspects of the case, and when we see in the face, limbs, or body indications of his brain or mental condition, we should analyse and describe—first, the position of features and parts as we see them, then the muscles which produce these positions or movements, knowing that the muscular condition which has produced the movements or positions is the result of the state of the corresponding nerve-centres. It has been said that a man's face is the index of his mind, and this is true, for all the varying changes of expression in the face (except those of colour) are due to changes in the facial muscles, and these solely depend upon changes in nerve-cells.

The knowledge that we already possess of the nerve-centres is from observation of the condition of the muscles. In a given case, comparing the state of the muscles during life as they may be affected with paralysis or spasm with the brain lesion found after death, and by collecting and comparing many cases, it has been found that destructive or irritative lesions of certain parts of the brain cause paralysis or spasm of a certain

set of muscles corresponding. It is probable then that by carefully continuing these methods of examination—that is, by describing with accuracy all states which are indicated by conditions of the muscles—we may add still more to our knowledge of the functions of different parts of the brain, and gain a further insight into the pathology of that large group of nervous centres termed "functional." And to conduct such inquiries is a proper work for the physician. The objects of this paper have been to stimulate observations, and to direct and guide inquiries by definite lines and methods of investigation. Descriptions and definitions of some characteristic positions of parts and conditions of muscles have been given to aid in the clinical record of cases. Practical points are to some extent insisted on as specially characteristic means by which we may judge of the condition of the nervous system or of some centres forming it.

Irregular muscular movements, such as different forms of spasm, tremors, tic, &c., have often attracted much attention; but of these nerve-muscular conditions we have nothing more to say here. When dealing with a nervous case, however obscure and difficult to describe, if there be any such spasms or tremors, &c., local paralyses or weakness, movements or special passive positions, the case may be characterised by the description of these signs, and such indications of the state of nerve-centres are worthy of clinical study.

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