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THE SIGNIFICANCE OF MOTOR DISTURBANCE IN INSANITY.

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The essential unity of mind is an axiom. It has its different phases, its subdivisions and varying forms, but the omnipresent and unvarying *ego* binds all together in one indivisible whole whose individuality is always unique and sharply defined.

The text of this paper is the indivisibility of brain activity. The purpose is to call attention to the inseparable character of all cortical action, the dependence of each class upon the other, be it sensory, motor or ideational, and in particular to dwell upon the nature of the motor disorders that accompany the ideational disturbances; to indicate, if may be, the points of consonance in their states of diseased functions, and especially to call attention to the value that motor phenomena so frequently have in determining questions of diagnosis and prognosis in mental disorder.

It is quite reasonable to anticipate that this study will prove important. A large part of the expression of ideation is in form of muscular activity. It is true that the localization of functions in the brain has brought into marked prominence the preponderance of activities of certain types in certain areas, and we fear that the emphasis that has been given to such evidences of localization has in too great degree thrown in the background and covered over the fact that this localization is, after all, only the localization of centers from which cortical activity finds egress in certain forms, dependent, after all, upon other parts of the cortex for their especial kind of activity and possessing in themselves also many other kinds of energizing capacity.

The interdependence of all these so-called centers is well illustrated in mind disorders. The functions of the cortex are, after all, essentially indivisible, be these sensory or motor, ideational or

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reflex and instinctive. The varieties of motor disturbances that are found in insanity are numerous. Their significance varies greatly. I have thought that it might be useful to divide them generally into two classes. The first class might be termed incidental, the second essential.

As an example of the first may be mentioned the hemiplegia or monoplegia that sometimes precedes or complicates insane states. As an illustration of the second may be named the speech disturbance of the paretic, in which the disturbance in the motor mechanism seems inseparably bound up with the dementia of the disordered mind activity. Of the former it is not our purpose to speak at length. It is probable that they are found in greater proportion among the insane than in the sane. The vulnerability of nervous tissue that finds expression in mental derangement also shows itself in vascular degenerations and the grosser forms of disease that cause the paralyses. Extravasations, thrombi, and emboli are probably more numerous among the insane than among the sane; so also doubtless are cerebral abscess, foreign growths, or the special degenerations of syphilis, tuberculosis or carcinoma. I know of no accurate statistics on these points, but our experience readily recalls the frequency with which fatal terminations among the insane occur from one or the other of these complications. The relation of certain forms of infantile paralysis to imbecility and idiocy is something similar to this. There is in some of these cases doubtless a direct causative relation between the hemiplegia or other paralytic affection and the general defect in development of the cerebral cortex. In other cases the connection is only incidental. The tissues of the cortex are more vulnerable and the grosser lesions more frequently occur at the time that a general error in nutrition is seen that results in general defect in the cortical development.

Passing to the second class it is of interest first to notice how motor disturbance and defect is connected with states of intellectual deficiency. In almost every case of intellectual deficiency more or less error in muscular development will be seen to accompany it. The muscles are of small size and defective power. Even in the cases that are of comparatively better muscular development, in which the individual groups of muscles are of apparently normal size, slowness in reaction time under stimulus, and defective coördination of the different groups are found. There is a marked awkwardness in gait and inability to perform the

nicer and more delicate muscular movements; just as the cells that coöperate to evolve complex ideas and develop forms of intellectual energy are unable, through absence or imperfect development of communicating channels, to produce the evidences of this coöperation, so are the cells that stimulate individual muscles, through the same want of connecting lines, unable to coöperate with others to evolve the more complex and more finely adjusted muscular movements. This applies to the muscles of locomotion, in which defective coöperation and diminished power is very generally noticeable, and also the muscles of articulation. Speech is slow and imperfectly articulated. It is not so much incoördination as want of coördination, not so much confusion in the activity of separate muscles as absence of power to bring them into combined movement. Just as in the intellectual field weakness and limited range are the characteristics, so in the motor field simple movements of limited extent are alone possible. It is interesting to parallel the awkwardness and limited range of motor power in cases of imbecility with the limitation in ideational activity.

In the treatment of such cases improvement in the one field comes in the same manner and from the same kind of training as in the other. The muscular power is increased and its range enlarged by methodic exercise of muscles, bringing more and more of them into combined action and subjecting them gradually to more prolonged and more complex tasks. The ideational field is extended and developed in like manner. Simple intellectual tasks are gradually made more complex, and step by step the range is widened as new channels of communication are opened by extension of fibrillary ramifications in the cortex. Neither can ever attain marked prominence, because the number of the cells is limited and the extent of their fibrillary ramifications also restricted by nutritive error or deficiency.

Coming to the more active forms of insanity the parallel may be continued in the study of dementia. The facial expression, the attitude, the range of movement in the dement all betoken diminished intercommunication of cortical cells, a marked limitation in muscular power, and a reduction to simpler forms. The complex in motor action becomes more difficult or impossible, the same reductions being seen here as are noted in the ideational realm.

There is a form of dementia designated as organic that is more likely to be associated with *foci* of degeneration in the cortex, giving rise to localizing symptoms in the motor field. This is because

the degenerations of this form are grosser — that is, more complete in the cells or groups of cells that it attacks, more irregular in extent and less molecular in character. We will see as we pursue our study that the presence or absence of distinct localized motor phenomena in insane states depends upon the character of the degenerative process rather than upon its extent. If it is gross in character — that is, a complete destruction of the parts affected rather than molecular — then we may expect more evidence of complete loss of motor power in certain areas or more evident limitation of this power. If it is molecular — that is, not accompanied by complete degeneration and complete destruction of functional power in certain cells or groups — there is diminution but not complete loss of muscular power and less pronounced, less complete loss in ideational capacity. In each case the character of the degenerative process, as evidenced in disordered functions in one field, shows itself by similar evidences in the other area.

Let us turn next to the changes of senility. Compare in these the effects in the ideational field with those in the motor. The same correspondence is to be noted. In old age the ideas are of more limited range, new thoughts are more infrequent, there is a tendency to fixation, an aversion to change, a loss of memory, enfeeblement of intellectual grasp and a general aspect of weakness and unsteadiness. At the same time there is a gradual diminution in motor power. There is the bent form, the relaxed facial outlines, the unsteady and uncertain gait, the weakness of tremor, the loss of confidence in power of equilibrium, as shown in use of staff or the arm of another. The speech of the senile is especially characteristic of this union of phenomena. It is ataxic, amnesic, and aphasic. The loss of memory limits the range of expression, the weakness of mind is seen in the slowness of reaction time and the simplicity of the expression, while the motor disturbance is seen in indistinct and hesitating enunciation, piping voice, and the restricted power of modulation and absence of forceful and clear-cut articulation. Here, too, the varying types of mental disease are accompanied by varying motor phenomena. Pure senile dementia is a negative state, a limited range of action in mind and body. Senile mania and senile melancholia show less actual loss of power and more confusion, there is less loss of memory and less paresis, more emotional disorder and more muscular restlessness. The fact that the degeneration is not so complete nor destructive is seen in the one set of symptoms as it is in the other.

Take again the insanity of alcoholism; tremor, impaired equilibrium, weakness, ataxic and aphasic speech are among the motor phenomena of the alcoholic. Irregularity is a prominent symptom. So also in the ideational realm, rapid emotional fluctuations, instability, weakness, amnesia, a blurring of the intellect, and fleeting hallucinations are prominent signs of disorder. In this form of insanity motor disorders are nearly always present. They are characterized also by irregularity and marked variations, and in no other form of insanity are the pathological changes more variable or more unequal in distribution. While they are pronounced where they do exist, and destructive in character, they attack cells and groups of cells in an irregular and seemingly erratic distribution. Large areas are not affected, so that distinctly localized symptoms are not numerous, but tremor, muscular weakness, incoördination and loss of capacity for delicate motor manipulation all betoken the presence of destructive lesions of irregular distribution and extent.

In the motor as in the ideational field the symptoms are correspondingly special and characteristic, noticeable for their irregular exhibition and their elements of instability.

In epileptic insanity there is also a most interesting correspondence between the disorders of the motor field and those of the intellectual zone. The motor disturbance of the epileptic attack has many points of resemblance to the mental symptoms of the insanity that so frequently results from the disease. It is paroxysmal and explosive, violent and sudden; so also are the mental symptoms paroxysmal, often sudden and unexpected in development, violent and explosive, and notoriously uncertain. The change in disposition in the epileptic is remarkably characteristic. From this change alone an experienced observer will frequently be led to suspect the presence of epilepsy. There is present extreme irritability, a combative tendency, undue suspicion, and sudden and violent out-breaks of temper from comparatively slight causes.

It is easy to note the points in which these show resemblance to the well-known motor phenomena of the epileptic attack. The correspondence may be carried farther, however. It is well known that epileptic insanity has a marked tendency to develop dementia. The enfeeblement is pronounced and characteristic and often rapid. In the chronic form it often reaches a most extreme degree. Our epileptic demented are among those mentally most helpless and most pitiable, wrecks of the saddest type. They are often easily distinguishable, and not from their mental characteristics, or the

absence of them alone, for the motor phenomena are equally peculiar and significant. The awkward gait, expressionless countenance, immobile or unnaturally distorted; the rigidity of muscles in the extremities that causes each individual digit to stand out apart from its fellows; the slow and imperfect speech, all show in this area the same degenerative changes, preventing the coöperation of groups of cells in rhythmic action. The range of action is greatly restricted, the more delicate movements are impossible, fine adjustments can not be made, and the movements are comparatively simple in kind. It is interesting to watch the movements of the chronic epileptic in whom dementia is pronounced, and to compare the mental with the bodily states. The kind of degeneration that is portrayed in one will be seen also in the other. If the dementia is considerable the awkwardness, speech disturbance, and restricted muscular action will also be evident. If there is but little dementia there will be less motor depreciation. The exceptions to this rule are remarkably infrequent.

It is in paretic dementia particularly that motor disorders have been most conspicuous in the standard descriptions of insanity. We have reserved consideration of this variety thus far because we desired to make prominent the fact that motor symptoms were of interest in many other forms as well as in this, which has been, heretofore, most conspicuous in literature. Paretic dementia has sometimes been called a premature old age, and, as far as the motor symptoms are concerned, there is a marked correspondence between the two forms. Dementia is prominent in each, with motor enfeeblement, speech disturbance, and often impaired coördination. As in the other forms of mental disorder, so here we find a characteristic combination of the two sets of symptoms; where the dementia is marked, the mental enfeeblement conspicuous, we see, also, slow speech, slow movement, awkward gait, limited range of movement, an extremely limited power of combining movements, and inability to execute the delicate and complex, where coördination is most required. The writing of the paretic in this form of the disorder is most characteristic in the evidence it gives of loss of memory, of motor function in the elision of syllables, and the omission of letters, or of whole words. In the more active forms, characterized by exalted delusions and general extravagance and disorder in ideation, we find overaction and disorder in the motor field. The motor symptoms show this in the failure to execute intended movements correctly, the confusion in coördination. In both fields the rapid approach of weak-

ness and destructive degeneration is prominent. In this form of insanity the destructive nature of the diseased processes is the most conspicuous of all insanity. In this form motor complications are most numerous and most conspicuous. In this form persistent and complete dementia, rapidly supervening, is most prominent; and in this form, also, motor enfeeblement, rapidly progressing, permanent, and resulting ultimately in complete paralysis, is a prominent part of the symptomatology.

Turning for a moment to the general varieties of insane states, if we may so speak, how often we are led to speak of a paralysis of volition. Patients say, "I know I should do so and so, but I simply can not do it." There is a full knowledge of what is required, but when the time of action comes the patient simply can not bring about a rise of energy in cell activity to the point of action. This paralysis of will relates both to ideation and to movements. The motor functions are inseparably bound up with the general ideational activity and the process affects all alike. Similarly the nature of insane states is portrayed in the motor symptoms of stuporous insanity, in mania, and in melancholia. That these changes are more molecular, more essentially nutritive errors, rather than destructive processes, is shown in the absence of actual loss of motor power and the absence of evidences of prominent motor enfeeblement.

This paper is already too long and we must hasten to a close. We have avoided statistics, that are often misleading because based upon erroneous data, and we have also avoided the description of special cases. The object has been to bring more prominently into view the intimate connection that exists generally in insanity between the motor functions and the pure intellectual activities of the cortex, a connection that should lead us to study the states of motor activity in any case of mind disorder.

As expressed in the muscular activity, the nature of the pathological change is often as surely shadowed forth as in the phenomena of mind disorder. A conclusion that seems impressed upon us is that the activities of the cerebral cortex are, after all, a unit.

They all go together to make up one harmonious whole, and the perversion of the *ego* in insanity is the evidence of a general disturbance in the cortex. Because, therefore, signs of disorder seem limited to certain intellectual areas, we should be careful not to be too hasty in placing a limit on its influence over other activities of the cortex. There is a certain indivisibility of cortical energy that

makes limitation in the influence of pathological changes of purely cortical character well nigh impossible.

The general nature of the essential motor disorders of insane states indicate that they are disorders of the elements that originate activities rather than of the centers from which these activities finally leave the cortex. The accidental motor symptoms are, on the other hand, more directly connected with the pathological changes of these centers. It seems to the writer, too, that a conclusion that is justifiable, and also borne out by histological investigation, is that the motor element is a cell rather than an area, a cell that probably differs in form from cells with other functions, but is not restricted to certain areas of the cortex. The division would seem to be more naturally among the forms of cells and the layers of the cortex rather than among special areas.

I refer now more particularly to the elements that originate impulses, ideational, sensory, or motor, rather than to the elements through which they finally leave the cortex. If my meaning is clear a distinction can be drawn between the two classes of elements, and it is the intimate and indivisible blending of the one class that gives rise to the indivisibility of the symptoms in insane states and the difficulty in accurately determining the extent of the disease in the cortical functions.