

THE CROONIAN LECTURES ON EVOLUTION AND DISSOLUTION OF THE NERVOUS SYSTEM.

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LECTURE I.

IN the first place, I most heartily thank you, Mr. President, for permitting me to give these lectures.

The doctrine of Evolution daily gains new adherents. It is not simply synonymous with Darwinism. Herbert Spencer applies it to all orders of phenomena. His application of it to the nervous system is most important for medical men. I have long thought that we shall be very much helped in our investigations of diseases of the nervous system by considering them as reversals of evolution, that is, as Dissolutions. Dissolution is a term I take from Spencer as a name for the reverse of the process of evolution.

The subject has been worked at for many years. About half a century ago, Laycock applied the doctrine of reflex action to the brain. Sir Charles Bell, in speaking of degrees of drunkenness, and Baillarger, in speaking of aphasia, have pointed out that there is a reduction from the voluntary towards the most automatic. The late Dr. Anstie's researches (*Stimulants and Narcotics*) are perhaps the most valuable of all contributions towards the study of diseases of the nervous system as examples of dissolution, although he did not use [that term]. I refer, also, with great respect to the most valuable and highly original work which Ross, Ribot, and Mercier have done in the same direction. The brilliant researches of Hitzig and Ferrier, besides their obvious great value in other ways, are of very great value in supporting the doctrines of evolution and dissolution of the nervous system. In this connection, I gladly mention with great respect a recent valuable paper on cerebral localisation by Dr. Sharkey.

Wishing, as soon as possible, to give illustrations of dissolution, I will make the necessary preliminary remarks as short as I can. I speak only of the most striking aspects of evolution and dissolution, leaving entirely out of account some very important factors specially insisted on by Herbert Spencer. I regret that time renders it necessary for me to simplify my subject by serious omissions. Spencer, to whom I am under the deepest obligations, must not be judged by my present application of his doctrines, or, rather, of part of them. I have to ask pardon for the use in this lecture of some popular terms. "Most voluntary," though it has a technical sound, is, when used in contrast to "most automatic," a popular term; later on, it will be discarded. I have also to acknowledge an omission; I speak for the most part of the cerebral system only, almost ignoring all divisions of the cerebellar system. For the present, I neglect the absolute distinction which there really is between mental and nervous states.

Beginning with evolution, and dealing only with the most conspicuous parts of the process, I say of it that it is an ascending development in a particular order. I make three statements which, although from different standpoints, are about the very same thing. 1. Evolution is a passage from the most to the least organised; that is to say, from the lowest well organised centres up to the highest least organised centres; putting this otherwise, the progress is from centres comparatively well organised at birth up to those, the highest centres, which are continually organising through life. 2. Evolution is a passage from the most simple to the most complex; again, from the lowest to the highest centres. There is no inconsistency whatever in speaking of centres being at the same time most complex and least organised. Suppose a centre to consist of but two sensory and two motor elements; if the sensory and motor elements be well joined, so that "currents flow" easily from the sensory into the motor elements, then that centre, although a very simple one, is highly organised. On the other hand, we can conceive a centre consisting of four sensory and four motor elements, in which, however, the junctions between the sensory and motor elements are so imperfect that the nerve-currents meet with much resistance. Here is a centre twice as complex as the one previously spoken of, but of which we may say

that it is only half as well organised. 3. Evolution is a passage from the most automatic to the most voluntary.

The triple conclusion come to is that the highest centres, which are the climax of nervous evolution, and which make up the "organ of mind" (or physical basis of consciousness) are the least organised, the most complex, and the most voluntary. So much for the positive process by which the nervous system is "put together"—Evolution. Now for the negative process, the "taking it to pieces"—Dissolution.

Dissolution being the reverse of the process of evolution just spoken of, little need be said about it here. It is a process of undevelopment; it is a "taking to pieces" in the order from the least organised, from the most complex and most voluntary, towards the most organised, most simple, and most automatic. I have used the word "towards," for, if dissolution were up to and inclusive of the most organised, etc., if, in other words, dissolution were total, the result would be death. I say nothing of total dissolution in these lectures. Dissolution being partial, the condition in every case of it is duplex. The symptomatology of nervous diseases is a double condition; there is a negative and there is a positive element in every case. Evolution not being entirely reversed, some level of evolution is left. Hence the statement, "to undergo dissolution" is rigidly the equivalent of the statement, "to be reduced to a lower level of evolution." In more detail: loss of the least organised, most complex, and most voluntary, implies the retention of the more organised, the less complex, and the more automatic. This is not a mere truism, or, if it be, it is one that is often neglected. Disease is said to "cause" the symptoms of insanity. I submit that disease only produces negative mental symptoms answering to the dissolution, and that all elaborate positive mental symptoms (illusions, hallucinations, delusions, and extravagant conduct) are the outcome of activity of nervous elements untouched by any pathological process; that they arise during activity on the lower level of evolution remaining. The principle may be illustrated in another way, without undue recapitulation. Starting this time with health, the assertion is that each person's normal thought and conduct are, or signify, survivals of the fittest states of what we may call the topmost "layer" of his highest centres: the normal highest level of evolution. Now, suppose that from disease the normal highest level of evolution (the topmost layer) is rendered functionless. This is the dissolution, to which answer the negative symptoms of the patient's insanity. I contend that his positive mental symptoms are still the survivals of his fittest states, are survivals on the lower, but then highest, level of evolution. The most absurd mentation, and most extravagant actions in insane people are the survivals of their fittest states. I say "fittest," not "best;" in this connection the evolutionist has nothing to do with good or bad. We need not wonder that an insane man believes in what we call his illusions; they are his perceptions. His illusions, etc., are not caused by disease, but are the outcome of activity of what is left of him (of what disease has spared), of all there then is of him; his illusions, etc., are his mind.

After this brief sketch, I mention what may appear to be a drawback. Scarcely ever, if ever, do we meet with a case of dissolution which we can suppose to be the exact opposite of evolution. Often enough, however, do we meet with its near opposites. I will try to dissipate any difficulties that may arise. We make two broad divisions of cases of dissolution, Uniform and Local.

In Uniform Dissolution the whole nervous system is under the same conditions or evil influence; the evolution of the whole nervous system is comparatively evenly reversed. In these cases the whole nervous system is "reduced," but the different centres are not equally affected. An injurious agency, such as alcohol, taken into the system, flows to all parts of it; but the highest centres, being least organised, "give out" first and most; the middle centres, being more organised, resist longer; and the lowest centres, being most organised, resist longest. Did not the lowest centres for respiration and circulation resist much more than the highest do, death by alcohol would be a very common thing. Another way of stating the foregoing is to say that increasing uniform dissolution follows a "compound order;" these stages may be rudely symbolised thus, using the initial letters of, highest, middle, and lowest centres. First stage, or depth, of dissolution, h ; second stage, $h^2 + m$; third stage, $h^3 + m^2 + l$; etc. Although I shall say very little, later on, of involvement of middle and lowest centres, in cases of uniform dissolution, it is most important, especially with regard to clear notions on localisation, to recognise that the order of dissolution is a compound order.

The next division is Local Dissolution. Obviously, disease of a part of the nervous system could not be a reversal of the evolution of the whole; all that we can expect is a local reversal of evolution, that there should be loss in the order from voluntary towards automatic in what the part diseased represents. Repeating, in effect, what was said

on uniform dissolution, it is only when dissolution occurs in all divisions of the highest centres that we can expect a reduction, from the most voluntary of all, towards the most automatic of all. Dissolution may be local in several senses. Disease may occur on any evolutionary level, on one side or on both sides; it may affect the sensory elements chiefly, or the motor elements chiefly. It must be particularly mentioned that there are local dissolutions of the highest centres. It will be granted that, in every case of insanity, the highest centres are morbidly affected. Since there are different kinds, as well as degrees, of insanity (for examples, general paralysis and melancholia), it follows of necessity that different divisions of the highest centres are morbidly affected in the two cases. Different kinds of insanity are different local dissolutions of the highest centres.

I now come to give examples of dissolution. I confess that I have selected cases which illustrate most definitely, not pretending to be able to show that all the diseases of which we have a large clinical knowledge exemplify the law of dissolution. However, I instance very common cases, or cases in which the pathology has been well worked out; they are cases dependent on disease at various levels from the bottom to the top of the central nervous system. Most of them are examples of local dissolution.

1. Starting at the bottom of the central nervous system, the first example is the commonest variety of progressive muscular atrophy. We see here that atrophy begins in the most voluntary limb, the arm; it affects, first, the most voluntary part of that limb, the hand, and, first of all, the most voluntary part of the hand; it then spreads to the trunk, in general to the more automatic parts.

To speak of a lower level of evolution in this case, is almost to state a barren truism; at a stage when the small muscles of the hand only are wasted, there is, centrally, atrophy of the first or second dorsal anterior horn, and the lower level of evolution is made up of the higher anterior horns for the muscles of the arm. This statement, however, is worth making, for it shows clearly that, by higher and lower, is meant anatomico-physiologically higher or lower.

2. Going a stage higher, we come to hemiplegia, owing to destruction of part of a plexus in the mid-region of the brain. Choosing the commonest variety of hemiplegia, we see that there is loss of more or fewer of the most voluntary movements of one side of the body; we find that the arm, the more voluntary limb, suffers the more and longer; we find, too, that the most voluntary part of the face suffers more than the rest of the face. Here, we must speak particularly of the lower level of evolution remaining; strictly, we should say collateral and lower. We note that, although the unilateral movements (the more voluntary) are lost, the more automatic, the bilateral, are retained. Long ago, this was explained by Broadbent; subsequent clinical researches are in accord with his hypothesis. The point of it is that the bilateral movements escape in cases of hemiplegia, in spite of destruction of some of the nervous arrangements representing them; these movements are doubly represented, are represented in each half of the brain. Hemiplegia is a clear case of dissolution, loss of the most voluntary movements of one side of the body, with persistence of the more automatic movements.

3. The next illustration is paralysis agitans. Apart from all speculation as to the seat of the disease, the motorial disorder illustrates dissolution well. In most cases, the tremor affects the arm first, begins in the hand, and in the thumb and index-finger. The motorial disorder in this disease becomes bilateral. In an advanced stage, paralysis agitans is double hemiplegia with rigidity—is a two-sided dissolution.

4. Next we speak of epileptiform seizures, which are unquestionably owing to disease in the mid region of the brain (middle motor centres). Taking the commonest variety, we see that the spasm mostly begins in the arm, nearly always in the hand, and most frequently in the thumb or index-finger, or both. These two digits are the most voluntary parts of the whole body.

5. [The next illustration was by cases of temporary paralyses after epileptiform seizures.]

6. Chorea is a disease in which the limbs (the most voluntary parts) are affected more than the trunk, the more automatic parts; the arms, the more voluntary limbs, suffer more than the legs. The localisation of this disease has not been made out. Symptomatically, however, it illustrates dissolution. Chorea has a peculiar interest for me. The great elaborateness of the movements points, I submit, to disease "high up"—to disease on a high level of evolution. Twenty years ago, from thinking on its peculiarities, it occurred to me that convulsions represent movements—a view I have taken ever since.

7. Aphasia well illustrates the doctrine of dissolution, and in several ways. We consider a case of complete speechlessness.

a. There is loss of intellectual, the more voluntary language, with

persistence of emotional, the more automatic language. In detail, the patient cannot speak, and his pantomime is of a very simple kind; yet, on the other hand, he smiles, frowns, varies the tones of his voice (he may be able to sing), and gesticulates as well as ever. Gesticulation, which is an emotional manifestation, must be distinguished from pantomime, which is part of intellectual language. b. The frequent persistence of "yes" and "no" in the case of patients who are otherwise entirely speechless is a fact of extreme significance. We see that the patient has lost all speech, with the exception of the two most automatic of all verbal utterances. "Yes" and "no" are evidently most general, for they assent to, or dissent from, any statement whatever. In consequence of being frequently used, the correlative nervous arrangements are of necessity highly organised; and, as a further consequence, they are deeply automatic. c. A more important though not more significant illustration is, that the patient, who cannot get out a word in speech, nevertheless understands all that we say to him. Plainly, this shows loss of a most voluntary service of words, with persistence of a more automatic service of words. d. There are three degrees of the utterance "no" by aphasics. A patient may use it emotionally only; most automatic service. Another patient may also be able to reply correctly with it; a less automatic, but still very automatic, service (here there is some real speech). There is still a higher use of it, which some aphasics have not got. A patient who can reply "no" to a question, may be unable to say "no" when told to do so. You ask the aphasic, "Is your name Jones?" He replies, "No." You tell him to "say no;" he tries and fails. You next ask, "Are you a hundred years old?" He replies, "No." You tell him to "say no;" he cannot. Whilst not asserting that the inability to say "no" when told is a failure in language, it is asserted that such inability, with retention of power to use the word in reply, illustrates dissolution. e. A patient, who is speechless, may be unable to put out his tongue when told to do so; that he knows what is wanted, is sometimes shown by his putting his fingers in his mouth to help out the organ. That the tongue is not paralysed in the ordinary sense is easily proven; the patient swallows well, which he could not do if his tongue were so much paralysed as "it pretends to be;" besides, on other occasions, he sticks the tongue out, for example to catch a stray crumb. Here is a reduction to a more automatic condition; there is no movement of the tongue more voluntary than that of putting it out when told.

[The lecturer then remarked on swearing, and on the utterance of other and innocent ejaculations by aphasics, remarking that some of these utterances have elaborate propositional structure, but no propositional value; the patients could not repeat what under excitement they uttered glibly and well. He spoke next of the frequent retention of some recurring utterances by aphasics, such as "Come on to me." These were not, from the mouth of the aphasic, of any propositional value, they were not speech. He had no explanation to offer of them; but stated the hypothesis that they were the words the patient was uttering, or was about to utter, at the time he was taken ill.]

8. So far I have spoken of local dissolutions occurring on but one half of the nervous system on different levels. Coming to the highest centres, I speak of uniform dissolutions, of cases in which all divisions of these centres are subjected to the same evil influence. I choose some cases of insanity. In doing this, I am taking up the most difficult of all nervous diseases. I grant that it is not possible to show in detail that they exemplify the principle of dissolution, but choosing the simplest of these most complex cases, we may show clearly that they illustrate it in general. I take a very commonplace example, delirium in acute non-cerebral disease. This, scientifically regarded, is a case of insanity. In this, as in all other cases of insanity, it is imperative to take equally into account not only the dissolution, but also the lower level of evolution that remains. The patient's condition is partly negative and partly positive. Negatively, he ceases to know that he is in hospital, and ceases to recognise persons about him. In other words, he is lost to his surroundings, or, in equivalent terms, he is defectively conscious. We must not say that he does not know where he is, because he is defectively conscious. His not knowing where he is is itself defect of consciousness. The negative mental state signifies, on the physical side, exhaustion, or loss of function somehow caused, of some highest nervous arrangements of his highest centres. We may conveniently say that it shows loss of function of the topmost "layer" of his highest centres. No one, of course, believes that the highest centres, or any other centres, are in layers; but the supposition will simplify exposition. The other half of his condition is positive. Besides his not knowings, there are his wrong knowings. He imagines himself to be at home or at work, and acts, as far as practicable, as if he were. Ceasing to recognise his nurse as a nurse, he takes her to be his wife. This, the positive part of his condition, shows activity of the second layer of his

highest centres, but which, now that the normal topmost layer is out of function, is the then highest layer. His delirium is the "survival of the fittest states" on his then highest evolutionary level. Plainly he is reduced to a more automatic condition. Being, negatively, lost to his present "real" surroundings, from loss of function of the highest, latest developed, and least organised, he positively talks and acts as if adjusted to some former "ideal" surroundings, necessarily the more organised.

I now make some general remarks on the eight illustrations, in order to prevent certain misunderstanding. It is asserted again that each of the eight cases is a different dissolution. All that is meant is, that each shows a reduction from the voluntary towards the automatic, in what the centre, or part of it, which is diseased represents. If we take extreme cases, the case of progressive muscular atrophy, and the case of insanity (delirium in acute non-cerebral disease), we say that the two are alike, because in each there is reduction to a more automatic condition; and we say, too, that they are very unlike, the parts of the nervous system morbidly affected being exceedingly different.

I have so far almost ignored the distinction between nervous states and mental states. Now, if the case of insanity be considered as a series of mental phenomena only, it would be absurd to compare, or even to contrast, it with progressive muscular atrophy, which is a series of physical phenomena only. But no difficulty can arise, if it be understood that insanity or "disease of the mind" is, with medical men, disease of the highest nervous centres, revealing itself in a series of mental phenomena. We compare and contrast disease of the highest centres with disease of some anterior horns (some lowest centres), revealing itself in atrophy of certain muscles. But, acknowledging this, it may be said that the two things are so exceedingly different, that it is frivolous to compare or even to contrast them on any basis. Yet no one denies that each is a morbid affection of the central nervous system. This being granted, the rejoinder to those who insist on the extreme unlikeness is, that the lesion in one is at the very bottom, in the other at the very top, of the central nervous system; two lesions cannot possibly be further apart in the central nervous system. Still, it may be said that classification, on the principle of dissolution, if true, is of no value; that it is of no use making an orderly ascending series, from progressive muscular atrophy to insanity—of no use showing that progressive muscular atrophy is reduction to a more automatic condition, a small corner on the lowest level; that hemiplegia is such a reduction on a larger scale, higher up; and that insanity is such a reduction on the topmost level, and on the largest scale—that, even if this kind of work could be thoroughly well done, it is not worth any one's while to do it. I grant that such a classification is not of direct value, but yet, I think, of much indirect value, for clinical purposes. We require in our profession two kinds of classification. The use of two kinds of classification may be easily illustrated. There is a classification, or strictly an arrangement, of plants by the farmer for practical purposes, and there is a classification of plants by the botanist for the advancement of biology. I submit that there is no more incongruity in classing together progressive muscular atrophy and insanity, upon the basis mentioned, than there is in classifying the bamboo with common grass, or the hart's-tongue with the tree-fern in a botanist's garden. Such kind of classification of plants would be absurd in a farm or kitchen-garden; and so a classification of diseases of the nervous system, upon the principle of dissolution, would be absurd in an asylum or in the wards of a hospital. I know of no other basis, than that supplied by the doctrine of evolution, on which cases of insanity—diseases of the highest centres—can be studied comparatively with non-mental diseases of the nervous system—diseases of lower centres.

I next speak of different depths of particular dissolutions. The deeper the dissolution, the shallower the level of evolution remaining. In hemiplegia, owing to a lesion of the internal capsule, there are, according to the gravity of the lesion, three degrees or depths. (Of course, the division into three degrees is arbitrary.) In the first degree, there is some paralysis of the face, arm, and leg; in the second, there is more paralysis of these parts, and, in addition, there is a greater range of paralysis—the patient's head and eyes are turned from the side paralysed. Here is illustrated what I call "compound order." The difference between the two degrees is, not that in the second there is more paralysis only, nor that there is a greater range of paralysis only, but in both respects; there is more paralysis of the parts affected in the first degree and extension of range of paralysis to parts beyond them. An adequate doctrine of localisation has to account for increase of paralysis in "compound order" on increasing gravity of lesions. In the third degree, of, or rather beyond, hemiplegia, there is universal immobility. In this degree, the patient has lost consciousness, and this loss may be said to explain why he does not move the "other" or

"second" side of his body. I hope later to show that explanations of materialistic states by psychical states are invalid.

I wish here to bring evidence in support of the opinions I have long held—that all parts of both sides of the body are represented in each half of the brain. The view I take is simply an extension of Broadbent's hypothesis, already referred to. My supposition is that the limbs of the two sides are very unequally represented in each half of the brain, whilst the bilaterally acting muscles are very nearly equally represented in each half. Evidence that at least some parts of both sides of the body are represented in each half of the brain is that, consecutive to a negative lesion of one internal capsule, there is wasting of nerve-fibres "descending" into both sides of the spinal cord.

Degrees of epileptiform seizures illustrate different depths of dissolution. There are degrees of these, from—to take an example—spasm of the thumb and index-finger to universal convulsion.¹ That these degrees are compound is very evident. The first stage of the fit is, to speak roughly, that the arm is a little affected; the second stage is that the arm is more affected and the face a little; the third stage is that the arm is most affected, the face much, and the leg a little. This compound order of spreading, which any adequate doctrine of localisation has to account for, may be symbolised thus: a , then $a^2 + f$, then $a^3 + f^2 + 1$, etc. There are degrees beyond this to universal spasm; these cases, I submit, supply further evidence that both sides of the body are represented in each half of the brain. Certain experiments of Franck and Pitres (*Arch. de Phys.*, August 15th, 1883, No. 6) bear in a most important way on the question as to double representation. After exposing the so-called motor region² of each half of the brain of a dog, they removed the motor region on one half and then found that faradisation of the "arm-centre" on the half intact (left) produced universal convulsion; they found, too, that the spasm followed a particular order—that it affected the right arm (so to call it), then the right leg, then the left leg, and then the left arm. "L'épilepsie peut donc se généraliser malgré la destruction préalable de la zone motrice d'un côté, malgré la section longitudinale complète du corps calleux" (Franck and Pitres). Here seems to be evidence that both sides of the body are represented in each half of the brain, and also that the two sides are differently represented in each half. The distinguished French physicians to whose observations I have referred hold, I must mention, that "Le cerveau commence l'attaque, la protuberance, le bulbe, et la moelle la généralisent." If this be so, still proof is given that movements of all parts of the body are under command of, if not represented fully in, each half of the brain. This is a matter of extreme importance for the doctrines of evolution and dissolution. The evidence, as I read it, is, that the middle motor centres (a discharge beginning in parts which causes epileptiform seizures) of each half of the brain represent movements of both sides of the body. Other facts will, I think, show that the highest motor centres (frontal lobes) re-represent, in more intricate combinations, all that the middle centres have represented in simpler combinations; a discharge beginning in part of these more evolved centres produces an epileptic seizure, which is, so to speak, a "more evolved convulsion" than an epileptiform seizure.

[In the remainder of the lecture, many degrees of aphasia were instanced, to illustrate again different depths of dissolution, and different shallows of evolution remaining, and also to illustrate the dual symptomatology of disease. The wrong words uttered by a patient who has "defect of speech," are owing to activities of healthy nervous arrangements, whilst the disease is answerable only for the patient's not saying the right words. The states comparable, in a case of "defect of speech," with the states in the case of another aphasic, and who can only say "no," are (1) negatively, inability of the former to say the right words, with the latter speechlessness; and (2) positively, the utterance of numerous wrong words by the former, with the retention of "yes" and "no" only by the latter. In the former, the dissolution is slight, and the level of evolution very high; in the latter, the dissolution is deep and the level of evolution very shallow.]

¹ I am not speaking of epileptic attacks, which depend, I think, on discharges beginning in parts of centres of a higher, the highest, level of evolution. A man long subject to very limited epileptiform seizures may at length have seizures beginning in the same way and becoming universal, but these are not epileptic seizures, they are only more severe epileptiform seizures.

² I say "so-called motor region" not because I deny that the parts in this region are motor—I call them the middle motor centres—but because I believe the parts in front to be motor also, to be the highest motor centres.

There are said to be twelve medical periodicals published in Japan. The Derby Town Council have increased the salary of Mr. William Iliffe, the medical officer of health, to £200 per annum.