

PARALYSIS AGITANS.

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THESIS FOR THE DEGREE OF M.D.

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### I. HISTORY.

That a disease so striking in its results as Paralysis Agitans, and one imprinting such a characteristic appearance upon its subjects should have remained unrecognised as a clinical entity until towards the end of the first quarter of the present century, is a remarkable instance of the fact upon which Charcot so frequently laid stress, viz: that we often only see what we expect to see, and that prejudice blinds us to such an extent that we pass by the most obtrusive facts, unless they happen to fit in with our preconceived notions; nay more, we wilfully put aside facts which do not seem to coincide with what we are looking for, and accept only those which we actually expect to find.

It is little less remarkable that the first to give a distinct account of this affection should have been one whose

opportunities of observing its phenomena were apparently very limited.

The "Essay on the Shaking Palsy", published by James Parkinson in 1817, seems to have been founded upon only six cases. Three of these were presumably his own patients (cases i, iv, & vi,) but of these case iv. is very imperfect, the only symptom mentioned being "a trembling of the arms", beginning about four years before he came under observation. "The opportunity of learning its future progress was lost by his removal to a distant part of the country". Cases ii. & iii. were met with casually in the street, and case v. was only observed from a distance. So that of these six cases, he had only two from which to draw accurate conclusions, and yet from these he managed to evolve a description of the disease which, although it has been since amplified, has never been surpassed as a clinical picture; and is absolutely accurate as far as it goes, with the one exception that in his two cases the tremor spread from arm to arm, instead of secondarily involving the leg on the first affected side before attacking the opposite arm. He therefore theorised from insufficient data in laying down a law that the course observed in these two cases was the usual course of the disease.

But how much useless argument and how much error would have been avoided had those, who even whilst accepting his

authority and naming the disease "Parkinson's Disease", only followed him in adhering closely to his definition of the condition:- "Involuntary tremulous motion, with lessened muscular power, in parts not in action and even when supported; with a propensity to bend the trunk forward, and to pass from a walking to a running pace: the senses and intellect being unimpaired". (The italics are mine.) Had due consideration been given to those few words, all the confusion which for so many years continued to exist between this disease and Disseminated Sclerosis would have been avoided; and by them he has completely cleared himself of the charge of having confounded the two diseases. I do not mean to assert for a moment, that Parkinson differentiated Disseminated Sclerosis as a distinct disease, but I maintain, that he very strongly insisted upon a distinction between conditions in which tremor occurred during rest and those in which it only occurred during movement. I insist particularly upon this point, because I find that there is a general consensus of opinion that Parkinson's description did not distinguish the disease from Disseminated Sclerosis, and that it was left to Charcot to do so. This error can only have arisen from Charcot's writings having been read with attention, and Parkinson's with little or none. Charcot<sup>10</sup> himself quotes the very same authorities as Parkinson, viz: Galen and Van Swieten. He admits

that in his papers<sup>2</sup>(in the Gazette Hebdomadaire) he himself had confounded the two diseases. Can anything be clearer than the following statement of Parkinson's, "but a much more satisfactory and useful distinction is made by Sylvius de la Boë into those tremors which are produced by attempt at voluntary motion, and those which occur whilst the body is at rest"? (loc. cit. p. 20.) He goes on to say, Sauvages distinguishes the latter of these tremors by observing, that the parts continue moving even when supported, whilst other tremors cease when voluntary movements stop, or the limb is supported. And a little later on he says, "a small degree attention will be sufficient to perceive that Sauvages, by this just distinction actually separates this kind of tremulous motion, and which is the kind peculiar to this disease, from the genus tremor". So I maintain that although Parkinson did not define and describe Disseminated Sclerosis, he laid down a definition of Paralysis Agitans so exact and decisive that any one confounding a case of Disseminated Sclerosis with one of that disease, should have only himself to blame. But this is what actually happened again and again, and it was not until Charcot at last definitely described the symptoms to be expected in Disseminated Sclerosis and gave a full account of the morbid anatomy of that affection that observers began to see Parkinson's Disease, as he himself had clearly seen it fifty years before. As already pointed out, Charcot fell into this error at one time. In the paper referred

to (written with M.Vulpian)<sup>2</sup> he thus graphically describes the tremor of Disseminated Sclerosis as being typical of Paralysis Agitans: "The tremor in fact never shows itself so strongly as when the patient attempts to make any use whatever of his hands, for example to dress himself or to eat; but it is especially in the act of drinking that it becomes most exaggerated, the glass is so much shaken that the liquid is scattered about ...." and so forth. Oddly enough, he begins his paper with a long extract from Parkinson's Essay. It was not until 1867, that Charcot pointed out the distinctions between the two diseases, doing for Disseminated Sclerosis what Parkinson had done for Paralysis Agitans. This was first definitely done in Ordenstein's Thèse de Paris.<sup>3</sup> On page 69 the distinctions are thus briefly summed up:-

(1) In Disseminated Sclerosis the motor troubles are much more marked and show themselves principally in the lower limbs, and always attain to a much higher degree than in the upper limbs.

(2) The appearance of the tremor on voluntary movement only.

Descriptions of the morbid state of the central nervous system which constitutes Disseminated Sclerosis had been published before (Cruveilhier, Carswell, Türck, Rokitansky, Frerichs, Valentiner, Rindfleish, Leyden, Zenker.) The first cases fully recorded clinically and pathologically in England, were those of Foxon

were those of Moxon.<sup>4</sup> But apparently even as late as 1875, the distinction between the two diseases was not clearly recognised in England, for in that year Buzzard<sup>5</sup> thought it advisable to show two cases at the Clinical Society of London, one of Paralysis Agitans, and the other of Disseminated Sclerosis, and to point out the differences existing between them; giving as his excuse for doing so, not the rarity of either disease, but the frequency with which they were confounded. He gives Charcot full credit for the differentiation. In the previous year Sir T. Grainger Stewart,<sup>6</sup> in a clinical lecture delivered in the Royal Edinburgh Infirmary had ably drawn the same contrast and published the lecture. The fact of the publication of this lecture, not of its delivery to students, shows how necessary it was at that time to call the attention of the profession generally to the difference existing between the two diseases. It followed from this confusion having existed for so long that there was, prior to this time, a large amount of literature on the subject of Paralysis Agitans which is almost useless now-a-days. This applies particularly to the morbid anatomy, many of the recorded cases having been instances of Disseminated Sclerosis and not of Paralysis Agitans. But since that date more or less careful clinical details have been given with the records of autopsies, and I shall refer to some of the most important

of these later on.

Since 1868, little has been added to our knowledge of Paralysis Agitans. A few relatively unimportant symptoms have been observed, e.g. the piping voice by Buzzard (1880), the fact that the ocular muscles escape from the general rigidity by Beevor (1885), and "latero pulsion" which is incidentally mentioned in a case of Charcot's about 1880, but of which I am enabled, by the kindness of Dr. Beevor, to record in the following pages what I believe to be a unique example, along with two cases of my own in which the symptom was present. I have only met with three other cases of lateropulsion in the literature of the subject.

## II. CLINICAL CASES.

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The following five cases are at present under my care at the Hospital for Epilepsy and Paralysis, Regents Park, London.

### CASE I.

E.H., f. aet. 53. Twelve months ago patient noticed that the left hand was weak, and that the arm was inclined to flex at the elbow. Her friends objected to the manner in which she carried her umbrella when not in use, characterising it as "silly", and attempted to force her arm down. She has had a great deal of trouble for some time, two of her children, just grown up, having died of phthisis within two years; and another is at present suffering from the same disease. There is now very slight tremor in both hands, so slight that she herself has not noticed it. The fingers are held in the interosseous position, the arms flexed and slightly abducted from the sides. Both hands are decidedly weak, the grasp of both being only 20

measured by the dynamometer. The expression is fixed, the neck stiff, and she bends slightly forwards; as she herself expresses it, she feels as if her head and shoulders were pulled forward and downwards. There is so far no apparent alteration in her speech. She suffers much from a sensation of heat, is very restless, and obliged to change her position frequently. During an interview of about ten minutes duration, she gets up and sits down again at least half a dozen times. There is a tendency to propulsion. The reflexes are normal. There is a good deal of neuralgic pain in the left arm.

#### CASE II.

G.M., m., aet 60. Was seized a year ago with tremors in the right calf. He believes that this limb was first affected because it had been broken twenty-five years before. The right hand and arm became affected one month after the leg. Tremor is now perfectly characteristic, the muscles of the calf being most affected in the leg, so that the heel beats upon the ground as he sits. The hand is characteristically involved, but there is as yet no muscular rigidity, although the fingers are occasionally drawn down in a cramp-like manner, towards the palm. The tremor ceases for a few seconds on gentle voluntary movement, but is much aggravated by violent exertion, as in grasping the dynamometer, when the whole limb is violently agi-

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speech. She suffers much from a sensation of heat, is very  
restless, and obliged to change her position frequently. During  
an interview of about ten minutes duration, she gets up and sits  
down again at least half a dozen times. There is a tendency to  
prostration. The reflexes are normal. There is a good deal of

*Lisa Mason*

*Case II Specimen of hand-writing*

steeping the dynamometer, when the whole limb is violently agi-

tated. He complains much of feebleness of the right hand, but as usual in early stages this is more apparent than real, as the grasp of the hand is 80. There is however some diminution of muscular power, as that of the left hand is 90, and the patient is a right-handed man. There is some tremor of the facial muscles, this chiefly marked on the right side. The back of the neck is slightly stiff and occasionally painful. He sometimes feels as though the head were drawn forward and the chin bent towards the chest. The face is decidedly fixed and expressionless. There is nothing noticeable about the voice. Voluntary movements are slow. The patient is very restless and gets up and sits down frequently. Sensation of heat is very troublesome, but occurs only at night, when even in very cold weather he can bear very few bed-clothes.

There is as yet no characteristic attitude or gait, but the case is undoubtedly one of Paralysis Agitans. It forms an interesting contrast with the last case. Here the tremor though not very violent and capable of being checked to a certain extent by will, as in the effort of writing, is much in excess of the rigidity which is hardly observable except in the upper facial muscles. In the other case, in which the condition has existed for about the same time, rigidity and its consequences are very well marked, whilst the tremors are very slight indeed.

### CASE III.

J.C., m., aet 56. Nearly seven years ago patient was suddenly seized with right Hemiplegia. This was complete, and was accompanied at first by some motor aphasia which soon passed off. The paralysis of arm and leg persisted for a considerable time, and it was three months before he could get about at all. About two months after the stroke, as power began to be regained the right leg commenced to shake, and a fortnight afterwards the hand and arm became affected in the same way. This shaking has continued ever since and has become gradually worse until quite recently, but the tremor seems at all events not to have increased during the last few months. So far the history is suggestive of post hemiplegic chorea, rather than of Paralysis Agitans, but I think that what follows is conclusive as to the nature of the disease.

The patient's attitude is very characteristic. He stands bent forward and with head somewhat depressed. The arms are flexed at the elbows and abducted from the body, although there is no contracture to suggest pyramidal degeneration. The fingers are in the interosseous position and the typical pill-rolling movement of the thumb and fingers upon one another is well marked. The nature of the tremor in arm and leg is also characteristic and unlike anything I have seen in so-called post-hemiplegic chorea. The expression is typically fixed. The

upper part of the face is quite expressionless. If told to look up he raises his eyes, and elevates his brows by contraction of the frontalis muscle, the head being held stiffly and not thrown back at all. The voice is monotonous and with a tendency towards the high pitch characteristic of the malady in its latest stages. In turning round he turns "all of a piece", turning shoulders and pelvis simultaneously, instead of shoulders first and pelvis afterwards as in health. He has the short step of the later stage, and exhibits a tendency not only to propulsion and retropulsion, which are both well marked, but also, especially on turning, he frequently runs off in an unexpected manner towards the right. Voluntary movements are performed slowly and deliberately, and he has some difficulty in rising from his chair. He was at one time extremely restless, and unable to keep in one position for any length of time, rising up and sitting down again at short intervals. Lately however, this symptom has not been marked.

In this case the patient always feels chilly, a much rarer symptom than the sensation of unpleasant warmth, so often complained of. The knee jerks are only elicited with the greatest difficulty, and by the help of Jendrassik's method of re-inforcement, the reflex on the right side being as difficult to produce as that on the left.

An interesting point about this case is, that the disease

has persisted for nearly seven years, and still the tremor has remained almost unilateral. I say almost, because - and this is a very important point, as tending to refute the diagnosis of "Hemiplegic Chorea"- there is slight tremor in the right hand, and if the shaking of the right side be forcibly prevented this left sided tremor becomes at once very pronounced. If all the disorders of movement following at once upon hemiplegia are to be looked upon as "Post hemiplegic Chorea", then this is an example of that condition. But it is at the same time a well marked example of the hemiplegic type of Paralysis Agitans, and is undoubtedly an example of that disease.

What the cerebral lesion was, is difficult to determine. Haemorrhage is, I think, practically excluded, for it is almost impossible to conceive that a haemorrhage so extensive as to cause complete hemiplegia with aphasia, should not have done sufficient damage to the motor tract to set up descending degeneration; and of this there is absolutely no evidence. There is no true secondary contracture, and the knee jerks, far from being exaggerated, are well-nigh absent, that on the right side as well as that on the left. Embolism is also improbable, there being no cardiac lesion, and I am inclined to think that thrombosis was the cause of the condition. But whatever the lesion may have been, there is no doubt that it must have interfered seriously with the nutrition of the cortical motor cells,

and that when their function became in part restored, their power of keeping up continuous control over the lower centres had been lessened, although apparently their trophic function had not been seriously interfered with.

It may be objected, that the hemiplegia may have been a mere coincidence in this case, but the relationship between it and the succeeding Paralysis Agitans was so close, the tremor beginning as soon as slight power was regained in the limbs, that I have more difficulty in looking upon it as a coincidence, than I have in accepting it as the cause of the condition. Buzzard<sup>7</sup> has recorded a case in a woman, 66 years of age, who woke up suddenly one morning, vomiting and retching, and found that she had lost power to some extent in her left arm and leg, and that she could not keep those limbs still. The shaking was extremely violent at first, but gradually diminished in intensity. Ten weeks afterwards, her hand was steady when at rest, but moved rhythmically, - flexion and extension of the wrist at the rate of about three per second - on voluntary movement. Wrist reflex and patellar reflex exaggerated on the left side. Grasp of the left hand 22, of the right 40. There were no symptoms of Paralysis Agitans beyond the movements, which were far from typical, occasional flushes, and a subjective sensation of heat. I do not think that this case can in the least degree be compared with mine, which is a true case of Paralysis Agitans

of the hemiplegic type. Dr. Buzzard's case was probably an example of Posthemiplegic Hemichorea, but I have given it here, partly as a contrast to my own and partly because he says, "here the tremors closely resemble those of Paralysis Agitans, and the case might easily be mistaken for one of that disease".

Auerbach<sup>8</sup> has recorded a very similar case to mine of Paralysis Agitans following hemiplegia, but in his case, the movements did not begin till a much later period after the onset of the paralysis, viz. eight months. There seems to be little doubt that his case also, was a case of true Paralysis Agitans.

Brousse<sup>9</sup> has an article "Paralysie Agitante Posthemiplegique" which I have not been able to obtain.

#### CASE IV.

S.L. F., aet 63. Some years ago she was much frightened by a sudden maniacal outburst on the part of an epileptic sister with whom she lived alone. A week afterwards, shaking began in the left thumb, extended to the fingers, and thence to the whole limb. The left leg was next attacked, then the right arm, and afterwards the right leg, the disease thus extending according to the most frequent type. The movements are now general with the exception of the head, which does not itself shake; they are very severe and quite characteristic. The masseters are

1. 

2. 

Case IV Attempts to write name  
"Sarah Lanning"

also involved, their tremor being very great at times and giving the patient a most peculiar appearance; she cannot tell me however at what period the lower jaw began to be affected. The shaking can be stopped for a moment or two, by an effort of will, but returns with increased violence afterwards; it ceases during sleep and even before actual sleep supervenes. The patient tells me, that as she dozes off the movements cease, before she quite loses consciousness. The expression is fixed, there is pain and stiffness in the back of the neck, and on attempting to look up, the eyes are raised and the frontalis muscle strongly thrown into action without any throwing back of the head. Voluntary movements are slow, but if told to seize a thing quickly she can, by a great effort, manage to do so. On attempting to walk there is some delay in starting the movements. There is a tendency to propulsion and (this was volunteered by the patient) to latero-pulsion, but there is no tendency to retro-pulsion, even when she is drawn sharply backwards. Speech is slow and monotonous, and there is a delay before answering to the simplest question; there is no sign of the "festination" of speech which is sometimes noticed. The subjective sensation of heat is great and causes much discomfort, restlessness and frequent desire to change the position are present to a marked extent. The knee jerks are quite absent, but this may be on

account of the difficulty of eliciting them from the existence of rigidity in the muscles flexing the knee. The chief points of interest in this case are; 1. The sudden onset; 2. the involvement of the masseters; 3. the tendency to latero-pulsion.

#### CASE V.

M.S. F. aet 66. Four years ago whilst alighting from an omnibus, she slipped and strained her left shoulder somewhat severely, this was followed by pain and stiffness in the left arm which persisted for about a month; shortly afterwards the left hand began to shake and the tremor gradually became worse. The left leg became involved in the tremor about a year after the hand, and shortly afterwards the right hand; the right leg is apparently not affected. The shaking is now much more severe in the right arm and hand, the fingers are held in the interosseous position and the rolling of the thumb and fingers upon one another is very characteristic. There are also rapid, continuous, alternating movements of pronation and supination. The head in this case certainly shakes, though very slightly; the tremor is not communicated. The lower lip and the masseters are also slightly involved. The expression is very fixed and the frontalis and corrugator supercilii muscles are strongly tonically contracted. The head is carried stiffly and bent forward; when told to look up to the ceiling the patient only raises her eyes. In walking the elbows are held flexed and

*Handwritten signature*     *John K. Lewis 39*     *Mar*

~~Delaware~~

—     Schreiber 39 Marshall St.

P.S. Patient was unable to write any more.

Case V Attempt to write Maria Schreiber  
39 Marshall Street

slightly abducted from the sides. The patient leans forward and, in turning, she turns all of a piece. The steps are somewhat long, slow, and slouching. She feels constantly chilly. There is no tendency to pro- or retro-pulsion. Voluntary movements are executed fairly rapidly, but the patient complains much of the comparative slowness of her movements; she has evidently been a very energetic woman. The knee jerks are brisk and there is no clonus.

### III. SYMPTOMS.

#### TREMOR.

Usually the earliest, and certainly the most constant symptom is the tremor. This is rhythmical and continuous, whether the parts be at rest or in motion; it usually begins and continues greatest in the muscles of the hands and forearms, the interossei being much involved; the thumb and fore-finger frequently moving upon one another, as though they were rolling a pill or, "a pencil or a little ball of paper" (Charcot) between them, the wrist is also rapidly flexed and extended, or pronated and supinated, but the range of movement is, at all events in the early stages, not great. The tremor usually starting from one hand, often first affecting the thumb alone, spreads gradually to the rest of the limb, and then at a varying interval, to the lower limb of the same side. At a later period often after a long interval, it may be of years, the arm of the opposite side becomes affected, then the leg.

(Marshall Hall<sup>//</sup> attempted to divide the cases into hemi-

plegic and general; and the fact that for a very long time the tremor and rigidity may be almost entirely confined to the arm and leg of one side, justifies the distinction; but it is interesting to note, as an instance of a correct conclusion being arrived at from false premises, that the case which he describes as an example of the hemiplegic type of Paralysis Agitans, was really one of Disseminated Sclerosis. The patient was a young man aged 28, and the tremor was much increased by (or occurred only upon?) voluntary movement, it was particularly observed "as he walks". There was "a peculiar lateral rocking motion of the eyes" and "a degree of stammering and defective articulation". This is a very fair clinical picture of Multiple Sclerosis). This is the general rule as to the spread of the disease, but there are exceptions, occasionally the tremor spreads first to the opposite arm and then to the leg of the side first affected, finally involving the other leg. Sometimes the tremor starts in the leg instead of the arm, and then may spread either to the arm of the same side or to the opposite leg. As the disease progresses, the amplitude of the oscillations tends to become greater. The head is occasionally involved in the tremor. In many cases in which there is an apparent movement of the head, this is merely communicated from the shaking of the limbs; and as Charcot pointed out, <sup>12</sup> if these be for-

cibly prevented from moving, the movement of the head ceases. Personally, I have only seen one case (my own case V.) in which the head was involved in the tremor, but it occurs fairly frequently.

Peterson<sup>13</sup> noticed it in nine out of forty-seven cases, in all of which it was possible to determine the participation of the muscles of the neck in the tremor; this is, however, above the average proportion.

Hilton Fagge<sup>14</sup> was undoubtedly in error when he stated, as if it were the rule, "presently the remaining limbs suffer in their turn, the head also begins to shake". It may be, that he confounded some cases of senile tremor in which shaking of the head is a prominent symptom with true paralysis agitans.<sup>15</sup> He was equally in error, if not more so, in his dogmatic statement a line or two lower, "nor do the jaws ever take part in the movement". In one of the cases afterwards to be alluded to, under the head of Traumatism as a cause, the lower jaw was in constant motion which had supervened upon its dislocation; and in one of my own cases the actual chattering of the teeth caused by the tremor in the masseters is a striking feature (case IV). In another of my cases (case V.) the lower jaw is also involved. Trousseau<sup>16</sup> describes the case of a woman aged 60, a veritable case of the disease, in which the masseters were conspicuously affected by the tremors; he seems at one time to have regarded

the involvement of the jaw as the ordinary rule, for in giving a general description of the malady, he says, "les muscles de la mâchoire se prennent à la tour".<sup>17</sup> Atkins<sup>18</sup> also recorded a case in which the lower jaw was implicated. Hadden<sup>19</sup> described a case of Dr. Ord's in which there was a grinding movement of the jaw from side to side. Tremor of the tongue also occurs, even when the tongue remains lying in the floor of the mouth, with consequent difficulty of articulation. This is usually a late symptom and may be accompanied by a troublesome dribbling of saliva.

Whitaker,<sup>20</sup> I think, goes too far when he says, "there is usually some tremor of the tongue". It is, at all events in early stages of the disease, the exception rather than the rule. The lower lip, facial muscles, and orbiculares palpebrarum are sometimes tremulous, and if the tremor in the limbs be of the hemiplegic type the movement in these muscles may be more marked on, or even confined to, the affected side.

The tremor may at first be only occasional and so slight as to be hardly noticed; but it gradually becomes continuous and more and more severe, to cease only during sleep. Indeed in some cases it would appear ultimately to continue then, as in one of Parkinson's cases.<sup>21</sup> This patient became the subject of an inter-current attack of hemiplegia, during which the shaking entirely ceased on the paralysed side. A remarkable and somewhat important fact as regards the tremor from the point of view

of the diagnosis and possibly also of the pathology of this disease, is that the movements frequently cease entirely for a short interval during voluntary effort and, in some cases, the will suffices to keep the part at rest for a varying interval, always short and measured rather by seconds than by minutes; the tremor usually returning with increased violence in spite of the strongest efforts on the part of the patient to restrain it. The rate of the tremor is usually given about five oscillations per second. Marie<sup>22</sup> gives the rate as five. Ewald,<sup>23</sup> five. Grashey<sup>24</sup> 4.14, to 5.34. Gowers<sup>26</sup> 4.8 to 7. Hüber<sup>25</sup> gives 3.43 to 5.57. Peterson<sup>27</sup> 3.7 to 5.6. Wolfenden and Dawson Williams<sup>28</sup> 5.2 & 5.1. The last two observers pointed out, that the tremor is, as it were dicrotic, and that the true rate would be 10.2 & 10.4. It will thus be seen that there is a striking similarity in the results obtained by different observers; all, with the exception of those of Gowers, being practically identical.

Although the tremor is, as has been said, one of the first symptoms of the malady, still cases do occur in which it has remained absent or nearly so, for a long time after the other symptoms have developed. One of my own patients (Case I.) is an example of this; the tremor being scarcely perceptible and not complained of, although other signs of the disease are well marked and have been in existence for a year. Several cases of this kind are recorded by Charcot and Bourneville.<sup>29</sup> In one case

the tremor was absent after the disease had existed for four years, although the position, motionless expression, or want of expression, subjective sensation of heat, and frequent necessity for changing the position were well marked. The patient's age was 52. In another case, aged 50, all the symptoms, with the exception of the tremor were present in 1872, the illness having followed upon mental emotion caused by an attempt on the part of the Communists to press him into their ranks in 1871. Charcot also quotes a case communicated to him by Gowers, of a woman aged 47, who had all the symptoms of Paralysis Agitans with the exception of the tremor which was scarcely apparent. Three other cases are recorded by Charcot of the same nature.<sup>30</sup> In one, a man, aged 47, the left thumb first felt weak, the weakness then spread to the hand and arm; then the right hand was affected so that writing became slow and difficult, finally the lower limbs were involved. There was slowness of voluntary movement, typical attitude, fixity of expression, propulsion, necessity of frequent change of posture, subjective sensation of heat, and complete absence of tremor, with the exception of a very slight amount in the left hand, which the patient himself had not noticed. In another case the duration had been no less than ten years. The position and fixed expression were quite characteristic, articulation was slow with a tendency to be high

pitched, movements were sluggish with difficulty in starting them, there was dribbling of saliva from the mouth and latero-pulsion towards the left, but no tremor whatever; the writing was slow and difficult, but its character was unchanged.

The other case is a very remarkable one; the patient was a young man aged 26, and the rigidity which was very marked affected chiefly the extensor muscles of both upper and lower limbs. Tremor was almost entirely absent "it is so slight, so little appreciable that it is scarcely visible".<sup>31</sup>

Some interesting cases of the same kind have been recorded by Beevor.<sup>32</sup> In the first, male, aged 49, weakness began in the left arm, five years before the case was shown; then in turn, the left leg, right leg and lastly the right arm. Attitude and expression were characteristic, the voice was high pitched and monotonous, there was stiffness in the back of the neck, and he only raised the eyes when looking up, the fingers were flexed at the metacarpo phalangeal joints, extended at the others. There was slowness of movements with delay in starting them, he moved the body as a whole and very stiffly. There was a tendency to pro-pulsion and there had been a tendency to retro-pulsion, which had disappeared. There was a feeling of heat and restlessness, no tremor whatever, except, perhaps, slight movements of the tongue and chin and occasionally of the orbicu-

lares palpebrarum. An interesting case has been published by

This patient remained under observation for eight years after the publication of Beevor's paper, and I have had frequent opportunities of seeing him. I was never able to detect any tremor up to the time of his death, which took place suddenly from cholera nostras during the hot summer of 1893. His, was a most typical case of Parkinson's disease with the single exception of the absence of tremor.

In the second case, male aged 62, duration was also five years. The disease first showed itself by a gradual necessity of taking short steps in walking, followed by stiffness in the back of the neck and general weakness. The symptoms were characteristic; fixed attitude of head, trunk and hands, slow, delayed movements, pro-pulsion and retro-pulsion, speech monotonous, loss of power of finer movements, absolutely no tremor.

In the third case, there was only slight tremor, although the disease had existed for five years, the other symptoms were very marked.

The fourth case seems to me to have been a doubtful example of paralysis agitans and may have been an anomalous case of hemiplegia.

Beevor in the same paper refers to a patient of Buzzard's in whom there were no tremors, although the disease was so far advanced that the man was bed-ridden and almost helpless. A

full account of this interesting case has been published by Buzzard<sup>33</sup> himself, who remarks in reference to it, "but we do not know whether the symptom tremor has always been absent. It is quite possible that there may have been a certain amount, perhaps too small to attract the patient's attention". The tendency however, is for the tremor to increase in violence as time goes on, not to disappear, and it seems to me much more likely that in this case it never existed.

Betz<sup>34</sup> has also recorded cases without tremor. Amidon<sup>35</sup> has published four cases, two of these are doubtful and none of them so well marked as those of Charcot, Beevor and Buzzard.

Axenfeld<sup>36</sup> has also related a case with extreme rigidity in which there was no tremor, unless the patient was much irritated, when very slight shaking occurred. Tremor under such conditions might well be termed physiological.

The tremor is said to cease completely in some cases for a short period before death, as in a case recorded by Dowse,<sup>37</sup> in which it was absent for several days before the fatal termination.

## MUSCULAR RIGIDITY.

Charcot<sup>38</sup> remarks that most observers have overlooked this symptom. Certainly Parkinson makes no mention of it, but Sanders<sup>39</sup> in his admirable article "Paralysis Agitans" gives a very good description of it. It is worth noting that Sanders<sup>40</sup> included under the generic title "Paralysis Agitans" several distinct diseases, and the only one which we now call by that name is his Idiopathic paralysis agitans senilis festinans. The result of this rigidity is to imprint a very curious and almost unmistakable appearance upon the patient. The position of the hands and arms and the general attitude are very characteristic; the fingers are flexed at the metacarpo-phalangeal joints by rigidity of the interossei, extended at the other joints and directed towards the ulnar side as in rheumatoid arthritis; the thumb is in contact with the forefinger much in the position of holding a pen; the elbows are flexed and either glued, as it were, against the body or slightly abducted and held stiffly. The head, shoulders, and trunk are inclined more or less forwards and downwards. In the later stages, the chin may be drawn tightly down on the chest, the knees strongly flexed and the feet extended in the position of Talipes Equinovarus. This is by far the most common form of rigidity, and may be called the flexor type; but rare cases occur in which the extensor muscles are chiefly af-

fect. The arms then hang stiffly down, rigidly extended at the elbows; and the metacarpo-plalangeal joints are also extended; there is an impossibility of flexing the knees in walking, which gives an aspect of spasticity to the patient, but the knee jerks are not exaggerated, there is no ankle clonus and there is no true spasticity. Charcot<sup>41</sup> has recorded a very interesting case of this kind. Occasionally cases have been met with in which the head has been strongly drawn backwards by rigidity of the retrocollic muscles.<sup>42;42A</sup> The expression is fixed and immovable, the upper part of the face hardly moves at all, the frontalis and corrugator supercilii muscles may be in a state of strong tonic contraction, and the skin of the forehead thus thrown into deep wrinkles. As first pointed out by Beevor,<sup>43</sup> the oculo-motor muscles usually escape the general rigidity. If told to look to one side the eyes are first turned and then slowly, and with apparent difficulty, the head is turned in the same direction; the same thing occurs in looking up, the eyes are turned upwards, but the posterior cervical muscles are little if at all put in action to throw the head back. Sometimes the orbicularis oris is so much involved in the rigidity that the lips are tightly pressed together, no red mucous surface is visible and the skin round the mouth is wrinkled.<sup>44</sup> When the patient speaks the lips alone move and there is no play of expression. Stiffness in the

muscles at the back of the neck has been pronounced, and pain in that region has been much complained of in many cases which I have seen. The speech is monotonous and usually slow, but in some cases although there may be delay in beginning a sentence the words when once started follow one another with great rapidity, a sort of "festination" analogous to that of the gait. In the later stages the voice becomes shrill and high pitched. This was first noticed and recorded by Buzzard,<sup>45</sup> and apropos of this he makes the following interesting observations, "When a very advanced period of old age has to be represented" (on the stage) "the tone of voice adopted is exactly of the shrill piping character which we note" in paralysis agitans; he adds that since he noticed this piping voice in cases of shaking palsy, he has been on the look out to see if it was common in exceptionally aged persons, but has not found it to be so. He concludes "I cannot help thinking that the conventional voice of age on the stage has originally been derived from the study of some old persons with this disease, and thence handed down as we know is the stage custom to successive generations of performers." The laryngoscopic appearances are normal in these cases. Rigidity and tremor of the tongue and of the muscles of the lips account for the difficulty of articulation and dribbling of saliva met with in advanced cases.

Allied to the rigidity is a peculiar symptom occasionally met with, namely a kind of cataleptic condition of the limbs.

Buzzard<sup>46</sup> has described two cases in which it was present, the limbs if lifted and placed in any position remained there for a considerable time; when told to lower the limb some time elapsed before any movement was made and then the limb descended slowly. Voluntary movements are usually very slowly performed; if told to pick up an object from the table the hand is stretched out very slowly and carefully as it were; by an effort the patient can make the movement quickly, but if left to himself he does not do so. There is also a delay in starting the movements; rising from a chair is done slowly and with difficulty, and, when standing, some time elapses before the attempt to walk forward is successful. The feet feel, according to the descriptions given by patients, as if they were glued to the ground.

Buzzard<sup>47</sup> has described a curious modification of this symptom. The patient was an engine driver aged 64, "whilst he was at rest there was no shaking of his legs, but if he stood up and attempted to walk he remained for a time unable to start, his feet however beating the ground rapidly. All of a sudden this would cease, and he would start off at a fair pace though he required someone to hold him up. This "marking time" action when he tried to walk had been observed about eight months." The patient was much struck with the suggestion that it resembled the skidding of the wheels of a locomotive on slippery rails. With regard to the gait some misconception appears to

exist. In most descriptions one finds it described as consisting of a series of short quick steps tending to become a run and associated with much difficulty on the part of the patient of stopping his forward progress. In fact in many cases the pace becomes faster and faster until the patient either falls or manages to stop himself by catching hold of an article of furniture, or by running up against a wall, unless he should happen to be caught and stopped by a bystander; this constituting what is known as pro-pulsion. Now although this is certainly a type frequently met with in advanced cases before absolute helplessness with impossibility of any kind of progression supervenes, it is certainly not characteristic of the earlier stages of the malady. In them as a rule, the steps are rather slow, but very long and slouching, the feet being little raised above the ground, but the strides taken being considerable in extent. I shall refer to this again when speaking of latero-pulsion.

RETROPULSION is as the word implies, the reverse of propulsion. Trousseau<sup>48</sup> claimed to have been the first to describe it. It may be either spontaneous or elicited; in the former case the patient may be attempting to move forwards when he is irresistibly drawn backwards, his retrograde steps become faster and faster, and he falls to the ground unless caught by an attendant. It is quite unsafe to leave a patient with a tendency to retropulsion standing by himself, as the retrograde movements frequently start without any voluntary attempt at motion

in any direction. Both pro-pulsion and retro-pulsion may be easily elicited, as pointed out by Hadden,<sup>49</sup> by gently pressing the patient's head either forwards or backwards as the case may be. Charcot's method,<sup>50</sup> and a useful one, for eliciting retro-pulsion, was to give a sharp unexpected pull at the patient's clothing behind. Retro-pulsion, as a rule, precedes pro-pulsion; both may exist in the same patient, and perhaps the latter is the commoner of the two.

LATERO-PULSION is a term which may be applied to a similar phenomenon which consists in the patient's being irresistibly driven to one or other side. I have only been able to find four published references to it, one in the case already quoted as one of paralysis agitans with absence of tremor. In the account of this case Charcot (or Bourneville) says "il n'y a pas de tendance à la pro-pulsion ou à la rétro-pulsion; mais, de temps en temps, mme. G . . . se sent invinciblement entraînée vers le côté gauche."

Gowers<sup>51</sup> says one patient in turning often took a few unintended steps to one side.

Peterson<sup>52</sup> mentions one case in which the symptom was present and Heilmann<sup>53</sup> also has recorded one. I am convinced that this tendency to latero-pulsion is not nearly so rare as it would appear to be from the small number of cases recorded. I believe it is over-looked because it is not looked for or inquired about. Two of my own cases present it in a fairly marked degree

(cases III and IV) and in both these the patients themselves complained of the symptom without any inquiry about it on my part, which I think adds to its value. But certainly the most marked example which I have ever seen or heard of is one which is at present under the care of my friend Dr. Beevor, at the National Hospital for Paralysis and Epilepsy, Queen's Square, and which he has kindly allowed me to refer to. The poor woman's life is made a misery to her by this symptom which is much the most prominent one in her case. Other symptoms are present, but they all sink into insignificance before this tendency to latero-pulsion. The patient can manage a few steps straight forward pretty well, but as soon as she attempts to deviate however slightly from the straight line, off she goes to one side, one foot after another, faster and faster until she falls or saves herself by clutching at some neighbouring object or by running up against a wall. As a rule this takes place at every fifth or sixth step, and she cannot get about at all except by clinging to a friend's arm, who is ready at any moment to restrain the tendency towards lateral movement. This patient told me, and practically demonstrated the fact, that by taking long slouching steps she was able to a great extent to overcome this tendency, and it struck me that in this we may have the explanation of the peculiar sliding long stride of the earlier stages of paralysis agitans; that it may be an unconscious effort on the part of the patient, as it is a conscious

one in this woman's case, to restrain the tendency towards retro-pulsion or propulsion as the case may be. When the disease progresses and muscular power has become enfeebled then this restraining influence can no longer be exerted, the patient abandons the futile effort and the short running steps are the result of the uncontrolled tendency. It is interesting to note that Sanders<sup>54</sup> foresaw the possibility of this symptom occurring for he said, "No case is recorded of a disposition to fall or move sideways."

In speaking of the rigidity of voluntary muscles, I stated that Beevor had pointed out that, in the majority of cases, the oculo-motor muscles escape, but Debove<sup>55</sup> has shown that this is not always the case. In investigating the cause of the difficulty & fatigue in reading experienced by some patients afflicted by this disease, he found that the tremor had little to do with it; the chief cause of the feeling of fatigue experienced was one which he designated "ocular latero-pulsion." This is, I think, most easily and clearly described by considering what occurs when a patient with this symptom attempts to read, say a newspaper printed in columns. We may call three columns A, B, and C, respectively, and presume that our patient is reading the middle one B. When he arrives at the end of the line his eyes involuntarily continue their movement in the direction they have been pursuing, and he is, as it were, obliged to read a word or

two of the beginning of a line in column C, and there is an appreciable interval before he can turn them back to the beginning of the next line in column B, and when he does so he overshoots the mark, and reads involuntarily a few words at the end of the corresponding line in column A. The former, namely, overshooting the mark in the direction of C, Debove likens to propulsion, and the latter to retro-pulsion, and states, "That the retro-pulsion is more annoying and puzzling to the patient than propulsion." He explains this very plausibly by the fact that whilst reading the line the eye moves slowly, and the innervation of the muscles is not intense, whilst when the patient wishes to turn the eye back to the beginning of the line he wills it to move more quickly, and the innervation being more intense, the mark is overshoot to a greater extent.

Neumann<sup>56</sup> has observed a similar case. In order to avoid the annoyance caused by this symptom both patients were in the habit of folding the newspaper, whilst reading it, so that only one column should be visible at a time.

#### LOSS OF MUSCULAR POWER.

Charcot<sup>57</sup> asserted that the term Paralysis as applied to this disease was a misleading one, as there is no definite loss of muscular power until the last stages are reached. Beevor<sup>58</sup> makes the same statement. Trousseau<sup>59</sup> also remarked upon the con-

servation of muscular power, and mentions one case in which the grasp of the right hand, which was most affected, registered 50 on the dynamometer, and that of the left hand, which was not affected by the tremor, only 40. Hilton Fagge<sup>60</sup> has well pointed out that the stronger hand in this case was the right one, and that we have no means of knowing what its powers might have been before the onset of the malady. Patients certainly complain very much of a sense of weakness in the affected parts, and there is without doubt a loss of power of performing fine movements.

Buttoning a coat for instance is accomplished with very great difficulty even when there is not much tremor. But dynamometric evidence is not wanting to show that there is a real loss of power in many cases long before the disease has reached its last stages. In six cases examined by Bourneville,<sup>61</sup> the following were the average grasps:-

	<u>Right,</u>	<u>Left.</u>
1.	60	42
2.	67	63
3.	59.6	41.4
4.	39.6	43.4
5.	65.5	42.3
6.	41.4	33.3

He found the average grasp of five healthy people of the same

age as these patients to be 85, and very remarkably this loss was as well marked in early cases as in advanced ones. In three of the cases the weakness was more marked on the side affected by the tremor than on the other. In two of my own cases (Cases I and II.), in which the symptoms have only existed for a year, the muscular power is decidedly lessened. In case I. the grasp of each hand is only 20, in case II. the right grasp is 80, this being the most affected side, whilst the left grasp is 90. The patient is a right-handed man so that these figures have great significance. The weakness may finally become so great that the index of the dynamometer cannot be moved at all, but there is never absolute loss of power.

#### RESTLESSNESS.

Another symptom which is rarely absent is great restlessness. The patient must constantly change his position. He gets up and sits down again frequently, the mere effort of slightly raising himself from the chair seeming to afford relief for a short time. In some cases the sufferer is compelled to get up from his seat and walk about for a little at very frequent intervals, and in bed a frequent change of position is absolutely necessary. When the disease is advanced and a patient helpless and bedridden from rigidity, this restless discomfort, combined with the impossibility of a change of position without the aid

of an attendant, almost amounts to torture. An advanced case of Paralysis Agitans makes more demands upon a nurse's forbearance and patience than any other disease with which I am acquainted, chiefly on account of this terrible craving for change of posture.

### SENSORY SYMPTOMS.

Rheumatoid pains are very common in cases of Paralysis Agitans and often precede as well as accompany the tremors. Occasionally the pains are very severe. One of Charcot's patients was a woman who had suffered for several years before the onset of the tremors from violent pain localised in the course of the nerves of the leg and foot. These parts were the first to be attacked by the tremor. The pain was intensely severe and lasted till the death of the patient.<sup>62</sup> Romberg<sup>63</sup> has recorded the case of a man in whom the tremor was for a long time confined to the left side, although it ultimately spread to the right. It was accompanied by very severe "tearing" pain in the affected limbs, and when the pain was most intense the tremor was most severe. Pain in the back of the neck is a frequently complained of symptom, often so severe as seriously to interfere with sleep.

Numbness or tingling in the affected extremities is sometimes experienced, but there is never any anaesthesia.

Another conspicuous symptom, probably due in some way to

disordered action of the sympathetic, is an intense subjective sensation of heat, often general, sometimes confined to the affected limbs, but most commonly experienced chiefly at the epigastrium. Boucher<sup>64</sup> describes at great length a very typical case in which this symptom was so extremely marked that the patient, perhaps with a little unconscious hyperbole, declared that she was "dans le feu, dans les flammes d'enfer." In most cases the sensation does not amount to more than one of uncomfortable warmth, and is usually worse at night, so that very few bed-clothes can be tolerated. The actual temperature of the body is not increased, but the surface temperature may be considerably raised. Reynolds<sup>65</sup> records a case in which the surface temperature of the limb affected by the tremor was raised 4° F. above that of other parts of the body; but this was a doubtful case of Paralysis Agitans. Grasset and Appolinario<sup>66</sup> in the case of a patient in whom this symptom was extremely marked, found the temperature taken on the forearm, to be 36.8° C. (98.24° F.), as against 33.6° C. (92.48° F.), When the temperature was taken in the same way in healthy subjects - a difference of nearly 6° F. Berger also maintains that whilst the general temperature remained normal, there might be a marked peripheral increase. Peterson<sup>67</sup> in a case in which the patient complained of great heat over the abdomen, found the temperature in the mouth

to be 98.5° F., and that of the abdominal surface to be 97° F. But he does not compare the abdominal surface temperature with that found in healthy people. Charcot<sup>68</sup> claimed to have been the first to have remarked this symptom, and he certainly was the first to publish an account of it. But Duckworth<sup>69</sup> had observed it in 1866, prior to the publication of Charcot's lecture, which was delivered in 1868. In his case there was no general rise of temperature, and that is certainly the rule.

Associated in many cases with this sensation of warmth, but sometimes quite independent of it, is a tendency to profuse sweating. In one case mentioned by Duckworth, that of a woman aged 29, in whom there were tremors and marked sweating, there was a history of hyperlactation, and she had had five children in seven years. There is little in the case as described to lead one to look upon it as a case of Paralysis Agitans. It seems quite as likely to have been a case of incomplete Exophthalmic Goitre, or, still more likely, the symptoms were due to a condition of extreme debility. But in the first case in which he observed the extreme sense of heat, hyperidrosis was very marked. She was "bathed in perspiration." Both these symptoms are well marked in my own Case IV.

Occasionally instead of heat, patients complain of feeling chilly. This is the case in two of my own patients (cases III. and V.) and it is not uncommon.

In five cases of unilateral Paralysis Agitans, Gowers found the pupil smaller on the affected side than on the other.<sup>70</sup>

### REFLEXES.

The state of the reflexes in Paralysis Agitans is usually normal. In two of my cases, however, the knee-jerk was absent in one, and could only be obtained with great difficulty in the other. In one case mentioned by Buzzard<sup>71</sup> the knee-jerk was only just obtainable. In another case recorded by Barr,<sup>72</sup> the patellar tendon reflex was almost absent. In rare cases the knee-jerk is increased and there may even be ankle-clonus. Hadden<sup>73</sup> described a case which was under Dr. Ord in St. Thomas' Hospital in 1881. The tremor began in the left leg, spread to the left arm and then to the right arm. The tendon reflexes were exaggerated both in the arms and legs. There was no clonus. He suggests "it is possible that in some cases the lateral columns become affected secondarily, and hence the occurrence of rigidity and cramps." But of this involvement of the pyramidal tracts, there is absolutely no post mortem evidence. A case has been recorded of cervical myelitis in which movements occurred simulating those of Paralysis Agitans. Such a case would probably be followed by pyramidal sclerosis, and we should have exaggerated reflexes, but it would not be a case of Paralysis Agitans properly so called.

TACHYCARDIA.

Marie and Azonlay<sup>74</sup> have recorded a tendency to a rapid pulse. In thirty-one cases which they examined with reference to this symptom, they found that

in 7 cases the pulse was 76 or below

in 5 " " " " 76 to 90.

in 19 " " " " 90 - 102.

Peterson,<sup>75</sup> however, only found the symptom present in one out of forty-seven cases. In this case the pulse rate was 120. I have never seen it myself, and one is inclined to think that the increase of pulse rate may have been due to the more excitable French temperament under the stimulus of a medical examination. At all events it is evident that the symptom is not a frequent one, and I do not think that one pulse rate of 120 in forty-seven patients is a greater proportion than one would expect to find in a series of cases of almost any disease taken at random.

CONDITION OF URINE.

Cheron<sup>76</sup> made an exhaustive investigation into the condition of the urine in Paralysis Agitans. His chief conclusions are thus summed up: "There is an increase in the quantity of the urine, which is often more than double the average amount, as well as an increase in the quantity of the phosphates, the phosphoric acid of which is often triple the normal quantity. As

to the sulphates their increase is inconsiderable." He further states that these changes may be found in the urine before any of the symptoms of the disease have shown themselves, and that in those cases which have followed suddenly upon an injury, severe fright etc., this merely acted as an exciting cause to start the symptoms, the predisposing cause, viz:- exhaustion of the nerve centres, as evidenced by the increase of urinary phosphates having been at work for a long preceding period. These experiments appear to have been very carefully carried out, but I am not aware that they have been confirmed by any other observer.

#### MENTAL CONDITION.

One clause in Parkinson's definition of the disease was, "the intellect being uninjured."<sup>77</sup> In the majority of cases there is for a very long time no sign of diminution of intellectual power, a certain amount of depression and irritability being a natural consequence of the extremely painful and hopeless condition in which these patients find themselves. But as the disease progresses the memory becomes very uncertain and ultimately the intellect may be very much impaired, a kind of senile dementia being the result. But a considerable number of cases have been recorded in which true insanity was associated with Paralysis Agitans. Ball<sup>78</sup> goes so far as to say that "a slight degree of intellectual perturbation is almost the rule in this affection."

### MORBID ANATOMY.

The earliest attempt to suggest a Morbid anatomy for this affection was made by Parkinson himself.<sup>84</sup> He describes a case "related by Dr. Maty in the third volume of the Medical Observations and Inquiries". The patient, the Count de Lordat, was overturned in his carriage from a high and steep bank. His head struck against the top of the coach and was bent from left to right. Sometime afterwards he began to find difficulty in uttering words, and his left arm appeared weaker, which symptoms gradually increased. The arm wasted to some extent. The next Spring, fifteen months apparently after the onset of difficulty of speech, he became affected with involuntary convulsive motions all over the body, "a spitting began, and now it was with difficulty that he uttered a few words". Dr. Maty saw him for the first time three and a half years after the accident. He still walked alone with a cane from one room to the other, but with great difficulty and in a tottering manner; his left hand and arm were much reduced, and would hardly perform any

motion; the right was somewhat benumbed, and he could scarcely lift it up to his head; his saliva was continually trickling out of his mouth, and he had neither the power of retaining it, nor of spitting it out freely. What words he still could utter were monosyllables, and these came out after much struggle, in a violent expiration, and with such a low voice and indistinct articulation as hardly to be understood but by those who were constantly with him. He fetched his breath rather hard: his pulse was low, but neither accelerated nor intermitting. He took very little nourishment, could chew and swallow no solids, and even found great pain in getting down liquids". The words "great pain" are probably a literal rendering of the French words "grande peine" and should have been translated "great difficulty". I have been thus particular in transcribing the main points of this remarkable and historical case, because I think it will be evident from a careful perusal and study of them that the case was not one of Paralysis Agitans at all. Indeed Parkinson himself never claimed it as one. All he says is, "in some of the symptoms which appeared in this case, an agreement is observable between it and those cases which are mentioned in the beginning of these <sup>85</sup> pages". And again, these "constitute such a degree of accordance as, although it may not mark an identity of disease, serves at least to show that nearly the same parts were the seat of the disease in both instances".

It is particularly stated that the patient "was much emaciated". This then were it not for the movements, might have been an example of Amyotrophic Lateral Sclerosis, and it is note worthy that Dr. Maty makes no reference whatever to any involuntary movements in his graphic description of the patient's condition when he saw him. Post mortem, the chief morbid appearance was a hypertrophy of the Medulla Oblongata, "the membranes which, in their continuation inclose the spinal marrow, were so tough that we found great difficulty in cutting through them and we observed this to be the cause of the tendinous texture of the cervical nerves". The substance of the Medulla was very firm, and this firmness extended for some distance down the spinal cord, gradually, however, becoming less. We have manifestly to deal here with a meningitis, the inflammation having involved also the Medulla and cord. The out-going nerves were compressed and their sensory roots irritated. But this is not Paralysis Agitans. I have gone into this case at greater length than I should otherwise have done were it not that it is continually quoted, and quoted too as if it were Parkinson's own case, and he himself had observed the phenomena and performed the autopsy. This error is made by Elliotson,<sup>86</sup> Trousseau,<sup>87</sup> Eulenberg,<sup>88</sup> Gowers,<sup>89</sup> Hadden<sup>90</sup> and others, and the case seems to be accepted unhesitatingly as an example of his disease. Parkinson<sup>91</sup> reasoning from this case, suggested that the cause of shaking Palsy might be "some slow a

"some slow morbid change in the structure of the Medulla, or its investing membranes or theca, occasioned by simple inflammation, or rheumatic or scrophulous affection". Trousseau<sup>92</sup> followed Parkinson in his ideas of the Morbid Anatomy and Pathology of the affection. He believed that there was "a circumscribed phlegmasia of certain parts of the cerebro-spinal axis, a spurious phlegmasia if you will, essentially chronic and latent of which the ultimate consequences are sclerosis, with fatty degeneration of the nerve elements, and possible softening of the medullary fibres."

Another historical case is that of Oppolzer.<sup>93</sup> The onset was apparently very sudden in a man of 60, the subject of extreme terror. The tremor accompanied intentional movement and was started by it. There were convulsive attacks towards the end of the illness, after each of which the trembling would cease for about half an hour. He became semi-comatose, and finally died of an intercurrent pneumonia. The patient was found at the necropsy to be the subject of aortic disease, and of old standing phthisis. As the case is so often quoted I give the account of the changes found in the nervous system in full.

"The walls of the cranial vault were very thin and presented some roughening on the surface of the inner table. The Dura Mater was thickened and adherent here and there to the skull. The Pia Mater was opaque and infiltrated with serous

"exudation. There was also a pretty considerable amount of the  
"same exudation in the sub-arachnoid cellular tissue. The cere-  
"bral convolutions were diminished in size, and the sulci be-  
"tween them appeared deeper than normal. The cortical substance  
"was a pale brown colour. The medullary substance was perfectly  
"white and furrowed by dilated vessels. The brain-tissue was  
"firm and moist. In the ventricles were some drachms of trans-  
"parent serous fluid. The ependyma, especially in the region  
"of the posterior cornua was granular. In the substance of the  
"optic thalamus of the right side was an apopleptic cyst the  
"size of a small bean, the walls of the cyst being pigmented.  
"The pons Varolii and the Medulla Oblongata were very manifestly  
"indurated. The spinal cord was firm; in the lateral columns,  
"principally in the lumbar region, the medullary substance was  
"seamed with grey opaque streaks." ."

"MICROSCOPICALLY, in the substance of the pons and of the  
"Medulla was an abnormal growth of connective tissue, which ex-  
"plained the induration presented by the parts. As to the opa-  
"que streaks observed in the lateral columns of the cord, they  
"were due to the presence of connective tissue in process of  
"development."

This case certainly presents some points of resemblance to  
that quoted by Parkinson, so far as the appearances found in  
the Medulla are concerned, but dealing as we are with a man the

subject of advanced arterial degeneration the probability is, that the sudden onset of his symptoms was due to haemorrhage into the optic thalamus, injury or disease of which is well known to give rise to tremors which may closely resemble those of Paralysis Agitans. Leyden has recorded a case in which movements of this kind, confined to the right arm occurred in a patient the subject of sarcoma of the left optic thalamus.<sup>94</sup> But this could not be called a case of Paralysis Agitans, a disease in which tremor, although usually a very conspicuous symptom is not by any means an indispensable one. There are no other distinctly characteristic symptoms in Oppolzer's case, unless we include a tendency to fall forwards, which occurred at a later period in the history of his illness, and which may arise from brain disease of various kinds and in various situations. All the other symptoms might be accounted for by the vascular degeneration.

A somewhat similar case has been recorded by Sée in which tremors began in the left foot and some time afterwards the rest of the limb and the arm of the same side became affected. He supposes that they were due to haemorrhage into the substance of the brain "in the neighbourhood of the basal ganglia". (the lenticular nucleus or optic thalamus) presumably not involving the internal capsule, as there is no hemiplegia, hemianaesthesia, or hemianopsia recorded.<sup>95</sup>

Murchison and Caley<sup>96</sup> record the case of a man aged 71, who died of Typhus Fever on the twelfth day of the illness. For twelve years he had suffered from movement of the right hand which gradually extended to the other extremities and to the head. Tremor was much increased by excitement and by voluntary movement. Latterly the body had been much bent forward. These are practically all the clinical facts of the case as given by Murchison, and they certainly leave room for doubt as to whether the case was an instance of true Paralysis Agitans or one of Senile Tremor. On the tenth day of the fever the patient was quite unconscious. There was albumen in the urine, and the whole body, including the facial muscles was "in constant and violent tremulous movement". The following lesions of the nervous system were found post mortem by Dr. Caley.

- (1) The cortical or connective tissue layer of the cord was thickened, showing more nuclei than usual. These were often found in little groups, were chiefly observed in the cervical and dorsal regions, and the changes were most marked posteriorly.
- (2) Passing from the cortical layer into the substance of the cord, there were irregular tracts and patches of connective tissue thickly nucleated, which as well as the altered cortical layer stained very deeply with carmine. The reticulum of the cord was much thickened, especially in the neighbourhood of the connective tissue

patches, which were irregularly distributed and occurred only in the dorsal and cervical regions usually near the exit of the posterior nerve-roots, and generally a little external to them. The roots were unaltered.

(3) The central canal of the cord throughout was completely transformed. In its site was an oval tract, much larger than the normal canal, crowded with cells most of which were like white blood corpuscles, others oval and elongated, none however presenting the characters of the normal epithelium of the canal. This tract occupied the site of the central substantia gelatinosa as well as of the canal itself.

(4) The capillary vessels of the gray matter of the cord, and to a less extent those of the white, were distended with blood and in some cases contained aggregations of white corpuscles, forming as it were plugs. Here and there were small extravasations.

(5) Scattered throughout the cord, chiefly in the gray matter were small deposits of leucocytes or exudation cells met with equally in all regions.

Caley remarks that there were thus two kinds of morbid change:-

1. CHRONIC causing thickening of the cortical layer and reticulum with the formation of patches of connective tissue induration.

11. ACUTE giving rise to capillary congestion, extravasations, and scattered patches of exudation. He suggested that the acute process coincided with the attack of Typhus, and the "consequent exacerbation of the Paralysis Agitans."

It is doubtful whether Murchison really looked upon these lesions as the cause of the tremulous condition of the patient. Speaking five years later at the Pathological Society and referring to this case, he said that the fact that the patient died of Typhus detracted greatly from the value of the observations.<sup>97</sup> It is however important to note that in the second of Joffroy's cases, to be presently quoted, similar lesions to those regarded by Cayley as acute, were found, although there is no history of an acute febrile termination of Joffroy's case, and this was in his opinion the most typical case of Paralysis Agitans of his three patients.

Dowse has described the pathological appearances found in one case.<sup>98</sup> The patient was aged 52 at the time of death and the illness had lasted for nine years. The shaking began in the head, the right arm was next affected, then the left arm and then the legs; the patient could stand, but if she attempted to walk forwards she took a few rapid steps backwards and would fall if not supported. After being helpless in bed for sometime the sphincters became incompetent and the intellect failed. The tremors ceased for a few days before death.

It will be seen that this was a somewhat anomalous case, the commencement of the tremor in the head being distinctly unusual.

POST MORTEM. The brain weighed fifty-three ounces; the grey matter was normal, the arteries at the base were atheromatous, the nerves firm, the medullary matter was glistening and firm and the spinal cord very firm.

MICROSCOPICALLY. There was an atrophic granular pigmented fuscous degeneration of the nerve cells at the decussation of the anterior pyramids, of those of the olivary body, of the nucleus of the ninth nerve, of the laminae and corpus dentatum of the cerebellum and in the anterior cornua of the spinal cord. There was cortical sclerosis of the posterior and right lateral columns of the cord with miliary and colloid degeneration and miliary changes in the white matter of the corpora striata and hemispheres. In one part of the nucleus of the fifth nerve was a cavity containing a collection of colloid bodies; minute vessels were thickened and some sacculated, with well marked perivascular spaces.

The above abstract is taken from the Society's Transactions and from the Lancet's report of the meeting, as the proof sheets of the paper in the transactions had apparently been very carelessly revised. Dowse himself was not inclined to look upon the lesions in his case as the cause of the symptoms. <sup>99</sup> Joffroy

gives particulars of the lesions found in three subjects of Paralysis Agitans.<sup>100</sup> The first and second cases were undoubted instances of this disease; the third was somewhat doubtful, though the only reason he gives for doubting its nature is that there was a rheumatic history.

He found three constant lesions.

1. Complete obliteration of the central canal by proliferation of the epithelium lining the ependyma.
2. Proliferation of nuclei surrounding the ependyma.

The proliferation of the epithelial cells had spread to the connective tissue around the central canal. The nuclei of the connective tissue had proliferated to a considerable distance from the canal, these nuclei, which are visible in a child, and become less so in the aged, here constitute an important lesion.

3. Pigmentation of the nerve cells. Pigmentation was very pronounced, especially in the cells of Clarke's vesicular column.

In the first of the cases he found a special lesion. This case was accompanied from the onset by a tendency to retro-pulsion. The lesion consisted in a circumscribed meningitis with production of connective tissue nuclei and accumulation of leucocytes forming a rounded mass, which had distended and deformed the point of the calamus scriptorius. The alteration

Demange in one case.<sup>101</sup> There was periependymitis with obliteration of the ependymal canal and irritation(?) of the posterior roots. Sclerosis of the column of Goll and a very slightly marked disseminated interstitial myelitis at some points of the white antero-lateral columns.

Redlich gives the results in seven cases.<sup>102</sup>

The spinal cord was most affected; small patches of sclerosis were found, chiefly in the posterior columns of the cord. Similar but less extensive patches were found in the lateral columns, whilst in the anterior columns they were slight or absent. The median and ventral parts of the posterior columns near the posterior commissure were generally most affected. All the changes were most marked in the lumbar and cervical enlargements. In the cervical region there was almost always a more or less diffuse sclerosis in the columns of Goll. The sclerotic patches were of the nature of perivascular sclerosis. In the parts most affected, it appeared as if the nerve fibres had gradually atrophied through the increase of the interstitial tissue. The vascular changes were of the nature of endo- or peri-arteritis, with extension of the inflammatory process into the surrounding parts. The ganglion cells of the anterior horns and of Clarke's column were pigmented. He refers to ten other recently published cases in which similar changes were found. These together with those given above certainly give

some support to his conclusion that Paralysis Agitans is a disease having a definite pathological anatomy.

Luys states, that in two cases, he found hypertrophy of the nerve cells in the Medulla (?) and pons.<sup>103</sup> The patients were both women, who died respectively at the age of 62 and 65, after having presented symptoms of Paralysis Agitans; e.g. trembling of the hands, special movements of the fingers, general muscular weakness, and stiffness of the muscles of the neck. In both cases shaking of the head was noted.

He found marked firmness of the pons and bulb, indicating a certain amount of interstitial sclerosis. On making transverse sections, he noticed a rosy colouration of the grey substance, and here and there indications of greyish induration corresponding to patches of interstitial sclerosis.

MICROSCOPICALLY; after hardening with chromic acid, he found considerable hypertrophy of the cells of certain groups in the central region of the pons. The cells were swollen, very clearly defined and their processes were also very apparent, the cells being twice the normal size. This hypertrophy appeared to exist only in certain zones and to be concentrated exclusively in the median region of the pons, whilst in the medulla the cells were of normal size. This observation would have been of the greatest value had it been confirmed by subsequent observers,

but this has hitherto not been the case.

Other lesions have been described in other cases. Skoda's case which occurred in a woman aged 34, was evidently one of disseminated sclerosis.<sup>104</sup> Lebert found a shrunken sclerotic nucleus in the upper part of the cord, (possibly the result of previous inflammation) in another case.<sup>105</sup>

Cohn<sup>106</sup> found cerebral atrophy in a man of 49, and in a man of 74, atrophy of the spinal cord at the second cervical vertebrae.

Marshall Hall noted the resemblance of the tremor to that observed in cases of disease of the pons, and of the corpora quadrigemina.<sup>107</sup>

Ordenstein<sup>108</sup> tries to sustain the theory, that the bulb and the pons are the seat of the disease chiefly on account of the supposed fact that in disseminated sclerosis, tremor only occurs when sclerotic patches are found in those parts of the central nervous system. He mentions a case recorded by Leubuscher, in which tremor resembling that of Paralysis Agitans occurred in a young lady who was afterwards found to be suffering from a tumour of the pons.<sup>109</sup>

In contrast with the cases mentioned above in which definite lesions of the nervous system were found post mortem, there have been several well marked cases of the disease in which most careful examinations were made by very competent observers

and in which absolutely nothing abnormal was found.

Charcot<sup>110</sup> has recorded three of these, Olivier one (by oral communication) to Ordenstein;<sup>111</sup> Th. Simon,<sup>112</sup> four cases; and Westphal one.<sup>113</sup> This last case was of six years duration.

Gowers<sup>114</sup> practically denies that any true pathological anatomy exists: he devotes a short paragraph to its consideration, merely mentioning the observations of Charcot, Berger, Westphal, and Luys.

Charcot<sup>115</sup> always held that there was no discoverable lesion. He speaks of it as "an affection which belongs to the great category of neuroses, and in which at the autopsy one finds no lesion of the nerve centres." This is I believe the generally accepted view at the present time and I think that few would agree with Dr. John Murray,<sup>116</sup> in believing that "cases are nearly always due to chronic connective tissue changes in the cord, as described by Cayley, and to a considerable extent amenable to treatment." At the same time I have thought it well to gather together the principal published accounts of the lesions hitherto found in this mysterious disease, as they may at some future date be proved to have a greater causal connection with the disorder, than we now credit them with.

## PATHOLOGY.

In the absence of any accepted Morbid Anatomy, a good many theories have been elaborated to account for the phenomena of this disease.

Dr. Hughlings Jackson's views, emanating from such a source, are worthy of the deepest respect and merit a very close examination. In addressing the British Medical Association at Leeds in 1889, he thus refers to Paralysis Agitans. <sup>117</sup> "I submit the hypothesis that (1) Progressive Muscular Atrophy (2) Paralysis Agitans and (3) General Paralysis are homologous diseases. The comparison and contrast is not of wasting of muscles, tremor, and a negative psychological defect. Analysis shows, I think, that, artificially limiting illustration to the hand, there is loss respectively of (1) simplest (2) more complex and (3) most complex movements of the hands. The comparison is of three cases of paralysis. The lesion is supposed to be wasting of cells in the order from smallest towards largest, of lowest, middle, and higher motor centres respectively." He then refers back to what he calls the "hierarchy" of the motor centres. His classification is, briefly, as follows:-

(1) The anterior spinal horns and their homologues higher up ((nuclei of motor cranial nerves) which are the lowest motor centres of the cerebral and cerebellar systems:- affected in Progressive muscular Atrophy.

(2) The convolutions of the Rolandic region are the middle motor centres:- affected in Paralysis Agitans.

(3) The prae-frontal lobes are the highest motor centres:- affected in general Paralysis.

Each of these motor centres with their corresponding sensory centres from successive <sup>forms</sup> "levels of evolution of the central nervous system." The cerebellum is designedly ignored. We can now understand what follows. "In Paralysis Agitans there is (this is of course hypothetical) loss of more complex movements" of the hands "(than in Progressive Muscular Atrophy previously discussed) "those represented in middle motor centres. There is retention of the most complex movements represented in the highest motor centres, and also of the simplest represented in some lowest. With this loss of more complex movements (we might say "middle movements") there is, in the tremor, development of simplest movement of the same muscles, the latest stage being rigidity. I submit that these movements are the result of mere physiological over-activity

of the healthy lowest motor centres. To repeat, there is a duplex condition of the hand; negatively loss of complex (middle) movements of its muscles, and at the same time, super-positively, overdevelopment of simplest (lowest) movements of the same muscles. This case differs doubly from (1) (Progressive Muscular Atrophy) for in it the movements lost are (a) simplest, and (b) both the cerebrum and cerebellum are cut off from the muscles; whilst in (2) (Paralysis Agitans) the movements lost are (a) more complex, and (b) the cerebellum remains united through the lowest motor centres with the muscles. (I have suggested that the cerebellum cooperates with the anterior horns in producing the tremor.)"

This then is Hughlings Jackson's view, and may be summed up shortly as a conjecture that the phenomena of Paralysis Agitans may be explained by a wasting of nerve cells in the Rolandic area allowing of a mere over-activity of the healthy lowest motor centres, viz: the cells in the anterior cornua and the nuclei of the motor cranial nerves.

I have quoted this view at some length, in the first place because it is that of our most eminent neurologist; and in the second because it, or some modification of it, is the one which I am most inclined provisionally to accept. There are however several objections to accepting it exactly as it stands:-

(1) If these motor cells in the cortex are, as Dr. Jackson supposes, wasted, why do we not find post-mortem microscopic evidence of this? In the other two diseases with which he institutes a comparison we certainly do find this evidence. In the case of Progressive muscular Atrophy (and I might add in Infantile Paralysis) there is marked wasting of the cells in his "lowest motor centres." In general Paralysis again the nerve cells in the Frontal and Parietal cortex shows granular, fatty, or pigmentary degeneration. They are altered in shape, and have lost their processes and have undergone atrophy: the gray matter being much wasted. But in the case of Paralysis Agitans what evidence have we of this process? I can find no description, in any published account of post-mortem appearances found in this disease, of any atrophy of motor nerve cells in the Rolandic motor cortex, and although in some cases some atrophy of the brain has been recorded, this has been probably merely a senile change, and not greater than that which frequently exists in advanced life without giving rise to any symptoms.

(2) If we are to assume an atrophy of these cells we should expect to find a loss of their nutritional power over the fibres proceeding from them, and hence some amount of degeneration of the Pyramidal tracts. But this has, in well

marked cases of the disease, rarely, if ever, been found and the rigidity is certainly not due to Pyramidal Sclerosis. The usual manifestations of such a sclerosis in exaggerated tendon reflexes and clonus are almost invariably absent, the latter being extremely rare, and the exaggerated reflexes when they exist being no brisker than those found in many neurasthenics in whom there is no suspicion of a lesion of the cord. In two of my own cases the knee jerk was quite absent in one (case iv) and in the other (case iii) could only be elicited by Jendrassik's method of reinforcement, and then only with great difficulty. This is the more remarkable as this patient had been completely hemiplegic on the right side for two months before the onset of his Paralysis Agitans, and we should therefore have expected some degeneration of the Pyramidal tracts in his case. But the right jerk was quite as difficult to obtain as the left, and its absence was certainly not due to rigidity of the muscles flexing the leg upon the thigh.

(3) Jackson says "there is, in the tremor, development of simplest movements in the same muscles, a later stage being rigidity. Now although in the majority of cases the tremor precedes the rigidity, this is by no means always the case. I have already mentioned several cases

in which the rigidity was well marked whilst the tremor was absent. In one of my own cases the rigidity, as shown by the interosseous position of the hand and the flexed elbow, is very pronounced, whilst there is practically no tremor. (case i). And I think I may venture to say that it is the rule in cases which follow the hemiplegic type to find some evidence of rigidity in the muscles of the side last affected before any tremor can be discerned in them. I presume Jackson's idea is that as the atrophy proceeds in the cortical cells their influence is at last abolished and continuous rigidity results. But this seems to me to fail to account satisfactorily for those cases in which the rigidity precedes the tremor.

(4) There are a number of cases on record in which the shaking began and spread rapidly immediately after a fright or severe shock. My case iv is an example of this and I shall refer to several others under the head of Etiology. Even slight traumatism may be the determining cause of the onset of the disease, and it is very difficult to conceive that any of these influences could cause "wasting" of the cortical nerve cells in such a sudden manner as to produce the symptoms almost immediately.

But if for the words "wasting of cells" we substitute "change of nutrition in the cells of the Rolandic convolutions

with consequent loss of control of the lowest motor centres", I think we have a probable pathology which explains well almost all the symptoms of this complicated malady. These changes in nutrition are as Gowers puts it "far too fine to be revealed by alterations of structure recognisable by the microscope".<sup>118</sup> This view is not open to the objections raised to Jackson's theory, as:-

- (1) We should not expect microscopical evidence of a purely nutritional change in the cells.
- (2) We should not necessarily get a descending degeneration of the Pyramidal tract, as we should in an atrophy of the cells.
- (3) It is quite easy to conceive a loss of control over the lowest motor centres depending upon a condition of malnutrition of the higher centres being steady at one time and intermittently greater and less later on, thus accounting for the occurrence of slight rigidity without tremors in the earlier stages of the disease followed by rigidity plus tremor at a later period.
- (4) A nutritional or functional change might occur almost instantaneously.

Gowers' theory is much the same as this, but presents one important point of difference. He argues that "if we ascend

the motor path the first nerve-cells we meet are those of the motor cortex, and if the stimulation causing the tremor comes from the brain it must proceed immediately from those cortical nerve-cells." He adds "it must be remembered that all disturbed function of high motor centres is expressed through lower centres, hence the functions of the motor cells of the cord are disturbed in a similar, though secondary manner; which disturbance when long continued may tend to acquire relative independence." And again, evidently referring to the cells in the cerebral cortex, not to those in the cord, he argues that there is a treble change:- (1) "There is the intermitting release of nerve-force causing the tremor; (2) there is a more continuous but slighter activity of the cells producing the rigidity; and (3) there is lessened capacity for activity causing weakness." <sup>119</sup> Now, substituting the motor cells in the cord for the cerebral cortical cells, I am quite disposed to agree with this:- the intermitting release of nerve force from the spinal nerve-cells causing the tremor, and a continuous over-action of these cells giving rise to the rigidity, both being due to a loss of the control exerted by the cortical centres: the rigidity to a lesser amount of loss of control always present, the tremor to an intermittent increase of the same loss; the weakness, which is usually a late symptom being due to a functional exhaustion of these same

spinal nerve cells from prolonged uncontrolled over-action. I differ from Gowers in that I do not believe that there is, as he holds, an over-action in any way of the cerebral cells, but an under-action: for the facts point to a paresis of those cells not to a condition of morbid excitation.

Cases of Paralysis Agitans which have followed upon hemiplegia, such as my own case iii, in which there is little doubt that we have to deal with a true example of this disease, support the view that the symptoms are due to a lessened excitability of the cortical nerve cells, not to a morbid increase of their functions. Transient attacks of hemiplegia have occurred in the course of the disease, which may possibly be due to temporary exhaustion of the over-acting spinal cells, and more lasting ones in which an intercurrent true hemiplegia occurred. This as Gowers points out is not to be wondered at as both diseases occur in elderly people in whom vascular degeneration is likely to be present. In a case described by Parkinson, hemiplegia occurred in a man aged 72 who had for eleven years been the victim of this disease. <sup>120</sup> Recovery took place in a fortnight but whilst the paralysis lasted the shaking which was general completely ceased on the paralysed side, to recommence as power was recovered. Naturally, from the date of the Essay no mention is made as to the state of the rigidity on the paralysed side. In tetany we have practically

the same position of the hands as we get in paralysis agitans. The same muscles are affected as are first affected in the latter, and I think it probable that we have the same process at work, viz: paresis of the cells of the cortex allowing of the continuous over-action of the cells in the anterior cornua of the cord. It is well known that complete removal of the Thyroid Gland has given rise to tetany in many cases.<sup>12/</sup> Horsley<sup>12/</sup> found that removal of the Thyroid in monkeys caused a tremor closely resembling that of Paralysis Agitans, which at first ceased on voluntary movement, but later on was even increased by it. There was also marked rigidity and some paresis of the affected muscles. The rigidity varied "directly as the force of the tremors". The hands, feet and jaws were successively invaded in the order mentioned. Division of the motor nerves caused cessation of the tremors. Hence Horsley whilst not altogether denying the possibility of their being due to idiopathic muscular contractions, was inclined to look upon them as central in origin. He removed the upper limb centre in the cortex without stopping the tremor. This is the more remarkable as he has twice observed a complete attack of left Hemiplegia in his monkeys, such as those described by Berger as occurring in Paralysis Agitans, coming on suddenly, and whilst it lasted the tremor disappeared from the paralysed side. One can only explain this by supposing that his operation was

not extensive enough. In cases of removal of cerebral tumours the whole of what is at present known as the motor area may be removed without causing more than a slight paralysis and rigidity on the opposite side of the body.<sup>122</sup> The hemiplegia disappeared in an hour and the tremors became very marked. It will thus be seen that removal of the thyroid gland in monkeys may produce a condition closely resembling paralysis agitans, this phenomenon preceding the onset of the myxœdematous condition; whilst in the human subject tetany may be set up by removal of the same gland. In tetany we have exactly the same position of the hands as in Paralysis Agitans the same muscles are affected as are first implicated in the latter, and I think it probable that we have the same process at work in both diseases, viz: a paresis of the cells in the cortex allowing of a continuous over-action of the cells in the anterior cornua. Tetany being, except in purely hysterical imitations of the disease, a disorder which follows upon exhausting drains upon the system, e.g. diarrhoea, hyperlactation etc. it is most likely that these "middle centres" suffer from a want of nutrition and thus lose control for a time over the lowest centres, and it is only reasonable to suppose that the same is the case in Paralysis Agitans.

The probability that we have to deal with a paresis and not with an undue irritability of the motor cells is so well

shown by Sir T.Grainger Stewart that I cannot do better than transcribe his words, "What can be said as to the mode of production of the symptoms? Is the jerking a result of irritation; of more intense innervation, or is it due to a diminution or interruption of ordinary nerve force? Most likely it is the latter. The facts of its occurrence in advanced life, as of its resulting in true paralysis, make this probable to begin with: and if we assume the rapid and temporary interruption of the nerve influence upon which the muscular tone depends, we can understand how, this being confined to certain groups of muscles, the antagonistic muscles prevailing for the time, produce the peculiar movements. It is however, extremely difficult to understand how regular periodic intermissions of nerve force should occur in antagonistic groups of muscles so as to produce the rhythmical oscillations. Of course on the hypothesis of irritation this would be equally difficult to explain."<sup>124</sup>

It seems to me that this difficulty may, to some extent at all events, be got over by remembering that contraction of one group of muscles necessarily involves, in ordinary physiological action, relaxation of the antagonistic group; and vice versa relaxation of the former involves a corresponding contraction of the latter, and it must also be noted that in Paralysis Agitans the tremors are flexor in origin; the muscles

primarily and chiefly involved being the flexors of the joints whilst the contractions of the extensor muscles rarely extend the joints even to their natural position. In fact the movement of the extensors is nothing more than the necessary coordinated movement due to the alternate contraction and partial relaxation of their opponents. Therefore we have only to assume a remittent over-discharge of energy from the spinal cells dominating the fibres of the flexor group of muscles (due to a remittent loss of control of the cortical motor cells) to make a corresponding but alternating discharge of energy from the spinal cells presiding over their antagonists a physiological necessity. In a very able, if somewhat fanciful article in the British and Foreign Medico-Chirurgical Review headed, "Paralysis Agitans and Insular sclerosis", the writer says - <sup>125-</sup>

"The continuous action of the muscles in health, the unsteadiness of fatigue, the intermittent tremor of sclerosis, the perpetual agitation of Paralysis Agitans and the rhythmic action of the heart appear to us only degrees of the same phenomenon.

The sustained contraction of a voluntary muscle has been shown by well known experiments to be the result of innumerable separate contractions of the muscle repeated at extremely short intervals of time, thus becoming confluent and producing a uniform effect.....

Hence the sole difference between the rhythmical action of the heart and the continuous action of the voluntary muscles is, that in the former the long interval between each shock and its successor allows of complete relaxation, while in the latter no sooner has the relaxation begun than a new shock catches the muscle, and re-contracts it before the relaxation is considerable enough to be appreciated except by the most delicate instruments: similarly the difference between the same continuous action and the remittent action in sclerosis is that the minute interval of the former becomes in the latter great enough to be appreciated by the unaided senses."

He supposes that the rapidity of sequence of the shocks varies with the resistance they have to overcome. When the resistance is greater the frequency is lessened, thus tremor results. He draws a comparison between nerve-cells and the cells of an electric battery and continues.

"If therefore we can show that in Paralysis Agitans and Multiple Sclerosis the resistance to the passage of the current along the nerve fibres is increased, the tremor is explained on purely physical grounds."

As the writer takes for granted that the anatomical changes in Paralysis Agitans are similar to those in disseminated sclerosis, accepting the changes found in Joffroy's and

Murchison's cases as the probable cause of the symptoms, he argues that the conditions there met with do materially diminish the conducting power of the fibres; that is, they increase the resistance.

Now this may be true in disseminated sclerosis, but we have absolutely no proof of it in Paralysis Agitans. On the contrary, as already stated, our knowledge of the morbid anatomy of this condition, if there be any, is so conflicting as to be of little use at present. But he adds, "Whether the tremor of fatigue be due to increased resistance or to diminished rapidity of accumulation in the centre is not material to the argument, but the fact that fatigue does cause tremor in healthy subjects, tremor which first shows itself on movement only, and, if the fatigue be greater at rest also, proves that the two varieties of tremor are not radically distinct."

I am much inclined to think that the tremors of fatigue and of terror are much more closely allied to Paralysis Agitans, than are those of disseminated sclerosis, and no one is likely to argue that the former class of tremors (of fatigue or fear) are due to any organic change such as would be likely to interfere with the conduction of nerve impulse. They are due, almost certainly to temporary changes of nutrition in the cortical nerve cells which probably interferes with their controlling

power over the spinal cord cells.

In fact, there is "a diminished rapidity of accumulation" of the force requisite for this control, and the result is its remittent exercise and consequent tremor.

The same thing, I suggest, occurs in Paralysis Agitans but limited, for some reason which I cannot attempt to explain, almost entirely to the centres which preside over the lower cells concerned in the contractions of the flexor muscles of the limbs and trunk.

Gasternatzwy's experiments, on the production of tremors by stimulating the cortex in narcotised dogs, are interesting as illustrating the effect of depressed vitality of the cells of the Rolandic area. He found that under the influence of chloroform the excitability of the cortex of the cerebral hemispheres gradually diminishes, becoming less and less the longer the animal is kept under the influence of the anaesthetic; until, at last, the tonic muscular contractions elicited by its stimulation are replaced by tremors in the limb whose centre is stimulated. <sup>126</sup>

Ordenstein says - <sup>127</sup>

"The tremor appears to belong to the group of Paralyzes and not to convulsions amongst which it has been included by most authors. There is never a state of irritation, never an innervation more intense than normal, but always

a paralysis though in slight degree. Simple clinical observation confirms this opinion. On seeing a patient afflicted with Paralysis Agitans, no one could maintain that the cause of the perpetual oscillations was due to an excess of innervation, rather than to a perpetual interruption of the normal innervation current."

To a certain extent this differs from my theory but the difference is more apparent than real. He supposes that there is a paresis of the cells in the medulla and Pons (P.18) and cord, causing them to discharge their energy only at intervals. I suppose that there is a decrease of energy of the controlling cells in the motor cortex of the brain allowing these cells intermittently to assert their uncontrolled supremacy. We are agreed that the lesion is a Paralytic one; we only differ in our location of the seat of the paresis. The rigidity is, I think, a great point in favour of my contention; for I hold that there is a more or less continuous loss of control of the higher centres over the lower ones, giving rise to a more or less continuous muscular rigidity; the intermittent still further lessening of this control and partial resumption of it causing the tremor.

## AETIOLOGY

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### CAUSES.

SEX. The disease is certainly more frequent in males than in females.

Gowers gives the proportion as fifty to thirty.<sup>128</sup>

In Peterson's forty-seven cases there were twenty-nine males.<sup>129</sup> Therefore out of 127 cases, seventy nine were males and forty-eight females, practically a proportion of eight to five.

### AGE AT ONSET.

<sup>130</sup>Ball has asserted that "the classical period of Shaking Palsy lies between forty and fifty", but I am not inclined to think that it is more frequent in this decade of life than in the next. Of recorded cases the age of very many is given at sixty, and the disease has only been in existence for a few years.

Gowers gives the average age of commencement as fifty two. Peterson, out of his forty-seven cases, had twenty three

or nearly one half which began between fifty and sixty; and only nine between forty and fifty. Under forty it is rare.

Huchard has recorded an extraordinary case in which tremors had been present from the age of three.<sup>131</sup> The girl was eighteen years of age at the time the paper was written. There was slight tremor at that time in the left arm and leg, also in the right hand. There was tremor in the tongue when protruded. She was a little slow in answering questions but this may easily have been accounted for, by the fact that her intellect was very dull. Her memory was bad and she was very emotional. There is absolutely no other symptom recorded which could in any way justify the diagnosis of Paralysis Agitans. There was no deformation of the hand, no rigidity, no sensation of heat, no propulsion, and as to attitude, Huchard simply says that, "she walks slightly bent forward".

This is much more likely to have been a case of meningeal thrombosis or haemorrhage than one of Paralysis Agitans: the lesion being of sufficient gravity to irritate the cortical motor cells and dull the intellect without being severe enough to cause actual paralysis; but it is only just to state that Huchard expressly lays stress upon the fact, that the condition did not supervene upon any acute illness. A case is quoted by Huchard, in which the disease began at fourteen after a fright.

I have not been able to obtain the original paper.<sup>122</sup>

Duchenne has seen a case at sixteen.<sup>133</sup>

Siridey (mentioned by Charcot) has recorded one case which began at seventeen.<sup>134</sup>

Buzzard had one case at twenty one, which was very rapid in its progress.<sup>135</sup> First very slight shaking of the right hand occurred; in three months he was obliged to give up work as a butcher. Two months later his left hand became involved and after another two or three months his legs. A month or two after this his swallowing became affected and his mouth was always full of saliva. His articulation was also embarrassed. Such rapid progress is very rare. There was a history of *Masturbation and of excessive Sexual intercourse.*

In another case recorded in the same lecture, in a patient aged 38, there was also a history of *Excessive Sexual intercourse.*

Charcot has recorded a marked case which began after an attack of rheumatic fever, in a man aged twenty.<sup>136</sup>

#### HEREDITY.

This is a very doubtful factor.

Gowers states that the sister of one patient and the mother of another suffered from Paralysis Agitans.<sup>137</sup> Sir T. Grainger Stuart mentions one case in which the mother and aunt of the

patient were said to have been similarly affected. <sup>138</sup>

Mantle gives the history of a patient who also suffered from Political mania, and whose brother suffered from Paralysis Agitans. <sup>139</sup>

Weber had a case whose brother was a victim of the same disease. <sup>140</sup>

Two of Peterson's cases were brother and sister. <sup>141</sup>

TRAUMATISM often appears to play the part of an exciting cause, or at all events it determines the part in which the earliest symptoms shall manifest themselves.

Gowers mentions a case in which the symptoms commenced in an arm which "had been the seat of slight tremor since a burn of the palm in youth". <sup>142</sup>

Beevor mentions one in which the tremor began in a hand in which a needle was embedded. <sup>143</sup>

In two of Gowers's cases "the exciting cause was a fall on the shoulder, and in each the tremor commenced in the arm injured". <sup>144</sup>

Handfield Jones had a case in which the right arm began to shake after the patient had been knocked down by a blow on the right shoulder. <sup>145</sup>

Charcot has recorded several similar cases. <sup>146</sup>

I. A lady severely bruised her left thigh in falling from a carriage; some time afterwards severe pain came on in the

course of the sciatic nerve, and in a short time the whole limb began to shake. At first occasional, the tremor became permanent and finally extended to the other limbs.

II. In 1873, a woman aged 55, sprained her left ankle, and whilst the swelling and difficulty of walking still continued, she noticed that the foot began to shake. This shaking remained confined to the left lower limb till 1876, when the hand of the same side became affected.

In 1878 the shaking was still most marked on the left side, but the right was also involved. Other symptoms of Paralysis Agitans e.g. fixity of expression, stiffness of neck, forward inclination of the body and a tendency to both pro-pulsion and retro-pulsion were present.

III. This case is interesting as showing how in a predisposed subject, the localisation of the symptoms may be determined by an injury. A man aged 68, had suffered for three years from Paralysis Agitans of the right side, when he happened to dislocate his lower jaw whilst yawning.

The reduction of the luxation was immediately followed by tremor in the lower jaw, which persisted, and at the same time saliva began to dribble from his mouth.

In my own case V. the patient had strained the shoulder of the arm first affected by the tremor shortly before the movements began.

FATIGUE or OVEREXERTION of a limb may act in the same way as

traumatism, though more rarely. Gowers relates the case of a woman who "was much shocked at a neighbour being killed in a railway accident: she went to the funeral, carrying a heavy child on the left arm; the arm felt very tired afterwards, and the feeling of fatigue persisted and gradually changed to one of stiffness which proved to be the commencement of Paralysis Agitans. <sup>147</sup>

This cause is a particularly interesting one, as it is that suggested by Parkinson for the first case which he records. <sup>148</sup> The patient was a gardener and the tremor began in the left hand and arm. He had been engaged for several days in employment requiring considerable exertion of that limb. Althaus had a case in which the onset of the illness was ascribed to over-exertion in lifting a heavy load. <sup>149</sup>

FRIGHT & SHOCK are not uncommon causes..

My own case, in which the tremor followed upon an out break of acute mania on the part of an epileptic sister, with whom the patient lived, is an illustration of this. (Case IV)

Many of Charcot's cases began during revolutions and insurrections in Paris. <sup>150</sup> In one of these cases (the wife of a Municipal guard) the patient's right hand began to shake immediately after she had been startled by seeing her husband's horse return riderless to the barracks, he at the time being engaged in putting down the insurrection of June 1832. In another (a case

of Hillairet's) a man saw his son killed, and the tremor immediately began. Oppolzer's case in which the movements began after extreme terror caused by (among other things) the bursting of a bomb, was I venture to think a case of haemorrhage into the Optic Thalamus. I have referred to this case under the head of Morbid Anatomy. <sup>151</sup> Ball relates a case, in which the tremor succeeded a violent fit of anger, and persisted, spreading in its usual course, from the right arm which was first affected to the other limbs. <sup>152</sup>

How slight the cause of the emotional disturbance may be which acts as the determining cause of the malady is shown by a case recorded by Atkins, in which the tremor began immediately upon the patient's discovering that a £5, note had been stolen from him whilst he was intoxicated. <sup>153</sup> It is right however to take into consideration that the man was an agricultural labourer, and that the loss must have been a very serious matter for him.

Allied to these cases is the strange one related by Gowers, in which a stream of water suddenly flowed from a tap on to the left wrist of a woman, aged 37, who was sitting quietly at work. "She was much startled, the left arm immediately began to shake and the tremor persisted, passing to the leg, and afterwards to the limbs on the opposite side. When I saw her a year later she presented all the characters of the disease in its typical form." <sup>154</sup>

GRIEF AND ANXIETY often seem to play an important part as determining causes. In one of Trousseau's cases the malady began after a prolonged illness of the patient's wife, during which he nursed her devotedly, but which terminated in her death. <sup>155-</sup> One of my own cases was apparently determined by these causes, child after child having succumbed to Phthisis, and one of the patient's children is at present suffering from the same disease.

EXPOSURE TO COLD has been frequently given as a cause. Boucher describes at great length a very typical case in a woman, 50 years of age, who had lived for many years in a cold, damp dwelling, and who had had a perfect mania for washing clothes, standing to do this for hours almost daily in a cold, draughty passage. <sup>156</sup> Besides this, she insisted on flooding her dwelling-chamber with water once or twice a week, and leaving it damp. It is not surprising that this woman ultimately became ill, the only wonder is that she reached her time of life without some serious illness; but the causal connection between her remarkable habits and her Paralysis Agitans, is not very obvious. Nevertheless as this case - apparently this one, at least, for no reference to it is given - is frequently brought forward to show that prolonged cold and damp may be a cause, I have thought it right to quote it. She had left her unhealthy house some years before the onset of her symptoms, but her passion for damp and draughts still persisted.

Bastian has recorded a doubtful case in which the symptoms followed upon exposure to cold and wet.<sup>157</sup> Romberg described a case in which a man had been plundered and stripped by Cossacks, in 1813, in snowy weather.<sup>158</sup> But very rightly, I think, Charcot is inclined to look upon the terror and not the cold as the cause of the subsequent malady. Peterson mentions two patients who dated the onset of their disease from exposure during a great "blizzard."<sup>159</sup> The tremor followed almost immediately upon the exposure to the cold, and the exertion required to reach their homes.

The disease has also followed in some cases upon acute febrile disorders, e.g. malaria and enteric fever.

But in a very large proportion of the cases, no assignable cause can be traced. The disease comes on insidiously, often hardly noticed by the patient, until it has been in existence long enough to force itself upon his attention and that of his friends; and then he may remember that from time to time, for a considerable period, the thumb and fingers of the first affected hand have shaken slightly, and that he has experienced a sense of weakness in the affected limb, without however attaching any importance to either symptom.

PROGNOSIS.

We can only now in 1895, re-echo the words of Trousseau written in 1859:-

"Il n'y a pas de chance de guérison, elle entraîne fatalement dans un temps plus ou moins rapproché, la mort du malade."

But the disease is essentially slow in its progress towards death, and although in some cases all the limbs may become very speedily involved, nevertheless the sufferer may drag on a miserable existence for many years. Hanfield Jones mentioned one case in which the symptoms began at 60, and the patient, an inmate of Chelsea Hospital, lived to the age of 107. This was probably a case of "Senile Tremor." The disease has undoubtedly lasted for thirty years. Weber had a case which had lasted 24 years. <sup>160</sup> In fact it may be said, that Paralysis Agitans itself is rarely fatal, but as a very serious impediment to the recovery from inter-current diseases it has a most important influence. Pneumonia, as noticed by Trousseau, <sup>161</sup> is rendered very much graver by its presence, and the same may be said of all respiratory diseases. Bedsores only occur from the absolute want of

power on the part of the patients of changing their position, which is one of the most conspicuous features of the advanced stages. They do not appear to be due to a loss of the trophic influence of the spinal cells, as in diseases of the cord. When they do appear death is usually not far off. The paresis of the sphincters, particularly of the bladder, which may occur at this stage, renders the complete antiseptic treatment of the ulcers a matter of extreme difficulty. Ultimately, unless some acute disease occurs, the patient dies of pure asthenia.

Paralytic tremors are typical and may be included although the tremor may be absent entirely.

It is not a case of "Paralytic rigidity" simply because there happens to be some involuntary tremor or movement of a limb or limbs which continues during rest in manifestly a paralytic error. Nevertheless that this has been frequently done, the preceding and subsequent pages of this paper sufficiently demonstrate.

The chief sources of error are -

1. Misdiagnosed tetanus.
2. Functional or hysterical tremor.
3. Simple tremor.
4. Toxic tremors, especially mercurial.
5. Tremors of debility.
6. Post-paralytic

## DIAGNOSIS.

A well-marked case of Paralysis Agitans in which the characteristic tremor, attitude, fixity of expression, speech, pro-pulsion or retro-pulsion and restlessness are present, cannot possibly be mistaken for any other disease. On the other hand the absence of one or more of these prominent symptoms does not by any means exclude a diagnosis of this disease. For instance a case in which the attitude, expression, and restlessness are typical can safely be included although the tremor may be absent entirely.

But to label a case "Paralysis Agitans" simply because there happens to be some involuntary tremor or movement of a limb or limbs which continues during rest is manifestly a serious error. Nevertheless that this has been frequently done, the preceding and subsequent pages of this paper sufficiently demonstrate.

The chief sources of error are -

1. Disseminated sclerosis,
2. Functional or hysterical tremor,
3. Senile tremor,
4. Toxic tremors, especially Mercurial,
5. Tremors of debility,
6. Post-Hemiplegic Chorea.

1. Disseminated Sclerosis. This is essentially a disease of early adult life, most cases commencing before 30. Paralysis Agitans is decidedly rare before 40.

The tremor in sclerosis almost always occurs only upon voluntary movement, although Buzzard mentions a case in which the movements occurred during rest; the autopsy proving that the case was one of disseminated sclerosis.<sup>162</sup> In Paralysis Agitans on the other hand the trembling continues during rest, and may even be lessened on voluntary movement.

Buzzard states that cases occasionally occur in which the tremor is most marked during voluntary movement, but in the vast majority of cases of sclerosis the limbs are absolutely still during rest.

The character of the alteration of speech when present differs greatly in the two diseases. In sclerosis each syllable is separated from the next, and articulation is laboured, constituting the so-called "scanning speech". In Paralysis Agitans the speech is slow, deliberate, and monotonous; or there may be delay in commencing a sentence after which the words come tumbling out rapidly one after the other, constituting the so-called "festination" of speech. In the later stages there may be great difficulty

of articulation owing to tremor of the tongue, and rigidity of all the muscles of articulation.

Nystagmus is a common symptom in disseminated sclerosis; it is never present in uncomplicated cases of Paralysis Agitans.

The state of the limbs differs widely in the two diseases;

In sclerosis there is a total absence of the characteristic attitude of Paralysis Agitans. Contracture is a much earlier symptom, and much more marked than in the latter disease. The reflexes are often much exaggerated in the former and ankle clonus is frequently present, whilst it is rare to find any marked change in the reflexes in the latter, and the change may be in the direction of diminution of activity.

The lower limbs are usually involved earlier and to a much greater extent in disseminated sclerosis than they are in Paralysis Agitans. These points should suffice to distinguish the two diseases.

2. Functional or Hysterical Tremor. This is much more likely to be confounded with disseminated sclerosis than with the true shaking palsy; and the mistake is frequently made of regarding early cases of the organic disease as functional.

In true hysterical tremor there are none of the signs of Paralysis Agitans except the shaking, and frequently the

limb is violently agitated as a whole. There may be other signs of hysteria such as patches of anaesthesia; or even hemianaesthesia, with peripheral limitation of the field of vision most marked on the anaesthetic side.

In one such case which came under my care after having existed two years, strong suggestion to the patient that the movements would soon cease, and the application of a series of blisters in the form of bands encircling the arm, which was alone affected, brought about a cure within six weeks. This case had been diagnosed and treated as one of Paralysis Agitans.

3. Senile Tremor. It is a mistake to regard this as an affection only of extreme old age. I have seen a man, aged 40, who presented all the symptoms in a fairly well marked degree. He was nevertheless able to follow his occupation as a coachman, and was so used to the tremors, that he thought nothing of them. In these cases the tremor, and that alone, constitutes the malady; there are none of the other symptoms of Paralysis Agitans, the head is almost always involved in the shaking, and usually both upper extremities are involved simultaneously.
4. Toxic Tremors, especially mercurial. The chief points of distinction are that there is no rigidity, the characteristic attitude and expression of Paralysis Agitans being quite absent in these tremors. In the case of mercury,

the movement is increased on voluntary effort, in early stages only occurring when such effort is made. There is often also a dark line on the gums at the reflexion of the mucous membrane from the teeth.

5. TREMORS OF DEBILITY. The general condition, usually very anaemic, of the patient suggests the cause of the tremor which is the only symptom present bearing any resemblance to those of Paralysis Agitans.
6. POST-HEMIPLEGIC CHOREA. A form of movement occasionally occurs on the hemiplegic side which bears a close resemblance to the tremor of Paralysis Agitans. But the facial muscles are usually involved in the spasms to a much greater extent than in Paralysis Agitans, where their implication is somewhat rare. There is, besides, the fact that the condition supervened upon a hemiplegic state; and the lesion being usually situated in the posterior part of the Optic Thalamus, there is nearly always sensory impairment of the affected side, and there may be hemianopsia and loss of the special senses on that side. The tendon reflexes are usually exaggerated in the affected limbs, and the tremor is absolutely unilateral. The typical expression, attitude, and gait are wanting, and there is no tendency to pro- or retro-pulsion. Occasionally cases occur from haemorrhage in this situation in which the involuntary

movements constitute almost the whole clinical picture. Cases have also occurred in which true Paralysis Agitans has supervened upon hemi-plegia.

### TREATMENT.

Of treatment there is little to be said. As a rule, from my own experience I should say invariably, the disease goes on from bad to worse in spite of all that may be done to check its progress. But other practitioners would appear to have been more fortunate. I therefore describe here a few cases of reputed cures, and examine briefly their claims to be regarded as such, and the value of the methods used to obtain them.

#### ELECTRICITY.

Hammond reports that, out of six cases, he cured four within two months by a continuous current applied to the spinal cord, the sympathetic (?!) and the affected muscles. He at the same time gave a pill twice a day containing Phosphide of Zinc and extract of nux vomica. <sup>163</sup>

Mann reports a case which was complicated by mania. <sup>164</sup> He prescribed milk diet, warm baths with cold affusions. Sodii Bromid: Tinct: Hyoscyam:  $\bar{a} \bar{a} 3\bar{f}$  ter die galvanisation to the spine and passed through the temples ("bi-temporal current").

The mental excitement soon subsided and the trembling ceased. At the end of the second month the mental state was normal. A mixture containing quinine, phosphorus and strychnia was substituted for the Bromide and Hyoscyamus, and general faradisation for the continued current.

The result was a complete recovery.

I have not been able to obtain the original papers in these cases, but it seems to me (a priori) to be extremely doubtful that they were true cases of Paralysis Agitans.

The last case had, judging from the report, a very acute onset and the tremor began with the mania and subsided almost pari passu with it. Butler has recorded a case of cure of "Paralysis Agitans senilis" by the use of a magneto- electric machine. But his case was very evidently one of simple senile tremor.<sup>165</sup>

Sir T. Russell Reynolds claimed a cure from the use of the continuous current.<sup>166</sup> But absolutely the only symptoms in the case, as recorded, were tremors and a feeling of warmth in the right arm, temperature increased 4°F. over the biceps, and very slight tremor in the right leg. The patient had had a great deal of worry immediately before the onset of the symptoms and I think it more than probable that they were purely "functional" using the word here as a synonym for hysterical. Reynolds himself says "The term which I have employed to denote the case

involves no theory, it is but the name of a prominent symptom, a symptom, which in this instance constituted almost the whole of the affection and which after a fortnight's duration without the slightest tendency to improvement was quickly removed by a special form of treatment." And referring to the state of the patient after treatment he says:-

"There is no jactitation, and only the slight tremor already described when the hand, with something in it, is raised towards the mouth."

Clearly this was no case of Paralysis Agitans and I am quite sure that the distinguished author of the paper would not now regard it as one.

This case is often mentioned as a cure of Paralysis Agitans.<sup>167</sup> I have therefore given it at some length.

The mode of electrification employed was a Pulvermacher's chain of 120 links. Suggestion probably played as important a rôle as electricity in the cure.

DRUGS.

Chloral. Ball states that one case was much relieved by the administration of chloral hydrate.<sup>168</sup> Althaus tried the drug in ten cases. In six it caused mental excitement and increased the shaking. In four others grs.xx given three times a day had no effect whatever.<sup>169</sup>

In none of the cases did the chloral afford the slightest relief.

Bromide of Camphor. Sir Dyce Duckworth administered this drug to a man aged 60, in whom the disease had been in existence for two years.<sup>170</sup>

He began with gr.i thrice daily and gradually increased the dose to grs.xv in the day. He also employed galvanisation, gradually increasing in strength of current, applied to the parts affected by the tremor. The case was a unilateral one and not very typical. The only symptoms mentioned were pains in the legs and arms preceding the tremors. Tremor in the fingers and forearm, ceasing during voluntary movement; rigidity of the muscles of both arm and leg; sensation of heat, restlessness and sweating. Two or three times each night the patient was awakened by "paroxysms of trembling in the arm".

I am inclined to think that this may have been a case of "pre-hemiplegic chorea".

The patient improved considerably under treatment and left the hospital almost well.

Edgar records a case with tremor of the head and arms, the tremor becoming worse on voluntary movement. No other symptoms suggestive of Paralysis Agitans were present. <sup>171</sup>

A pill containing camphor monobromide grs iii extract Belladonnae gr.  $\frac{1}{2}$ , extract Gentian q.s was given thrice daily, and the patient was cured in a little over three weeks.

Charcot recommended that camphor monobromide should be carefully tried. <sup>172</sup>

I have tried it myself in several cases without good results.

Chloride of Barium. Brown Sequard stated that this drug was of real value in Paralysis Agitans. <sup>173</sup>

Arsenic. Eulenburg cured a case "presenting a great resemblance to Paralysis Agitans" by hypodermic injections of one part of fluid arseniate of potash to two parts of distilled water. <sup>174</sup>

Fifteen injections caused cessation of the tremor. He injected as a dose the equivalent of from 14 to 20 centigrammes of fluid arseniate of Potash.

Codeine combined with Hydrobromide of Hyaseine. Peterson <sup>175</sup> gives one half to two grains of the former combined with grs.  $\frac{1}{100}$  of the latter administered twice or thrice daily.

He states that his patients have derived considerable benefit from its use.

Hyoseyamine. Amidon found Hyoseyamine of great benefit. He administered it in a dose of .006 gr. of crystalline Hyoseyamine twice or thrice a day. Seguin states that Hyoseyamine achieves in Paralysis Agitans what no other remedy ever has done viz., arrests the movements for four hours or more without causing insensibility. <sup>176</sup>

In one case mentioned by Erlenmeyer, crystallised Hyoseyamine had no effect on the tremor. In this case curare hypodermically diminished it.

A strong infusion of Valerian grammes 20 to grammes 200 of water with grammes 25 of Bromide of Potash added and given in doses of 4 tablespoonsful daily much diminished the tremor. <sup>177</sup>

Eulenburg says, "I have not been able myself to get any benefit from the long continued use of Extract of Hyoseyamine or of Hyoseyamine". <sup>178</sup>

Conium was much recommended by Handfield Jones. <sup>179</sup> He records four cases, two of which were cured by this drug, but they were evidently not cases of Paralysis Agitans. The fourth case which was a true case of the disease, as far as one can judge from the description given, was not benefitted at all.

That Handfield Jones had no clear idea of what was then and is now understood by Paralysis Agitans is very apparent

from the tenor of the greater part of his lecture, especially of the latter part of it. All tremors occurring whilst the limbs were at rest, with the exception of those obviously due to the action of a toxic agent such as Mercury, were unhesitatingly classed by him as cases of Paralysis Agitans.

Ferrous carbonate. This drug may be called a historical one in the treatment of Paralysis Agitans and it is always given on Elliotson's authority. Why this should be so it is not easy to conceive. He only cured one case of tremor by its use and he himself is at pains to point out that this was not a true case of Paralysis Agitans.<sup>180</sup> He gave it in four or five cases of the true disease and with signal failure in each case. The patient in the case of cure was only 35 years of age (at most) and he was satisfied that his case differed from that of older cases. He distinctly states, "When it (Paralysis Agitans) occurs in the decline of life I have hitherto found it perfectly incurable."

Cod Liver Oil and Iodide of Potassium. Bastian recorded a case in which the predominant symptom was the tremor.<sup>181</sup> It is a very doubtful case of Paralysis Agitans. Considerable improvement occurred under the use of Cod liver oil and Iod: of Pot:  
Cod Liver Oil and Phosphorus.

I now come to what must be looked upon as a unique case. The symptoms were certainly those of Paralysis Agitans, the

course of the disease had been typical as regards the involvement of the limbs and the patient had suffered from it for a considerable time. He was under the care of Dr. Ramskill at the Hospital for Paralysis and Epilepsy, Queens Square.

It is so remarkable that I make no apology for transcribing it verbatim. <sup>182</sup>

A carpenter aged 52, who had always enjoyed good health, and had never had syphilis or rheumatism and had always been free from extraordinary anxieties, came under the care of Dr. Ramskill suffering from Paralysis Agitans. He acknowledged to having been rather intemperate.

Both his parents died of old age. The complaint began  $2\frac{1}{2}$  years previously by trembling in the right hand which soon extended to the whole arm, and then to the leg of the same side. Two years afterwards, the opposite side suffered in a like manner, and when he presented himself to Ramskill he was incapable of dressing himself, and was obliged to run when he attempted to walk. He had some difficulty of articulation, but otherwise his general health was very good. Various remedies were tried without any satisfactory result. On October 8th. 1864 he was ordered Cod Liver Oil  $3 \overline{\text{I}}$  with phosphorized oil of the Prussian pharmacopoeia  $m \overline{\text{iv}}$  ter die. He shortly began to show signs of amendment, and by July 3rd. 1865

he had grown stout, the trembling had entirely ceased, and his gait was natural although brisk movement occasioned an effort.

Cannabis Indica, has been found of service as a palliative, and strychnia is certainly valuable as a tonic.

Weber recommends Paraldehyde very strongly as a means of relieving the distressing restlessness. He gave it at bedtime in doses of mxv to m xx. <sup>183</sup>

Brown Sequard's orchitic fluid was administered to four patients in the Hospital for Paralysis and Epilepsy, Queen's Square with negative results. <sup>184</sup>

Struck by the points of resemblance between Paralysis Agitans and Tetany and by the effect of removal of the Thyroid Gland in monkeys, <sup>185</sup> I administered Thyroid Extract to one patient, giving one of Burrough's tabloids thrice daily. She took them for a week, and had to give them up, as they seemed to aggravate instead of alleviating the symptoms. She was very susceptible to their influence and a condition of thyroidism was the result. I feel inclined to give it a further trial beginning with a smaller dose.

Suspension. Charcot strongly advocated Suspension as a means of alleviating some of the distressing symptoms. <sup>185</sup> He says -

"In cases of Paralysis Agitans, we may say in passing that we had to do here with true Parkinson's disease and not

simply with tremor. The results of suspension have been very favourable. In four cases of this kind who were suspended from seven to twenty three times, the sleep became better, whilst the sensation of heat which occurs especially at night was remarkably lessened; the rigidity of the limbs and the troublesome, sometimes painful symptoms which the patients experience in them were much improved; in the case of one, a woman aged 43, the phenomenon of propulsion disappeared; on the other hand we have never noticed any appreciable modification of the tremor. We feel encouraged by what we have related, to recommend treatment by suspension in Paralysis Agitans, especially when the rigidity of the different parts of the body, and the different painful sensations which so often accompany it, are particularly pronounced."

Rest, good diet, freedom from worry, and from anything likely to give rise to shock or alarm are however more essential than any methods of treatment by electricity, drugs or suspension. If, in addition to securing these for the patient, and having him carefully nursed, we administer nervine tonics (especially arsenic and strychnia which may be given hypodermically), Cod Liver oil and some sedative at bedtime, such as paraldehyde, we are doing almost all that can be done for the unfortunate sufferers.

Hyoscyamine may be tried if the tremor be a source of very great annoyance to the patient, but the unpleasant effects of this drug when given in sufficient quantity to check the movements, make it only of value when these are very pronounced.

In cases in which the tremor is but slight, the palliative is worse than the disease. It has of course no effect upon the other symptoms. As for a cure, in the present state of our knowledge, we cannot expect to obtain one.

The only recorded case which bears close scrutiny is that of Ramskill's patient, and even in that no reference is made to any characteristic attitude or rigidity.

We have to do with a hopelessly incurable condition and all our efforts must be directed towards making the wretched existence of these unhappy patients a little more endurable.

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