The Epileptic Paroxysm

By
James Oliver M.B., M.R.C.P. Lond. F.R.S. Edin.

The whole molecular world, organic as well as inorganic, exists in a perpetual state of trepidation. In the former, life is the manifestation of an inherent power, possessed by its molecules, of adaptation to surrounding circumstances, and it is the complete failure of this capability, which renders the animate at once an inanimate object. As we ascend the scale of animal life, we witness the gradual evolution of a heterogeneous and highly instable representative structure – the nervous system – a medium of communication, not only between every molecule of the body, but between every ultimate tissue of the organism and its environments, and through which, by a process of action and reaction, equilibration is maintained. In the body itself, and its surroundings, there are many factors for ever at work, which tend to avert molecular stability, influenced as this is by these changes

affecting the elasticity or density of the structure. If the elasticity of any body be materially augmented, we shall forthwith detect a corresponding increased proneness to be influenced by, and radiate, molecular disturbances; whilst any increase, on the other hand, in its density, must necessarily be accompanied by a diminution and limitation: bearing as these two qualities, elasticity and density, do a direct antithesis to each other. Although the causation of epilepsy, exciting, as well as predisposing, is still a question wrapt in obscurity, there can exist no doubt in the scientific mind, that the manifestation of the disorder is the result of some occult change, which has arisen in the whole or some part of the cerebro spinal system. In man, the structural arrangements of the nervous system are so complex, and the functions so entangled, that a satisfactory and withal comprehensive description of the epileptic paroxysm is rendered necessarily difficult. The most typical attacks

however are those, in which the dis= charge, beginning in the highest nerve centres descends in a more or less markedly progressive and rapid manner, and invades the whole representative structure. The mode of onset, may, and frequently does vary, not only in different individuals, but in the same individual at different times, we may therefore encounter every possible variation, according to the part of the nerve structure primarily dis= turbed, the completeness or incom= pleteness of its molecular instability, and proneness to radiation. When a fuse, is applied to any part of a gunpowder tract, of like elasticity and density throughout, the molecular disturbance may travel in any or every direction. It is possible how= ever, to so alter in parts, the density of this highly instable compound, as to intercept effectually the molecular wave in its passage, and thus, limit its power of propaga= tion. This simile, to my mind, reveals well the true characte of a nerve discharge, and the manner in which it may spread in those

with an epileptic predisposition.

I The attendant sensorial and intellectual disorders.

Deriving, as we do, all knowledge of our own existence, as well as that of an outside world, through the medium of our special senses, including the tactile – of which all the others are highly organised modifications – I propose to include in a common description, the epileptic disturbances manifested by, and attributable to changes either arising in the centres receiving, or translating impressions. Here as elsewhere the discharge may be more or less confined, the causal instability being limited, and the surrounding structure remaining unaffected by the apparently spontaneous molecular respiration, preventing its further radiation. The whole question is one wrapt in obscurity, full of complexity and surrounded with difficulty, yet teeming with interest, and from a medico-legal point of view, worthy of our most serious consideration.

Hitherto loss of consciousness was

and still is by some considered an essential sign of epilepsy, it is however a variable accompaniment of the manifestations of this disorder. In many confirmed cases, I have witnessed exactly the same epileptic phenomena in the same patient at different times, associated with complete or incomplete loss of consciousness, or wholly unattended by any sensorial or intellectual disturbance whatever. When the mental change is evinced, it is not necessarily an early symptom. Many patients retain for a more or less lengthened period of time, after the initial disturbance, a full knowledge of their own bodily state and everything that happens around them. The epileptic discharge, it is true, begins usually in the highest parts of the cerebro spinal system and descends; it may however, originate primarily in any part of this nervous tract and radiate more or less irregularly. In the most marked and severe epileptic attacks, loss of consciousness is invariably complete, and is ever, I believe, the earliest manifestation of the paroxysm. The discharge under

such circumstances, is, as a rule so rapidly transmitted, that the abolition of consciousness, and the evolution of the motor and other allied disturbances are apparently simultaneous. The period, during which there is this total interference with the reception and translation of impressions, appears to, and is spoken of by, the patient, as a "blank".

The individual in a state of epileptic unconsciousness, may or may not retain his equilibrium; he may, without any warning whatever, fall suddenly on the ground in a helpless and passive state; he may maintain his posture, and evince no further outward manifestation, other than, a somewhat strange and vacant, yet withal, characteristic stare and fixity of the eyes. In yet another set of cases, of not infrequent occurrence, we witness the evolution of thought more or less coherent and intelligible and the performance of actions, more or less complex and difficult of attainment, with a total suppression of consciousness. With the initiation of unconsciousness,

the individual frequently falls, sus=
taining at times severe bodily in=
juries, even fractures and dislocations.
Here, doubtless, the onset is so sudden
and shock like in character, that
there results a complete inhibition
of the motor centres, and consequent
cessation of the ever existing tone, with
total muscular relaxation and loss
of equilibration. In the individual
who retains his position, the discharge
may travel and affect the whole
representative structure of the special
senses, or be confined to one or more
of these special sense centres: as
a rule, the disturbance in such
occurs in the centre appreciating
and translating impressions, and not
in that receiving them: it may,
however, occur in one or both, and
we may encounter every possible
variety. There may be complete and
very transient loss of eyesight, with
or without accompanying auditory
change. The patient may retain
the power of hearing, but be at the
same time wholly incapable of
comprehending and defining the im=
pressions conveyed to the auditory centre.

The auditory tract may remain undisturbed - the individual comprehending and retaining what may be said - and yet there coexist, with complete cessation of the functional activity of the visual centre a total inability to express in spoken words, thoughts resulting from these impressions (auditory). Mental phenomena may however exist and be revealed, whilst consciousness itself is in abeyance, the individual under such circumstances becoming a wholly irresponsible agent. Many of the actions performed during this state appear more or less automatic in character, often they are most complex, and may be exhibited, apart from any evident or necessary motive. During the state of epileptic unconsciousness, I have frequently witnessed the patient run forward with much impetus, as though impelled by some irresistible power. In one case the individual coming in contact with a bed, which happened to impede the course, was thrown violently on the floor - performing a somersault and landing on the other side of the bed. This patient sustained a

severe bruise of the left hip by the fall, and continuing unconscious for several seconds afterwards, would have succeeded in recovering the erect position and rushing on again, had I not prevented her by physical force. These movements may by some be considered as post epileptoid or even hysteroid in character, that however they may be an accompaniment, and not merely a sequence of the epileptic state, I have no misgivings. Many patients display an awkward propensity for undressing, and it is often difficult to prevent them from throwing off every vestige of dress on the body. This peculiarity may be a concomitant of the minor attack with mere loss of consciousness, or a truly post epileptoid phenomenon, exhibited after a severe paroxysm. In one case which came under my notice, that of a female, the patient always undressed, and if possible got into bed, and this whether in her own house or that of any friend or stranger. The importance of a knowledge of such facts, from a medico legal point of view, cannot be overrated.

The act, may result from a feeling-prior to the attack – of impending illness; for in the majority of our automatic movements, the cell and fibre arrangement is so perfect, that the least stimulus, may serve to call into action and evoke unconsciously, with machine-like regularity the associated train of events. The act of undressing, has doubtless through habituation become more or less automatic. In some cases of epileptic unconsciousness, it appears totally unconnected with any feeling of indisposition – One had I interrogated, whilst so undressing, as to why he did so, replied, "I am going to work", and this patient having already thrown off his coat and waistcoat, had unlaced and taken off his boots, and was about to take off his trousers when he recovered consciousness and redressed, retaining no knowledge whatever of what had transpired. Another patient, the subject of severe as well as minor epileptic attacks, had during the occurrence of a minor attack started to prepare the table for tea – a duty assigned to him some weeks pre-

previously – he arranged the dishes with wonted regularity, and was on regaining consciousness much astonished when he saw, and was told, what he had done. Some years ago, a female patient told me, that in her slight fits she habitually, irrespective of the time of day, put some tea into the tea pot with hot water and placed it by the fire, but never at any time remembered anything of the act nor any reason for so doing. Suicidal and homicidal tendencies are also occasionally manifested. Lately, a girl under my care attempted during a state of epileptic unconsciousness, to strangle herself, by tying tightly round her neck, a piece of tape used in her work, and would have succeeded in so ending her life, had the ligature not been cut in time. Another female, would have committed suicide by cutting her throat, had she not been dispossessed of the razor, and this patient's father, strange to say, subject also to epilepsy, did in a slight attack, actually commit suicide by cutting his throat.

Our feelings, thoughts, and actions,

are usually conscious, that however they are not invariably so appears more than problematical. To say the individual feels, without knowing he feels, is somewhat paradoxical, it cannot however be more so than to say the individual thinks and acts without the knowledge of thought or action, tenets which we must admit. Although the whole structural arrangement, necessary for the reception and conduction of impressions, from the periphery to the higher centre is intact and functionally active, yet because the impressions so received fail to be appreciated by the organism, we say, the feeling does not exist. It is not the feeling which does not exist, but the consciousness of the existence of the feeling, which is non-existent.

II The cry.

The epileptic cry is comparatively speaking an infrequent accompaniment, but an early manifestation, of the paroxysm. It is uttered, so far as I have been able to judge, in about five per cent of the fits. In

Some cases it is never noted, whilst in others it is an occasional but never a constant association. It appears to be, a mere casual motor coincidence, dependant upon a state of more or less complete inflation of the lungs at the time of the initial nerve disturbance. The cry, when emitted, is very characteristic, but difficult of imitation, and is a wholly unconscious phenomenon, as the patient never at any time retains any knowledge of its utterance. Sounds more or less articulate in character and associated with the consciousness of a developing aura and consequent fit are commonly uttered and are most probably the result of fear or in some few cases apparently of pain.
The epileptic cry is an invariable manifestation of a general seizure, sudden and severe, the molecular change affecting the whole representative structure in an incalculable period of time. The muscles of the chest and vocal apparatus, act in concert through habituation: the resulting automatic centre being located in the highest part of the motor nerve tract, and represented

on the surface of one or other demi-sphere, according to individual peculiarity, in the neighbourhood of the centre for speech. The epileptic cry, so far as my observation goes, leads me to believe is especially noted in right-handed individuals, when the nerve discharge, from external manifestations, originates in the left hemisphere; rather than, when, in the same individual, the molecular disturbance primarily affects the right cerebral lobe. In left handed patients again I have invariably noted its association, with an initial molecular discharge in the right hemisphere. The cry is produced, by an associated action of the muscles of the chest and vocal apparatus, whereby the air expelled from the lungs is forced through the narrowed glottis. It is a true part of the paroxysm, and may be evinced by patients equally whether asleep or awake at the time of the onset of the attack.

III The motor manifestations of the paroxysm.

Prior to an epileptic attack,

there exists an instability, more or less uniform and complete of the cerebro spinal system, but whether of gradual or rapid production has not yet been determined. Under such circumstances however, any slight initial excitation apparently, peripheral or otherwise, may suffice to throw the whole or any part of this nerve tract into a state of molecular trepidation, and determine a seizure. In the most typical cases, when the discharge begins in the highest part of the nervous system, it invariably descends, and invades in a somewhat regular manner the various motor centres, arranged, in an order, dependant on structural development and evolutional requirement. When we recall the fact, that higher organisation and greater functional activity, are undoubted concomitants of diminished structural stability, it is not at all astonishing, that wherever there is a strong epileptic tendency, the highest parts of the cerebral lobes, should so frequently be the seat of initial disturbance. The outward manifestations,

of the epileptic paroxysm, may however be limited or even assume an irregular mode of progression, facts explicable on a hypothesis of varying elasticity and density of the nerve tissues. Sometimes, I have witnessed, the motor disturbance confined to one or other or both orbicular muscles of the eye, to one side of the face, to the face and arm, to one side of the body, or again, although rarely, to one or other or both lower extremities. In a characteristic attack with uninterrupted propagation of discharge, the first evidence of motor disturbance, is a deviation of the eyes and head, in association, to one or other side of the body. Simultaneously, with the deviation of the eyes and head, I have occasionally noted a rotation of the body on its own axis - one or more times - whether from left to right or right to left being determined by the side towards which the head is at first directed, the body turning to the same side, as the head. The ~~of~~ cerebral change originates primarily in the hemisphere, away from that, towards which, the eyes and head are

directed. If the discharge arise in the right cerebral lobe the eyes and head are deviated to the left, should however the initial molecular change occur in the left cerebral lobe, the eyes and head will be directed to the right side of the body. The right sterno mastoid, acts so constantly in concert with the muscles of the left half of the body, that it may be considered a left sided muscle, although anomalously innervated, whilst the left sterno mastoid on the other hand becomes a right sided muscle. The structural arrangements of the nervous system are most complex and habit determines the association of movements apparently governed by nerve centres far removed from each other. Ever we have enunciated the axiom, that the more frequently a nerve tract is traversed, the more susceptible does it become to like excitations. The deviation of the head to one or other side of the body, has gradually through habituation, become a movement, associated with the deviation of the eyes - In early life, when reading, the head follows close-

by the movements of the eyes, as they pass from one side of the page to the other. In looking at anything placed to the extreme right or left of the body, the head with the eyes are deviated towards the object. Here the change in position of the head, affording as it does greater definition has through habit become unconsciously associated with the movements of the eyes. Under such circumstances there must either be in the centre regulating the movements of the eyes, a direct representation of the associated head muscles, or there exists a direct communication, between the right ocular motor centre and the lower centre governing all the movements of the head and neck. Any molecular disturbance therefore, radiated to the ocular-motor centre, is forthwith, and without any appreciable interval, transmitted to the head and neck centre. Often, I have witnessed a marked deviation of the eyes and head, for some time prior to any further motor manifestation, and in some cases even, this has been the

sole sign of muscular disturbance. I have also frequently noted that although the eyes and head may at the onset of the paroxysm, be directed to one side, yet during the fit itself they are drawn and remain deviated towards the other side of the body, a manifestation which indicates the spread of the molecular disturbance to the opposite hemisphere. Under such circumstances, however, the eyes and head invariably return again, as the paroxysm is ceasing, to that side towards which they were at first deviated. Occasionally I have observed throughout the whole duration of a paroxysm, a rapidly alternating deviation of the eyes & head from side to side. As a rule, it will be remarked, that the epileptic motor regression, is, in the inverse order of its progression.

IV Tongue biting.

In the usual march of the paroxysm, the motor disturbance now spreads to the muscles of the face and jaw, and almost simultaneously to those of the tongue,

which organ at this period of the attack frequently suffers laceration by the teeth. Although tongue biting is a symptom of some worth in the diagnosis of epilepsy, it is not in my opinion an infallible sign, as some authors would have us believe. I have often witnessed laceration of the tongue, during convulsive seizures, in which the movements were purely hysteroid or pyrosive in character. In these cases two, as I shall presently show, happens invariably in true epileptic attacks, the tongue was constantly bitten on the side corresponding with that on which the convulsion was more marked. It is therefore in my judgment more than a mere casual coincidence. The mechanism of this phenomenon is one, regarding which there is still much diversity of opinion. When the mode of progression of the epileptic paroxysm is regular, I have as a rule remarked, that whenever there is manifested any noteworthy variation in the nature of the convulsion, as in affects the two sides of the body, the tongue suffers lacera-

tion on that side on which the motor spasm has been greater. * I have drawn attention to the fact, that when ankle clonus can be developed after the cessation of an epileptic fit, the to and fro rhythmical movement of the foot is always more readily produced, and continues longer thereafter to be evinced, on that side on which the convulsion has been more marked. I may here add, that I have constantly verified the existence of laceration of the tongue, when present, on that side on which the ankle clonus has been more readily obtained. It will be detected almost invariably on that side, towards which the eyes and head are primarily deviated. Tongue biting depends, not on a protrusion of the organ between the teeth, as is commonly believed, but on an intrusion – if I may be allowed the expression – whereby, the half primarily affected by spasm, is drawn more or less markedly ~~between~~ towards that side and nipped between the teeth. The mouth seldom remains open during the epileptic seizure, as one

* State of the knee jerk & occurrence of foot clonus after Epilepsy. Edin. Med. Journ. Sep. 1886.

or two occasions however, I have had the unusual advantage of noting, under such circumstances, the probable manner in which motor spasm of the tongue could determine the seat of laceration. In one case, the fit was more especially confined to the left side of the body, and the tongue was so markedly deviated towards this side, that had the jaws been forcibly closed the organ must inevitably have suffered laceration. This patient invariably bit the left side of the tongue, and in all the attacks I witnessed, the left side of the body was that specially affected by motor spasm. Protrusion of the tongue is an act associated with depression of the lower jaw, and consequent elevation of the hyoid bone, and although it is possible, that dissociation of these movements, during a fit, may result in laceration of the tongue, yet the close relationship that exists, between this phenomenon and the nature of the convulsive seizure, compels us to seek a further explanation. It is a true part of the motor manifestations, and not

more than a mere casual coincidence. In the early days of unilateral atrophy of the tongue, the patients so suffering, usually complain, that during mastication the organ has frequently been bitten on the wasted side; the healthy muscles being in such cases defectively opposed, and as yet unaccustomed to the morbific change, thrust the organ between the teeth. Here the weaker side, practically represents, that unaffected by spasm, at the commencement of the epileptic paroxysm. If therefore, the tongue biting in epilepsy, were due to a protrusive movement of the organ, we should seek the laceration on the side away from that primarily affected by motor spasm.

Motor disturbances in the limbs.

In the most characteristic epileptic attacks, the motor spasm so far as the limbs are concerned, appears at first in one or other upper extremity as the case may be, the initial manifestation being always in that toward which the head is primarily deviated. It then spreads in a somewhat regular manner

to the lower extremity of the same side, to the lower extremity of the opposite side, and finally attacks the remaining upper limb. The march of regression is, as a rule, in the inverse order of progression, the spasm disappearing first in the group of muscles last affected, and continuing longest in those primarily disturbed. It is but seldom however, that we witness this complete uniformity in progression and regression, the nerve structure being so complex and irregularly liable to change as to allow of almost every conceivable variation. The convulsion itself is usually divided into two stages, the tonic or initial, and the clonic or sequential. Here again we rarely see the regular association, and may often detect the simultaneous existence of these two muscle states, and every possible intervening gradation, in the different limbs. Experimentally, if a stimulus of regular and never varying quantity, traverse the nerve tract of a muscle, no change in its structural state, as evidenced by contraction, will

result. In order that a muscle may be thrown into contraction, the force or quantity of the stimulus must vary, and according to the rapidity with which the waves of molecular motion follow each other, so do we develop a tonic or clonic spasm more or less distinct. The tonic state results, if the waves of excitation are uniform, and follow each other with such rapidity, that ere the influence of each preceding impulse has finally disappeared, a new wave of motion has already been transmitted. Clonic convulsion, on the other hand, is the outward manifestation of impulses, or groups of impulses, transmitted to the muscle, but separated by more or less distinct intervals, which allow of the muscle returning, after each excitation, to a state of comparative inactivity - Initial tonic convulsion, eventually, replaced by clonic, is commonly observed in pure functional or so called idiopathic epilepsy, whilst initial clonic spasm, on the other hand, is a common feature of epileptiform disorders, dependant, as a rule, on some coarse cortical lesion

of the cerebrum. Clonic convulsion, when a sequel of tonic spasm, apparently depends for its development, upon a somewhat exhausted state of the still highly instable nerve cells. Its frequent though not invariable coexistence however, with the venous turgescence, resulting from interference with the respiration, renders it highly probable that the impregnation of the blood with carbonic acid, may aid in determining clonic spasm, through increasing the density of the disordered nerve tissue. Tremor more or less limited in extent is frequently noted, as a motor manifestation of the epileptic paroxysm. During the fit, and under certain circumstances, I have been able to develop this trepidation, especially in the lower limbs, by merely straightening the leg already slightly bent by a feeble yet maintained tonic contraction. I have also witnessed, the spontaneous development of this variety of spasm or clonus, when the leg, slightly bent at the onset of the paroxysm, has become straightened and somewhat

stiff during the fit itself. Whilst the character of the convulsion may vary, so may the extent and manner in which the muscles are involved; and this in the majority of cases without any very apparent cause. In a few cases with distinct cerebral or spinal lesion, I have noted, a definite alteration in the character and evolution of the motor phenomena in idiopathic epilepsy. Some years ago, I saw, a girl epileptic from childhood, in whom, the convulsive seizure had always been general affecting all four limbs. At the age of ten, this patient during a fit, suddenly developed a complete hemiplegia of the left side, the result apparently of haemorrhage, into the right cerebral lobe. In all attacks hereafter, the convulsive phenomena were confined to the right half of the body. The girl is now fourteen years of age, and although she has acquired a fair amount of volitional power over the left arm and leg, the

convulsion never spreads to this side. Although, prior to the occurrence of the haemorrhage into the right hemisphere, the left arm and leg had always evinced motor disturbance, they, now, remain perfectly quiescent, throughout the fit. Here the cerebral lesion is the undoubted cause of alteration in the paroxysm, its mode of operation however is, at present, difficult to determine. In another case, I witnessed the rare association of epilepsy with paraplegia, the result of pressure in the lower dorsal region of the cord, from Pott's disease. It is more than likely that, in this case, the epilepsy was truly idiopathic and cerebral, and wholly independent of any cord lesion. The curvature had existed from childhood, and gave rise to no material inconvenience, until the age of forty-five, when complete paraplegia resulted. He regained the control power in the legs, in the course of twelve months, and it was not until one year later, that he was the subject of his first

epileptic fit. The attacks there= after recurred more or less regular= ly, every three months, always in the night and during sleep. At the age of fifty-two, seven years after the first attack of paraplegia, he came under my notice having again lost completely the power in both lower limbs. Gradually he began to amend, and on the day previous to an epileptic seizure, I had noted, that he was able to move feebly and very imperfectly the left leg, foot, and toes; over the right he had no power whatever. During the fit which was typically epileptic the head was drawn from side to side alternately, both upper limbs were at first the seat of tonic, and afterwards of clonic spasm. The left leg, at first straight and somewhat rigid manifested - during the existence of clonic spasm in the upper extremities - a general tremor, whilst the right leg, throughout, evinced no change. Later on, having recovered almost completely power in both legs, all four limbs alike were the seat of convulsive disturbances during the epileptic fit.

It is more than probable that, in this case, the pressure on the lower dorsal part of the cord, determined, the free= dom from motor disturbance of the right leg, and existence of respiration instead of clonic spasm in the left during a paroxysm, when the paraplegia was almost complete. Epilepsy, purely idiopathic in character is often found co-existent with infantile or adult hemiplegia - The association may be a mere casual co-incidence - In many such cases the motor manifestations are confined to the hemiplegic side, and the fact that there is frequently no intellectual derangement whatever, is indicative of an epileptiform, rather than, an epileptic disorder, and points to some coarse cortical lesion, as the cause of the chronic motor spasm. The length of time which may elapse, between, the occurrence of the hemiplegia, and the epileptic or epileptiform manifestations, may vary. In one case, which came under my notice, twelve years had elapsed, and here the convulsions were invariably general, not limited or confined to the hemiplegic side. The whole question is

one wraps in obscurity, for it is quite possible, that apart from the hemiplegia, this lad, might have been the subject of idiopathic epilepsy.

The position of the limbs may, during the paroxysm, vary in the same as well as different attacks. One or more of the extremities may be unaffected; and occasionally although rarely the motor evolution may be crossed, the spasm being located in the upper extremity on one side and in the lower on the other. When three limbs are invaded, it is more commonly noted in one upper and the two lower than in the two upper and one lower. Sometimes one or more limbs may be flexed and one or more may be straight. In one case, the upper limbs were invariably raised above the head during the attack, whilst in another, they performed a to and fro wiping like motion. If a patient during an approaching paroxysm hold anything in the hand, the object is tightly grasped, whilst the tonic state exists, but is invariably dropped with the onset of the clonic convulsion. Flexion is a common posture assumed not only by

the upper but also by the lower limbs. In the upper, when flexion predominates, the arm is usually adducted and drawn across the front of the body, the elbow and wrist are more or less markedly flexed, whilst the thumb is bent in on the palm of the hand and the other fingers too. When the lower limb is similarly involved, the thigh is bent on the abdomen, and the leg on the thigh, whilst there is an associated extreme dorsal flexion of the foot. With strong flexion in the limbs, the head is often bent forward on the chest, and so powerful and sudden is this initial force, that I have seen the patient, so curled up, thrown out of bed, with violence on the floor. In some rare instances, I have witnessed a dominating extension of the lower limbs, associated with well marked plantar flexion of the foot, so extreme, as to make the foot and leg almost straight. Occasionally, under such circumstances, there is noted a slight disposition to arching of the back, the head at the same time being drawn back.

Micturition -

During the fit there is frequently involuntary passage of urine. This, by some authorities, is considered a pathognomonic sign of epilepsy, as however I have occasionally witnessed the association of this phenomenon with convulsive seizures typically hysteroid in character, I cannot view it as an infallible symptom. Although micturation is often a concomitant of the severe epileptic paroxysm, with total loss of consciousness, yet the act is one which may be manifested, apart from the combination, either with intellectual perturbation alone, or mere motor spasm, without loss of consciousness. In one case, which recently came under my notice, the patient, occasionally the subject of fully developed attacks of epilepsy, frequently experienced a mere trepidation of the nature of a general fine clonus of the right leg. In such minor attacks, and without any intellectual disturbance whatever, the bladder invariably expelled its contents, the patient retaining throughout a full knowledge of the act, but being wholly unable

to prevent it. I have also witnessed the bladder empty itself during simple epileptic unconsciousness, unaccompanied by any motor manifestations. One lad, was the subject of minor, as well as severe epileptic attacks. In the minor, consisting in complete loss of consciousness and slight tremor of both upper extremities, especially the right, the vesical contents were invariably expelled. This patient never fell during the minor attacks, but if standing, when so affected, maintained the erect position. In some cases, the true and sole aura of an approaching paroxysm, is the feeling, of a desire to micturate, and if the act can be forthwith accomplished, the sensation passes off, and no further epileptic manifestation ensues. If from surrounding circumstances the bladder cannot be emptied, the sensation may occasionally pass off, but more commonly it determines a fully developed fit, in which, the vesical contents are then expelled. In some few cases, there is apparently, a hyperesthesia of urine, the water passed immediately

after the attack, being paler than normal and of unusually low specific gravity. This anomaly is probably comparable, with the enormous secretion of saliva, which I have often noted, and to which I shall presently draw attention. On three occasions, I have detected a slight trace of albumen in the urine, after the paroxysm, but never any trace of sugar. The emptying of the bladder during a fit, apparently, depends on the state of distension of this viscus at the time of onset. In some cases, it appears, to result, from an inhibition of the bladder sphincter. As a rule however, it is effected, by a direct contraction of the bladder muscle, aided by the superincumbent pressure exerted by those of the abdominal walls.

Erection of the penis, and emission of semen.

In severe attacks of Epilepsy, I have witnessed on several occasions, erection of the penis, but never on any time ejaculation of semen, nor have I been able to detect, after

the fit, any evidence of its emission. It is possible however, that should the circumstances favorable for the act exist, emission may result. Erection, appears to result, from a general involvement of the body structure, as I have never noted its presence in mild attacks.

Defaecation.

The involuntary passage of feces is an act, of very rare occurence, during the epileptic fit, as I have only once noted it in the many hundreds which I have witnessed. In this case, the copious evacuation which resulted, leads me to believe that the more tonic contraction of the body muscles, as a whole, determined the expulsion of the contents of the rectum, apart from any special contraction of the intestinal tract, or inhibition of the sphincter muscle.

Salivation.

A copious flow of saliva, is a frequent accompaniment of the epileptic paroxysm, and is most commonly noted, in those fits, which are preceded by a distinct epigastric aura. As a

rule, the secretion is thin and watery, characters exhibited by that produced by excitation of the Chorda tympani nerve, or associated with a distinct feeling of nausea. In several cases, the saliva has literally poured out of the mouth, its downward flow into the stomach being prevented, by the existence of oesophageal spasm, to which I shall presently draw attention. If the tongue has been bitten, the saliva may be tinged with blood. In a few rare instances, I have witnessed a markedly sanguinolent discoloration of the secretion, and yet have been unable to detect any laceration of the tongue. Under such circumstances the blood is probably the result of a transudation from, or direct rupture of, the blood-vessels situated somewhere in the pharynx. The secretion of saliva, during the epileptic fit, appears to be of a purely nervous character, and wholly independent of any direct alteration of the blood supply to the glands. Increased blood supply, is, ever, a necessary concomitant of augmented functional activity.

but what I mean to infer is, that, the alteration in the vascular state of the gland, is not the initial cause of the hypersecretion, but merely an essential association. The lacrimation is probably purely central or cerebral, and not truly reflex, and is apparently connected with motor disturbance even of the jaw. I have remarked its presence alike during the existence of a distinct pallor as well as marked flushing of the face.

Vomiting.

This is, I have never witnessed, during the epileptic seizure, although I have, in a few rare cases, noted its occurrence before and after the fit. The symptom is ever a most dangerous one, as food is apt to pass into the glottis, and bring about a fatal result. When we remember that salivation is a frequent concomitant of the paroxysm, it is surprising that vomiting never occurs. In order that the contents of the stomach may be expelled, the cardiac orifice must remain patent, and this, probably, never happens during a fit.

Contraction of the gullet and Cardiac end of the stomach, is, apparently, produced, before the gastric organ itself becomes invaded, or affected by the superincumbent pressure of the diaphragm, and abdominal walls. In a few rare instances, patients who during a ~~fit~~ meal, have felt the usual Epigastric aura common to them before a fit, have informed me that they have then occasionally experienced some difficulty in swallowing, a fact strongly in favor of early spasm of the gullet.

Abortion.

In a few rare instances, I have noted perfect immunity from epileptic attacks in females during gestation, as a rule, however, this physiological state interferes in no way with the recurrence or character of the paroxysms. Women who suffer from epilepsy are invariably most prolific, and it is somewhat astonishing, that, although the whole body Structure appears to be more or less invaded by a severe paroxysm, the uterus, when in a state of gestation, is seldom so involved, as to expel its

contents. The epileptic fit itself I have never known to be the initial factor in producing abortion. The accident however occasionally happens, and is then commonly the result of some direct injury, sustained during the fall.

The state of eyelids.

During the fit, the eyelids are usually open, on several occasions however, I have observed a closure of one eye, not only during the state of tonic contraction; but also during the existence of clonic spasm. The eye closed is invariably that towards which the eyes and head are primarily deviated, the other eye remaining open throughout the attack. In a few cases, I have seen both eyes firmly closed by spasm. During violent exercise screaming, sneezing, and so forth it has been suggested that closure of the eyelids then, produced by contraction of the muscles is for the purpose of protection; a wise provision of nature to prevent rupture of the distended blood vessels. Rupture of the blood vessels of the eye, deep or superficial, is however an accident of so infrequent oc-

currence during the fit - When the eyelids are as a rule open - that I question their alleged protective efficiency when closed. Closure of the eyelids is effected more especially by a descent of the upper lid and I am inclined to think that during the epileptic fit closure is prevented by a dominating, and early, contraction of the levator palpebrae.

The state of the pupils

During the actual fit itself, the pupils are as a rule widely dilated; on two separate occasions only, have I witnessed marked contraction, a condition which must be considered as very rare. In a lad, aged eight, the subject of minor as well as severe and general epileptic attacks, I had the opportunity of witnessing several paroxysms. During and after the minor fits in this case, it was difficult nay utterly impossible to elicit with certainty whether unconsciousness was complete or but partial. I believe there was more intellectual disturbance, the result of limitation of the epileptic discharge to the left cerebral lobe, deranging the higher centres of this hemisphere alone. In the

minor attacks, he was totally unable to speak, yet appeared not wholly unconscious, but seemed to comprehend, although somewhat imperfectly, what was said to him. The sole muscular manifestation of the paroxysm was a twitching of the orbicularis of the right eye, associated with a dilation of the pupil of the same eye, whilst that of the left eye was unaffected throughout the attack. In this case the dilated pupil was on the side, towards which the head would probably have been primarily deviated, and away from that hemisphere the seat of initial discharge. Associated activity of the two hemispheres of the brain is the rule, yet it is possible, and the above case somewhat favors the acceptance of the theory, that dual and independent action is probable. In this case the dilation of the pupil (right) in the minor attacks, may be considered as comparable with the dilation which normally results, when an individual is directed to look into space. The pupillary change in this case suggested to me the possibility of being able to derive some valuable

information - from the pupil states so constantly associated with epilepsy and to which I shall presently refer - ~~the~~ in determining approximately the seat of initial cerebral disturbance.

Dilation of the pupils, as is well known, occurs during violent muscular effort: it is however a noteworthy fact that this state of pupils is a concomitant of the minor attack, as well as the severe epileptic paroxysm. Pupillary dilation was at one time considered to be dependant on a contraction of the blood vessels of the iris. Now were the old theory admissible, that contraction of the blood vessels of the brain, as manifested by a pallor of the face, is the initial change in the epileptic fit, dilation of the pupils, as a consequent of contraction of the blood vessels of the iris, might be feasibly maintained. During ordinary blushing, the vessels of the retina and the brain, have been seen to dilate, it is therefore more than problematical that the vessels of the iris are similarly affected. If however the pupillary state, were the

result of alteration in the calibre of the blood vessels circulating in the iris, we should expect to find dilatation of the pupil associated with epileptic pallor, and diminution in the size of the pupil, coexistent with initial flushing. Although contraction of the pupil has been noted during the fit, the condition is extremely rare, and marked dilation is the rule, whether there be manifested an initial pallor or flushing of the face. The pupil state in epilepsy appears to me to be wholly independant of the sympathetic influence, also totally unconnected with any cord change whatever, and is most probably of a purely cerebral origin.

In many cases of epilepsy, I have frequently remarked, during the period of immunity from attacks, the existence of a permanent inequality of the pupils. I have also it is true occasionally observed an inequality of the pupils in individuals of apparently good health, but the common association of this phenomenon in epileptics, makes it somewhat problematical, that it may be a direct result of the

proneness to this chronic functional dis=
order. In some cases, I have noted, that
the pupils, apart from any attack are
ever widely dilated, and either do not
react at all to light, or but feebly, the
nature of the contraction at the same
time being wavy and uncertain. The
pupil, under such circumstances, dis=
plays a marked proneness to dilate a=
gain, the contraction produced, being most
fleeting and transitory, which otherwise
in good health would continue so long
as the exciting cause lasted. When
the pupils are unequal, the least
effort at accomodation may determine
equality, the inequality only reappear=
ing with the state of comparative rest.
In testing the reaction to light, I have
frequently remarked, that, whilst the
pupils may in conjunction react well
to this excitation, separately, the one
more dilated will be found to con=
tract less markedly, and with less cer=
tainty than the smaller and at the
same time manifest a great tendency to
return forthwith to its pre existing state
of dilation. The iris itself is a
highly organised structure, and as the
epileptic may be considered as epileptic

even to the finger tips, it is quite possible that this protoplasmic veil in the eye participates in the general structural instability. So far as my observation goes, a careful scrutiny of these cases with inequality of pupils, reveals no constant information regarding the seat of initial cerebral disturbance, as manifested by the primary deviation of the eyes and head.

The dilation of the pupil, during the actual fit, results probably from a withdrawal of the usual nerve tonic influence, whilst the permanent wavy and uncertain state of the pupils, so constantly observed in epileptics, is the result of some occult change in the iris itself.

Vascular changes

Palpitation is often a precursor of the epileptic seizure, (minor as well as severe) and in some cases in even constitutes the distinct aura or warning of an approaching paroxysm. During many fits, in the male and female alike, I have detected a marked increase in the frequency of the pulse, reaching though rarely as high as 120 or 140 per minute. After the closation

of the attack is gradually lessens in frequency and returns to its normal rate. Augmentation of the pulse rate is more commonly observed than diminution; in a few rare instances however I have found a pulse averaging as a rule 76 per minute reduced during the actual fit itself to 48. In many cases, I have remarked no apparent or rather appreciable change whatever, whilst in one occasion only, did I note, intermission in a pulse, which at other times was perfectly regular.

In some cases, there is either a marked pallor or distinct flushing of the face, indicative respectively of contraction and dilation of the blood vessels: occasionally however during the same attack I have observed an alternation of these two vascular states. During a severe paroxysm, the face, irrespective of its initial color, is invariably livid, because of the interference, from muscle spasm, with the pulmonary circulation. The cyanosis gradually lessens, and the face re-assumes its normal color as the clonic

spasm becomes more completely interrupted.

During severe fits haemorrhages more or less extensive may result. In the skin, these usually partake of the character of petechiae, and are most commonly detected on the neck, the eyelids, and external ears, especially the lobes. On one occasion I witnessed a distinct and comparatively speaking profuse haemorrhage from both internal ears. Not infrequently I have noted extensive subconjunctival haemorrhage, in one or both eyes, which underwent, during the process of absorption, the usual changes incident to such. Occasionally as I have already remarked rupture of blood vessels occurs in the pharynx or oesophagus.

Respiration.

In minor epileptic attacks, with mere loss of consciousness and slight flushing of the face, I have frequently observed a marked acceleration of the respiration. As a rule however in the typical attacks there is interference with the respiratory movements, and signs more or less distinct of asphyxia result from a fixation of the respiratory muscles

and spasm of the glottis. In many cases the asphyxiated state becomes so marked, that death seems inevitable.

Finger snapping.

Finger snapping, is an odd gesture, yet in one case I constantly witnessed its manifestation during the epileptic unconsciousness. It is supposed to be a sign indicative of contempt, whether there ever was such idea in the mind of my patient prior to the exhibition of this peculiar phenomenon I failed to elicit.

The state of the reflexes

During the epileptic fit there is total abolition of all reflexes, the pupils fail to respond in the usual manner when exposed to a strong light, the conjunctiva when touched fails to elicit a reflex contraction of the orbicularis, and when favorably situated, the plantar surface of the foot fails when tickled to produce the usual muscular contraction.