

Med. Lib.

THE
WEST RIDING LUNATIC
ASYLUM

MEDICAL REPORTS.

EDITED BY

J. CRICHTON BROWNE, M.D., F.R.S.E.

VOL. I.



LONDON:

J. & A. CHURCHILL, NEW BURLINGTON STREET.

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"For, if the lute be not well tuned the musician fails of his harmony. And, in our present state, the operations of the mind so far depend on the right tone and good condition of its instrument, that anything which greatly contributes to preserve or recover the health of the Body is well worth the attention of the Mind."—BERKELEY.

PREFACE.

IN the harmless, but vindictive, attacks which have been recently directed against the public lunatic asylums of this country, it has been a frequent charge that no scientific work is accomplished in them. It has been an often repeated accusation that the medical officers of these establishments are so absorbed in general or fiscal management, in farming or in devising ill-judged amusements for their charges, that they have no time nor energy left to devote to professional research. And it has been further asserted that when these medical officers have by any chance ventured to enter the field of original investigation, they have, as a rule, signally failed in achieving any useful result, because they are blinded and misled by an erroneous method and by philosophical phantasms, and are destitute of that strict inductive faculty, which their censors are of course presumed to possess in a pre-eminent degree.

While no sympathy, or even toleration, is felt for such unwarrantable statements, or for the incapacity or disappointment of which they are the offspring; for that ignorance which knows nothing of medical literature; for that shallow-mindedness which recognises in the beneficent government of a community only the degradation of the huckster; for that pusillanimity which evades all metaphysical considerations, or for that pauperised scientific spirit which ignores everything save weights and measurements, still a belief is entertained that there has

perhaps been some remissness on the part of those engaged in the superintendence of our hospitals for the insane in publishing the results of their observations, and in contributing, in proportion to their opportunities, their full share, to our stock of precise knowledge. The just and exalted conception of an asylum medical officer's mission, which constitutes him the guardian and friend as well as the medical adviser of his patients, which gives an adequate prominence to the claims of practical humanity and raises even the details of administration into parts of a comprehensive scheme of treatment, does not certainly exclude original inquiry and experiment, nor the obligation of perpetuating experience and of adding to the resources of the healing art. On the contrary, it implies all these, and is best realised when they are combined with that modest philanthropy and laborious routine work which ought to form the staple of his daily life. That there has been any slackness on the part of asylum medical officers in completing the full tale of professional duty in accordance with this high standard, has been to a certain degree due not merely to the engrossing and exhausting character of these occupations which have properly filled the first place in their attention, but also to the absence of any immediate stimulus to the arrangement and elaboration of the materials collected, and to the want of any ready channel of exposition.

It is with the view of supplying this deficiency, and of affording an incentive to the utilisation of much valuable information, hitherto buried in case-books and diaries, that the present volume has been projected. How far it has fulfilled its purpose, in rescuing from forgetfulness anything worthy of remembrance, its readers must decide. Its com-

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pilation has at any rate been a source of gratification to the editor, and has united with him in an agreeable enterprise a number of those who have been and are his fellow-labourers and friends.

The editor regrets that the limits originally assigned to this work have necessitated the exclusion of several interesting articles. The materials for all those contained in it, except two, those of Mr. Burman and Mr. Ward, have been obtained from the wards or records of the West Riding Asylum.

Henceforth a volume of 'West Riding Lunatic Asylum Medical Reports,' equal in size to the present one, will be published annually, in the fervent hope that the series may in some measure conduce to the relief of suffering, the advancement of science, and the credit of the medical profession.

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CRANIAL INJURIES AND MENTAL DISEASES.

By J. CRICHTON BROWNE, M.D., F.R.S.E.,

MEDICAL DIRECTOR WEST RIDING ASYLUM, AND LECTURER ON MENTAL DISEASES TO THE LEEDS SCHOOL OF MEDICINE.

THOSE who would investigate the effects, immediate and remote, of mechanical violence applied to the cranium, will still find the subject involved in doubt and confusion. Not only are these effects very various, and often apparently irreconcilable with each other, but medical authorities are divided in opinion as to their existence, or the importance to be attached to them. Some confidently assert that no injury to the head is so trivial as to be despised; while others, by their observations, suggest the idea that the skull might be opened and the brain sliced away with only a temporary inconvenience. Mr. Erichsen describes the case of a lady who did not fall nor strike any part of her body or head, but forcibly slipped down three or four steps on her heels, and who in consequence of this insignificant concussion suffered from confusion of thought, loss of memory, and incurable paralysis. On the other hand, Dr. C. A. Tolson reports in the 'Pacific Medical and Surgical Journal' for May, 1869, the case of a man who sustained an alarming wound of the skull from a circular saw, and who was not much the worse for it. The cut extended from just above the nose in front to the occipital protuberance behind, and measured nine inches

in breadth and three in depth, so that the two halves of the skull fell apart more than an inch, and had to be bound together by a tourniquet. The scalp wound healed almost by the first intention; there were no unfavorable symptoms, and in three weeks the man was able to resume his usual occupation.

Notwithstanding the diversity of opinion, however, and the apparent incompatibility of facts bearing upon this topic, it is believed that a careful inquiry will conduct to certain definite and practical conclusions, and will establish the principle that cranial injuries are, at least, prolific sources of mental derangements. An examination of the cases which have passed under treatment in the West Riding Asylum in recent years creates no confidence in the permanence of the recovery of the victim of the circular saw; it suggests, rather, that the evil consequences, as regards mental health, accruing from violence applied to the head, have not yet been sufficiently realised.

Certain facts widely known and generally misinterpreted have tended to disparage the gravity and importance of cranial injuries as causes of mental disease. The artificial distortion of the head wilfully produced by certain American tribes, which is ascertained to have occasioned no perceptible impairment of intelligence, has made the statements of physicians as to the momentous effects of any interference with the integrity of the cranium seem extravagant and absurd; for there can be no doubt that extreme and peculiar deformity of the skull has been habitually secured by means of external pressure by whole tribes, without deteriorating from their capacity, or entailing any propagation of idiocy or insanity amongst them. Were the only proof of this statement derived from our knowledge of ancient crania, such as those found in Peru, little difficulty would be experienced in disposing of it and the objections founded upon it. In that case we might, perhaps, doubt whether the small elongated and flattened skulls excavated from the graves of sand and salt at Atacama, or from the tombs of Titicaca, belonged, as has been alleged, to the very beings who gave evidence of their intellectual capacity by the erection of those striking architectural structures amongst the remains of which they are found deposited. We might suggest that these misshapen heads had adorned the shoulders of the successors of the architects of those Incas who depopulated Peru, or that they

did not come into fashion until the excavations, towers, monuments, and sculptures were completed, and the extinction of the race drew near. We might even argue that they were not typical, but singular and abnormal specimens selected and preserved because of their malformation, or that they represented an enslaved, an inferior, or an idiotic caste. In short, we might dispose of these ancient crania in a variety of ways, without contravening the great law borne out by so many conspicuous coincidences, that cranial deformities and injuries are associated with mental defects and disorders. The evidence, however, of the fact that mental is not a necessary consequence of cranial distortion, is not wholly, nor even in great part, deduced from the information which we possess respecting these ancient crania. The same custom which imparted to them their peculiarities is still prevalent in some parts of the American continent, so that its effects can be accurately observed. The Chinouks, Kathlamets, Clatsaps, and numerous other tribes of the Columbia river, still by mechanical contrivances flatten the heads of their infants until a model deformity is attained, consisting in a depression of the forehead, and consequent elongation of the whole head, until the top of the cranium becomes, in extreme cases, an almost horizontal plane. The infant, soon after birth, is placed in a wooden cradle prepared for it, and has a board strapped across its forehead and secured by cords or bands, which are tightened until the desired deformity is procured. It is seldom or never taken from the cradle except in cases of severe illness, until the sutures of the skull have in some measure united, and the bones become firm and solid. So severe is the compression employed that sloughing of the integument sometimes takes place, while the appearance of its subject, with its little eyes forced out by the tightness of the bandages, is said to be always exceedingly painful; and yet this terrible and unnatural operation does not appear to exert any prejudicial influence upon the intellect of those upon whom it is performed. It is the verdict of all trustworthy travellers that, for shrewd intelligence and practical acquirements, the flat-heads are not inferior to their round-headed neighbours; not only so, but the process seems to be regarded as educational, for amongst those tribes who practise it, it is a degradation and sign of inferiority to possess an unmodified head. He whose

skull has been neglected in his infancy is looked upon with disdain, and is incapable of succeeding to any public office of distinction. The head, in short, must be distorted in youth in order that it may be useful to its owner in mature years.

In considering this very striking instance in which a cranial injury of a most afflictive kind is not followed by mental curtailment or disorder, it must be remembered, in the first place, that the process by which the injury is produced is a rough but effectual method of obtaining the survival of the fittest, and of extinguishing all weakly beings with any tendency to cerebral disease. Great numbers of infants die during the compression, and those who outlive it must be hardy in no ordinary degree. Then, in the second place, it must be remembered that the physical effect of the compression has been shown to be chiefly displacement, and not any arrest of development. Dr. Morton, than whom no higher authority could be quoted upon such a question, affirms that, after immense numbers of measurements, he has satisfied himself that the various modes of distorting the cranium occasion no diminution in its internal capacity, and, consequently, do not affect the size of the brain. The effect of the compression is that certain portions of the brain are dislodged, but not dwarfed nor destroyed; that the anterior lobes of the cerebrum are developed laterally and backwards, but retain their identity and uses. In the third place, it must be remembered that the style of distortion adopted is generally an exaggeration of a natural conformation. Wherever in ancient or modern skulls the intervention of art is perceptible, it is plain that it has operated upon a forehead extremely low and broad by nature. In speaking of the American family, Humboldt has remarked that there is no race on the globe in which the frontal bone is so much pressed backwards, or in which the forehead is so small. In the fourth place, it must be remembered that, on the removal of the compression, the brain somewhat recovers its position, as disfigurement is always more remarkable in young than in old persons. Pickering says that as the Chinouks grow up the cranium tends to resume its natural shape, so that the majority of grown persons hardly exhibit traces of the existence of the practice, except in the unusual breadth of the upper part of the face. In the fifth place, it must be remembered that the skulls of savage tribes are much

thicker than those of races which have undergone civilisation, and that the damages effected by compression of the head are, therefore, more of an osseous and less of a nervous character. The natives of Van Diemen's Land break wood on their heads with impunity; this is also the case amongst the Penhuenches in South America and Indians in Brazil. The skulls of Australians are thicker than those of Europeans. Herrera mentions that the Spanish conquerors of America were not able to split the skulls of the aborigines of Cuba and Haiti with one stroke of the sword, and Delagorgue describes the remarkable thickness of the skulls of the Zulu Kaffirs. In the sixth and last place, it must be remembered, and this consideration is, perhaps, as important as any, that the nervous system is much less delicate and susceptible in uncultivated than in civilised races. The cerebrum of a savage can endure without detriment what would be fatal to that of a man descended from a line of civilised ancestors. "The thoughts of men are widened with the process of the suns," and their brains also are in some respects weakened. What Herbert Spencer calls the progressive aggregation of psychical states that are connected in experience, takes place not only in the individual, but in successive generations. Physical organisms inevitably establish a co-ordination of psychical states corresponding with the external circumstances by which they are surrounded. Successive increments gathered from the experiences of successive generations, strengthen and multiply and expand such psychical states. A structural modification of the nervous centres is gradually brought about, parallel with their enlarged activities. As we shall hereafter see, the dimensions of the brain are increased, and as we must now remark its susceptibility is also augmented. As thought becomes more swift and complex, its instrument becomes more delicate and fragile. As the rude implements of primitive life are to the marvellous machines of our present civilisation, so is the brain of the savage to that of the civilised man; in both are there an infinitely higher intricacy, and combination; and refinement, and in both is there a greater liability to damage and derangement. We may without hesitation assert that no infantile brain amongst ourselves could tolerate the compression to which the brains of infant Indians are harmlessly subjected; were the

experiment tried, death would result, or, if that was unhappily avoided, incurable idiocy.

Now, although no artificial distortion of the head is in vogue amongst ourselves, it would appear that other kinds of cranial injuries begin to operate as causes of mental diseases at a very early period of existence, and vindicate what has been said as to the more sensitive and irritable condition of the civilised brain even before it has grown up into its civilisation. Dr. S. G. Howe has intimated in his 'Report on Idiocy in the State of Massachusetts,' that he had encountered, in his investigation, at least seven cases, in which mental weakness was due to attempts on the part of mothers to procure abortion. Dr. Howe has not given the evidence which enabled him to connect the idiocy with the criminal attempt in these cases, but his general character for scientific carefulness entitles us to believe that he had good grounds for his assertion. The powerful inducements towards secrecy under such circumstances, and the difficulty which must be felt in distinguishing what is attributable to direct violence, and what to the moral condition which suggests such violence, must always involve cases of this kind in great obscurity and doubt. It is not incredible, however, that notwithstanding the care with which the foetus is sheltered in the uterus, floating as it does in an elastic fluid and surrounded by many folds of protecting membranes, injuries may be inflicted on its cranium, and involve arrest of its development. But, however this may be, no question can arise that injuries sustained at the next epoch of existence—the moment of birth—may permanently and disastrously interfere with mental health. Abundant proof exists that the act of parturition may imprint upon the nervous system of the nascent infant serious and peculiar evils. At the time of parturition the brain of the infant is not only larger in proportion to the body than at any subsequent period, but has also a higher physiological and pathological importance. In the adult, the proportion of the brain to the body is as 1 to 40; in the infant at birth it is as 1 to 6. In the adult the consistence of the brain is firm, in the infant at birth it is semifluid. In the adult the cerebral vessels are tenacious, and capable of resisting considerable pressure; in the infant at birth they are soft and easily lacerated. In the adult the brain possesses a comparatively per-

manent organisation ; in the infant at birth it is in a state of transition, undergoing great and rapid changes, from the embryonic to a higher stage of development. From these differences it results that the brain of the infant at birth is in a peculiarly susceptible and sensitive condition, and exceedingly liable to be injuriously affected by any violence applied to it. We find accordingly that affections of the nervous system, due to morbid states and disturbances of the encephalon, constitute the chief causes of infant mortality immediately after birth and for some years subsequently, and that various circumstances point to the compression to which the cranium and its contents are subjected during parturition as the sufficient explanation of this fact. Although the foetal head has been so constructed with sutures and fontanelles that it may undergo considerable temporary alteration in shape and volume in its passage through the pelvis, without prejudicial consequences, yet there is a point beyond which its compression cannot be carried with safety, and this is less removed from the average standard than might at first be supposed. Dr. Hamilton, when speaking of the occasional difficulty of deciding in individual cases whether the maternal passages are or are not of such dimensions as to allow the child to pass, remarks that "in this question even the miscalculation of the sixteenth part of an inch might prove fatal to the life of an infant." If this is so, it is clear that a very trifling disparity between a foetal head and the pelvis through which it has to pass may eventuate in evils short of fatality, but still exceedingly serious. The adaptation of the foetal head to the maternal canals is so very close and accurate as it occurs in parturition in females of our own race, that deviations of a very slight degree in the relative size of the head of the child and the maternal outlet lead to differences of a notable description in the safety or danger of the whole process, to the life of the child and its general well-being. Convincing proof of this was adduced by the late Sir James Simpson, to whom it occurred that the slight difference in size which is known to exist between the heads of male and female children at birth, afforded a criterion for testing the results produced by such a difference. By unassailable statistics and arguments he established that the greater size of the head of the male infant at birth, which exceeds that of the female by three eighths of

an inch in circumference, by one eighth of an inch in transverse diameter, and by two eighths of an inch when measured from ear to ear, is the sole cause of the larger number of complications and casualties accompanying and following male births. He established also that these complications and casualties as they affect the child are not exhausted at the time of delivery; but that they continue to influence the male constitution for some years afterwards, so as to predispose it to disease, and to render those disorders which do occur in it more dangerous and fatal than in the female. He has further shown that the pathological characteristics in question gradually diminish in the male system, as life advances from the moment of birth onwards. "The diseases of the nervous system," observes Dr. Farr in the Registrar General's Second Annual Report, "are twenty-three per cent. more fatal to males than females, the chief difference arising from the diseases which affect children."

I am inclined to believe that the observations of Sir James Simpson just referred to afford a clue to the explanation of some part of the increase of insanity, which has kept pace with the advance of civilisation, if indeed it has not outrun it. There would be no extravagance in suggesting that cranial injuries, due to some disproportion or defective adaptation between the head of the child and the pelvis of the mother, are responsible to some extent for the growth of mental defects and derangements in recent times. Whatever disputes may arise as to the question whether insanity is actually increasing at the present day, none can occur as to the statement that it has increased enormously during the progress of mankind from a savage into a civilised state. "There can be little doubt," says Dr. Tuke, "that insanity attains its maximum development among civilised nations, remaining at a minimum among barbarous nations as well as among children and animals."¹ In some uncultivated tribes it seems to be almost unknown. Dr. Lillybridge, of Virginia, who was employed by the United States Government to superintend the removal of the Cherokee Indians in 1827, and who saw more than twenty thousand Indians, and inquired much about their diseases, informs us he never saw nor heard of a case of insanity among them. Dr. Butler, who was a devoted

¹ 'A Manual of Psychological Medicine.' By Drs. Tuke and Bucknill. 1st Ed., London, 1858, p. 50.

missionary and physician among the Cherokees for a quarter of a century, testifies that he had never seen a case of decided insanity among them, though he occasionally saw them delirious from bodily diseases, and adds that an intelligent chief, a man eighty years old, assured him that he had never known a case of insanity among his people such as he had seen in the hospital at Philadelphia.¹ Cinquez, and others of the Armistad negroes, when in America, after visiting the Hartford Retreat, and seeing the patients there, stated that insanity was very rare in their native country. Most of them had never seen an instance of it. Cinquez, however, said that he had seen one case. Other authorities might be quoted to show that a similar immunity from mental diseases is enjoyed by South Sea Islanders, Tartars, Abyssinians, and Nubians, and that this cannot be adequately accounted for, by the early extinction of weakly lives amongst these races, or by anything but the hypothesis that the circumstances of civilisation favour the increase of insanity.

Now, parallel to this increase of insanity, which has been observed to mark the transition from a rude to a cultivated condition of society, there is an increase in the average dimensions of the cranium. Dr. J. Barnard Davis has proved by many careful experiments that the mean internal capacity of the skull in Europeans is 92·3 cubic inches; in Americans 87·5; in Asiatics 87·1; and in Australians 81·9. Dr. Prichard expressed his belief that the present inhabitants of Britain have "much more capacious brain cases" than the ancient inhabitants, while Professor Broca found that skulls from graves of the nineteenth century in Paris were larger than those from vaults of the twelfth century in the proportion of 1484 to 1426. Dr. Morton demonstrated that, the average capacity of the Caucasian skull being calculated at 90 cubic inches, the adult skulls of the ancient Peruvians gave an average capacity of 73. Mr. Pratt, of Bond Street, who provided a large portion of the armour used at the Eglinton tournament, distinctly stated that scarcely any of the helmets could be worn on that occasion before they were enlarged.

Then again, coincident with this enlargement of the head, which takes place contemporaneously with the progress of civilisa-

¹ 'The American Journal of Insanity, No. 3. Utica, 1845.

tion, there is a corresponding increase in the difficulties and dangers of parturition. In savage women child-bearing is a comparatively simple process, causing little inconvenience, and accomplished with the greatest facility and rapidity. In the women of civilised races, on the other hand, owing to a less perfect and equitable adjustment between the child to be expelled and the maternal outlet, it is a most tedious and hazardous operation.

In these three facts, then—1st. That insanity is much more prevalent amongst civilised than barbarous races ; 2nd. That the dimensions of the cranium are greater in civilised than in barbarous races ; and, 3. That parturition is attended with much greater difficulty and risk in civilised than in barbarous races, may probably be discovered a very significant relation. It has been shown that the trifling excess in size of the male over the female head at the time of birth entails an increased liability to mental and nervous diseases, and it is not therefore unreasonable to conclude that the more considerable excess in size of the skull in civilised over that in barbarous races entails also the same penalty. Sir James Simpson did not trace the pernicious effects of the greater compression of the male head at birth for more than a short period thereafter, but arguments might be adduced to prove that they may really extend over the whole of life, and either directly or through the instrumentality of convulsions or some other intermediate disorder, eventuate in no immaterial propagation of mental aberration. Of course the same arguments apply with equal force to the pernicious effects of that greater compression of the head at birth which we have shown to be cotemporaneous with civilisation.

The prejudicial consequences which are known to accrue from tedious and abnormal parturition strongly corroborate the suggestion which has been offered as to the influence of cranial compression at birth in producing a certain increase of insanity, and unmistakably demonstrate that injuries then received may be fruitful sources of subsequent mental infirmities. It admits of proof that every variety of unnatural labour, in which greater or more prolonged pressure is exerted on the head, and especially those in which asphyxia neonatorum and suspended animation immediately result, may ultimately be followed by idiocy, imbecility, or a peculiar and intense susceptibility to mental

derangement. Nor can this be considered surprising when the character of the injuries sustained under such circumstances is borne in mind. Even where no instruments have been used to complete delivery, it is not uncommon to find in children who have perished during or after tedious or abnormal labour lacerations of the dura mater, and extravasation of blood between it and the bones, rupture of the great sinuses, with copious hæmorrhage over the brain, or punctiform capillary apoplexies on the surface of the convolutions. When injuries of this description have occurred without extinguishing life, the almost inevitable consequence is that the nutrition and growth of the nervous centres are retarded and modified at a most critical period of their history. Perhaps also an insidious inflammatory process is lighted up, or a local atrophy is induced, or a departure from the normal type of development of the skull is occasioned. But even where no distinct anatomical lesions such as those enumerated have occurred, mental weakness or disease may still spring out of tedious or unnatural labour, through extreme capillary congestion, through the prejudicial influence of convulsive attacks, or through the simple dynamical effects of compression of nerve tissue.

Hitherto attention does not appear to have been sufficiently directed to the important part played by compression of the head at birth in the causation of idiocy and insanity. Many of the highest authorities have altogether ignored it. Dugès, however, has distinctly traced idiocy and hemiplegia to injuries in protracted labour, and Dr. W. J. Little has described a variety of nervous affections due to the same cause in a very able paper, communicated to the Obstetrical Society by Dr. Tyler Smith in 1861. Dr. Little has especially connected with such injuries a determinate spastic rigidity of the limbs, assimilated to trismus nasentium, and frequently associated with imbecility of mind. He enumerates forty-seven cases, in all of which there were something abnormal in the act of parturition and persistent spastic rigidity, characterised by impairment of volition, with tonic contraction, and ultimately structural shortening in varying degrees of a few or many of the muscles of the body, and in many of which there were chorea, convulsions, weakness or eccentricity of mind, or other disorders of the nervous system.

Great difficulty is experienced in estimating the extent to which cranial injuries sustained in tedious or abnormal labour are responsible for idiocy and mental disease, and even in discovering their existence as a cause of mental aberration in any particular case. Parents are prone to explain the idiocy of their children by any fantastic or superstitious theory that may be suggested to them. They prefer that it should have a mysterious origin, and scout with contempt any simple physical way of accounting for it. A woman assured me recently that the deaf-mutism and idiocy of her son were due to the circumstance that a dumb man had begged from her, and frightened her during her pregnancy. She was incredulous when I expressed my opinion that they might more reasonably be ascribed to the facts that her child was stillborn after a labour of forty-eight hours' duration, was not brought to life for ten minutes, and suffered from convulsions for three weeks. In some cases, however, the dependence of idiocy upon the mode of birth may be clearly made out. It was so in that of M. R—, who was under my care some time ago, and who was one of a large family of healthy and intelligent children. He was born, after a tedious labour, with a huge caput succedaneum, testifying to the pressure to which he had been exposed. He was not expected to live, did not cry for some hours after birth, could not suck for several days, had twitchings of the limbs for a fortnight, and then spasm for about three months. He did not walk until he was three years old, and then with a tottering, unsteady gait, and only acquired a few monosyllables a year afterwards. He grew up a typical example of that kind of idiocy which generally results from tedious and abnormal but non-instrumental labours, and which is not altogether of the baser sort. Although exceedingly feeble in his mental powers, ineducable, and unable to articulate distinctly, he could still pick up and play upon the piano any tune which he might hear, and manifested some vigour of memory in certain directions. He had a small conical head, badly shaped features, and a convergent strabismus, and was at times distressingly dirty and mischievous in his habits.

All the disastrous consequences as to mental health which have been attributed to tedious and abnormal labours are of course more conspicuous in cases in which instrumental in-

interference has been had recourse to. The forceps are undoubtedly responsible for no small amount of idiocy and insanity, and indeed a careful inquiry into the mental condition of a number of children who have been delivered by them creates the impression that in some more harm results from their use than is ordinarily suspected. Where the bones of the skull have been crushed by them, complete idiocy, with permanent deformity of the head, most often follows. This condition is illustrated in G. W. K—, aged 10 years, and now an inmate of the West Riding Asylum, whose head is terribly distorted. G. W. K— was a first child, born at the full time, but when his mother was somewhat advanced in life; his head was of large size, and delivery could not be effected without the forceps, which were accordingly applied, and by which the parietal bones on both sides were depressed and broken. Immediately after birth the head was noticed to be larger on the left than the right side, and to present a large rounded eminence in the left coronal region. That shape it has preserved ever since. Soon after birth convulsions came on, and these recurred three or four times a day for twelve months, when they suddenly ceased. He sucked properly, but did not walk until he was two years old, and has never learnt to speak. He is now a stout, healthy-looking boy, well formed, except in the head, but thoroughly idiotic. He spends his whole time when not asleep in running without purpose from place to place, waving his hands rhythmically before him, and uttering loud, harsh, automatic cries from time to time. He cannot feed himself, nor attend to the calls of nature, and only manifests intelligence by recognising the person who waits upon him, and by imitating the movements of some of his companions in the ward. G. W. K— has a sister three years younger than himself, and born in a normal way, who is a healthy vivacious child.

If the injuries inflicted by the forceps are less severe than those described above, then imbecility may result. J. V. H—, aged 34, a farm labourer, and now in this asylum, was helped into the world by forceps, and has always been what his father terms "queer thoughted." His mother was a little ricketty woman, and bore only one child alive. Seven other children, four boys and three girls, were destroyed by craniotomy. J. V. H— still bears on his left temple the mark of the forceps, to

which he owed his survival. His head is also unsymmetrical. He seemed dead, and was blue all over for half an hour after birth, and was restored by means of warm baths. He has been always peculiar. As a child he was wilful and passionate, and could not be taught to read. He never had any of the ordinary diseases of childhood, but suffered much from congestion of the eyes and attacks of giddiness, which were aggravated by any attempt at mental application. At sixteen years of age he had an attack of acute mania, from which he recovered in a few months. Since then he has been childish, unstable, disturbed nightly by terrible dreams, unable to climb to any height without giddiness, and an intense feeling of fear, and at times irritable and excitable. In August, 1867, he became notably more restless and violent, and in November of the same year gave himself up to the police, and asked to be placed in security, as he had an almost irresistible impulse to murder several members of his family. For two years past he has been under care here. He is a weak, simple-minded man, vain and irresolute, incapable of steady occupation, and liable to exacerbations of excitement bordering upon mania. He is, in short, a good example of that imbecility which is produced by cranial injuries of a minor degree inflicted by the forceps at birth.

* The list of evils, as regards subsequent mental conditions to be attributed to the forceps is not, however, exhausted when idiocy and imbecility have been enumerated. I have seen a case of moral insanity in which there were grounds for believing that the perversion of character would not have existed but for the distortion of the head which the forceps had caused. T. T— was the son of wealthy and highly educated parents, but grew up wild and depraved amidst goodness and refinement. He was a first child, born of an excitable mother, after a protracted labour, and by the aid of forceps, which squeezed his head so considerably that it never altogether recovered its natural shape, but remained of an irregular form, with depressions in each parietal bone. Along with the cranial irregularity there were other morbid phenomena, such as slight exophthalmos, with bronchocele, partial strabismus, and a strong hæmorrhagic diathesis, while the symptoms of deranged mental action were multiform and obvious. When four years

old this boy habitually refused to make use of the water-closet or chamber utensil, and passed his excrement on the floor or threw it out of the window. When six years old he stole toys from shops in the most impudent manner, and gave them away to his companions. When seven he stole money from visitors in his father's house, and from strangers when the opportunity presented itself. When ten years old he was sent to a school on the Continent, where he stole silver plate and ran away. When twelve years old he committed numerous extensive robberies from the house in which he was boarded, and introduced to his associates there obscene books and prints. When thirteen years old he had connection with a child aged nine. When fifteen years old he abandoned himself to drunkenness and immorality, and wrote odiously profane letters to all his relatives and acquaintances. His subsequent career was marked by profligacy and vice of every description, varied by exhibitions of what might be termed intuitive talent, which enabled him to gain several prizes and distinctions. It was with great difficulty that the relatives of this lad could be brought to regard his conduct as the result of disease, or to look with forbearance upon acts so foreign to their own nature, so incomprehensible by any standard to which they were accustomed and so repugnant to the dictates of religion and morality. The utter incorrigibility, however, of T. T— under every species of correction; his indifference to all ordinary motives and inducements; his general and progressive eccentricity of manners; his asseverations that he could not by any effort restrain himself; and the contrast which his conduct presented to that of his brothers and sisters reared in precisely similar circumstances, at length persuaded them that he was the victim of moral insanity, and that his mind and life had been warped by the forceps which had crushed his cranium.

Besides idiocy, imbecility, and moral insanity, a peculiar constitutional tendency to mental or nervous disease must be adverted to as one of the evils occasionally dependent upon injuries inflicted by the forceps at birth. An intensely nervous temperament, an exquisite susceptibility, an incompetency to sustain the trials of life, and a liability to mental derangement, have been several times noted in those who have been free from any hereditary taint of madness, but who have had their heads

compressed by the forceps in delivery. This inherent weakness was manifested in T. A—, from Bradford, lately an inmate of this asylum, who belonged to a family in which no mental disease existed, who was a sober and prosperous man, but who was sent here labouring under intense religious depression brought on by the death of his wife. On inquiry it appeared that T. A—, whose head bore record of the forceps blades, had always been somehow different from his kindred, and had exhibited perpetually singularities of thought and feeling. Volatile, passionate, exuberant, he had given way to despondency on the slightest reverse, and had passed into actual insanity when any real misfortune happened. I have watched two cases of typhoid fever, in which the patients were robust young men, who had been delivered by forceps, and whose heads had been somewhat crushed by them, although they exhibited no permanent deformity, nor, indeed, any visible mark or trace of the application, except that they were somewhat smaller than those of the other members of their families. Both these young men had displayed excellent abilities, but possessed intensely nervous and impressionable temperaments with some impulsiveness. In both the fever was characterised from the first by the predominance of all nervous symptoms; in both, delirium was early, continuous, severe, and uncontrollable; and in both death ensued purely from cerebral complications.

Risk of another kind of cranial injury besets the child immediately after birth. If that has been safely accomplished, dangerous compression of the head, and the forceps with their malignant gripe having been escaped, hazardous constriction may be wilfully applied to it. I recollect once visiting the lying-in room, and finding the infant there crying violently, while the nurse forcibly squeezed its head between two towels until the bones overlapped each other at the fontanelles, with the benevolent purpose as she assured me of closing it up. I have been since informed that this practice is frequently observed in some districts of the country, and that it is sometimes carried on for weeks after birth. I have not been able to connect with it nervous or mental disease in any instance; but it can be scarcely necessary to point out how pernicious and reprehensible it is.

- In the early years of extra-uterine life there is, I believe, a greater liability to be prejudicially affected by any violence

applied to the skull than is ordinarily admitted. My observations lead me to believe that at this period, when the nervous centres continue delicate and friable in an extreme degree, there is less danger of painful consequences from simple concussion than at a more advanced epoch of life, but more danger of subsequent disaster from any physical lesion of the brain or its vessels, and, of course, a greater proclivity to such physical lesions. A blow or fall may be the starting-point of acute hydrocephalus, which when it spares life never leaves the mind unscathed, or may break open the door for convulsions with their attendant calamities.

In childhood, the risks of concussion increase rapidly, while those of actual physical injury proportionately diminish as the encephalic structures consolidate and assume a permanent shape. Now, indeed, even trifling concussions, particularly when often repeated, have very decisive effects, as in the following remarkable case which came under my notice some years ago:—A. R—, a boy about ten years old, of very nervous temperament, who had been kept at home up to that age, was then sent to a day school, where he at once gained credit by his quick apprehension and superior memory. It was soon discovered, however, that he disliked both the discipline and the work, and that he feigned various ailments in order that he might stay away from school. This malingering was clever but unmistakable, so he was quietly given to understand that his complaints would not be attended to. In a short time it became apparent that there was a singular falling off in his intellectual power, and a deterioration in his moral character. From being sharp and active he grew dull and stupid. From being amiable and obedient he grew irascible and insubordinate. Soon also other phenomena came to the surface, which indicated the real nature of these alterations in capacity and disposition. He began to squint, to pause, and stare vacantly about him for a few moments in the midst of anything he was doing, and to press his hands to his head as if he felt pain there. Grave alarm was now awakened, and A. R— was closely watched, when it was accidentally found out that he was in the habit of beating his head against the wall for the purpose of making himself genuinely ill and thus obtaining his object. His method was to stand with his back to the wall and give his occiput two or three sharp taps against

it. This, as he himself confessed, when charged with it, he had done once at least almost every day for three weeks in the hope that he would bring on some slight illness and thus secure exemption from the hated tasks and routine. The taps could not have been severe, as A. R— always shrunk from pain, and as the part which he had invariably struck was only slightly swollen and tender when his extraordinary practice was detected. The consequence of his conduct was, that he sunk into a state of imbecility or acute dementia, which continued for several months. Ultimately, however, he made a good recovery.

Symptoms somewhat similar to those presented by A. R—, or, at least, of the same class, if less pronounced, occasionally follow blows and contusions sustained in games and athletic sports. Dr. Farquharson, who was lately medical officer of Rugby School, when speaking of football as played there, says: "The shocks and jars to which the brain and spinal cord are exposed by this mode of playing the game are considerable, for not only do the boys frequently fall on their heads, but there is much twisting and wrenching of the back. We might almost expect the injurious results to resemble those met with in railway accidents, and though I have never heard of any such insidious secondary consequences, it is hard to suppose that the delicate nervous matter can be thus knocked about with impunity. A master in a large public school, who has given some attention to this subject, tells me that a well-marked difference is thus often made in boys as they grow up, and that he has over and over again seen the fine edge and keenness of talent worn away by such rough usage."

It is necessary here to point out the distinction which prevails between compression of the cranium in children and in adults. In the former the inner table does not break so readily as in the latter; the brain bears simple pressure better, and the level of the bone is gradually restored without the aid of a surgeon, and without permanent disturbance of the cerebral functions. When in young children we have the bone hollowed or indented without actual fracture or solution of continuity, the pulsations of the brain beneath, aided by the natural elasticity of the textures, tend slowly to elevate the depressed portion and restore it to its normal position. Along with this restoration of position, a restoration of healthy mental action takes place; mental

oppression and lethargy disappear, and no greater liability to consecutive mental derangement is retained than would have been incurred by the concussion accompanying the injury minus the depression. Avellan states that "a girl of fourteen had a depression of the right parietal bone from a blow, which gave rise to mental derangement, amounting almost to imbecility, for three months, at the end of which time the depressed bone gradually resumed its level and the girl completely recovered." When, however, no spontaneous cure of this description takes place after depression of the skull occurring in early life, and where no accommodation of the brain to its altered circumstances, by expansion in other directions, has been successfully accomplished in those cases in which the depressed bone is not restored to its proper level, then lasting mental disorder may be looked for, unless operative interference affords relief. This is not altogether so extreme and hopeless an expedient as might at first be imagined. Dr. Lockhart Robertson has reported the case of a sailor, an inmate of the Cumberland Asylum, who had a depression of bone on the postero-superior margin of the right parietal bone, caused by a fall from the mast of a ship when he was thirteen years old, who was insane for thirty-one years thereafter, and who then entirely recovered his soundness of mind on the removal of the depressed bone by trephining.

In dealing with the mental diseases resulting from cranial injuries in adults, it will be neither requisite nor profitable to describe them in connection with the different kinds of injuries out of which they may arise, nor to attempt any classification of them founded on their mode of origin. The effects of the various kinds of cranial injuries, both immediate and secondary, are usually of a very mixed character, so that it would not be possible, even if it were desirable, to separate them into groups corresponding with the varieties of these injuries enumerated by surgeons. We shall therefore consider together the effects of concussion, whether from violence impinging directly on the head, or communicated from some other part of the body; of fractures of the skull, simple or compound, and with or without depression; of rupture of any of the encephalic vessels, and of punctured, incised, or lacerated wounds of the brain substance itself, with or without loss of substance.

Concussion is, of course, the most important element in the vast majority of cranial injuries, in relation to subsequent mental infirmity. Not only does it accompany, in greater or less degree, almost all those other injuries which produce structural lesions, and contribute as much, perhaps, to the consecutive mental changes as the structural lesions themselves; but it is by far the most frequent kind of cranial injury, and the most fruitful source of ulterior misfortune. No computation can be formed of the amount of mischief which results, sooner or later, from that shaking of the brain in its case which we call concussion, but it is undoubtedly enormous. Long after the shaking has been forgotten, distressing and far-reaching sequelæ may continue to present themselves, and this too even when the shaking was of a trifling character. Reference has already been made to the grave consequences of slight concussions when frequently repeated, in connection of the case of A. R—, and numerous examples of them might be here quoted from the books of this Asylum. Colliers, of whom a considerable number are constantly under treatment here, are, of course, much exposed by their avocation to injuries of the head, and, in some instances, suffer from these more than they are themselves willing to allow; familiarity with them has bred contempt for them, and the unobtrusive but indisputable inroads which they make on mental integrity are rarely recognised. But occasionally a case presents itself in which they cannot escape acknowledgment. J. H— carries on his scalp eight entries in coal dust of wounds which happened in the pit, and which were thought of no great moment, although two of them were followed by short insensibility, and one, the last but one, by a little delirium. After the last three accidents, the relations of this man, who was always sober and steady in his habits, noticed a progressive weakness creeping over him. The delirium left him in a state of melancholia, in which he tried to hang himself, and the last *coup*, which followed that attempt in six months, plunged him into a state of fatuity, in which he still continues.

What the condition of the brain in cases of this description is, it is impossible to say. Even when death has been produced by concussion an examination of the brain and its membranes has failed to reveal any alteration of natural appearances. We are justified, therefore, in concluding that concussion may exert

its worst influence without any organic change which is capable of being detected. Everything points to the conclusion that the evil of concussion really consists on what may be called dynamical changes in the nerve cells and their connecting fibrils. We have reason to know that complete derangement of the mental powers may depend upon modifications in the polar molecules of the nervous element, upon changes in the temperature, chemical composition or reproduction of the nervous tissues, which even aided by scientific instruments we are unequal to discover. So infinitely delicate and complex is the arrangement of the cortical layers that a defect or vice in their actual constitution may exist congenitally or be induced by circumstances, without ever affording any other evidence of its presence than the disordered phenomena in which it is expressed during life. Such a defect or vice of general or partial distribution is probably produced by the jarring or agitation of concussion. The action of the jarring or agitation of concussion in producing such changes is not without analogy in our physical experience. Wrought iron in some inexplicable manner loses its fibrous and assumes a crystalline character, after undergoing intense or long-continued concussion, and a solution in a state of unstable equilibrium which remains fluid when cooled, even 10° below its freezing point, suddenly solidifies when any agitation is communicated to it as by the dropping of a particle of sand upon its surface. These curious phenomena do not, perhaps, throw much light on the *modus operandi* of concussion on the cerebrum, but they illustrate how without any alteration in the vital properties of the nerve tissue a state of change may be set up by any violent agitation or vibration.

The action of slight and continued vibrations or oscillations on the cerebrum have not yet been fully investigated. The information, however, collected as to the influence of railway travelling upon health, suggests that they are not unimportant, while some cases clearly indicate their existence. A gentleman travelling by second class, in an express train at night, stretched himself out and endeavoured to go to sleep. When in a semi-waking condition, he was surprised by a procession of singular appearances that floated before his eyes. Figures in every variety of costume and attitude, gorgeous flowers, animals of which Cuvier never dreamt, seemed to glide into his field of

vision, dwell there for a few moments and then vanish, being followed by others with which they were wholly unconnected. He watched this phantasmagoria, then seen for the first time, with interest and curiosity, and tried to analyse it, but was unable to make out any law regulating the succession of the figures or the duration of the continuance of each. No shred of association or congruity seemed to bind them together. When he opened his eyes, the figure which for the instant possessed them remained in view for a couple of seconds, then lost its clearness of outline and aspect of substance, and faded away. He was lying with his head upon a plaid wrapped up as a pillow, and the carriage was jolting abominably. He found that when he raised himself upon his elbow and held his head in the air with his eyes closed, the procession was interrupted to be at once resumed when he replaced his head on the plaid or leant it upon the window frame. When he made a prop of his arm and laid his head on his hand the figures reappeared, though less numerous, definite, and distinct; but whenever he sat up or held his head so that it was entirely surrounded by the atmosphere, no visions appeared. He satisfied himself by numerous experiments that his hallucinations, if they may be so called, were dependent upon the movements of the carriage communicated to his head by contact with some portion of it.

In this case an oscillation or jolting which usually occasions nothing more than discomfort developed a condition closely bordering upon the morbid, and it did so because the gentleman to whom the strange experience happened was at the time in bad health, brought on by great mental anxiety, a fact which conducts us to the important consideration how far cranial injury by concussion, compression, or fracture, in every case is subject to modification by circumstances altogether independent of the character or extent of the injury itself. Every practical surgeon must have observed that in cases of injury of the head there are differences in the whole cause of symptoms produced which cannot be accounted for by any corresponding difference in the character of the injury. The same lesion occurring under circumstances exactly similar will give rise to symptoms in one case slight and in another urgent. This is only explicable by taking into consideration certain qualifying circumstances which materially modify the effects of cranial injuries, and

which we shall briefly allude to under three heads: 1st, age; 2nd, previous condition; and 3rd, locality of the lesion.

I. *Age*.—In addition to what has been already said as to the influence of age, or, rather, of youth, in modifying the effects of cranial injuries by virtue of the varying conditions associated with developmental processes, it is only requisite here to advert to a law which has been observed, to regulate mental diseases proceeding from cranial injuries with great consistency; and that is, that they most frequently tend to assume that special type which is most characteristic of the age of the individual to whom the injury occurs. This may be best explained by a few illustrations briefly summarised:

1st. E. B—, male, aged 20, was “dropped” when an infant, had his head hurt, and is now idiotic.

2nd. M. H—, female, aged 16, fell off some steps on to the back of her head a few months ago when cleaning the house, and has had an attack of hysterical mania.

3rd. A. W—, male, aged 35, had a kick from a horse on the head and suffered from acute mania.

4th. A. M—, female, aged 46, and at climacteric period, was knocked down by her husband, struck her head, and is recovering from melancholia.

5th. M. K—, male, aged 65, fell down a stair, was treated for fracture of the base of the skull, and is now a well-marked example of senile dementia.

II. *Previous condition*.—The bodily and mental state of a person experiencing a cranial injury exercises a considerable influence over the effects subsequently produced, as to their severity and duration. An examination of the patients in the West Riding Asylum with reference to this subject seems to justify the following conclusions:—

1st. That idiots, imbeciles, and chronic lunatics, do not suffer from cranial injuries in an equal degree with persons of average and sound mind.

2nd. That those who are hereditarily predisposed to insanity suffer more seriously from cranial injuries than those who are exempt from such predisposition.

3rd. That those who, without hereditary predisposition to insanity are of intensely, nervous diathesis, who are sensitive,

excitable, 'impulsive, and wayward, suffer more seriously from cranial injuries than those who are of more stolid constitution.

4th. That those who are in feeble health, or who are debilitated by privation, or are recovering from any acute disease, are more seriously affected by cranial injuries than those who are well nourished and robust.

5th. That those who are given to excesses, sexual or alcoholic, suffer more seriously from cranial injuries than those who are abstemious and temperate.

It seems unnecessary to quote numerous illustrations of these statements, which almost justify themselves with their conformity with well accredited principles. Every asylum medical officer must have observed the comparative impunity with which idiotic and demented patients can undergo concussion or cranial injury. G. E—, aged 12, from Sheffield, an epileptic, imbecile, fell, while in a fit, on October 18th, 1868, off a chair on which he had mounted, with his head first on the floor, with such a crash that the attendant who picked him up thought he must be killed. The skin was not broken, but an enormous bloody tumour formed on the crown, and then, owing to looseness of the cellular tissue, spread downwards in every direction, until the circumference of the head was increased by several inches, and its aspect was that of chronic hydrocephalus. G. E— recovered from his fit in the usual way and time, and never complained about the accident, nor showed any signs of having suffered from it. His capacity, which was repeatedly tested, was not in any way impaired, nor did any perturbation occur. J. H—, aged 50, from Leeds, after he had suffered from epileptic fits for several years, and from considerable enfeeblement of mind also, when in Canada in 1857 fell, in a fit, on the corner of an iron stove, and caused a depressed fracture of the frontal bone, of which a considerable portion of bone had to be removed. He felt a great deal better for a time after this accident. The epileptic seizures were less frequent, and the mind was clearer and stronger. S. K—, aged 46, from Halifax, has suffered from chronic mania since January, 1867. For eighteen months past she has been in the habit, whenever an opportunity has permitted, of hammering her head upon the table in the most energetic manner. Any one seeing her do this, and hearing the

noise of the concussion, would suppose that the skull must be inevitably fractured. The only effect, however, is that the skin on the forehead has become thickened and indurated. She is not at all more fatuous now, nor excited than she was two years ago.

The liability to be gravely affected in mental health by any cranial hurt conferred by the hereditary proclivity to mental disease is receiving perpetual illustrations. J. W. M—, aged 24, tailor, from Leeds, was admitted to the West Riding Asylum on the 22nd of March, 1870. His father was formerly an inmate of this Asylum; his mother died in an attack of puerperal mania, and a maternal uncle was insane. On the 28th of February, 1870, he received a tap on the left temple from a tailor's goose, which was being carried past him by a fellow-workman, and which bruised the skin. Immediately after the blow he felt giddy and sick, and from that time till March 4th complained of pain in the head. He then sought medical advice, was ordered change of air, and went to the country, where, however, he remained only one day, returning home with aggravated cephalalgia, and with occasional sickness. His expression of face became wild, and he grew sleepless, for which he had the hypodermic injection of morphia. On March 8th he became restless and talkative, and on the following day fierce mania set in, for which he had to be tied down in bed. When admitted into the Asylum, he was in an exceedingly emaciated and spent condition, and was also wildly maniacal. Tranquillity was secured by chloral, but he gradually sank, and died on March 28th, four weeks after the injury. At the post-mortem examination no trace of the injury could be detected but a small scar on the skin of the temple. All the thoracic and abdominal viscera were healthy. The skull was unsymmetrical, bulging posteriorly to the left. It was very thin, and there was some adhesion of the dura mater, which was also attenuated along the median line. The vessels of the pia mater were engorged, and the puncta vasculosa were numerous on section. The cineritious matter was of a rose-pink tinge, and deepest in colour in its outer layers.

A state of nervous irritability or exhaustion, however induced, seems to expose to danger from cranial injury in an equal degree with hereditary tendency. Delirium tremens and *mania à potu*

have been brought on by trifling concussions happening to habitual drunkards.

All additional observations, however, upon the variations produced in the mental effects of cranial injuries by the previous condition of the persons sustaining these injuries, and by their localisation, must be reserved for the next volume of these Reports, in which also the pathological changes due to such injuries, such as clot, inflammation, abscess or sclerosis, will be considered together with the varieties of the mental effects themselves, arranged under:—1. Prolonged suspension of consciousness; 2, improvement in mental power; 3, change of character; 4, complete mental derangement.

OBSERVATIONS
ON THE
PHYSIOLOGICAL ACTION OF NITROUS
OXIDE.

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As nitrous oxide is now attracting so much attention as an anæsthetic, it may, perhaps, be worth while to consider another of its physiological actions, viz. the remarkable power it possesses of stimulating the functions of life, with the view of ascertaining in how far, if at all, we may avail ourselves of this property of the gas in a therapeutic sense.

Nitrous oxide was discovered by Dr. Priestley in 1776. The essential part of its history, if we except the recent application of it in dentistry for anæsthetic purposes, consists in the record of Sir Humphry Davy's 'Researches on Nitrous Oxide.' It will be necessary, to the full treatment of the subject, to quote largely from this work; but before referring to it more particularly, a few points of minor interest may be noticed.

The Dutch chemists were of opinion that nitrous oxide was highly fatal to life, because it was incapable of decarbonating the blood.

Dr. Mitchell, an American chemist, attempted to base a new theory of contagion on the supposed properties of the gas, which he called the oxide of septon, and which he imagined was capable of producing the most terrible effects when

respired by animals in the minutest quantities. This doctrine seems to have been generally accepted in America and England until it was subverted by Sir H. Davy's experiments.

Dr. Hermann, in 1844, published the result of his researches into the action of the gas. He expresses the opinion that its use must be attended with great danger, from the fact that it produces dyspnœa unperceived by the patient on account of anæsthesia, and that asphyxia might be thus induced. (Quoted in 'British Medical Journal,' April 18th, 1868.)

Dr. Bigelow, who in 1848 employed the gas to produce anæsthesia in a case of excision of the breast, reports that sixty quarts were consumed during the operation. He comments on the lividity and muscular rigidity caused by its use, and expresses an opinion that the lungs cannot procure sufficient oxygen when, as in this case, it only has access to them in a form in which it is chemically combined with nitrogen.¹

A great number of other theories have been advanced to explain the manner of its action, of which I will quote two, as they serve to show how great a diversity of opinion seems to exist, even up to the present time, on the subject.

In the 'Medical Times' of April 18th, 1868, Dr. Richardson expresses his belief that nitrous oxide is an asphyxiating agent, the effects of which are identical with those of poisoning by carbonic acid gas; whilst Dr. Zeigler ('On Nitrous Oxide for Medicinal Application') affirms "that it is the direct opposition and natural antidote to narcotising agents and asphyxiated conditions."²

Sir Humphry Davy tells us that his researches on nitrous oxide cost him thirteen months of incessant labour; ten months being employed in making the experiment from which his conclusions were drawn, and three months in recording them. In every detail of his work he says that he adhered to the strictly inductive method, with a total rejection of that abstract speculation and hasty generalisation of which early experience had taught him the folly.

This work was carried on at the Bristol Pneumatic Institution, founded and maintained by the exertions of Dr. Beddoes,

¹ 'Boston Medical Journal,' vol. i, p. 17. Quoted by Dr. Amory.

² "Report of the papers read at the Odonto-Chirurgical Society," 'British Journal of Dental Science.'

who had conceived the idea that many forms of disease could be most advantageously treated by the inhalation of "factitious airs," and it was to aid him in his efforts to establish his new system of therapeutics that Dr. Beddoes secured the services of Mr. Davy. Hence we understand the more readily why so much time and attention were expended in studying the physiological action of the gas.

In reference to its physical and chemical properties, it may be well to remember that nitrous oxide has a high specific gravity, 1.527, as compared with common air; and that it is unalterable in its constitution at temperatures below ignition. "It is composed of oxygen and nitrogen, existing, perhaps, in the most intimate union which those substances are capable of assuming, for it is unalterable by those bodies which are capable of attracting oxygen from nitrous gas and nitrous acid at common temperatures" (Sir H. Davy's 'Researches'). It is soluble in double its volume of water.

When he came to inquire into the physiological action of nitrous oxide, Sir H. Davy was struck by the peculiar change in the colour of the blood, as seen when drawn from the living animal while breathing the gas, and also as found in the vessels of those destroyed by it, after death. It was invariably purple red. This change, he thought, might be due to the decomposition of the nitrous oxide in the blood, which he had before ascertained was capable of absorbing a large quantity of the gas, and to its recombination with other hæmic constituents, resulting in the formation of new chemical compounds.

Thereupon he instituted a series of experiments for the purpose of discovering what changes were effected in nitrous oxide by the respiration of animals; from which he concluded "that a somewhat larger quantity of nitrogen was produced when nitrous oxide was breathed than during ordinary respiration, but, on the other hand, there was a much smaller residual quantity of oxygen in the air-holder than when common air was breathed," and also much less carbonic acid produced.

"Analogical evidences," he says, "were not in favour of the hypothesis of decomposition. It was difficult to suppose that a body requiring the temperature of ignition for its decomposition by the most inflammable bodies, should be partially absorbed and partially decomposed at 98° by a fluid apparently possessed

of equal attractions; rather one is led to believe that the production of nitrogen during the respiration of nitrous oxide is not owing to decomposition, but rather to a new arrangement produced in the principles of the impregnated blood during circulation, from which, being supersaturated with nitrogen, it gives it out through the moist coats of the vessels."

He gives a large number of tables showing the results of the analyses of the residual airs after determinate quantities of different gases had been respired. They are so concisely arranged, and so instructive, that I have thought it well to quote two or three.

At 63° 161 cubic inches of atmospheric air were respired in a mercurial air-holder for near a minute; 19 inspirations were taken. The residual gases filled a space equal to 152 cubic inches, and analysed they were found to consist of

Nitrogen	117.0 cubic inches.
Oxygen	23.6 " "
Carbonic acid	11.4 " "

The 161 cubic inches before inspiration were composed of

Nitrogen	117.0 cubic inches.
Oxygen	42.4 " "
Carbonic acid	1.6 " "

At 47° 182 cubic inches of nitrous oxide were breathed for near 40 seconds; 8 inspirations were made. The residual air filled a space equal to 128 cubic inches, and were found to consist of

Carbonic acid	5.25 cubic inches.
Nitrous oxide	88.75 " "
Oxygen	5.00 " "
Nitrogen	29.00 " "

Consequently, in this experiment 93.25 cubic inches of nitrous oxide had disappeared, and it is seen that no other products are formed than those formed when common air is breathed.

At 61° 182 cubic inches of hydrogen were breathed in the air-holder; 6 inspirations were made. The residual air filled a space equal to 184 cubic inches, and was found to consist of

Carbonic acid	4.8 cubic inches.
Oxygen	4.6 " "
Nitrogen	21.0 " "
Hydrogen	153.6 " "

It would seem, then, that whether nitrous oxide or hydrogen is breathed, nearly equal quantities of carbonic acid and oxygen are given off from the lungs, which would suggest the inference that in neither case does any purely chemical action take place between the blood and gases in the lungs.

Still further with the view of determining whether nitrous oxide was only dissolved unchanged in the blood, or that decomposition took place, he made careful experiments to ascertain if nitrous oxide could be expelled from blood impregnated with it; and though he could not arrive at an absolutely conclusive result on account of the great heat required to expel it, he nevertheless conjectured that he had been able to effect this separation.

He found it difficult to account for the disappearance of the nitrous oxide in the system; the more so from the fact that when nitrous oxide is decomposed by combustible bodies the quantity of nitrogen evolved is rather greater in volume than the pre-existing nitrous oxide. He conjectured that much of the nitrogen taken into the system during the respiration of nitrous oxide must be either eliminated in a new combination, or given out by the capillary vessels through the skin.

Dr. Hermann's observations, before referred to, led him to the conclusion that nitrous oxide neither enters into combination with, nor suffers changes from, nor produces changes in, the blood, though readily soluble in it. Blood saturated with it shows no sign of change, the spectrum change being the same.

In reference to the physiological action of the gas, Sir H. Davy, after many and careful experiments, in the course of which he compared the effects produced by nitrous oxide with those resulting from the administration of other gases, as oxygen, hydrogen, carbonic acid, and carburetted hydrogen, concluded that the former possessed most singular powers of stimulating the animal functions, and through this excessive stimulation causing death. Sir H. Davy explains that the gas employed in his experiments was procured from nitrate of ammonia, and received into large jars filled with water previously saturated with the gas. The animal was introduced into the jar by being carried under the water. The first experiment he describes was made on "a stout and healthy young cat of four or five months

old. For ten or twelve moments after introduction he remained perfectly quiet, and then began to make violent motions, throwing himself round the jar in every direction. In two minutes he appeared quite exhausted, and sank quietly to the bottom of the jar. On applying my hand to the thorax I found the heart beat with extreme violence; on feeling about the neck I could distinctly perceive a strong and quick pulsation of the carotids. In about three minutes the animal revived, and panted very much, but still continued to lie on his side. His inspirations then became longer and deeper, and he sometimes uttered very feeble cries. In four minutes the pulsations of the heart appeared quicker and feebler. His inspirations were at long intervals, and very irregular; in five minutes the pulse was hardly perceptible; he made no motions, and appeared wholly senseless. After five minutes and a quarter he was taken out, and exposed to the atmosphere before a warm fire. In a few seconds he began to move and to take deep inspirations; in five minutes he attempted to rise on his legs, but soon fell again, the extremities being slightly convulsed. In eight or nine minutes he was able to walk, but his motions were staggering and unequal, the right leg being convulsed, whilst the other was apparently stiff and unmovable. In about half an hour he was almost completely recovered." I have selected and quoted at full this account of his first experiment with the gas on lower animals, as it seemed to me a typical example among a large number recorded by him in detail.

In another experiment he found that a kitten of six weeks old was destroyed by the gas in five minutes. A rabbit of a month old survived introduction into the gas only three minutes. A goldfinch died in less than a minute. He found that those animals which were withdrawn from the jar as soon as they were rendered senseless, almost invariably recovered in less than half an hour, the signs of recovery being resumption of the act of respiration; convulsions, more especially affecting the posterior extremities, and a greater or less degree of paralysis of these, which was generally the last symptom to disappear.

It was noticed that in all these experiments a certain quantity of the gas was absorbed, the water rising in the jar during the respirations of the animal. The results of some experiments made to ascertain whether animals deprived of common air by

immersion in water, or by introduction into jars of hydrogen gas, died as rapidly as those exposed to the action of nitrous oxide, showed that animals lived at least twice as long in the latter as in hydrogen or water. This result seemed to confirm the view before advanced, that death was caused by the specific operation of the gas on the vital tissues.

With the assistance of Dr. Kinglake and Mr. Smith, he examined the bodies of the animals killed by inhalation of nitrous oxide, and he thus describes the condition of the internal organs: "The lungs are pale brown red, covered here and there with purple spots; the liver is of a very bright red. Both the auricles and ventricles of the heart are filled with blood; the auricles contract for some minutes after death, but the ventricles quickly lose their irritability. The blood in the left ventricle and the aorta is of a tinge between purple and red, whilst that in the right ventricle is of a dark colour."

In further noticing the recorded experimental efforts made to show the physiological action of nitrous oxide, mention may be made of those of Dr. Amory, who last year wrote a pamphlet 'On the Physiological Action of Nitrous Oxide, as shown by Experiments on Man and Lower Animals.' The author makes no mention of Sir H. Davy's researches in the two pages devoted to the "History" of the subject, and remarks on the very slight knowledge we possess in regard to its physiological action.

He commences the inquiry by experiments instituted to ascertain to what extent, if at all, the inhalation of nitrous oxide impedes the exhalation of carbonic acid from the lungs, and arrives at the conclusion that not more than half the quantity is exhaled, which is known to be produced when atmospheric air is breathed.

In his experiments for the purpose of determining how long nitrous oxide was capable of sustaining life, although he states that he used every precaution to guard against impurity and the presence of atmospheric air, there is certainly some source of error, for it would appear from them that an animal is capable of living half an hour in an atmosphere of the gas; indeed, no case is recorded in which the animal died in less than thirty-two minutes after introduction into the vessel of nitrous oxide. It is manifest that he experimented only with the dilute gas, and there is consequently little cause for surprise at his statement

that "never has an animal died unexpectedly, and it was always very difficult for me to cause asphyxia. I have now two dogs alive which have not respired for one whole minute several times when undergoing an experiment."

Conclusions like these, drawn from inaccurate experiments, tend to convey erroneous notions as to the true physiological actions of the gas, and might, if acted on, produce the most disastrous results in practice.

I would, therefore, invite attention to the following experiment made upon rabbits, the method described by Sir H. Davy being strictly adhered to in performing them:—A large bell-jar was placed in a vessel nearly full of water, and, the air being withdrawn by suction, the water was allowed to rise in the jar until it was completely filled. Nitrous oxide, conveyed by means of a flexible tube from an iron vessel, containing it in the compressed liquid form, was then made to displace the water until the jar was almost full of the gas; it being necessary that it should stand in two inches of water to ensure that no air was admitted from without. A circular piece of wood floated inside the bell-jar for the support of the animal being experimented on. The water surrounding the jar was raised to a temperature of from 75° to 80° .

A strong lively rabbit of three months old was introduced, by being passed under the water (which could be done in less than two seconds) into the nitrous oxide. It remained quiet for three or four seconds; then a sudden change of expression in attitude and look took place; it seemed startled and half bewildered, and the next moment plunged forward. On coming in contact with the side of the jar it made efforts to climb over the obstacle. On closely observing the motions, however, it was seen that they were of a convulsive character, the limbs of the right side being in more rapid motion than those of the left, while there was spasmodic contraction of the muscles of the right side of the neck. In ten seconds the animal was unable to stand, and rolled on to its side; it still, however, made futile attempts to recover its equilibrium; these soon ceased, giving place to slight convulsive twitchings of the fore legs; in thirty-five seconds all muscular movement had entirely ceased in the limbs. The breathing was quick, the animal panting as if exhausted; the heart could be felt beating rapidly, and with

apparently increased force. In forty-five seconds no respiratory movement could be seen; the heart gave a few fluttering beats, and seemed to stop entirely, but on applying the hand to the thorax, an occasional contraction could be felt for some seconds after.

The animal was taken out limp and dead one minute and three quarters from the commencement of the experiment.

Into the same gas I next introduced a rather smaller rabbit than the one first subjected to experiment. It was affected in a similar manner, but the struggling continued nearly three quarters of a minute, and it uttered two or three feeble cries, then it fell on its side panting a good deal, but evincing no sign of feeling when the paw was pinched. It continued for nearly a minute in the same condition, except that the respiratory efforts gradually became feebler, and were made at increasingly longer intervals. At the end of two minutes respiration had almost entirely ceased; the heart's contractions, too, were very feeble; the animal was then withdrawn from the jar seemingly dead, there being extreme flaccidity of the whole muscular system. On being placed on the floor it at first showed no sign of life, but in a minute efforts at respiration were quite evident, and in another half minute it began to attempt to gather up its legs; it was able to stand in three minutes, though the hind legs were still very feeble, as when pulled from under the body they were very slowly drawn up again.

The gas was then renewed, and another rabbit about three months old introduced. Almost immediately it raised itself on its hind legs, and with its fore legs fidgeted against the side of the jar. The convulsive nature of the movement and the drawing of the neck to the right side were even more marked than in the first instance. Muscular activity ceased in rather less than a minute; breathing continued fifteen seconds longer, and the heart contracted at intervals of three seconds until two minutes and a half from the commencement of the experiment, at which time the rabbit was taken out quite dead.

To try the effect of nitrous oxide in the dilute form, I next filled the bell-jar with a mixture of the gas and common air in the proportion of four of the former to one of the latter.

The animal employed in this experiment was a rabbit of about the same size and strength as those before experimented on. It

rested quietly on the float for nearly ten seconds after introduction into the jar, then it began to plunge about in an aimless way, until, in the course of its movements, its hind legs slipped between the edge of the float and the side of the jar into the water. It was allowed to remain in this position; and after making a few slight efforts to recover its equilibrium, soon became perfectly quiet. It had now been in the jar three minutes; respiration was, as in the other cases, of a panting character, though not in so marked a degree; it was the same with respect to the cardiac contractions—their force and frequency were increased. The animal seemed drowsy, and made no movement when pinched; but as soon as the hind legs were replaced on the float the same aimless movements as those at first noticed recommenced, to cease again when the feet no longer came in contact with any resisting object. This series of phenomena was repeated many times, the animal appearing to be readily excited to the performance of reflex acts after it had lost sensibility of the skin.

At the end of five minutes, as little further change had taken place in the symptoms, one half of the gas was withdrawn, and replaced by pure nitrous oxide from the iron vessel. The movement soon became more active, although unchanged in character, and disturbance of the circulatory and respiratory act more exaggerated; in the course of a very short time, however, all movements except slight tremor of the head and neck, and those accompanying the performance of respiration, ceased. At the end of ten minutes the vital functions were at a very low ebb; there were no longer signs of the existence of reflex irritability, and little to indicate that the animal still lived, beyond an occasional convulsive inspiration and the faint beating of the heart. Nevertheless, the animal lived for three minutes longer without any further change that could be detected. Then a stream of nitrous oxide direct from the iron vessel was conducted by means of india-rubber tubing, and made to discharge itself in the mouth and nostrils, when immediately violent twitchings of both were observed, and the animal uttered loud cries. For two or three seconds rigidity of the limbs was produced, then death quickly supervened.

Of two rabbits about the same age as the former, one was deprived of life by immersion in water, and the other by a blow

on the neck. The former struggled in the water half a minute; air bubbles continued to rise until the end of a minute; one or two slight convulsive movements were noticed at the end of one minute and a quarter; the animal was quite dead in one minute and a half from immersion.

The second rabbit manifested no sign of life at the end of twenty seconds; he struggled violently for ten seconds after the blow was struck. This was the animal which had been the day before rescued from death by nitrous oxide.

In less than half an hour after death I examined the bodies of all these animals.

The subject of the last experiment had sustained a comminuted fracture of the atlas and axis. His lungs presented darkish red patches, resembling those seen in circumscribed pneumonia; this condition, I thought, might have arisen from the inhalation of the nitrous oxide, or, on the other hand, simply from the ducking of the day before, though I gave directions that he should be placed before the fire after the experiment, and be kept warm until perfectly dry. On examining the heart, I found the left ventricle well contracted, the right cavities of the organ contained a little dark blood.

In the case of the rabbit killed by drowning, the lungs were gorged with blood, and externally they had the dusky, finely-mottled appearance usually seen in the lungs of animals which have died from asphyxia. The right cavities of the heart were distended with dark blood, and the left tolerably well contracted.

On comparing the lungs of the animal destroyed by nitrous oxide with those of the one killed by drowning, I found that a marked difference between them could be detected both in outward appearance and in essential condition. The lungs of the former seemed collapsed, and when the thorax was opened they could be with difficulty seen occupying the posterior (superior) part of the cavity. On drawing them forward, except for the purple spots noticed by Sir H. Davy, they were seen to have an exsanguine aspect, and on cutting into them, scarcely any blood escaped from the cut surface, which looked pale and rather white. Their weight was less than half that of the lungs of the drowned rabbit; scarcely any sense of crepitation was yielded on compressing them. This being the general condition, the

purple spots, which were from four to six in each lung, arrested the attention the more readily. They might be described as circumscribed congestions of the organs, involving the pleura and the lung substance in the immediate neighbourhood, for on cutting into them the purple (they seemed to me rather pink than purple) staining was seen to penetrate one eighth of an inch or more from the surface; blood oozed from the cut surfaces, but the colour remained the same, even when pressure had been applied to empty the vessels, from which it would seem probable that, to some extent, extravasation of blood had taken place.

The condition of the heart closely resembled that of the drowned rabbit, the only difference being that the blood which distended the right auricle and ventricle of those destroyed by nitrous oxide was scarcely so dark in colour as that in the corresponding cavities of the former animal. The conditions of the brains were apparently the same in all.

From these experiments it is seen that an animal may be destroyed by exposure to an atmosphere of nitrous oxide in one minute and three quarters, being but a few seconds more than the time required to cause death by submersion in water; and as shown by Sir H. Davy's experiment, just double the time required for the fatal operation of hydrogen under similar conditions. If we could extract all the atmospheric air from the lungs of animals, before subjecting them to the influence of nitrous oxide, there is every reason to believe that it would then prove much more quickly destructive to life. In support of this hypothesis, I may quote an experiment recorded by Sir H. Davy, in which much of the air of the lungs had been displaced by hydrogen. He writes: "I attempted to inspire nitrous oxide, after having made two inspirations, and a complete expiration of hydrogen; but in this experiment the effect of the hydrogen was so debilitating, and the consequent stimulation by the nitrous oxide so great as to deprive me of sense. After the first three inspirations I lost all power of standing, and fell on my back, to the great alarm of Mr. Dwyer, who was noting the periods of inspiration." Again, in further showing that nitrous oxide is incapable of supporting life without admixture with air, there is the fact that animals which have been made to breathe that gas for a short time, and then submerged in water,

die sooner than animals thus treated which have previously been breathing common air.

Having noticed the physiological action of this gas on the lower animals, we will now pass on to notice its effects on man. In the concentrated form it produces anæsthesia in so rapid and agreeable a manner, that there is only time to remark that the gas has a pleasant taste and odour; that it causes a sense of dimness to pass before the eyes, and gives rise to a sound as of rushing water in the ears, when all consciousness and power of volition are annihilated. The outward signs of its action as seen by a spectator do not make quite so agreeable an impression on the mind, for with the commencement of anæsthesia lividity of the face sets in. The muscles lose their tonicity; the jaws and lips fall asunder; the head droops, and the face assumes a besotted aspect. Generally, loud snoring accompanies inspiration, when the anæsthesia is very profound, though this is not always the case. When an unusually large quantity of the gas has been inhaled to produce anæsthesia, or when the gas has been in the slightest degree diluted with common air, convulsions may occur affecting the muscular system generally, though it is more common for only the muscles of one limb to be affected. Mr. Fox has noticed that violent twitchings often occur when young children are made to inhale the gas.

The intermediate signs are, that the breathing becomes quicker in about twenty seconds after the commencement of inhalation, and the pulse at first feels strong and less compressible than before the inhalation; at the end of a minute, however, it becomes smaller again and less frequent. Complete anæsthesia is sometimes produced in less than a minute, but in the majority of cases the inhalation must be continued a minute and a half. When the administration is discontinued, recovery very rapidly takes place, the first feelings being like those one has on being suddenly awaked from an agreeable sleep; and on rising from the chair there is for a moment or two a feeling of unsteadiness, together with slight confusion of ideas, and a tendency to stammering in speech. It is very rarely that any disagreeable after effects are complained of.

There remains now to be considered the effect produced on man by the inhalation of nitrous oxide mixed with common air. It would seem that in the experiments of Sir H. Davy

with the gas made on himself and his friends, the diluted form of it was always used ; for though no air was added before the commencement of the experiment, yet as the nitrous oxide was always breathed from and into a silk bag, it soon became diluted with the residual air given off from the lungs. And we have seen, from the experiments on rabbits, how different are the effects produced by it on the animal economy when employed pure, and when even a very small quantity of air is mixed with it. Perhaps the most interesting part of the ' *Researches on Nitrous Oxide* ' is that treating of its action on man, and one cannot but wonder when reading it that an agent shown to be capable of inducing such singularly pleasing conditions of mind should have been suffered to remain so long forgotten, as it were, or remembered only to be used by electro-biologists, mesmerists, and other charlatans.

After having satisfied himself, by cautious and frequent attempts, that not only was nitrous oxide respirable, but apparently, contrary to the prevalent opinion, comparatively innocuous in small quantities, he determined to respire, continuously, a tolerably large quantity of the gas. The description of the feelings it produced I will venture to quote at length, as no one having respired nitrous oxide before, they were, no doubt, produced solely by the specific operation of the gas. He says :

" Having previously closed my nostrils and exhausted my lungs, I breathed four quarts of nitrous oxide from and into a silk bag. The first inspiration occasioned a slight degree of giddiness ; this was succeeded by an uncommon sense of fulness in the head, accompanied with loss of distinct sensation and voluntary power, a feeling analogous to that produced in the first stage of intoxication ; but in less than half a minute, the respiration being continued, they diminished gradually, and were succeeded by a sensation analogous to gentle pressure on all the muscles, attended by a highly pleasurable thrilling, particularly in the chest and extremities. The objects around me became dazzling, and my hearing more acute. Towards the last inspirations the thrilling increased, the sense of muscular power became greater, and at last an irresistible propensity to action was indulged in. I recollect but indistinctly what followed ; I know that my motions were various and violent. These effects very soon

ceased on discontinuing the respiration. In ten minutes I had recovered my natural state of mind.* The thrilling in the extremities continued longer than the other sensations. This experiment was made in the morning; no languor or exhaustion was consequent. My feelings throughout the day were as usual, and I passed the night in undisturbed repose."

In prosecuting his researches he made many experiments to ascertain how long the gas might be breathed with safety, its action on the pulse, and its general effect on the health when often respired. He found that he could never breathe it in any quantity so long as five minutes, and that "whenever its operation was carried to the highest extent, the pleasurable thrilling gradually diminished, impressions ceased to be perceived, vivid ideas passed rapidly through the mind, and voluntary power was altogether destroyed, so that the mouth-piece generally dropped from my unclosed lips." Sometimes when breathing it there were feelings of intense intoxication attended with but little pleasure; at other times sublime emotions, connected with highly vivid ideas.

After having for a fortnight breathed nitrous oxide daily, and often as many as four times a day, he found that he was more irritable and restless than usual; that he slept less, and "previous to sleep the mind was long occupied by visible imagery." Appetite and pulse were not materially affected, though there were uneasy feelings about the præcordia analogous to the sickness of hope.

He notices its efficacy in relieving headache, and its power of removing intense physical pain he had good opportunities of witnessing in himself and others. Describing the effects from long-continued inhalation of the gas in a dilute form—on this occasion he made use of a breathing chamber—he says: "My emotions were enthusiastic and sublime. I endeavoured to communicate the discoveries made during the experiment, but my ideas were feeble and indistinct; one collection of terms, however, presented itself, and with the most intense belief and prophetic manner, I exclaimed, 'Nothing exists but thoughts! the universe is composed of impressions, ideas, pleasures, and pains!' When I was awakened from this semi-delirious trance, indignation and pride were the first feelings produced by the sight of the persons about me." The exhilaration consequent

upon this prolonged inhalation (rather more than half an hour) did not disappear for nearly two hours.

In another instance he remarks, "the pleasurable sensation was so intense and pure as to absorb existence, and I fell into unconsciousness."

A great number of Sir H. Davy's friends inhaled the nitrous oxide, and, at his request, wrote a detailed account of the impressions produced. Mr. Coleridge, Mr. Southey, Mr. Lovell Edgworth, and Dr. Roget were of the number experimented on. The sensations described were almost invariably of a pleasurable nature, as will be abundantly proved by a few very short extracts. One gentleman writes: "I soon felt my nervous system agitated by the highest sensations of pleasure, which were difficult of description. It is but giving a faint idea of my feelings to say that they resembled those produced by a representation of an heroic scene on the stage, or by reading a sublime passage in poetry, when circumstances contribute to awaken the finest sympathies of the soul."

Mr. Burnet writes: "Inhaling the gas I felt as if every nerve was gently agitated with a lively enjoyment."

Mr. Edgworth says: "The principal feeling was a total difficulty of restraining my feelings, both corporeal and mental, or, in other words, not having any command of myself."

Mr. Southey felt sensations perfectly new and delightful.

Dr. Beddoes and Dr. Kinglake, though much exhilarated by the gas, noticed when the effects were passing off a momentary recurrence of rheumatic pains, not felt for some time before, and that a yellow area caused by a leech-bite became, during inhalation, red and swollen, and the itching and tingling was so great as to cause a fear of suppuration.

In reading these details, which occupy many pages of the work, one is struck with the almost universal confession of inability to describe such wholly new and delightful feelings as were experienced; in many cases, in the endeavour to do so, the mind seemed to call up the memory of its happiest moments, and these failed to equal in degree and vividness the delicious intoxication of nitrous oxide. One is almost tempted to ask, Can we not with this

"Sweet oblivious antidote
Cleanse the stuffed bosom of that perilous stuff
Which weighs upon the heart?"

In certain of the experiments the muscular actions sometimes connected with the feelings produced by nitrous oxide seemed to depend upon the particular habits of the individual—"they were mixed automatic motions." As he records his conclusions respecting the action of nitrous oxide, Sir H. Davy compares it to the diffusible stimuli, and says that, like them, it increases the force of the circulation, produces pleasurable feelings, alters the condition of the organs of sensation, and ultimately causes death.

In endeavouring to account for the absence in this case of the exhaustion, consequent upon the operation of other diffusible stimuli, he attributes it to the greater quantity of oxygen that is combined with the blood than in common respiration, though in the earlier part of his researches, before referred to, he advances many arguments in favour of the view that no decomposition of nitrous oxide does take place in the blood. The singularly evanescent character of the effects produced are also against this view of an increased supply of oxygen from decomposition of the gas; it seems far more probable that all the effects are due to a sudden interruption of nutritive changes in the system, and their rapid disappearance to an equally rapid exhalation from the lungs of the unchanged nitrous oxide.

On the whole, I think we may conclude that a tolerably close analogy subsists between the causes of death from immersion in an atmosphere of nitrous oxide and those from submersion in water. In the former case the residual air, gradually given off from the lungs, as replaced by nitrous oxide, is again available for respiration, whereas in the latter when given off it either escapes through the water or is immediately swallowed by the animal. This may possibly account for the somewhat greater prolongation of life in the one case than in the other, and for the longer continuance of the cardiac contractions; which fact again, in its turn, may assist us in endeavouring to explain the absence of engorgement of the lungs in cases of death from nitrous oxide: for, though the contractions are known to take place, it is probable that from the great distension of the cavities of the right side of the heart by accumulation in them of venous blood, their walls are paralysed before those of the left. So that blood may be still received from the lungs and propelled

into the arteries, when there is complete arrest of the current in the opposite direction.

I have lately, on many occasions (using Mr. Clover's apparatus with large supplemental bag), inhaled the nitrous oxide in the dilute form, and administered it both to my friends and to certain patients suffering from melancholia and other forms of insanity. It was from the phenomena manifested in some of the latter cases that I was led more particularly to investigate the rationale of the production of those feelings of exhilaration which are almost invariably observed in people of sound mind when under the influence of the gas; for these phenomena, if they had been witnessed by the first experimenters with nitrous oxide, would undoubtedly have earned for it the name not of "laughing" but of "crying gas."

Mr. J.—respired six quarts of nitrous oxide mingled with two of common air. A few seconds after the commencement of the inhalation the pulse began to grow firmer and less compressible, and to decrease in frequency, falling from 85 to 75 in the course of the first minute. In less than a minute the breathing became quicker, and almost of a blowing character. He was somewhat exhilarated, and stamped with his feet to show the satisfaction he felt. The breathing then assumed a laboured—almost stertorous—character, and I attempted to remove the face-piece; but he clutched it firmly and resisted my efforts to do so—not long, however, for he soon began to lose consciousness, and his hold relaxed. On recovery, which was almost instantaneous after removal of the inhaler, he said he felt as if just roused from a delicious sleep.

Dr. N.—inhaled a combination of about four of nitrous oxide to two of common air. The feelings experienced during each stage of the operation of the gas, up till the power of communicating them failed him, were described as they occurred, and written down at the time. He first felt a difficulty in moving the extensors of the left arm, then the flexors became affected in like manner. The feeling next spread to the right arm and hand, and immediately afterwards to the lower extremities, and there was a sense of tingling all over the body, accompanied by a sort of vibratory agitation of the muscles generally. He then said, with great emphasis, "intoxication," and ceased further communicating his feelings, though he seemed to know and be able to appreciate what was taking place about him. There seemed no disposition to laughter. He soon fell into a partially anæsthetic condition; but on an attempt being made to touch the conjunctiva, he seemed to be roused to perfect consciousness again, and tried to remove the face-piece, saying he had something to tell us. Inhalation was then discontinued; he had breathed the gas a little over two minutes. He imagined that he had made a very important discovery, showing the manner in which nitrous oxide acted, but on endeavouring to recall it, no trace of it remained, beyond a confident feeling that such a discovery had flashed across his mind.

Mr. D.—next inhaled the diluted gas. In half a minute the respiration became

hurried and the pulse accelerated. In one minute the pulse had risen from 84 to 110, but was not more compressible than at the commencement. There was twitching of the eyelids, and he said he felt jolly, but lazy, and in a lounging mood. At the end of two and a half minutes he felt numbness in the feet, and hot and flushed about the face and ears. At three and a half minutes the pulse was 106, tolerably firm; respiration 40. He now cried in an excited voice, "I have something to explain—give me some air!" The inhalation was continued altogether seven minutes, when lividity of the face began to set in. Except a little confusion of mind, accompanied by flushing of the face, which continued about a quarter of an hour, he felt much as usual.

Mr. H—, who had taken nitrous oxide before, and was quite sure it would immediately make him feel stupid and sleepy, next inhaled the gas, combined with about an equal amount of atmospheric air. He remained perfectly quiet for nearly a minute, and when asked how he felt, said he was drowsy and just going to sleep. He was told that he must keep awake. When he had respired the gas for nearly two minutes, and seemed indisposed to activity of any kind, he was told in a loud voice to get up, and asked if he was not ready to dance; at the same time he was seized by the arm as if to lift him from the chair. He immediately sprang to his feet, saying he was ready for anything, and began capering and swinging his arms about as though he had lost all control over his movements. He came to himself, however, in a few seconds, looked bewildered, and said that he remembered nothing from the first few seconds after the commencement of the inhalation.

The dilute gas has almost invariably an exhilarating effect upon me; for the first few seconds the symptoms resemble those caused by the pure gas, but come on more gradually. The breathing is first affected, and frequently at the end of a minute is of a panting character. At this stage a slight sense of suffocation may be felt, soon passing off, however, not to return again as long as the supply of nitrous oxide is abundant. The next symptom is a feeling of fulness in the head, and a tendency to fixedness of the eyes; then it soon becomes apparent that general sensibility is affected, the perception of external objects being slower. Next is noticed a sense of increased resistance in the feet, suggesting the idea that they might act involuntarily in throwing the body forward. These symptoms become more marked, and develop into unmistakable dizziness, more noticeable, of course, if the inhalant is standing, and then an effort is required to maintain the equilibrium. At this stage too are perceived the thrilling and vibratory sensations; the accommodating power of the eye is affected, and objects are seen as through a mist. The senses of smell and hearing become more acute—distant and otherwise faintly heard sounds are judged to be near, and are distinctly heard; if they are of a

rhythmical kind, as the sounds of a mason's hammer, they seem to recur more frequently, and the appreciation of the rhythm is more acute. And now the more strictly mental symptoms come into prominence.

Having on one occasion inhaled the gas, when I had a rather severe headache, it was at this stage the sense of pain left me, after which it seemed to me there was an interval between the perception that the pain had gone, and that feeling of satisfaction which always follows sudden relief from suffering, and my mind began to busy itself with definitions of pleasure and pain; but this mood quickly changed to one of extreme self-confidence—recklessness as to every other consideration but that of having plenty of nitrous oxide, and a general feeling of contempt for all metaphysical questions whatever. Ideas rushed in a disordered current through my mind, and delirium set in. It is at the commencement of this stage that the mind loses the power of discriminating between the appropriate and the ridiculous, and is preternaturally susceptible of receiving and being influenced by suggestions from without; and it is on the ideas and actions now initiated that the delirious intoxication turns. The ideas seem, as it were, to expand beyond the recognition of the mind, which at this point in its disordered activity also seems to vault over that interval which in its normal condition it recognises to exist between the wish and its realisation. Automatic acts succeed each other, or are repeated with great rapidity, and are performed in an exaggerated manner, the subject of the experiment shouting and gesticulating with the greatest vehemence should he wish to communicate any, even the most trivial thing, and often repeating the last word of a sentence many times, and each time in a louder key.

I have endeavoured to arrest the action of the gas in all stages of its operation, with the view of analysing, if possible, the state of mind indicated by the confident belief that a great discovery has been made. When it is considered with what avidity the gas is inspired, and that it is necessary that the inhalation should be discontinued at the very moment when the enjoyment it is affording is at its height, and when all sense of prudence and responsibility seems to be annihilated, it will be understood how great are the difficulties in the way of success in such an attempt.

On account of the delirium which always accompanies this condition I never could be certain, on recovering from the effects of the gas, that I had not passed through a short stage of unconsciousness, nor that the idea my mind had grasped as being the last that had passed through it was indeed the last. In the milder forms of delirium it has seemed to me as though consciousness kept ebbing and flowing. I feel sure, however, that in some instances I have been able to secure the receding thought, and to retain it until the momentary confusion of mind had passed off.

Two such instances I will describe. On one occasion I wanted to find out how much gas was being consumed in the experiment, and impressed on my mind the exceeding desirableness of learning this. On emerging from the state of delirium I found myself with uplifted hand in the act of striking my knee, to impress upon my memory the fact that I had refilled the inhaling bag; and I fancied that I either had shouted, or was upon the point of doing so, in a triumphant voice, "I have filled it again." The act by which I sought to emphasise the *important* observation was a repetition of a blow I had already given my knee, as there was still some feeling of it left, and I thought that it was due to this that I had so suddenly awaked to perfect consciousness. I found that I really had turned the key to admit more of the gas into the bag. Had I not come to myself at that moment, I have no doubt that in the next this trivial occurrence would have been magnified beyond recognition, and have left the feeling that I had discovered the secret of the universe.

The second time returning clearness of intellect found me vociferating, in a most triumphant tone of voice, and each time I fancied in a higher key, "Off, off, off." In this case the predominant idea before the commencement of the experiment had been that I should notice how, and in what time, I passed *off* into unconsciousness.

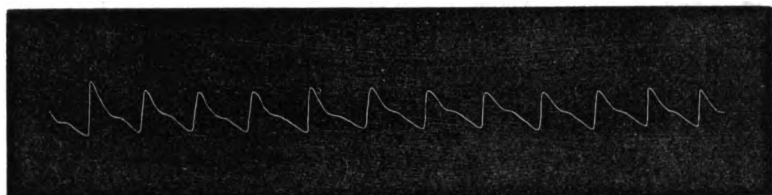
Again, to show how susceptible to suggestion the mind becomes under the influence of nitrous oxide, and how it takes up and exaggerates any activity, whether bodily or mental, and how great the tendency is to dwell on and intensify any process of thought or series of automatic acts, I may describe how I was affected by the gas on other occasions.

I respired it standing, to notice whether this position would in any way incite to bodily activity. As soon as I felt the influence of the gas stealing over me I commenced gesticulating, and immediately noticed a strong tendency to repeat the same movements, which though at first wholly voluntary, soon became automatic in character, and required an effort to stop them. Commencing to shuffle about my feet as if dancing, I quickly found myself going through the steps of a Scotch reel, the only dance I ever properly learnt, and which I believed I had forgotten. Each step was made with more alacrity than the one before, until I found it impossible to maintain any degree of accurate adaptation of the inhaler to my face, and then the feelings of exhilaration died away. On almost immediately resuming the inhalation in the sitting posture, however, I passed into the delirious stage in a few seconds. I have found that, by imitating the contortions of face attendant upon crying or laughter, I can at will, at a certain stage in the operation of nitrous oxide, induce a most uncontrollable paroxysm of either. The general propensity to laughter I have thought might be attributable, in some measure, at least, to the fact that when the inhalation has been continued a certain length of time, convulsive contractions of the diaphragm always occur, which would of course initiate one very important movement in the automatic series accompanying laughter. The sense of hurry and tumultuous rushing of ideas through the mind may be exaggerated by, if it is not, in a great degree, due to, the furious panting which is commonly observed before delirium sets in.¹

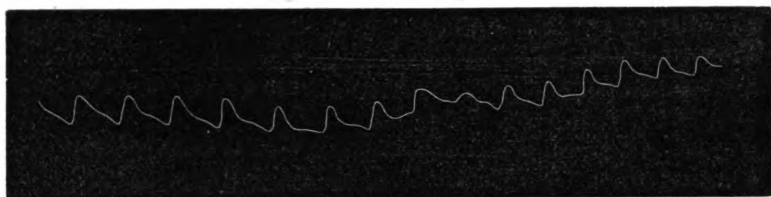
To assist in determining the state of the circulation while nitrous oxide is being breathed, the following sphygmographic tracings were taken. For tracings Nos. 1 and 2, I am indebted to the kindness of Mr. Thompson. Nos. 3 and 4 I have borrowed from Dr. Amory's pamphlet.

Dr. Amory's experiments to test the alterations in arterial pressure, as indicated by its action on the brain, in which he adopted the plan recommended by Dr. Hammond, showed that

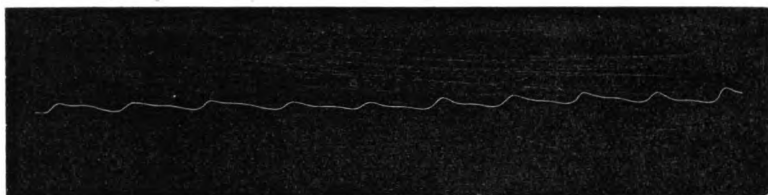
¹ It would seem from the experience of those who have been rescued from death by drowning, that the same apparent exaggeration of time and of ideas occurs at a certain stage of the asphyxiating process by water as is seen in that by nitrous oxide.



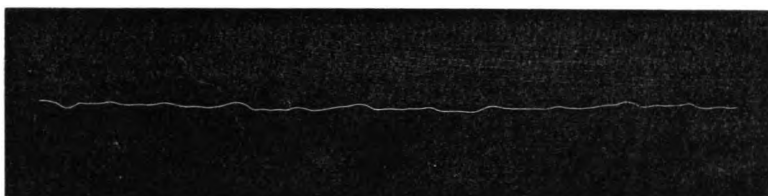
1.—Taken before commencement of inhalation.



2.—Taken when the diluted gas had been inhaled one minute.



3.—Taken before inhalation.



4.—Taken during anaesthesia.

a considerable augmentation of it took place as long as the contractions of the heart continued to be moderately strong, *i. e.*, until profound anaesthesia set in. The sphygmographic tracings seem to confirm this observation.

In commenting on the physiological action of nitrous oxide, are we warranted in attributing to it any of the stimulating properties possessed by the more commonly recognised stimulants?

To what is all this seeming exuberance of vitality due? It

is clear that Sir H. Davy, when stating his opinion that nitrous oxide might be compared to other diffusible stimuli, thought it should be ranked as one of the most powerful we possess, seeing that the activities due to its operation are of such a violent character as to cause rapid exhaustion of the vital forces, and ultimately death. This idea influences, and in some degree warps, his judgment with respect to the manner of its action, as is evident from his expression of surprise at finding that its stimulant action was not capable of immediately neutralising the debilitating effects of the hydrogen he had breathed, and his unwilling recognition of the fact that a rabbit experimented on, was drowned much sooner after breathing nitrous oxide than it would have been under ordinary circumstances. Notwithstanding these facts, he advances the conjecture that "nitrous oxide may be with advantage applied, mingled with oxygen or common air, to the recovery of persons apparently dead from suffocation by drowning or hanging.

The activity manifested, when the gas is administered pure, would seem to be of that convulsive kind which precedes most forms of death brought on suddenly, and caused by violence. The excitement caused by the diluted gas is apparently a part of the same process; less readily recognised, however, because the subjective feelings bear some resemblance to those accompanying the highest expression of bodily health and vigour.

Is not the stage of excitement seen in the course of the operation of all anæsthetics an accidental one, and due to the increased susceptibility of the body and mind to those incentives to activity which are scarcely ever absent during the administration of anæsthetics?

The much debated question, what is a stimulant? naturally presents itself when discussing the physiological actions of so singular and powerful an agent as nitrous oxide.

It is certain that our views on this point have been and are still being very much modified; so much so that we almost feel disposed to question the power of any substance, excluding, of course, those essential to the sustenance of life, to produce, even momentarily, a true exaltation of vital force.

Let us assume, however, that in nitrous oxide we have a chemical compound which, like chloroform, æther, and alcohol, possesses both stimulating and anæsthetic properties. This

similarity of action, associated with such marked diversity in physical properties and chemical¹ composition, is enough to make one regard with suspicion the long accepted doctrine that stimulants and anæsthetics owe their peculiar influence to the elective affinity possessed for them by the nervous substance, and more especially by that part of it which presides over volition. Doctrines, however, which like this derive support from such conjectures as ~~that~~ because chloroform is found in larger quantities in the brain than in the liver after death, caused by it, and conversely that because arsenic is more abundant in the liver than in the brain under like circumstances, each organ exercises an elective affinity for the one and the other respectively, we surely do well to call in question. We should indeed expect, *a priori*, that the brain being so highly vascular an organ (receiving, according to Haller, so large a proportion as one fifth of the whole mass of blood), would receive more of any volatile substance than the liver, provided that the substance was introduced into the general, and not directly into the portal circulation. Again, in the case of poisoning by arsenic, we should naturally look for more of it in an organ where the circulation is comparatively slow, and where the chief blood supply is from the portal system, than in one receiving none but arterial blood, flowing in a more rapid current. In discarding this explanation of the mode of action of stimulants and anæsthetics we can, happily, immediately take refuge in another, which, unless it can be demonstrated that nervous tissue has an elective affinity for imperfectly arterialised blood, is worthier our acceptance. Dr. Snow, by careful experiments and observations on chloroform and other anæsthetics, arrived at the conclusion that chloroform, ether, and similar substances, when present in certain quantities in the blood, have the effect of limiting those combinations between the oxygen of the arterial blood and tissues of the body which are essential to sensation, volition, and, in short, all the animal functions. These substances modify and, in large quantities arrest, the animal functions, in the same way and by the same power that they modify and arrest combustion, the slow oxidation of phosphorus, and other kinds of oxidation unconnected with the living body, when they are mixed in certain quantities

¹ See reference to experiment on himself, page 38.

with the atmospheric air. Dr. Snow also proved that the diminished oxidation is not explained by the combination of the narcotic substance with the oxygen of the arterialised blood, for the vapours of chloroform and ether escape unchanged in the expired air (quoted by Dr. Johnson in his 'Remarks on the Physiology of Anæsthesia').

Dr. Prout and others have observed that alcoholic liquors diminish the amount of carbonic acid given off from the lungs.

Dr. Harley has discovered that narcotics so opposed to each other in apparent characters as strychnia, hydrocyanic acid, ether, and quinine, in large doses, have one and the same influence, viz., a lowering one upon the rate of oxidation of the blood (quoted by Dr. Anstie, 'Stimulants and Narcotics').

The consideration of these facts presents a wide field for inquiry, and it would seem probable that we have in them an explanation of the mode of action not only of stimulants and anæsthetics, but of all poisons.

Dr. J. Reid proved that when imperfectly arterialised blood was present in the arteries, the heart appeared to act with greater force, and there was increased pressure on the walls of the arteries. Do we not observe a similar condition of the circulatory system at the onset of most acute diseases, indicated by the quick and incompressible pulse? In Bright's disease and in some cases of lead colic, the same symptoms may be noted; so that if the pulse grows stronger and firmer during the administration of chloroform, ether, alcohol, and nitrous oxide, we should not jump to the conclusion that they are exerting a true stimulating influence on the vital functions.

The most able investigators into the mode of action of anæsthetics are agreed that, under their influence, "the nervous centres begin to be affected soon after the earliest symptoms of peripheral sensory paralysis have appeared, and in the following order: 1. Cerebral hemispheres. 2. Cerebellum. 3. Spinal cord. 4. Medulla oblongata. All agree that the activity of the sympathetic system survives the extinction of the functional activity of the above-mentioned centres" (Dr. Anstie, 'Stimulants and Narcotics').

We should then expect some of the first symptoms of the action of an anæsthetic to manifest themselves in modifications of the functional activity of the cerebral hemispheres. Arguing

in favour of the view that certain agents have a true stimulant action, Dr. Anstie, in describing the symptoms of chloroform-narcosis, writes: "The effect upon the intellectual operations during the first few seconds of inhalation appears to be an invigorating one. Needless timidity and distress vanish, while consciousness is as yet unaffected, and the expression of the face is bright and intelligent." Is this effect, in any true sense, an invigorating one, and not rather the first sign of the progressive loss of the power of the mind rightly to appreciate surrounding conditions, which culminates in complete paralysis of the cerebral functions. The grounds of apprehension remain the same, and one might question the appropriateness of characterising the timidity and distress by which the mind was oppressed as needless, when there lies immediately before it the possibility of a fatal issue of the ordeal to be passed through.

In modifying, by means of alcohol, the nutrition of the brain in a corresponding degree to the above, in certain forms of disease, and thus allaying undue irritability of the organ, we may have the explanation of the beneficial effects seen to follow its administration in these cases.

But there seems good ground to question the validity of arguments in favour of the possession of a true stimulant action by alcohol, based on the fact that enormous quantities of this substance are tolerated in certain exhausted states of the body, for it has been noticed that in many cases where much has been administered, there is no evidence of any large proportion of it circulating in the blood, seeing that there is almost total absence of the alcoholic odour in the breath. That it is not absorbed into the system is, probably, the true explanation of the tolerance and absence of narcosis in these cases. Dr. Anstie remarks, too, on the singular fact that, though enormous doses of alcohol and of opium can be borne without the production of narcosis, in certain exhausted states of the nervous system, chloroform cannot be taken in larger quantities than in health; if the latter was administered by inhalation, we surely need not look far for the explanation of the difference; but if, like the opium and alcohol, it was received into the stomach, the difference gives rise to a very difficult problem. Bearing, too, on this question of the arrest of nutritive changes caused by the introduction of chloroform and other similarly endowed sub-

stances, into the body, are Dr. Anstie's interesting experiments, by which he showed that when chloroform was injected into a frog's body, soon after an injection of strychnia, the onset of the tetanic spasm was delayed several minutes.

Further investigations may clear up many obscurities and apparent contradictions, which seem to stand in the way of a clear understanding of the manner in which these remarkable substances act; but we should, perhaps, have formed less decided opinions in respect of the efficacy of the stimulant method of treating disease, had not the transition from blood-letting to stimulation been so sudden.

The effects of nitrous oxide diluted with common air on those suffering from mental diseases may be in some measure understood from a few notes of cases in which it has been administered.

A. R.—, suffering from melancholia of many months' duration, says she believes the world is destroyed, and is very miserable. After inhaling the nitrous oxide, which decidedly lessened the frequency of the pulse and rendered it feeble, as well as caused deep and rapid respiration, said she felt happy, and as if she had been in heaven. No tendency to excitement was manifested, and this might be attributed to the fact that great caution was used in the administration on account of the feeble state of her health. She refused her breakfast in the morning, but sat up and took her dinner voluntarily half an hour after the inhalation, and said she felt better.

M. A. L.—. Case of melancholia of nine months' duration. Is almost constantly bemoaning her condition, and expressing fears that she will never get well again, though anxious to recover and return to her family. She was told before inhalation that the gas would make her happy and do her good. Soon after the signs that the gas was beginning to operate, as indicated by the breathing, she began to be excited, saying she felt as if in heaven; tears streamed down her cheeks. She declared, with great emphasis, that now she could go home and attend to her house and children, and that she felt as she used to do when at home—quite happy. In a short time the lividity, which had begun in the early stage of the operation of the gas, became more marked, and she felt less confidence. The facepiece was now removed; on coming to herself she began to weep hysterically; the effect soon passed off. Her pulse had been very little affected.

2nd administration.—Began to grow somewhat livid at the end of first minute, and to moan in a doleful manner as she took deep inspirations. The moaning gradually became louder, until it sounded more like screaming than moaning. At the end of inhalation, which had been continued two and a half minutes, when she had completely recovered consciousness, she said she had been resting, had had no distinct feelings of any kind, but experienced a general sense of comfort, and had done so all the time. She said she certainly had no recollection of having

moaned and wept; on the contrary, she had been enjoying a perfect rest, and had felt like her former self. When asked to describe more particularly her feelings, she compared them to those caused by beer, but that they were much pleasanter. She said she felt better two hours after, and that her head felt stronger.

On many other occasions she inhaled the gas with results corresponding to those just described. The effects are of a transient nature, and the mind reverts to its former state in less than an hour after the inhalation.

S. W.—suffers from melancholia. For the last fortnight has been dull and listless, seldom speaking a single word, and returning an unmeaning stare when addressed. On entering the room she has a depressed, apathetic look; shows some timidity on seeing the inhaling apparatus, but makes no active resistance to the administration of the gas. At commencement, pupils were dilated; pulse 102, small and compressible. In half a minute pulse was 132, and signs of commencing lividity about the eyelids. The gas was further diluted with air; forty-five seconds, pulse 138. Inspiration and expiration accompanied by moaning sounds, as if she was in great distress. At the end of a minute and a half the pulse was 132, soft and jerking. Sensibility somewhat affected; pupils more widely dilated. At the end of three minutes pulse was 172, same character as before, and strongly indicative of the unfilled state as well as flaccidity of the arterial system; the venous system, on the contrary, showed all the signs of being loaded with blood. Seems still very miserable, and tears are streaming down her face (abundant flow of tears almost invariably accompanies this stage of paralysis of the vascular system). Inhalation was continued with a more dilute preparation of the gas. In ten minutes (from first commencement) pulse was 128; conjunctiva much injected. The inhalation was discontinued; there was some confusion of mind for two or three seconds, but almost immediately she recognised those about her, addressing them by name in a firm, distinct voice. She spoke, too, about her children, and asked to be made quite well that she might go home to them.

Inhalation was then resumed for nearly three minutes, and until partial anaesthesia had set in; it was then stopped, and in a few seconds she stood up smiling, and saying, in a cheerful tone of voice, she felt much better. When asked if she was not tipsy, she laughed, and said no, her father had taught her better than that. She continued talking about her family in a firm confident tone, and the expression of her face was so changed that one might well have failed to recognise in her the downcast patient of an hour ago. In this case the relapse into the melancholic condition was less rapid than in the case of M. A. L.—, and the traces of the excitement were visible in her conduct next day.

B. M.—, also case of melancholia. Spends the day moaning and repeating short half-incoherent sentences about her “pa and ma.” She made some slight resistance at first, but in half a minute the respiration became deep and prolonged, and of a sighing character. One minute pulse had increased in frequency, and was fuller; she now began to moan as she breathed. At the end of two minutes signs of commencing lividity were observed.¹

In five minutes she began to be excited, and talked connectedly about former

¹ I should explain that in all the cases the inhaler was frequently removed, to allow of one or two inspirations of fresh air.

friends and incidents. On hearing laughter she at once commenced laughing; then her mind wandered away to the memory of scenes of dissipation she had mixed among; and she sung snatches of lively songs, talked about policemen, Protestants, &c., and, in short, manifested all the signs of intoxication. When the inhalation was stopped, there was a quick transition to her former state.

M. L.—. Case of partial dementia—ideas of an erotic nature predominating. Soon began moaning and crying; at the end of four minutes she was crying furiously, then there was a sudden change to laughter, and back again to crying. On recovering, she said she had been very happy, and thought she had been on the way to heaven.

M. E. C.—. Mania. Pulse 138. Is in a state of wild excitement—struggling, tossing her limbs about, and muttering and whispering nonsense. She soon became perfectly quiet after commencing to inhale the gas, but in two and a half minutes a moderate degree of excitement returned. In four and a quarter minutes she was laughing and shouting. In eight and a half minutes pulse 110; asleep. She remained in this condition a minute after the facepiece was removed, then began to be excited again. In about a quarter of an hour after taking the gas she went to sleep and slept two hours. Since admission to the asylum, three days ago, has not been seen to sleep. She also was tolerably quiet throughout the night, though she had up to this time been very noisy.

M. A. J.—, case of dementia. The nitrous oxide soon brought on excitement. She laughed, was restless, and began talking of incidents of her former life, among other things saying she had come for a halfpennyworth of nitre. The next day, for the first time since her admission, began to employ herself by helping to put the ward in order.

In other cases of partial dementia in which I have administered the gas, this recurrence of the mind to former events of life has been very striking, and a patient from whom one would have thought that the power of coherent speech had gone for ever has, under the influence of the gas, related, in a collected manner, long passages of her past life. One patient, who has been demented for years, and is almost incapable of comprehending the simplest question about her health, while the gas was being administered to her began talking of the time when she had been a nurse, and, when questioned, described the house where she had lived, gave the name of her mistress, and, among other things, said, "And she told me to dress the baby, and I dressed it, and she sent me for my character." None of these facts can be elicited when in her ordinary state of mind, though she is docile enough, and seems glad to be noticed.

Is there in this case any analogy to the lucid interval so often noticed to occur in lunatics a short time before death? May it

not be, in both instances, due to the inability of the vital powers any longer to supply sufficient nutriment to the whole nervous mass? and in the running down of the mind, as it were, the functional activity of that portion of the cerebral substance built up under the most favorable conditions of life alone survives.

It would not seem, from cases in which it has been inhaled every day for some time, that the repeated administration of nitrous oxide modifies the symptoms produced to any noticeable extent, or renders the system either more or less susceptible to its influence.

I think it would, from these experiments, be premature to express any decided opinion as to the likelihood, or otherwise, of nitrous oxide ever being regarded in any measure as a valuable therapeutic agent. A wider application of its uses, when the gas shall have become less expensive, and when more convenient appliances for its administration in the dilute form have been devised, may show that the power it possesses of momentarily changing the current of ideas, and of giving a new direction to thought, is not without some practical value, and that it may with advantage be employed in certain forms of mental disease.

THE
SPHYGMOGRAPH
IN
LUNATIC ASYLUM PRACTICE.

By GEORGE THOMPSON, L.R.C.P. LOND.,

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It has been remarked by a teacher of the science of medicine, who holds a place in the highest rank of his profession, that too much time has been wasted in the vain hope of building up a true system of the pathology of mental alienation by the microscopical examination, only, of the brains of insane people, and that it is high time we resorted to some other method of research, in order to attain the much desired object. To start from the groove in which we have travelled so long and so smoothly, to make, as it were, a path for ourselves, is at all times a hazardous task. But it does seem strange that, with all the keenness displayed by modern investigators, who have more particularly directed their attention to the subject of nerve-pathology, the instrument of Marey, which, according to Dr. Anstie, has maintained its value in the opinion of all, except those who expected diagnostic miracles from it, should have been so utterly neglected.

It is now almost three years since I first used the sphygmograph in researches upon the pulse-form in persons affected by disease of the nervous-centres. For some time past I have implicitly trusted this instrument as a means of discovering at least one form of brain-disease at an earlier period of its exis-

tence than is indicated by any other method. I believe that the sphygmograph will be proved ere long to be as necessary to the detection of some forms of so-called nerve-degeneration as the stethoscope and ophthalmoscope are to that of disease in the thorax and optical apparatus.

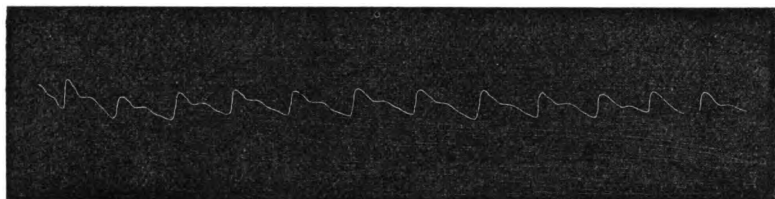
Dr. Burdon-Sanderson has pointedly remarked that, whatever else may be questioned, it cannot be denied that the sphygmograph is an impartial and consistent witness.

The method of using the sphygmograph is now so well known and the tracings obtained by its use are so familiar by means of the published observations of Drs. Anstie and Burdon-Sanderson, that it is deemed hardly necessary to traverse again minutely the ground so ably gone over by the observers above mentioned, but as these 'Reports' may possibly fall into the hands of some readers who, from various circumstances, have not been able to familiarise themselves with the instrument, the method of its application, and the results obtained therefrom, I think it advisable to recapitulate, in a cursory manner, the indications obtained by the application of the sphygmograph to the normal radial pulse.

I should first mention that, after many comparative failures and disappointments, resulting from the use of Marey's instrument, as it is issued from the makers in Paris, I adopted the modifications and means of more effectual adjustment suggested by Dr. Anstie, and figured and explained at page 783 of vol. i of the 'Lancet' for 1868. I find that by making use of the modifications referred to I can reckon upon having a definite and constant amount of pressure, and am thus relieved of one well-recognised source of fallacy.

Characteristics of the healthy pulse.—The tracing No. 1 is

No. 1.



one which I have selected as representing pretty fairly what

is usually understood to indicate a healthy condition of the heart and blood-vessels. It was taken from the pulse of a colleague three hours after dinner. On examination it will be seen to represent (1) a sudden expansion of the artery, indicated by the straight and almost perpendicular up-stroke which is said to be owing to the jerking forwards of the fluid contained in the vessel, and which corresponds to the first four fifths of the heart's contraction; (2) a rounding off of the up-stroke at the apex, which is owing to the gradual lessening of the force of the shock towards the end, and corresponds to the remaining fifth of the systolic period; (3) a slanting down-stroke, which indicates collapse of the arterial system; but, as this descent is not steady and even, it requires more detailed explanation. It will be seen that at a distance of about two fifths of the fall, measuring from the summit, the line of descent is abruptly stopped, and for a short distance is continued in a horizontal direction. The line then, for the remainder of its course, passes obliquely and more gradually than at first downwards, until it reaches its lowest point. The break in the line of descent represents what is termed the aortic notch, corresponds to the closure of the aortic valves, and denotes, also, that the double current of the blood, forwards to the capillaries, and backwards to force tightly together the valves at the base of the aorta, has ceased, and that there only remains the forward current, which is indicated by the remainder of the down-stroke.

It is generally supposed that we have now considered, or at least have enumerated, the whole of the phenomena which occur with, and succeed to, each beat of the heart. But it is still a matter of dispute in some quarters whether there is not a fourth event to account for, viz. that period which corresponds to the cardiac diastole. It cannot be disputed that the cardiac diastole does occur; but it is extremely doubtful if there is ever an indication of it in the perfectly healthy sphygmographic tracing. In fevers and other adynamic diseases, however, it is reasonable to suppose that a recoil of the blood against the ventricular aspect of the aortic valves may produce a secondary wave, and that it does so because the heart is more or less insensible to the presence of the blood in its cavities until sufficient time has elapsed to allow a second wave to be felt in the larger arteries,

and which, when seen in a tracing, is called dicrotism. An illustration of this phenomenon is displayed in tracing No. 2, which is taken from a person suffering from pyrexia.

No. 2.



Now, it will be seen that in order to get a perfectly healthy succession of events such as is mentioned under the previous headings, there must be (1) a healthy heart, which shall be so sensitive that at the moment of filling it shall send its contents into the arteries; (2) a system of valves so perfect that they shall be able to prevent back flow; and (3) arteries and capillaries with walls of such resiliency and consistence that they shall readily receive and transmit the fluid which is intended to nourish them and the parts beyond and around them. But if by any chance any one of the conditions is wanting; if the heart, from sheer want of power, or of adaptive perception, does not contract when contraction should occur; if there is incompetence or partial closure of the valves; or if from some decay or change in the vascular walls the vessels are incapable of receiving the blood, or having received it lack the power to assist it in its progress, then we find in the sphygmographic tracing an indication of the failure in a link in this very important chain of events.

We have now reached that stage of knowledge of sphygmography that we are able to arrange roughly the morbid conditions of the circulatory apparatus into two divisions, viz., those which are referable to the heart itself, and those which are referable to the capillaries and arteries. We may go even further than this by again subdividing each division into causes purely mechanical, as incompetence of valves and decay of the component parts of the heart and arteries, and causes which may be traced to a vital origin. The following formula is pre-

sented as a means of explaining more clearly this method of division :

Heart	Mechanical.	Degeneration of muscular substance.	{	From loss of substance. From deposition of morbid matter.
		Imperfection of valvular action.		
Vessels	Vital.	Loss of sensation of the presence of the blood from paralysis of the cardiac nerves.		
	Mechanical.	Morbid deposits in coats of vessels.	{	
		Degeneration of vascular substance.		
	Vital.	Paralysis and irritation of the vaso-motors.		

In the remarks which follow I shall avoid, as far as possible, any reference to any morbid condition of the heart and its more immediate appendages; and confine myself to the consideration of the conditions which are supposed to have their origin in impairment of function or changes in the substance of the minute arteries and capillaries. I have adopted this course, not because of any disregard of the important part which diseases of the heart may play in the causation of insanity, but because it appears to me that at present more good will result from the study of one particular form of insanity, which seems to depend more on vessels than on the heart itself. I have, therefore, carefully examined the heart stethoscopically in all cases, and in those to which I shall chiefly draw attention, I have ascertained that that organ was healthy.

Having considered the tracing derived from the normal pulse-wave, and the conditions which give rise to the various phenomena indicated therein, we will proceed to the study of what is seen when the sphygmograph is applied to the radial pulse, where disease of the circulatory apparatus, or rather that portion of it which is included under the head of capillaries and arteries, is presumed to exist; and as the space allotted to this paper is somewhat limited, it would, perhaps, be as well for the present to confine ourselves to the study of the results obtained by the use of the instrument in the investigation of that form of disease which is known by the name of general paralysis of the insane.

There is every reason to believe, judging from the conclusions arrived at by those who have investigated the subject by means of the microscope, that general paralysis of the insane is always

associated with, if not, in fact, due to, changes in the capillaries and minute arteries. In the case of the former structures it has been noticed by Wedl and other observers that nucleated granular cells are formed in the walls, and that these cells eventually calcify, and cause lessening of the calibre of the vessels. In the latter structures the changes are said to consist in calcification of the purely fibrous structures, and in fatty degeneration of the muscular substance. Van der Kolk and Ekker have noticed anomalies of the calibre of the vessels of the brain, and it may be inferred that these anomalies of calibre, as well as change of consistence, of the cerebral vessels, merely indicate a similar condition of the vessels spread throughout the entire body.

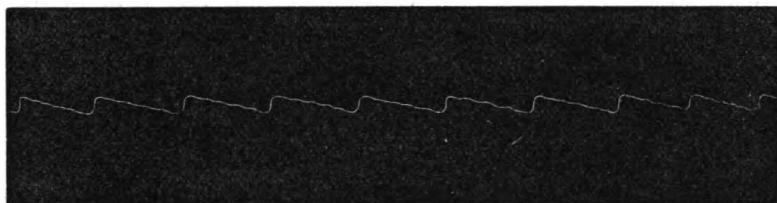
Let us then notice briefly the pulse-tracing which is obtained from general paralytics. By reference to No. 3, taken as a

No. 3.



typical example out of a large number of similar tracings, it will be seen that the line of ascent is slanting and short, while that of descent is gradual and prolonged, and does not display the usual aortic notch, but, instead, presents a number of wavelets which, if counted carefully, will be found to have eight distinct rises and depressions.¹ The tracing No. 4 is copied from Dr.

No. 4.



¹ It should be explained that 8 is only mentioned as the number of wavelets in the case referred to. I find that the number varies from 6 to 10.

Carpenter's 'Human Physiology,' and when compared with tracing No. 3, it will be seen how much they resemble each other. The tracing No. 4, however, does not represent one taken from a general paralytic, but from the wrist of a healthy individual who had been immersed in cold water for some length of time, and who was, in consequence, in a state of chill. Let us then consider how this marked resemblance may be explained. In both cases the arteries and capillaries are presumed to be in a state of contraction; in the case of "chill" in consequence of spasm of the vessels just mentioned; in the case of general paralysis in consequence of pathological changes which we shall immediately explain. In each case, however, the short line of ascent may be explained by saying that the arteries are in a state of tension, and are not fairly distensible; that beyond a certain point they are not able to contract so as to pass the blood onwards, and that they are, therefore, passive, and contain a much greater amount of blood previous to the heart's systole, than when of normal resiliency—in fact, that they in some degree resemble the veins. It will be easily seen that, under such circumstances, the heart labours at a great disadvantage; that the amount of blood which this organ can throw into the vessels at each of its contractions is small, and that the distension of the already filled arteries is slow in taking place. The wavy down-stroke may be accounted for by the same loss of resiliency in the vessels and by the narrowing of the capillaries. The result of all these departures from the natural condition is that because of the very small amount of blood which passes into the arterial system at each beat of the heart, the aortic valves are never widely distended, and that there is no appreciable interval between the opening of these valves and their closure to give time for the formation of an aortic notch; and that arterial collapse is of the most trifling amount, and very slow in its occurrence.

The subject from whom the tracing No. 3 was taken was admitted to the West Riding Asylum in September, 1870, æt. 33, and was said to be suffering from "mania." He had always been of sober habits. A few months before his admission his wife and other relatives noticed a marked change in his character; from being reticent and humble he became forward and presumptuous, and soon developed delusions as to the posses-

sion of wealth and high social status. For two months after his admission he continued excited, with persistent delusions; and in the meantime slight hæmatoma auris was developed. He then settled down and became useful as a store-room assistant, and it was thought not improbable he might recover. The sphygmographic tracing was taken on the 5th April, 1871, and confirmed the diagnosis which had been arrived at, that he was suffering from general paralysis, which was but too truly decided by the occurrence of a distinct epileptiform seizure on the 1st of May.

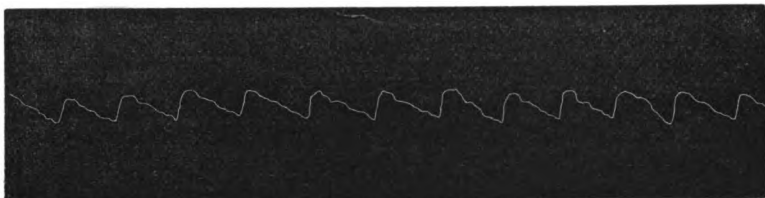
No. 5.



The accompanying woodcut, No. 5, represents a marking obtained from J. W. S—, æt. 24, a cabdriver, who was admitted to the West Riding Asylum on the 11th of March, 1871, at which time he was suffering from maniacal excitement. He had been of temperate habits, and the first symptoms of insanity consisted in his having undertaken to start an extensive hotel business, though at that time he had no reasonable amount of capital to carry out the undertaking, and no prospect of being able to borrow. He succeeded, however, in procuring a lease of the premises, and employed carpenters, bricklayers, and other artisans, and “treated” them liberally. After about a fortnight he broke down, became excited and destructive, and was brought to this asylum. At first he was treated as labouring under mania, had digitalis and bromide of potassium, but the delusions of grandeur such as his being King of England, Earl of Pomfret, &c., which he had when admitted, remain to this day though all indications of “mania” have disappeared. The marking is decidedly characteristic of general paralysis, and there are corroborative symptoms which have recently become developed, viz. inequality of the pupils, tremulousness of the tongue, and alteration of gait.

The next two cases present similar tracings, and from the length of time which has elapsed since these markings were obtained their significance as a means of diagnosis has now been fairly tested.

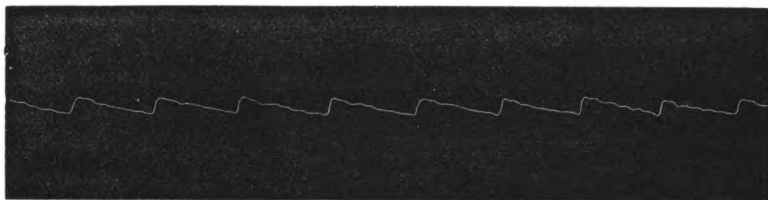
No. 6.



CASE 1.—R. F—, whose tracing is shown in fig. 6, was admitted to the West Riding Asylum early in 1868, labouring under great excitement. After a short residence he was discharged recovered, but at the end of two months was brought back again excited. It was still, however, doubtful if he was suffering from more than a recurrence of simple mania. The excitement continued for about four months, when he became perfectly quiet, and was able to manage a sewing machine. In the meantime, however, one month from his readmission, the sphygmographic tracing No. 6 was taken, but at that early stage of my investigations I did not recognise its important bearings. Six months after his readmission he had passed into a state of dementia, with the usual muscular and other symptoms of general paralysis. He continued to get worse, but lingered on until November 25th, 1870, when he died of general paralysis.

The other case is that of—

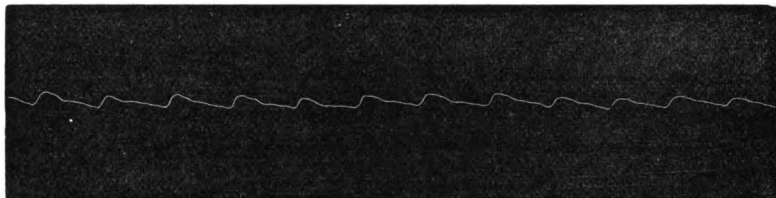
No. 7.



CASE 2.—G. F—, æt. 47, who was first admitted on the 23rd of November, 1868. The tracing No. 7 was taken three days after admission. He was admitted in a state of wild excitement with exalted ideas, which was followed by a period of depression, in which he refused to take food, and he even went to the extent of trying to hang himself on one occasion, about four months after his admission. He, like R. F—, seemed to recover eventually, and in December of the following year he was, after a month's trial, discharged, apparently recovered. Four months later he was readmitted with marked symptoms of what had only been suspected before, general paralysis. G. F— is now in an advanced stage of the disease,

suffers from frequent attacks of an epileptiform character, and is almost utterly demented. His death is daily expected.

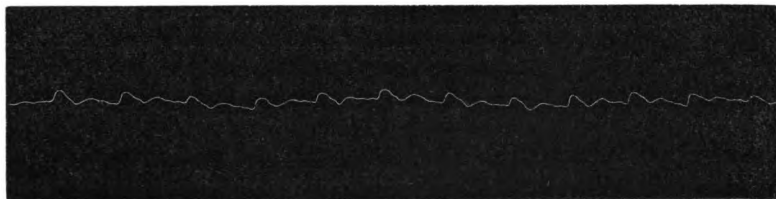
No. 8.



The foregoing cases are inserted for the sake of showing the pulse-form as seen in general paralysis, when not exposed to any circumstance which might tend to modification of its character. But it has been ascertained that even in general paralysis the vessels are capable of being acted upon by certain drugs, and that they are particularly susceptible to the influence of the *physostigma venenosum* (Calabar bean), to which so much attention has been drawn by the experiments and observations made by Dr. T. R. Fraser, and published in the 'Transactions of the Royal Society of Edinburgh.' This drug has been used extensively by Dr. Crichton Browne, in the treatment of general paralysis in this asylum, and has been recommended by him as a valuable means of exercising a favorable influence on the course of the disease. In every case its employment has been attended with marked benefit. The next case illustrates its effects.

CASE 3.—A. D—, a married woman, æt. 33, who was admitted on the 16th of January in the present year, and from whose radial pulse the tracing shown in fig. 8 was taken. At the time of her admission she had well-marked symptoms of general paralysis. On the following day she was put on one eighth of a grain of the extract of Calabar bean, which was followed by very marked improvement, which has continued to the present time. The sphygmographic tracing was taken on the 5th of May, and will be seen to mark a condition of vessels very different from the preceding ones.

No. 9.



CASE 4.—W. V—, æt. 35, male, who had been in another asylum, was received into the West Riding Asylum on the 24th of January, 1871, with undoubted symptoms of general paralysis. One sixth of a grain of the Ex. physostig. was ordered, and has been continued up to the present time with marked improvement. The marking No. 9 was taken from his pulse on the 1st of May.

The last case to which I shall draw attention, as bearing upon treatment, is that of—

CASE 5.—S. M—, æt. 39. It is reported of him that he has been of an ambitious temperament since he came to manhood, and that latterly he had “gone in” for improving himself, and had “studied” much. A fortnight before his admission he became excited and unmanageable, and was therefore removed to the workhouse. When admitted to the West Riding Asylum he had exalted ideas; there were inequality of the pupils, tremor of the lips, and awkwardness of gait. On the 9th of January, fourteen days after admission, he was ordered the Ex. of Calabar bean in doses of one sixth of a grain three times a day. The quantity was raised on the 19th to one fourth of a grain. On the 23rd of March there was such marked improvement in his condition that the use of the extract was discontinued. The tracing fig. 10 was taken on the 10th of April. At the present time (May 11th)

No. 10.



there is a slight tendency to relapse, but the improvement which seemed to have had origin in the use of the Calabar bean continued for some time after the use of the drug was stopped.

We will now consider the bearings which the conditions that give rise to tracings Nos. 3 to 7 have on the study of the pathology of general paralysis of the insane.

It is quite clear that from the earliest period of the existence of the disease now under consideration there is a persistent contraction of the minute arteries. It is a well-recognised fact that the smaller the calibre of the vessel the greater is the proportion of muscular substance; and it is also well known that by virtue of this great preponderance of muscular substance the minute arteries possess the power of contraction to a great degree.

The condition of spasm, to which reference has been made,

may be produced artificially in a number of ways, as by the application of cold, or by the administration of atropia, bromide of potassium, and ergot of rye; but unless spasmodic action be kept up by the continuance of the means which first produced it, the vessels recover themselves, and no evil result ensues. But if, as in continued ergotism or in general paralysis, the spasm, or in other words loss of function, continues, then the only result to be looked for is a permanent change in the vessels themselves as a primary effect, and degeneration of the parts supplied as a secondary effect. Arterial degeneration, whether produced by ergot or not, has long been regarded as a frequent cause of gangrene. The symptoms of ergotism, when this condition ends in gangrene of the extremities, resemble in many respects the symptoms which are noticed in general paralysis. These are, tingling of the feet, hands, and head; drowsiness, giddiness, indistinctness of vision, and an unusual gait; epileptiform convulsions and coma, a voracious appetite, and purpura.¹

Having considered the analogy which exists between ergotism and general paralysis, we will consider what are the bearings which the tracings 8 to 10 have on the therapeutics of the latter disease. I would again call attention to marking No. 2, which, as has been previously said, is one which indicates a condition of pyrexia. That tracing was taken from the pulse of a woman who was far advanced—commencement of third stage—in general paralysis, but who was then suffering from inflammatory fever due to bronchitis. and whose pulse-tracing when there is no fever is like No. 7.

Now, the tracing No. 2 shows that though in the “normal” condition of general paralysis the vessels are in a state of perfect spasm, they are, until the disease has progressed very far, capable of distension, and of assuming a condition which in all respects resembles what is seen in pyrexia in persons of ordinary constitution. Dr. Fraser,² in his article on the “Physiological action of Calabar bean,” says that when applied to the web of the frog’s foot the tendency of this drug is to dilate the vessels, and this action he attributes to a specific effect on the ganglia and nerves which govern the calibre-changes of the vascular

¹ Aitken, ‘Science and Practice of Medicine,’ 4th Ed., vol. i, 781.

² ‘Transactions of the Royal Society of Edinburgh,’ vol. xxiv.

system. It will be seen, then, that the action of the Calabar bean is similar to that which Dr. Radcliffe attributes to inflammatory fever, viz. paralysis of the vaso-motor nerves. Now, if it be granted that the structural changes in the vessels and the impoverishment of the parts which should receive blood through these vessels are due to the persistent spasm of their muscular substance, it is rational to suppose that any means of relieving this spasm, and of promoting dilation of the vessels in consequence, must at least retard the decay of such portions of the system as depend on these vessels for their supply of the fluid by which their renewal is effected. I believe that in Calabar bean we have a means antagonistic to spasmodic action. The cases enumerated as having been treated thus are but a small portion of the persons confined in the West Riding Asylum who are suffering from general paralysis, and who have been subjected to the treatment indicated, and I do not exaggerate when I say that in every case very marked improvement has followed the use of the drug.

To recapitulate then: General paralysis of the insane is a disease which may be presumed to be owing to a considerable extent to persistent spasm of the vessels which leads to change in their component elements, but more especially in the muscular substance. This persistent spasm, by reducing the amount of blood which can pass through the vessels to the parts to be nourished, prevents renewal of these parts, and, consequently, wasting. The most rational treatment indicated is to relieve this spasm. Further, the sphygmograph, by indicating the true nature of the disease at a period when it could barely be suspected by other symptoms, affords an opportunity of applying remedies when mere function is disturbed, before actual change has begun, and when the remedial means can be of the most avail.

I must now close this imperfect paper; but I hope, ere long, to be able to give the results of some investigations which I have in hand, which are especially directed to the subjects of melancholia and ordinary dementia.

THE
OPHTHALMOSCOPE IN MENTAL AND
CEREBRAL DISEASES.

By CHARLES ALDRIDGE, L.R.C.P. LOND.,

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WAKEFIELD.

THE use of the ophthalmoscope in the diagnosis of cerebral diseases has, during the last three or four years, received the attention of the physician. Indeed, as far back as the year 1865 we find a book published on the subject by Dr. Bouchut, of Paris.

In this country it has been investigated by several physicians, amongst whom I may mention Dr. Hughlings Jackson, Dr. Ogle, and Dr. Clifford Allbutt, of Leeds. Taking the work of the ophthalmologists as a starting-point, they have gradually worked out a great number of interesting facts bearing upon the connection of diseased conditions of the optic nerves and retinae with deeper seated disease of the central nervous system.

Unfortunately these researches are scattered through various medical journals, and chiefly those given up to the special department of ophthalmic surgery; so that the student is often unable to obtain information without wading through a mass of literature. The only book in the English language which touches on this subject, as it is interesting to the physician, is a 'Treatise on Diseases of the Eye,' by Mr. J. Soelberg Wells.

I do not propose in this paper to go over the same ground as the above-named observers, but rather to record observations

of my own, made in certain classes of cases which have hitherto received but little attention.

In this country Dr. Allbutt was the first to examine and to publish the result of his observations on the changes seen in the optic nerves and retinae of the insane. The West and North Riding of Yorkshire Lunatic Asylums furnished him with cases. His observations extended over a wide field, and recorded the appearances seen in several different forms of insanity; but, owing to his not being resident in or near the asylum, and not, therefore, possessing a very intimate knowledge of the patients, their previous symptoms, and the effects of treatment, they can only be regarded as a most valuable foundation upon which other observers may be encouraged to raise a superstructure. Dr. Allbutt treated most fully on the lesions of the optic disc in the general paralytic, and also considered mania; but, as he drew no distinction between acute, chronic, and recurrent mania, his observations require elucidation and extension.

Dr. Allbutt also recorded the appearances seen in the eyes of forty-three epileptics, and says, "In fifteen, disease of the optic nerve and retinae were found, nine were doubtful, and nineteen showed no change. Simple epilepsy is not commonly followed by disease of the optic nerve. In most of the cases presenting optic changes organic disease was known to exist from the other symptoms." And, lastly, he records observations on idiocy and dementia.

In the space allotted to me it would be impossible for me to treat all the subjects which I have investigated as fully as I should wish, or as they deserve. I shall, therefore, confine myself to epilepsy, recording, at the same time, some observations which, perhaps, hardly come within the scope of this paper, but which possess considerable interest. I speak of the appearance of the fundus oculi, as seen by the ophthalmoscope in the dying and the dead.

The alienist physician has many advantages in pursuing an investigation of this latter nature, for he is living in the house with his patients, and can obtain the earliest possible intelligence of death, and thus make his observations before the cornea becomes clouded, owing to absorption of the aqueous humour and death of the epithelium. Then, again, the utter fatuity and obliviousness of the patient in many cases of mental decay,

and in all those to which the observations in this treatise refer, render what to a sane person, at such a moment, would be cruel and inhuman, of as little importance or inconvenience as the feeling of the pulse or the administration of a stimulant.

Observations on the Eyes of the Dying and the Dead with the Ophthalmoscope.

CASE 1.—The first case recorded is that of G. W—, æt. 44, suffering from general paralysis of the insane. He was perfectly blind, and was known to be the subject of white atrophy of the optic discs. For several days before death he was suffering from pneumonia; but one night, seeming suddenly to become more feeble, my friend and colleague, Mr. Thompson, was called up. On his arrival he found the man in articulo mortis. The dilated condition of the pupils suggested to him the possibility of making an examination of the fundus oculi. Before he could do this the patient had expired. The examination of the fundus was made, and the following appearances noticed:

“January 12th, 1868.—Ten minutes after death:—Retinæ of both eyes pale, optic discs white and atrophic, and having no vessels on their surface. After leaving the disc the vessels have a varicose or beaded appearance.”

Without being aware of the above case, and being at work with the ophthalmoscope, it occurred to me that the observation of the retinal circulation of the dying and the dead must have considerable interest, and might possibly throw light upon various morbid states, such as syncope, coma, epilepsy, &c. I therefore looked about for an opportunity of making such observations, which soon presented itself. The following cases are interesting, from the fact that they all slightly differed, and yet had many conditions in common.

CASE 2.—A. H—, æt. 45, the subject of chronic disorganization of the brain, had for a few days been suffering from bronchitis, and on the evening of the 5th of April, 1871, was in a dying state. Pulse 140, small and feeble; respirations 80; an accumulation of mucus in the throat, and a condition of unconsciousness. Only one eye could be examined, as the other (the right) was slightly injected, and had lost the epithelium from its cornea.

Left eye.—There is slight central white excavation of the optic disc, which is round, well defined, and of a pale pink colour. The veins are of full size, but the arteries are smaller than usual. During the examination the disc became paler, and the arteries smaller. As this was being noticed, one nurse observed to the other that the patient was ‘changing,’ and so she was, for her pulse had become more feeble and infrequent; indeed, she seemed to be about to breathe her last. One ounce of brandy in a little water

was given, and as this seemed to revive her the examination was resumed. The disc was now pinker, and the vessels fuller than when last seen, and presented much the same appearance as when first observed.

By vigorous stimulation and careful attention she was kept alive until next day, when she died at eleven o'clock. Eight minutes after the last respiration I examined the fundus oculi, and recorded the following appearances:

The optic disc is of a papery whiteness; the central excavated portion, however, is of a more brilliant white than the rest. Only one vein can be seen on the disc, and that does not reach the margin. It is the central main venous trunk before its division into ascending and descending branches. The branches can be seen on the retina, but seem to spring from the edge of the disc. They present a beaded appearance—that is to say, a portion of vein is empty, then a bead of blood is seen, and beyond that another portion of empty vein, and so on. Some veins contain as many as half a dozen of these beads, the rest of the veins near the periphery being full of blood, and presenting much the same appearance as during life. The arteries do not present this beaded appearance, but cannot be seen on the disc, as they have become empty where they cross it. At first they seemed to spring from the edge of the disc; their calibre is reduced, so that they present an attenuated appearance; yet in other respects they seem to differ little from arteries in the living subject. A few minutes later they are observed to be slowly emptying themselves from the centre towards the periphery, until in ten minutes from the commencement of the examination not an artery is to be seen. The choroidal glow is good, although slightly paler than it was during life.

A second examination was made six hours after death, and much the same state of things existed then as has been described above. The choroidal glow had become of a yellowish pink; but the veins remained in exactly the same state as before.

CASE 3.—W. N.—, æt. 40, the subject of chronic mania. Two hours before death he was very pale, with contracted and insensitive pupils, small, irregular, and intermittent pulse, with feeble sighing and infrequent respiration. The lower extremities were perfectly cold up to the pelvis, and he was unconscious. The pupil having been dilated with atropine, the following appearances were noted:

Right eye.—The optic disc is of a pale pink colour, being slightly darker towards the temporal side. The veins are of medium size, and contain dark blood. Arteries small, but fairly numerous. Choroidal glow of a medium tint.

Left eye.—The optic disc is of a pale pink tint, and well defined; the veins are of medium size, and the arteries small and thready.

These eyes were again examined eight minutes after the last respiration, and the following changes noted:

Right eye.—The optic disc is of a papery-white appearance, but near its centre there is a faint pink tinge. The lower veins are seen to pass over the disc, and are uninterrupted in their course. The upper ones, however, are not seen upon the disc, but seem to spring from its edge. One or two arteries are seen proceeding over the surface of the disc, and the rest are well seen in their course through the retina.

Left eye.—The optic disc is very white, but has a narrow zone of a greyish tint, situated about equidistant from the edge and centre of the disc. Only one vein can be seen to cross its surface, the rest seem to spring from its edge; in the remaining part of their course the veins are full of blood, and do not present the beaded appearance observed in the case of A. H. The arteries are in much the same state as during life, only they are not visible on the disc, but become so at the edge, at a little distance from it.

Six hours after death a second examination was made; the arteries were now no longer visible, having emptied themselves; the veins remained full, as at the last examination; but the choroidal glow was of a yellowish-pink tint.

A third examination was attempted some ten hours after death; but the corneæ had by that time become so clouded and granular from loss of their epithelium, that the details of the fundus could not be seen. There was still, however, some choroidal glow, but it was much paler, and of a yellower tint than when last observed.

The next three cases record the state of the retinae only after death.

CASE 4.—E. F—, æt. 60, had been in the asylum for about six weeks. She was in a very feeble state on her admission, and had refused food all along, under the delusion that some harm was intended her. About three days before her death pneumonia set in, and she rapidly sank. The optic appearances were thus recorded:

Right eye.—The optic disc is large, with irregular but well-defined edges, and of a papery-white appearance. The veins are of small size and light red colour; they are seen passing over the disc, and are not interrupted in their course by gaps or intervals. There is, however, a bead in the main venous trunk, near the centre of the disc. No arteries can be seen in this eye.

Left eye.—The optic disc has the same papery-white appearance as that of the right, and only one vein can be seen to pass over its surface; the rest seem to spring from the edge of the disc, and are uninterrupted by empty spaces in their course to the periphery. The arteries, which are of small calibre, are seen to commence at some little distance from the disc, and those smaller twigs which usually proceed from the edge of the disc towards the yellow spot are not to be seen. The choroidal glow is slightly paler than usual, and the vasa vorticosa can be seen.

Six hours after death the veins were found to be in exactly the same condition as before, but no arteries could be seen in either eye. The choroidal glow was found to be of a yellowish-pink tint, and the details of the choroidal vessels were no longer visible.

CASE 5.—A. M. P—, æt. 25, had suffered from acute mania for several months, and had become demented. Whilst in this latter condition she had an attack of pneumonia of both lungs, which proved rapidly fatal. Half an hour after the last respiration I made an ophthalmoscopic examination of the eyes, and noted the following changes;

Right eye.—The optic disc has a papery-white appearance, and is not well

defined from the choroid. Some of the veins are seen to pass over its surface in a state of unbroken fullness, whilst others are interrupted by spaces, and present a beaded appearance. A third class can be seen to spring from the edge of the disc, and do not pass over its surface as during life. The arteries are not to be seen near the disc, and only one or two can be seen at all, these seeming to commence at a great distance from the disc. The choroidal glow is of a greenish tinge, and the choroidal vessels are not visible.

Left eye.—The optic disc is of a papery-white appearance, and has a woolly-white edge. The veins seem to pass over its surface in an uninterrupted manner, only one or two seeming to spring from its edge; and in no part of their course do they present a beaded appearance.

Six hours after death a second examination was made, but no change was found to have taken place.

CASE 6.—A. W—, æt. 50, a case of chronic dementia, who had been in the asylum for many years, died from phthisis, with gangrene of the lung.

One hour after death the eyes were observed, and thus described:

Right eye.—There is perfect whiteness of the optic disc, and not a single vessel can be seen to pass over its surface, although several veins seem to spring from its edge, and are beaded more or less in their course through the retina. No arteries are visible, and the choroidal glow is of a faint yellowish pink.

Left eye.—The optic disc is very white, and several veins are seen to pass over its surface; they do not seem to be interrupted by gaps or intervals. No arteries can be seen, and the choroidal glow is of a very faint pink tinge.

These eyes were again examined eight hours after death, and the above appearances had undergone no material change.

The last case I am able to give has reference to the state of intense hyperæmia, observed a few hours before death in a man suffering from phthisis—

CASE 7.—B. C—, æt. 40, has been expected to die for some hours. There is now an accumulation of mucus in the throat; pulse 100, small and feeble; respirations 60, and laboured in character. The extremities are cold, and he is hardly conscious, although able to swallow liquids. The pupils, which were contracted, are now dilated under the influence of atropine. On examination of the eyes with the ophthalmoscope, in the right eye the optic disc is defined and of a deep red tint, hardly distinguishable from the surrounding choroid, which is of a very dark colour. The veins as they pass over the disc are very large, but where they pass over the choroid they are greatly dilated and very tortuous, seeming to give off innumerable branches of large size, giving rise to secondary twigs, which in the normal state of things would be scarcely visible. Numerous small arteries spring from the edge of the disc, and the main trunks are of average size. The blood in both arteries and veins is of a dark colour, that in the veins being remarkably black.

Left eye.—The optic disc is highly congested, but defined from the surrounding choroid; the veins are enormously distended and tortuous, giving off numerous branches and containing very black blood. The arteries are of good size, and a number of small arterial twigs springs from the edge of the disc; the contained blood being

of a darker colour than that ordinarily seen in arteries. No signs of hæmorrhage or effusion about either optic discs or retina.

Since the above observations were made, which I then believed to be quite original, I find that M. Poucet, of Strasburg, has published the result of his examinations of the eyes of men and animals after death. In the April number of the '*Archives Générales de Médecine*, 1870,' M. Bouchut claims to have been the first to publish the appearances of the fundus oculi as seen by the ophthalmoscope after death; his statements having been made in 1866.

The '*Lancet*' gives the following extract from M. Poucet's paper :

"On examining the eyes of the human subject, the following were the appearances seen in one case seven hours after death—Papilla white, pearly, distinctly differentiated in tint from the general fundus of the eye, which was yellowish white, with a slightly rosy hue. Not a single vessel visible at the papilla. At the periphery very small irregular clots were contained in otherwise empty vessels, and these succeeded each other at short intervals. The arteries could not be distinguished from the veins, and the choroidal plexuses were also indistinguishable."

My observations, recorded above, in some respects agree with those of M. Poucet. Only it will be noted that exactly the same conditions did not obtain in every case. In four cases clots formed in the veins, and in three no vessel could be seen to contain blood in that portion which passed over the optic disc. M. Poucet says that the arteries could not be distinguished from the veins, nor can this be wondered at when we consider that his observations were made eight hours after death; for in the above cases the arteries were seen to empty themselves, so that they had almost ceased to be visible half an hour after death, and had completely disappeared in six hours. He found the choroidal plexuses indistinguishable seven hours after death, so that in the above cases although they were well seen immediately after death, yet, six hours after, they had ceased to be evident, and the choroidal glow is then described in terms closely corresponding with those used by M. Poucet.

On carefully considering the above cases, there are several points which seem common to the whole. First and most

notably the fact that the capillary tint of the optic disc is the first to give way; secondly, that the arteries begin to empty themselves in the direction of their current; and lastly, that the veins also empty themselves in the direction of their current, but do not do so completely. These processes are all in accordance with the known physiological behaviour of vessels, and would *a priori* have been expected to take place. The only irregular proceeding was the disappearance of the capillary tint before the arteries had thoroughly emptied themselves, because the blood which they passed on must have found its way into the capillaries, and one would therefore have expected them to have remained full until after the arteries had ceased to contract. That no change took place in the veins after the first few minutes can be easily accounted for by the fact that as soon as the capillaries had become empty the motor power had ceased to operate upon the venous blood. It may be objected that the capillaries of the disc are not in connection with the retinal vessels which proceed from its centre, but are derived from a vascular network which encircles the optic nerve at its entrance into the eye, and which is derived from the short posterior ciliary arteries, and, according to Heber,¹ directly from the choroidal vessels. Still, be that as it may, the vessels of one part should behave in the same manner as those of another if subjected to the same conditions. And that the choroidal vessels do this is shown by the fact that they empty themselves coincidentally with those of the retina, causing the gradual change of tint observed in the glow reflected from the fundus after death. An important and interesting question presents itself in connection with these observations, and that is the relation they stand in to the two simple modes of dying, viz.—1. Death from syncope, or failure of the moving powers of the circulation; and 2. Death from apnoea, or impediment to the aeration of the blood in the lungs. For an inquiry of this nature, however, a greater number of cases would be required than I am able to present, and numerous instances of these two modes of death from different causes would require to be obtained in order to make the inquiry complete. In most of the cases above recorded the patients died slowly, and from failure of the moving powers of the circulation. In the case of B. C. we have an instance of the second mode

¹ 'Archiv. f. Ophth.,' Bd. xi, i, p. 1.

of death, viz. that depending on imperfect aeration of the blood. B. C. was the subject of serious lung disease, and died at last in a state of suffocation from accumulated secretion in the bronchi. But here, unfortunately, we have no record of the post-mortem ophthalmoscopic appearance. It is probable that in this case the over-distended state of the veins may have caused them to remain full after death, although they might not retain the large calibre which they possessed during life.

One interesting fact about this case is that the blood in the arteries is noted to be of a darker colour than natural, and that in the veins to be very black. This is in accordance with the known condition of the blood in the larger arteries and in the left cavities of the heart in persons dying of apnœa. I believe the retinal vessels afford a better field for observations of this nature than those of the conjunctiva, or of any other portion of the systemic circulation. It is well known that oxygenation of the blood may take place through the skin and mucous membranes. And it is probable that such oxygenation was taking place in the conjunctival vessels and in those of the superficial and exposed parts of the body, in the case of B. C.; for we find that although great congestion of the retinal circulation was observed, yet there was little or no injection of the conjunctiva.

The next and most important inquiry is, what value these signs possess as a mode of determining whether death has taken place in cases where there is some doubt?

We do indeed possess a valuable, although not a certain, sign of death in the clouding of the cornea; and to show that this is so I may state that, but for the destruction of the corneal epithelium and consequent opacity, I should have been able to record many more observations in this department of my subject, for I often found the cornea so clouded as to perfectly prevent observation, even several hours before death: and in the case of A. H. only one eye could be seen, as the cornea of the other was rendered opaque from this cause. On the other hand, in many cases the cornea retains its transparency for several hours after death.

It is true that we do not often require any other signs of death than those we already possess in cessation of the circulation as observed in the heart and pulse; cessation of the respiration; the absence of sense and motion; the facies hippocratica, the state of the skin, and the extinction of muscular irritability; also

extinction of animal heat; cadaveric rigidity, and putrefaction. But still the fact remains that persons have been buried alive, when in a condition so nearly resembling death that medical men could not detect any signs of life. In the case of the Honourable Colonel Townshend, related by Cheyne in his "English Malady," and quoted by Dr. Guy, could Drs. Cheyne, Baynard and Skrimme have seen the retinal circulation of their noble patient they probably would not have left him for dead, as we are told they did, only to be confounded by his speedy return to activity. Again, in this country the inquiry does not possess the same importance as in Catholic countries, and hot climates, where interment of necessity quickly follows death. The appearances of the fundus oculi, however, would become of immense importance in a medico-legal point of view, could we by a great number of observations come to certain definite conclusions as to the appearances characteristic of various modes of death; and also if any connection between the conditions observed and the period of time which had elapsed since death took place, could with any degree of certainty be determined. For instance, the dead body of a child is picked up in the street by a police officer; it presents no external sign of violence, and the cause of its death, together with the period of time which has elapsed since death, are problems which the medical man is called upon to solve. Now, if the eyes were examined, and the fundus oculi presented the same appearances as were seen in the man B. C., no hesitation would be experienced in saying that death had been caused by suffocation. How the suffocation had been produced would, of course, be a question to be answered by evidence and other signs. But if, on the contrary, the appearances presented by the fundus oculi were such as were seen in W. N. then death would be attributed to asthenia, and the cause might have been exposure to cold, or nervous shock.

Lastly, and not by any means the least important question which might possibly be determined by this means, is the occasionally much vexed one of the presumption of survivorship.

Observations on the Eyes of Epileptics with the Ophthalmoscope.—Epilepsy presents a wide field for observation, and although it has attracted, and still continues to attract, the attention of many earnest workers in the department of scientific medicine

yet amongst the various instrumental means that have been employed in the elucidation of its pathology, strange to say, up to the present time the ophthalmoscope has hardly been employed in a systematic manner. Doubtless this is attributable to the facts that great difficulty attends the observation of the eyes of an epileptic during the fit, and that the epileptic convulsion is sudden, and gives but little warning of its approach. We must, therefore, be in very close relation with our patients in order to obtain an examination of the fundus oculi at this period.

Asylum wards present, perhaps, the best field for observations of this nature, for there a large number of epileptics are gathered together, and some of them are sure to have one or more fits in the course of every day. But even under such circumstances the difficulty is great. During the last month or six weeks I have spent many hours each day in a ward which has twelve epileptics amongst its inmates, and yet not one fit has occurred in my presence.

My notes of cases were all obtained by my accidentally finding a patient in a fit, and then sending for my lamp; so that in almost all the instances quoted the observations refer to that stage of stupor which succeeds the clonic convulsion, and in which the patient is wholly or partially unconscious.

In one case I was able to see the condition of the retinal circulation during the clonic convulsive stage; but I have never yet been able to obtain a view of the fundus oculi when the patient was in the stage of tonic spasm; one great reason being that this stage is of such short duration that, unless a patient developed a fit during the time that an ophthalmoscopic examination was in progress, it would be hardly possible to effect an observation during its continuance.

My inquiries have embraced the epileptic in all the conditions under which he is found; that is, in all the stages of his malady, and under the varied kinds of medical treatment to which the majority of epileptics in this asylum are subjected.

My subject seems naturally to divide itself into two great primary divisions, namely: observations during the paroxysm, and in the inter-paroxysmal state.

Observations during the paroxysm.—I will first give an

account of the cases as they were noted at the time of observation, and then comment upon them.

CASE 1.—A. S—, æt. 70, has for two or three years suffered from disorganisation or atrophy of the brain, accompanied by frequent attacks of epileptiform convulsions, and characterised by dementia with occasional excitement.

I first made an examination of the eyes about five minutes after a convulsion had ceased, when her respiration was of a spluttering character, and when she was perfectly unconscious.

In the right eye the optic disc was very white, there being only the faintest pink tinge to the outer side. The veins were full, the arteries of small size, and not very numerous.

In the left eye the optic disc was very pale, and of irregular shape, the veins of good size, and the arteries very small.

As I finished writing down the above description she had a second fit, and this time I was able to see the optic disc in the right eye during the greater part of the time in which the clonic convulsions continued.

The disc became very pink, so as to be almost indistinguishable from the surrounding choroid. The arteries were very small, but there was no alteration in the state of the veins. As the convulsions ceased, and the sighing, spluttering respirations came on, the disc was observed to become slowly but markedly white, until in a few moments it presented much the same appearance as when first seen. The veins became larger, but the arteries remained small. The colour of the blood in the vessels was not noted.

CASE 2.—C. M—, æt. 35, whose case is again referred to in this paper, where the appearances presented by her eyes, in the ordinary inter-paroxysmal period, will be found. The following is the recorded state of the fundus oculi, as seen by the ophthalmoscope five minutes after the convulsion had ceased, and when the respiration was spluttering and the patient perfectly unconscious.

Right eye.—The optic disc is very pale, but there is a slight yellowish-pink tint about it. The arteries are small, but the veins are of good size.

Left eye.—The optic disc presents much the same appearance as that of the right, but is, if anything, a little deeper in tint. The arteries are small, and the veins of good size.

In about an hour, when consciousness had returned, and when she was able to move about, but was still somewhat confused, a second examination was made, and the changes then noted consisted in a deepening of the capillary tint of the disc, and a slight increase in the size of the arteries, the veins remaining in much the same condition as before.

CASE 3.—M. A. W—, an account of whose inter-paroxysmal state will be found at p. 127. Some few minutes after a convulsion had ceased, when the respiration was of a spluttering character, and the patient in a state of unconsciousness closely resembling sleep, the following appearances were observed:

Right eye.—Optic disc of a pale yellowish-pink tint, almost white; veins of large size, arteries small. In about ten minutes the disc had deepened in tint, and the arteries had increased in size, and about this time consciousness had returned.

CASE 4.—M. H—, whose usual condition will be found described at page 114. The first examination was in the sleepy stage, succeeding the convulsion, and the appearances were as follows :

Right eye.—The optic disc is very pale, of an almost papery whiteness; veins of medium size, arteries not noted.

Left eye.—The optic disc is not very distinct at the margins, but very pale, although there is more capillary tint observable than in that of the right side. The veins are dilated and the arteries small.

By the time this examination was concluded she had, as is her custom, begun to be very violent, so as to require four persons to hold her. During this stage of excitement the fundus of the right eye was well seen, and these appearances noted.

The optic disc has become deepened in tint, so that a white rim, not before distinguished, is now well marked. Arteries larger, veins much as before.

The next case differs from the rest, in that the observations extended over several days, and have reference to a condition known as the status epilepticus.

CASE 5.—A. G—, *æt.* 44, had been epileptic for many years. She had not had a fit for some few months, and of late had ceased to take bromide of potassium, which had proved most beneficial to her.

April 1st.—During the day she has had nine very severe convulsions, never thoroughly recovering consciousness before being again attacked. She has not taken any nourishment. Ordered four ounces of whiskey, and

Pot. Bromid. ʒss ,
Tr. Sumbul. ʒiij ,
Aqua ʒviij — ʒj , *ter die*.

April 2nd.—She has not had any convulsions since last night, and has swallowed a fair quantity of liquid food. She is now in a semi-conscious state, but difficult to rouse, and disinclined to move. The pupils are dilated and inactive when in a strong light.

Right eye.—Optic disc well defined, and of a very pale pink tint, but palest towards the inner side; arteries distinct, but much finer than usual; veins of medium size; choroidal glow rather pale.

Left eye.—Optic disc of a pale pink tint, lightest at the inner side; veins of medium size, arteries small. As the examination proceeded the patient became so drowsy as to require shaking and rousing up; and whenever her attention could be attracted, then the capillary tint of the disc deepened; but no change could be observed in either the arteries or the veins.

April 5th.—Her general condition is much the same. No change of fundus.

April 6th.—She has been somewhat excited this morning, but is still very stupid. The eyes present some slight changes, the capillary tint of the optic disc in each eye being of a deeper tint, and the arteries and veins slightly fuller.

April 10th.—She is now perfectly conscious, and has had no return of the

fits. The optic discs are of a much deeper pink tint than they presented before, and both arteries and veins are increased in size. There are now observed for the first time a number of small arteries springing from the edge of the disc, and ramifying in all directions.

I shall now quote a description of the only case on record where an examination of the retina was made during the fit, and then review the cases quoted in connection with the phenomena of the epileptic fit.

Dr. Hughlings Jackson describes the appearances he saw in the retina of an epileptic during a portion of the fit, and is quoted by Mr. Soleberg Wells, under the title of *Epilepsy of the Retina*, in his 'Treatise on Diseases of the Eye.' He says :

"In one case, however, a case of "epileptiform convulsions," I had an opportunity of examining the fundus of the eye, if not during a genuine fit, at least during a condition in which consciousness was lost, and in which the pupils, ordinarily small, were dilated as under the influence of atropine. The optic discs were extremely pale. Once the vessels disappeared for an appreciable time. After a while, however, they reappeared, and were found to vary with the respiration. When the patient inspired, the vessels disappeared, returning again on expiration, like lines of red ink upon white paper."

This case is, as far as I have been able to ascertain, the only recorded observation of the circulation of the retina during the fit, and Dr. Jackson has thought it worthy of a special name ; but, in applying that name, he causes unnecessary confusion, for here it is used to express a condition which is but symptomatic, and, as it were, an index of a more general state. Elsewhere, he refers to temporary loss of speech which he has called "epileptic aphonia," and compares and contrasts it with sudden loss of sight, which he has been accustomed to speak of as "epilepsy of the retina," or "epileptiform amaurosis." Thus when this term is used we always labour under a sense of confusion, not knowing whether a mere local affection of the retina, unconnected with the cerebral circulation, and causing temporary blindness, is meant ; or whether the term is used to express a condition which is common to the whole cerebral circulation, but only visible at that one point.

Dr. J. Russell Reynolds comments severely upon this indiscriminate use of the word epilepsy, and says, "Renal asthma

would be a term as pathologically correct as 'renal epilepsy;' dyspnœa of the fingers as justifiable as the expression 'epilepsy of the retina.'" The appearances detailed in the above cases must therefore be considered in their relation to the condition of the cerebral circulation during the epileptic fit, and are useful only in so far as they throw light upon it. Now, in the first instance, let us analyse them, and see what conditions they have in common, and the order in which the different appearances were observed. The first thing observed in each case, and one common to them all when in the stage of stupor succeeding the convulsion, is great paleness of the optic disc, showing emptiness of the capillaries. Next, there are smallness and attenuation of the retinal arteries—this, of course, one would naturally expect to find in conjunction with loss of capillary tint; and lastly, there is a restoration of the circulation more or less complete. In one case, that of M. H., No. 4, this restoration of the circulation was somewhat sudden, and overstepped the natural bounds, being coincident with great excitement and mental confusion. During the convulsive stage, in the case of A. S., No. 1, the optic disc was seen to be greatly injected, and the arteries larger than usual; this condition being succeeded by paleness of the same part, and contraction of the arteries, coincident with the stage of stupor. We must next consider the relation which these conditions bear to the phenomena of the epileptic fit, and how far they coincide with the current theory of epilepsy.

Dr. Russell Reynolds, in his 'System of Medicine,' gives the accepted pathology of the fit as follows:—"By contraction of the vessels the brain is deprived of blood, and consciousness is arrested; the face is, or may be, deprived of blood, and there is pallor. By contraction of the muscles, which have been mentioned, there is arrest of respiration; the chest walls are fixed, and the other phenomena of the first stage of the attack are brought about."

"The arrest of breathing leads to the special convulsions of asphyxia, and the amount of these is in direct proportion to the perfection and continuance of the asphyxia."

"The subsequent phenomena are those of poisoned blood—i. e. of blood poisoned by the retention of carbonic acid, and altered by the absence of a due amount of oxygen."

It would thus appear that the congested condition of the disc

seen in the case of A. S., No. 1, during the clonic convulsive stage, is quite in accord with the theory of the pathological condition of that stage, viz. congestion and loading of the vessels of the brain from obstruction to the return of blood through the veins, on account of the contraction of the muscles of the neck and the immobility of the thorax.

This condition is succeeded by an almost opposite one, viz. that of partial anæmia of the disc and contraction of the arteries, the veins not altering much, or, at any rate, not so suddenly as the arteries. Now this state of things was observed in all the cases examined, and as it is coincident with the third stage, or stage of stupor, it may be most frequently observed, owing to the quietness and insensibility of the patient. In the stage of stupor we have a condition very closely resembling sleep; and according to the current theory of the condition of the brain during sleep, the external and general points of resemblance are supplemented by the internal and local. It has been stated, by whom I do not now remember, that the conditions of the retinal circulation during sleep is that of anæmia. I have often tried to convince myself of the truth of this by observation, but have not as yet succeeded; the inquiry being attended with extreme difficulty, on account of the turning up of the eyeball under the lid during sleep; and the fact, familiar to every one, that few sleepers can bear a strong light being thrown into their eyes without awaking. If this be really true, however, the conditions have a closer analogy than we have yet been able to prove. This stage of anæmia would therefore seem to be simply a state of profound exhaustion of the nervous centres, owing to deficient blood supply at a time when they require a large quantity of well oxygenated blood to repair the injury they have received from a circulation of blood charged with carbonic acid and the débris of the tissues.

This supposition is greatly favoured by the fact that this state of anæmia of the retina will continue for days in the stupor which follows a long succession of fits. In the case of A. G., No. 5, we have an illustration of this; for there the retinal anæmia continued through several days, and was accompanied by stupidity and confusion of mind. When intelligence had returned, then, and then only, was the circulation found to be in its normal state.

We have now to consider what permanent effect the constant occurrence of variations in their calibre will have upon the retinal vessels. And this brings me by a natural transition to the second portion of my subject, namely, the state of the fundus oculi in the epileptic during the interparoxysmal period.

Observations during the inter-paroxysmal period.—In order to determine this with some degree of accuracy, I have collected and recorded one hundred and two cases of epilepsy, giving the result of an ophthalmoscopic examination in each case. At the end of this paper the details of these cases will be found numbered and arranged to facilitate reference.

On a careful examination of these cases, it will be found that in a great majority of them a condition of hyperæmia of the retina and optic disc was found.

Mr. Power, in his work on diseases of the eye, describes hyperæmia of the disc as being of two kinds, active and passive; active when it affects the arteries as well as the veins, passive when the veins only are affected. The former may be caused by section of the sympathetic nerve in the neck; by straining of the accommodation, as in doing fine work; or, and this is by far most frequently the case, it may occur as the forerunner of inflammation from different causes. The latter is met with in those who are asthenic from any cause, and where the return of blood from the eye is impeded by intra-cranial or intra-orbital disease. Mr. Soleberg Wells says, "In the venous or passive form of hyperæmia, we notice that the retinal veins are abnormally large, dark, and perhaps tortuous, which is especially marked in the smaller veinlets, which may present a somewhat corkscrew appearance." "This form of hyperæmia is mostly slow in its development, and is due to a state of venous congestion, dependent, perhaps, upon some disturbance in the general circulation, or upon local causes which impede the efflux of blood from the retinal veins."

By comparing this definition of hyperæmia with an analysis of the cases, we shall find that we have to do with the passive form in the great majority of instances. In some few the congestion is active, and in them it is the forerunner of inflammation, in fact, of a descending neuritis.

In twenty-six cases the veins are recorded as being tortuous ;

and of these in eighteen cases they are said to be large, in six of medium size, and in two cases only were they small.

In thirty-two cases the veins are described as being large but not tortuous; and in thirty-five they are said to be of medium size. In seven cases only are they spoken of as small. We thus find that in fifty cases, or one half, the retinal veins have been found to be abnormally large; and not only is this the case, but of the remainder many are described as being "numerous," "much branched," and often "tortuous."

The optic disc, in nearly every instance where there was enlargement of the retinal veins, was found to be of a deep red tint. Very little alteration was observed in the arterial supply; in some few cases the arteries are said to be small and thready, and in those some atrophic changes were observed. It may be proper here to mention the fact that the central white spot, which for a long time was thought to be devoid of blood-vessels, could be seen in many cases to be of a slightly pink tinge, and in others of even a deeper shade than this. Thus confirming the statement of¹ Niemetschek that he has observed a capillary network covering it.

Having thus found a condition of chronic passive hyperæmia of the retina in the epileptic during the interparoxysmal period, let us consider the causes that lead to the dilatation and varicosity of the veins in the general system, and how many of these are found in the epileptic. We may then learn to what extent the appearance observed in the retinal circulation may be taken as an index of the changes going on in the wider circles of the cerebral circulation.

Rokitansky says that phlebectasis may attack the whole venous system uniformly, or it may be limited to almost any section, and that it is either originally developed on the small veins (venous radicles), and extends from them to the great trunks, or it may commence in the latter and retrograde thence to the ramifications. He gives the following as causes of phlebectasis;—mechanical impediments to the circulation; pressure on a large venous trunk; excessive activity of an organ, accompanied by its enlargement and hypertrophy; also repeated hyperæmia and inflammation of an organ.

Of these causes we find several in active operation in epi-

¹ Prager 'Viertel Jahrschrift,' Bd. i, p. 132, 1866.

leptics, not only in the cranial but in the general circulation. And foremost of these is hyperæmia, generally of the passive kind, but occasionally active; as in the condition known as epileptic mania. Again, pathological anatomy has shown many different conditions occurring in the bodies of epileptics, and not connected with the disease in the way of causation, but such as are produced by constant congestions, viz. thickening of the bones of the skull, together with thickening of the skin of the scalp, coarseness of the hair, and lastly dilatation of the capillaries of the medulla oblongata. Shroeder Van der Kolk has shown that in all epileptics there is a dilated condition of the capillary blood-vessels and secondary granular degeneration of the medulla oblongata. This dilatation he regards as the proximate result of the fits, and not as their cause. He also states that with these changes vascular dilatation in the brain, and particularly in the cortical substance, goes hand in hand. The small ganglionic cells become compressed by the dilated vessels, and perhaps also in consequence of the more albuminous nature of the intercellular fluid. Dulness and loss of memory are the results; or if, after a fit, an unusual current of arterial blood is supplied, we have following immediately upon the paroxysm, over irritation, rage, and acute mania, which is present in so many epileptics. How well does all this chime in with the conditions found in the retinal circulation both during the paroxysmal and the inter-paroxysmal periods. The general condition of the retinal circulation, as has been shown, being one of passive hyperæmia, there is accompanying this, and in relation with it, a state of dementia; the dementia being most profound where the dilatation of the veins is the greatest. Again the remark as to the mania or excitement following immediately after the fit in many cases being due to "an unusual current of arterial blood" supplied to the brain, brought to my mind—for I had not seen Van der Kolk's book until my observations were completed—the case of M. H., No. 4, the details of which have been given above. I there noted that during the stage of excitement immediately following the epileptic fit there was increased vascularity of the disc, and that the arteries had become larger; and I remarked upon the fact of this sudden restoration of the circulation being accompanied by excitement.

We thus learn, from pathological anatomy, that the same con-

ditions are found in the cerebral vessels after death that the ophthalmoscope has revealed to us in the retinal during life.

Moreover, the secondary nature of these changes which I have endeavoured to point out is found to agree with the opinions of eminent pathologists as to the production of the same conditions in other portions of the nervous centres in the epileptic.

We may, therefore, take the ophthalmoscopic appearances of the retinal circulation as an index and guide to the condition of the cerebral, and from this basis we shall be able to make some interesting inquiries and investigations into the influence of drugs upon the intra-cranial circulation, and, in the first instance, this will bear reference only to epileptic conditions. In order, therefore, that we may be the better able to judge of such effects, we must first inquire if the condition of passive hyperæmia of the retina bears any direct relation to the number, frequency, and severity of the fits. That there is an intimate relation between these conditions will, I think, be proved by reference to cases Nos. 3, 4, 47, and 98, which are those of epileptics who have a great number of fits almost every day, and in whom they are of a very severe character. We find that their retinal veins are described as enormously dilated and tortuous, and the optic discs are said to be of a deep red colour, and sometimes not easily distinguished from the surrounding choroid, although of transparent appearance and free from œdema. Again, we find by reference to such cases as Nos. 25, 37, 45, 54, and 56, that where the severity and number of the fits has diminished by a free use of the bromide of potassium, the passive hyperæmia of the retina is not so great as in those cases where it has been used with benefit and then discontinued. In the cases numbered 28 and 96 the bromide was given for a considerable time, and great benefit derived, but was discontinued, and since then the patients have slowly become worse, having more fits, and, as is always the case, becoming more stupid and demented, also more liable to maniacal attacks. We find here that the condition of passive hyperæmia has become established again.

In order more conclusively to prove this point, I now give the condition of the retina of M. A. G—. At No. 54 will be found the condition of her retinal circulation when

taking the bromide, and when she was not having more than one fit in a month. At the time when the present observation was taken she was having fits every day, owing to the omission of the drug. In the right eye the optic disc is of a very red colour, and the veins are greatly dilated and tortuous. The arteries are numerous, but not very large. In the left eye the optic disc is very red, and the veins very much dilated, the arteries being of medium size.

I might multiply cases of this kind from my note-book, but that quoted will suffice to indicate that the reduction in the amount of passive hyperæmia does not take place immediately as a direct effect of the action of the bromide upon the blood-vessels, but is rather due to the reduction of the number of fits, which cause the constant congestions. And this conclusion accords well with the theory of the action of the bromide of potassium thus expressed:—"The sedative effects which I believe it to possess upon the medulla oblongata act forcibly in checking the development of the phenomena and the establishment of the pathological condition."¹

It will be found that, in a great number of cases, 'ergot is said to have been given during the maniacal attacks; and I now append two or three cases of epileptic mania, where examinations were made before and after its administration

CASE 1. — M. H—, æt. 21, became very maniacal and violent after a succession of fits. She was only semi-conscious, and seemed to have hallucinations. On examination, her optic discs were found to be of a deep red colour, almost deeper than the surrounding choroid, but perfectly transparent. Both arteries and veins were gorged with blood, and the number of small arteries seemed to be increased in size.

She took the Ext. Ergotæ Liq. in two-drachm doses every four hours, and although several examinations were made during the week which followed, but little change could be seen. However, in about a fortnight, when she had become quiet, the congested stage had passed away, and the condition was such as will be found described in Case No. 42.

The next case I shall quote, and the only one for which I can find space, is that of M. H— (No. 43).

CASE 2.—She became greatly excited and very suicidal, attempting to tear open her throat. Her eyes were examined, and the active hyperæmia seen was such as is described in the above case. Ext. Ergotæ Liq. was given, and in four days

¹ 'Edinburgh Medical Journal,' June, 1865.

the active condition had subsided, and the condition of passive hyperæmia described in the tables was then observed.

From what I have said, I think it will be admitted that the ophthalmoscope is of considerable use in the estimation of the effects of treatment in these cases; and the inference would seem to be that the remedial agents which are of most value are those which tend to equalise the circulation.

In making these observations, I have been greatly struck by the infrequency of œdema and atrophy of the disc in even the most advanced cases of epilepsy, where the dementia was most profound, and where considerable brain disease might have been suspected. The cases numbered 95, 96, and 101, are the only ones recorded as having the discs hazy or swollen. Those numbered 60, 61, 70, and 84, are stated to be atrophic. In six cases, those numbered 7, 41, 46, 47, 94, and 99, hemiplegia of long duration was noted. No marked change or difference was noticed in the condition of the optic nerves or retinæ of the two sides. In Nos. 7 and 47 there was absolutely no change to be detected; in No. 99 the optic disc is smallest on the paralysed side, and what is also worthy of note, there is want of development on that side of the body, as well as wasting of the soft parts. In No. 46 the optic disc on the paralysed side is slightly hazy. These cases are insufficient in number; and unaccompanied as they are by any good history of the conditions immediately following the lesion which was their cause, do not justify any theory being founded upon them. It is, however, a significant fact that there should be so little sign of general cerebral disturbance having taken place, even at a remote period, in these cases, where from the effects we should expect a serious organic alteration.

In all the cases referred to with the exception of eight, the convulsions were bilateral, and of these, in six they occurred on the right, and in two only on the left side. In five of the cases of hemiplegia the convulsions were unilateral, and affected only the paralysed side; but in the sixth they were bilateral.

The urine was examined in every case, but was not found to contain either albumen or sugar, and was almost always found to have an acid reaction.

The colour of the irides was found to vary considerably; as in forty cases they were some shade of brown, in eight light

blue, in twenty-eight dark blue, and in twenty-four of a grey tint. The diameter of the pupils varied in the different cases from $\frac{3}{8}$ to $\frac{8}{8}$ of an inch, but it was equal in the two eyes in all except one. With regard to their sensibility to light: thirty-six are recorded as being active, sixty-two as sluggish, and two as inactive. Although these latter details seem unimportant, and do not bear directly upon the subject in hand, yet at the commencement of the investigation it was thought that they might possibly be of use, and indeed it was felt that the investigation could not be considered complete without them.

Ophthalmoscopic Observations on the actions of Remedies.—Before concluding this paper, I wish to detail some cases in illustration of a subject which has for a long time past occupied my attention, and which has been touched upon in the section of this paper which is devoted to epilepsy. I refer to the use of the ophthalmoscope in the estimation of the action of medicines. Almost every other instrument which has been introduced for placing the art of medicine upon a more exact and scientific basis, has been brought into play in the elucidation of the various phenomena which different remedial agents produce in the system. Now, as in many instances, these drugs are believed to produce changes through their action on the blood-vessels, either commencing at the great central organ of the vascular system, the heart, or at the other end of the tree by variations in the calibre of the capillaries and small arteries, through the influence of the nerves which govern and regulate their action; so it seems to me that we can have no better means of judging of such effects than by our sight, for the evidence afforded to us by it is always regarded as the most convincing that we can obtain. By the use of the ophthalmoscope the retinal vessels are brought under our immediate observation, so that we are able to notice the smallest variations in their size, and even the shade of colour possessed by their contained fluid.

As illustrations, I shall here confine myself to observations of the effects produced on the circulation by four well known agents, one of which differs entirely from the other three in its action upon the walls of the blood-vessels. These agents in their effects resemble the opposite conditions produced by irritation of the

great sympathetic, on the one hand, and the complete section of that nerve, on the other. In the former instance, namely, irritation or cicatrix of the nerve, we find, as Bernard and others have proved, that a decided contraction of the arteries is produced, and consequent pallor of the surface; whereas, when the nerve is completely divided the opposite condition obtains, viz. that of dilatation of vessels producing injection and flushing. These effects are not produced so much by diminished or increased force of the circulation, owing to decreased or increased action of its central propelling agent, the heart, as by increased or diminished resistance in the extreme or capillary circulation, as the one or the other condition of the sympathetic nerve prevails.

These drugs are the ergot of rye, the nitrite of amyl, nitrous oxide gas, and the hydrate of chloral.

I do not here propose to give any detailed account of the action of these drugs upon the general system, or of their probable therapeutic value; for in the case of the ergot and the hydrate of chloral such work has, to a great extent, been done within the last six months by Dr. Crichton Browne; and with regard to the nitrous oxide gas by Dr. Mitchell, in the present volume; but rather to confine myself to proving the value of the ophthalmoscope as an agent for elucidating one of the most obscure subjects in the whole field of practical medicine.

The cases in which the nitrite of amyl was used are dilated upon more fully than the rest, as the symptoms following its administration are not so completely worked out and recorded as is the case with the others. It was, therefore, thought that the facts should be given for the benefit of those who are working at the subject from a different point of view.

I would, in passing, draw attention to the fact that in all the cases where this agent was administered, mental excitement and hilarity were observed, and also to the fact that the flushing seemed to have certain definite centres of origin, and that it not only occupied the face and neck, but that it also involved the skin of the chest, and even that of the abdomen.

And first, as to the action of the ergot of rye.

CASE 1.—M. A. C—, æt. 40, the subject of epilepsy, and a patient who had never been treated. The condition of the fundus, when first observed, was as follows:

Right eye.—Optic disc round, well defined, and of a deep transparent pink

tint; veins of large size, numerous, and tortuous; arteries also of large size and much branched.

Left eye.—Optic disc of fair size, and of a deep red tint, but transparent appearance; veins of large size, tortuous, and numerous. Arteries of medium size, and numerous.

Two drachms of the liquid extract of ergot were now given. Half an hour afterwards a second examination was made; no change could be noted either in the size of the vessels or in the capillary tint of the disc. In two hours she was again examined, and the vessels were thought to have become slightly thinner, the change in calibre being most marked in the arteries. There was, however, no apparent change in the capillary tint.

She was ordered to take the same dose of the drug three times a day, and fourteen days afterwards she was again examined with the ophthalmoscope. The fits had in the mean time become less frequent, as formerly she had had a fit every day, but during the last week she had only had three fits in all.

The changes in the retinal circulation were now found to consist in contraction of the arteries, lowering of the capillary tint of the disc, and a decided reduction in the calibre of the veins.

This case, with the two recorded at page 93, will, I think, be sufficient to establish the fact that ergot produces contraction of the minute arteries of the retina; and also that such effect is not produced instantaneously, but that some time is required before any evident change can be seen; and that to obtain the full effect it must be taken for several days, so as to bring the patient thoroughly under its influence.

CASE 2.—J. D.—, a stout well-nourished girl, of dark complexion and full habit, fairly intelligent, although the subject of epilepsy, inhaled the nitrite of amyl for half a minute. After smelling at the drug for the first time she said it was not pleasant, and that she did not care for it; she, however, took several good sniffs, and then seemed to enjoy the odour, as she followed the bottle with her nose as it was being drawn away from her, and afterwards was most ready to inhale, seizing the bottle with avidity. After taking two or three deep inspirations, a bright scarlet flush appeared on the face, and quickly involved the whole head, neck, and front of the chest as low as the nipples. The flush seemed to have several foci or points of origin, around which it spread until the whole surface was involved in one uniform blush. These foci were the point of the nose, the skin over the malar bones, the tip of the chin, and the cavity of the outer ear. When the flush was most intense the patient seemed excited, and became very talkative, occasionally bursting into fits of laughter. During the stage of flushing the pulse was taken, and found to be 108 in the minute, and of full and bounding character, whereas before it had been 85, and of normal tension. The eyes, which had been previously observed, were now again examined, and the retinal arteries were seen to be evidently increased in size, and the capillary tint of the disc deepened; but little or no change was observed in the calibre of the veins.

CASE 3.—M. H.—, the subject of epilepsy, and considerably demented, in-

haled the nitrite of amyl for about one minute. Her face became flush and the flushing was seen to involve the whole of the head, face, neck and upper part of the chest over the sternum. The parts became of a bright scarlet colour, most intense on the face, sides of the neck, and lobes of the ears. The eyes glistened, and a slight flow of tears was excited. Her pulse increased 20 beats in the minute, and became fuller in character. About this time she began to be talkative and inclined to laugh; but afterwards there seemed to be some mental confusion, as on leaving the room she did not know which way to turn to go to the dayroom of the ward she had lived in for many months. When the flush was deepest the eyes were examined, and the retinal arteries found to be increased in size, together with deepening of the capillary tint of the disc, but no alteration in the size of the veins.

CASE 4.—M. A. G.—, æt. 38, is a stout well nourished and dark-complexioned woman, considerably demented, and the subject of epilepsy. After inhaling the nitrite for about a minute, a bright scarlet flush was seen to involve the whole of the face, head, neck, and upper portion of the front of the chest. The flush seemed to commence at the tip of the nose, point of the chin, and interior of the outer ear; and from these points spread quickly until the parts above named were involved. There was some inclination to laugh, and a slightly excited and talkative condition produced. The pulse, which had been 60 and feeble, was increased to 95 and became full and soft. The eyes, which had previously been examined, were found to have changed considerably, the retinal circulation being modified by increase in the size of the arteries and deepening of the capillary tint, the veins remaining in the same condition as before the inhalation.

CASE 5.—M. C.—, æt. 25, a pale, thin girl, suffering from chronic dementia, but at times exhibiting erotic propensities. Before the inhalation the pulse was 60 and thin and feeble. Afterwards it increased in fulness and beat 90 in the minute; at the same time the whole of the face, ears, neck, and upper part of the front of the chest became suffused with a bright scarlet flush. The eyes were now again examined, and the retinal arteries found to be increased in size, and the capillary tint of the disc deepened in colour. The increase in the size of the arteries was well seen in a very fine and thread-like arterial twig, which passed across the optic disc and ran for some distance on the retina; and which was observed to be double its former size after the inhalation.

CASE 6.—A. J.—, æt. 17, an emaciated pale-faced girl, the subject of acute dementia, having cold extremities and a feeble pulse of 80, inhaled the nitrite of amyl for one minute. A bright scarlet flush was observed involving the whole of the face, ears, and neck; and also, in a blotchy manner, the front of the chest and abdomen as low down as the umbilicus. It seemed to commence and radiate from several points, viz. the tip of the nose, the skin over the malar bones, the point of the chin, and the inner part of the outer ear. The blotchy condition, however, observed on the chest and abdomen did not spread into one uniform flush, as was seen to be the case on the face and neck. The pulse had now increased to 100, and was of a fuller character. On examination of the eyes at this stage the retinal arteries were seen to be greatly increased in size, and the optic discs which had been very pale were now of a deep red tint. The enlargement of the arteries was most easily seen in the small thread-like twigs which proceed from the inner side of the disc.

Considerable mental activity was manifested in this case; from being stupid and apathetic she became talkative, and had outbursts of hysterical laughter and weeping.

CASE 7.—A. E. P—, æt. 26, a pale anæmic-looking girl suffering from secondary dementia of one year's duration, inhaled the nitrite of amyl for half a minute. Almost immediately after the first inspiration, several foci of increased vascularity were observed, the tip of the nose and the inner part of the external ear being most markedly affected. The blush spreading from these centres quickly involved the whole of the head and neck, and to a less extent the front of the chest and mammæ. Her pulse increased 20 beats, and became fuller in character. The retinal circulation was seen to be more free, the arteries becoming enlarged and the capillary tint of the disc deepened. About this time she became slightly excited and hilarious, talking freely, and laughing in a silly sort of way.

CASE 8.—M. A. C—, æt. 42, the patient whose case is detailed above as having taken the ergot with benefit, and with the production of contraction of the retinal vessels, was now asked to smell at the nitrite of amyl bottle; this she did, and expressed herself as pleased with the sensations produced, although she did not become talkative or show any disposition to laughter. Her face became flushed, of a bright scarlet colour, the neck and upper part of the chest being involved; the pulse increased from 85 to 101, and became fuller in character. The retinal circulation was next observed, and the arteries were seen to be larger, and the capillary tint deeper, the change in the size of the arteries being here most evident in the smaller twigs, which were attentively observed both before and after the exhibition of the drug.

CASE 9.—E. A—, æt. 30, fairly nourished, and of light complexion, next inhaled the nitrite for a short time. Her face, neck, and chest became suffused with a bright scarlet flush, which seemed to have the same points of origin as in the other cases, viz., the tips of the nose and chin, the malar bones, and the deeper portion of the external ear. Her pulse increased 20 beats, and she became very hilarious, laughing and talking immoderately. Her retinal arteries, which had before the inhalation been of a very fine and thread-like appearance, were now much increased in size.

The nitrite was administered to a great number of persons both sane and insane, male and female, and always with the same effect. In every case the flushing commenced at several different points, the most frequent being the tips of the nose and chin, the skin over the malar bones, and the recesses of the outer ear; from these it spread until it had involved the whole of the surface of the head, neck, and front of the chest. In one case only was this increased vascularity seen to affect the skin of the abdomen. Every one in the first instance declared that the smell of the vapour was unpleasant, but after trying it a second time they seemed to enjoy it, so that in some cases it was with difficulty that the inhalation was stopped. The next fact worthy of note was the feeling of bewilderment and confusion complained of in the head. The hand was put up to the

forehead as though they had just awakened from sleep. The flush was noted to become more intense, and of a brighter scarlet, after the bottle had been removed from the nostrils and a few inspirations of pure air had been made. It was at this time that the retinal circulation was observed, and from the above cases it will be seen that the arterial and capillary circulation was always greatly increased, the effect being observable here as soon as in any other portion of the systemic circulation. As the mental confusion passed away, the patients always became talkative, and were easily excited to laughter, which in one case assumed a hysterical character, and ended in weeping. They complained of a feeling of heat, and tingling of the ears and cheeks, but no other disagreeable feeling was experienced; indeed, the novelty of the sensation and the joyous appearance of persons who had inhaled prevented any lack of subjects for observation.

When Dr. Mitchell was conducting his experiments with nitrous oxide gas, I had opportunities of making an ophthalmoscopic examination of the eyes in two cases. When in the excited and hilarious condition which results from inhalation of the nitrous oxide mixed with air, and when the head and neck were deeply flushed, the retinal circulation was seen to be in a state of excitement, the arteries being dilated, and the capillary tint of the disc deepened. In fact, the changes then seen very closely corresponded with those detailed above, as seen after the administration of the nitrite of amyl.

I shall next record my observations in several cases where chloral hydrate was being administered.

CASE 10.—M. A. S—, æt. 33, a stout well-nourished and florid-complexioned woman, the subject of epilepsy, was examined one hour after taking 30 grains of the hydrate of chloral. She was not at all drowsy, although this was the first dose she had taken. There was no flushing of the face, and no change was observed in the retinal circulation. Six hours afterwards her eyes were again examined, she had just been roused up from a sound sleep, having been awakened by the light reflected from the ophthalmoscope. The vessels were now seen to be decidedly smaller, and the capillary tint of the disc paler; but the vascularity increased as she became more thoroughly awakened, so that the anæmia may possibly have been due to sleep, and not to the chloral.

CASE 11.—M. H—, æt. 22, a stout well-nourished woman, labouring under epileptic excitement, took 30 grains of the hydrate of chloral. One hour after its administration she did not seem drowsy, and was as quarrelsome as ever. The retinal circulation had undergone no apparent change. One hour after taking 60 grains she became drowsy and unsteady on her feet, and complained that

she was drunk. Her eyes were again examined, but no change could be seen in the retinal circulation; but as her discs are naturally of a deep tint, any slight increase of vascularity would not be very quickly perceived. Four hours after taking this increased dose she was sleeping soundly, and could with difficulty be awakened. When she was thoroughly asleep the retinal circulation exhibited signs of anæmia, the disc being paler, and the arteries of smaller calibre. After she had been awakened, and walked up and down the room for a short time, she was again examined, and the vascularity of the retina seemed to have become re-established. She again fell asleep, and the circulation reassumed the anæmic state before noticed.

CASE 12.—E. A—, æt. 30, thin, and of fair complexion, was taking the hydrate of chloral in 30-grain doses. One hour after taking a dose of this medicine she was examined with the ophthalmoscope. At that time there was no flushing of the face, and no feeling of drowsiness. The retinal arteries were seen to be increased in size, this being most obvious, as they were very numerous, but of fine calibre, so that any alteration in their thickness could be quickly observed. The capillary tint of the disc showed but little change, as in the first instance it was of a deep red tint.

In November of last year my friend, Dr. Nicol, made some ophthalmoscopic examinations of the eyes of patients taking this drug, and when I mentioned to him the fact that I was working at the subject, he kindly placed his notes at my disposal. He thought that in most of the cases he could detect pallor of the discs, and an absence of vessels from the disc in one case; but he notes at the same time that the patients were so drowsy that they fell asleep during the time an examination was in progress.

The deductions, if any might fairly be drawn from such a small number of instances, would be that the chloral hydrate increases the calibre of the arteries, and consequently the vascularity of the retina until such times as the patient falls asleep, and that the anæmic appearances seen at the latter period are those which are said to be characteristic of healthy sleep.

Enough, I think, has been said to prove that in the ophthalmoscope we have a most useful instrument for investigating the effects of remedies on the system, and this being done my object is for the present accomplished.

I have already exceeded the space allotted to me, and must therefore leave a number of subjects altogether untouched, hoping to be able to deal with several other forms of mental and cerebral disease in future papers.

*Cases illustrating the Ophthalmoscopic Appearances presented by Epileptics.*¹

CASE 1.—E. O—, F., æt. 18, admitted Nov. 21st, 1868. *General condition.*—She became epileptic when thirteen years of age, the first fit being as severe as any that have followed. After one year's treatment by the bromide of potassium and occasional hip-baths the menstrual function was established. Since then the fits have been less severe and frequent, and the mental state has improved, although she is still at times excited. *Urine.*—Sp. gr. 1018, acid, no albumen, no sugar. *General condition of eye.*—Prominence, normal; irides, dark grey; pupils, R. 5, L. 5, sluggish. *Ophthalmoscopic examination.*—Right eye: O. D. of a pale pink colour, well defined, and having a zone of pigment to the inner side; there is a slight central white spot; the veins are of large size; the arteries medium size and numerous. Left eye: O. D. pale pink, and having a larger white central spot than in the right; veins of large size; arteries more numerous than in the right, but of the same size; choroid of a medium tint. *Remarks.*—Is now taking bromide of potassium, which has acted beneficially.

CASE 2.—E. F—, F., æt. 24, admitted Oct. 22nd, 1869. *General condition.*—A deaf mute, who has been epileptic from birth. Her fits are most severe and frequent, being amenable to no kind of treatment. She is convulsed on both sides, and always falls on her face. Has been very weak-minded all her life, but is able to write imperfectly, and can converse on her fingers. She is very passionate and violent at all times. *Urine.*—Sp. gr. 1025, acid, no albumen, no sugar, copious deposit of lithates. *General condition of eye.*—Prominence, normal; irides, light brown; pupils, R. 6, L. 6, sluggish. *Ophthalmoscopic examination.*—Right eye: O. D. fairly defined, of a deep pink tint, and lighter to the inner side; veins rather large; arteries numerous, but thin; no pigmentation of the retina. Left eye: O. D. of the same colour as the right; veins large; arteries not so numerous as in the right. *Remarks.*—Has taken atropine, but with little effect.

CASE 3.—H. H—, F., æt. 24, admitted Oct. 1st, 1867. *General condition.*—Became epileptic soon after birth. Has a number of severe convulsions about every two or three weeks, and has none in the intervals. She is convulsed on both sides, and gives a long warning by stamping on the floor. She is stupid, and always ready to fight on slight provocation. *Urine.*—Sp. gr. 1018, acid, albumen in small quantity, no sugar. *General condition of eye.*—Prominence, normal; irides, light brown; pupils, R. 4, L. 4, active. *Ophthalmoscopic examination.*—Right eye: O. D. well defined, having a large central white spot; veins greatly dilated and tortuous; arteries numerous and of large size. Left eye: O. D. the same tint as in the right, but having a smaller white central spot; veins much dilated, tortuous, and giving off many branches; arteries more numerous than in the right, but of the same size. *Remarks.*—Has not taken medicine.

CASE 4.—H. E—, F., æt. 40, admitted Aug. 30th, 1856. *General condition.*—

¹ These cases were originally drawn up in a tabular form, in which, however, it was found impracticable to produce them. It is only necessary to explain that O. D. stand for optic disc, R. and L. for right and left, and that the diameter of the pupils is given in 48ths of an inch.

Has been epileptic since birth, her fits being very severe, and generally occurring during the night. Occasionally she has a fit during the day, and then mostly at the menstrual period. She is stupid and demented, and sometimes violent. Is convulsed on both sides, and bites her tongue. *Urine*.—Sp. gr. 1020, acid, no sugar, no albumen. *General condition of eye*.—Prominence, normal; irides, violet-blue; pupils, R. 8, L. 8, sluggish. *Ophthalmoscopic examination*.—Right eye: O. D. well defined by a circle of pigment; it is of a deep-red tint, and has no central white spot; the veins are enormously dilated; arteries large, and very numerous. Left eye: O. D. well-defined, of a deep-red tint, and having a small central white spot; the veins are enormously dilated, and the arteries large and very numerous. *Remarks*.—Has not had any treatment.

CASE 5.—E. C—, F., æt. 52, admitted Jan. 11th, 1865. *General condition*.—Became epileptic when she was twenty-three years of age. After this she had fits of a severe character, about once a month, but they did not occur at the same time as menstruation. During the last five years she has not had a fit, nor has she menstruated during that period. She is now an intelligent and orderly patient, not being subject to the attacks of violent excitement from which she formerly suffered. *Urine*.—Sp. gr. 1016, acid, no sugar, no albumen. *General condition of eye*.—Prominence, eyeballs retracted; irides, grey; pupils, R. 4, L. 4, active. *Ophthalmoscopic Examination*.—Right eye: O. D. indistinct at the margins, and nearly the same tint as the choroid. There is a small central white spot. the veins are of a medium size, slightly tortuous; arteries small. Left eye: O. D. slightly indistinct at the margin of a deep red tint, and having a central white spot; the veins a medium size; arteries a fair size. *Remarks*.—Has not taken any medicine.

CASE 6.—R. H—, F., æt. 31, admitted April 4th, 1871. *General condition*.—When twenty years of age she became epileptic, and says that the first fit was as severe as any she has had since. She is convulsed on both sides as a rule, but at times only on one. Has mitral disease, but otherwise is in good bodily health. The fits occur every day, and in greater number at each menstrual period. Her mental state is that of slight dementia, with frequent attacks of excitement. *Urine*.—Sp. gr. 1018, acid, no albumen, no sugar. *General condition of eye*.—Prominence, normal; irides, violet blue; pupils, R. 6, L. 6, active. *Ophthalmoscopic examination*.—Right eye: O. D. of a darkish pink colour; veins a medium size; arteries numerous, and of good size. Left eye: O. D. smaller, and slightly paler than the right; veins a medium size; arteries numerous. *Remarks*.—Has not yet been subject to any kind of medication. Only had one fit since admission.

CASE 7.—E. G—, F., æt. 26, admitted Nov. 20th, 1869. *General condition*.—Became epileptic when five years of age, the first fit being followed by left hemiplegia which now exists, there being permanent contraction of the left hand. Her fits were very frequent and severe, but have been greatly mitigated by treatment with the bromide of potassium. On her admission she was stupid and unintelligent, but is now possessed of a fair amount of intelligence, although at rare intervals she becomes violent. Fits have no connection with the menstrual function. *Urine*.—Sp. gr. 1010, acid, no albumen, no sugar. *General condition of eye*.—Prominence, normal; irides, brown; pupils, R. 5½, L. 5½, sluggish. *Ophthal-*

oscopic examination.—Right eye: O. D. large, and well defined by a narrow white rim, the rest of the disc being of a medium pink colour; veins large; arteries small, and numerous. Left eye: O. D. smaller than the right, and like it, defined by a white rim; the veins are of a medium size; arteries numerous. *Remarks.*—She has taken bromide of potassium.

CASE 8.—C. M.—, F., æt. 35, admitted March 25th, 1855. *General condition.*—Has been epileptic since birth; on her admission the fits were most frequent and severe at the menstrual periods; of late they have occurred almost every day. She is convulsed on both sides and bites her tongue. Formerly she was subject to frequent attacks of excitement, accompanied by great violence; but during the intervals possessed considerable intelligence. She has, however, slowly become stupid and demented, and is now never excited in the slightest degree. *Urine.*—Sp. gr. 1025, acid, no albumen, no sugar. *General condition of eye.*—Prominence, slightly increased; irides, brown; pupils, R. 5, L. 5, sluggish. *Ophthalmoscopic examination.*—Right eye: O. D. medium size, of a pale pink tint; veins of a medium size; arteries large. Left eye: O. D. well defined, and slightly darker than the right, there is a slight central white spot; arteries and veins as in the right. *Remarks.*—Has not taken medicine since her admission.

CASE 9.—A. S.—, F., æt. 34, admitted Sept. 22nd, 1855. *General condition.*—Became epileptic soon after birth. The fits have not been so frequent of late, and never seem to bear any relation to the menstrual function. When taking bromide of potassium she seldom has a fit, and is more intelligent and less violent. She is convulsed on both sides. *Urine.*—Sp. gr. 1018, acid, no albumen, no sugar. *General condition of eye.*—Prominence, normal; irides, greyish brown; pupils, R. 7, L. 7, active. *Ophthalmoscopic examination.*—Right eye: O. D. of a transparent pink tinge, and having a small central white spot; veins of medium size; arteries small, not very numerous. Left eye: O. D. of a transparent pink tint, the central white spot is larger than in the right; veins of fair size; arteries smaller than in the right. *Remarks.*—Is taking the bromide of potassium and with benefit.

CASE 10.—A. G.—, F., æt. 37, admitted Jan. 30th, 1869. *General condition.*—Has been epileptic since birth, the fits not having been so severe in their nature since her children were born. For about a year after her admission she had fits very frequently, almost every day, but under the bromide these have been slowly reduced in number until during the last twelve months she has only had fits on two occasions, and then had nine in one day, remaining very stupid for several days. *Urine.*—Sp. gr. 1035, acid, no albumen, no sugar, a copious deposit of lithates. *General condition of eye.*—Prominence, normal; irides, brown; pupils, R. 5, L. 5, active. *Ophthalmoscopic examination.*—Right eye: O. D. well defined, of a light pink tint, and transparent appearance; veins rather large; arteries of fair size, and numerous. Left eye: O. D. well defined, of a pink tint, and transparent appearance, the inner half being the lighter; veins of good size; arteries numerous. *Remarks.*—Has taken the bromide of potassium and with a beneficial result.

CASE 11.—M. B.—, F., æt. 32, admitted Oct. 31st, 1867. *General condition.*—Has been epileptic since birth. Her fits are now very frequent and severe. She falls down suddenly, giving no warning. The menstrual function seems to have no influence on them. Is demented, and ever ready to fight on slight provocation. *Urine.*—Sp. gr. 1025, no albumen, no sugar. *General condition of eye.*—Promi-

nence, normal; irides, grey; pupils, R. 6, L. 6, sluggish. *Ophthalmoscopic examination*.—Right eye: O. D. rather small and of a deep red tint; veins rather large; arteries numerous, there being a great number of small twigs springing from the edge of the disc, which has no central white spot. Left eye: O. D. small, but rather larger than the right; veins dilated and tortuous; arteries very numerous; no central white spot; the disc being of a deep red tint. *Remarks*.—Has not received any medical treatment.

CASE 12.—J. H—, F., æt. 59, admitted Feb. 22nd, 1871. *General condition*.—Her first fit occurred about two years ago, and for about sixteen months after that she had frequent attacks, having as many as seven or eight fits in a day. Since her admission she has had very few fits, and her mental condition has improved, as she is now orderly although demented. *Urine*.—Sp. gr. 1016, acid, no albumen, no sugar, copious deposit of lithates. *General condition of eye*.—Prominence, normal; irides, grey; pupils, R. 3, L. 3½, inactive. *Ophthalmoscopic examination*.—Right eye: O. D. of medium size, pale yellowish pink colour; the veins are small; the arteries thready and not numerous; the choroid near the disc is of a deepish muddy colour, otherwise normal. Left eye: O. D. smaller than the right, but of a paler tint; veins small; arteries thready; no disease of choroid. *Remarks*.—Has taken bromide since her admission.

CASE 13.—M. R—, F., æt. 40, admitted Sept. 28th, 1867. *General condition*.—Has been epileptic since childhood. The fits, which were very severe, are now milder and more infrequent, seldom occurring during the day. She is very demented and perfectly unable to take care of herself. Is convulsed on both sides and gives no warning. *Urine*.—Sp. gr. 1025, acid, no albumen, no sugar, contains lithates when fits are occurring. *General condition of eye*.—Prominence, normal; irides, grey; pupils, R. 6, L. 6, inactive. *Ophthalmoscopic examination*.—Right eye: O. D. oval in shape, and slightly irregular in outline; of a medium pink tint, and somewhat hazy; veins are very much dilated, but do not contain very dark blood; arteries small, the lower ones tortuous. Left eye: O. D. very ragged and irregular at inner side and whiter than the right; veins of large size; arteries medium sized and more numerous than in the right; choroid of a deep tint. *Remarks*.—Has taken the bromide, but with little benefit.

CASE 14.—M. S—, F., æt. 27, admitted June 4th, 1869. *General condition*.—Became epileptic during her first menstrual period, and for many years never had fits at any other time. Before her admission she had the fits during the day, but a long course of bromide has reduced the number, and now they only occur occasionally in the night, and just before the menstrual period. Irritable and peevish, with occasional attacks of violence of which she retains no recollection. *Urine*.—Sp. gr. 1015, acid, no albumen, no sugar, some lithates. *General condition of eye*.—Prominence, normal; irides, dark blue; pupils, R. 5, L. 5, sluggish. *Ophthalmoscopic examination*.—Right eye: O. D. slightly oval, of a medium pink tint and transparent appearance; veins of medium size and very numerous; arteries large and very numerous; all the vessels are tortuous and much branched. Left eye: O. D. well defined, of a pale pink tint, and transparent appearance; veins are rather larger than in the right, and are tortuous and much branched; arteries are of large size; the inner side of the disc is the whitest but of a yellowish tint. *Remarks*.

—Says that she has had two fits during the night, and has a bad headache now in consequence; has a well-marked bromide eruption on face.

CASE 15.—S. A. S—, F., admitted Dec. 5th, 1867. *General condition*.—Became epileptic when eight years of age, and since then she has had about two or three fits every day. They are not more frequent at the menstrual period. She is of feeble mental power, and becomes at times greatly excited. Is convulsed on both sides and bites her tongue. *Urine*.—Sp. gr. 1018, slightly alkaline, no albumen, no sugar. *General condition of eye*.—Prominence, normal; irides, light brown; pupils, R. 5, L. 5, sluggish. *Ophthalmoscopic examination*.—Right eye: O. D. of large size and transparent pink appearance; there are numerous small vessels proceeding from all parts of the disc; veins all large, numerous, and much branched; arteries large and tortuous. Left eye:—O. D. well defined and of a transparent pink tint; there is a small central white spot, and the inner side is whiter than the outer; veins large and much branched; arteries of good size, having a double outline and being much branched. *Remarks*.—Had two fits a few hours ago; has not taken any medicine for some years.

CASE 16.—L. H—, F., æt. 34, admitted Aug. 8th, 1868. *General condition*.—She has been epileptic since she was twenty. Since then she has had frequent fits, but they are recorded as being most numerous and severe at the menstrual period. She is very much demented, and is at times subject to attacks of violent excitement. *Urine*.—Sp. gr. 1015, acid, no albumen, no sugar. *General condition of eye*.—Prominence, normal; irides, blue; pupils, R. 4, L. 4, sluggish. *Ophthalmoscopic examination*.—Right eye: O. D. of large size and transparent pink tint (rather deep); veins are of medium size, tortuous, and much branched; arteries large and having a double outline; a great number of very fine vessels proceed from the edge of the disc; choroids are of a deep tint. Left eye: O. D. defined at the outer side by a rim of dark pigment; has a deep pink tint and no central white spot; veins are large, very tortuous on some of their branches, and also numerous; arteries numerous, of fair size, and much branched. *Remarks*.—Has not taken any medicine for some time past; when excited has derived benefit from the ergot treatment.

CASE 17.—B. H—, F., æt. 30, admitted April 4th, 1870. *General condition*.—Has fits most severely and frequently at each menstrual period; is convulsed on both sides, and bites her tongue. In the intervals she has a few slight fits, and becomes greatly excited after them, being as a rule quiet and stupid. *Urine*.—Sp. gr. 1025, acid, no albumen, no sugar. *General condition of eye*.—Prominence, normal; irides, blue; pupils, R. 4, L. 4, sluggish. *Ophthalmoscopic examination*.—Right eye: O. D. is small, of irregular oval shape, and of a deep pink tint, hardly distinguishable from surrounding choroid. Its centre has a minute yellowish-white spot; veins very numerous, slightly tortuous, and much branched; arteries of medium size, and very numerous; choroidal glow light. Left eye: O. D. has a small white central spot, the rest of the disc is of a deep red tint, slightly hazy, but well defined. Veins are very numerous, greatly dilated, and somewhat tortuous; arteries very numerous, and of small size; choroidal glow light. *Remarks*.—Has occasionally taken ergot for excitement, but has not been subjected to any systematic treatment for the fits.

CASE 18.—E. W—, F., æt. 34, admitted Jan. 20th, 1871. *General condition*.—Has been epileptic since she was five years of age. The fits occur almost every day, and bear no relation to her menstrual function. She is convulsed on both sides, and very severely. Is very stupid and quarrelsome at all times, and occasionally wild and violent. *Urine*.—Sp. gr. 1012, acid, no albumen, no sugar. *General condition of eye*.—Prominence, normal; irides, brown; pupils, R. 5, L. 5, sluggish. *Ophthalmoscopic examination*.—Right eye: O. D. is slightly oval in shape, of a deep red tint, and having a small yellowish-white central spot. Veins are of medium size, and tortuous in their larger branches, but numerous small veins spring from the edge of the disc; arteries small and numerous; choroidal glow dark. Left eye: O. D. smaller than the right, and of a deeper red tint; it has no excavation spot, but is generally of a transparent appearance; veins are of medium size, somewhat branched; arteries small and numerous. *Remarks*.—Has been treated by ergot for a short time only.

CASE 19.—E. L—, F., æt. 37, admitted Oct. 19th, 1865. *General condition*.—Became epileptic after the first few menstrual periods. The fits, which occur generally during the night, are most severe and numerous at the menstrual periods. She is greatly demented, and at times violent. *Urine*.—Sp. gr. 1020, acid, no albumen, no sugar. *General condition of eye*.—Prominence, normal; irides, blue; pupils, R. 5, L. 5, sluggish. *Ophthalmoscopic examination*.—Right eye: O. D. slightly oval, defined to inner side by a narrow white zone, the rest of the disc being of a pink tint, palest in its inner half; veins are of medium size, branched, and somewhat angular; arteries are small, but not very numerous. Left eye: O. D. has an outer zone of a deepish pink tint, and a central yellowish-white spot: veins of large size, and somewhat tortuous; arteries are numerous, but not tortuous. *Remarks*.—Has not taken any medicine for a long time.

CASE 20.—M. A. B—, F., æt. 28, admitted Jan. 23rd, 1865. *General condition*.—Became epileptic at twenty-one years of age; the fits for some years occurred only at the menstrual periods, and were accompanied by erotic propensities. Of late, however, they have become more frequent, and occur never seldomer than once a fortnight. She is somewhat demented and quarrelsome, and at times becomes very violent. *Urine*.—Sp. gr. 1010, acid, no albumen, no sugar. *General condition of eye*.—Prominence, normal; irides, brown; pupils, R. 4, L. 4, active. *Ophthalmoscopic examination*.—Right eye: O. D. is round and well defined, of a deep pink tint, and transparent appearance; the veins are of medium size, and tortuous where they pass over the disc; arteries are small, but numerous; choroid dark. Left eye: O. D. is a deep red tint, and somewhat hazy; veins are of a larger size than those in the right; arteries are of small size, and numerous; many are seen to spring from the edge of the disc. *Remarks*.—Has taken bromide at various times, but with little good effect.

CASE 21.—A. L—, F., æt. 24, admitted Nov. 20th, 1868. *General condition*.—Has been epileptic since birth, and has had fits frequently since; indeed, almost every two or three days, but they are said to be most frequent at the menstrual periods. She is greatly demented, and at times very much excited. *Urine*.—Sp. gr. 1020, acid, no albumen, no sugar. *General condition of eye*.—Prominence, normal; irides, greenish-grey; pupils, R. 5, L. 5, sluggish. *Ophthalmoscopic ex-*

amination.—Right eye: O. D. round, of a deep uniform pink tinge, and slightly hazy to outer side; veins are of medium size, and somewhat numerous; arteries are of small size, and numerous. Left eye: O. D. defined, somewhat hazy, and of a deep pink tint; veins are numerous, and much branched; arteries also numerous, small, and branched; choroid of a deep tint. *Remarks*.—Has not had any medicine for a considerable time.

CASE 22.—E. W—, F., admitted Oct. 18th, 1868. *General condition*.—Has been epileptic since birth, but the fits became much more severe after the first menstrual period. Since her admission she has not improved in any respect, although she has taken medicine of one kind or another ever since her admission. She is stupid and demented, and very seldom excited. *Urine*.—Sp. gr. 1025, acid, no albumen, no sugar. *General condition of eye*.—Prominence, eyes sunken; irides, blue; pupils, R. 4, L. 4, sluggish. *Ophthalmoscopic examination*.—Right eye: O. D. small, of a deep pink tint, but rather pale to the inner side; veins are of medium size, tortuous, and much branched; arteries are also numerous and branched. Left eye: O. D. rather larger than the right, of a deep red tint, but transparent appearance; veins are of large size, and much branched; arteries very numerous; choroidal glow dark. *Remarks*.—Has been treated, but with little or no benefit.

CASE 23.—E. N—, F., æt. 40, admitted April 6th, 1864. *General condition*.—Has been epileptic since birth. Her fits now occur at intervals of a few weeks, and are not so severe in character as they used to be. She is demented, and at all times quarrelsome. At times becomes excited and very violent. Has a conical shaped head and stupid expression. *Urine*.—Sp. gr. 1018, acid, no albumen, no sugar. *General condition of eye*.—Prominence, eyeballs slightly retracted; irides, blue; pupils, R. 4, L. 4, active. *Ophthalmoscopic examination*.—Right eye: O. D. oval, with its long axis upwards, of a deep red tint in the centre, but of a grey round the edge; veins are of medium size, and small number; arteries are small and few in number. Left eye: O. D. of a greyish and pink tinge, somewhat hazy and indistinct at the margins; veins are of medium size; arteries small. *Remarks*.—Has had bromide treatment some time ago, and with benefit.

CASE 24.—B. J—, F., æt. 38, admitted March 13th, 1865. *General condition*.—Has been epileptic since seven or eight years of age. The fits now occur in groups of ten or twelve at intervals of a fortnight. She is convulsed on both sides, bites her tongue, and remains in a very stupid condition for some time after the fits. Her mental state is that of almost complete dementia, varied by occasional outbreaks of violent mania. *Urine*.—Sp. gr. 1020, acid, no albumen, no sugar. *General condition of eye*.—Prominence, sunken; irides, brown; pupils, R. 5, L. 5, sluggish. *Ophthalmoscopic examination*.—Right eye: O. D. small and somewhat oval, of a hazy red tint; veins are numerous, and of medium size, springing from all parts of the disc; arteries are very numerous. Left eye: O. D. somewhat irregular in shape, and of a pale pink tint; veins of medium size, and much branched; arteries numerous and small; choroid of medium tint. *Remarks*.—Has not had any treatment for some years.

CASE 25.—E. G—, F., æt. 23, admitted Nov. 23rd, 1870. *General condition*.—Became epileptic at thirteen years of age, at the time of the first menstruation. After

marriage the fits became more frequent and severe. They generally occur during the night, when she is convulsed on both sides, and bites her tongue. She is demented, and at times violent. *Urine*.—Sp. gr. 1020, acid, no albumen, no sugar. *General condition of eye*.—Prominence, normal; irides, blue; pupils, R. 4, L. 4, active. *Ophthalmoscopic examination*.—Right eye: O. D. small, slightly oval, and of a medium pink tint, slightly hazy; veins are of medium size and numerous; arteries small but somewhat numerous. Left eye: O. D. is small, of a deep red tint, and slightly hazy; veins are rather large and tortuous; arteries are numerous and small. *Remarks*.—Has improved greatly under the bromide treatment.

CASE 26.—E. H—, F., æt. 30, admitted Sept. 26th, 1868. *General condition*.—The first fit occurred when she was two or three years of age. They have slowly become more severe, and occur in greatest number at the menstrual period. She is convulsed on both sides, and bites her tongue. Her general mental condition is that of dementia, and she becomes occasionally very greatly excited and violent. *Urine*.—Sp. gr. 1025, acid, no albumen, no sugar. *General condition of eye*.—Prominence, normal; irides, greenish-grey; pupils, R. 5, L. 5, sluggish. *Ophthalmoscopic examination*.—Right eye: O. D. is well defined, of a transparent pink tint; veins numerous and of medium size—they proceed from all parts of the disc; arteries are of fair size, and a number of small ones spring from the edge of the disc. Left eye: O. D. is of a transparent pink tint and well defined; the veins, which are of medium size, ramify in all directions, and are slightly tortuous; arteries are numerous, and spring from all parts of the disc. *Remarks*.—Under the ergot treatment she has greatly improved; the fits of violence have become very rare.

CASE 27.—E. A—, F., æt. 32, admitted Feb. 2nd, 1869. *General condition*.—She almost every day has two or three fits, and about once a month, for a few days, she will have as many as six in the day, and this is usually at the menstrual period. She is always stupid and demented, but never excited. *Urine*.—Sp. gr. 1012, acid, no albumen, no sugar. *General condition of eye*.—Prominence, eyes sunken; irides, dark blue; pupils, R. 4, L. 4, sluggish. *Ophthalmoscopic examination*.—Right eye: O. D. small, of a red colour, and slightly hazy; veins are of medium size and numerous; arteries very numerous and of good size, springing from all sides of the disc. Left eye: O. D. slightly oval, of a deep red tint, and transparent appearance; veins are larger than in the right; arteries very numerous, and spring, in many cases, from the edge of the disc. Choroids contain but little pigment. Vasa vorticiosa are very well seen. *Remarks*.—Has not had any treatment for the fits during the last few years.

CASE 28.—C. I—, F., æt. 35, admitted July 25th, 1865. *General condition*.—Has been epileptic since birth, but the fits did not become very severe or frequent until after her marriage, which took place when she was fifteen years of age. They now occur in greatest number and are most severe at the menstrual period. She is very stupid, and excited at times, and, as a rule, her intelligence is not very great. *Urine*.—Sp. gr. 1025, acid, no albumen, no sugar. *General condition of eye*.—Prominence, normal; irides, dark blue; pupils, R. 6, L. 6, sluggish. *Ophthalmoscopic examination*.—Right eye: O. D. is of small size, well defined, and of a deep red tint, except to the inner side; veins are large, somewhat tortuous, and nume-

rous; arteries are small, and not numerous; the double outline can be traced in nearly all. Left eye: O. D. is ill defined at its upper margin, where there is a small, irregular, white patch, probably congenital; disc of a red tint and transparent appearance; veins are numerous, dilated, and tortuous; arteries of medium size and tortuous. *Remarks.*—About a year ago she took the bromide for some time, and then the fits became less frequent and severe; but she refused to take any more, so it was omitted.

CASE 29.—A. S—, F., æt. 29, admitted Dec. 23rd, 1867. *General condition.*—Duration of epilepsy unknown. Now has fits once a month at the menstrual period, when they are numerous and very severe. She is convulsed on both sides, and bites her tongue. Is greatly demented, and at times much excited and violent. *Urine.*—Sp. gr. 1018, acid, no albumen, no sugar. *General condition of eye.*—Prominence, normal; irides, grey; pupils, R. 3, L. 3, active. *Ophthalmoscopic examination.*—Right eye: O. D. is small, and of a transparent pink tint; veins are large and numerous, being somewhat wavy; arteries, of medium size but very numerous, spring from the edge of the disc on all sides. Left eye: O. D. is very small, and of a red tint; veins very large and numerous; arteries numerous but small. Choroid in both eyes deeply pigmented, so that the globe is of a yellowish-brown tint.

CASE 30.—M. A. J—, F., æt. 32, admitted Dec. 7th, 1870. *General condition.*—The fits occur in greatest number, and are most severe in character, at each menstrual period, but she has fits of a slighter character during the intervals. Is always demented and quarrelsome, but at times becomes very violent, the violence being most marked when the fits are slightest. *Urine.*—Sp. gr. 1020, acid, no albumen, no sugar. *General condition of the eye.*—Prominence, normal; irides, blue; pupils, R. 4, L. 4, sluggish. *Ophthalmoscopic examination.*—Right eye: O. D. small, and of a deep red tint, surrounded by a narrow zone of a woolly pink aspect, giving an indistinct margin to the disc; veins are numerous and of medium size; arteries are numerous, of medium size, and spring from all sides of the disc. Left eye: O. D. of a deep pink tint and transparent appearance, having a lunette to the inner side; veins of medium size, somewhat tortuous and numerous; arteries numerous. *Remarks.*—Myopic. Has only taken the extract of ergot at times for excitement.

CASE 31.—E. A. B—, F., æt. 34, admitted April 23rd, 1868. *General condition.*—The fits, which are not severe, occur at any time during both day and night, and do not seem to have any relation to the menstrual period. She is greatly demented and dirty in her habits at all times, but is also occasionally violent. *Urine.*—Sp. gr. 1025, acid, no albumen, no sugar. *General condition of eye.*—Prominence, normal; irides, brown; pupils, R. 6, L. 6, sluggish. *Ophthalmoscopic examination.*—Right eye; O. D. of good size, well defined, and having a bright central spot, the remainder being of a transparent pink tint; veins are large, but not numerous; arteries small. Left eye: O. D. has a bright central spot, but is otherwise of a red tint, darker than the right; veins are of medium size and more numerous than in the right; arteries numerous and small.

CASE 32.—E. H—, F., æt. 24, admitted Oct. 18th, 1862. *General condition.*—Has been epileptic since birth. The fits are said to have been more frequent at

the menstrual periods, when she becomes very violent. She now has fits frequently and of a severe character, having no relation to the menstrual period. She is always very stupid and dirty in her habits, and at times very violent in her conduct. *Urine*.—Sp. gr. 1020, acid, no albumen, no sugar. *General condition of eye*.—Prominence, normal; irides, blue; pupils, R. 4, L. 4, sluggish. *Ophthalmoscopic examination*.—Right eye: O. D. is of a transparent pink tint, darker to the outer side; veins are numerous and of medium size; arteries are small and numerous. *Remarks*.—Has not been treated lately.

CASE 33.—M. T., F., æt. 25, admitted Dec. 22nd, 1862. *General condition*.—Has been epileptic since she was ten years of age, she fell down and was convulsed during the first fit, but was not so long confused after the fit then as now. The number of fits vary, but seem to bear no relation to the menstrual function. She is convulsed on both sides. Her mental condition is dull and stupid, dementia characterised by peevish temper and occasional violence. *Urine*.—Sp. gr. 1020, acid, no albumen, no sugar, slight cloud of lithates. *General condition of eye*.—Prominence, normal; irides, greenish grey; pupils, R. 6, L. 6, sluggish. *Ophthalmoscopic examination*.—Right eye: O. D. has a small central white spot, is well defined, and of a transparent pink tint; veins are of small size; arteries very small and numerous. Left eye: O. D. is defined, slightly smaller than the right, of a transparent pink tint; veins are larger and more numerous than in the right; arteries small and numerous; choroidal glow in both eyes light. *Remarks*.—Bromide of potassium has reduced the number of fits.

CASE 34.—M. L., F., æt. 30, admitted Dec. 10th, 1868. *General condition*.—Became epileptic about four years ago after being frightened by a person dressed up as a goat. Before coming to the Asylum she usually had fits in the daytime, but now they occur during the night and seldom in the day, no relation to the menstrual period being observed. She is convulsed on both sides. Mentally is irritable and of violent temper. *Urine*.—Sp. gr. 1015, acid, no albumen, no sugar. *General condition of eye*.—Prominence, normal; irides, blue-grey; pupils, R. 5, L. 5, sluggish. *Ophthalmoscopic examination*.—Right eye: O. D. slightly oval, well defined, and of a transparent red tint; veins are dilated and much branched; arteries numerous and of fair size. Left eye: O. D. is of a pink tint, and has to its inner side a white lunette; veins are dilated; arteries numerous, and of medium size; choroids are deficient in pigment, and show vasa vorticiosa. *Remarks*.—Myopic. This patient has grey hair, and tells me that it became so first when she was twelve years of age. Her father she does not remember, but her maternal grandfather had grey hair at twelve years of age. Her mother had grey hair at the same time. An only brother had grey hair at the same age; all had blue-grey eyes. Two sisters of her mother also had the same grey hair and eyes.

CASE 35.—A. J., F., æt. 30, admitted Jan. 6th, 1862. *General condition*.—Became epileptic at eleven years of age, the fits consisting then simply in loss of consciousness unattended either by fall or convulsion. Of late years she has always fallen, but has been only slightly convulsed, the movements being more attempts to arrange her clothing than actual atonic convulsions. She is simple-minded, has a bad memory, and is at all times ready to fight upon the slightest provocation. *Urine*.—Sp. gr. 1018, acid, no albumen, no sugar. *General condition of*

eye.—Prominence, normal; irides, grey; pupils, R. 4, L. 4, active. *Ophthalmoscopic examination*.—Right eye: O. D. is small, has a very minute central white spot, and is generally of a deep pink tint and transparent appearance; veins rather large, but not numerous; arteries are of good size, and have the same distribution as the veins. Left eye: O. D. has a small central white spot, the remainder being of a deep red tint and transparent appearance; veins are of medium size, tortuous, and more numerous than in the right; arteries as in the right.

CASE 36.—M. L.—, F., æt. 38, admitted July 10th, 1863. *General condition*.—No information as to when she became epileptic. Has a few fits every six weeks, and these are only of a mild character, and unattended by convulsion. She simply falls down in an unconscious state, which lasts a few moments only. She is very stupid, and quite unable to attend to her personal wants. *Urine*.—Sp. gr. 1020, acid, no albumen, no sugar. *General condition of eye*.—Prominence, normal; irides, dark blue; pupils, R. 5, L. 5, sluggish. *Ophthalmoscopic examination*.—Right eye: O. D. very small, and indistinct at the margins, of a deep red tint, and having a minute central spot of a pale pink tint; veins are small, but tortuous, numerous, and much branched; arteries numerous, but small. Left eye: O. D. smaller than the right, of a deep red tint, somewhat irregular in shape, and having a spot of black pigment to the inner side; veins are small, tortuous, and numerous; arteries very small, and somewhat numerous.

CASE 37.—M. J. H.—, F., æt. 32, admitted March 16th, 1870. *General condition*.—Became epileptic when eighteen years old. Has since had fits at the menstrual periods, when she has had as many as ten in a day. Soon after her admission the number of the fits diminished, and now she only has one or two at each menstrual period. She is fairly intelligent, but very hypochondriacal, and at rare intervals violent. *Urine*.—Sp. gr. 1025, acid, no albumen, no sugar. *General condition of eye*.—Prominence, normal; irides, brown; pupils, R. 4, L. 4, active. *Ophthalmoscopic examination*.—Right eye: O. D. somewhat oval, of a delicate pink tint to the outer side, and nearly white in the remaining part; the whole being of a transparent appearance; veins are of medium size, arteries also of medium size, and not numerous. Left eye: O. D. small, indistinct at the margins, the central part is pink, and the remainder slowly shades off into white; veins are very small, tortuous, and numerous; arteries numerous, and small.

CASE 38.—R. H.—, F., æt. 28, admitted Nov. 20th, 1868. *General condition*.—Became epileptic some five years ago through "disappointment in love." Has since had fits of great severity at each menstrual period. Is still demented, and at times very greatly excited. *Urine*.—Sp. gr. 1025, acid, no albumen, no sugar. *General condition of eye*.—Prominence, normal; irides, hazel-brown; pupils, R. 4, L. 4, active. *Ophthalmoscopic examination*.—Right eye: O. D. is slightly oval, of a pink tint, and transparent appearance; there is a lunette of a bright white colour to the inner side; veins are of medium size; arteries of medium size, and numerous. Left eye: O. D. small, of a pink tint, and having a lunette of bright white to the inner side; veins are of medium size, and tortuous; arteries small, but very numerous. *Remarks*.—Has taken bromide with marked benefit.

CASE 39.—M. N.—, F., æt. 33, admitted Feb. 10th, 1871. *General condition*.—Became epileptic when twenty years of age, and has had fits almost every day

since. They have been most numerous and severe at the menstrual period. She is convulsed on both sides, and bites her tongue. She is greatly demented, and at all times ready to quarrel; is also very hypochondriacal. *Urine*.—Sp. gr. 1018, acid, no albumen, no sugar. *General condition of eye*.—Prominence, normal; irides, violet; pupils, R. 4, L. 4, sluggish. *Ophthalmoscopic examination*.—Right eye: O. D. is indistinct at the margins, of a pale transparent pink tint; veins are of medium size, but somewhat tortuous; arteries small, but numerous. Left eye: O. D. is small, of a transparent appearance, and pink tint; veins are of a medium size, and more numerous than in the right; arteries are small, but numerous. *Remarks*.—Has derived great benefit from the bromide treatment, which was commenced soon after her admission.

CASE 40.—M. O—, F., æt. 40, admitted July 5th, 1865. *General condition*.—Has been epileptic since birth. Since then they have occurred almost every day, and have been of a severe character. Have been most numerous at the menstrual periods, but as these seem more on the decline, she has not had so many fits. *Urine*.—Sp. gr. 1012, acid, no albumen, no sugar. *General condition of eye*.—Prominence, normal; irides, iris is adherent to the cornea by means of a cicatrix in the latter following a wound; pupils, R. 4, L. 4, active. *Ophthalmoscopic examination*.—Right eye: O. D. is of a deep red tint, with a minute white central spot; veins of medium size, and numerous; arteries of fair size, and numerous. *Remarks*.—Has not had any medical treatment for some years.

CASE 41.—A. D—, F., admitted March 2nd, 1860. *General condition*.—Has been epileptic since soon after her birth; and has almost always been strongly convulsed on both sides. She has the greatest number of fits just before each menstrual period. She is considerably demented, but still possesses considerable intelligence. At long intervals she has attacks of great excitement, and has generally a peevish and uneven temper. *Urine*.—Sp. gr. 1025, acid, no albumen, no sugar. *General condition of eye*.—Prominence, slightly prominent; irides, yellowish-brown; pupils, R. 3, L. 3, sluggish. *Ophthalmoscopic examination*.—Right eye: O. D. slightly oval and indistinct to inner side, and of a deep transparent pink, the central portion being lighter than the rest; veins are very numerous and large, but not tortuous; arteries of fair size and double outline; numerous small vessels proceed from the edge of the disc. Left eye: O. D. well defined, and having a narrow white rim to the inner side, the remainder being of a deep pink tint; the veins are very much dilated and full of dark blood; arteries of fair size; there are a number of large vessels (veins) proceeding from the edge of the disc. *Remarks*.—Complains of headache, and says that she has had two fits during the day. Has been treated by bromide of potassium some time ago.

CASE 42.—M. H—, F., æt. 22, admitted Dec. 19th, 1870. *General condition*.—Became epileptic when she was twelve years of age. She has now a great number of fits at every menstrual period, both during the day and the night. She is then greatly excited, very violent, and at the same time stupid and only half conscious. She is convulsed on both sides, and gives notice of the approach of the fit by a cry. *Urine*.—Sp. gr. 1035, acid, no albumen, no sugar, copious deposit of lithates. *General condition of eye*.—Prominence, normal; irides, brown; pupils, R. 2½, L. 2½, inactive. *Ophthalmoscopic examination*.—Right eye: O. D. well defined, of

a pale transparent pink tint, and having a fair-sized central yellowish white spot; veins of large size and very tortuous; arteries of medium size and numerous; very few vessels spring from the edge of the disc. Left eye: O. D. round and well defined, of a deep red tint, but transparent appearance; there is a central yellowish-white spot, and more arteries spring from the edge of this disc than the right; veins are large and very tortuous, also in large number. *Remarks.*—Has derived benefit when excited from a free use of the extract of ergot.

CASE 43.—M. H—, F., æt. 30, admitted March 13th, 1869. *General condition.*—The fits occur every night just as she is falling asleep, and for a few days at each menstrual period she has a great number, and becomes very violent, being only semi-conscious. She is at these times very suicidal. She is a very weak-minded girl, and unable to do work of any kind. *Urine.*—Sp. gr. 1018, acid, no albumen, no sugar. *General condition of eye.*—Prominence, normal; irides, dark blue; pupils, R. 4, L. 4, sluggish. *Ophthalmoscopic examination.*—Right eye: O. D. oval, and having a lunette of a very white tint to the inner side, the rest of the O. D. is of a deep red and rather dull; veins small and of nearly equal size with the arteries. Left eye: O. D. round, and also having a white lunette of small size to inner side, the rest of the O. D. being of a deep pink tinge; the veins are small and numerous; the arteries numerous and of fair size. *Remarks.*—Has taken ergot at times for excitement.

CASE 44.—E. A. W—, F., æt. 26, admitted Oct. 25th, 1870. *General condition.*—On her admission she had fits every day, and was very violent. Now she only has them at each menstrual period, and then is not so violent. She is perfectly demented, and does not remember the most elementary facts. She is convulsed on both sides, and gives no warning. *Urine.*—Sp. gr. 1020, acid, no albumen, no sugar. *General condition of eye.*—Prominence, normal; irides, brown; pupils, R. 4, L. 4, sluggish. *Ophthalmoscopic examination.*—Right eye: O. D. well defined, of a large size, and having a fair-sized central white spot; veins are of medium size, and not tortuous; arteries are small; there is a zone of pale choroid, most marked to outer side of O. D. Left eye: O. D. perfectly round and well defined, having a large central yellowish white spot; veins are of medium size, but more numerous than in the right; arteries small; in this eye there is also a zone of pale choroid round O. D. *Remarks.*—Has been treated at times for excitement by the extract of ergot.

CASE 45.—J. S—, F., æt. 28, admitted Jan. 1st, 1870. *General condition.*—Five years ago, after her first confinement, she had her first fit. Fits then occurred about every three months at a menstrual period, and just before her admission they became very severe, and have occurred ever since at each menstruation. Has been treated by bromide, and now the fits are neither so severe nor so frequent. Her mental condition has improved; although she is still slightly demented, she is not nearly so violent. *Urine.*—Sp. gr. 1025, acid, no albumen, no sugar. *General condition of eye.*—Prominence, normal; irides, brown; pupils, R. 4, L. 4, active. *Ophthalmoscopic examination.*—Right eye: O. D. is of a deep red colour, and has an indistinct margin, also a central white spot of small size; veins few and of medium size; arteries numerous, but very minute; choroid pale. Left eye: O. D. well defined, having a small central white spot, and being of a

deep red tint, nearly as deep as the pale choroid around it; veins are of medium size, and not numerous; arteries small, but not numerous. *Remarks.*—Has been treated by bromide of potassium, and has derived great benefit from it.

CASE 46.—A. T—, F., æt. 50, admitted Dec. 2nd, 1865. *General condition.*—Had her first fit when twenty years of age, and since then has been the subject of left hemiplegia. After this she did not have a fit until eight years ago, and since that time she has had a few convulsions at each menstrual period. *Urine.*—Sp. gr. 1020, acid, no albumen, no sugar. *General condition of eye.*—Prominence, normal; irides, brown; pupils, R. pupil dilates irregularly, owing to adhesion of the iris to capsule of lens. *Ophthalmoscopic examination.*—Right eye: O. D. small and well defined, but of a deep red tint, and somewhat hazy; veins are large and tortuous; arteries are of normal size, and have a double outline; the retina near disc is slightly hazy. Left eye: O. D. smaller than right, has ragged edges and is of a deep red colour; veins are few, but very large and tortuous; arteries are very small; this disc is more indistinct and hazy than the right. *Remarks.*—Has not had any treatment.

CASE 47.—M. A. C—, F., æt. 45, admitted Feb. 26th, 1864. *General condition.*—Generally has her fits during the night, at the rate of one or two each night. She is only convulsed on the right side, which is paralysed, with great carpo-pedal contraction. She is greatly demented, but in good bodily health, being very stout. *Urine.*—Sp. gr. 1020, acid, no albumen, no sugar. *General condition of eye.*—Prominence, normal; irides, dark brown; pupils, R. 4, L. 4, sluggish. *Ophthalmoscopic examination.*—Right eye: O. D. round and well defined, of a deep transparent pink tint; veins are of large size, somewhat tortuous and very numerous; arteries of full size, and much branched; choroidal glow dark. Left eye: O. D. of good size, and of a deep red tint, but transparent appearance; veins are of large size, tortuous, and much branched; arteries of medium size; choroid dark coloured. *Remarks.*—Has not taken any medicine for the fits.

CASE 48.—M. H—, F., æt. 25, admitted July 13th, 1869. *General condition.*—Became epileptic when fourteen years of age, at her first menstrual period; for a few years the attacks were of a very mild character, but after marriage they became more severe, and her intelligence became impaired. She is now stupid, and at times violent. *Urine.*—Sp. gr. 1020, acid, no albumen, no sugar. *General condition of eye.*—Prominence, normal; irides, dark brown; pupils, R. 4, L. 4, sluggish. *Ophthalmoscopic examination.*—Right eye: O. D. is pale to inner side, but slightly pink to the outer; veins are numerous, but of medium size; arteries are of small size, but pale; choroid pale. Left eye: O. D. is smaller than the right, but of a deeper tint; veins are rather large; arteries numerous, but small. *Remarks.*—Had two fits this morning, and is in a very bad temper. Great improvement has been derived from bromide treatment.

CASE 49.—M. V—, F., æt. 24, admitted, July 28th, 1870. *General condition.*—Has been epileptic since birth; the fits occur almost every day, and are of a severe character, but are most numerous about the menstrual period, and are accompanied

by great violence. During the intervals she is stupid, and inclined to fight on very slight provocation. *Urine*.—Sp. gr. 1012, acid, no albumen, no sugar. *General condition of eye*.—Prominence, increased; irides, brown; pupils, R. 5, L. 5, sluggish. *Ophthalmoscopic examination*.—Right eye: O. D. is well defined, has a large central excavation of a yellowish-white tint; the outer zone is of a deep pink, and the whole of transparent appearance; veins are of large size, very numerous, and the large trunks much branched; arteries rather small. Left eye: O. D., like the right, has a large central yellowish-white spot, the remainder being of a deep transparent red; veins are numerous and tortuous, but not much branched; arteries are rather larger than in the right.

CASE 50.—M. H.—, F., æt. 37, admitted Jan. 15th, 1869. *General condition*.—Has been epileptic for ten years, the first fit being as severe as any of the subsequent ones. She now has several fits of a slight nature almost every day; they do not seem to be connected in any way with the menstrual period. She is very greatly demented, and at times excited. *Urine*.—Sp. gr. 1015, acid, no albumen, no sugar. *General condition of eye*.—Prominence, normal; irides, brown; pupils, R. 4, L. 4, sluggish. *Ophthalmoscopic examination*.—Right eye: O. D. is of a pink colour with a defined margin, and having a semicircular deposit of pigment on the inner side; the arteries are very numerous, and of medium size; veins large; the choroid is of a deep red colour. Left eye: O. D. is redder, and has a well-defined edge; the veins are large, and the arteries, which are numerous, seem to be larger than usual. *Remarks*.—Has not had any treatment for the fits.

CASE 51.—A. L.—, F., æt. 29, admitted Jan. 23rd, 1868. *General condition*.—Has been epileptic since fourteen years of age. No aura. She now has fits at each menstrual period, when several will occur in one day. She is convulsed on both sides and bites her tongue. Her mental condition is that of considerable dementia with occasional attacks of great excitement. *Urine*.—Sp. gr. 1020, acid, no albumen, no sugar. *General condition of eye*.—Prominence, sunken; irides, light brown; pupils, R. 5, L. 5, sluggish. *Ophthalmoscopic examination*.—Right eye: O. D. is of a deep pink tint, and has a well-defined margin, beyond which there is a zone of a lighter colour; the veins are large, and the arteries larger than normal; choroidal glow of a bright red colour. Left eye: O. D. is red, and of oval shape; beyond the discs to the inner side there is a semicircular zone of a hazy pink colour. *Remarks*.—Has had ergot, to subdue excitement.

CASE 52.—E. B.—, F., æt. 25, admitted Dec. 7th, 1870. *General condition*.—Became epileptic when eleven years of age, at the time of the first menstruation. Since then the fits have occurred only at the menstrual period, and became more severe as she got older. Under treatment she has improved, the fits have become milder in character and fewer in number, and her mental state, although characterised still by considerable dementia, is clearer, and she is less excited. *Urine*.—Sp. gr. 1025, acid, no albumen, no sugar. *General condition of eye*.—Prominence, normal; irides, brown; pupils, R. 5, L. 5, sluggish. *Ophthalmoscopic examination*.—O. D. is ill-defined, of a dark red colour, and surrounded by a zone of a lighter colour; the veins are small, and the arteries rather smaller than usual; the cho-

roid has a deep tint. Left eye: O. D. is small, round, and of a dark colour; the veins are small, and the arteries very fine.

CASE 53.—E. S—, F., æt. 30, admitted Sept. 14th, 1867. *General condition.*—Has been epileptic since she was a year old. The fits became more severe and numerous after her first menstruation. They now occur in great number and severity at each menstrual period. She is convulsed on both sides and bites her tongue. As a rule she is demented and unintelligent, and at times becomes very violent. *Urine.*—Sp. gr. 1012, acid, no albumen, no sugar. *General condition of eye.*—Prominence; eyes sunken; irides, blue; pupils, R. 4, L. 4, sluggish. *Ophthalmoscopic examination.*—Right eye: O. D. is of a deep pink colour, and well-defined at the margin; there is a slight central white spot (physiological excavation); the veins are much dilated; the arteries numerous and of medium size; the choroid is light in tint, being only slightly darker than the disc. Left eye: O. D. slightly oval in shape, of a deep red tint, and having a medium-sized white central portion. *Remarks.*—She has been treated by the bromide, and under its influence has improved, but during the last two or three months she has not taken any medicine.

CASE 54.—M. A. G—, F., æt. 45, admitted Sept. 30th, 1868. *General condition.*—Has been epileptic since she was thirteen years of age, and since then has had a number of severe fits at each menstrual period, seldom having one during the intervals. She is demented, and at times has become greatly excited of late. *Urine.*—Sp. gr. 1014, acid, no albumen, no sugar. *General condition of eye.*—Prominence, normal; irides, greenish grey; pupils, R. 4, L. 4, active. *Ophthalmoscopic examination.*—Right eye: O. D. is of a medium pink colour; just within its outer border a black circle is observed, and there is a slight white spot in its centre; the veins are medium sized, and the arteries numerous, small, and tortuous; the choroid is of a deep tint, darkest near the disc. Left eye: O. D. the same colour as in the right, and it is surrounded by a zone of a light colour; the veins are of a medium thickness; the arteries larger, fewer, and straighter than in the right. *Remarks.*—Has greatly improved under the bromide treatment.

CASE 55.—L. M—, F., æt. 34, admitted Nov. 5th, 1863. *General condition.*—Her epilepsy commenced when she was about six years of age. The fits became more severe and frequent as she grew older, and were most numerous at the menstrual period. Her mental state has also greatly improved, and she is now no longer subject to attacks of violent mania from which she formerly suffered. *Urine.*—Sp. gr. 1020, acid, no albumen, no sugar. *General condition of eye.*—Prominence, normal; irides, dark brown; pupils R. 6, L. 6, active. *Ophthalmoscopic examination.*—Right eye: O. D. is of a pale pink colour, rather indistinct at the margin, and has slight central excavations; the veins are medium sized; the arteries rather large, but not numerous; choroidal glow dark. Left eye: O. D. of a fair size; transparent pink colour being palest at the inner side, slight central white spot; veins of medium size; arteries rather smaller and more numerous than in the right. *Remarks.*—Has improved very much under the atropine treatment. Has not had a fit for fifteen months.

CASE 56.—J. D—, F., admitted Jan. 10th, 1870. *General condition.*—Became epileptic soon after the first menstrual period, and has had a succession of rather severe fits at each period since. She is convulsed on both sides and bites her tongue. Is now fairly intelligent, but complains of feeble memory, so much so that she cannot recollect her own age. She was excited for a short period after her admission, but is now more intelligent and quiet. *Urine.*—Sp. gr. 1018, acid, no albumen, no sugar. *General condition of eye.*—Prominence, eyes exceedingly prominent; irides, dirty grey; pupils, R. 7, L. 7, active. *Ophthalmoscopic examination.*—Right eye: O. D. of a medium pink colour; no white central spot; the veins large and full, and having a double outline; arteries of large size and numerous; a great number of small arteries proceed from the edge of the disc. Left eye: O. D. rather lighter coloured than the right; there is a central white spot of small size; veins dilated; arteries numerous, and of large size; choroid of a dark colour. *Remarks.*—Is taking the bromide and has derived great benefit from it.

CASE 57.—S. A. J—, F., æt. 49, admitted Dec. 7th, 1853. *General condition.*—She has now been epileptic for twenty years; her first fit occurred after marriage owing to trouble. This trouble seems to have been owing to the fact that her husband never performed the act of coition properly, owing as she says to his being constantly drunk. She has a great number of fits every day, and they do not seem to have any connection with the menstrual period. She is demented and hypochondriacal. *Urine.*—Sp. gr. 1010, acid, slight cloud of albumen, no sugar. *General condition of eye.*—Prominence, normal; irides, bluish grey; pupils, R. 5, L. 5, sluggish. *Ophthalmoscopic examination.*—Right eye: O. D. of a pale pink tint, and having a central white spot; veins dilated; arteries of fair size and numerous. Left eye: O. D. smaller, and whiter than the right; veins numerous and much dilated; arteries of medium size. *Remarks.*—Has taken the bromide of potassium for about two months, with the result of greatly reducing the number of her fits.

CASE 58.—T. J—, M., æt. 18, admitted Feb. 22nd, 1868. *General condition.*—Became epileptic when two years of age. On his admission he had several fits every day, and they were of a severe character. He will now have an interval of three weeks or a month without any fits, and then have one or two. He is fairly intelligent, but complains of having a bad memory. At times he becomes excited. *Urine.*—Sp. gr. 1033, acid, no albumen, no sugar, lithates. *General condition of eye.*—Prominence, normal; irides, dark blue; pupils, R. 7, L. 7, sluggish. *Ophthalmoscopic examination.*—Right eye: O. D. small, slightly irregular, and of a deep red tint; veins are of large size, and tortuous; arteries small, and very numerous. Left eye: O. D. small, and irregular at the margins, of a uniform deep red tint, and slightly hazy; veins are large, tortuous, and rather numerous; arteries of medium size, and numerous; choroids contain very little pigment; vasa vorticosa are very well seen, and there is a pinkish white spot to inner side of disc. *Remarks.*—Has not taken the bromide for some time; but soon after his admission the fits were reduced in number, and his intelligence improved under bromide and ol. morrhue.

CASE 59.—J. D—, M., æt. 27, admitted Nov. 27th, 1868. *General condition.*—

Duration of epilepsy not known. He now has a number of severe fits once a week, and never at longer intervals. He is demented, and childish in manner, and at times violent. *Urine*.—Sp. gr. 1018, acid, no albumen, no sugar. *General condition of eye*.—Prominence, normal; irides, light blue; pupils, R. 6, L. 6, sluggish. *Ophthalmoscopic examination*.—Right eye: O. D. is defined at inner side by a narrow white rim, the remainder being of a deep pink tint; veins are rather large, but few; arteries are also large, and not very numerous. Left eye: O. D. is also defined by a narrow white rim, the rest being of a deep pink tint, and transparent appearance; veins are more numerous than in the right eye, and of medium size; arteries are of medium size, and numerous. *Remarks*.—Has taken bromide.

CASE 60.—T. G.—, M., æt. 32, admitted April 10th, 1865. *General condition*.—Has fits very frequently, and never at longer intervals than a few days. He is completely demented, and dirty in his habits. Never becomes excited. *Urine*.—Sp. gr. 1015, acid, no albumen, no sugar. *General condition of eye*.—Prominence, eyes slightly prominent; irides, light brown; pupils, R. 4, L. 5, sluggish. *Ophthalmoscopic examination*.—Right eye: O. D. is of small size, and has a central white spot, the remainder being of a deep pink tint; edge of disc has black pigment on it; veins are of good size, and somewhat tortuous; arteries very numerous, and of fair size. Left eye: O. D. is white to inner side, and in the centre; to the outer side it is red and somewhat hazy; veins are of medium size, and numerous; arteries small, and fairly numerous.

CASE 61.—W. M.—, M., æt. 30, admitted July 29th, 1867. *General condition*.—Became epileptic at seven years of age, the cause being, in all probability, meningitis. Has fits almost every day. No long intervals are known to occur. He is utterly demented, and dirty in his habits, yet at times he displays a disposition to commit suicide. Suffers from phthisis, and has left hemiplegia. *Urine*.—Sp. gr. 1020, acid, no albumen, no sugar. *General condition of eye*.—Prominence, eyes slightly retracted; irides, dark blue; pupils, R. 5, L. 5, active. *Ophthalmoscopic examination*.—Right eye: O. D. is irregular at the edges, and white, although there is a slight capillary tint; to its upper and inner side there is a very white spot, which looks like a slight prolongation of the disc; veins small and few; arteries very small, and not numerous. Left eye: O. D. more defined than the right, and very white, with a slight capillary tint; veins are small and few; arteries of very small size, and not numerous; disc is slightly indistinct to outer side; vasa vorticosa are very well seen.

CASE 62.—T. S.—, M., æt. 45, admitted Nov. 1st, 1866. *General condition*.—The duration of his epilepsy is not known. He has about two or three fits every other day, but seldom at longer intervals, or in greater number. He is greatly demented, and at times becomes excited and very violent. *Urine*.—Sp. gr. 1020, acid, no albumen, no sugar. *General condition of eye*.—Prominence, eyes sunken; irides, dark blue; pupils, R. 5, L. 5, active. *Ophthalmoscopic examination*.—Right eye: O. D. of good size, and well defined, being of a deep transparent pink tint; veins are of large size, and much branched; arteries of medium size, and numerous. Left eye: O. D. well defined, and of a deep pink tint, and transparent appearance;

veins of large size, and much branched, as are those of the right; arteries of medium size, and very numerous.

CASE 63.—W. G.—, M., æt. 43, admitted April 2nd, 1867. *General condition*.—Became epileptic when three months old. Has fits every three weeks, and generally during the night. He possesses a fair amount of intelligence, but suffers from considerable loss of memory. At times becomes very violent. *Urine*.—Sp. gr. 1012, acid, no albumen, no sugar. *General condition of eye*.—Prominence, eyes slightly sunken; irides, dark blue; pupils, R. 6, L. 6, sluggish. *Ophthalmoscopic examination*.—Right eye: O. D. small, ill formed, and of a deep red tint, having a spot of black pigment to the inner side; veins are of medium size, and much twisted; arteries small, twisted, and numerous. Left eye: O. D. small, ill defined, and of paler tint round the edge, though red in the centre; veins are of medium size, tortuous, and numerous; arteries are small, very numerous, and thready. *Remarks*.—Has taken ergot for excitement.

CASE 64.—J. E.—, M., æt. 35, admitted Nov. 15th, 1869. *General condition*.—This patient had two epileptic fits when he was six years of age, and then remained free until his twenty-ninth year. The fits occur in great numbers every fortnight or three weeks. He is demented and stupid, but at times becomes excited and very violent. *Urine*.—Sp. gr. 1018, acid, no albumen, no sugar. *General condition of eye*.—Prominence, normal; irides, light brown; pupils, R. 6, L. 6, sluggish. *Ophthalmoscopic examination*.—Right eye: O. D. well defined, having a small central white spot, and being of a transparent and deep pink tint; veins are of medium size, and numerous; arteries of fair size, and not very numerous. Left eye: O. D. defined by a white rim, and having a central white spot; the remainder being of a deep pink tint, but transparent appearance; veins are of medium size, but smaller, and not so numerous as in the right; arteries small, and not numerous. *Remarks*.—Has not taken medicine.

CASE 65.—J. B.—, M., æt. 30, admitted Dec. 31st, 1864. *General condition*.—Duration of epilepsy not known. He has about four or five fits every day, and is frequently much excited, and very violent. Always demented and stupid. *Urine*.—Sp. gr. 1020, acid, no albumen, no sugar. *General condition of eye*.—Prominence, normal; irides, mud colour; pupils, R. 6, L. 6, sluggish. *Ophthalmoscopic examination*.—Right eye: O. D. slightly oval, having a small central white spot and transparent appearance, the remainder being of a deep pink tint; veins are of medium size, and somewhat numerous; arteries small and numerous. Left eye: O. D. has a larger central white spot than the right, the remainder being of a deep pink tint; veins of medium size, and not numerous; arteries of small size, and numerous. *Remarks*.—Has not been treated for the fits.

CASE 66.—R. S.—, æt. 37, admitted June 30th, 1862. *General condition*.—Became epileptic when fourteen years of age; has one or two fits every three or four days, but never at longer intervals, or in greater number; is demented, and at times excited. *Urine*.—Sp. gr. 1018, acid, no albumen, no sugar. *General condition of eye*.—Prominence, normal; irides, red-brown; pupils, R. 4, L. 4, active. *Ophthalmoscopic examination*.—Right eye: O. D. is well defined, and of a pink tint, the inner side being lighter than any other portion; veins are of medium

size; arteries of good size and numerous; no sign of œdema. Left eye: O. D. is of a deeper pink than that of the right, but lightest on inner side; the veins are more numerous and tortuous; arteries also very numerous, and of fair size about either disc. *Remarks.*—Has not taken any medicine for some time.

CASE 67.—J. L—, æt. 30, admitted Oct. 24th, 1868. *General condition.*—Became epileptic when twenty years of age; the fits occur every few days, and not in great numbers. He is demented, and at times violent. *Urine.*—Sp. gr. 1025, acid, no albumen, no sugar. *General condition of eye.*—Prominence, eyes slightly sunken; irides, dark blue; pupils, R. 5, L. 5, sluggish. *Ophthalmoscopic examination.*—Right eye: O. D. is well defined, but of a deep pink tint; has a central light pink spot of small size; veins are numerous, of large size, and tortuous; arteries are also very numerous, and of good size. Left eye: O. D. is very red, but is defined from surrounding choroid; veins are of great size, and are tortuous; arteries large, numerous, and very tortuous. *Remarks.*—The fits have been reduced in number and severity since he took the bromide.

CASE 68.—I. S—, M., æt. 37, admitted Nov. 6th, 1860. *General condition.*—Became epileptic when six years of age. He now has fits every two or three days, but never in greater numbers than three or four at a time. He is demented, and at times violent. *Urine.*—Sp. gr. 1012, acid, no albumen, no sugar. *General condition of eye.*—Prominence, eyes retracted; irides, light blue; pupils, R. 4, L. 4, sluggish. *Ophthalmoscopic examination.*—Right eye: O. D. is not very sharply defined, but there is a white scleral half-circle to its inner side; the disc of a deep pink tint; veins of large size, and slightly tortuous; arteries very numerous. Left eye: O. D. has the same lunette to inner side as is seen in the right eye, and is of a deep pink tint; veins are not quite so large, and are tortuous; arteries are very numerous, and of good size. *Remarks.*—Has not taken the bromide.

CASE 69.—E. H—, M., æt. 27, admitted Feb. 15th, 1864. *General condition.*—Duration of epilepsy unknown. Now has one or two fits every few days, and is not known to have had them in groups. Is convulsed severely, and on both sides. Present mental state is one of great dementia, but at times he becomes excited and violent. *Urine.*—Sp. gr. 1016, acid, no albumen, no sugar. *General condition of eye.*—Prominence, normal; irides, dark blue; pupils, R. 3, L. 3, active. *Ophthalmoscopic examination.*—Right eye: O. D. rather pale, being nearly white at the margins; veins of medium size and few in number; arteries of fair size, and few in number. Left eye: O. D. is slightly oval, and of a deeper tint than the right; veins are more numerous, and the arteries also numerous and of larger size than in the right; no œdema of disc.

CASE 70.—G. S—, M., admitted July 6th, 1862. *General condition.*—Duration of epilepsy not known. He now has one or two fits every day, and about once a month he has about ten or twelve fits in one day. He is always stupid and demented, but at times becomes greatly excited. *Urine.*—Sp. gr. 1019, acid, no albumen, no sugar. *General condition of eye.*—Prominence, normal; irides, dark blue; pupils, R. 5, L. 5, sluggish. *Ophthalmoscopic examination.*—Right eye: O. D. large, of a pale pink tint, and well-defined margin; veins are of large size,

and slightly tortuous; arteries of large size and very numerous. Left eye: O. D. smaller, and of a deeper red tint; there is a narrow circle of a bright white surrounding the disc; veins are of medium size, slightly tortuous; arteries are of medium size, and numerous. *Remarks.*—Internal strabismus, which is most marked during and immediately after a fit. Has taken the bromide for some time with but little good effect.

CASE 71.—T. W—, M., æt. 25, admitted March 15th, 1858. *General condition.*—Has been epileptic since birth. Now has a fit or two every day, but does not have a number of fits at long intervals. Is perfectly demented, and never becomes excited. *Urine.*—Sp. gr. 1020, acid, no albumen, no sugar. *General condition of eye.*—Prominence, normal; irides, blue grey; pupils, R. 4, L. 4, sluggish. *Ophthalmoscopic examination.*—Right eye: O. D. is well defined and of a transparent pink tint; veins are of medium size, but numerous; arteries small and numerous. Left eye: O. D. is of larger size, but of the same transparent pink tint; veins are larger and more numerous; arteries are numerous and of medium size. *Remarks.*—Has not taken medicine for a long time past.

CASE 72.—M. E—, M., æt. 43, admitted July 3rd, 1864. *General condition.*—Has been epileptic since birth. Now has a succession of eight or nine fits every ten days or a fortnight, but never at longer intervals. The convulsions are severe, and on both sides the body. He is demented, and at times violent. *Urine.*—Sp. gr. 1018, acid, no albumen, no sugar. *General condition of eye.*—Prominence, sunken; irides, brownish-grey; pupils, R. 3, L. 3, active. *Ophthalmoscopic examination.*—Right eye: O. D. is of deep red tint, and with difficulty distinguished from the surrounding choroid, especially towards the outer side; veins are of medium size and few; arteries few and numerous. Left eye: O. D. is less defined than the right, and of a deep red tint; veins are larger and more numerous than in the right; arteries of medium size and numerous. There seems to be slight œdema in the outer half of each disc, and there the vascularity is most marked. *Remarks.*—In this case there was great ataxy of the eyeballs, but the sight was good. Has taken the bromide.

CASE 73.—M. M. D—, M., æt. 25, admitted Oct. 7th, 1864. *General condition.*—The duration of the epilepsy is not known. He has fits in groups of twenty or thirty about every six weeks. They have of late increased in severity. He is perfectly demented and unintelligent. At times becoming very excited and violent. *Urine.*—Sp. gr. 1025, acid, no albumen, no sugar. *General condition of eye.*—Prominence, normal; irides, yellowish brown; pupils, R. 4, L. 4, active. *Ophthalmoscopic examination.*—Right eye: O. D. small, having a ragged white margin, and being generally of a pink tinge; veins rather large; arteries small, and not numerous. Left eye: O. D. has a ragged edge, is rather larger than the right, of a deep pink tinge, and rather hazy; veins medium size; arteries rather small. *Remarks.*—Has not taken any medicine for some time.

CASE 74.—W. B—, M., 20, admitted Feb. 1st, 1870. *General condition.*—Has been epileptic since birth. Has one fit every week or ten days. Fits are very severe in character. He is demented and almost idiotic, but becomes more stupid after each fit. Is also subject to attacks of excitement. *Urine.*—Sp. gr. 1012,

acid, no albumen, no sugar. *General condition of eye.*—Prominence, normal; irides, blue grey; pupils, R. 4, L. 4, active. *Ophthalmoscopic examination.*—Right eye: O. D. irregular in outline, of a pale greyish pink colour; veins large, and decidedly tortuous; arteries small. Left eye: O. D. well defined, and white in its inner half, the outer half of a pink colour, and slightly indistinct; veins large, and very tortuous; arteries of a fair size, and also tortuous.

CASE 75.—J. B.—, M., æt. 28, admitted Jan. 21st, 1869. *General condition.*—Is not known when the epilepsy commenced. Has fits every few months, when he becomes very greatly excited, but during the intervals he is fairly intelligent. *Urine.*—Sp. gr. 1020, acid, no albumen, no sugar. *General condition of eye.*—Prominence, eyes slightly sunken; irides, slightly sunken; pupils, R. 5, L. 5, active. *Ophthalmoscopic examination.*—Right eye: O. D. well defined, of a transparent pink tint; veins of medium size; arteries nearly as large as the veins. Left eye: O. D. smaller than right, of a transparent pink tint; arteries and veins of equal size. *Remarks.*—Has taken bromide, with good effect.

CASE 76.—J. B.—, M., æt. 35, admitted May 24th, 1870. *General condition.*—Has not been epileptic from birth, but when he had the first fit is not known. He now has about six or seven fits every eight weeks. They are, however, slight in character. He is demented, but never violent. *Urine.*—Sp. gr. 1010, acid, no albumen, no sugar. *General condition of eye.*—Prominence, normal; irides, blue grey; pupils, R. 3, L. 3, sluggish. *Ophthalmoscopic examination.*—Right eye: O. D. well defined, of a deep red colour, and transparent appearance; veins large; arteries a fair size, and very numerous. Left eye: O. D. well defined, having a central yellowish white spot, and being generally of a dark red colour; the veins rather large; arteries of fair size.

CASE 77.—W. E.—, M., æt. 34, admitted April 14th, 1869. *General condition.*—Duration of epilepsy not known. He has one or two severe fits every day, and seldom or ever misses a day. He is utterly demented, but at times violent. *Urine.*—Sp. gr. 1018, acid, no albumen, no sugar. *General condition of eye.*—Prominence, rather sunken; irides, grey; pupils, R. 9, L. 9, sluggish. *Ophthalmoscopic examination.*—Right eye: O. D. well defined, small, and of a darkish pink tint; veins small; arteries very fine. Left eye: O. D. indistinct at the margin, of a deep pink tinge; veins small; arteries also very small.

CASE 78.—G. D.—, M., æt. 45, admitted June 15th, 1861. *General condition.*—Has been epileptic since birth. Generally has his fits during the night, and at long intervals, when he has a succession. He is now quite demented, but is never violent. *Urine.*—Sp. gr. 1020, acid, no albumen, no sugar. *General condition of eye.*—Prominence, nominal; irides, blue; pupils, R. 4, L. 4, active. *Ophthalmoscopic examination.*—Right eye: O. D. rather indistinct at the edges, and having a very deep central excavation, of a bright white colour; veins rather large; arteries small and numerous, proceeding from the edge of the disc. Left eye: O. D. smaller than the right, and of a paler pink tinge; there is a small central excavation, which is, however, neither so deep or so white as in the right; veins are rather large, arteries are of fair size, and not numerous.

CASE 79.—E. S.—, M., æt. 25, admitted April 6th, 1866. *General condition.*—

Duration of epilepsy not known. The fits are not of a slight nature, and will occur three or four times a day, and at times during the night. He is convulsed on the left side, which has been paralysed for some years. *Urine*.—Sp. gr. 1020, acid, no albumen, no sugar. *General condition of eye*.—Prominence, normal; irides, blue grey; pupils, R. 8, L. 8, active. *Ophthalmoscopic examination*.—Right eye: O. D. is well defined, there being a broadish zone of bright white, with a central of a greyish pink tint; veins are of small size; arteries are also very small; choroid pale; retina more transparent than usual. Left eye: O. D. larger than the right, and of a more uniform tint; is decidedly white, but with a slight tint of pink throughout; veins are of small size, and few; arteries small and few. *Remarks*.—He has improved slightly under the bromide.

CASE 80.—W. B.—, M., æt. 22, admitted July 6th, 1868. *General condition*.—Has been epileptic since birth. The fits occur in great numbers and at intervals of three to four weeks. He is very stupid as a rule and subject to attacks of excitement. The stupor is most profound when the fits are most numerous, and the excitement when they are fewest. *Urine*.—Sp. gr. 1020, acid, no albumen, no sugar. *General condition of eye*.—Prominence, normal; irides, light brown; pupils, R. 7, L. 7, active. *Ophthalmoscopic examination*.—Right eye: O. D. small and round; has a cloudy white margin, the remainder being of a deep red colour; veins large; arteries small but not numerous. Left eye: O. D. well defined and somewhat small; there is an outer zone of a white colour, the remainder being of deep pink tint; veins are of moderate size; arteries fairly numerous. *Remarks*.—Has taken the bromide for some time, but with little good effect.

CASE 81.—C. W.—, M., æt. 30, admitted March 6th, 1869. *General condition*.—Has been epileptic since he was seven years of age. The fits have now become very severe, they occur in groups about every ten days, and have never been known to occur less frequently. *Urine*.—Sp. gr. 1015, acid, no albumen, no sugar. *General condition of eye*.—Prominence, eyes sunken; irides, grey; pupils, R. 4, L. 4, sluggish. *Ophthalmoscopic examination*.—Right eye: O. D. irregular in outline, oval, the long diameter being from below upwards and from right to left; of a deep pink tint; veins very large and slightly tortuous; arteries small and proceeding from all sides of the disc. Left eye: O. D. small but regularly shaped, rather indistinct at the margins, and of a deep red tint; veins much dilated; arteries rather small but very numerous, and proceeding from all parts of the disc.

CASE 82.—D. W.—, M., æt. 53, admitted Feb. 29th, 1856. *General condition*.—Became epileptic when thirteen years of age. The fits now occur in groups of twenty or thirty every month or six weeks, and are accompanied by stupor and sometimes by great excitement. He is demented and unable to employ himself. *Urine*.—Sp. gr. 1025, acid, no albumen, no sugar. *General condition of eye*.—Prominence, normal; irides, grey; pupils, R. 5, L. 4, sluggish. *Ophthalmoscopic examination*.—Right eye: O. D. fairly defined but slightly indistinct at the edges; of a deep red tint and very hazy appearance; veins are very large and extremely tortuous; arteries small but numerous; disc seems to be slightly swollen. Left eye: O. D. defined by a narrow white rim, has a central white spot, and the remaining portion of a pale pink tinge; veins are small but tortuous; arteries of fair size

and not very numerous. *Remarks.*—During the attack he has been treated with tinct. sumbul and brandy, and the last two are reported to have been of slighter character and shorter duration.

CASE 83.—J. T—, M., æt. 56, admitted Nov. 15th, 1862. *General condition.*—When the epilepsy commenced is not known. The fits occur now in groups of twenty or thirty every six or eight weeks. In the interval he only has a fit now and again. He is possessed of fair intelligence during the intervals, only complaining of defective memory. Becomes very stupid and occasionally excited during the attacks. *Urine.*—Sp. gr. 1018, acid, no albumen, no sugar. *General condition of eye.*—Prominence, slightly sunken; irides, greenish grey; pupils, R. 4, L. 4, sluggish. *Ophthalmoscopic examination.*—Right eye: O. D. round and well-defined, being of a pale greenish white tint; veins numerous, much branched, and of large size; arteries numerous and of fair size. Left eye: O. D. round and well-defined by a narrow white rim of a greyish pink tint and having a slight pale yellowish white central spot; veins rather large and somewhat numerous; arteries of medium size and not numerous.

CASE 84.—G. O—, M., æt. 21, admitted March 2nd, 1869. *General condition.*—Has been epileptic since birth. He now has two or three fits of a slight character every day. He is childish and demented. Labours under sudden impulse to destroy himself, and then becomes greatly excited and violent. His head is very large, but the sutures are quite closed. *Urine.*—Sp. gr. 1018, acid, no albumen, no sugar. *General condition of eye.*—Prominence, slightly prominent; irides, light blue; pupils, R. 4, L. 4, sluggish. *Ophthalmoscopic examination.*—Right eye: O. D. irregular in shape, the margins shading off in a feathery manner and being of a bright white colour; the central parts are of a pink colour; veins are small and tortuous; arteries small and numerous; the retina is so thin that the details of the choroidal vessels are very plainly seen. Left eye: O. D. larger than the right, defined at the inner side by a white rim; the outer side has a white woolly appearance; the whole of the disc is very pale but has a slight pink tint towards the centre; veins are small and tortuous; arteries numerous, small, and tortuous; retina thin; little pigment in choroid vasa vorticososa very distinct. *Remarks.*—Has taken bromide of potassium, but with little or no effect.

CASE 85.—J. B—, M., æt. 37, admitted Feb. 5th, 1865. *General condition.*—Became epileptic when five years of age. Has one or two fits every week, but never has a great number in a group. He is demented and childish in his manner, and very occasionally excited. *Urine.*—Sp. gr. 1024, acid, no albumen, no sugar. *General condition of eye.*—Prominence, normal; irides, light blue; pupils, R. 3, L. 3, active. *Ophthalmoscopic examination.*—Right eye: O. D. round and well-defined except at the inner side; of a transparent tint; veins rather large; arteries numerous but small. Left eye: O. D. well-defined, the inner half is of a bluish white colour, the outer of a red hazy appearance; the veins are large and very tortuous; arteries small; in the situation of the yellow spot there is a large convex white substance which is irregularly marked by brown spots, and seems to bulge forwards as though the choroid had become destroyed over it and had left a little pigment scattered over it; it is of a brilliant white. *Remarks.*—Took the bromide some time ago with slightly good effect.

CASE 86.—G. C. A—, M., æt. 26, admitted June 28th, 1869. *General condition*.—The duration of his epilepsy is not known. He has about two fits each day for a week, and then will remain free for five, six, or eight weeks. He is demented as a rule, but when having fits is excited and suicidal. *Urine*.—Sp. gr. 1020, acid, no albumen, no sugar. *General condition of eye*.—Prominence, eyes slightly prominent; irides, brownish grey; pupils, R. 5, L. 5, active. *Ophthalmoscopic examination*.—Right eye: O. D. of irregular oval shape; the inner half is of a very pale bluish white colour, the outer of a hazy pink colour; veins and arteries of nearly equal size. Left eye: O. D. round and well-defined, the inner side of a pale bluish white tint, outer side red but not hazy; veins are rather large and slightly tortuous; arteries of fair size and much branched. *Remarks*.—Taking the bromide with apparent good effect.

CASE 87.—J. S—, M., æt. 28, admitted Oct. 16th, 1865. *General condition*.—Date of first fit not known. He now has a fit occasionally, and about every three months a succession of ten or fifteen in one day. After each fit he becomes greatly excited for a few minutes, his ordinary condition being that of unintelligent dementia. *Urine*.—Sp. gr. 1020, acid, no albumen, no sugar. *General condition of eye*.—Prominence, eyes slightly prominent; irides, dark brown; pupils, R. 6, L. 6, sluggish. *Ophthalmoscopic examination*.—Right eye: O. D. well-defined, of a transparent pink tint, palest in the centre; veins are of medium size but tortuous; arteries numerous and of fair size. Left eye: O. D. well-defined and regular in shape, of a pale transparent pink tint; veins of medium size; arteries nearly as large as the veins and rather numerous. *Remarks*.—Has taken bromide since March 2nd with good effect.

CASE 88.—J. B—, M., æt. 21, admitted April 6th, 1868. *General condition*.—Became epileptic when about fifteen years of age, in consequence of a blow on the back part of the head from a brick. He has since his admission had numerous severe attacks of the status, and has received vigorous medication at various times. *Urine*.—Sp. gr. 1025, acid, no albumen, no sugar. *General condition of eye*.—Prominence, eyes sunken; irides, dark blue; pupils, R. 9, L. 9, sluggish. *Ophthalmoscopic examination*.—Right eye: O. D. well defined by a narrow white rim, the remainder being of a pale pink tint; veins are of medium size, and not numerous; arteries small and fairly numerous. Left eye: O. D. is of a medium size, and fairly well defined; of a deep pink tint and transparent appearance; veins are of medium size, and fairly numerous; arteries are numerous, and of medium size.

CASE 89.—E. S—, M., æt. 50, admitted May 3rd, 1867. *General condition*.—Has been epileptic since birth. Has several fits every day for a week, and then will not have any for three or four weeks. He is demented, and inclined to quarrel. At times he becomes very violent. *Urine*.—Sp. gr. 1023, acid, no albumen, no sugar. *General condition of eye*.—Prominence, eyes prominent; irides, light brown; pupils, R. 4, L. 4, active. *Ophthalmoscopic examination*.—Right eye: O. D. is indistinct, and of a greyish pink tinge round the edge, the central portion, which is small, being of a pink tint; veins are thin where they pass over the disc, elsewhere they are large and tortuous. Left eye: O. D. is small and indistinct at the margins; to the inner side there is a portion of a pearly tint, the rest being of a greyish pink tint; the veins, which are small and tortuous, spring from the

edge of the disc, the centre being free from vessels; arteries are very thready and few. *Remarks.*—Atrophy in both eyes. Has taken ergot, and received great benefit; the attacks of excitement being fewer, and not so prolonged.

CASE 90.—W. T—, M., æt. 50, admitted Feb. 10th, 1868. *General condition.*—Patient commenced to have fits when thirty-six years of age. Now has several fits every few days, and at intervals of a fortnight he has a succession of about twenty fits in one day. He is stupid and quarrelsome, and at times becomes very much excited and very violent. *Urine.*—Sp. gr. 1020, acid, no albumen, no sugar. *General condition of eye.*—Prominence, normal; irides, dark blue; pupils, R. 4, L. 4, active. *Ophthalmoscopic examination.*—Right eye: O. D. is well defined, and of normal size; there is a rim of white round the disc, which is elsewhere of a dirty pink tint; veins are of medium size, and much branched; arteries are numerous, and of fair size. Left eye: O. D. is larger than in the right eye, has a white centre, and a narrow white rim round edge, most marked towards the inner side; veins are of medium size, and not very numerous; arteries numerous, and of fair size. *Remarks.*—Has taken bromide, and under it the fits have become less frequent, and not so severe.

CASE 91.—M. D—, M., æt. 40, admitted Oct. 7th, 1864. *General condition.*—Has been epileptic since birth. Now has fits at short intervals, when he will have four or five severe convulsions in a day. He is always of a violent temper and vicious disposition. *Urine.*—Sp. gr. 1025, acid, no albumen, no sugar. *General condition of eye.*—Prominence, normal; irides, yellowish brown; pupils, R. 6, L. 6, sluggish. *Ophthalmoscopic examination.*—O. D. is defined by a white rim, and is of a deep pink tint; veins are numerous, and of good size; arteries very numerous, and of fair size. Left eye: O. D. indistinct at the margins, hazy, and of a deep pink tint; veins of medium size; arteries of small size and numerous. *Remarks.*—Atrophic changes going on in the left eye.

CASE 92.—E. B—, M., æt. 29, admitted June 20th, 1868. *General condition.*—Became epileptic when two years of age. Has two or three fits every few days, and never at longer intervals or in greater number. He is fairly intelligent, but has a deficient memory, and does not become excited. *Urine.*—Sp. gr. 1012, acid, no albumen, no sugar. *General condition of eye.*—Prominence, normal; irides, dark blue; pupils, R. 4, L. 4, active. *Ophthalmoscopic examination.*—Right eye: O. D. well defined, and of a pale transparent pink tint; veins dilated, but not numerous; arteries small, and not very numerous. Left eye: O. D. well defined, and of a deeper pink tint than the right; veins of large size and tortuous, being more numerous than in the right eye; arteries of medium size, and not very numerous.

CASE 93.—G. B—, M., æt. 32, admitted June 23rd, 1865. *General condition.*—Became epileptic when sixteen years of age. He now has several fits about every week, and seldom at longer intervals or in greater number. He is demented and quarrelsome, at times becoming very violent. *Urine.*—Sp. gr. 1025, acid, no albumen, no sugar. *General condition of eye.*—Prominence, normal; irides, blue; pupils, R. 5, L. 5, active. *Ophthalmoscopic examination.*—Right eye: O. D. is just distinguishable from the choroid, and is of a hazy pink tint; there is a small

lunette to the inner side; veins small; arteries small and few. Left eye: O. D. is of a deep red tint, and somewhat hazy appearance; veins are small, but numerous; arteries small; there is also a lunette in this eye, to the inner side of the optic disc. *Remarks.*—Has taken the bromide for a few months with benefit.

CASE 94.—R. W., M., æt. 43, admitted March 22nd, 1858. *General condition.*—Has been epileptic since being four years of age. Now has at least one fit a day, and is not known to go for any period of time without any at all. Is convulsed on the right side only, which is paralysed. He is demented, and at times becomes excited. *Urine.*—Sp. gr. 1012, acid, no albumen, no sugar. *General condition of eye.*—Prominence, normal; irides, greyish yellow; pupils, R. 3, L. 3, active. *Ophthalmoscopic examination.*—Right eye: O. D. well-defined by a narrow white rim, and of a transparent pink tinge; veins of medium size, but branched; arteries normal in size and distribution. Left eye: O. D. is irregular, white, and ragged at the edge, the rest being of a deep pink tinge; veins and arteries small.

CASE 95.—H. E., F., æt. 42, admitted July 14th, 1863. *General condition.*—She now has the fits in great number at each menstrual period, and they occur most frequently during the night. She is stupid and demented, but seldom excited. Now is slightly paraplegic from spinal disease. Has not had any medical treatment for the fits during the last three years. *Urine.*—Sp. gr. 1025, acid, no albumen, no sugar. *General condition of eye.*—Prominence, normal; irides, brown; pupils, R. 5, L. 5, sluggish. *Ophthalmoscopic examination.*—Right eye: O. D. is of a deep red tint, hazy, and hardly distinguishable from the surrounding parts; veins of medium size; arteries small. Left eye: O. D. of a deep red tint, and more hazy and indistinct than the right; veins are of medium size, and rather tortuous; arteries small.

CASE 96.—E. F., F., æt. 20, admitted Jan. 27th, 1868. *General condition.*—Became epileptic when ten years of age, and has rapidly grown demented. She menstruated first at sixteen years of age, but the establishment of the discharge seemed to increase the number and severity of the fits. Now has fits every week, and never has less than six in one day. She was formerly very suicidal when excited, and has made many attempts to destroy herself. She is now at times violent to others, and is demented and dirty in her habits. *Urine.*—Sp. gr. 1030, acid, no albumen, no sugar, abundant lithates. *General condition of eye.*—Prominence, normal; irides, brown; pupils, R. 6, L. 6, sluggish. *Ophthalmoscopic examination.*—Right eye: O. D. is large and much squared, it is of a deep red tint, and very hazy; the retina near is also dull and hazy, rendering the optic disc somewhat indistinct; veins are dilated, tortuous, and hazy, on and near disc; arteries of medium size. Left eye: O. D. of large size, indistinct at the margins, and pale to the inner side; veins are dilated, tortuous, and full of dark blood; arteries are small, and somewhat numerous; both disc and retina near it are dull and indistinct. *Remarks.*—Had a fit about an hour ago; is now very stupid, but in her usual condition. Will not take medicine now, but at one time took bromide with benefit.

CASE 97.—J. M., F., admitted May 15th, 1865. *General condition.*—Her

first fit occurred during the first menstrual period. She now has a fit or two every month, but they do not seem to have any connexion with the menstrual period. She is possessed of considerable intelligence, but has a disregard for truth, and a great propensity for collecting property of all kinds. Is seldom violent. *Urine*.—Sp. gr. 1018, acid, no albumen, no sugar. *General condition of eye*.—Prominence, slightly prominent; irides, brown; pupils, R. 4, L. 4, sluggish. *Ophthalmoscopic examination*.—Right eye: O. D. of a medium pink tint and transparent appearance; veins of medium size, and slightly tortuous; arteries are of medium size in the main branches, but a large number of very small size spring from the edge of the disc. Left eye: O. D. of a pale pink tint and transparent appearance, being lighter to the inner; veins are of medium size, and slightly tortuous; arteries of fair size, and not numerous; choroid of a deep tint. *Remarks*.—Has not taken any medicine for the epilepsy.

CASE 98.—M. A. W.—, F., æt. 34, admitted Nov. 10th, 1862. *General condition*.—Has been epileptic and idiotic from birth. She has about three fits every day during three days in each month, the time seeming to have no reference to the menstrual period. Is stupid and idiotic, very pugnacious, violent and destructive. *Urine*.—Sp. gr. 1025, acid, no albumen, no sugar, copious deposit of lithates. *General condition of eye*.—Prominence, normal; irides, grey; pupils, R. 5, L. 5, sluggish. *Ophthalmoscopic examination*.—Right eye: O. D. has a small white centre, and is of a deep red tint, indistinct at the margins, but of transparent appearance; veins are very numerous and tortuous; arteries are of medium size, and much branched; many small vessels spring from the edge of the disc. Left eye: O. D. defined at its upper margin, the lower one being indistinct; there is a slight black patch to inner side of disc; veins of large size, tortuous and numerous; arteries of fair size and also numerous; disc is of a deep red tint, but transparent appearance. *Remarks*.—Has taken the bromide, but with little or no good effect.

CASE 99.—M. W.—, F., æt. 29, admitted Nov. 11th, 1870. *General condition*.—Had her first fit when thirteen years of age, when she became paralysed on the right side. This paralysis continues, and there is carpo-pedal contraction. She has not had many fits since admission, and they do not bear any relation to the menstrual periods. She is, as a rule, stupid and unintelligent, but becomes at times very violent, is at all times ready to fight on the smallest provocation. *Urine*.—Sp. gr. 1020, acid, no albumen, no sugar. *General condition of eye*.—Prominence, normal; irides, light blue; pupils, R. 6, L. 6, sluggish. *Ophthalmoscopic examination*.—Right eye: O. D. is well defined, but of a deep red tint, and slightly hazy; veins are of a large size, and much branched; arteries are of good size, and tortuous; choroid near disc is rather white in patches. Left eye: O. D. smaller than the right, of a deep red tint, and transparent appearance; veins are of medium size and numerous; arteries are numerous and of small size.

CASE 100.—S. T.—, F., æt. 35, admitted Feb. 6th, 1869. *General condition*.—She has an occasional fit either during the night or in the daytime, but as a rule her fits are confined to the week during which her menstrual period occurs. She is convulsed on both sides, but does not cry out until the end of the convulsion. She is now very stupid, and cannot remember the most simple facts; but is not at all violent. *Urine*.—Sp. gr. 1025, acid, no albumen, no sugar, abundant deposit

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of lithates. *General condition of eye.*—Prominence, sunken; irides, violet blue; pupils, R. 4, L. 4, sluggish. *Ophthalmoscopic examination.*—Right eye: O. D. small, defined by a narrow rim of a greyish pink tint, the rest of the disc being of a deep red; veins are numerous and of medium size; arteries also numerous, and rather small; the vessels in this eye pass in all directions from the disc, and are of nearly equal size, arteries and veins respectively. Left eye: O. D. is of nearly the same red tint as the choroid; it is, however, defined from it; veins are numerous and of medium size; arteries small and also numerous. *Remarks.*—Took the bromide of potassium for some time and with great benefit.

CASE 101.—M. W—, F., æt. 37, admitted Jan. 23rd, 1869. *General condition.*—Her first fit occurred after the birth of her fourth child, but does not seem to have been connected with that event. She has a number of fits about each menstrual period, and in the intervals she remains perfectly free. She is demented, and has a very bad memory, and when having fits becomes violent and very suicidal. *Urine.*—Sp. gr. 1020, acid, no albumen, no sugar. *General condition of eye.*—Prominence, sunken; irides, blue; pupils, R. 3½, L. 3½, sluggish. *Ophthalmoscopic examination.*—Right eye: O. D. very small, and of a deep red tint; there is a ring of black pigment round the edge of the disc; the choroid near is atrophied; veins are of large size, but not numerous; arteries minute. Left eye: O. D. small and ill-shaped, being of nearly the same tint as the choroid; veins are large and more numerous than in the right; arteries minute; both discs and retinæ are hazy. *Remarks.*—Was treated with bromide of potassium for some time, and great improvement followed.

CASE 102.—M. C—, F., admitted May 31st, 1869. *General condition.*—Had one fit when a few months old, and was not known to have another until she was thirty years of age, and this occurred during the act of coition. She since then has had a succession of fits at each menstrual period. She is fairly intelligent, but is inclined to quarrel, and at times becomes very violent. *Urine.*—Sp. gr. 1025, acid, no albumen, no sugar. *General condition of eye.*—Prominence, eyes slightly prominent; irides, light brown; pupils, R. 4, L. 4, active. *Ophthalmoscopic examination.*—Right eye: O. D. is well defined, of a pink tint, but paler to the inner side; the whole of a transparent appearance; veins are of large size, and much branched; arteries small and numerous, many springing from the edge of the disc. Left eye: O. D. well defined, of a paler tint than the right, and transparent appearance; veins are of medium size, and much branched; arteries numerous and of medium size; many springing from the edge of the disc. *Remarks.*—Great improvement has taken place in her condition since she was put on the bromide treatment.

A CONTRIBUTION
TO THE
STATISTICS OF GENERAL PARALYSIS;
WITH REMARKS.

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THE following statistical record of 341 cases of *General Paralysis*,¹ admitted into the Devon County Lunatic Asylum, from its opening in 1845 to the end of the year 1870, has been compiled with great care, principally from the case-books, registers, and annual reports of the asylum, and partly from my own personal observations during a residence of two years as Assistant Medical Officer. In order to facilitate comparison, a few statements and opinions of some of the leading authors and other writers on this subject will be given as I proceed.

Admissions.

The total number of admissions during the period of twenty-five years was 4062—1963 males and 2099 females. Of these, 341 were cases of general paralysis, viz., 276 males and 65 females. The per centage of cases of general paralysis, on the total admissions, was 14 per cent. in the males, and 4 per cent. in the females, or $8\frac{1}{2}$ per cent. of the whole. The proportion of males to females was a little more than 4 to 1. This proportion is exactly the same as that given by Dr. Robert Boyd, in a

¹ Without here entering into a discussion as to what would be the most suitable and appropriate name for this fatal disease, I may merely say that, though I prefer the appellation *progressive general paresis*, I shall, nevertheless, in this paper, adopt (what Dr. Bacon has termed) its "more familiar misnomer," *general paralysis*. I use the qualification "*general*" not so much in reference to the fact that the disease ultimately becomes universal, as that it affects both mind and body.

paper¹ to which I shall again have occasion to refer, as the result of his twenty years' experience at the Somerset County Asylum, where the cases of general paralysis admitted amounted, in the males, to $8\frac{1}{2}$ per cent., and in the females to 2 per cent. of the total admissions during that period. The proportion seems to be greater at the West Riding Asylum, Wakefield, where Dr. Crichton Browne, from his experience, fixes it at 5 to 1; whilst at Hanwell² and Charenton it is still higher, and stated to be 7 or 8 to 1.

According to Austin's³ experience, in 147 cases occurring at the Bethnal House Asylum, the proportion was about 2 to 1. Out of 619 patients admitted at Charenton⁴ during the years 1826—28, 109, or one sixth, were cases of general paralysis. Calmeil⁵ states that, of 1200 male patients examined by him, 80, or 1 in 15, were paralytics; but that of 500 women only 10 were so affected, or 1 in 50; this gives a proportion of 8 males to 1 female.

Deaths.

The total number of deaths during the twenty-five years amounted to 1393, 769 males and 624 females. Of these, 271—males, 225; females, 46—were deaths of general paralytics, making, amongst the males, the high per centage, on the total deaths, of 29·25, and, amongst the females, 7·37, or, in both sexes, 19·45. Thus considerably more than one fourth of the total deaths amongst the males were cases of general paralysis. In 1851 and 1864 the mortality from general paralysis was even higher than this, being, in each of those years, one fourth of the whole mortality. Many of these cases, as we shall see further on, were carried off by phthisis, diarrhœa, &c.,

¹ On "General Paralysis of the Insane," 'Journal of Mental Science,' April, 1871.

² Dr. Tuke, in a discussion which followed the reading of Dr. Boyd's paper, stated that he had always found the proportion of males to females to be at least 8 to 1 amongst the general paralytics at Hanwell. This does not seem to be the rule there, however; for, in the 'Hanwell Annual Report' for 1870, I find that out of 47 deaths from general paralysis, 37 were males, and 10 females, or in the proportion of about 4 to 1; and of 104 cases of general paralysis left, 60 were males and 44 females—considerably more than half being females.

³ 'A Practical Account of General Paralysis,' Lond., 1869, p. 60.

⁴ 'Des Maladies Mentales,' par E. Esquirol, tome second, p. 272.

⁵ 'De la Paralyisie, Considérée chez les aliénés,' p. 370.

as *secondary* causes ; and they are with greater propriety termed deaths “ *of general paralytics* ” than from general paralysis ; but, in all, general paralysis was the *primary* disease.

Dr. Boyd (loc. cit.) states that of 924 deaths, from all causes, which took place during twenty years at the Somerset Asylum, 162, or 18 per cent., were due to general paralysis. According to Dr. Damerow,¹ out of 604 deaths, during a period of ten years at the Halle Asylum, 125 men and 22 women had suffered from dementia paralytica, the mortality from general paralysis being, amongst the males, more than one fourth, and amongst the females more than one eighth. Out of 1698 deaths, from all causes, occurring during the year 1859, in 39 English county or borough asylums, I find that 384, or 22½ per cent., were attributed to general paralysis ; and out of 1992 deaths, in 1869, occurring in 36 asylums (principally county, and in Great Britain), that 366, or 18½ per cent., were attributed to the same cause. I find that for any *single* year the per centage varies greatly in different asylums, and the same remark applies to the per centage in any *single* asylum from year to year. Thus, at the Newcastle Borough Asylum, in 1866, 50 per cent. of the deaths were from general paralysis ; but in the next two years 30 and 15 per cent. respectively, and in the 36 asylums just referred to (the majority of the annual reports being dated 1869) the per centage of deaths from general paralysis varies from 34½ per cent. at the Chester County, to 1½ per cent. at the Suffolk County Asylum, being in the intermediate asylums as follows :

Armagh District, 33 per cent. ; City of London, 30½ per cent. ; Cumberland and Westmoreland, 26½ per cent. ; Durham County, 26 per cent. ; New York State, 23½ per cent. ; Glasgow Royal, 21 per cent. ; West Riding of Yorkshire, 20 per cent. ; Colney Hatch, 18½ per cent. ; Murray's Royal (Perth), 18 per cent. ; Kent County, 16 per cent. ; Dundee Royal, 14½ per cent. ; Royal Edinburgh, 14 per cent. ; Aberdeen Royal, 13½ per cent. ; Richmond District (Dublin), 13½ per cent. ; Bristol Borough, 12½ per cent. ; Friends' Retreat, 11 per cent. ; Cambridge County, 9 per cent. ; and in the Inverness District, 6 per cent.

In the ‘ Twelfth Annual (1870) Report of the Commissioners in Lunacy for Scotland,’ it is stated that 36 out of 407 deaths, occurring during the past year in royal or district asylums,

¹ ‘ Journal of Mental Science,’ No. 61, p. 112.

were due to general paralysis, making about 9 per cent.; in private asylums, 8 out of 35, or about 23 per cent.; in parochial asylums, 3 out of 33, or 9 per cent.; and in lunatic wards of workhouses, 2 out of 52, or nearly 4 per cent.; giving a total number of deaths, during the year, of 527, of which 49, or 9½ per cent., were deaths ascribed to general paralysis.

Age on Admission.

The following table (I) gives the details as to this. In decades the largest number—130 out of 341 cases—were admitted between the ages of 40 and 50; but the number was still greater for the decade, 35 to 45, being 155 out of 341 cases. The disease has been decidedly most common between the ages of 41 and 45 years. The average age on admission is somewhat lower amongst the females than the males, being 42 in the latter and 38½ in the former. The lowest age was 22, there being two cases (one of each sex) admitted at that age; both died in about two years after admission, and the female was an Exeter prostitute.

There is at present in the asylum a well-marked case of general paralysis, a female, aged 24 years, in whom the alleged cause of the disease was fright. The age of the oldest case on admission was 66 years.

TABLE I.

Age on admission.	Males.	Females.	Total.
From 20 to 30 years . . .	17	11	28
„ 30 to 40 „ . . .	91	22	113
„ 40 to 50 „ . . .	109	21	130
„ 50 to 60 „ . . .	38	6	44
„ 60 to 70 „ . . .	11	1	12
Unknown	10	4	14
Total . . .	276	65	341
From 36 to 40 years inclusive .	62	7	69
„ 41 to 45 „ „ .	70	16	86
Decade from 36 to 45 „ Total	132	23	155

Calmeil observed the disease most frequently between the ages of 32 and 40, only two cases occurring before the thirty-second year.

Romberg states, more vaguely, that the predisposition to the

disease is greatest between the thirtieth and fiftieth year. Maudsley states that it is " emphatically the disease of manhood, for it is hardly ever met with before 30, or after 60."¹ Two thirds of the 147 cases observed by Austin occurred between the ages of 30 and 50, the period of greatest frequency, in both sexes, being the decade between 30 and 40. Dr. Robert Boyd (loc. cit.), after twenty years' observation, states that the disease is most common between the ages of 37 and 47.

Condition as to Marriage.

It will be observed, from the following table (II), that two thirds of the cases were married, the married being to the single in the proportion of 5 to 2.

TABLE II.

Condition as to marriage.	Males.	Females.	Total.
Married	182	33	215
Single	63	23	86
Widowed	22	7	29
Unknown	9	2	11
Total .	276	65	341

It is a noteworthy fact that, whilst among the married the proportion of males to females is 6 to 1, amongst the single it is only 3 to 1. This relative difference may, perhaps, be explained by the fact that intemperance and irregular habits are much more common amongst single than married females. In fact, all the single females have been domestic servants, charwomen, or washerwomen, and in nearly all their cases there is a history of irregular or intemperate habits; and it will be seen, as we proceed, in what a large proportion of cases the disease has been attributed to these causes. More than half of the whole number of cases were married males. The greater frequency of the disease amongst the married is evidently due to the fact that, at the average age, on admission, of general paralytics, viz., 42 years, the majority of our future patients are married, and exposed to all the cares and troubles incident to wedded life amongst the lower classes.

¹ 'The Physiology and Pathology of the Mind,' 1st Ed., Lond., 1867, p. 360.

Results.

The following table (III) gives the results as they appear in the case-books and registers of the asylum.

TABLE III.

RESULTS.				Males.	Females.	Total.
Died . . . . .	.	.	.	225	46	271
Discharged "recovered" . . . . .	.	.	.	10	2	12
Discharged not improved . . . . .	.	.	.	9	4	13
Discharged relieved . . . . .	.	.	.	8	2	10
<i>Still living (Jan. 14th, 1871).</i>						
	M.	F.	T.			
Of those admitted in 1862	1	...	1			
" " " 1864	2	2	4			
" " " 1865	1	2	3			
" " " 1867	3	1	4			
" " " 1868	2	...	2			
" " " 1869	6	4	10			
" " " 1870	9	2	11			
				24	11	35
Total				276	65	341

It will be observed that 12 cases have been discharged as being "recovered." I have examined carefully the records of these cases, and the following is the result:—10 cases (8 males and 2 females) have remained well, or, at any rate, have not been readmitted into the asylum, and 2 males have since returned and died. Of those still remaining out, one is referred to by Dr. Bucknill, in the 'Sixth Annual Report of the Devon County Asylum' (1852), where he states that this was the only case he had observed in which there was no affection of the mental functions, and the only case he had known to recover. With regard to two more of the cases of recovery still remaining out, I may state that they have been discharged during my residence here. They were sent home in the care of friends at their earnest request, being free from mental symptoms, but still retaining some of the physical indications of the disease in a distinctly appreciable, though slight, degree. These two cases were classed amongst the "recoveries" for the sake of convenience, not being cured of the general paralysis, but being something more than "relieved," the next statutory term. They have now been at liberty

fifteen and eighteen months respectively. Of the 2 relapsed cases, 1 was discharged during my residence; he was first admitted on October 19th, 1868, with extravagant delusions and well-marked physical symptoms of general paralysis; he gradually improved, the delusions disappeared, and he became quiet and rational. He was discharged, at the request of his friends, on July 6th, 1869, with only a slight tremulousness of the tongue remaining. On September 8th, 1870, he was readmitted with symptoms of general paralysis more strongly marked than ever, and he died within three months after readmission. The relieving officer who brought the patient back stated that he had done little or nothing towards making his own living, and had subsisted mainly on charity, during the fourteen months he was at home. The other relapsed case is one referred to by Dr. Saunders in the 19th 'Annual Report of the Devon County Asylum' (1865), and it is a very interesting one. The patient was admitted on January 29th, 1863, with the symptoms of general paralysis marked in more than an ordinary degree, having tremors of the tongue and other muscles, and characteristic delusions of an ambitious and exalted nature; he gradually became weaker and more demented. On the 11th of April a large carbuncle formed on the nape of the neck, which exhausted him very much, but from which he recovered, and, after a short residence, he lost his delusions, became strong and robust, and worked on the farm; there was an entire freedom from tremulousness, either of the tongue or of the muscles of the extremities, and he was discharged, apparently recovered, on the 18th of July, 1863. He was readmitted into the asylum, however, on the 20th of April, 1864, in the last stage of general paralysis and died seven weeks after. I beg to refer the reader to the above-mentioned Report for further details of this instructive case. Dr. Saunders states that the history of this case is "confirmatory of the opinion held by most English psychologists, that general paralysis, as met with in asylums, is an incurable form of disease." It is my humble conviction that, until we are able to recognise the disease at an earlier period of its existence (probably by means of the ophthalmoscope), and until we know something more definite as to its pathology, we shall not be able to treat the disease radically, or entertain any hopes of its complete cure. The history of the two relapsed cases to

which I have just referred very well illustrates the remissions which may occur in the course of general paralysis (which, according to M. Baillarger, vary in duration from one month to two years), and tends to confirm my opinion that it is, as a rule, not advisable to discharge such cases. It also supports the statement of Dr. A. Sauze,¹ that, "whatever be the dominant form of the intermission occurring in a well-marked case of general paralysis, there always remains, in a greater or less degree, an enfeeblement of the intellectual and moral faculties, which renders the patient more or less incapacitated for managing his own affairs; and his detention in an asylum, however intolerant it may at first sight appear, is assuredly needful for his own interests." But, as with the two cases just mentioned, we may, nevertheless sometimes discharge such cases, in the care of friends or relatives, at their earnest request, not liking to refuse this concession, when they take upon themselves the responsibility, and promise to take good care of the patients and bring them back on the first symptom of relapse occurring. The fact that these remissions and intermissions so frequently occur in the course of real general paralysis ought to stimulate us to make further and continued attempts, by means of medicinal and moral treatment, to control, and perhaps arrest, the progress of the disease. I am afraid, however, we shall be unable to make any satisfactory headway in this direction until mental diseases are included as an integral part in every course of practice of medicine, when general practitioners, who have the best opportunities of studying the disease at its outset, may perhaps be able to recognise it, and the vital importance of its early treatment. It is a favorable sign of the times that this "divorce of insanity from the study of the practice of physic" has been strongly condemned by Dr. Arthur Mitchell, one of the Commissioners in Lunacy for Scotland, in his very able and practical 'Morrisonian Lectures' for this year. Without any special reference to, and supposing that the diagnosis was correct in each of, the eight cases of complete and permanent recovery which have, so far, occurred in this asylum (in none of which cases can I find any history of alcoholic excess, and half of whom were excited and exalted, and half depressed, on admission), is it not possible

¹ "On Remissions in the Course of General Paralysis," in the '*Annales Medico-Physiologiques*.'

that many of the cases of so-called recovery from general paralysis have been recoveries from a combination of melancholia (the depression and fidgetiness which so often follow on, what I may perhaps term, an acute accession of chronic debauchery) and chronic alcoholism? Are not these the very cases which are at the same time the most likely to be, and the most often confounded with, general paralysis, and which only a very perfect history and the further progress of the case can enable us to diagnose with certainty? These are questions which I should very much like to dilate upon, with illustrative cases, but it would be both inconvenient and out of place to do so in the present paper.

In connection with Dr. Bucknill's case of recovery referred to above, in which the mental functions were not affected, it is interesting to note that, in a paper already quoted from, Dr. Boyd states that the "general paralysis or palsy sometimes precedes the mental derangement; this would occur where the spinal cord first became diseased, and the disease afterwards attacked the brain. Such cases, originating in the spinal cord, are the most likely to be checked, if detected early." I cannot find, however, that he refers to any case of complete and permanent recovery occurring within his experience at the Somerset Asylum. Dr. Williams¹ relates the case of a man suffering from undoubted symptoms of general paralysis, both mental and physical, who, after mercurial treatment, was discharged recovered from the Sussex County Asylum, on May 1st, 1868. He, however, feared an ultimate relapse, since "the thickness of speech did not entirely leave" the patient; but, on inquiry, Dr. Williams informs me, in a letter dated February 18th, 1871, that the man is still out, and having called on him quite recently, he finds him "apparently quite well, both in mind and body." Austin, in his monograph, states that "the first stage of the malady—that which precedes the insanity—is, indeed, hopeful, though, perhaps from our comparative ignorance of its symptoms, we may permit ourselves to be unphilosophically sanguine of its curability." Esquirol² considered the disease to be incurable, and M. Roger Collard, during twenty years' experience at Charenton, had not observed a single case of complete recovery. M. Calmeil, in his excellent monograph, '*De la Paralyisie*,' &c.,

¹ '*Medical Times and Gazette*,' May 30th, 1868.

² '*Maladies Mentales*,' tome ii, p. 263.

p. 366, gives the particulars of two cases in which, at the end of ten months, the symptoms disappeared, and which he relates principally in the hope of encouraging the treatment of the disease, but concerning which, however, he significantly remarks:—"Auxquels je n'attache du reste qu'une médiocre importance."

Duration of the Disease.

The length of residence in the 271 cases of death amongst the general paralytics as given in Tables IV and Table V, shows the total duration of the disease in some cases in which this was ascertained.

TABLE IV.

Residence in asylum at time of death.	Males.	Females.	Total.
Under 1 month . . .	24	3	27
From 1 to 3 months . . .	43	—	43
" 3 to 6 " . . .	30	6	36
" 6 to 9 " . . .	30	6	36
" 9 to 12 " . . .	15	3	18
" 1 to 2 years . . .	53	12	65
" 2 to 3 " . . .	19	6	25
" 3 to 4 " . . .	6	8	14
Above 4 years . . .	5	2	7
Total . . .	225	46	271

TABLE V.

Total duration of disease.	Males.	Females.	Total.
From 1 to 3 months . . .	6	1	7
" 3 to 6 " . . .	1	—	1
" 6 to 9 " . . .	4	—	4
" 9 to 12 " . . .	4	—	4
" 1 to 2 years . . .	10	2	12
" 2 to 3 " . . .	4	1	5
" 3 to 4 " . . .	1	2	3
More than 4 years . . .	2	—	2
Total . . .	32	6	38
Average duration of the disease {	1 year, 3 months.	2 years, 3 months.	1 year, 9 months.

The most common length of residence was from one to two years, just about one fourth of the whole number of cases having

resided in the asylum during that period of time. There were just about twice as many between one and two years as in the period next in frequency, viz. six to nine months. One tenth of the cases died within a month after admission, and only 7 out of the 271 cases survived admission for periods exceeding four years. Considerably more than half the whole number of cases died within twelve months after admission. The average total duration was one year and nine months in both sexes, but was a year longer in the female than the male sex, being, in the former, two years and three months, and, in the latter, one year and three months; and whilst 3 out of every 5 females who died lived for more than twelve months after admission, only 2 out of every 5 males did so. This longer duration of the disease amongst the females is remarkable, and I am inclined to attribute it, more particularly, to the less frequent occurrence of the "paralytic furor" amongst them, in the experience of this asylum (which also supports the statement of Salomon,¹ that the depressed form of general paralysis is more frequent amongst the women than the men), and the greater tendency amongst them, as compared with the males, to lapse into a listless demented condition and accumulate adipose tissue, and, generally, to the fact that, as a rule, the female patients are better nursed and attended to than the male. These are favorable and refreshing facts for those who advocate *female* nursing amongst the males in the sick and infirm wards of our asylums. Dr. Crichton Browne has already testified² to the advantages which have accrued from the adoption of this system at the West Riding Asylum, Wakefield (where, during my residence as clinical clerk, I was enabled to appreciate its benefits), and it has since, I hear, been extended in that asylum with good results. It is wonderful how long some of the poor female paralytics will eke out a miserable existence. I can very well recollect the case of one female, occurring within my own experience at this asylum, who, emaciated, bed-sore, wet, and dirty, and requiring to be fed and attended to like a child, lingered bed-ridden, in this condition, for about twelve months.

Many cases of prolonged duration of the disease are men-

¹ "On the Pathological Elements of General Paresis, or Paresifying Mental Disease," 'Journal of Mental Science,' 43, p. 369.

² 'Annual Report of the West Riding Pauper Lunatic Asylum,' 1867, p. 26.

tioned by various authors and writers. Perhaps one of the longest on record is mentioned by Dr. Boyd (*ut antea*); it was a case in which there was no mental disorder, but which lasted for fifteen years. Calmeil estimates the average duration of the disease at thirteen months. Romberg states that the duration extends from one to three years, and, in solitary cases, to five or six years. Austin states that the more usual duration of paralytic insanity is under three years; and Maudsley estimates it at from a few months to three years.

Per-centage of Cases admitted during each year.

The following Table (VI) gives the total admissions during each year, with the cases of general paralysis and the per-centage thereof on the total admissions.

TABLE VI.

Year.	Total admissions.	Cases of G. P.	Per-centage of cases of G. P. on total admissions.
1845-46	346	8	2·31
1847	139	6	4·31
1848	116	9	7·75
1849	111	4	3·60
1850	131	7	5·34
1851	119	10	8·40
1852	116	5	4·31
1853	98	3	3·
1854	133	4	3·
1855	143	5	3·49
1856	156	7	4·48
1857	154	10	6·49
1858	157	13	8·28
1859	175	19	10·85
1860	165	17	10·33
1861	170	8	4·75
1862	208	21	10·
1863	174	22	12·63
1864	169	17	10·
1865	180	15	8·33
1866	152	18	11·84
1867	168	29	17·26
1868	185	35	18·91
1869	194	27	14·
1870	203	22	11·
Total . .	4062	341	<i>Average 8·50</i>

It will be observed that though there has, on the whole, of late years, been a considerable increase in the per centage of cases of general paralysis admitted, yet it has by no means been steady and gradual, but irregular; for instance:—In 1860, in round numbers 10 per cent. of the admissions were cases of general paralysis; but next year only 5 per cent., and, in 1862, 10 per cent. again. From 1865 to 1868 the per centage steadily increased, being, in 1865, 8 per cent., in 1866 12 per cent., in 1867 17 per cent., and in 1868 19 per cent. In 1868 the maximum per centage was attained; and, since then, the per centage has steadily decreased, being 14 per cent. in 1869, and only 11 per cent. in 1870; but taking the table as a whole, I think I should scarcely be justified in asserting that general paralysis is on the decrease in Devonshire, although there has certainly been no steady increase.

Causes of the Disease.

The following Table (VII) gives, in detail, the causes probable or assigned, in the cases admitted.

TABLE VII.

CAUSES.	Males.	Females.	Total.	Males.	Females.	Total.
<i>Moral, e.g.—</i>						
Mental anxiety	8	1	9			
Pecuniary distress or difficulty	7	1	8			
Fright	3	5	8			
Domestic affliction (death, or serious illness of near relatives)	7	—	7			
Religious excitement	4	1	5			
Loss of employment or good situation	4	—	4			
"Adversity"	2	—	2			
Disappointment in love	1	1	2			
Domestic troubles (ill-treatment by, or bad conduct of, relatives, &c.)	1	1	2			
Loss of ship in gale	2	—	2			
Grief and disappointment	—	1	1			
"Want"	1	—	1			
Loss of property	1	—	1			
"Inability to provide for family"	1	—	1			
Total moral causes				42	11	53

TABLE VII—continued.

CAUSES.	Males.	Females.	Total.	Males.	Females.	Total.
Brought forward—						
Total moral causes . . .				42	11	53
<i>Physical, e.g.</i>						
Intemperance, drink, and dissipation	15	4	19			
Falls and injuries to the head	12	—	12			
Sunstroke ¹	7	—	7			
Profligacy and irregular habits	1	4	5			
Nervous "debility and excitement"	1	1	2			
Yellow fever	1	—	1			
"Hardships in the Crimea"	1	—	1			
Hard work and exposure	1	—	1			
Hyperlactation	—	1	1			
Syphilis	1	—	1			
Total physical causes				40	10	50
Cause unascertained				194	44	238
Total				276	65	341

It will be observed that the causes were not ascertained in more than two thirds of the whole number of cases admitted. The total number of cases attributed to *moral* causes was somewhat larger than that of those due to *physical* causes, but of 53 cases attributed to moral causes, 37 were due to mental anxiety, fright, pecuniary distress, domestic affliction, or religious excitement; whilst out of 50 cases due to physical causes, no less than 43 were ascribed to the three causes of intemperance, injuries to the heart, and sunstroke; thus showing the importance of these latter as individual causes, they being in fact the most common causes of all; for, out of every five cases in which the cause was ascertained, one was due to intemperance and dissipation, and another to a fall on, or injury to, the head. Out of 49 cases (41 males and 8 females) admitted under my own observation, I ascertained hereditary predisposition to exist in 8 cases (6 males, 2 females) or in 16 per cent.

¹ The occupation of those in whom the cause was sunstroke, was in 4 cases—*soldier*; in 1—*carpenter*; in 1—*thatcher*; and in 1—*gardener*; all, from the nature of their occupation, being frequently exposed to the rays of the sun.

Calmeil mentions as the most frequent causes, flights of the imagination, domestic chagrin, and reverses of fortune; but above all alcoholic and venereal excesses, excess in coffee drinking, and the abuse of mercury. He also states that he had only seen one case in which the disease was due to a "physical" cause ("cause physique," *sic*), and I presume he means by this a blow on the head, for he mentions, as being common causes, alcoholic excess and exposure to heat, &c., now generally classed as physical causes. Most writers, indeed, since Calmeil's time have recognised as the most frequent causes of the disease (or apparently so), excesses, alcoholic and venereal; but Austin¹ states as his opinion that "an acutely painful impression on the moral sensibility is the usual cause of general paralysis," and he very much doubts "the truth of the reiterated assertion that drunkenness is often the immediate cause of insanity, and still more of general paralysis." The experience of this asylum tends to confirm the assertion of Austin that "moral agony" is the cause in the majority of cases of general paralysis, for, as we have just observed, the cause in the majority of cases was a moral one, and although, as an individual cause, intemperance would seem to carry off the palm, it is an open question as to whether or not many of the cases attributed to such excess have been rightly so attributed, and whether the excess in some of these cases was not rather the effect than the cause of the disease. I can call to mind several cases admitted into the asylum, within my own experience, in which the cause assigned by an indiscriminating relieving officer or overseer was "drink," but in which a careful cross-examination as to the history of the patient showed that such was not really the case, but that it was as I have just surmised it might have been.

Occupations of Cases.

These are shown in the following Table (VIII).

¹ 'On General Paralysis,' pp. 77 and 80.

TABLE VIII.

OCCUPATIONS.	Males.	Females.	Total.	Males.	Females.	Total.
Group A.						
Surgeon and apothecary . . . . .	...	...	...	1	...	1
Group B.						
Veterinary surgeons	2	...	2			
Mine agent	1	...	1			
Spirit merchant	1	...	1			
Commercial traveller	1	...	1			
House agent	1	...	1			
Clerks or accountants	4	...	4			
Professor of music	1	...	1			
Chemist	1	...	1			
Yeoman	1	...	1			
Innkeepers	3	...	3			
Brewers	2	...	2			
Master-mariners and pilots	4	...	4			
Maltsters	2	...	2			
Farmers	3	...	3			
Millers	2	...	2			
Bankruptcy bailiff	1	...	1			
Butler	1	...	1			
Occupation not stated	7	...	7			
No occupation	1	...	1			
				39	...	39
Group C.						
Grooms	2	...	2			
Gentleman's servants	3	...	3			
Coach or omnibus-drivers	3	...	3			
Coachmen	4	...	4			
Cab-drivers	4	...	4			
Quack doctor	1	...	1			
Waiters	2	...	2			
Porters	2	...	2			
Barber	1	...	1			
				22	...	22
Group D.						
Waggoners and carriers	6	...	6			
Butchers	3	...	3			
China-dealer	1	...	1			
Grocers	2	...	2			
Asylum attendant	1	...	1			
Fishmonger	1	...	1			
Auctioneer	1	...	1			
Book-hawkers	2	...	2			
Shop-keeper	1	...	1			
Poulterer	1	...	1			
				19	...	19
Group E.						
Labourers	45	...	45			
Mariners	19	...	19			
Soldiers or pensioners	16	...	16			
Farm labourers	16	...	16			
Carpenters and cabinet-makers	18	...	18			
Tailors	9	...	9			

TABLE VIII (continued).

OCCUPATIONS.	Males.	Females.	Total.	Males.	Females.	Total.
Group E (continued)—						
Shoe-makers	8	...	8			
Masons and plasterers	7	...	7			
Smiths and blacksmiths	8	...	8			
Painters, plumbers, and glaziers	7	...	7			
Clock and watch-makers and jewellers	4	...	4			
Cordwainers	2	...	2			
Whip-maker	1	...	1			
Bakers	2	...	2			
Wool-comber	1	...	1			
Saddlers	2	...	2			
Sawyers	5	...	5			
Thatcher	1	...	1			
Coopers	2	...	2			
Iron-moulder	1	...	1			
Fisherman	1	...	1			
Gunsmith	1	...	1			
Gardeners	4	...	4			
Potters	2	...	2			
Rope-maker	1	...	1			
Miner	1	...	1			
Brush-makers	2	...	2			
Engine-drivers	3	...	3			
Compositor	1	...	1			
Glass-cutter	1	...	1			
Stoker	1	...	1			
China-menders	2	...	2			
Wood-turner	1	...	1			
				195	...	195
Group F.						
Housewives . . . . .	...	20	20			
Domestic servants . . . . .	...	16	16			
Occupation not stated . . . . .	...	5	5			
Washerwomen . . . . .	...	4	4			
Charwomen . . . . .	...	3	3			
Milliners and dressmakers . . . . .	...	3	3			
Needlewomen . . . . .	...	3	3			
No occupation . . . . .	...	2	2			
Staymaker . . . . .	...	1	1			
Hay-sorter . . . . .	...	1	1			
Shoe-binder . . . . .	...	1	1			
Lace-maker . . . . .	...	1	1			
"Prostitute" . . . . .	...	1	1			
Silk-weaver . . . . .	...	1	1			
Shop-keeper . . . . .	...	1	1			
Fish-wife . . . . .	...	1	1			
Glovemaker . . . . .	...	1	1			
				...	65	65
Total				276	65	341

I have divided the occupations into six groups—A to F respectively. Group A includes one of a class now rarely met with in county asylums. Group B consists of the better class of patients generally found in such asylums, and who, from the nature of their occupation, do a certain amount of brain work, and are more liable than any of those included in the other groups to cerebral excitement. Group C consists of those who, as a rule, are notoriously addicted to alcoholic excesses. Group D is composed of a quieter set of men, some of whom, nevertheless—perhaps the waggoners more than any of the others—have “thirsty” occupations. Group E includes those who make their living entirely by manual labour, and perform little or no brain work; more than two thirds of the whole male paralytics belong to this class. If, then, general paralysis is so common in county asylums, and if the great majority of cases of it belong to the class of manual labourers, I cannot see the foundation for the assertion made by some authors (notably by Esquirol and Romberg) that general paralysis is most common amongst the higher classes, and those who overwork their brains. I am scarcely prepared to assert that cases of general paralysis are not proportionally more frequent in private than public asylums; for in Scotland during the year 1869, 8 out of 35 deaths, or 22 per cent., were ascribed to general paralysis; whereas in royal and district asylums during the same year, 36 out of 407, or only 9 per cent., were attributed to that cause; but if, during a period of many years, the proportion of deaths of general paralytics in private asylums is greater than it has been in this asylum, viz. 29·25 per cent. amongst the males, and 7·50 per cent. amongst the females, then the mortality from that disease in private asylums must be considerably more serious than we have yet distinctly been given to understand it is. The progress made by civilisation is, I believe, less a fact in Devonshire than in many other counties; for in this county, in which there are few busy centres, and in which the science principally cultivated is agriculture, there still lingers a large amount of superstition; and although we have not, even yet, exterminated our “savages,”¹ there is nevertheless this large mortality from general paralysis. The fact is, that the causes which most commonly give

¹ See ‘Exeter and Plymouth Gazette,’ of recent date, for an “Account of some Families in the North of Devon, still living in a state of Barbarous Primitiveness.”

rise to the disease are quite as rife (if not more so) amongst the lower as amongst the upper classes, and the latter being less in number than the former, we should expect the disease to be more common amongst the former, both proportionally and absolutely. Probably Dr. Sankey is correct when he states that the predisposition to the disease is in the following order:—1st, males of the lower classes; 2nd, males of the upper classes; third, females of the lower classes; and fourth, females of the upper classes.¹ I am sorry that the facts on which we might discuss this most interesting question are as yet both vague and scanty, and probably when the statistical tables recommended by the Medico-Psychological Association and the Commissioners in Lunacy shall have been adopted in all asylums, both public and private, we will be in a better position to deal with it. A general tabulated account of the causes of death in the various asylums and institutions for the insane throughout the kingdom, such as I observe in the Report for 1870 of the Scotch and Irish Commissioners in Lunacy, would be a desirable addition to our own 'Blue Book,' and enable us to institute comparisons as to the results in different asylums and in different classes of society, which might tend to clear up this question, and others of a similar nature.

Prichard² says that general paralysis is a comparatively rare disease in private asylums, and according to statements made to him by Dr. Bompas, it would seem that out of 285 patients received into his establishment at Fishponds, near Bristol, only five were the "victims" of general paralysis, most of these being persons addicted to alcoholic excesses. In the Retreat, near York, the disease is of very rare occurrence.

The occupations which, next in frequency to that of labourers, recruited the ranks of general paralytics in the Devon County Asylum, were those of soldiers and marines, or mariners; one seventh of the whole number of males being of one or other of these occupations. This fact seems to confirm the statement of Calmeil³ (which, however, is much more applicable to France than Great Britain), that "de toutes les professions, celle des armes exerce l'influence la moins douteuse et la plus funeste;"

¹ 'Journal of Mental Science,' No. 48, p. 476.

² 'Treatise on Insanity,' p. 108.

³ 'De la Paralytie, &c.,' p. 373.

and it is a fact that privates, both of the marines and line, and seafaring men, are very liable to excesses, both venereal and alcoholic, and to all the other common causes of general paralysis.

Group F consists of the females, one third of whom were housewives, and one fourth domestic servants.

Causes of Death.

Without entering into needless detail, I will simply specify the immediate causes of deaths, which have been most frequent amongst general paralytics in this asylum, in their order of frequency:—

- 1st. Gradual decay or exhaustion of the vital powers.
- 2nd. Phthisis pulmonalis.
- 3rd. Epileptiform or apoplectiform convulsions.
- 4th. Bed-sores or sloughing.
- 5th. Inflammation, and other diseases of the lungs.
- 6th. Diarrhœa.

Out of 271 deaths, 3 males died from gangrene of the lungs, and 3 males from the passage of food into the larynx, causing suffocation.

Post-mortem appearances.

By far the most common general post-mortem appearances have been extensive sub-arachnoid serous effusion, with atrophy and shrinking of the grey matter of the convolutions, and adhesions of the pia mater to their cortical substance. These general appearances were also found by Dr. Sankey¹ to be most common amongst general paralytics, and more common with them than other patients. This atrophy, then, with compensatory effusion, cannot be set down as characteristic of general paralysis, since, as we all know, exactly the same general appearances are frequently found in cases of chronic insanity and senile dementia; but, to say nothing here of the histological peculiarities of the degeneration of the brain in general paralysis, so well shown by the microscopical researches of Wedl, Rokitsansky, Sankey, Lockhart Clarke, and others, there is this fundamental difference between the atrophy and degeneration as found in general paralysis, on the one hand, and in chronic insanity and senile dementia on the other, viz. that in the former they are produced in the space of about two years, and in persons of middle

¹ 'Journal of Mental Science,' No. 48, p. 483.

age, whilst in the latter many years must elapse before the same results are attained. This atrophy of the brain is absolute as well as relative, for, according to experiments made by Dr. Bucknill on the brains of general paralytics dying in this asylum, it appears that the density of the brain is always diminished, and that there is a loss of specific, in addition to absolute size and weight. I would refer the reader to the sixth annual report of the Devon Asylum for details as to these interesting experiments. Contrary to the researches of Calmeil, who states that it is habitually healthy, Dr. Bucknill, after numerous observations of the spinal cord in cases of general paralysis, "always thought it presented a less diameter than ordinary;" and further investigation has confirmed his observations in this respect, and shown that in it, as well as in the brain, elementary degeneration and other changes ensue, and that the disease is, as Dr. Bucknill, in 1852, believed it to be—"a disease of nutrition affecting the whole nervous system." Here then we have mental derangement and progressive general paresis produced, as symptoms, by an organic disease, which, commencing usually in the brain, but sometimes in the spinal cord, ultimately, though gradually, affects both. This disease is apparently, in many cases, as tangible as Bright's disease of the kidney, which Dr. Wilks thinks it probably much resembles.¹ The general homology between the lesion of the brain in many cases of general paralysis, "contracted granular" kidney and cirrhotic liver, is, indeed, in many respects perfect; in all there is general atrophy, adhesion of the investing capsule, and a morbid increase of fibrous elements at the expense of the cellular. May we not, then, regard the disease of the brain in such cases as being homologous to that presented by the "contracted" kidney and cirrhotic liver, and, looking upon it as a *cirrhosis* of the cortical substance and ganglia, consider the symptoms and results to be analogous? Why should not such morbid changes occur from *toxic* causes in the brain as well as in the "gouty" kidney or the "gin-drinker's" liver? and is there not reason to believe that alcohol is an important agent in producing the disease of the nervous system in many cases of general paralysis? The frequent occurrence of

¹ "Some cases of General Paralysis," &c., 'Guy's Hospital Reports,' Third Series, vol. xvi, 1871.

the disease amongst drunkards, and the fact that the morbid changes are generally, in the first instance, vascular, and occur in those parts of the brain where vessels most abound, tend to make us believe that the disease is often of toxic origin. These remarks only apply, of course, to one (yet a large) class of cases of general paralysis, for in many cases, although the ultimate results are very similar, the causes and morbid processes are different.

Complexion of Cases.

Of 40 cases now resident in the Devon County Asylum the complexion is as follows:—

	Males.	Females.	Total.
Dark or darkish	17	6	23
Medium	12	2	14
Fair	3	0	3
	—	—	—
Total	32	8	40

Dr. Saunders (the Medical Superintendent) informs me that, during his twelve years' experience here, he has always observed the great majority of cases of general paralysis to present a dark complexion. This is not surprising amongst people now generally supposed to be a branch of the Celtic race, and amongst whom the great majority of persons are dark-complexioned. We should also expect to find, from affinity of race, that the same state of things existed across the Channel, and such is, indeed, the case, for Calmeil ('De la paralysie,' &c., p. 372) states, that the greater number of cases of general paralysis have dark hair and a skin "brune et basanée." Austin, however, at the Bethnal House Asylum, has observed that the complexion of the "victims" of general paralysis is "almost universally" fair, and he attributes the "greater frequency of the disease amongst the fair" to their sanguine temperament and "greater moral susceptibility," and he considers this an argument in favour of his belief that "moral agony" is the most frequent cause of the disease. The facts I have just stated in reference to the complexion of cases in this asylum do not, however, tend to support Austin's argument in this respect, and, moreover, though in Scotland the Saxon element predominates, and the majority are of a "sandy" complexion, we have no evidence to show that general paralysis

is more common there than in England ; indeed, the general evidence is in favour of our presuming that it is more common in England than Scotland, and in France than either.

Concluding Remarks.

I shall not take up further space by recapitulating the leading facts to be gleaned from my record of these 341 cases of general paralysis. I have endeavoured to be as concise as possible ; but, being under the belief that much of the pathology of this disease is yet to be learnt from explorations in new and unexpected directions, I may seem, in the eyes of some, to have been discursive a little here and there. This belief, coupled with my datum—that this very fatal and common disease demands our strictest attention and most minute examination—must be my excuse. I cannot conclude without acknowledging many valuable facilities afforded, and much kind assistance rendered me by Dr. Saunders in the compilation of this paper.

ON THE
TREATMENT OF INSANITY
BY THE
HYPODERMIC INJECTION OF MORPHIA.

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It was in the year 1843 that Dr. Wood, of Edinburgh, first employed the hypodermic method of administering morphia, though he employed it in a much more limited manner than that in which it is now used. He believed that its power of allaying pain depended on its localised action, and always applied it over the seat where pain was felt on pressure, although he appears also to have recognised its general effects on the system. From this time it was much used in Scotland, but it was not until 1858 that it was first tried in London by Mr. Charles Hunter, and it is to him that we are indebted for its more extended use, as from that time he was led to test more thoroughly the medicinal action, both of morphia and other drugs (atropine, quinine, &c.), injected hypodermically. Dr. Wood only injected morphia in the locality of the pain, and thought that its general effects on the system were due to sympathetic action; Mr. Hunter, on the other hand, from his experiments deduced—

First. That in neuralgia equal benefit followed distant injection of the cellular tissue as followed the injection of the neuralgic site.

Secondly. That localisation was not necessary to benefit a given part.

Thirdly. That for several reasons it was better not to localise.

The chief being the infliction of unnecessary pain; the

almost certain risk of irritating, thickening, or inducing suppuration in the part from the injection. It, moreover, became evident that a large class of cases of neuralgia would be excluded from this treatment, if it was necessary to inject the neuralgic site.¹

Mr. Hunter next goes on to show that by injections into the cellular tissue we have "a mode of attacking cerebral excitability more rapid, certain, and pure in its action than by stomachic doses; and still further, "that, injected in this manner, the action differs from that of the drug taken by the mouth; thus, that it does not cause dryness of the mouth, nausea; sickness, or constipation, and possesses more diaphoretic action." He showed also that morphia hypodermically injected acts much more quickly.

Now, to bring the hypodermic injection of morphia within the range of remedies for the treatment of insanity, the adoption of Mr. Hunter's theory is, of course, absolutely necessary, as here we have diseases most commonly of a centric origin, and, therefore, totally incapable of being treated in this way if the action was only local. A dose of morphia injected into the cellular tissue under the skin is at once absorbed by the capillaries, passing directly into the systemic circulation, and being conveyed to the heart, thence to the lungs, and further to the brain. There is, therefore, nothing in any way to prevent the natural, full, and rapid action of the drug administered. It is on this account necessary to be very cautious as to the quantity injected, since the dose once administered, the full effect of the drug must follow. On the other hand, when a dose of any drug is given by the mouth, and passes into the stomach, it has the manifold and complicated actions of the digestive system first to encounter. It may become altered and its action destroyed by the gastric juices; it may never pass out of the stomach into the circulation at all, and, therefore, be totally ineffective; and this has been found to be the case with opium in some instances. But should it be absorbed, it must then pass through the portal circulation before it reaches the general circulation and arrives at the heart. There are, therefore, many reasons why the action, by injection, should be "more rapid, certain, and pure;" and, still further, there may be reasons why medicines administered in this way may act so differently as to be regarded as distinct medicines.

¹ Hunter, 'Speedy Relief of Pain, &c., by means of the Hypodermic Method.'

This Mr. Hunter claims in the case of morphia, for the reasons mentioned. He thus describes the action of morphia injected hypodermically:—"The pulse instantly rises, the system glows, the face may slightly flush as the skin gets warm, and rapidly perspires, the pulse then goes down ten or twenty pulsations below the normal standard. The brain is soothed; sleep is gentle and happy. The patient awakes restored. There is no dryness of the mouth, no nausea, no sickness, nor constipation of the bowels, for the morphia has gone to the brain by the shorter and more direct road."

Although in many cases this is found to be true, and little or no gastric derangement follows the use of morphia by this method, still others do occur in which the tongue becomes coated, and sickness is produced, either almost immediately, or some hours afterwards; and in one case, which I shall refer to afterwards, vomiting occurred after the hypodermic injections, when an equivalent dose was tolerated by the mouth, and produced no bad effects. An equivalent dose appears to be about three times the quantity injected.

I may here remark that most of my own observations on this method of treatment were made before I had an opportunity of reading Mr. Hunter's pamphlet, and perhaps on this account they may be more valuable, as showing to what extent they bear out his remarks.

The syringe I have used is the one ordinarily sold for this purpose without the screw adjustment, which though perhaps scarcely so well adapted for very concentrated solutions, is more convenient if the patient be at all inclined to resist the injection. The barrel of the syringe is graduated to twenty minims of liquid.

The ordinary solution used was one containing one grain of the acetate of morphia dissolved in forty minims of distilled water,¹ with the addition of an exceedingly small quantity of acetic acid; and in this we have a liquid so nearly neutral and so devoid of any irritating properties that it is but little likely to produce any unpleasant consequences, even when the injection is frequently repeated in nearly the same situation. As to the mode of injection, if the patient be inclined to resist and be in

¹ The mode of preparation is as follows:—Morph. Acet., ʒj, is added to Aq. Destil., ʒv, which, with the addition of 2 minims of acetic acid, will easily dissolve the morphia.

bed, this is easily accomplished in any case with the assistance of two attendants, one of whom presses the shoulders of the patient, while laid on his back, firmly on the bed, while the other holds the arm to be injected across the body in a semiflexed position, and restrains his other hand. Should the patient not be in bed, if the patient's arm be passed round the waist of an attendant standing close to him, and be held in that position, the injection will still be easily accomplished. The required amount of fluid having then been drawn into the syringe, care being taken that no bubble of air is included, the nozzle screwed on tightly, a portion of the skin of the outer and posterior part of the upper arm is then pinched up between the finger and thumb of the left hand, while the other holding the syringe passes its point through the raised portion of the skin well into the cellular tissue; in doing this, the syringe should be held at the lower extremity of the barrel, so as to obviate the chance of breaking or bending the small tube of which the nozzle is formed; the fluid is then injected, and before withdrawing the point from beneath the skin the thumb of the left hand should be pressed over the orifice of the puncture, so as effectually to close the opening as the tube leaves it; the small tumour produced by the fluid may then be made to disappear by lightly rubbing with the thumb of the other hand, which disperses the fluid in the cellular tissue, and prevents any portion from oozing out through the point of puncture: if this be done, no dressing of any kind will be required.

One of the earliest cases that turned my attention specially to this method of treatment, and perhaps on the whole the most successful I have ever had, was that of

CASE 1.—J. K—, who had been for some years a patient in the Warwick County Asylum. He was suffering from chronic mania, which underwent exacerbations, each of which lasted about five weeks, and was succeeded by an interval of about three weeks during which he was quiet. The attacks commenced by his refusing food, and then becoming excited and noisy, so much so that he enjoyed the reputation of being by far the most noisy patient in the whole building. For these attacks he had been treated by various remedies, and amongst others by morphia by the mouth, without any beneficial effect, though it must be stated that this may at any rate partially have been caused by the fact that it was often impossible to get him to take any medicine; and I think it will be found that it is in these cases in which the mode of treatment will prove more especially beneficial, as in it we have a simple and easy manner of administering medicine with a certainty of its having a chance of producing its effect. In October, 1869, my attention was called to this patient at the

evening visit, by the attendant, who informed me he was "off," meaning that one of his attacks was commencing. He had taken no food that day, was excited and noisy, constantly singing and whistling. Knowing that he would not take medicine, it occurred to me to try the morphia puncture. I accordingly injected a quarter of a grain into the arm. The next morning I was told that a quarter of an hour after the injection he was perfectly quiet, that he had slept and remained in bed all night. When I saw him he had taken his breakfast and had resumed his ordinary condition. For about five weeks from this time there was no return of excitement, but then he again became noisy. This was again checked by a single injection of a quarter of a grain. Since that time he has been subject to similar attacks, but at longer intervals, and until March of the present year one or at most two punctures have sufficed to check the attack.

March 22nd.—After having been free from any attack for a longer period than usual (nearly three months), he again became depressed and refused his food. One quarter of a grain of morphia was injected at 7 p.m. He was noisy until 11 o'clock, but then quiet for the remainder of the night.

23rd.—To-day much excited, noisy, and talkative. Rep. inject. Morph. Acet. gr. $\frac{1}{4}$. Restless during part of the night.

24th.—Still excited. Bowels have not acted for two days. Tongue thickly coated with white creamy fur; breath very offensive. Has taken very little food. R. Mist. Alb. $\frac{3}{4}$ ss stat. sumend. The bowels acted, and at night rep. inject. Morph. gr. $\frac{1}{4}$.

25th.—Slept till 5 a.m. To-day much excited, can with difficulty be made to keep his clothes on. Takes part of his food. Inject. Morph. gr. $\frac{1}{4}$.

26th.—Was noisy during part of night, but has been quiet all to-day, and taken most of his food. Tongue slightly coated white. Rep. inj. Morph. $\frac{1}{4}$ gr.

27th.—Slept all last night. The excitement has subsided, but still does not take food well. Bowels relaxed. R. Haust. Rhei c. Opio. Omit inject.

28th.—Slept well. Quiet to-day. Has taken food. Diarrhœa ceased.

29th.—Has resumed his ordinary condition.

This attack, although not checked as quickly as on previous occasions, was still of much shorter duration than his old attacks, which generally lasted about five weeks. I do not think that the constipation in the early part in any way depended on the morphia, and, in fact, afterwards we have the opposite condition arising, while the injections were still being continued. Lately the first symptoms of the exacerbation have been those of depression, passing, in the present instance, into noisy excitement.

The pulse taken during one of the attacks in this case was—

Before the injection	118, very feeble.
Five minutes after	108, feeble.
Two and a half hours after	94, fuller, but soft.
Five hours after	84, same.
Next day	98, feeble.

In another case, also of chronic mania, the result was equally good.

CASE 2.—H. W—, a case of chronic mania, subject to periodical outbursts of excitement, lasting a week or ten days.

April 9th.—Became excited, and in the evening wildly so, raving and abusive. Eyes widely dilated and staring: foaming at the mouth. Has taken no food during the day. With some difficulty a quarter of a grain of morphia was injected into the arm. In about ten minutes she became so much quieter, that she was allowed to remain up until her usual bedtime.

10th.—Passed a quiet night, and to-day has almost resumed her ordinary condition, has taken her food, and employed herself in her usual manner.

No further treatment required.

In another case, that of E. G—, chronic mania, with occasional excitement. On the first occasion the exacerbation was checked by one injection of gr. $\frac{1}{4}$. A second attack by two on consecutive nights. On the third attack it appeared to lose its effect.

In the case of C. G—, suffering from chronic mania, accompanied by frequent sleeplessness, restlessness, and noisiness at night, when chloral and opium by the mouth had failed to produce any effect, the hypodermic injection was tried. She was quiet, but vomited several times during the night, the sickness also continuing throughout the following day. After an interval it was again tried, but with a similar result.

In a case of chronic mania, in which very severe symptoms were developed (mentioned to me by Mr. Aldridge, of the West Riding Asylum), an injection of one sixth of a grain produced quietness for forty-eight hours. When the symptoms recurred the injection was repeated, with like effect, and so on for six times, when she resumed her ordinary condition.

The next cases I shall mention are two in which the injection of a quarter of a grain of morphia has been repeated nightly for eighteen months, the one an instance of epileptic mania, accompanied by occasional outbursts of excitement of a most violent character, the other of chronic mania. In both these, except at times of greater excitement, throughout the whole time no increase of dose has been required; but any attempt to lessen it has been at once followed by a bad night. In the first, previously to the time when the injections were commenced, the patient, E. W—, had for a long time taken morphia daily. The fits were occasional, and she was often subject to headaches and constipation. Since November, 1869, when the injection was commenced, she has not had a single fit, and states that her

headaches have been much less frequent, at one time also there seemed to be some improvement in her mental condition, but lately this has not been confirmed. The other patient, H. S—, was subject to frequent attacks of gastric derangement, often accompanied by increased mental excitement. Since she has had the injections two of them have occurred, but generally her health has been decidedly better. She had also been taking opium or morphia by the mouth for a long time.

In both these cases the puncture has always been made on the posterior part of the upper arm (either right or left), and on one occasion only has it caused any inconvenience, by the formation of a small abscess, which was troublesome for a few days.

CASE 3. *Acute melancholia*.—M. P—. Acute mental anguish and restlessness, with sleepless nights. Refusal to take medicine.

August 5th.—For week has had inj. Morph. Acet. $\frac{1}{2}$ gr. at bedtime. Sleeps at night, but no mental improvement.

September 2nd.—Inject. Morph. Acet. $\frac{1}{2}$ gr. has been continued nightly. As she became restless at night, Chloral Hyd. was ordered in gr. xl doses each night. Injection discontinued. The chloral did not produce sleep, and the injection gr. $\frac{1}{2}$ was again continued, combined with the chloral; with this she slept, but, as during the day, her mental anguish has been extreme; for last twelve days she has also had Morph. gr. $\frac{1}{2}$ every morning.

8th.—Some improvement; chloral \mathfrak{z} ij and injec. Morph. Acet. gr. $\frac{1}{2}$ continued nightly. Omit Morphia in morning.

October 20th.—Chloral discontinued. Inject. Morph. gr. $\frac{1}{2}$ continued nightly. Sleeps at night. No improvement in mental condition.

December 8th.—Same condition, but inclined to be restless at night. Injection increased to gr. $\frac{1}{2}$ every night.

January 15th.—No change. Sleeps well.

February 10th.—Has the delusion that the injection is given to take her life, and her mental distress is increased every night at the time of injection. It was therefore discontinued for a night or two, and as she slept well without it, has now been omitted. Mental condition unchanged.

In this case the injection proved very useful in procuring sleep at night. Afterwards losing its effect, it was given in combination with chloral, and acted well, though each failed when given alone. Throughout it produced no permanent effect on the mental condition. The history in this case shows very strong hereditary tendency to insanity.

CASE 4. *Acute melancholia*.—S. H.—. Great mental anguish, and strongly marked suicidal tendency.

March 17th.—On 13th became very unmanageable, and would not take her draughts (Chloral 3ss at night, and Morph. Acet. gr. $\frac{1}{2}$ in the morning). Morphia gr. $\frac{1}{2}$ was injected hypodermically on that and following night, when she resumed her draught (Morph. gr. $\frac{1}{2}$ at night).

April 17th.—Appeared to improve for a short time, but the mental distress became more intense, and she was ordered Morph. gr. $\frac{1}{2}$ every morning, injec. Morph. gr. $\frac{1}{2}$ at night. Continued for three nights. Vomiting on each occasion after the injection. Omit injection. The morphia was afterwards increased, as much as three grains daily being taken without producing sickness.

CASE 5. *Acute melancholia with excitement*.—E. S.—. Very noisy and restless at night. Much emaciated.

March 21st.—Inject. Morph. Acet. gr. $\frac{1}{2}$.

22nd.—Restless last night. Rep. inject. gr. $\frac{1}{2}$.

23rd.—Restless. Rep. inject. gr. $\frac{1}{2}$.

24th.—Slept part of night. Continue injection gr. $\frac{1}{2}$.

25th.—Slept part of night; very noisy and restless all to-day. Rep. inject. Morph. gr. $\frac{1}{2}$.

26th.—Slept well all night. Rep. inject. gr. $\frac{1}{2}$.

29th.—The injection gr. $\frac{1}{2}$ has been continued nightly, and there appears to be decided gradual improvement. Mental distress not so great; complexion more healthy; is more manageable, and will now take medicine. Omit injection. Repeat Morph. Acet. gr. 1 every night.

For some time before the injections were tried the patient had been under a tonic treatment, but without any effect.

CASE 6. *Melancholia (acute)*.—J. S. W.—. On admission, January 28th, extremely depressed; will scarcely answer any question, even when several times repeated. Says "he is given over to sin."

January 29th.—Last night was restless when put to bed, and would not remain in bed. He was therefore ordered a draught, which he would not take. Morph. Acet. gr. $\frac{1}{2}$ injected hypodermically. Restless part of night. To-day inclined to be violent; resisted being dressed. R Tinct. Opii $\mathfrak{m}\mathfrak{x}\mathfrak{v}$, Sp. $\mathfrak{A}\mathfrak{e}\mathfrak{t}\mathfrak{h}$. S. 3ss. Aq. 3j three times a day.

7 p.m.—Has refused medicine. Inject. Morph. gr. $\frac{1}{2}$.

30th.—Restless part of last night; attempts to tear his clothes, and very unmanageable. 7 p.m.—Has taken two doses of his medicine and more food.

February 1st.—Remained in bed last night, and slept.

Patient continued the medicine, and steadily recovered.

CASE 7. *Mania*.—M. B.—. Has lately been sleepless at night and very noisy, so much so that she is quite hoarse to-day. For several days has taken very little food.

March 22nd.—Inject. Morph. Acet., gr. $\frac{1}{2}$.

23rd.—Slept last night, and has taken her food better to-day. Nothing to-night.

24th.—Noisy last night, and has again taken scarcely any food. Rep. inject. Morph., gr. $\frac{1}{2}$.

25th.—Slept most of night, and has taken her food. Rep. inject.

26th.—Noisy part of night, but is, on the whole, much better, and takes her food. Rep. inject.

27th.—Slept most of night.

The injection was continued for two more nights, and she then continued to sleep without it, took her food, and continued to improve.

CASE 8. *Acute mania*.—H. P.—. Noisy, violent, and excited. Sleepless and noisy at night.

April 17th.—R. Pulv. Podoph., gr. j.

18th.—Bowels acted freely during the night. This morning is quiet, and will converse rationally.

19th.—Again as much excited and noisy as before. Inject. Morph. Acet., gr. $\frac{1}{2}$, at 6 p.m.

20th.—Had a quiet night and slept. Will again talk quietly and rationally. Nothing to-night.

22nd.—Again noisy, incoherent, &c. Rep. inject. Morph., gr. $\frac{1}{2}$. The patient was in bed. The pulse, before the injection, 116 in the minute, small and jerking. Five minutes after, 116. Two hours and a half after, 96, fuller; restless and noisy. Five hours after, 100; very restless, noisy, and out of bed.

23rd.—Restless and noisy all night. To-day same condition. R Tr. Opii, mxl ; Sp. Æth. S., ʒss ; Aq., ʒj , bis die sumend. Pulse after two doses, 98. Much quieter.

29th.—Has continued quiet and without any return of excitement. Bodily condition improving. The medicine continued. Here on the second occasion, the injection did not take effect. The pulse was lowered, but was equally so after the opium by the mouth. On the first occasion the patient was quiet for forty-eight hours.

CASE 9. *Puerperal mania*.—M. N.—. June 23.—Much emaciated. Restless, incoherent, raving about her child. Last night, R Morph. Acet., gr. $\frac{1}{2}$. Had no sleep; part of night restless and out of bed. Does not take food well. Rep. Morph., gr. $\frac{1}{2}$.

24th.—Noisy, restless, no sleep. R Chloral, ʒss , statim sumend. 10 p.m., not slept. Rep. Chloral, ʒss .

25th.—Slept about two hours. Noisy rest of night and to-day. Very pale. Pulse quick and feeble. 12 noon. Rep. Chloral, ʒss . 10 p.m., no sleep. R Inject. Morph., gr. $\frac{1}{2}$.

26th.—Restless and noisy all last night. Fell asleep this morning at 8.30, sleeping well till 7 p.m., and even then required rousing for food. Again slept till 10 p.m. More composed and took food well.

27th.—Noisy last night. Rep. inject. Morph., gr. $\frac{1}{2}$, at 7 p.m.

28th. Noisy till 4 a.m., then slept two hours. To-day more quiet. 6.30 p.m., Rep. Inject. Morph., gr. $\frac{1}{2}$.

29th.—Noisy till 6 a.m., when slept six hours. Rep. Inject. Morph., gr. $\frac{1}{2}$, 4 p.m.

30th.—Restless till 8 a.m., when slept till 3.30 p.m.

July 1st.—Noisy last night. R Pot. Brom., ʒj ; Sp. Vin. Gal., Aq., āā ʒss ; ter die sumend.

2nd.—No sleep last night, very noisy. R Inject. Morph., gr. $\frac{1}{2}$, 12 m.

3rd.—Had a good night. Rep. inject., gr. $\frac{1}{2}$ 12 noon.

4th.—Slept beginning of night, then noisy. R. Chloral, 3ss, 12 noon. 8.30 p.m., no sleep. Inject. Morph., gr. $\frac{1}{4}$.

5th.—Slept well till 12 at noon.

15th.—Much improved. The inject. Morph., gr. $\frac{1}{2}$ has been repeated each day at 3 p.m., and has been generally followed by good nights. Cont. inject., gr. $\frac{1}{4}$.

26th.—Has not slept so well for the last four nights. Increase inject. to gr. $\frac{1}{2}$.

28th.—Has slept well the last two nights.

Soon after this time the injections were discontinued, and she slept well, with Chloral Hyd., 3ss, every night. She has since been discharged. It will be noticed that in this case sleep rarely followed the injection in less than from eight to twelve hours.

CASE 10.—*Puerperal mania*.—M. H.—. Pale, emaciated, not much excitement. Reported to have slept well until the night before admission on April 29th. R. Chloral, 3ss, hori. som.

April 30th.—Noisy and restless all night, and to-day much excited, shouting and singing. R. Chloral, 9ij, at 7 p.m. 12 midnight, still noisy. R. Chloral, 3ss.

May 1st.—Extremely excited and noisy all night and this morning. 12 noon, inject. Morph., gr. $\frac{1}{4}$. In about a quarter of an hour became quiet, and slept all the afternoon.

2nd.—Had a quiet night, and to-day is composed and will answer questions rationally. 7 p.m., Rep. inject. gr. $\frac{1}{4}$. Pulse 98, feeble. 10 p.m., skin moist, perspiring. Is sleeping quietly. Pulse feeble, 96.

8th.—The injections (gr. $\frac{1}{2}$) have been repeated nightly. She has continued to have good nights, and is improving in her general condition.

CASE 11.—*General Paresis*.—E. S.—, very frequently restless at night, and for this has taken digitalis, hyoscyamus, and chloral, all of which have in turn lost their effect. For the last few nights has been restless and out of bed all night.

April 22nd.—Inject. Morph. gr. $\frac{1}{4}$. Pulse before 100, feeble, soft; five minutes after 92, much fuller. Two and a half hours after 98, quiet in bed and asleep. Five hours after 90, asleep.

23rd.—Slept well all night. Rep. inject. Pulse before 98; two and a half hours after 77, sleeping.

24th.—Restless latter part of night. Rep. inject. gr. $\frac{1}{4}$.

25th.—Restless and out of bed all night.

The injections have since been repeated, but without effect.

CASE 12.—W. B.—, convalescent from melancholia, but still complains of sleeplessness at night. Has also rheumatic pains in legs and back.

April 6th.—Inject. Morph. gr. $\frac{1}{4}$ at 7 p.m. 12 midnight complains of pain all over. Face flushed, conjunctivæ injected, pulse 100; very restless and irritable.

7th.—Continued sleepless and restless all night. To-day the pain is better, and he is more composed.

8th.—Slept well.

9th.—Slept.

This case is only mentioned on account of the first effect pro-

duced by the injection. This was identical with that which is at times so well marked when opium is given by the mouth. This is the only case in which I have ever seen it produced by morphia injected hypodermically.

The last case I shall give is one of senile mania, when Hyoscyamus and Chloral Hydrate had been given, the latter in $\frac{1}{2}$ doses, for constant restlessness, both without any effect. One sixth of a grain of morphia was therefore injected into the arm of the patient, who was aged 74, but during the night he continued as restless as ever. In the morning he was still restless, the morphia having produced no effect on the mental symptoms, but on the excito-motor system it had acted, the countenance was extremely pallid, the pulse very feeble, and the surface of the body cold. There was not any coma; when spoken to he answered directly, although incoherently. Stimulants were given and he rallied. This case resembled in some respects several cases mentioned by Drs. Bucknill and Tuke, of extreme intolerance of opium. I mention it as showing that in this class of cases the injection should at any rate be used with great caution.

The above cases will be, I think, sufficient to show that in this mode of treatment we have at least a valuable adjunct to our other remedies in the treatment of insanity, and especially in those cases where there is refusal or great unwillingness to take medicine, as by this means that amount of exhaustion is avoided, of which a struggle between the nurses and patient in administering a dose of medicine must always be productive. In some of the cases of chronic mania the effect was indeed almost magical, and it is in these where I have seen most special benefit from its use. In the cases of puerperal mania the general effects appear to be good, as indeed we should expect, from the effect in them of opium given by the mouth. In Case 13 the injection of a third of a grain of morphia acted almost as a charm where seventy grains of chloral had failed to produce any effect on the previous night. The case of Mary N— is also interesting, as illustrating the deferred action of morphia by injection, and showing that the delayed effect of the drug cannot always be ascribed, when given in the ordinary manner, to its non-absorption into the system. The results in melancholia have not been so good as might have been expected, but the

fact that the first three cases mentioned in which it was tried have all proved extremely unfavorable ones, and as yet not amenable to any kind of treatment, must be taken into consideration. In the last case of melancholia, and the one of acute mania, the opium combined with sulphuric ether acted more satisfactorily than the injection of morphia alone. In the case of epileptic mania, the fact of the patient not having had any fits during the eighteen months in which she has had the injections, is worth bearing in mind, though I have not sufficiently tried it in epilepsy to know whether this can be said to be in any way due to the treatment.

As regards the constitutional effects it is more difficult to form an opinion in insanity than in other diseases, as in it the various preparations of opium are generally so well borne. In those cases where it has been used for a length of time, it has not produced constipation or any other unpleasant symptom, except in the one instance where a small abscess formed. I have mentioned several cases in which sickness and vomiting were produced, and in one case where large doses of morphia were given by the mouth without any such result. Morphia given in this way does in many cases appear to act as a tonic, to improve the general tone of the system and the appetite; but so it does most undoubtedly when given by the mouth, and it is probable that it acts thus generally by allaying the nervous irritability which, when present to any great extent, prevents the patient from caring for his food.

On the whole the cases I have given may appear scarcely so favorable to this mode of treatment as they should do—for while on the one hand I have given several in which the good results were well marked, on the other I have given some in which the action was not altogether satisfactory.

In the earlier stages of insanity often seen in private practice, but so rarely met with in asylums, I should expect that this mode of treatment would prove of great benefit.

MOLLITIES OSSIUM

AND

ALLIED DISEASES.

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THE disease mollities ossium is so rare in its occurrence, and so little has been established as to its pathology, that the notice of a few cases that have occurred in the West Riding Asylum lately, with comments on the cause, may prove of interest to many in the profession. The subject has been frequently touched upon and treated *in extenso* by various authors, each one choosing some channel very little, if at all, connected with the special subject, that it renders it extremely difficult to peruse the various monograms and statements of cases. The most satisfactory essays that have been published on this subject are, one written by Dr. J. Jones, of Georgia, in the 'Transactions of the American Medical Association;' in which there is a valuable synopsis of cases, and one in 'Guy's Hospital Reports' (1864), by Mr. Durham. Frequent allusion to, and occasional extracts from, these two papers will be made in the comments appended to the statement of cases which follows.

In the following paper the original cases that bear on the subject will first be quoted, with such remarks as may be thought necessary, and then the suggestions of the different writers, as to the pathology and cause of the diseased condition, will be treated at length.

The cases being so numerous, considering the number examined, in an asylum for the insane, strikes one as, perhaps, bearing on the much-vexed question of "breaking of ribs in

asylums;" but no direct argument can be constructed out of the history of cases of a particular disease, although it may indirectly have some weight as an argument for the more brittle condition of the bones of some inmates of such institutions.

The number of cases that have been examined is roughly about 1400 women and 180 men. In 540 of these post-mortem examinations have verified the diagnoses. 1040 of the 1620 examined are either in the Wakefield Asylum at present, or have left that institution since April, 1869.

The first case, the particulars of which I have laid before the Obstetrical Society, is that of J. M—. The history of her case is as follows:

CASE 1.—J. M—, æt. 39, admitted into the West Riding Asylum 9th November, 1866. She was placed under the dementa, and the following notes were made of her condition. Soon after her admission she was noticed to be thin, had spinal curvature, and projection of the chest; she is described in further notes as much improved, in fact as much so as to be able to sit up and to employ herself in light work, such as knitting.

1869, August 16th.—The chest has grown out and projects forwards considerably; the upper part of the sternum (the manubrium) sinks in, while the upper part of the body of the sternum with the adjacent cartilages of the ribs projects, forming a conical bulging of the size of a large orange. The spine has antero-posterior curvature; the ribs project behind and form two large protuberances, one on each side of the distorted vertebral column. She complains of the slightest pressure, even her arms seem painful on being touched, while her chest is so sensitive that she cannot bear the lightest touch of the stethoscope for examination. The bones of the extremities are not in the least bent, but the legs are so weak that she cannot be induced to stand on them, although when the weight of the body is taken off she can move the legs, showing no true paralysis. She gradually became worse, and died January 2nd, 1871. At the post-mortem examination, at which the writer had the opportunity of being present, the following was found to be the condition:—Rigor mortis not present; general appearance of the body, greatly emaciated and much distorted and the bones much softened; the head is not misshapen, but the chest is malformed; the head is sunk into the thorax, and the ribs and upper part of the sternum project considerably; the clavicles are bent forwards, and the upper opening of the thorax is greatly contracted; the pelvis does not seem to have lost its external shape, nor are the extremities at all bent. On opening the chest it was found that the ribs could be cut through with an ordinary scalpel easily, and the spine was seen to be distorted, having both antero-posterior and lateral curvatures. The bodies of the vertebræ were of the same soft consistence as the ribs. The pelvis, which was removed entire without any trouble as regards the bones, has been shown at the Obstetrical Society. The section of the bones was made with an ordinary knife, and presented the appearance so well described by Hunter as

sponge soaked in fat; they were dark in colour, easily bent by pressure, although each regained its form, if the pressure had not been too great, directly it was taken off. The distortion of the pelvis was of the beak-shaped variety, as is so frequent in cases of this kind; the sides at the acetabula were pinched in, the sacral vertebrae falling in behind. The diameters of the pelvis in the fresh state were as follows:—At the brim, lateral four inches at the widest part, which only consisted of a narrow slit about three quarters of an inch broad on the left side; the greatest antero-posterior diameter, again, only consisted of a narrow slit about an inch broad and three and three quarter inches long; a ball whose texture was unyielding and diameter an inch could not have been passed through the brim without undue pressure. The outlet was so contracted that the measurement was—antero-posterior three inches, and lateral three quarters of an inch. The viscera were all healthy, except the brain, which was much wasted, especially in the ganglia at the base. A specimen of the bone, consisting of the projecting part of the body of the sternum, was submitted to chemical examination by Mr. Alexander Pedler, F.C.S., with the following result:

It lost, when thoroughly dried at 100° C., 24·74 per cent. of water; the dried sample then contained 32·75 per cent. of oily and fatty matters, or 26·49 per cent. of the bone in its original condition, and the remaining 48·77 per cent. of the original bone consisted of true bone. One hundred parts of true bone, after the fatty matter had been carefully removed by ether, and the water by drying, contained 76·29 parts of cartilage and other organic matter, 23·71 parts of inorganic matter. This last consisted of—

20·81 parts of calcic phosphate.
 ·81 parts of magnesia phosphate.
 1·61 parts of calcic carbonate.
 Traces of sulphuric acid, fluorine, &c.

Comment to any extent is needless; the post-mortem appearances show to what an advanced stage the disease had proceeded. The analysis of the bone agrees in its main features with other analyses; for example, in Rokitsansky's 'Pathological Anatomy' (vol. iii, p. 181), the following is given as the analysis of the rib of a person affected by mollities ossium:

Specific gravity	. 0·721	
Cartilage, fat, vessels	. . . . .	76·20
Organic constituents	. . . . .	76·20
Basal phosphate of lime and phosphate of magnesia	. . . . .	17·48
Carbonate of lime and other salts	. . . . .	6·32
Inorganic constituents	. . . . .	23·80

In an analysis of the bones in a case of general paralysis by Dr. J. C. Brown, of Liverpool, contained in a paper by Dr. Rogers, of the Rainhill Asylum ('Liverpool Medical and

Surgical Reports,' vol. iv, October, 1870), the constituents are given as—

Phosphoric acid	16.89
Lime	22.2
Magnesia and alkalies	1.05
Carbonic acid	1.71
Inorganic	41.85
Organic	58.16

The wide difference between this analysis and the two preceding may easily be accounted for by the supposition that the last must have been a case not far advanced in the disease.

The leading symptoms were well marked in the case above mentioned, but the disease seems to have been of somewhat longer duration than they usually are. The weight of the above patient gradually declined from sixty-eight pounds in January, 1868, to sixty-two pounds in June, 1869, after which date she was not weighed in consequence of her bedridden and helpless condition.

CASE 2.—J. P., admitted in 1864, æt. 38. No mention is made of any deformity whatever during the first few years of her residence at the asylum; in fact, she was well enough during the first three years of that period, both mentally and physically, to be employed in the laundry.

1868, January 25th.—She is now suffering from rheumatism, and complains of pains in the back and legs; she walks with the utmost difficulty, and will often lie in bed half the day. She is tolerably intelligent, but is very querulous.

1869, April.—Her chest has grown out very much lately, and she is a great deal more helpless than she was. She suffers from rheumatic pains; the heart is displaced upwards by the deformity of her chest; she lies in bed a good deal now.

May 7th.—Has been gradually getting worse; her chest has become more and more deformed, her breathing more difficult. She sank and died to-day.

Nobody can doubt what the case was on reading it over carefully; the pains so characteristic, followed by the remarkable distortion of the chest, are pathognomonic of the disease.

If any doubt could exist, the following extract from the report of the post-mortem examination would completely set it at rest.

Body much emaciated and deformed. The upper part of the sternum, with the ribs attached, bulges prominently forwards; the ribs are indented and distorted, and the whole thorax is forced down into the abdomen, so that the floating ribs on the left side nearly rest on the crest of ilium. The spine is bent forwards and

towards the right side; all the bones are much softened, quite flexible, and readily broken; the ribs cut like cartilage, their cut surfaces are dark in colour, and very greasy to the touch.

Heart.—A few specks of atheroma on the lower part of the aorta and its valves.

Brain substance generally watery, and of a doughy consistence; slight wasting of the convolutions; ganglia plump and well rounded. Such was the softness and flexibility of the bones that the humerus of the left arm was taken between the thumb and forefinger of each hand, and broken without the exercise of any unusual force.

The weight of this patient shows a continual fall; she weighed ninety-four pounds in January, 1868, and in March, 1869, she only weighed sixty-six pounds, showing a loss of twenty-eight pounds in fifteen months.

The pains, which are called rheumatic in the notes, are well marked as prominent symptoms of the malady. It is to be regretted that no analysis of the bones of this patient was made, but there is complete certainty that the disease would have been found to be as advanced as in the first case.

CASE 3.—E. B., æt. 27, admitted 22nd September, 1862. In the early notes no mention is made of any deformity. She suffered from epilepsy very severely.

1868, June 26th.—She is now in very feeble health, and is unable to stand from partial paralysis of the lower extremities. She can knit, and is most pleased when so employed or when reading the Bible.

1870, January 15th.—Mention is here made of a most peculiar form of "aura;" when about to have a fit she cries out suddenly, "Dangers and bolsters." She is in very feeble bodily health, and is the subject of spinal curvature; she has very defective circulation in the lower extremities.

June 4th.—She sits now with her knees drawn up towards her chin, her legs are bent at the knee and cannot be straightened, her back is also bent but can be straightened. Movement of any kind causes her pain, the cuticular sensibility seems to be diminished in the extremities, she is unable to walk but has the power of advancing one foot before the other when she is supported and asked to do so.

July 8th.—Sank very rapidly and died. The post-mortem examination was made the following day; the following are notes partly from memory:—The chest very much misshapen from falling in of the ribs; the bones everywhere are very soft, being easily cut with an ordinary knife, so soft, indeed, that the shaft of the femur was cut through with a knife by a subcutaneous operation. They are also dark in colour, seemingly filled with fat, they all feel greasy when cut into. The bones of the ribs, sternum, and vertebræ are specially noted as extremely soft. There are a few specks of atheroma in the aorta.

The first notes in this case as to the post-mortem appearances are, it is to be feared, lost, but sufficient has been quoted to

show that this was unmistakably a case of mollities ossium. The weight of this patient shows a continuous and gradual fall from January, 1868, at which date she weighed ninety-four pounds, to June, 1870, when she only weighed seventy pounds, a fall of twenty-four pounds in two years and a half.

CASE 4.—E. C., æt. 70, admitted April 18th, 1867. She was epileptic and in very feeble health, but on admission no distortion of her body is noted, nor does she seem to have suffered from the intense fragility of her bones until after a year's residence in the asylum.

1868, January 10th.—She fell and fractured the radius of her right arm; a starch bandage was applied, and perfect union took place.

During 1869 she fractured her wrist and the clavicle; around the fractured ends of the bones large masses of osseous material were deposited, but no union existed between the ends of the clavicle.

In the latter part of May, 1870, the right clavicle and the acromion process of the scapula were fractured. Mention is also made of great deformity of the thorax and spine, which seems to have been so great as to preclude the usual method of treatment; the fracture did not unite properly, although callus was thrown out at the fractured ends.

1871, January 15th.—Stress is laid on the great deformity that the body had acquired.

The progress of this case was gradual, the chest having contracted on both sides and the spine become bent; her mental capacity was of so low a nature as to preclude any symptoms, as pain occurring to herself, to be mentioned; she now lived an automatic life, rarely speaking, and when she did it was unintelligible.

Post-mortem appearance.—Body very much emaciated and deformed. There are traces of previous double fracture of the right clavicle, and also a thickening of the right wrist from impacted fracture of the radius. The bones of the skull are of average thickness, soft and of a bluish tinge; brain substance soft, ganglia wasted, but the convolutions not so. There is a lateral curvature of the spine in the thoracic region, the convexity to the right side. The ribs numbering 2—9 on both sides have been fractured midway between the sternum and vertebral column, some of them in two places. They are all old fractures, and the united extremities point inwards. The ribs are cut easily with an ordinary scalpel. The spine at the lumbar region bulges much forwards and to the left side. The sides of the pelvis where the acetabula are placed bend inwards, causing much narrowing, with a beak anteriorly.

The case, until the post-mortem appearances are studied, seems to resemble more a case of fragilitas ossium than mollities, but the fact that a knife passed through the ribs easily is rather strong evidence that it was a case of mollities ossium.

The weight in this case shows the gradual wasting of the body. She was 101 lbs. in April, 1869, and only 80 lbs. in January, 1871. This shows a falling off of 21 lbs. in less than two years.

The cases that now follow are at present in the West Riding

Asylum, and it will be a matter of great interest to watch them through the stages of the disease.

CASE 5.—This is perhaps not so well marked a case, but it comes under another disease closely allied to malacosteon, if it is not a true case of that disease.

A. F.—, æt. 29, admitted 14th of March, 1868. The first note of any interest beyond that she is an epileptic and in feeble bodily health is made in September, 1870, when it is reported that she fractured the left humerus. Although every effort was made to promote healthy union, none took place.

1871, April.—She complains of pains in the legs, although she does not experience any in the back. There is slight abnormal projection of the seventh cervical vertebra, and also of the 9th, 10th, 11th and 12th dorsal and 1st lumbar. The sternum shows some slight projection at the junction of the manubrium with the body of the bone. The pains in her legs she describes as mainly affecting the joints, and the knees more particularly. The bones generally ache whenever they are even touched by anything. The pains have troubled her for some few months. There is no visible distortion of the pelvis when viewed from without, but the internal examination shows the sacrum and coccyx to bend forwards, and the curve of the former bone to be much increased; the spines of the ischia are closely approximated, allowing only two fingers to pass between them. The dimensions of the brim are not materially altered.

The case is not so well marked an example of this disease as some of the others, but the pains in the legs and the acute sensibility of the bones, together with their fragility, render it extremely probable that this is a case of mollities ossium.

The weight of this patient has not materially decreased up to the present time, but one may expect to find a loss of flesh recorded in future notes.

CASE 6.—S. A. B.—, æt. 25, admitted 17th September, 1861. Has had two children, but no particulars are given as to her labours. She was well nourished and not deformed, on admission, and for a time became quite stout.

1869, October 9th.—Her legs are stiff and her back is deformed. This deformity is getting worse.

1870, June 4th.—She has been losing flesh of late and looks pale; there is curvature of the spine—it is antero-posterior and very considerable; the right side of the chest seems larger, particularly behind, due to sinking in of the ribs on the left side at the angles. Two years ago was able to walk perfectly well; the power of locomotion then began gradually to get weaker, and now there is no power even to support the weight of the body for any length of time.

1871, April.—Her height has gradually diminished, she now only measures 58 inches when extended on the bed; this measurement would be considerably less if she stood up, on account of the crouching posture which she assumes. The whole of the dorsal vertebræ project backwards, and the sternum is curved forwards and bulges considerably. The left side of the thorax is still further distorted by the sinking in of all the true ribs at their angles. The nates seem dipped in on each side, just above and behind the trochanters. The spine of the ischium is separated from its fellow by a space of $1\frac{1}{2}$ inch. The vaginal examination gives the following results:—The brim is beaked in front and contracted at the acetabula; it is

also filled up in the centre behind by the projecting sacrum. The greatest diameters at the brim are, lateral $2\frac{1}{2}$ inches, antero-posterior $2\frac{1}{2}$ inches. The outlet consists of two circular openings of a figure-of-eight shape, the contraction being due to the approximated spine of each ischium; only two fingers could be passed through this contraction, while the two apertures would each have admitted a smallish orange; the antero-posterior diameter measured $3\frac{1}{2}$ inches. The sacral curve is much exaggerated, and the coccyx projects (although freely movable) far into the posterior circular aperture. The configuration of the sacrum externally is that of an exaggerated curve; it forms half a circle whose diameter would be $3\frac{1}{2}$ inches.

The weight of this patient has steadily declined. At the early part of her residence in the asylum she increased in weight from 117 lbs. (in January, 1868), until the end of 1869, when she weighed 137 lbs. During the year 1870 she lost weight at a gradually increasing rate, and at the end of that year weighed 92 lbs.; while three months after that, or in March last, her weight is registered as 80 lbs., a loss of flesh amounting to 57 lbs. in fifteen months.

CASE 7.—M. H.—, æt. 35, admitted 2nd January, 1869. There is no note of any importance as to the existence of any pains or malformation, but the first note announces the fact that her breasts were in such a condition as to leave but little doubt that she had recently been delivered of a child; she was melancholic, and had suicidal propensities.

1871, February 14th.—For about two months past she has complained of pains in the chest, back, and limbs, which have become more frequent and severe lately. She describes them as shooting pains, like the cutting of a knife, and as being more severe on the left side. She has a slight antero-posterior curvature of the spine, and also a slight lateral one, with the convexity towards the right side. She complains of pain on pressure in every bone in her body, but most severe between the scapulae at their inferior angles; the chest seems bulged forwards about the junction of the lower and middle third of the sternum, and is flattened at the sides. When walking she holds her hips, and leans very much to the left side, and says that the pain is very much more acute when she is in the upright position. In the lower extremities reflex action is good, and sensation perfect and equal. She complains of pain in voiding her urine. Her condition in April, 1871, was but very little altered, but the following particulars may be thought interesting. She says that she has felt these pains for the last twelve months, but it is only during the last few months that the pains have been at all sharp. The pains are very acute in the knees and sides of the thighs, but they are not continuous; "they come and go." She has had six children during the last twelve years; the first three were unassisted in their births, but for the fourth instruments had to be used; for the fifth the operation of turning had to be performed, and some other means taken to deliver her, but she does not know what, as she was put under chloroform; at the sixth labour she was put under the influence of chloroform, and some very serious operation had to be performed, but she knows nothing as to its nature. The vaginal examination shows great deformity to exist in the pelvis; the greatest lateral diameter at the brim is $3\frac{1}{2}$ inches, while the antero-posterior diameter only measure $2\frac{1}{2}$ inches; it is heart-shaped, and the sacral cavity is very deep; the outlet only admits two fingers in

the lateral diameter; the anterior portion of the pelvis is pinched in, in the usual way, just in front of the acetabulum on each side; the projection of the bodies of the sacral vertebræ greatly encroaches on the space at the brim of the pelvis. The weight of this patient has not undergone any material diminution.

CASE 8.—S. A.—, æt. 36, admitted April 5th, 1864. The notes of the early history of this case are deficient in interest, and have no bearing on the disease in question.

1871, May 9th.—About six months ago she complained of being weak, and did not take her food well. She was slightly lame, but it was attributed to weakness. About a month ago she complained of pain in her limbs, and seemed more lame. As little could be made of her statement, an anodyne was ordered and extra diet given, but she has slowly become more feeble and unable to walk. She now states that she feels pain in her joints, and if she is not soon cured she will die. She states that she cannot feel the ground under her feet, but there is perfect sensation in the feet and legs, and reflex action is good. She can draw up the legs in bed; there is slight cedema of the right foot. The chest is narrowed by the sternum bulging forwards, but there is no sinking of the head into the chest; the ribs seem to be very soft, as the slightest pressure upon them causes them to bend under the finger. The *alæ* of the pelvis do not seem to be altered in shape, nor are they painful on pressure, as are all the ribs. There is no curvature of the spine, and no evidence of pain on percussion of the projecting spines of the vertebræ, although she complains of pain on movement. She is unmarried, and has never had any children. When she walks she holds her hips with her hands, and shuffles along much in the same way as the last (Case 7) was noticed to walk. No deformity of the pelvis.

On considering the cases just related, there is not much more to be gleaned concerning the disease; the usual symptoms which have been frequently observed in other cases on record are shown with more or less prominence, and the typical rostrated pelvis is present in almost all of them.

The pathology of the disease has perhaps been more fully investigated by Mr. Durham in 'Guy's Hospital Reports' (1864) than by any other author of modern times, and the explanation of the disease offered in that paper more fully coincides with the writer's opinion than any previous theory advanced by other authors. "In the histories of all cases, without exception, mention is made of the existence of some influence well known to be capable of producing great general depression of the nervous system." This being so, there can be but little doubt that this depression of the nervous system must be a powerful agent in the causation of the disease; in the cases quoted in this paper the operation is well marked. In them the general depression of the nervous system had involved the

intellect. It would be useless to discuss the theory that some acid in the blood causes the disease. Acid has been found in the bones of only one or two cases affected with this disease, whilst in many others no trace has been found of any free acid, so that its absence in the majority of the cases indicates that it is not an adequate explanation of the origin of the pathological state; and again, neither lactic nor any other acid has been found in the blood in a free state, as far as the writer knows, nor can it be conceived for a moment that the blood itself would retain its fluidity if either free lactic or any acid were present.

Many authors have suggested some abnormal condition of the blood as the cause of the disease; but in what way must the blood be deficient to occasion such a sensible diminution in the deposit of true bony matter? Surely in the phosphates and also in the lime salts. Now, if the blood be deficient in these salts, how can the free excretion of the lime salts in the urine be accounted for, or how can atheromatous deposits be found in the aorta, as in two cases given above? The separation of the lime salts by the kidneys is probably an analogous act to the elimination of sugar in diabetic patients. The blood containing the proper proportion of these salts, and none being separated from it in this condition of malnutrition of the osseous structure, retains and accumulates them to a certain extent, the kidneys then acting as eliminators of this new effete material. Complete analysis of the blood in these cases would demonstrate the proportion of the salts met with under such circumstances. The blood, when the first symptoms of the disease set in, being of normal constitution, still further search must be made for its true primary cause. Can it be in the periosteum as a diseased membrane? Proesh has suggested this as the cause, but no abnormal condition of this membrane has been noted by any of the various investigators who have studied its microscopic histology, and in the most advanced cases no material change can be distinguished by the naked eye. An alteration in the osseous structure, of such gravity produced by the diseased action of this membrane, would surely leave such a changed state of the periosteum itself that it would be well marked even to the unaided eye. The theory put forward by Lobstein, who attributes this gradual disappearance of calcareous particles to the increased activity of the

absorbent vessels, due, probably, to a more energetic innervation, has many and strong arguments in its favour; but it is strange that only the earthy portion of the bone should be separated out and absorbed by these more active vessels, whilst the animal matter and fat, although effete, still remain; again, the rate of absorption being increased, the duration of the disease seems too long for an accelerated process of absorption.

This latter observation also affects part of the theory advanced by Mr. Solly, the other and more important portion of which is "that it is of an inflammatory character; that it commences with a morbid action of the blood-vessels, which gives rise to the severe pains in the limbs invariably attendant on this disease, but more especially in its commencement, and exhibits itself after death by an arterial redness of the parts." Mr. Durham says, in his paper before alluded to, soon after quoting the opinion of Mr. Solly—

"General feverish symptoms do not appear to have been frequently met with during the earlier stages of the malady. . . . In no case could the patient be said to have suffered from acute inflammatory fever, the symptoms being always of a low and occasionally of an intermitting type."

The absence of any inflammatory fever in the commencement of the majority of the cases would lead one to differ from Mr. Solly, at the same time remembering that the whole osseous frame is implicated in many of the cases. If there was well-marked fever, with great fluctuations of temperature or other signs of constitutional disturbance, the theory would be more probable, but in the almost universal absence of such symptoms it does not hold good.

In the cases given no rise of temperature was noticed, nor was there any febrile disturbance of long-continued duration to attract attention. The constant medical supervision maintained at the West Riding Asylum and the occasional mention of an ordinary temperature in some of the notes go far to prove that no febrile disturbance was present. Now, although the pathological condition of the arteries may be advanced as a strong argument in favour of Mr. Solly's theory, yet the conditions that exist may be attributed to a variety of other causes. The opinion of Dr. Joseph Jones is to the following effect:—"It is not unreasonable to refer the origin of the disease in this case to the derangement

of the blood and nutritive act by the presence and continued action of a special poison, especially as this disease is known to originate most frequently amongst the ill-conditioned and ill-fed inhabitants of large manufacturing towns, and in females whose menstrual function had been deranged for long periods of time, or whose forces had been depressed by the demands made upon the nutritive elements by repeated pregnancies. In a word, we are disposed to refer the origin of the disease in this case to constitutional derangement rather than to a strictly local disease of the bones. This conclusion is further sustained by the fact that a large proportion, if not all the cases, of the mollities ossium heretofore reported exhibit marks of constitutional derangement, fever, wasting, and abnormal condition of the urinary secretion preceding and accompanying the local disease in the bones." This statement shows that Dr. Jones's opinion is that the true primary cause of the disease is a fault in the nutritive act, in consequence of the previous unhealthy condition of the vital forces. In this, perhaps, but more particularly in Mr Durham's theory, the greatest truths lie hid. It will be useful now to inquire, perhaps, into the functions of the nervous system in nutrition, and also into the effect of the cessation of that action, and the consequences of any perverted act of the nerve force. Although it may be taken as proved, there is some direct or indirect nervous influence at work in most acts of nutrition, the following extract from Paget's '*Pathology*' (vol. i, p. 39) may not be inappropriate:

"It may be held, I think, that in the higher vertebrata some nervous force is habitually exercised in the construction of all the parts in or near which nerves are distributed, and that it is exercised, not merely in affecting or regulating the size of the blood-vessels of the part, but with a more direct agency as being one of the forces that concur in the formative process." And again Mr. Paget says (vol. i, p. 44):—"The integrity of the nervous centres and trunks which are in anatomical relation with a part is essential to its due nutrition." Assuming that some essential nervous influence is always brought to bear upon the nutritive processes, cannot this fact be applied in this disease, in which it seems that the sole change that takes place is either a cessation of nutrition in the osseous structure or a perverted action of the nutritive process,

either of which might be, with every appearance of reason, attributed to the direct or even indirect effect of loss or impairment of nervous force.

The perverted action of the nerves which control to a greater or less extent the formation of the bones would fully explain the post-mortem appearances in this disease. Assuming the supposition that nervous force does enter directly into the nutritive act as true, the indirect influence of the paralytic dilatation of the blood-vessels would naturally have a great effect on the formation of the bone, that would proceed naturally if the contractile coats of these arteries were in their normal state of tension produced by the action of the nerves. The post-mortem appearances observed give weighty corroboration to this assumption. Mr. Durham, who has examined at least hundreds of specimens, says that he has found "an increased quantity of blood present in the bone, at any rate during the earlier stages of the disease. . . . In the later stages of the disease the minute vessels in the affected bone appear to become more or less highly congested and dilated, in still later stages to degenerate, or in some instances to rupture." The observations of Mr. Solly, "that there is a general redness of the parts affected," as well as those of Mr. Durham, quoted above, would all be fully explained by paralytic dilatation of the smaller vessels.

Not allowing that there is no direct nervous influence in nutrition, the explanation of the disease is even more apparent, since perverted action of these nerves which control the function of nutrition would throw light on the true nature of the disease. Ample demonstrations are of course required of the changes that take place in the nerves distributed to the parts, and also in the great nervous centre, the spinal cord. It is to be hoped that such minute observers as Drs. Beale and Lockhart Clarke may interest themselves in this rather neglected subject, and submit to careful microscopic examination the nerves distributed to the bones so affected, and also the spinal cords of the patients.

The disease, viewed under this light, would assume a comparatively clear and consecutive history; its many symptoms are easily referable to this view, and the invariably predisposing cause of some one or more influences having the effect of prostrating or impairing the energy of the nervous system would be

reasonably a forcible argument in its favour. The presence of fat and other products of impaired nutrition in the bones would rather tend to establish the idea than constitute an argument against its truth. The absorption of the bony material need not be altered in any way, but proceed as in healthy and normally nourished bone. Paget's Pathology (vol. i, p. 133):—"I have already said that it is common in many atrophied bones to find an excess of fatty matter: I referred to old bones laden with fat as examples of such atrophy. But it is now to be added that the bones, like other organs, are liable to a fatty degeneration which, because of the obscurity of its origin, we must be content to call spontaneous; and this fatty degeneration of the bones is the disease which most English writers have described as *mollities ossium*."

It is on such evidence as that above given that the writer has advanced this idea for the consideration of the profession. More extended research into the minute structure of the nerve and nerve centres which should show some pathological change even in the earliest stages of the disease, may in future times establish as a fact what is now only advanced as a probability.

ON
PROGRESSIVE LOCOMOTOR ATAXY
AND
SOME OTHER FORMS OF LOCOMOTOR DEFICIENCY
AS
FOUND IN THE INSANE.

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SCARCELY any apology is required for directing attention once more to the subject of locomotor ataxy. Though it has occupied the attention of many observers of late years, it is far from being exhaustively known. The disease is one possessing so much of the charm of a functional disorder for those of a speculative turn, and at the same time such a definiteness of structural site (as far as we see at least), that it continually tempts the inquirer to new exertions.

A new interest is lent to this disease, when it is found in the domain of the alienist. A steady march onwards seems still to be characteristic of its progress; the lesion of the mind is probably definite, like that of the spinal cord. At least the question whether this is so or not, is one of the greatest interest. Has the mind too its "posterior columns"? What happens if they take to degenerating?

In the first place, the essential elements of the disease must be briefly noticed. The cord is found affected in its posterior portion. More particularly the change appears to commence close to the posterior median fissure where deepest, and to spread forwards and laterally in a wedge-shaped manner, while the posterior roots of the nerves are involved in changes of an atrophic sort, and their ganglia are enlarged and congested (Bourdon). The lower part of the cord in the dorso-lumbar region is generally the first to be affected thus, and the more

life is prolonged, the greater, in many cases at least, appears to be the extent of cord that is found involved.

The intimate changes that take place appear to be these:— In the nerve fibres themselves, atrophy,—diminution, and disappearance; in the very fine cellular substance that supports the fibres (*neuroglia* of Virchow), at first multiplication of elements, fibres and nuclei making their appearance, then shrinking, and along with these the formation of *corpora amylacea*, or starchy particles; in the walls of the vessels likewise multiplication of elements (*verdickte Adventitia*, Niemeyer), from which, aided possibly by a little meningitis, result abnormal adhesiveness of the *pia mater* to the cord at the part, and in the same parts the cropping up of numerous oil globules and granules (Aitken).

Along with these changes in the cord (perhaps a little before them or a little after them), comes, as is well known, the characteristic unsteadiness of gait, caused not so much by any yielding of either limb when weight is thrown upon it, as by the abnormal behaviour of each as it is lifted and moved forward towards the position it is to occupy. For instead of moving in a plane nearly parallel to the direction in which the patient wishes to go, the leg starts rather hastily, or, in fact, quite spasmodically, away in an outward direction, as if trying to avoid its fellow; and then, after a rather wavering course forwards, the heel is hurriedly brought down, the body thrown forwards, and the opposite leg commences a similar procedure. Take along with this an uncertainty about the balancing of the trunk, while it remains poised on one leg, and the idea of most that is characteristic in the ataxic gait is completed.

No mention has been made of the cephalic lesions, which often accompany ataxia of the extremities. These are peripheral affections of the first, second, third, fourth, fifth, sixth, and seventh nerves (Aitken, 'Science and Practice of Medicine'), producing anomalous sensations, or impairing sensation or motion where they are distributed. The contrast between the central seat of mischief, as regards the trunk, and the peripheral seats in the head, is a curious one; but not much weight is here laid upon it, because on the one hand it is not known whether the peripheral nerves of the lower part of the body are not similarly involved in disease to those of the head,¹ and on

¹ Examinations of the real nerve-endings are so difficult to conduct.

the other hand, lesions in parts of the brain where they were unexpected may have been overlooked.

Having thus stated the most prominent points in the natural history of locomotor ataxy, I go on to record a few cases where there was combination with insanity.

CASE 1.—W. M.—, admitted into the West Riding Asylum, Wakefield, on the 14th April, 1868, æt. 45, single. At the time of admission he was in feeble health, very low-spirited, with a wound in his throat from an attempt on his own life. He had delusions that people tried to poison him. This was his first attack of mental disorder: he was nearly blind at this time.

He was ordered castor oil, which produced black stools in considerable quantity. After that his spirits rose. On April 24th he is reported as eating and sleeping tolerably, and as improving, but slowly. On October 25th, "mind unchanged, feebler." On October 5th, 1869, "he imagines that he has a snake in his bowels. Ataxic symptoms well developed. He thinks that the snake goes in at his toe and up to his abdomen." On the 6th, "unable to stand."

Present state—from examinations on 29th March and 8th April, 1871.—Height about six feet; of powerful build; hair dark, wanting over the parietal, occipital, and frontal bones; head narrow, high, and long from before backwards; features regular, large; expression, kind and beaming as he speaks, otherwise he has a look of careful and concentrated attention; well nourished. He cannot walk or stand, and is driven about on a chair with wheels.

His hearing is not good (though he states that it is excellent). The ticking of a watch, which can be heard by an ordinary ear at two yards off or more, he cannot hear with the right ear beyond three inches, nor with the left beyond four inches. He is blind in both eyes as far as distinguishing objects is concerned; he knows whereabouts in the room the window is, and he knows when a light-coloured object is brought before his eyes. Ophthalmoscopic examination reveals unusual whiteness of the discs, the veins very few, dark, and distinct, the arteries hardly noticeable, and very few, and a slight pit in the centre of each disc.

The sense of smell is, he says, good. He can recognise tincture of *asafoetida* as analagous in smell to onions, and tincture of lavender as being like something he has smelt before. According to his own statement he relishes his tea and coffee, and prefers the former; he likes these sweet. Feeling (tested by pricking and pinching) appears very much diminished in the legs and feet. Localisation is tolerable in the foot, but bad in the whole leg; on the left foot he recognises prickles on the great toe and on the little toe; on the right foot he assigns a prick to the great toe after some hesitation, and he makes a mistake when the little toe is pricked. Sensations of this kind are slowly transmitted. In the hands and forearms sensibility to pricking and pinching is much better than in the feet; there appears some slowness in transmission. Sensibility to tickling is good in the feet, but he says it is like a pinhead touching him. When a hand slightly warmed is applied to the feet or hands he knows the difference of temperature at once. Cold too (cold water) is at once recognised, and produces a shiver when applied to the leg over a surface of a square inch or so in area.

He says that he can feel the floor with his feet (as he sits), but not well. His legs, he says, feel "lumb." He has curious feelings of a cord constricting his body, and of little bindings on his fingers.

When he tries to walk, he has not the slightest capability of supporting himself. His legs sprawl about when he makes the attempt. If his chair is pushed on from behind he is stupid in manœuvring his legs, and brings them slowly and in a roundabout way into position. He can fasten a button, but he makes exaggerated movements in order to manage this, his hands tending to dash about a little. He has some power of distinguishing the heavier of two objects by taking one in each hand. Thus he can distinguish between four and five ounces put in the palm of his hand, but not between three and a half and four ounces.

The power of the muscles of his arms, shoulders, and trunk (as judged by a dead pull as he sits) is very considerable indeed, and so also is that of his legs.¹ He pulls out, almost with ease, to their full extent, two spring balances whose combined power equals a weight of eighty pounds, and moves by the same effort a heavy table to which they are attached; this with the right hand alone. When his left arm is half flexed, he can by flexing it further draw out the spring balance to thirty-five pounds. Articulation is very good. Reflex action to tickling (or the other modes of stimulation mentioned) is almost nil. The contractility of the muscles to Faradisation was tried with a force of current sufficient to bend my own wrists or those of an attendant, a pole being held in each hand. With this current the response below the knee is nothing, except from the left gastrocnemius very slightly. Above the knee the left adductors respond in a decided manner. The right adductors are not so obedient; the glutæi refuse altogether to respond. The longitudinal muscles of the back seemed to respond a little. The muscles from the back to the shoulder contracted well. The recti abdominis contracted fairly. All the arm muscles responded well, the extensors less than the flexors. He eats his food well. His bowels are constipated; his pulse is very feeble, about 100. The heart appears to be normal; the first sound is soft. The lungs appear to be healthy.

He cannot retain his urine; it is strongly alkaline, with much mucus, and a little pus, with no albumen, or only a very slight trace.

Mentally.—Memory appears very good indeed. He retains still the delusions about snakes traversing his body. He seems decidedly disposed to take a happy

¹ I had mislaid the note of my own observations as to the hamstrings, and Dr. Sutherland, of the Wakefield Asylum, kindly made some observations for me. He found that when M— raised his knee very high as he sat, and flexed so as to bring the calf on the thigh, the right leg could with difficulty be pulled away from the thigh. The left could be got away more easily. In a healthy person it was found that the contraction of the hamstrings was so strong as to make a rigid bent lever of the leg, on which the body could be turned so as to bring the shoulders on the seat of the chair. It is a fact, however, that M— is a much heavier man than the other subjects of experiment, and that in his helpless state he requires considerable instruction, especially if resistance to the doctor is required, before he comprehends what is wanted. The result of my own observations was, as I now find, that expressed in the text.

view of things, and for one in his wretched state he speaks in a singularly hearty way. His disposition is frank and obliging while he is being examined.

He says he has had no severe pain, like rheumatism or neuralgia. His complaint began, he affirms, with advancing blindness. He has had bubo; and since then he had an eruption on his skin, which was, however, very itchy. He states further that he used to be employed as a charcoal burner, and that he was very frequently exposed to wet and to weather of all sorts, sometimes spending his nights in the open air.¹

CASE 2.—J. W—, labourer, admitted to the West Riding Asylum on 25th February, 1868, *æt.* 40, married; Methodist; this is his first attack (of mental ailment) and of three months' duration. He is not epileptic, suicidal, nor dangerous to others; supposed cause (of insanity), injury to the spine. Facts observed (by medical man certifying):—"He says that he has a great deal of property up and down, and the railway company owes him £2200. Says the 'White Swan' belongs to him, and that he is going to sell it. Talks very incoherently on other subjects."

On admission, he states that five years ago he was standing on a railway waggon, when, it having been made to move without any warning, he fell off, and that since then he has suffered as if from concussion of the spinal cord, with incontinence of urine, inability to walk, and occasionally, though rarely, the bowels have been evacuated involuntarily. He is found to be somewhat emaciated. There are the remains of a recent fracture of the left tibia and fibula, which he says occurred from his having tripped over a little stone when walking. The sounds of the heart are feeble and distant, but otherwise normal. There is no dulness on percussion, but bronchitic râles are heard all over the chest. On tickling the sole of either foot there is some reflex disturbance, but there is apparently no transfer of force to the other side, as the opposite limb is in no way disturbed. Pinched in one place he refers the sensation to some other place. Is somewhat demented, but answers questions in a rational manner. He is exceedingly mischievous; tears his bedclothes, breaks glass when an opportunity occurs, but expresses great contrition when remonstrated with, and says he cannot understand why he did it.

1868, October 21st.—He has been much more demented, and symptoms of general paralysis (?) with well-marked locomotor ataxy have appeared. He is in better bodily condition than when admitted. Optimism to a very marked degree has become developed. He charges those about him with having robbed him of millions of tons of gold, and demands compensation of a million a day, for losses sustained by his detention in the asylum. When walking, his legs are placed very widely apart, and if his eyes are closed he drops as if he were completely paralysed. He has incontinence of urine.

1870, April 27th.—He has gradually become more feeble, and the symptoms mentioned above have become more marked. He is ordered extra food with sherry wine.

¹ The first part of the case, as far as the beginning of the "Present state," is, as in the other cases, condensed from the Asylum Records: it was supplemented, in this case, from the patient's own narrative.

May 5th, 1870.—He is now suffering from dysentery. To have Pil. Cupri c. Opio om. quart. hor. Confined to bed.

May 8th.—He is now sinking rapidly. Takes large quantities of brandy. Died this day.

Certified cause, chronic disorganization of the brain and spinal cord. Locomotor ataxy.

Note by Dr. Crichton Browne.—In the earlier stages of W—'s illness there was a great deal of restless excitement. When the ataxic condition of the legs became such that he could only walk with great difficulty, he used to stoop down and move his hands and arms slowly downwards and then rapidly upwards, as if laying over his shoulders. When asked to explain this he said he couldn't walk for the sovereigns in which he was wading knee deep, and that he was obliged to clear them away before him.

*Autopsy.*¹—Forty-nine hours after death. Body much emaciated; free from bruises or marks, except a small abrasion over the right knee. Decay present over the abdomen. Rigor mortis present. Skull tolerably symmetrical and of average thickness. Dura mater slightly adherent. Whole brain weighs 46 oz. Numerous pachionian bodies. Pia mater thickened and white over the whole brain, but most so over the anterior and middle lobes. Four ounces of fluid escaped during removal. The convolutions are much wasted. A pale pinkish tinge in the grey matter. Puncta vasculosa numerous. Brain substance watery. Ventricles very large, and filled with clear fluid. The ganglia, which project into the lateral ventricle, have lost their fulness and roundness. Numerous small holes visible to the naked eye in the substance of the corpora striata. Pons, cerebellum, and medulla, weigh seven ounces. Heart weighs nine ounces; there are a few atheromatous patches on the valves. Its substance is firm; dark clots in the cavities. Valves competent. Right lung weighs eleven ounces; left lung, ten ounces. The right is generally adherent, by white thickened pleura, very emphysematous at its edges; the left not adherent, but emphysematous throughout. Liver weighs forty-seven ounces. There is slight thickening of its capsule; but it is otherwise normal in appearance. The spleen weighs two ounces, and is atrophied. The right kidney weighs four and a half ounces, the left four ounces. Both are nodulated masses, externally drawn and puckered into rounded lobules. Capsules inseparably attached and thickened. Irregular wasting of the cortical substance, which is pale in colour. Pyramids slightly congested. On removal of the spinal cord and opening of its sheath of dura mater, its arachnoid covering is found to be much thickened and of a milky white appearance. At the cauda equina and over the lumbar enlargement there are several dilated vessels gorged with blood. Extending up the posterior columns there is a softish white substance passing irregularly from side to side commencing over the lumbar enlargement, being thickest throughout the dorsal region, and becoming thinner again in the cervical. It seems to be under or in the visceral layer of the arachnoid, and resembles a streak of thick arrowroot milk in appearance. There seems

¹ This excellent account of the post-mortem appearances is taken from the Asylum Records, as are also the foregoing particulars. The examination of the cord is my own.

to be some dilatation of the vessels on each side of it, and especially in the neighbourhood of the origins of the posterior roots of the nerves. The ligamenta dentata are thickened, whitish, and opaque.

May, 1871.—The spinal cord, preserved up to this time in spirits, is found to be rather small in appearance and flattened from behind forwards, so that, in the lower part especially, the anterior fissure appears to run back for two thirds of the whole antero-posterior diameter of the cord. In the lumbar enlargement, on examination of thin sections under a power of about eighty, a broadly wedge-shaped portion of the posterior half of the cord, reaching nearly to the most anterior of the deep fibres of the posterior roots on either side, and pointing at the grey commissure, is found to be of a translucent material, yielding to pressure on the glass cover, but not breaking up, as if of a tough jelly consistence; displaying, when treated with acetic acid, numerous nuclei of connective-tissue corpuscles. This substance reaches the grey commissure and partly involves it; it involves also, as has been said, most of the rootlets of the posterior roots; it appears nowhere to have extended to the lateral columns, which, however, show a great tendency to break up in curved lines radiating from the centre of the cord. The same description applies to the dorsal region, and a small portion of the above morbid tissue may be seen in the cervical enlargement, at the site of the posterior fissure, which fissure is obliterated throughout. Numerous small bodies resembling corpora amylacea are to be seen in the grey matter, and among the fibres of the cervical enlargement.

I have been favoured by my friend Dr. Lawrence, second medical officer of the Cheshire Asylum, with brief notes of a third case, as follows:—

CASE 3.—R. G—, admitted March 23rd, from the workhouse, where he had been two years. During his stay there he gradually and steadily got worse, till he was scarcely able to walk without assistance; yet he had ideas of great personal strength, and was always saying that he was just going away to resume his occupation as a policeman. Since he came here there has been very little change in him, except that he has been, if anything, more unsteady on his legs. He can walk unassisted when once set agoing, but staggers on turning, and falls immediately when he shuts his eyes. His pupils are dilated equally. He retains considerable grasping power in his hands, and can draw up and push his legs with considerable force when lying on his back. His speech is very thick and hesitating, and his tongue tremulous on protrusion. His countenance is open and expressionless. To questions regarding his health, he invariably replies that he is getting better. He says he has property in the shape of houses, and a crown of glory which his heavenly Father has given him, but no money. He fancies he is very strong. In walking he throws out his legs in an uncertain, haphazard sort of way, widely apart, as if seeking for a firm basis, in the characteristic manner of locomotor ataxy. His speech, the tremulousness of his tongue and lips, with extravagant notion of his own strength, stamp him a general paralytic. The retinæ were found more anæmic than natural, the vessels were generally small and contracted. One head of the optic nerve was found small, round, and less clear than might have been expected.

This case is a remarkable one, as presenting the cephalic lesions of general paralysis, with, in the lower part of the body, symptoms characteristic of locomotor ataxy. As regards the time of advent of the symptoms, this case is also separated from some that will be adverted to. I hope at some future time to have the history of it in a state nearer completeness.

Along with these cases may be taken the two following:—

CASE 4.—R. H— was admitted into the West Riding Asylum on the 5th October, 1854, æt. 21, single; Methodist; first attack, has been insane two months, not epileptic nor suicidal, but said to be dangerous to others.

Facts observed by medical officer certifying:—Violence without any cause, and answering simple questions incorrectly.

Facts communicated by others:—He has attempted to strike his father and mother, without provocation, and afterwards not appeared conscious that he had done wrong.

Certified “melancholia”,¹ in reduced health.

On admission:—Hazel eyes, hair black, tongue white, pulse feeble, appetite good, bowels regular, skin moist, perspiration standing on forehead, no pain, silent and feeble.

March, 1855.—Has been employed; health feeble.

September, 1855.—Unemployed. When asked a question, he laughs and makes no reply. Improving in health.

December, 1855.—Employed at his trade, and more healthy.

January 22nd, 1863.—Is employed in the shoemaker's shop, and occasionally makes impulsive attacks upon others when excited. A few months ago, when passing out of the dining hall, he knocked an attendant down; no provocation had been given. He has since this occurrence been excited. He has a suspicious and vicious expression, and has lately grown demented. Is not generally difficult to manage.

March 18th, 1865.—No change in physical or mental condition.

December 28th, 1866.—In weak health. Employed in shoemaking. Has not been troublesome of late.

May 3rd, 1870.—He is now demented and morose; he shows much impatience when asked questions. There are symptoms of advancing spinal disorganization. He falls if tipped ever so slightly. There is marked reflex movement on tickling the soles of the feet. There is also numbness. He says that unless he looks at his feet he does not know where they are. He is reported to be disposed to unnatural crime as well as to masturbation.

May 10th, 1870.—He is suffering from frequent vomiting, though there is no sign of stomach derangement. Relieved by hydrocyanic acid and bicarbonate of soda.

Since his admission his weight has varied only a pound or two, up or down, from 140 lbs.

¹ There is evidently some mistake here.

Present state (29th March, 1871).—He is a man of middle height, with dark hair, wanting on the parietal regions; head short and broad, square-shaped; has rather irregular features, and an expression of disgust from the strong marking of the lines from the ala of the nose. He seems feeble, and is very pale. His sight appears to be fair; the optic disc is very small, and more red than normal, especially towards the circumference; the veins are black, numerous and tortuous. He hears tolerably. He recognises asafetida as having a garlicky odour.

There appears to be slight analgesia of the feet. A steel-pen point has to be pressed on them before he feels it, especially on the top of the foot and on the skin. He can distinguish pricking from pinching. Even when these are severely practised, on his feet or legs, he only says they "rather" hurt him. His gait is always peculiar, but rather variable. With his boots on, he seems at times to lift his feet too sharply, whereupon also they get too much outwards, and are set down with a jerk. Later in the examination there seemed to be more of a pendulum-like swing of the lower limbs, as if they were weak; and no throwing of them about; but they still went more outwards than is usual. When his boots and socks are off, the most notable facts are that he strains the flexors of the ankle very much in walking, and that he sets down the heel firmly first, before the rest of the foot. His course is rather devious, but there is not evident extravagance of single movements. When his eyes are shut, he can still stand or even walk, but he shows a slight inclination to sway about. He cannot stand on one leg either with his eyes shut or with them open. He can just lift the opposite leg off the ground for a moment. He says that weakness is the cause of this failure. In taking off his boots and socks he uses his hands to cross one leg over the other. Articulation is very slow, and often indistinct. He writes his name with a hand slightly shaky. The grasp of either hand is feeble, and when made to flex his knee against resistance at the calf the consequent effort is feeble. By the power of his arm alone he can pull out a spring balance to 23 lbs. only, which I can pull to 50 lbs., when the conditions of posture, &c., are the same. Reflex action seems about normal, or a little increased; it is stronger on the right side. There seems to be steady contraction of the *levator labii super. alaeque nasi* on either side. When the electro-muscular contractility is tried with the same current as in Case 1, the peronei do not respond, the muscles of the calf respond well, the flexors in the foot slightly, the biceps slightly, but more decidedly with the strongest current the machine is capable of. The glutsi does not respond at all, the latissimi dorsi does so fairly, the muscles of the arms and forearms answer well, the extensors of the right wrist not quite so well as the others. His tongue is pale and slightly furred, also slightly fissured; appetite he says is middling; bowels pretty regularly open. Heart's action irregular, sounds normal at the base; at the apex, first sound strong, apex beat rather diffused, goes down to sixth rib beneath the nipple. Pulse has a corded feel and longish wave. Flattening of chest opposite both apices anteriorly. Breath sounds natural, expansion equal. He says that he has to make water very often. The allusion to the sexual functions, in the history, should be attended to.

Mentally.—He is very dull and listless in general, and answers are with difficulty extracted; often when a question is insisted on he laughs, as if at the stupidity of the questioner.

CASE 5.—W. K— was admitted into the West Riding Asylum on the 5th April, 1870.

The facts noted by the certifying medical officer are:—"He is very sullen and morose, will not answer when spoken to; looks idiotically at you, and mumbles something to himself; talks incoherently; when taking exercise, suddenly stops, shakes his head and beats the ground with his feet." *Æt.* 56; married; Methodist; insane some months; supposed cause, drink; not epileptic nor suicidal, but is dangerous to others; has six children; can read and write; no relatives insane; will tear clothes and break windows; not attentive to the calls of nature; intemperate; no bodily disease; was eccentric before the present attack. Alteratives used before admission.

History.—A brother of this patient died in this asylum. This patient had an attack of paralysis affecting the left side two years ago. In early life he had an attack of rheumatism.

Condition on admission.—Mental and nervous:—There are spasmodic twitchings of the left hand; he grasps with an equal amount of force with both hands, but it seems to require much mental effort to sustain the force on the left side, and if his attention is directed to something else, the grasp of the hand relaxes at once. The face is drawn to the left side, the tongue is pushed out to the right. The right side of the face is flaccid looking, and he complains that food lodges between the gums and cheek on this side, and it requires the aid of his finger to remove it. The voice is husky and tremulous, his words are formed imperfectly, and he speaks as if his mouth were partially filled with food. The movements of the lower limbs are somewhat choreic in character; he trips over very slight irregularities in the floor; there is spasmodic jerking of the limbs, and he points his feet to the ground with much uncertainty. He is considerably demented, and is confused as to the year, month, and day. He is sometimes restless at nights. Circulation and respiration:—There is slight alteration of the first heart sound, which is roughened and prolonged. There is dilatation of the small capillaries of the skin. He is fairly nourished, and takes his food well.

Present state.—He is an old-looking man, of middle height, with a prominent under jaw. He says that his eyesight is very good indeed; the fact being that he can with difficulty read letters one sixth of an inch long; the left eye is the worse. His hearing is also bad, though he affirms it to be very good; a watch heard several yards off by an ordinary ear is heard by him for five or six inches with the left ear, and for two feet with the right ear. The sensibility to pricking and pinching appears normal in the feet. When asked to walk he does so; but both legs, and especially the right, give spasmodic jerks outwards. When he is asked to do anything with his hands or his head, there is a spasmodic jerking in the muscles concerned before the movement is accomplished. The grasping power of his hands is equal on the two sides, and very considerable. The legs are flexed with considerable power; he stands rather unsteadily with his eyes shut; he cannot stand at all on one leg with his eyes shut, or only for a very short time indeed. During examination, twitching goes on in the right side, even when he is standing still.

Mentally.—He says he is happy and well, and he wants to get home. He is inclined to look at everything in a happy light, and does not recognise his

increasing blindness and deafness, nor the jerking of his limbs when put in motion. He works as a field labourer.

In the first of these cases it is noticeable that the form of mental disorder was at first in the direction of depression. The man had lost his employment owing to his advancing blindness, and a master whom he had long served died about that time, so that he had no resource but the workhouse, and there he became melancholic. In this state he was admitted to the asylum, but he does not appear to have continued long in a very depressed frame of mind. In October, 1869, a year and a half after admission, the melancholia seems to have left only its traces in a delusion of a hypochondriacal nature. By this time symptoms of ataxia were observable, and he became unable to stand. At the time of examination again his spirits were good, almost expansive in character; he was voluble, and spoke about getting better in an eager and hopeful manner. There is therefore in this case a decided transition in the mental state as the ataxy becomes developed, and the change is from depression to exaltation. In the second case ataxy is present to a great degree, and with it are delusions of an expansive nature, bearing the character of mental exaltation. In the third case there is, again, a state of mental exaltation with the ataxy. In the fourth case neither the bodily nor the mental symptoms are of a sort easily defined; the former point to commencing ataxia, especially the state of the optic discs, the frequency of urination, the analgesia of the lower extremities, the gait, and the difficulty in getting started to walk; the latter point to a sort of moral insanity. There has evidently not been time in this case for the spinal affection, if present, to impress its character on the mental disease. In the fifth case there are ataxic symptoms, with a certain degree of the same elevation of spirits over what would be the healthy average under the patient's circumstances.

These facts seem to point to at least one accompaniment, in the mental centres, that of lesion in the subordinate machinery which appears to us as ataxia. That accompaniment is the state of buoyancy—high spirits. Nor is there anything improbable in this, even if we were to suppose that mind is in some respects out of the reach of body, for there can be no condition mentioned which would be more easily proved to depend often on

grossly material conditions than precisely this one of buoyancy or high spirits. In animals it can be produced almost at will by certain physical treatment, and in men it can be controlled by drugs to a very considerable extent, even with our present knowledge.

But it is well to add at once what additional evidence can be obtained. Three cases have been put on record by Westphal,¹ all of which had undoubted symptoms of locomotor ataxia, and supervening upon this, insanity; the latter affection took the form of "mental excitement and *manie des grandeurs*." In all three cases the spinal affection had shown itself (two, nine, and fifteen years respectively) before the patients were admitted under Dr. Westphal's care for mental alienation.

Here, therefore, is a certain amount of evidence; enough at least to justify us in asking whether there are any *a priori* grounds on which we might expect to find these two forms of disease linked to one another. To answer such a question it is necessary to insert some remarks as to the nature of what we designate "ataxia."

An anatomist, considering the machinery by which a limb is made to execute a movement, could conceive irregularity of the movement to occur in several ways. Putting aside the structural fitness of the bones and joints, as well as of the muscles, there are still the nerves, the channels through which the force acts on these, to be taken into account, and also the amount of energy devoted to the movement. It is probably safe to assume that the consequence of any morbid process in the different nerves, if it lasts for more than a few days, will be the non-transmission or the partial transmission of volitional impulse through some of its former channels. From this we should expect to find irregularity in a certain direction, viz. in that of an excess of action in muscles near to those paralysed and engaged in the same movements. For the will in no way recognises the paralysis of a special muscle in a co-ordinate group more than it does the action of that special muscle in health; a patient who gets Bell's paralysis is first made acquainted with the fact when he confronts his looking-glass or meets a friend; and again, there is no reason, so far as I know, to suppose that the power set free in a volition is absolutely confined to the exact

¹ 'Journal of Mental Science,' vol. x, p. 207. The translation by Dr. Rutherford.

fibres in which it has hitherto run; but there are very many reasons to suppose the opposite, or that part of the power may exhibit itself in other closely connected channels. The volitional power, therefore, flows out in quantity as before, and from that follow certain extravagances of movement. What is the nature of such extravagances? This at least can be said—their course is definite. A patient coming up to the hospital on the morning of his noticing a wryness of his features, makes often grotesque movements as he endeavours to explain how the thing happened. He throws all the former energy out to work his cheeks, lips, &c., for the act of speaking; and the parts that are sound are put into excessive action.¹ There is, however, definiteness in the extravagance, viz. thus far that each movement is extravagant in the same direction as those preceding and following it, and that the whole effect is but an exaggeration of the normal action of the muscles concerned. This may be still better noticed, I believe, in such cases of local paralysis as occur in the arms of men employed in swinging heavy hammers, in constantly writing, handling a paint-brush, &c. But a second fact is more important than this one, viz. that however such extravagance may be noticeable at first, it is *amenable to a process of education*, by which in course of time (a day or two in general) the extravagance becomes toned down, and a mode of gesture more suitable to the altered circumstances is fallen into.

A last possible cause of irregularity of movement is a change in the amount of the energy thrown out. The amount may be increased *in toto*, or individual channels may have an increased flow in them. The effect of this last will be undistinguishable from that of a diminution in certain channels, unless the total amount of power going to the limb can be estimated—a difficult, and at present, as far as I know, an impossible task.

To which of these sorts does locomotor ataxy belong? It has resemblances to the first form discussed, viz. that in which, by the blocking, complete or partial, of certain channels, a comparative overflow through the remaining ones is produced. It differs from this form in the fact that the extravagance is permanent, not temporary; the irregularity goes on, spite of all the

¹ There may be other elements in the cause of this excess; nevertheless they do not seem so constant as this one, and the following remark applies equally well if they are supposed present.

attention that the patient can bestow upon it, spite of all the lessons which nature, more or less unconsciously to him, bestows on the offending member, informing it that it no longer operates harmoniously with its situation in nature's scheme. Moreover, supposing that we have here the proper cause of the irregularity, the thing which nature in other instances teaches us would be best for the limb, is this, that its remaining powers should become subdued to a level consonant with the inaction of former co-operants. Even if the remainder be capable of supplying the place of the inactive part, the same subdual must take place for a long time, the pain of fatigue in the overworked parts being the agent through which reduction would be effected. But if the remainder be incapable of supplying the want, the subdual must be permanent, otherwise the working muscles will constantly carry the limb into all sorts of inconsistencies and dangers. Even then in this case I think we may justly say that locomotor ataxy, if it is a consequence of partial (incomplete) paralysis, is distinguished from other partial incomplete paralyses by the continuance of the flow of nervous energy into the channels left sound (coming out as persistent irregularity and, by-and-by, as spasm), that is, by *an escape of nervous energy in excess* of that which from the analogy of other similar natural operants, we conclude to be most beneficial for the continued life of the part affected, and of the organism that part goes to support.

It does not seem, however, to me to be in any way proved that there is necessarily a deficiency in the amount of nerve power expended on the ataxic limb or limbs. Besides calling to mind the continued normal nourishment of all the muscles, it is well to refer to the words of Trousseau, as regards this point, remembering meanwhile that "spasm" means a running away of nerve power through some channel, and that "there is no uniformity in the abnormal movements in any given case at a given time;"¹ that is, any muscle in the limb may be affected with spasm, or this with trifling exceptions. After quoting a case where there was anæsthesia both cutaneous and muscular, without any ataxia, Trousseau says, "This case, which I studied with the greatest care, proves therefore that muscular insensibility, which necessarily implies the loss of the sense of muscular activity, does not suffice for producing locomotor ataxy, and there must,

¹ Dr. C. Allbutt, in 'Brit. Med. Journal,' Feb. 20th, 1869.

in my opinion, be superadded another element, to which I shall revert by-and-by, namely, *spasm*." (Bazire's Translation. The italics are in the original). Spasm is therefore erected into an essential element of the disease, by Trousseau, and it is an acknowledged element with every writer, as far as I know, on the subject. Of this general opinion, along with the remarks made in order to show that a morbid excess of power is going off in ataxia, I intend to make use presently when examining the connection between the bodily and the mental disease when insanity appears on the stage.

But I must briefly turn aside to show what physical framework may possibly underlie this excessive expenditure on one, two, or more ataxic members. I take the lower limbs, as their action is easily reconciled in the imagination with the idea of ataxia, and among their actions that of walking may serve as a type of many others. The child, as we know, has to learn to walk. Each movement is, at first, the result of a separate volition. (There appears to be a certain amount of original endowment serviceable for the purpose, but this does not interfere with the main fact of an education being necessary. See Bain—"The Senses and Intellect," under the head of "Appetites and Instincts.") By-and-by, however, walking can be kept up without any volitional flow of appreciable magnitude, and the fact that much less of the power stored up¹ in the mental centres is required for walking is shown by the fact that while walking is going on attention can be directed to quite alien matters. Now, the force required to propel the limbs is the same in the one case as in the other. There must, therefore, be some fresh source of power. Where is this? All power is derived for the body from the matters ingested; these are variously metamorphosed, and the force latent in them is partly expended and partly stored up in the body. For the requirements of the nervous system the grey cells are the parts that store up power; the different organs draw upon these cells for it. Have the lower limbs a chance to draw upon any other part than on the volitional centres? Undoubtedly they have.

¹ Such a storing has become more and more evidently a fact since the doctrine of the conservation of force was established. As to its relation to time, the recent striking lectures of Professor Parkes, published in the 'Lancet,' seem to have, as a corollary, the possibility of its lying in store for longer periods than has recently been thought to be the case by another class of observers.

Not only so, but a great part of the centripetal current which guides the volitional impulse in the young child passes through neighbouring tracts of grey matter (in the spinal cord) to those along which the impulse descends. (According to Brown-Séquard's researches, sensory impressions are conveyed along the grey matter of the posterior, and, perhaps, even of the anterior columns, and volitional impulses are conveyed downwards in the white matter of the anterior columns and in the adjacent grey matter.) What more probable, then, than that the grey matter of the cord should, having already to draw on the blood for its contribution to the sensory and motor currents, at a period of growth, and having itself the capacity of growth, come to draw enough for setting on the artificial combinations of movement whenever the proper impressions arrive, subject only to the inhibitory power of the will, which, through the higher sensory organs, retains to itself the habit of corrective control over the movements concerned? For this, indeed, we require a possibility of the sensory stimulus communicating with the efferent current in the cord, and such a possibility when we deal with grey matter, where channels of communication of this sort are constantly being erected, or, at any rate, when we deal with the period of childhood, when nothing is more characteristic of the nervous system than the openness of all its channels to impressions, of whatever kind, is a requirement that will be conceded by every one as granted by nature. Here, then, are the elements of the process intervening between my volition to walk and my walking. The volition produces, perhaps, of itself, the very first movement, unless I move from a position so usual to me that with the sensory stimulus arising in the state of rest from the parts, a connected definite apparatus of cell and fibre, capable of drawing and storing power, already exists, and I have only to send down to the lumbar enlargement of my spine the little amount of power sufficient for setting the currents in the proper connection. At all events, after one leg is fairly in the position for walking, the reflex apparatus (reflex but educated) does all the rest, and only a very small stream of volitional energy is required, sufficient to keep the action going on (how we know not, but no doubt through the agency of multipolar cells), in a way that reminds one how the railway engine rushes along when the conductor only keeps a peg open.

The question as to where the afferent fibres in point lie, is one of some interest, and seems to have been settled decisively, at least in so far that they are found to be separate fibres altogether from those conveying sensations of touch, pain, temperature, and perhaps other things. If the seventh class of Brown-Séguard¹ named "incito-motor" fibres, refers to fibres educated to be incito-motor, as well as to those which are so by original endowment, then these fibres, subserving locomotion, no doubt are to be referred to this class. At any rate the phenomena of locomotor ataxia occasionally themselves show the separation, for we have undoubted cases recorded where there was no modification of the cutaneous sensibility, though the incito-motor fibres of locomotion were shown by the gait to be much deranged.² And, indeed, as it seems to me, a very little consideration of the matter will show how exceedingly singular and different from what we see would be the results, were changes in the cutaneous sensibility to affect the issue of power for walking. It has happened to every one to walk long distances in winter without a bit of feeling in either of his feet, and the same thing happens on a more extended scale to Arctic travellers; but I have never read, heard of, nor observed ataxia to follow this state when the cold had not advanced far beyond the cutaneous stage,³ and it would be too striking a symptom to have escaped notice, if all the members of a crowd of Christmas revellers who "didn't feel their feet," turned out ataxic.

The conclusion, therefore, seems justifiable that the afferent fibres for locomotive purposes are separate from those for cutaneous sensibility (*sensibility* being the name for the process by which impressions are transmitted to the mental, conscious centres).

What takes place then in locomotor ataxy? The pains seem

¹ 'Lectures on the Diagnosis and Treatment of Nervous Affections,' by Dr. C. E. Brown-Séguard, p. 11.

² See especially Bazire (translation of Trousseau), also 'Dublin Med. Journal,' vol. xlv, p. 480; a case of *hyper-æsthesia* in the Sydenham Society's 'Year-Book' for 1865, p. 86 (Bärwinkel), and collaterally, Trousseau's Lectures, Niemeyer's 'Pathologie und Therapie,' and 'Libidinous excess as a cause of Tabes Dorsalis,' by Professor Laycock.

³ I have the impression that in the history of Kane's arctic expedition, reeling and staggering are described as symptoms of the advanced stage of refrigeration, just previous to the wish to lie down and sleep, which accompanies the enthusiastic flow of ideas in the last stage of this singular form of death.

to point undoubtedly to some lesion of afferent fibres. The limbs are described as feeling "numb," or still oftener as feeling heavy when the patient tries to walk. What would be the physical accompaniment in the nervous system were the limbs actually heavier; were we to load a man's boots with lead? Evidently the ordinary flow of force for walking being found insufficient, an increased flow would have to take place from somewhere, and it takes place from the centre that wills, the sense of effort being always its mental accompaniment. If the sense of heaviness in the legs therefore corresponds to an increased flow from the mental centres, how does it arise when the limbs are not loaded? It seems reasonable to conclude—because some former source of power is stopped, and an increased flow of the volitional sort has to take place. What source of power can be stopped? Plainly, if there is a lesion of the afferent fibres, the efferent (educated "involuntary motor") conductors corresponding will be less incited to work in a degree proportionate to the lesion. The brain, therefore, is cut off from being able to use the subordinate source of power that had come to exist in the spinal cord. Hence arise increased volitional effort and the sense of heaviness. But there is every reason to suppose that that source of power in the cord still exists. The cells in connection with efferent fibres are rarely if ever modified in ataxia.¹ They go on drawing from the blood their store of power for and by which they live; what is to become of it? In the incipient stages no doubt much of it goes out in the old direction, in obedience to the afferent fibres left untouched; the rest may be supposed to issue irregularly in minute quantity upon its former recipients. But the evil goes on, and meanwhile the will makes energetic efforts to bring the limbs under its control, as we easily gather from the behaviour of the patients. It would appear that it never can resume its old power (of the infant stage) to the full; but it does resume it, in so far that efforts of the will do, as is well known, determine a copious flow of force into the limbs, only that supply is of a most irregular "spasmodic" sort.² Occasional

¹ They are in the anterior horns, "especially in the middle and anterior parts."
—Van der Kolk on the Spinal Cord.

² This increase of spasm when a volition is directed upon an organ, seems to me a most noteworthy point in several nervous diseases.

discharges of power, not due to the will in any way, also take place, and thus the full disease becomes developed.

Here then is, partly from the imagination, but in good part corresponding to facts, a scheme of the physical framework of locomotor ataxia, and it will be seen that the explanation coincides with the position that there is no loss of power in the limbs at any stage. It is, nevertheless, of little importance for my purpose that there should be absolutely *no* loss of power; both the pathology may allow of some little loss by the implication in the morbid process of a few connected cells of the posterior columns, and for my thesis as regards ataxy being a disease of escaping force, the obliteration of a few of the rills that contribute to the river, is of little consequence when it so soon becomes evident that the other tributary streams fill it until it overflows its banks.

It is now necessary to return to the connection of this disease of unstable power with insanity. What is the emotional accompaniment of expended power? I quote from Professor Bain:¹—"On the mental side the feeling of power is, in quality, pleasurable; in degree, both acute and massive; in speciality it connects itself with our active states." I should prefer to convert this last proposition, and to put the matter in this way:—Our active states are in part connected with a feeling pleasurable in quality, called the feeling of power. (For it must be observed that Professor Bain does not mean by "feeling of power," the psychical accompaniment of active exertion, though I find it convenient to use such or equivalent words with that signification.) When, therefore, a dribbling or gushing away of power, shown as muscular activity, is connected with a disease of the cerebral hemispheres, and presumably arouses in its course the mysterious phase of life we call *mind*, what ought we to expect but that the peculiar emotion of activity—the pleasure of power—should come abundantly forth, like coruscations of electric light, distinctive of what medium a current is passing through?

In fact, however, this is rather too wide an inference. Only "*in part*" are active states accompanied by the emotion of power. The limitation is laid down by Professor Bain (op. cit. p. 256):—"The emotion of power . . . is due to a sense of

¹ "Mental and Moral Science," p. 258.

superior might or energy *on a comparative trial*." (The italics are mine.) Now, no doubt Professor Bain would acknowledge that after a man's education (in the wide sense) is well advanced, an actual trial is not necessary, for that one person may *figure to himself* what his opponent can do, and exult over every occasion in which he exceeds this imagined standard. This is a proceeding which will be rendered easier of repetition, in vain persons, by the pleasure derived from each process being considerably greater to them than to meeker individuals. Still it supposes no little amount of education to figure to oneself the average capability of a man, in any fashion on which we can rely afterwards; and probably it is not till an age varying from fifteen to thirty and upwards that the most overweening self-estimation is likely to find it possible to go along in the world, enjoying from a considerable number of active exertions the pleasurable emotion of power. Hence we do not expect diseases of unstable power, below such an age, even if they do involve the cerebro-mental centres, to exhibit symptoms of extravagant self-esteem. There is still another and very important limitation:—"The pains of impotence are in all respects the opposite of the pleasurable sentiment of power" (Bain, *op. cit.*) But impotence is impossible absolutely, in a human being; it must be relative. And this is seen in one example the same writer takes: "being beaten in a conflict;" both combatants exert themselves, but one has the pain of impotence as a consequence. We shall easily remind ourselves of men who are perpetually being "beaten in a conflict;" men whose every exertion of their own power is accompanied with a sense of their own impotence; in whom the comparison with their fellow men is always to their own *disadvantage*; men timorous, hesitating, fearful in all the affairs of life. Does such a man take general paralysis, the accompaniment of outflowing power remains the same as in his sane state; he is fearful, suspicious, melancholic. Hence the low-spirited class of general paralytics.¹

. It can now be seen in what direction an explanation of the psychical phenomena of locomotor ataxy promoted to the brain is attempted. Granted that locomotor ataxy is a disease in which running away of power is an essential element, and

¹ It is necessary to state that I have made no observations in the direction of verifying this last explanation by reference to the histories of patients.

granted that there is that openness for transmission of organic impressions towards the mental centres, which (as in hypochondria) is often so marked in the insane diathesis; or, on the other hand, that the necessity for decay which lay upon the afferent fibres of locomotion, and produced (as we say) the lesion there, may extend by anatomical analogy to other fibres which subserve the comparisons between objective circumstances constantly going on in our minds subordinately to our volitional life; fibres, namely, which, with help, collect all the impressions for us, carry them toward the brain, and often are privileged to draw power for an "ideo-motor" action of their own; granted that these too are involved in the ruin, and that the stored up power they formerly set in motion is left to rush off wildly with each mad attempt to volitionize apart from a true sense of externals, and it will no longer remain a matter of surprise that exaltation is the phase of emotional life, which locomotor ataxy determines in the brain.

In this regard it is most interesting that the seat of lesion in general paralysis, as determined by Rokitsansky (see, for example, Salomon's paper, translated by Moore, in vol. viii of the 'Journal of Mental Science'), is the *lamina nervea* of the hemispheres, the thin white layer just under the pia mater, and that the lesion is essentially of the same nature as that described for locomotor ataxy. The changes attack also the other pale layers of the cortical substance, and the fibres passing through the grey matter at right angles to the plane of convolution. Whether homological reasoning can be carried to such an extent as to bear upon these facts, is not for me to say.

Before leaving this part of the subject, it is necessary to follow out an application of the reasoning used to explain general paralysis of the melancholic type, to the mental symptoms of ataxia. At the conclusion of his note on the case of J. W—, above, Dr. Browne added a remark, which I have preferred leaving to this stage. It is this:—"In all the cases of locomotor ataxy with mental derangement that have fallen under my observation, and in which there was optimism, the optimism has been invariably tinctured with suspicion, as in the case of W—."

Now, one of Westphal's cases illustrates the same curious fact

that suspiciousness may be coupled with the "*manie des grandeurs*." Is there anything that might help to explain this? There seems to me to be at least this much—that in the ataxic complaint, as in other complaints which involve helplessness, there is a very considerable quickening on the part of the patient, while still sane, of the faculties that border on suspicion of those around. Witness the querulous doubts of many people on a sick bed—how they will take food and medicine often only from one person, and so on! And ataxy is a disease like aphasia, of that peculiarly irritating type which gives, with the consciousness of honest exertion on the part of the patient, a result utterly out of proportion, or in no proportion at all, to the effort. If, therefore, an irritably suspicious stage of this sort runs before the insanity, plainly suspiciousness is very likely to be a prominent feature in the latter.—Madness reminds one of the melting of crystalline snow, where, as dissolution of the beautiful structure gradually takes place, we may still see floating in the structureless product solitary crystals from the former well-ordered mass. These crystals, alas! when the simile is applied, too often represent, as in this instance, the malevolent side of human nature.

Hitherto I have considered ataxia as developing into "*manie des grandeurs*." It will be remembered, however, that from the cases I have myself observed, the only general conclusion that could be drawn was that of a certain buoyancy, a state of high spirits. It will suffice very shortly to point to what the reader will no doubt remember for himself, that buoyancy of spirits is even a more general accompaniment of outflowing power than is the proper emotion of power, this last reposing, as it does, on a certain amount of education. Not by any means *all* outflowing power is so accompanied, but much is so, and especially when an excess runs off. Buoyancy therefore is very much to be expected, with any ataxia involving the conscious centres, in a patient who has in his previous life enjoyed the exercise of his powers to a fair extent. In this regard the case of W. R—, who displayed ataxic movements on his right side especially, but also on his left, which had previously been paralysed, and in whom a boyish height of spirits was apparent, is a very interesting and instructive one.

In this place should be noticed some views which are incon-

sistent with the above explanation. In the Sydenham Society's 'Year-book' for 1865, p. 86, there is a notice of an opinion of Axenfeld's, to the effect that locomotor ataxy is not allied to convulsive affections, since the movements of convulsion "occur independently of and against the will, while the former is manifested solely during voluntary movements." I think on the other hand that spasmodic movements may be observed occasionally in ataxia quite apart from the will or from voluntary movements, and the very irregularities that happen with voluntary movements *are* irregularities very much because they are *involuntary*. At the same time convulsion no doubt is separated from spasm of the choreic sort, the kind that occurs in ataxia. Dr. Lockhart Clarke¹ has ascribed the symptoms of locomotor ataxy to absence of tension or tone in some of the muscles. Now, if absence of tone during life is meant to imply loss of active power, this explanation would hold good to that extent; but we see spasm in all muscles in ataxy (as remarked above), therefore power is not lost, and it cannot be through that channel that loss of tone would bring on ataxy. On the other hand, if loss of tone is considered of itself to be capable of producing ataxy, the position requires independent proof, especially as tone is "a state in which they (the muscles) always appear to be when *not active* in health,"² and therefore we cannot readily suppose this state to have much to do with a disease, mainly, of voluntary activity. In infantile paralysis there appears to me to be loss of tone in certain muscles along with loss of voluntary power, and there the symptoms are those of the gradual subsidence of volitional movements in the whole limb of which I spoke above, whence the difficulty of getting such children even to try to walk.

Reflex movement to tickling seems to be often in considerable measure lost, in ataxy. In one of the cases recorded by Dr. Lockhart Clarke in the 'St. George's Hospital Reports for 1866,' reflex sensibility was exalted to an extraordinary degree. The educated "incito-motor" fibres of which I spoke above, are not by any means to be considered the same as those that are afferent for this reflex action; yet they would be nearly related

¹ 'British Medical Journal,' Sept. 25th, 1869.

² Kirke's 'Handbook of Physiology,' by Baker, p. 475.

to them, as would also the afferent fibres for *tone*, if there be such.

The electro-muscular contractility is worth study in the case of W. M.—. The fact is especially to be noticed, that in muscles long under the ataxic influence this contractility seems much diminished. This is the case also in general paralysis. (See Bucknill and Tuke, "Psychological Medicine," under "General Paralysis.")¹

The term locomotor deficiency may seem to point to a very arbitrary mark by which to classify cases together. Nevertheless, those that follow illustrate so well some singular aspects of the disorder to be found in asylums that they seem worthy of a clinical record; and as they were brought under my notice for their want of locomotor powers, I may preserve that common fact in view in naming them together.

The first case might seem to contradict what I have contended for in the first part of this paper as regards the mental accompaniments of excessive outflow of power; but I would remind the reader that all I have attempted to show is, that in the insanity which accompanies locomotor ataxy, we see still those mental features prominent which aforetime were wont to accompany the outflow of power in the sane state. It is only because in most sane men the accompaniment of activity is pleasure, that in most insane men the accompaniment of abnormal or spasmodic activity need be abnormal pleasure.

CASE 5.—W. C., æt. 15, was admitted into the West Riding Asylum on the 22nd December, 1870. His maternal aunt was idiotic; his maternal grandfather died of consumption. There was no other history of imbecility in the family. He was prematurely born, and is the eldest of twelve. Four of the family died in infancy.

Two years ago he began to become imbecile. He also fell down twice semi-unconscious, and in these falls cut his head. Both times this took place at the top of the staircase. There has been incontinence of urine by day, not by night. There has been irritation about the rectum. He is near-sighted.

On admission articulation is imperfect, and he walks with difficulty and in a straggling fashion. Head large, broad, and flat; palate highly arched, contracted,

¹ The spinal lesions in general paralysis have been described in a paper by Dr. Westphal, translated in Vol. XIV of the *Journal of Mental Science*.

and narrow. Has "Hutchinson's teeth;" manner shy; heart sounds indistinct, and both considerably prolonged. Scar on back of head, said to be from a fall downstairs. Was ordered nitrate of silver (gr. ss ter die) with opium.

January 31st, 1871.—Getting more unsteady. Cannot get about without assistance.

February 7th.—Now passes urine and fæces involuntarily. Cries after doing so.

8th.—Belladonna ordered instead of nitrate of silver.

14th.—Is troubled with vomiting. Ordered milk and lime water.

15th.—Has not vomited since.

18th.—A little better; no more vomiting.

March 16th.—Seems to have delusions of fear. Pupils dilated; grinds his teeth.

Present state, on March 28th, 1871.—Patient cannot leave his chair; violent spasms throw him down when he tries. The sense of sight seems dimmed. He makes no sign of apprehension, does not even wink when any object is suddenly brought within an inch of his eye. But he follows with his looks a white handkerchief that is moved about before him. When a lump of sugar is held up to him he at first seems to see it but dimly, and his hand and arm are jerked away from it, though there is a look of eagerness in his face. When the sugar is put in his hand he has difficulty in securing it, but carries it to his mouth with tolerable ease. After trying several other lumps he arrives at much greater proficiency in the necessary movements, and seems to see the sugar much more clearly. The left pupil is rather wider than the right. Hearing is tolerably good. The sense of taste seems preserved at least for sweet articles. He also appears to relish his food. He seems quite sensitive to touches or pinching, the signs seem to indicate pain in the head as well as in the region of the stomach. *Motion* is very much deranged. Thus, he articulates very imperfectly; "Oh dear!" is the only expression that can be made out, and that is not certain. Saliva runs over his mouth. When told to fasten a button he puts his hand to it, but only executes a tremulous movement after that. He does not sit still even when no one pays any attention to him, at least for the most part. When told to put out his tongue he opens his mouth and sends his tongue forward, so that the point presses on the teeth of the lower jaw; appears unable to protrude it farther. He cannot walk; when he tries, there is severe agitation of all the muscles of the body. When he tries to stand he sinks at once backwards. He can hardly make an attempt to put his feet forward. In general, any volition brings on violent spasm in the muscles to which it is directed (save in the case of the sugar just mentioned). This is especially marked when he is asked to look at a fixed point; the *orbicularis palpebrarum* is at once violently contracted. At present the extensors of the hip and knee are violently contracted when he is agitated as he sits. *Reflex action* is exaggerated in the feet; in the arms and face it does not seem at all exaggerated. In the feet it is exhibited in violent flexion. Electro-muscular contractility, with a current as for W. M.—(Case 1), is throughout not good. The extensor muscles of the right arm answer best to this stimulus. His tongue is brown in the middle, slightly fissured; his bowels are rather confined. He has not control of the sphincters of the rectum and bladder. The lymphatic glands of the neck are indurated and slightly enlarged; those near the brachial artery at the elbow are also enlarged. The heart sounds are sharp at the base and a little accentuated at the apex. In the chest a little wheezing is heard over the apex of the right lung. The pulse is

cordy, 108. The skin is natural. Urine acid, not albuminous, with a very slight excess of mucus.

Mental state.—He appears to understand what is said to him, but cannot reply by word or sign for his excessive agitation. Voluntarily he cries often, "Father, father!" and "Oh dear!" He seems excessively apprehensive; a movement near him, if it is visible, or a slight sudden touch on his skin, often produces crying and violent agitation. When not agitated he appears apathetic. Volition can be tolerably well exercised in reply to direct stimuli, as in the case of the sugar.

This case presents all the symptoms of chorea in its severest form. The disease, operating in an originally imperfect bodily framework, has advanced to a stage not very often witnessed. The ataxia of the voluntary movements is well marked in this as in other cases of chorea. It seems to me, however, to be ataxia of a different sort from that discussed above. There are no stinging pains, there is no sense of heaviness and deadness in chorea. On the contrary, the children who take it are often those who display through all their organization a hyper-sensitiveness, and hyperæsthesia is not infrequent in this disease. This points to some irritability about the recipient cells for external impressions. But these cannot alone be involved, for the cells for efferent fibres must be the seats of some abnormal force-producing process. The fact, too, that during sleep, when we know that the determination of blood is less to the higher nervous centres at least, the choreic movements diminish or cease altogether, is in favour of the view that over-supply of material to the power-producing organs is going on. Moreover, the will has a remarkable influence over these movements, as shown in the case of W. C—. Now, we know that by an increase of flow from the volitional source of power we can inhibit even tolerably powerful actions in the lower centres, such as breathing, the voidance of urine, of fæces, &c. There is no reason, then, why an abnormal amount of power should not be kept from going off, by an effort of will more powerful than ordinary. These facts seem to me to point to some congestion of the grey matter of centres of educated incito-motor activity, over which the will has retained a certain amount of control. Either the increase of the morbid process (as on awakening), or the diminishing of the inhibitory action of the will, as from nervousness at the presence of another person, will have the effect of increasing the spasms. This is, of course, only conjecture.

The next case is one of advanced general paralysis. The notes were taken with the view of ascertaining whether anything ataxic was present, it being unknown to me at the time that the man suffered from general-paralytic dementia. The clearness with which the distinctive points come out is, therefore, highly interesting.

CASE 6.—F. W.—, was admitted into the West Riding Asylum on 9th March, 1851. Had been an idiot in some degree from birth. Had been quarrelsome and passionate, and had made felonious attempts on girls and on his mother.

March 15th.—Has pain and giddiness in the head.

May 28th.—Improving. Tries to escape. Works in the weaving shop.

1866.—In feeble health. Said to have phthisis pulmonalis.

Present state, in March, 1871.—Owing to his demented state it is difficult to find whether sensation is much affected. He appears, however, to see and hear tolerably. He likes sugar. The most severe pinching in the feet does not appear to be felt, nor does pinching anywhere produce much effect. A steel-pen point can be pressed hard against his neck while his attention is diverted without his taking any notice of it. Movements are very slow. Articulation is slow and imperfect. He protrudes his tongue when he comprehends what is wanted of him (he understands signs better than words). Cannot walk; when he tries, the power seems to fail him. He must lean well forward and be supported. He prefers a sidelong movement, with both feet on the ground. He can stand without staggering when his eyes are shut and he can move his feet forward in the proper way for walking. He can also fasten a button pretty easily; can, when sitting, cross one leg over the other with the help of his hands, and he can pick up little bits of paper, sugar, &c., with precision. His eyes move properly. The facial lines are a good deal obliterated. Reflex action in any part is very slight or nothing. He does not pass water involuntarily. His tongue is pale and much fissured. Heart sounds at base soft, natural at apex; breathing sounds natural at apices. Pulse slow, but regular. Skin natural. Lymphatic glands natural.

Mentally.—He is very dull, often not understanding what is said to him; always slow to do so, and understanding signs often quicker than words. He is, indeed, in a state bordering on complete dementia.

The following case is in no inconsiderable degree parallel to those given by Niemeyer and Trousseau, to show that cutaneous anæsthesia is not necessarily accompanied by ataxia. It is not, indeed, easy in some insane patients to know whether the anæsthesia arises from lesion of the subordinate or of the highest nerve paths and centres, whether it is in the bodily or the mental regions that the obstacle to feeling arises; and the examination of this case, presented to the reader from notes taken on the spot, without bias in any way, must be judged of by each one for himself. The impression which I derived was that there really

was very general analgesia, and also considerable anæsthesia, in the ordinary acceptation of these words, and that the tolerably fair perception of the quality of objects put in the hands was partly got from muscular capabilities (the immense additional resource which fine movements give for discovering the qualities of a surface and the weight of a small body being well known both to physiologists and to practical men), and partly from the inkling that the patient unavoidably acquired of what was going on when some of the familiar objects round about were being selected for submission to her.

CASE 7.—A. M.—, æt. 37, a dressmaker, was admitted to the West Riding Asylum on the 8th March, 1867, from Leeds. The statement brought with her from the medical officer certifying was that she was "At times wild and very excitable when questioned; said she was thirty-two years of age; that she died last Monday and was in her grave, and repulsed me and her sister for disturbing her in her grave, and threatened to send an officer to take us before the magistrates. Refused to answer my questions, ordered me away, and struck me; my having had to certify about her on a former occasion seemed to produce the excitement." Age on first attack, thirty. Has been in the West Riding Asylum before. Has been unwell during the last seven years; cause unknown. Not epileptic, suicidal, nor dangerous. She is single, and belongs to the Independent denomination.

March 30th, 1867.—Before admission she was confined to her bed several years from her own desire, thinking herself dead. Since admission has remained in a similar state. She is a thin, spare woman, and appears to be suffering from monomania. Fibro-nervous temperament. Pupils rather contracted; her face generally impressed with a peculiar sepulchral cast.

Heart sounds.—First sound rather soft and blended with the second or diastolic sound; the pulse small, feeble. Lungs healthy to percussion and auscultation.

Digestive organs.—Some days refuses her food, on others takes nourishment freely, without feeding. Genito-urinary organs in a healthy condition.

April 16th.—Still continues under the same peculiar fancies, but not for so long periods.

May 3rd.—Has been two days without food, with her finger in her ear, thinking she is buried.

30th.—Is now sitting up in the day-room, having for some time been taking the following medicine :

Tinct. Ferr. Mur., ʒiij;
Quin. Disulph., ʒss;
Acid. Sulphur. dil., ʒj;
Aquæ, ad ʒxij. M.
ʒss ter in die.

And to which may be ascribed her present improved state.

June 6th.—Is able to talk with those about her, and appears more lively and animated at times; however, she relapses into her old condition.

August 20th.—Is still improving, and appears more lively; is able to walk

about the room without assistance; takes her food much better. Is still continuing the quinine mixture.

March 27th, 1868.—She still improves in bodily health, but her mind is still occupied by delusions as to her being about to die. She is altogether, she thinks, too feeble to work, and will, consequently, in no way employ herself.

Present state, on March 29th, 1871.—She is a thin, pale woman, about the middle height; her expression is that of misery.

Senses.—*Sight*:—She says a blue object is dark red. She can read tolerably large print, but nothing smaller. Pupils rather contracted. She appears to hear fairly. She recognises apparently a leather surface, a pair of gloves, a boot, by tactile power of her hands alone. She says she has no particular pain at present, but that at times she has pain when making water. Sensibility in the feet appears diminished. She knows the locality of a severe prick on the great toe, but not on the little toe nor the middle ones, except, perhaps, the second. She apparently does not feel pricking or pinching on the feet (unless severe). The sensibility of her hands is very much diminished, but she gets nervous and will not apparently confess to either pricking or pinching even on the lips or cheek. The diminution of sensibility seems less upwards.

Locomotion.—She does not lift her feet from the ground, but walks sideways, using her feet in a rotatory sort of fashion, the heel and the toes being alternately the centre of motion. When her eyes are shut she does not stagger nor seem inconfident of her power. She never sews; puts in a button very well. Speaks with very tolerable distinctness. She can raise her feet from the bed, but not far, and can pull them up, too, by flexion, but weakly. She has at present, and very frequently at other times, a tremulousness of the limbs, of the nature of that when a person ordinarily is cold or restless. Reflex action is exaggerated at the soles of the feet (to tickling), while sensation is decidedly lessened; she says she does not feel the tickling, when the reflex action is meanwhile considerable. In the nose reflex action is especially marked. There is slight right lateral curvature of the spine in the dorsal region and in the cervical region, with slight compensating curve at the seventh cervical vertebra.

This report is deficient in many particulars, but it is sufficient to show the contrast between the deficiency of sensibility and the comparative perfectness of movement. The symptoms seem to me to point to some lesion high up in the nervous framework. An irritation of the dorsal root of the sympathetic might have something to do with it, and the improvement in her symptoms under iron and tonics is also noteworthy. Delusions of death are not uncommonly accompanied in the insane by a general diminished cutaneous sensibility.

These, therefore, are three cases of locomotor deficiency from causes uncommon in ordinary practice; the first not so much from loss of power as from disease of the power-storing centres, showing itself as instability of the latent force; the second from loss of

power, and probably from degeneration of the cells to produce it; the third partly from debility, partly from a disorder of sensation acting on a weak intellect. In the first there is ataxia, in the last two there is none; but the first has an ataxia of a different intimate nature, probably, from that producing the locomotor disease. This last disease, to recapitulate, has for a prominent feature in its course a running away of the nervous force which ought to be stored up till the will should require it; and probably as a causally connected phenomenon, a development, when there is a tendency to insanity, of extravagant ideas of power or of buoyancy consistent with the expenditure of the bodily energy, and with nothing else, so far as can be seen.

Note.—I have taken little account in this paper of Dr. Radcliffe's theory of nervous and muscular action. This theory still remains in the region of hypothesis, and, enticing as it certainly is, the conclusions scarcely seem so much justified by the facts brought forward that there has arisen yet any need to translate fresh reasoning on connate subjects into language adapted to Dr. Radcliffe's views. I think, however, that the above arguments are capable of such a translation, and that only the way in which I have represented power as proceeding from the nervous centres and stimulating a muscle would fall into collision with the views of that eminent physiologist. After all, it is *but* the expression, "stimulation" of the muscle, that is objectionable; for power, force in some form, must proceed from the nerves to neutralize the electricity of the muscles; and if that force is in the form of an inversion of electrical conditions, such inversion must also have its competent antecedent. The "commutator" does not turn without the electrician's finger; so that all one would have to do to reconcile the above arguments with Dr. Radcliffe's views would be to transfer in imagination a considerable amount of the whole energy required for a completed volition to the muscle, leaving, however, enough to the nervous apparatus to give it the capability of counteracting the electrical tension between the molecules of the muscular elements.

The allegation of congestion as an efficient cause of chorea is also apparently objectionable, according to Dr. Radcliffe. But I should certainly hesitate to accept in an unqualified manner the foundation on which he builds this and similar opinions, that "the functional activity of an organ is directly proportionate to the activity of the circulation of arterial blood in that organ;"¹ for it must be taken into account that force may be stored at one time, and may be displayed afterwards when *not* being stored,² that is, that the above proposition must have the element of time taken into consideration in order to approach truth, and that experiments which must interfere with the nerve fibres in that respect, viz. *pressure* in which

¹ 'Lectures on Epilepsy, Pain, and Paralysis,' 1864, p. 93.

² The charging of a Leyden jar may be quite "separate" in time from the discharging.

they are most susceptible, are not to be taken as the basis of general propositions regarding ordinary nerve function. Lastly, congestion (inflammation also) and the active "circulation of arterial blood" are probably very different things; nor does it seem to me in accordance with clinical experience to take as a criterion of a localized congestion "an excited state of the circulation."¹

These reasons are stated here, not to make what would be a useless attempt to detract from the value of Dr. Radcliffe's labours, but that I may not be thought to have failed to have that respect for his opinions which should make me take them into account.

¹ 'Lectures on Epilepsy, Pain, and Paralysis,' 1864, p. 267.

ON THE ARTIFICIAL FEEDING OF THE INSANE.

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AMONG the most troublesome cases to be met with in asylum practice are those where the patients, for a longer or shorter period, persistently refuse to take food, and where, in consequence, recourse must be had to forcible alimentation. Such cases are by no means of rare occurrence, and the best method of dealing with them has been the subject of many interesting papers in the medical journals by various contributors, who have treated the subject fully and exhaustively. The means adopted for feeding these patients are different in different asylums, and the method a medical man has once become accustomed to employ he usually prefers, and considers superior to every other. As the subject is of some importance, inasmuch as a great deal of discomfort and annoyance both to the medical officer and the patient is avoided by the use of the simplest instruments, and the best mode of using them, perhaps it may be worth while to describe how these patients are managed in the West Riding Asylum.

Refusal of food is not a symptom which is confined to those who are the subjects of the same form of mental disorder. By far the greater proportion who exhibit this symptom are acutely melancholic; in whom the nervous system is so depressed and lowered, that the natural craving for food is altogether absent, in whom the mind is so preoccupied with the thoughts of its miserable condition, that the feeling of hunger is

entirely in abeyance and unheeded, in the presence of a more severe, though, it may be, groundless source of uneasiness and anxiety. It is well known that intense concentration of the thoughts upon any one subject, renders the mind incapable for the time being of noting impressions and circumstances, which at other times would excite active sensations, either of a pleasurable or painful nature, and become part of consciousness, and makes it likewise oblivious to the ordinary calls of appetite. The promptings of appetite, however, in the case of healthy and sane persons, soon assert their importance, and cannot be long disregarded; but in the case of the insane, with whom the mental effort and abstraction is involuntary and unconquerable, all inconveniences from external impressions and natural cravings fail to call forth any effort for relief.

Deliriums, more or less fanciful and absurd, are frequently associated with refusal of food; and though in many cases they arise from abnormal sensations, the result of simple dyspepsia, or more grave disorders, and thus are, as it were, the secondary, but not the less important, cause of the abstinence, in others they have no foundation in digestive derangements, and are the sole and primary cause; for example, one man abstains because he has got no money to pay for what is offered him; another, because he does not work, and consequently does not deserve it; a third asserts he has been dead for years, and has no farther need of food; a fourth affirms that everything that is set before him is poisoned, and prefers to suffer the pangs of hunger, rather than give his enemies the gratification of ending his days; while a fifth is in a state of constant alarm and terror, and paces the room from end to end, exclaiming that the last day is at hand, and the world is to be burned up. But when the digestive disturbance is the primary cause of the abstinence, the delirium has generally reference to the uneasiness and pains experienced; one fancies that his throat is closed up, and therefore he can't swallow; another says it is absolutely impossible for him to take anything, and that he already has more than he can contain, though he may have been fasting for days; while another fancies that there are serpents in his stomach, which can only be got rid of by starvation. In many of the latter class, the most insignificant feelings are magnified and dwelt upon, and their importance exaggerated to an extent greater

even than among hypochondriacs ; but when the delirium has reference to the patient's sensations, there is reason to suspect the existence of some functional or organic derangement of the digestive apparatus.

Abstinence from food in some cases may depend entirely upon organic disease of one or other of the organs more immediately concerned in the process of digestion, as, for example, the stomach or liver, without the existence of delirium ; and in such cases this symptom may be ascribed to a false cause, owing to the mental state of the patient, and food be forced upon him, which if his mind were not affected would not be so earnestly insisted upon. But these diseases, though their diagnosis is often extremely difficult, from the inability of the patient to communicate his subjective symptoms, can never be long overlooked, if the objective are duly attended to ; and even when they are present it is necessary to administer sufficient nourishment and suitable medicine, so as to prolong life as far as possible, though a favorable result cannot be ultimately looked for. In the case of an old woman, who died lately in this asylum, there was found after death extensive disease of the liver, which, from her appearance, and gradually progressing emaciation, had been diagnosed long before death. The liver was discovered to be hard and scirrhus throughout its entire substance. In her case life was prolonged for more than six weeks by the almost daily use of the stomach pump. Though able to walk about until two or three days before death, she became emaciated to an extreme degree, and betrayed great restlessness, with a quiet delirium, and a purposeless, ever-changing activity ; at the same time, she feebly resisted with what strength she retained, all efforts made to administer food, and would certainly have died of starvation six weeks sooner than she did, had not the stomach pump been employed.

Some from utter stupidity and helplessness are unable to feed themselves, or even swallow what is placed in the mouth ; such are those labouring under melancholia with stupor, and some of the cases of acute dementia ; while others offer a strong and determined resistance to alimention. Occasionally an acutely maniacal patient requires to be fed with the stomach pump, in order to ward off the great prostration and exhaustion which are sure to supervene after the violence of the mania has

subsided, and which are best met by a liberal supply of food administered during the attack. From whatever cause food is refused, and life thereby endangered from inanition, the stomach pump must be used, but not before all ordinary means for inducing the patient to partake voluntarily have been tried in vain. Its employment is not to be long delayed where necessary; but, on the other hand, it should not be resorted to too hastily, and be made to dispense with the patience and tact which are to be exercised in these cases on the part of officers and attendants. If a patient refuses food for some unimportant reason, or from pure obstinacy, and if it is considered that one application of it will succeed in correcting this perversity for the future, then it should be employed; but sending food directly into the stomach without its undergoing the natural process of mastication, or at least passing through the cavity of the mouth, where it is mixed with saliva, and prepared for its further digestion in the stomach, is a proceeding which the extremity of the case alone renders necessary, and justifies. No doubt, food in the stomach for some time after it has entered it stimulates a flow of saliva, which is swallowed, and so made available for the purpose of digestion; but this only to some extent makes up for the ordinary and thorough mastication of solid food, and its due admixture with the secretions of the salivary glands in the mouth.

Dr. Skae has suggested an ingenious method of inducing patients to take food of their own accord, viz. administering chloroform to the extent of producing excitement, and when they have under its influence so far forgotten themselves, sometimes they may be persuaded to do what at other times they object to. It is, however, only in the case of private patients, treated at their own homes, among their near relations, that this plan is recommended, and that more out of consideration for the feelings of the friends, who, if possible, are to be spared the spectacle of what would be to them a distressing operation; but such is the advantage of having a meal taken in the ordinary way, that in likely cases this method is worthy of a trial.

One of the most characteristic symptoms of want of food is the disagreeable fœtor which the breath acquires. It is something so peculiarly *sui generis*, and so distinct from the fœtid breath which marks ordinary dyspeptic derangements, that it

can be easily recognised by all who have perceived it for a limited number of times. It arises, doubtless, from the altered state of the secretions of the mouth and stomach. The mouth becomes clammy, the teeth become foul, and, in the worst cases, are covered with sordes; the tongue is coated with a thick white fur of old epithelium; little saliva enters the mouth, and what does so is allowed to escape by the lips. The offensiveness of the breath soon disappears in most cases, if a regular and sufficient supply of nourishment is administered, without the aid of medicine at all—a circumstance which shows that it mainly arises from the want of food and the consequent state of the mouth and the body generally, in which the wasting process far outstrips and exceeds the renewing; but so marked and constant is it, that in the case of newly admitted patients, about whom no very definite information can be obtained, it may be taken as a good guide as to whether the patient requires to be artificially fed or not.

When moral influences—persuasions, entreaties, commands, bribes, threats, &c.—have failed in inducing a refractory patient to take food, the spoon or the feeding-jug are to be tried; and the way in which the latter is most effectually employed—by laying the patient on his back, and compelling him to swallow one mouthful after another by compressing the nose, and so preventing respiration until deglutition has taken place, is so well known, and has been so fully described by Dr. Williams in the '*Journal of Mental Science*,' that it is unnecessary here to describe it. Neither need the method of feeding which Dr. H. Tuke practises, by means of a catheter passed through the mouth, if it is easily opened, but if not, through the nose, and entering the stomach—a plan which is not altogether free from danger—be detailed at length. Feeding through the nose has very rarely been found necessary in the West Riding Asylum, and almost every case is easily managed with the stomach pump, as it is employed there.

There are different ways of using the stomach pump; and, first, as to the position in which the patient is placed. Dr. Blandford, in his recently published '*Lectures on Insanity and its Treatment*,' has described minutely the method by which violent patients were fed by Dr. Stevens, of St. Luke's Hospital. He, as is generally done, had the patient seated in an arm-chair,

and restrained in that position by means of sheets, which rendered him incapable of any sudden movement, by being passed round the body and legs, and then drawn through the arms and legs of the chair. The chief advantage of the upright position is, that there is little risk of choking, should there be any regurgitation of the food, while the stomach pump is being used, as what fluid is returned readily passes out of the mouth, and the patient can again respire freely. In cases where there is not much resistance offered, this position is, perhaps, preferable to any other; but if the patient is very strong, and resists vigorously, it is almost impossible to hold him quiet in a chair by any means, which, however, can be easily done if he is placed in the supine position upon a bed, and held by a sufficient number of assistants, and that without any risk of bruising or inflicting any injury. The recumbent position is the one in which patients are always fed at the West Riding Asylum; and, notwithstanding the frequency with which the stomach pump has to be used, among nearly 1500 inmates, there has been no accident from choking, nor any untoward result whatsoever; and, indeed, this position seems to be as safe as the upright, provided the oesophageal tube is withdrawn, if the food is returned by the side of the tube to any extent. Moreover, whether the patient is in the upright or recumbent position, it is generally found to be useless to go on sending food into the stomach after it has commenced to reject it; so that, in either case, the tube should be withdrawn when this occurs, to prevent the whole being returned by vomiting. The great advantage of having the patient completely overpowered, and held perfectly quiet, is obvious, seeing that there is then no struggling or resistance; and the abdominal muscles being thus set at rest, there is much less chance of vomiting; whereas, if there is much struggling, the breath is held in, the diaphragm and the abdominal muscles are in a state of tension, and what is forced into the stomach by the pump is as speedily rejected.

The patient being in position, and held by attendants, the mouth has to be opened by one or other of the various forms of gags. Numerous clumsy and formidable looking instruments have been invented for opening the mouth, some of them worthy contemporaries of the iron shackles and other means of restraint belonging to a former period in the treatment of insanity, and

specimens of which are to be found in the lumber-rooms of almost every asylum. The gag most frequently employed is the one with which the ordinary stomach-pump case is furnished, and consists of a straight piece of wood with a hole in the centre of it, through which the tube is passed. Though this gag is almost in general use, there are several objections to it; and, first, it is often very difficult, almost impossible, to insert it in the mouth, and frequently this can only be done by using great violence, which is always to be avoided. Another objection to it is, that the tube has to be passed, so to speak, in the dark. It is pushed through the hole in the gag into the back part of the mouth, and as very little inclination can be given to it, it must be steadily thrust on, until it finds its way into the œsophagus, after being bent against the posterior wall of the pharynx, a proceeding which is apt to excite retching and contraction of the pharynx, and so render the passage of the tube still more difficult. In the West Riding Asylum the mouth is always opened by one of the screw keys, of which there are many varieties, and the wooden gag is dispensed with. These instruments should be light but strong, and the screw should be tolerably quick in its action, not for the purpose of forcing open rapidly jaws that are firmly clenched, but for the purpose of quickly taking advantage of any voluntary separation on the part of the patient. An instrument of this kind is easily applied, as it can be inserted wherever there is an open space between the teeth, and the mouth is then readily opened by turning the screw, no matter with what determination it is shut. When the mouth has been opened, the key should be committed to an assistant, whose only duty should be to hold it in its place; and this there is no difficulty in doing, as the head is held perfectly steady. In this way the greatest freedom is afforded in passing the œsophageal tube, and the finger may be inserted to give the tube the necessary inclination, and guide it over the root of the tongue into the œsophagus, should there be any difficulty in passing it.

The calibre of the œsophageal tube depends upon the size of the pump that is used. Too large a one is of no advantage whatever, and is decidedly objectionable on account of its inflexibility and the difficulty with which it adapts itself to the curved passage which it has to traverse, though it may be considered the safest because it cannot enter the larynx, or produce

laceration of the parts so easily. A medium-sized tube, open at the end, and without a wooden point, besides being introduced more readily, gives a freer passage for the fluid than one of large calibre, with two small openings a little distance from the extremity. In passing the tube there is sometimes a little pressure required to make it enter the œsophagus, on account of its having to follow a slightly obtuse curve, and coming in contact with the bodies of the vertebræ, which become prominent if the head is held far back. This pressure may be reduced to a minimum by directing the tube a little to the left side, as the œsophagus inclines to the left, in the upper third of its course, and by moving the head forwards when once the tube has reached the entrance of the œsophagus. In using the double-actioned stomach pump, it is profitable to have the tube attached to the orbital extremity, so that the pump may be held horizontally; in this way all air from it can be excluded by drawing the piston two or three times and depressing the end next the operator, before directing the current into the stomach. Instead of the pump, an india-rubber bottle with a nozzle fitting the tube is employed by some. In the West Riding Asylum the funnel, as well as the pump, is in frequent use. It is of a size large enough to hold a pint and a half, and the whole quantity which is to be administered may be poured into it at once. The funnel is attached to the tube by about eighteen inches of gutta-percha tubing. The fluid, by the force of gravity, flows slowly but steadily down, and by elevating the funnel above the body it is made to exercise a greater distending force on the stomach, as this force is equal to the weight of a column of fluid, of the area of the stomach, by the height of the fluid in the tube.

The frequency with which a patient requires to be fed depends upon the degree of exhaustion which is present, and the quantity which it is desirable to administer at a time. When the exhaustion is great, and the patient rapidly emaciating, or, when the stomach is irritable and can only retain small quantities, it is necessary to feed three or four times a day; but in most cases twice is sufficient, as there are few patients who cannot be prevailed upon to take something in the intervals.

The most convenient articles for administration with the stomach pump are a pint of new milk with a flipped egg, and a glass of sherry in it; or an equal quantity of beef tea, thick-

ened with arrow-root; but the diet as well as the medicine which it is proper to give must vary with the nature of the case, and at the discretion of the medical officer. The many cases of complete recovery of patients who have required feeding with the stomach pump for a long period are, perhaps, those upon which the asylum physician looks back with the greatest feeling of satisfaction, as being due to his care and attention. Other patients might have got well had they been properly tended to and nursed at their own homes; but these would certainly have perished had he not assiduously sustained the powers of life during the mental aberration.

Cases of recovery are not uncommon of patients who have been fed with the stomach pump daily, for a period of three months; and such a case, in which the disease was acute dementia, has only lately been discharged from the West Riding Asylum. Other instances, in which the disease has resulted in a less fortunate termination, have shown that the œsophagus need present no lesion, nor any abnormal appearance, after the protracted use of the œsophageal tube.

ARACHNOID CYSTS.

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CYSTS of the arachnoid cavity are rare, and when found in the insane are generally associated with some debilitated condition of the blood or nervous system. When once seen, the most inexperienced pathologist has no difficulty in recognising them, for their appearance is as striking and remarkable as it is uncommon. On removing the skull-cap and dura mater, instead of the convolutions of the brain, with its vascular pia mater meeting the eye, there appears a reddish, pulpy, fluctuating swelling on the surface of the brain, having such a uniform appearance that the outline of the convolutions beneath it is invisible. On attempting to strip off the cyst from the surface of the brain, it is usually found adhering to the visceral arachnoid along the centre of the longitudinal fissure; it is easily separated from the convolutions on either side; but if large enough to embrace the entire hemisphere, is found again to be adherent below, but in this situation usually to the parietal layer of the arachnoid membrane.

In an able paper on the subject of these cyst formations by Dr. Wilks,¹ it is stated that "they exist only on one side of the head." The following cases are remarkable, in that in no less than five instances out of the ten, cysts were found on the surface of both hemispheres. Of the remaining five, three existed on the left and two on the right side of the cerebrum.

¹ 'Journal of Mental Science,' April, 1865.

They are usually situated on the upper aspect of the centre of the convolutions, if not of large size, but may be so extensive as to wrap round and completely invest the hemispheres. They are occasionally, but very rarely, found at the base of the skull.

The dura mater covering them is frequently found stained of a reddish brown, green or blue colour. The cysts may take the form of a small sheath, not unlike the finger of a glove, in size and shape, or may consist of two large flat walls of organized lymph, which may be thick or thin, and divisible or not into laminæ. The cysts may be so soft that they cannot be removed without tearing, or of such strength and toughness that they will bear rough handling, or can be filled with water and suspended by cord without their walls giving way. They are generally thick in the middle, but become more attenuated towards the edges where the two walls adhere to one another, forming an acute angle, and here they are notched and bevelled so as to somewhat resemble the inferior border of the parietal bone. Minute vessels are frequently found in their substance, and this too when they lie apparently isolated from contact with the membranes around, and when no source of hæmorrhage can be detected in their neighbourhood. They may weigh from a drachm up to two or three ounces. Externally they are of a reddish yellow or dirty stone colour mottled with yellow, and within they may be green, red, yellow or mottled. When separable into layers, each layer from without inwards becomes more and more soft and gelatinous, and they may be lined or filled with a "putty-like" material, or may contain blood, in various stages of alteration, in red or liquid decolourised clots, semi-coagulated or liquid, or may contain greenish-brown bilious fluid, or transparent, limpid, alkaliescent serum.

When in course of formation, the cysts may appear as thin layers of blood, so soft as to be easily rubbed off by the finger, or as a thick, dark, widely spread clot, or as a tough leathery organized membrane.

If the history of the patients in whom these cysts are found is inquired into, it will be found that both among the sane and the insane they are frequently the sequelæ of blows and injuries to the head. Amongst the cases which follow will be found four instances in which injury to the head was in all probability

the exciting cause of this morbid condition, and in three out of the four cases it is worthy of remark that no hereditary history of insanity could be traced.

Cases have been cited in which it was supposed they were due to some condition which caused determination of blood to the head, as in opium poisoning, alcoholism, and the delirium of phthisis; and it will be seen that tubercle, intemperance, debauchery, pecuniary losses and domestic troubles, are all found playing a part in the history of the patients under consideration.

That some impoverished condition of the blood predisposes to their formation is very probable. In one case repeated crops of boils harassed the patient, in another amenorrhœa with anæmia-chlorosis was present; in two cases, erysipelas, in three purpura; in four, œdema of the legs, from some cause or other, and in no less than six cases tubercular deposits were found in the lungs. That tubercle should exist in these instances is remarkable, as being contrary to the experience of no less an authority than Rokitansky, who in his great work on pathology says, "Cysts and lipomatous tumours are rarely found in the arachnoid;" and, "Cyst formation, as a new growth, is rarely found concurrent with tubercle, either in the same organ or in the same organism generally."

In the first four of the ten cases which are described some tubercular deposit was found in the lungs, and although this does not explain much of their pathology, beyond the general fact that tubercle implies impoverished blood, and that such a condition predisposes to extravasation, still that tubercle should exist with them is a coincidence worthy of notice.

In addition to the brain wasting common to the mental disorder, there is great flattening and atrophy of the convolutions beneath the cysts, and in cases where one cyst only exists, the entire brain seems to be pushed across towards the other side of the skull, which is found to be unsymmetrical, the bulging being apparently caused by the harder and more solid brain, and not by the more yielding and compressible fluid, although this exerts pressure on the brain in the first instance. In one case the entire brain was found to be distorted, the corpora striata, optic thalami, and fornix being displaced by the pressure of fluid towards the opposite side, thus reducing the size of the ventricle; and in another, where the cyst was on the right side,

the half of the brain corresponding to it weighed three ounces less than its fellow of the opposite side.

The mental disorders with which these cysts are most frequently found are, first, organic dementia, in which five properly formed cysts were discovered; secondly, general paralysis, in which there were three cases of completely formed cysts, and in the remaining two cases we find idiocy and imbecility represented.

Amongst the 10 cases of fully formed cysts, 6 were males, 4 females; the age of the youngest patient was twenty-one, that of the oldest seventy-one; the longest duration of the mental disorder was fifty-seven years, and the shortest ten days only. These 10 cases were the result of 616 carefully performed post-mortem examinations, and are abridged from the West Riding Asylum records.

CASE 1. *Imbecility with tubercle*.—H. K—, a widow, æt. 57, an imbecile, was admitted to the West Riding Asylum on the 25th of July, 1870. Two of her brothers have been insane. She has always been regarded as a weak-minded, silly woman from her childhood. She has given birth to several children, who are all more or less deficient in intellectual powers; and she is said to have had a child by her own son. For some time past she has been afflicted with chorea, but only during the last two years has been looked upon as being absolutely insane. During that period she has been confined in the Doncaster Union Workhouse, where she has latterly become so noisy and excited that her removal to the asylum became necessary. When asked a question she stares vacantly about her, and then gesticulates in a wild unmeaning way; if she makes any reply, it is generally quite incoherent. The choreic symptoms continued for about six months, and she eventually died of diarrhoea on the 19th December, 1870.

Post-mortem examination sixty-six hours after death.—Skull universally thickened and engorged with blood. Immediately beneath the dura mater, over both hemispheres, there is a well-marked arachnoid cyst, of a reddish-yellow colour, and of tough consistence, presenting numerous minute vessels ramifying on its surface. This membrane is thickest over the frontal and parietal lobes, becomes attenuated over the occipital and temporo-sphenoidal, dips under the falx, and extends round the base of the brain surrounding the optic nerves, and terminating at the anterior margin of the cerebellum and pons. When reflected, the arachnoid, apparently in a normal condition is found below it, but this membrane is much thickened, and has a milky-white appearance over the cerebellum.

The whole brain and cyst weighs forty-two ounces. Seven ounces of fluid escaped during the removal of the brain. There is a nodule of tubercle at the apex of the left lung.

CASE 2. *Idiocy with tubercle*.—J. B—, admitted 6th April, 1864, æt. 21. Deaf, dumb, and an idiot from birth. He has been confined for eighteen years in the Barwick Workhouse, where he was considered a quiet, harmless patient, although reported to be addicted to vicious propensities and criminal assaults on

young children. He remained in the asylum for about six years in tolerably good health, being usually employed on the farm. Being unable to speak he was accustomed to express his wants by gestures, which it required some practice to understand. In 1866 he began to lose flesh, and he was harassed with crops of boils, which kept breaking out in succession. In 1870 he caught cold, and had a severe attack of broncho-pneumonia, from which he never recovered, and died on the 14th November.

Post-mortem examination thirty-three hours after death.—The skull is of average thickness, not symmetrical, bulging posteriorly to the right, very thin at the parietal eminences. Only the faintest trace of the sutures can be found.

No thickening of the membranes, except in the vicinity of the Sylvian fissure on the left side, where the arachnoid has a white and fibrinous appearance, and forms something like the membranous sheath of a cyst, now empty, measuring about two inches in transverse and antero-posterior diameter, and having the Sylvian fissure about a third of its length from its anterior margin. Beneath this cyst the convolutions are decidedly wasted. The whole brain weighs thirty-six and a half ounces. It has a somewhat unsymmetrical or twisted appearance, is very uniform in breadth from before backwards, having very little of the ordinary parietal bulging. On the left side there is a deep hollow or depression corresponding with the external parietal-occipital fissure. On the right side there is no such depression. The olfactory lobes are so wasted as to be scarcely discernible, and the optic nerves are also small. On both sides the pleuræ are thicker than usual. Both lungs show traces of bronchitis, emphysema, and pneumonia, and the right lung contains a little tubercular matter at its apex, and has one small cavity the size of a filbert, containing pus.

Kidneys.—Capsules adherent. Both have a granular appearance, and are lobulated.

CASE 3. *Organic dementia, with tubercle and atheroma.*—W. S.—, joiner, æt. 58. Admitted on the 4th of February, 1869. Mental disorder—dementia, with disorganization of the brain. In this case the patient had suffered for some time from partial fatuity and a cancer of the lower lip, which had been removed by operation. The excision was followed by a series of epileptic fits, sixteen months before admission, after which he became excited and unmanageable. Latterly he had been wandering about the country in a purposeless way, and had been subject to various delusions, saying that he had swallowed his tongue, that his teeth were too large for his head, and that he was possessed of enormous wealth. The cancerous tumour was again making its appearance on the lower lip on his admission, but it was not interfered with. At that time he was apparently in feeble health, the sounds of the heart being distant and indistinct, the arteries hard and unyielding, and probably atheromatous, and signs of bronchitis and emphysema being present in the chest. The left pupil was somewhat larger than the right, the tongue and lips were tremulous, the voice hoarse and indistinct, the gait uncertain and feeble, and his conversation very incoherent, with at the same time exalted ideas of his own wealth and powers.

He made no improvement during his stay in the asylum, which lasted for three months; but he was discharged at the end of that period at the urgent request of his friends.

On the 18th of June, 1869, he was readmitted, having been at home only eleven days, but having made himself so obnoxious to his relatives that they were very glad to get rid of him. His stay at home did not seem to have benefited him, as he was more feeble and emaciated, and more noisy and excited than when he left the asylum. The cancer seemed also to have increased in size, and it soon spread and occupied the whole of the lower lip. Ulceration set in, and the part became very loathsome from its tendency to hæmorrhage, and from its covering any vessel from which he took his food with blood and pus. After a consultation, it was removed. The wound healed successfully, and he remained apparently in better health for some months. About a year after the operation he became feeble, and unable to move about without assistance; and an attack of enteritis carried him off, after four days' illness, on the 11th of January, 1871.

Post-mortem examination twenty-five hours after death.—The bones of the skull were thinner than usual, and of a dirty yellow colour, but were fairly symmetrical. The dura mater was slightly adherent to the skull, and also to an arachnoid cyst below, which covered both hemispheres, and extended, in an attenuated condition, round the base, passing beneath the falx. It consisted of two thick layers of tough, fibrinous consistence, and dirty reddish-yellow colour, everywhere distinct and separable from each other, and having, in some places, semifluid and gelatinous contents. The walls of the cyst were thickest on the right side and in front, over the frontal convolution, thinning off posteriorly, and disappearing over the occipital lobe. The cyst gave a uniform appearance to the surface of the brain, and was so thick that the outlines of the convolutions could not be seen through it. Beneath it the visceral layer of the arachnoid was everywhere visible, being thickened, whitish, and opaque over the frontal and occipital lobes. The pia mater stripped freely. The whole brain weighed forty-nine ounces; four ounces of fluid escaped during removal. There was wasting of the convolutions and enlargement of the sulci in the parietal lobe. The grey matter was dark in colour, but thin; the white substance firm, but having a pinkish, blotchy appearance. The ventricles much dilated, and full of clear fluid; the corpora quadrigemina and optic thalami were atrophied, and the velum interpositum was thicker than usual. Cerebellum, pons, and medulla, six ounces. The heart weighed fourteen ounces. There was an enormous dilatation of the aorta, which, as well as the cardiac valves, was speckled with atheromatous deposit. The mitral valve was considerably thickened. Both lungs were emphysematous, and studded with nodules of tubercle. The right kidney had a small cyst, with fluid contents on its upper aspect. The mucous membrane of the intestines was thickened, congested, and ulcerated.

CASE 4.—*Organic dementia with tubercle and atheroma.*—M. A. W., married, æt. 63, admitted 28th December, 1868; a shrivelled, wrinkled old woman, of dejected appearance, who had for some time past been refusing her food under some religious delusion, and who stated that her soul was lost because she had left off attending a place of worship. No hereditary history of insanity could be traced to account for the attack; but it is said she ruptured a blood-vessel in her head some four or five years ago, and that there has been an alteration in her character ever since that time. She appeared very feeble, and when spoken to only replied in whispers. She was very emotional. The pulse was 120. There was a

systolic bruit at the base, and the chest was very resonant on percussion, with harsh and prolonged expiration. At first she was quiet, melancholy, and dejected, occasionally refusing her food; but latterly she became very noisy and quarrelsome, beating any of the patients in the ward who offended her, and getting out of bed at night to do so, if they in any way disturbed her rest. After having been six months in the asylum, she became gradually demented and feeble, and died on the 15th of June, 1870.

Post-mortem examination fifty-two hours after death.—*Head.*—Skull fairly symmetrical, bones very thick. On removing the dura mater there was found an arachnoid cyst on either side, investing the whole surface of the hemisphere. Brain weighed forty-two ounces. Convolutions wasted, and sulci gaping. Heart thirteen ounces. Mitral valves atheromatous. Left lung emphysematous. Right lung.—Pleura uniformly adherent, vomices of large size at the apex, and congestion of the lower lobes, which contained numerous points of tubercle. The left kidney was filled with cysts containing uric acid crystals.

CASE 5. *Organic dementia with atheroma.*—E. W—, æt. 39, married; admitted 5th March, 1869. Her father was insane. Some years ago her head was injured, but no mental symptoms followed the injury at the time. About two months ago her husband noticed that she was gradually losing her memory, and that she was failing in bodily health. She has suffered for some time from amenorrhœa, with anæmia chlorosis, and her speech has latterly become very thick and indistinct. She imagines that she is a great singer, and that she has seven children, whereas she has had only one child eleven years ago, who died young. The chest is resonant on percussion, and there is absence of præcordial dulness, the first sound of the heart being distant and indistinct. She laughs and holds out her hand to strangers as if they were old acquaintances, and seems much pleased at being noticed. She is very deaf, and does not always hear when spoken to; but if she understands the question, answers tolerably to the point, although she betrays a partial loss of memory.

She gradually improved under treatment, and was able to employ herself in the laundry until the 5th of April, when she suddenly became weak, pale and faint, and was obliged to be sent back to the wards. She was found to be almost pulseless; there was universal and prolonged tremor of all the muscles; the eyeballs appeared unduly prominent; there was ptosis of the right eyelid, and fibrillar trembling of the tongue. In about a month's time she recovered from this attack, but became very hysterical, frequently crying and asking for the jewelry and earrings of the other patients and nurses, and declaring they belonged to her, and that it was a great shame she should be deprived of them. Early in June, a month after the above symptoms were noticed, the muscular tremors again set in, and there appeared to be a kind of universal subsultus tendinum present, which rendered it almost impossible to count her pulse. She became very feverish and demented, and suffered from copious sweats, which greatly exhausted her. She gradually sank, and died on the 2nd of April, 1870.

Post-mortem examination fifty-six hours after death.—*Head.*—Skull-cap unsymmetrical; more capacious on the left side than on the right. Dura mater free. On removal of this membrane both hemispheres are found to be covered with layers of organized lymph. These layers on the left side form a perfect cyst, and

when tapped two ounces of grumous fluid escaped, but a large quantity of putty-like material remains behind. The walls of this cyst are so strong that they do not give way when the cyst is suspended with fine cord, and filled with water. Vessels can be distinguished in the substance of the walls of the cyst. The cyst on the right side is similar to the one on the left, but the walls are not quite so firm nor so highly organized. Each cyst measures eight inches in length and four inches in breadth.

The arachnoid is much thickened generally, and on the right side is of a brown colour.

The pia mater is thickened, and cannot be stripped without tearing the brain substance. The grey matter is somewhat wasted. The white matter is mottled and putty-like, and there is bristling of the fine vessels on section.

The vessels at the base of the brain are slightly atheromatous. The lining membrane of all the ventricles is very rough.

Weight of the whole brain, thirty-seven ounces; weight of pons, medulla, and cerebellum, six ounces; heart, six ounces. Valves atheromatous. Right lung universally adherent. Left lung emphysematous at the anterior margins.

CASE 6. Organic dementia.—L. J—, æt. 46, married, admitted 26th October, 1869. No family history of insanity. Some time ago she had an apoplectic fit, followed by loss of speech for about a week, and about a fortnight ago she had a second similar attack, followed by hemiplegia on the left side. She has suffered at different times from acute rheumatism, erysipelas, and dropsy.

On admission, she was in a state of extreme agitation, walking about, wringing her hands and crying, and complaining that she had been robbed of all her good clothes, and dressed as a pauper. She talked very volubly about former events of her life, saying that she was once such a fine, fat woman, and had such a colour in her cheeks, &c. &c. It was almost impossible to get her to answer a question, and there was great loss of memory. She was unable to tell what the year was, or where she had resided, or her age, but she could remember her own name. She was rather deaf, and so restless that it was impossible to make any physical examination of her condition. She continued to be noisy and troublesome until the beginning of the year 1870, when she seemed to have much less power on the left side than on admission.

On the 15th of March she took some hydrate of chloral, which was followed by the appearance of a purpuric eruption, which commenced on the left elbow, and gradually spread over the whole body. It was remarked that the part of the left leg which was covered with the papulæ became sensible to impressions, although there was complete anæsthesia of the part before the eruption appeared. There was a tendency to drowsiness, and a distinct odour of chloroform in the breath. Signs of bronchitis next appeared; there was difficulty of swallowing, and an accumulation of mucus in the throat; and she gradually sank, and died on the 22nd of March, 1870.

Post-mortem examination thirty-one hours after death.—Dark-coloured, petechial eruption on the chest, back, abdomen, and extremities.

Head.—Skull-cap thick and unsymmetrical, bulging posteriorly on the left. The dura mater on the right side presents a greenish appearance, and is found on section to form the outer covering of a huge sub-arachnoid cyst, co-extensive with

the right hemisphere, which presents a perfectly flat surface. The inner lining of the cyst is of a reddish green colour, and several ounces of a bilio-sanguineous fluid escape on section. Weight of entire brain, forty ounces. When divided, the right half of the brain weighs eighteen and a half ounces, while the left half weighs twenty-one and a half ounces, or three ounces heavier. All the convolutions are much wasted and flattened. The grey substance is very pale, the anterior portions of the middle lobes being softened and broken down. There is also a rusty brown clot with destruction of the surrounding tissue in the right corpus striatum. The brain substance is watery; seven ounces of fluid escaped on removal and section of the organ. Weight of pons, medulla, and cerebellum, four and a half ounces.

The heart weighs seventeen ounces. All the valves are incompetent, the aortic being thickened, puckered, and cartilaginous, and the mitral valves being so contracted as to scarcely admit two fingers.

Both lungs adherent in front; on section, frothy, sanguineous fluid exudes.

CASE 7.—Organic dementia with atheroma.—T. W—, æt. 71, admitted December, 1870, having been insane for twelve months, and on admission presenting all the appearances of far advanced disorganization of the brain. His expression was vacant and demented, and he was so feeble that he could not walk about the ward without assistance.

In January, 1871, he appeared weaker than on admission, and on the 4th of February he sank into a comatose condition, from which it was impossible to rouse him, and he died on the 7th of February, 1871.

Post-mortem examination sixty-one hours after death.—**Head.**—Skull-cap thickened and unsymmetrical, bulging on the right side. Dura mater free, but of dark colour on the left side, where fluctuation was apparent. This was due to the presence of a large arachnoid cyst, which contained about eight ounces of fluid of a dark greenish-brown colour. It extended from the falx over the hemisphere to the base of the brain, and the greater part of it was over the front and upper part of the hemisphere. The walls of the cyst seemed to consist of lowly organized lymph, of a reddish colour, and the inner surface was covered by semi-fluid material resembling half-coagulated blood.

The hemisphere was much wasted. On both sides of the brain the grey matter was much wasted, and of a pale colour. The white matter was very dusky. The ganglia were all awry, and on the left side they seemed to be pushed through beyond the median line. Weight of the entire brain, forty-five ounces. Weight of the pons, medulla, and cerebellum, six ounces.

Heart weighed fourteen ounces. The valves were competent, but atheromatous. Cavities dilated. Left lung: upper lobe very emphysematous. Right lung adherent generally; lower lobe soft and congested.

CASE 8.—General paralysis with atheroma.—T. L—, æt. 42, admitted 26th July, 1870, having been insane for eight months.

He has led a very wild kind of life, having been much addicted to drinking, and he has also had syphilis. During the last twelve months his health has been failing. He has been absent and preoccupied, and quite unable to give his attention

to his work. He has lately become depressed and troubled in his mind, owing to having lost a few hundred pounds in speculation and horse-racing. He has also refused his food, and been very restless at night.

On the 18th of October a purpuric discoloration appeared on the lower lip, but without any swelling, and on the 26th another large patch of purpura was discovered on the chest, and it was noticed that the slightest pressure on any spot produced this discoloration of the skin.

During the next two months he became more feeble and demented; he was constantly falling about, and his head and shoulders became much bruised. He had a severe attack of diarrhoea, from which he never rallied, and became more and more incoherent and unconscious, and died on the 10th of February, 1871.

Post-mortem emamination thirty hours after death.—*Head.*—Skull-cap of normal thickness, and fairly symmetrical. Bones of a bluish hue. There is a brownish, rusty staining of the inner surface of the dura mater.

Weight of the entire brain (with cysts) forty-six ounces. On removal, four and a half ounces of fluid escaped.

On each side and over each hemisphere there is found a distinct arachnoid cyst, commencing at the margin of the median fissure, and covering the whole of the upper and outer aspect of each hemisphere. They extend over the frontal and supra-orbital convolutions of the base of the brain, and become attenuated and terminate at the upper aspect of the occipital lobe behind.

The cysts are distinct, that on the left side being longer and thicker than its fellow. They have a dirty-white colour, mottled with yellow and black; are of a tough, fibrous consistence, and are formed of two distinct separable layers with fluid contents, and a lining of semi-coagulated and altered blood.

The cysts, after their contents are evacuated, weigh two and a half ounces. There is general thickening of the arachnoid with opacity, chiefly over the parietal lobes, and most marked on the right side.

Pia mater adherent and thickened. The surface of the convolutions is generally flat, and there is marked wasting of the parietal lobes.

Grey matter dark. Medullary matter blotchy, and of a dusky hue, with distinct bristling of the vessels, with tearing from their coats. Ventricles of a large size. Fornix soft and watery. Corpora quadrigemina apparently wasted. Large vessels at the base very atheromatous.

Weight of pons, medulla, and cerebellum, seven ounces.

Right lung adherent at the base, and emphysematous at its upper lobe and margins. Left lung universally adherent. The lower lobe hepatized.

CASE 9.—*General paralysis, with atheroma.*—C. R—, æt. 39, admitted 15th February, 1868. A case of far advanced general paralysis. He has been getting more feeble and dirty in his habits for some time past. On admission, he is restless in manner, and makes vain attempts to catch hold of imaginary objects in the air. There is dulness over the right lung on percussion, and patches of purpura cover the abdomen and thighs. The disease continued to make progress until December, 1869, when he became more feeble, and tumbled about, bruising himself severely on several occasions. It was also noticed that the legs were cedematous, and pitted on pressure. He gradually became more feeble, and died on the 10th of March, 1870.

Post-mortem examination thirty hours after death.—*Head: skull-cap.*—There is slight thickening of the bones. It is unsymmetrical, and bulges to the left posteriorly.

The dura mater is of a blue colour.

On removing this membrane, an arachnoid cyst is found extending over the whole of the right hemisphere, but not passing the falx or the tentorium cerebelli.

The arachnoid on the left side is thickened and opaque.

The whole of the brain tissue between the posterior bone of the lateral ventricle and the surface is in a semi-fluid condition. The anterior and middle lobes on this side are generally wasted.

The convolutions are wide and gaping. The optic thalamus is wasted, and in part absorbed upon the left side. The other ganglia are flattened, and pale in colour. The lining membrane of the ventricles is thick and rough.

Pons, medulla, and cerebellum, six ounces.

Heart.—Mitral valve thickened. Some slight atheroma of the aorta. Left lung emphysematous. Right lung slightly adherent, emphysematous, and hepatised in the middle and lower lobes.

Liver very pale and much enlarged, weighing seventy-two ounces. The substance is very hard.

CASE 10. General paralysis.—**R—G—**, basket maker, æt. 44. Admitted on the 7th of June, 1869. A general paralytic, who had suffered from epileptiform fits since he was ten years old. There is no hereditary history of insanity, but some years ago he fell from a high wall, alighting on his head, and since that time his intellect has appeared deficient. He has delusions of wealth, stating that he is going to realize a large fortune by speculation in water filters and coals. Four months ago he lost a cheque for a small amount, which seems to have weighed upon his mind, and since that time his character has undergone a change. He has threatened to cut his throat, and to jump out of the window. He has been sleepless at nights. For some time past he has kept a beerhouse, and has been addicted to habits of intemperance. There was great nervousness of manner, and his speech was thick and tremulous; the tongue was protruded to the right, and the right pupil was larger than the left. There were signs of bronchitis, and emphysema in the chest, but he gradually improved and was discharged on the 9th of May, 1870. He was readmitted on the 27th of January, 1871, having been at home eight months, where he endeavoured to work at his trade, being a basket maker. He soon was obliged to abandon his occupation, as he gradually became more and more feeble and demented, and at last so restless and unmanageable that he could no longer be kept at home. There was every sign of the mental disorder having made rapid strides; and, in addition, he was found to be suffering from pneumonia of the left lung. The heart's action became rapid (112); he had difficulty in breathing, and became feverish. There was occasional twitching of the muscles of the face, especially of the zygomatici on the right side. His gait was unsteady, and he could scarcely move without assistance. He had great difficulty in swallowing his food, the presence of which caused intense reflex action, until it was coughed back. The respirations and pulse increased in frequency, and he sank and died on the 17th of February, 1871.

Post-mortem examination forty-six hours after death.—Head.—Skull-cap fairly symmetrical. Bones soft, but of normal thickness. Dura mater free. On its removal arachnoid cysts were found covering both hemispheres. The one on the right side being exceedingly thin; the other on the left side being very opaque, especially over the anterior lobes.

The *brain* weighed 48 ozs. About three ounces of fluid escaped on its removal. The arachnoid was opaque, especially over the anterior portion of the brain. The pia mater stripped readily and was much congested. Convolutions *shrunk* and sulci gaping; the grey matter pale and wasted. The medullary matter exhibited numerous puncta vasculosa on section. The brain generally was water-logged. The ventricles are somewhat enlarged and contain fluid. Pons, medulla, and cerebellum, six ounces. Right lung: the middle lobe was adherent to the parietes posteriorly. Left lung free from adhesions. Both emphysematous and hepatized.

In reviewing the post-mortem appearances presented by the above cases, can we indicate any one point which may throw some light on the pathology or formation of these cysts?

In those cases where there is a distinct history of some injury of the head, it may be taken for granted that rupture of some minute vessel of the pia-mater undoubtedly took place; but in six of the cases where there is no history of external violence, atheroma of the vessels at the base of the brain or of the aorta was found, and it is not impossible that if such a degeneration is present in these larger vessels, it may also exist in the more minute capillaries, whose condition may be overlooked in a post-mortem examination, and an extravasation of blood take place, although no trace of rupture may be perceptible to the naked eye.

This course of events is not unlike what takes place when blood is extravasated in simple apoplexy, but the two cases differ in this point, that in apoplexy the rupture is of a comparatively large vessel, and a quantity of blood is poured out at once, pressing upon some part of the brain directly or indirectly which governs the organs of locomotion; and this part not being able to accommodate itself immediately to the intruding body, coma and paralysis result.

In one of the above cases a clot of large size, which had evidently been formed some time, was found in the corpus striatum, and in this case the rupture of the vessel in the head was immediately followed by apoplectic symptoms and hemiplegia.

But when blood is effused into the cavity of the arachnoid so as to form a cyst, the hæmorrhage is usually slow and gradual.

The space into which it flows is also capacious, and being accustomed to the presence of its own fluid secretion no acute symptoms follow immediately, although they may exist later on as the clot increases in size. All that can be detected at first is a gradual loss of the intellectual powers, which is in itself so common to the mental disorders which co-exist with these cysts that we cannot safely say this is due to such formations alone. Pain in the head referred to the side on which after death the cyst was discovered, has been more than once noticed; but there is no one symptom present during life which, taken by itself, is diagnostic of a cyst of the arachnoid cavity. By a combination of symptoms we might possibly make a guess that such a formation was present. There would be general paralysis or organic dementia present in an intemperate man, whose skull was unsymmetrical, whose pupils were unequal, whose bodily health was feeble, and who laboured under some condition in which poverty of blood was the prominent symptom, such as purpura, tubercle or anæmia, and who at some time or other had received a blow on the head, or some other injury, by which internal extravasation could be produced.

But where no vessel has been ruptured, as far as can be ascertained, and where the cyst lies isolated in the cavity of the arachnoid, having apparently no communication with any vessel in its neighbourhood, how can its presence then be explained? In this case the blood is said to have found its way there by exhalation, which is thought by some to be equivalent to invisible extravasation. Dr. Burrows¹ says on this point, "I agree with those anatomists who think that in these so-called exhalations the red blood-discs always proceed from ruptured vessels, for the most part so minute as not to be discovered by our usual means of investigation." But suppose that the clot which has been formed remains fixed and immovable, and is divorced from all vascular communication with surrounding parts, can it then of itself form vessels and become organized? John Hunter says on this point, "I have reason to believe that the coagulum has power under the necessary circumstances to form vessels in and of itself, for I have already observed that coagulation, although organic, is still of a peculiar form, structure, or arrangement, so as to take on the necessary actions. . . . I think I have

¹ "Croonian Lectures, 1835," 'Medical Gazette,' vol. xvi, page 710.

been able to inject what I suspected to be the beginning of a vascular formation in a coagulum when it could not derive any vessels from the surrounding parts."

But in addition to this spontaneous organization of coagulated blood, it has been noticed that not only in cysts of the arachnoid, but in blood effused and solidified in any other part, a thin membrane is formed around, which although it may keep the blood within bounds and prevent its pressing upon contiguous parts and interfering with their function, yet has the disadvantage of preventing the absorption of the clot when it is once formed.

And these membranes are not only formed round a single clot of blood, but round any number of clots that may be formed in any situation whatsoever.

Mr. Prescott Hewett says,¹ "I have lately examined a very good specimen of blood disseminated in patches over the surface of the serous membrane, the intervening parts of which present a natural aspect, with extravasation of blood into the cavity of the arachnoid. The patient lived nine days after the accident, and each patch of blood was found already covered by its own membrane." He also goes on to say, that such fibrinous coagula may exist in the cavity of the pleura, in joints, as in the cupped surfaces of the cartilages of the patella, or in aneurismal clots, in all of which cases they are covered by a fine transparent, polished membrane, and that even blood extravasated into the tissues becomes enveloped by a membrane, as in a clot found lying under the skin on the anterior surface of the tibia, or in those coagula found about the scalp after some injury to the head.

Andral found on one occasion a quantity of sanguineous serum collected in the cavity of the pleura. His description of this case is most remarkable. On the internal surface of the thoracic wall he discovered some hard, round knobs, which proved to be clots of blood, which having become organized, had become the seat of a process terminating in the production of a morbid fluid. The formation of polypi and cysts on the walls of the uterus may be traced to a similar process. It is well known that menstrual blood being more acid, and being mixed with mucus from the uterus and external parts of the organs

¹ 'Medical and Chirurgical Transactions,' vol. 28.

of generation, coagulates less perfectly than ordinary blood; but in cases of menorrhagia where these two exceptional conditions are more or less absent, polypi are frequently formed. The blood coagulates in lumps, adheres to the walls of the uterus, is added to by other discharges, and hence is formed the nidus of a polypus which soon becomes large and unwieldy. Sometimes, after a great strain or unusual exertion, the morbid growth is detached from the uterine parietes, and this is followed by alarming hæmorrhage. A case of this kind once occurred in the practice of the writer. An old woman, who had led a very sedentary life as a dress-maker, found as she approached the climacteric period that the catamenia ceased to flow. At the same time she was troubled with alarming symptoms of vomiting and hæmatemesis, and a large lump formed over the pubes. One day, when making an unusual effort to vomit, she felt something give way within her, and soon after she voided a quantity of blood from the vagina, together with an oval clot, perfectly white, and covered with a glistening membrane, and in all respects exactly resembling a hen's egg in size, form, and colour. It was thus she came to the change of life, and from that time forth her catamenia ceased to trouble her.

It is now almost universally agreed that these cysts are formed by some change taking place in extravasated blood, and are not due to either a splitting up of the dura mater and separation of its arachnoid, or to the organization of lymph poured out during a former arachnitis.

Whatever may be their origin, there can be no doubt that they are as interesting and remarkable as they are rare, and that they afford an ample field for future pathological and microscopical observation.

PHTHISIS AND INSANITY.

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DEGENERATION in the human frame is sometimes manifold. The wretched inheritor of the sins and infirmities of his parents, himself driven into the underways of life by his imperfect frame and bloated figure, not infrequently becomes the victim of intemperance, of sensuality, of neglect, adds to his inherited portion of scrofula and syphilis, and ends his days in the workhouse or the asylum. But such instances are hardly to be called common; on all sides those who tread the narrow path of health are surrounded by dangers if they deviate ever so little; and hence even in our civilised generation the prejudices of semi-civilised hardihood and ignorance being not yet cast away, in sight of the clear laws of hygiene, hardly any individual can point to himself as a good example of the normal *homo sapiens* or even *coquens*.

Among these dangers a frequent one is the separation from the nourishing material of the body, of a fluid incapable of sustaining the tissues it arrives among, and which takes a form that renders reabsorption difficult. A frequent form of such deposition is the substance called tubercle, a name generally given to a number of sorts of matter, presenting different structure and different chemical composition, but all agreeing in their being of too low a form to be capable of nourishing the tissues, and of a form not simple enough to resist the decomposing influences of the animal frame, or, at least, not insensible enough

to its vicissitudes for the neighbouring tissues to be able to tolerate them. If we have anywhere a disease the responsibility for which lies between the food, the blood, and the alimentary and blood-glands, it is surely this one; for it is characterised by the very fact that the tissues have a repugnance to the matters exuded, not as in many diseases an affinity for them. Much must be laid to the score of the circulating fluid, little can be laid to that of the tissues.

In the case of inflammation, indeed, there is undoubtedly some involvement of the elements of the tissues in the mischief, and inflammation is now acknowledged by many advanced physicians and pathologists to lead to the deposition of matters which would be called tubercle by the ordinary observer. Still even here the blood must be the source from which new material is derived, and the inflammation can but serve as the occasion for the degenerate exudation, which escapes at the natural exudation stage of normal inflammation.

Thus tubercle in its widest sense would seem to be a disease of the vegetative life; and this opinion is favoured by its speedy production in animals from mere mechanical interference with the circulatory process, as by the injection of mercury into their veins.

The vegetative life goes, however, not only hand in hand, but closely interlocked with the higher or animal life, nor can we even indicate closely the points and modes of connection between the one and the other. We know, nevertheless, that there are diseases which select the one rather than the other, and run a course in the one chosen, without much modifying the other. On this principle we have a practicable classification of diseases into those of the body and those of the mind, the former comprising all diseases of vegetative functions, the latter all diseases of animal function (of which *volition* is the characteristic), in either case the material changes which underlie the pathological phenomena being taken into account. No doubt there are diseases which cross the border and invade the alien territory, but this is not the rule with any one bodily disease (epilepsy comes nearest), and some predisposition in the nervous centres themselves is probably always a necessary element. The same cannot be said of mental disease; there are very many bodily diseases which this is capable of modifying seriously, and there

are some which (*e. g.* general paralysis) it appears directly to occasion. Moreover, mental disease is apt to induce a bodily feebleness of constitution, from those objective stimuli whose perception is so necessary to our performing healthily our various functions, feelings of hunger, thirst, the need of cleanliness, the need of exercise, of fresh air, and so on, being almost or altogether neglected. In fact, to summarise, we much oftener find the bodies of our patients affected in some peculiar way in asylums, than we find their minds affected in any peculiar way in hospitals.

The capability of such a sure disease of the organic life as tuberculosis to affect the functions of animal life is not, therefore, *à priori* probable, except, indeed, in so far as the diseased process interferes with the physical basis of these functions. And as we know that it is comparatively seldom that tubercle is found in the nerve tissue and muscles, and then only after its presence in other organs has enfeebled nutrition and rendered life but a matter of weeks or months, we may, perhaps, be allowed to conclude that these organs preserve so long the power of drawing from the blood the precise compounds suited for themselves, refusing the unassimilable parts, that the probability of their participation in the disease reaches a minimum.

Were this not so, were the morbid element in the blood known to pass readily through the capillaries subservient directly to animal life; did it show itself there as it does in other organs, we should expect phthisis to be continually coupled with some modification of the highest functions, in fact with insanity.

There would be little use in dwelling on such considerations were there any easy way to settle the question now being agitated, as to the connection of phthisis and insanity, by reference to the cases of phthisis and insanity themselves. No such easy way exists. What has been done in this department is mostly summarised or contained in an able paper by Dr. Clouston in the 'Journal of Mental Science' for April, 1863. This paper must furnish many of the facts brought forward here, and if when these are taken along with other original facts the probable conclusions do not turn out identical with Dr. Clouston's, it must be remembered that facts and conclusions are different things—those exact and fixed, and honorable to him who has brought them to the light of day, these the sport

of the human intellect, corresponding too rarely and often but for a little distance with the actual flow of natural circumstance.

The question of the connection between phthisis and insanity, if we consider it in the light of cases, is rendered much more complicated than it at first sight appears, from the fact that it is by no means yet determined how far phthisis represents a definite species of disease. If we are to accept the conclusions of eminent observers in Germany, different affections have passed under this common name. The products of pneumonic and bronchitic inflammations, which have undergone caseous metamorphosis, the true tubercle of acute tuberculosis, and a compound of these two, when caseous masses give occasion to the growth of tubercle in their neighbourhood, are all at different times at the root of symptoms put down as phthisis. And it is doubtful if we are justified in assuming in these cases a peculiarity of constitution the same in all; such a peculiarity is thought to be recognisable by a class of symptoms of a very indefinite kind, more or less characteristic of all individuals, having a constitution below par, and which at any rate will, no doubt, be capable of very considerable analysis, and further classification in time to come. So that were it found in a number of cases that a certain sort of insanity and phthisis went together, we should be more prepared to consider the insanity as affecting the lung, than the decay of the lung as causing the insanity, unless it could be shown that the phthisis was in all the cases at bottom one and the same lesion. For if this term represents different lesions, having but their seat in the lung in common, we should have to suppose a more special influence of the lung over the brain than that exercised by any other organ in the body—a position which there are no other reasons for accepting.

Nevertheless, taking the disease phthisis in its old acceptance, as a morbid process consisting of three stages, one of deposition, one of softening, and one of expulsion of "tubercle," there have been facts brought forward by Dr. Clouston which tend toward the establishment of a real specific connection between this disease and insanity. Statements of various other observers, quoted in his paper, are in favour of his views, but can hardly be dealt with here from particulars not being given. It is right to state that Dr. Clouston

gives also the opinions of some who are not impressed with the existence of any such connection. It is necessary to fall back on the statistics of the Edinburgh Asylum, as brought forward by the same writer. Out of 1082 deaths between 1842 and 1861 inclusive, phthisis was the assigned cause in 315 or in nearly one third. This is manifestly a large proportion; and Dr. Clouston contrasts it with the returns of death from phthisis in the eight principal towns of Scotland for the year 1861. In these towns, out of every 100 deaths above five years of age, 20 were from this disease, and above twenty years of age, 21 of every 100 was the proportion. The Edinburgh Asylum gave something over 29 out of every 100 deaths. Unfortunately, the returns for Scotland not being at hand, it is impossible to find how high Edinburgh and its neighbourhood stand in respect of phthisis, but it is an inquiry so much in point that its settlement might influence materially our acceptance of these figures, since they repose on cases (we suppose) drawn chiefly from that city and its neighbourhood.

In the case of the West Riding of Yorkshire Asylum a parallel set of figures can be brought forward, and the contrast between the asylum (which is situated in a district where phthisis is of about the average prevalence of the whole Riding), and the range of country from which the cases are drawn, as regards prevalence of phthisis, can be made. In all the cases made use of in this inquiry, the cause of death was assigned after post-mortem examination.¹ The number of these post-mortem examinations, the full and accurate reports of which have been examined with the view of throwing light upon this subject, was 500; in 152 of these tubercle was found; and the number in which tuberculosis of the lungs was the assigned cause of death was 78. This represents a proportion of 15·6 deaths from phthisis to every 100 deaths in the asylum. Let us contrast with this the proportion in the West Riding.

It would be unfair to contrast deaths in the asylum with deaths outside, unless children under five years of age were left out of consideration, for these do not appear within the walls of the institution. On the other hand, it seems questionable whether it is preferable, as it seems to Dr. Clouston to be, to

¹ The *primary* cause of death also is what is given, not complications nor inter-current conditions.

take only the deaths above twenty years, because "the deaths under twenty are so rare that the latter per centage forms the best standard of comparison." Obviously, if cases under twenty years are admitted, and if they do not die so plentifully as people outside, phthisis must come in for part of the improval, it being an appreciable cause of death in the country in general, under twenty years of age. Taking, then, persons over five years of age, what per centage of the deaths of such is due to phthisis? It would be best could the answer be given for the West Riding, but, unfortunately, this is impossible from the returns accessible. Over the whole kingdom, however, out of every one hundred deaths over five years of age, seventeen are ascribed to phthisis. In the Wakefield Asylum, as has just been mentioned, fifteen is the number. The result therefore differs materially from that obtained by Dr. Clouston in the Edinburgh Asylum, and presents an exception to his first conclusion, that "phthisis pulmonalis is much more frequent, as an *assigned cause of death*, among the insane than among the general population."

But there is another fact which renders the numbers taken from the West Riding of Yorkshire more important. It will be easily seen how high in respect of mortality from phthisis many parts of the Riding are, from a glance at Mr. Haviland's map of phthisis-distribution. These are the parts that furnish most patients to the asylum; Leeds, Bradford, and Sheffield give together of themselves a large proportion, and the mill hands and knife grinders in those towns are exposed to the causal conditions of phthisis in full force. Now, it is a fact that insanity is on the increase in the Riding, and expressly in the large towns. Here then would appear an argument in one direction, phthisis and insanity increasing together. Plainly if there be a connection between the two affections, there must be a heaping up of phthisical cases in the asylum. If phthisis can cause insanity, insanity goes to the asylum, and phthisis goes along with it. *In this very asylum, then, the per centage of deaths from phthisis is below the general per centage of the country.* The phthisis goes to the hospital, the dispensary, or the workhouse (nor can it be said that in these places the experience of the mental characteristics of such patients is what Dr. Clouston figures it), the insanity goes to the asylum *without* phthisis. This in itself is a singular fact.

It is necessary to take here a second argument which Dr. Clouston brings forward in support of a connection between tubercle and insanity, but in regard to which the figures at command restrict a comparison to the case of phthisis and insanity. This argument relates to the age at which the tuberculous insane die. Evidently, if insanity causes tuberculosis, we should find the tuberculous insane dying rather late in life, because most asylum patients are adults or old people. Again, if tuberculosis causes insanity, as Dr. Clouston affirms, we ought to find the tuberculous insane dying rather early in life, since tubercle is very much a disease of the young. Now Dr. Clouston does find in the figures from the Edinburgh Asylum some support for his view. But there is much to complicate such a question. Granted that "most" asylum patients are adults or old people (the age, at which most of those admitted are found to be, may probably be fairly stated as from thirty-five to sixty-five years), still there are numerous admissions at an age much earlier. The following table of the ages in different years in the West Riding Asylum may be given in illustration:

Years.	1863.	1864.	1866.	1867.	Average.
Under 15 years	3	13	4	6	6·5
Between 15 and 20 years	20	14	23	21	19·5
" 20 " 25 "	39	56	29	36	40·0
" 25 " 30 "	56	55	37	58	51·5
" 30 " 35 "	32	47	47	56	45·5
" 35 " 40 "	52	50	47	60	52·2
" 40 " 50 "	86	88	77	97	87·0
" 50 " 60 "	60	59	66	47	58·0
" 60 " 70 "	28	40	30	35	33·2
" 70 " 80 "	5	19	5	14	10·7
" 80 " 90 "	1	2	1	1	1·2
Unknown	5	2	5	5	4·2

We see from this that though most patients are admitted about the age of forty-five years, a large number come in even at twenty-five, and from that onwards increasingly. Now, if we glance at the Registrar-General's Report of the ages of those dying of tubercle or phthisis, we shall easily see that these are diseases of the comparatively young. If then we suppose that insanity assists in tuberculous growth (it is taken for granted throughout this paper that every one allows a connection between tubercle and insanity in so far as the insane expose themselves,

or are exposed, to conditions eminently favorable to the development of the former), and if we know, as we do, that youth predisposes to tuberculous growth, we shall not be surprised to find that it is in the young insane that tubercle most frequently proves fatal. In the year 1868, in England, far the richest decades in deaths from phthisis were from fifteen to twenty-five, and from twenty-five to thirty-five years of age. This generally holds good. Now, in the 152 cases in the West Riding Asylum in which the lungs were found tubercular, the ages at death were as follows:—

	Males.	Females.	Total.
Age between 10 and 20 years	1	5	6
" 20 " 30 "	10	13	23
" 30 " 40 "	19	20	39
" 40 " 50 "	17	14	31
" 50 " 60 "	18	12	30
" 60 " 70 "	6	10	16
" 70 " 80 "	4	1	5
Age not given	—	2	2
Total	75	77	152

	Males.	Females.	Total.
Age between 20 and 25 years	3	6	9
" 25 " 30 "	7	7	14
" 30 " 35 "	8	9	17
" 35 " 40 "	11	11	22

} 31

It is evident from this table that the most fatal age of the phthisical in the asylum has proved to be the decade between thirty and forty years of age, a time of life rather later than that generally reached by the phthisical in ordinary life. This would seem to be accounted for by such facts as that insanity is an inducing cause of tuberculosis, and that the young are not much admitted to asylums when already very phthisical, that is, when about the age of twenty years, while the sort of persons admitted at a time of life when insanity is beginning to crop up with vigour, is in a majority of instances such that time is required for the exciting causes more or less inseparable from asylum life to operate. There appears to be a fallacy in Dr. Clouston's argument in thus far that, while there can be no doubt the average insanescent individual is a man well on in years, there are very numerous instances of younger patients. It is a case in which averaging is disadvantageous,

and gives a false idea of the facts. If insanity were almost confined to a period of life close on its average period, we should at once suspect something on finding that those insane people who did die at an age considerably below the average often had tubercle. Plainly, then, the tubercle would be looked on as bringing about the insanity. But since there is abundant evidence that many people become insane independently of tubercle at an age tolerably favorable to the development of this product, we ought to expect from any point of view to find the tuberculous insane dying early.

In close connection with this part of the argument comes the question: How is the tubercle related to the insanity as regards time? Is the mental or the bodily lesion the first to appear? This is a point very difficult to settle. In many of the cases admitted to the West Riding Asylum it certainly appears as if the tubercle is developed after admission; but this is merely an impression remaining on the memory. Statistics are at present available only with regard to the time at which the patients die, and these statistics point to an early commencement of the phthisis in a good many of the cases, but to a later one in others. Dr. Clouston finds that 66 out of 282 cases that were tubercular died within the first year. Unfortunately, he does not mention how many of these sixty-six cases died from the tubercle, and how many from other causes. In the Wakefield figures an approach to this desideratum has been made by the classifying into stages, since very few indeed of those in whom the tubercle was found in the first stage (genuine acute tuberculosis being a rare affection) would have phthisis influencing much the fatal termination.¹ Now, the figures are the following:—

Of those who died with tubercle—

In the 1st stage, 8 have been in the asylum upwards of three years.

2nd	„	11	„	„	„	„	„
3rd	„	37	„	„	„	„	„

Out of the 500 cases examined post-mortem, 152 were tubercular, and these were distributed thus:—

Tubercle in the 1st stage	.	.	.	31
„	2nd	„	.	35
„	3rd	„	.	86
Total with tubercle				152

¹ The figures are found to be these: 32 of the 36, 7 of the 11, and none of the 8 had phthisis ascribed as a cause of death. One of the 8 had tubercle with hydrothorax.

Taking the two sets of numbers together, we see that in the stage (the first) where *other* causes than tubercle must have come in to aid the death, the greatest proportionate number died before three years (22:8); in the second stage, where the tubercle probably was a main cause, a somewhat smaller proportion (24:11) died within three years; and in the third stage, where probably death was owing to the tubercle altogether, the smallest proportion of all died before three years of asylum life were out (50:37). The ratios are approximately 89:32, 71:32, and 44:32; that is, most die under three years when tubercle is not the sole cause of death. These figures are the merest indicators; still they point to a desirable additional clearness, were Dr. Clouston's 66 cases of death within one year analysed. The same applies to the longer periods.

Supposing, however, for the sake of argument, that the insanity and the phthisis are almost contemporaneous in their development so much so as to lead one to admit, as Dr. Clouston, speaking more particularly of phthisical mania, puts it, "that tubercles must have already formed in the lungs, or a strong tubercular tendency been present, and about to pass into tuberculosis when the insanity appeared;"¹ we have still a most important question to consider, viz., how far insanity and how far tubercle were already in the constitution of the individual. Both are hereditary to a very great extent. It would have been very much in favour of the view that the tubercle is primary could it have been shown that in a large number of cases the tubercle was present in the family while the insanity was not. But the figures brought forward in Dr. Clouston's paper tell in the other direction, as far as he has been able to get any; unfortunately, as he justly remarks, it is seldom that asylum records give any information as to the prevalence of phthisis among relations of patients. What he finds is, that hereditary predisposition to insanity is, among the tubercular insane, somewhat more frequent than among the insane in general. Their parents have had also more or less the mental taint. From this results much, if it be granted what shall have some proof brought forward immediately to support it, that the insane diathesis lowers the bodily health; for then the parents have probably neither taken care enough of themselves nor of their

¹ P. 64, conclusion, 12.

children, and hence a strong tendency to tubercle may have been present, when the sudden exacerbation of self-neglect and exposure to sources of disease, that always mark the beginning of insanity, came on. Thus the cotemporaneous arrival of the insanity and the phthisical symptoms is accounted for in another way than by supposing the tubercle to cause the insanity.

It is now necessary to pass on to the alleged fact of the connection of tubercle more especially with one form of insanity. If this be true, however, it proves nothing in itself as regards the causal arrangement of the association. It may be, indeed, that phthisis tends more to produce that form, but it may be that that form tends most to produce phthisis. Hence many of Dr. Clouston's statements as to the number of melancholics, low-spirited general paralytics, suspicious monomaniacs, in whom tubercle was found, may as easily be regarded in the light of supports to the one side as to the other. The state of depression seems exceedingly favorable to the formation of tubercle, since during its continuance food and exercise are evaded as much as possible, and the patient shows utter indifference to bodily warmth. In the monomania with suspicion on which Dr. Clouston lays so much stress, and which he would call phthisical mania, there are special reasons why tubercle should be often developed. For the patients suffering from this form of mental aberration are of the most depraved habits, masturbators almost invariably, often out of bed at night, preferring often to sleep among their own filth, given to vomiting their food, often fond of undressing in the ward or the open air, and, in fact, of abusing their bodies in many ways. Moreover, these cases are so often hereditary or connected with a weak moral nature in the parents, that irregularities in matters of diet, exercise, self-command, have been laying the foundation of bodily disease for long, and this above all is a form of insanity which appears to some extent early in life in the form of eccentricity, and gradually gets worse and worse, quite independently of tubercle, as cases undoubtedly occur frequently where no tubercle exists. The following cases may serve for illustration of this position :—

CASE 1.—J. B—, æt. 36, married, admitted 17th February, 1865. Has ever since her admission being labouring under several delusions. Fancies that her children are being chopped up into mince-meat, and accuses those about her of

doing it, asserting that the reason that they are so persecuted is to rob them of their titles. She also fancies that she hears them crying out for her, and says that they cling to her. The nurse states that she often hears her conversing with them.

She also imagines that she is possessed of immense sums of money.

At times she becomes very violent and excited, but is controlled by ergot.

She is a well-nourished woman, of middle height and florid complexion.

Her lungs were free from any disease at the time of her admission, and are perfectly healthy now.

CASE 2.—B. B—, æt. 59, married, admitted 16th September, 1868. Has ever since her admission had delusions. Says that she is wronged and cheated out of money which is paid for her comforts here. Suspects everybody about her to be attempting to injure her. She is easily provoked to quarrel, and when she does so becomes very abusive. Also fancies that her husband is concealed in some part of the institution, and that she hears him calling to her; this makes her at times very wretched, and causes her to weep.

She is an old looking woman, but in fair bodily condition.

Respiratory system at time of admission was normal, and is so now.

CASE 3.—R. B—, æt. 66, widower, cloth weaver by occupation, was admitted 2nd February, 1866. Has delusions that spirits send inflammatory gas into his head, and take away his senses; they, the spirits, also burn his stomach and legs. Also hears voices both by day and night talking to him, and trying to get his money away from him, and prevent his sleeping well at night. He is, however, more annoyed by these voices while smoking.

He is in good health.

Respiratory system both at the time of admission and now is normal.

CASE 4.—W. D—, æt. 60, a widower, weaver by occupation, was admitted 14th March, 1870. Has a delusion that his wife has given him the venereal disease, and that his teeth are dropping out in consequence. He has no trace of the disease. He also accuses his son and wife of criminal intimacy, and in consequence has threatened the life of the latter, and says that all his family are conspiring together to kill him.

He is a man of florid complexion, is stout, and in good health.

Respiratory system at time of admission was normal, with the exception of slight emphysema, and is healthy still.

CASE 5.—P. H—, æt. 40, a widower, quack doctor by occupation, was admitted 21st February, 1867. Has delusions that people from all parts of the world pass electric currents through his body, thus rolling diseases into him, and that in some inexplicable manner they take the food out of his stomach. He says that the other day when several patients were vaccinated, himself being among the number, the diseases of the other patients entered into his blood, and poisoned him.

He is in robust health.

Respiratory system was normal at the time of admission, and is so now.

CASE 6.—M. S—, æt. 33, admitted 17th June, 1865. Has delusions that people come into her room of a night and pour aqua fortis on her to spoil her beauty, and has been known to wash her head twenty times in a day to get the

poison out. She also fancies that her heart has been pulled out while she was under chloroform; also thinks that she hears people talking through the walls to her. She often becomes excited, and makes attempts to escape.

She is of middle height, well nourished, of a sanguine temperament. Face is much flushed.

Respiratory system at the time of her admission was normal, and is so now.¹

It is not pretended that these arguments and facts prove that insanity does not depend on tubercle, any more than Dr. Clouston's facts and arguments can be said to prove that it does. This is a matter in which nothing is easier than to see that there is some causal connection, and nothing perhaps more difficult than to see what precisely is the order of the connection. Degeneration, as was said at the beginning, is sometimes multiple; in such a case the inquiry is of little practical good, and is most difficult of all. But often single defects are induced, and in such cases there is hope and use in research. Are the mental functions so influential over the bodily, that deviation of the mind necessitates impaired bodily health? Are the bodily functions so dovetailed into the mental that the one cannot be broken without the other being impaired? The answer seems to be only in one direction when we stick to the undoubtedly mental and the undoubtedly corporeal diseases in the common acceptation of these words. The bodily complaints are many in which the mind remains bright to the end; but, to quote the words of an authority, "insanity certainly does upon the whole reduce the mean duration of life" (Maudsley). When, however, we look to nature, whose facts our words are but weak expressions of, we find an immense debateable ground, and if we are philosophical, we find everything debateable ground. Nevertheless, for this question of tuberculosis is such refinement necessary? Be we sensationists, we must acknowledge that those appearances which we designate stomach, liver, lungs, and so on, are utterly removed wherever they intrude on the dream of our life, from our comparisons, memories, affections. Be we materialists, there is still matter in our body, from the humble calcic phosphate to the marvel of a thousand organized delicacies in the cortical brain-cell, and a great gulf separates the osmose of the gland from the subtle mercurial current of the nerve-centre.

¹ These cases are hardly typical of Dr. Clouston's phthisical mania, as he puts its symptoms, nor as it is described above; but circumstances have prevented the writer from completing at present this portion of the argument.

What phthisis or tubercle has to cross to get from the lower life to the higher is no small span ; but the damage of the mind, is it not the breaking of the keystone, the whole arch being then weakened to its foundations ?

Thus one is always inclined to fall back on general principles, rather than to attack such a problem from the endless complication of single facts. A line of argument still owing to the reader from the former point of view must be briefly adverted to now. It is the exposition of this statement on which a good deal has been founded, that insanity has the power of lowering the vitality and so of producing tubercle. In the present day an early effect of insanity is to bring the patient into an asylum, and it is only in the case of pauper asylum patients that this question has been raised, so that reference may first be made to the conditions under which the inmates in such institutions live.

There are certain conditions in asylum life that are in favour of the vital energies. The diet is good, and exercise is more or less enforced. But the diet is monotonous, a circumstance which undoubtedly takes away from the benefit derived from it, and, for those that have mind enough left, it is not received with the zest of that earned by the sweat of the brow, but with the depressing feeling that it is the "rates" that pay for it. The exercise is undoubtedly a genuine benefit in some forms, such as those of work in which the patient takes an interest, of dances, of country walks and other excursions that are often hailed with delight. On the other hand, the formal striding about in the airing court seems, though still much better than nothing, but a small advantage compared with that which the word "exercise" suggests to a sane man. Then a separate advantage, and one of an unmixed sort in the degree that it is sympathisingly and judiciously carried out, is the influence of sane, educated, reflective minds among the superior officers, on the wandering degraded natures under their care. As a modification to this must, it is to be feared, be put an influence of an opposite tendency from some inferior officers in every asylum, though this is, as all hope, small and diminishing.

In some asylums the state of the atmosphere in which the patients are immersed may be put as a favorable, in others as an unfavorable, condition. The same may be said as regards temperature ; the relation between this and ventilation is one

the proper maintenance of which is most difficult of attainment.

Among the unfavorable conditions operating probably more or less in every asylum is first the crowding together of the patients, by which during the night (in many cases), and during considerable parts of the day, or the whole day in bad weather, some of the respired air must have already given up its virtues at the pulmonary capillaries of many patients. Secondly, there is in very many cases the sense of confinement itself, the depressing effect of which nobody practically conversant with the insane will be inclined to deny. Thirdly, along with this goes the sense of subordination to discipline, and to discipline which, unfortunately but unavoidably, often seems to the patient of a most unreasonable kind.

These are influences of a general nature; but circumstances special to certain classes of patients have a more appreciable effect. For the misfortunes which would accompany many patients in their insanity, were they left out of the asylum, follow them even within its walls. Thus, when we take the first point, viz. diet, many patients, and especially those who are depressed, refuse their food, either habitually or now and again. If artificial feeding is resorted to, the effects can hardly be expected to be the same as when the nutriment is naturally ingested. Herein there is a constant source of poor blood, or of deranged nutritive life, both causes of tubercular deposition. Again, many patients eat too much, and there are good opportunities of so doing, since it is usual in asylums to distribute what is left of the rations among those who are unsatisfied. Lastly, certain patients occasionally add to their diet unwholesome and often disgusting substances, clothes, blankets, leaves, earth, ordure, and such like things. Again, as regards exercise, many patients who are demented or paralytic, or thought to be the one or the other, will not take exercise, and cannot without violence be forced to it, consequently they remain generally in the same place and posture day after day. On the other hand, others even of delicate constitution display the greatest indifference to weather of any sort, and will heedlessly expose themselves in the most severe seasons.

In respect of ventilation, the utter indifference shown by the insane as to the kind of air they breathe would be most extra-

ordinary were not the same fault so common among the sane. But in asylums the dirty habits of many patients make the matter worse; and though in some institutions much has been done to remedy this, still it is almost impossible to arrive at the standard of purity with the means which ratepayers are willing to put at the disposal of asylum authorities. Nothing short of an attendant day and night would keep some patients (of whom there are several in every asylum of any size) from frequently defiling themselves and the air about them, The same neglect is shown by many patients in the matter of temperature, and this is most important in the present argument, since if any are neglectful of this it is the depressed and the demented. (Dr. Clouston shows from figures that many of the melancholic insane die demented and tubercular.) These may be seen in winter days sitting on benches or chairs with hands and head drooping, the extremities cold and blue, and not unfrequently œdematous. Often such patients will not sit on a chair by the fire-place; they never give expression to a feeling of pain or cold, and their state is not always realised by a busy bustling attendant. Other patients get out of bed at night, quite irrespectively of temperature.

Another cause of depressed vital energy springing from insanity is masturbation. It is unavoidable that this should be frequent in asylums where restraint is not used.

Obviously, with the predominance of the favorable or unfavorable among these conditions, must go to a great extent, at least, the frequency or infrequency of tubercle in any asylum, if we make allowance for the character in this respect of the district that supplies the patients. When any new explanation of pulmonary consumption in asylums is set up, such as the precedence of phthisis to insanity alleged by Dr. Clouston, it would be very important that some estimate should be made of these two powerful and undoubted factors in the result. Such an excess as that which is found in the Edinburgh Asylum, over the average of the eight principal towns of Scotland is not greater than often subsists between one district and another. As regards the continental asylums, it is well known that the conditions in them favorable to depressed vitality and the appearance of tubercle are quite sufficient to account for a considerable excess over the districts from which they derive their inmates, and that the patients are, if not troublesome, much

more left to their own ways than with us, however injurious these are to themselves. In the case of American asylums, again, which furnish Dr. Clouston with figures favorable to his own views, the conditions mentioned above are not adverted to. We ought, therefore, to be enlightened on many points before the statistics of Dr. Clouston's paper can be accepted as sufficient premises for the conclusions he draws from them.¹

So far as to the conditions in asylum life tending to depress vitality, and their bearing on this question; something has, however, been founded, too, on the tendency which the insane *diathesis* produces in the same direction. The less decided forms of this diathesis produce an imprudence, an over-anxiety about trifles, a neglect of really weighty matters, which are recognised as common when the mind of an individual or the mental character of a family begins to get weak, and the more serious forms have been indicated under the head of individual disadvantages within an asylum. The accumulation of little mistakes of this sort may easily be watched in any neurotic family, and no fact is more interesting than the manner in which the eccentricities of the one member work on the eccentricities or over-susceptible disposition of another, and so on, till a perfect hothouse of fermenting irritability is produced, which only the asylum breaks up. Hygiene and health are frequently in this state of things sacrificed on the altar of petty jealousy, extravagant sorrow, and other ill-regulated emotional states.

It is necessary, in conclusion, to point to a form of disease seen in asylums and elsewhere, which should not be confounded with phthisical mania and is not, indeed, mentioned in this connection by Dr. Clouston. This is the mania, or rather delirium of advanced phthisis in neurotic individuals. It rests no doubt on a contamination of the blood comparable with that in idiopathic and in symptomatic fever, and in one variety of acute phthisis. The following cases sufficiently illustrate it.

CASE 1.—W. T—, æt. 56, corn miller, admitted 5th June, 1867. Previous to his admission had been very excited, pulling off his coat to fight, &c. Had delusions

¹ It is a fact, of which detailed proof might be offered, that with the careful regulation and improvement of the hygienic conditions in the Wakefield Asylum, a decided decrease of tubercle has been observed of late years. Dr. Clouston has himself had the same experience (Blandford).

that his wife was sprinkling water over him. His ideas seem to be obtuse; at present seems to have no knowledge where he is. Voice is husky and indistinct. He is very restless in his movements, and mutters incoherently.

Respiratory system.—There is well-marked dulness at the apex of right lung. There is also a cavity in its upper lobe. No vesicular breathing can be heard.

General condition.—Sallow complexion; pinched features; face rather livid. Countenance has a vacant expression; eyes large and prominent; tongue coated, very dirty. Bowels are regular; appetite capricious.

Treatment.—Ol. Morrhuæ. Cough mixture. Stimulants, and good nourishing diet.

14th June.—Died.

Post-mortem nine hours after death.—Body fairly nourished. Dura mater strongly adherent to the skull cap. Brain, 46 ounces; two or three ounces of fluid on the outer surface. Arachnoid thickened and opalescent. Lateral ventricles distended with fluid, and the tissue of the brain pale and anæmic. Cerebellum, &c., six and a half ounces. Lungs: both contained yellow tubercular deposit, with several cavities on anterior aspect, especially upper and middle lobes of the right lung; right, 60 ounces; left, 55 ounces. Heart, 12 ounces; walls fatty, especially those of right auricle and ventricle. Muscular tissue pale, of normal consistence. Liver pale and flabby; 64 ounces. Spleen, enlarged and softened, ten and a half ounces. Kidney: left, ten ounces, enlarged and with hydatid cysts and gelatinous tubercular deposit; right, also hypertrophied and congested, seven ounces.

CASE 2.—E. L—, æt. 25, married; a printer; was admitted 9th June, 1870.

Mental condition.—He is much excited and very reckless; talks incoherently and incessantly. Thinks he is followed by dogs, and is in great fear in consequence. He laughs immoderately.

Respiratory system.—Chest is resonant in front, but generally dull behind; gurgling sounds are heard all over, and there are signs of general infiltration of the lungs with tubercle, and the presence of cavities in both lungs. The voice is husky and indistinct.

General condition.—There are sordes on lips and teeth. The tongue is dry and cracked and brown. There is a hectic flush over the face. He is in a state of extreme emaciation. The nails are clubbed. There is no purging.

Treatment.—To have eight ounces of port wine in the twenty-four hours, and also extra food in the shape of milk, eggs, and strong broth; also half an ounce of Tr. Hyoscyami, t. d.

August 4th.—Has improved very rapidly, and is now heavier by many pounds and quite free from excitement; but examination of the chest does not show much improvement there.

If degrees of comparison may be used, the condition of the chest might be noted thus:—

	<i>Right.</i>	<i>Left.</i>
Expansion . . .	. 2 . . 2	
Dulness . . .	. 1 . . 1	
Pectoriloquy . . .	. 3 . . 1	
Tubular breathing . . .	. 3 . . 1	
Moist sounds . . .	. 0 . . 0	

Oct. 4th.—There has been no change in his condition, except that his mind has improved steadily. To-day he was discharged recovered—that is, as far as his mind is concerned.

Little has been said, nor have any fresh statistics been added to Dr. Clouston's as regards tubercle in other organs than the lungs, in the insane. The lungs are regarded as so typically the seat of this affection, and afford so definite a mark in a matter the boundaries of which, with advancing investigation, are getting much more indefinite, or altogether renewing themselves, that it seemed advantageous to confine the discussion to that scope. Not much has been added ; more has been done in the way of suggesting doubts and queries ; but it would be unfortunate were the matter considered to be foreclosed, and one position more added to that coarse and unreasoning materialism which would refer all insanity not only to the brain but primarily to the belly of man.

ACUTE DELIRIOUS MELANCHOLIA.

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DR. BLANDFORD, in his recently published and able work on 'Insanity and its Treatment,' has devoted a lecture to the consideration of a form of mental alienation which he calls "acute delirious mania," which appears to occupy an intermediate position between acute mania on the one hand and the delirium of certain bodily diseases on the other. It is to be regretted that Dr. Blandford has not given more space to a delineation of the symptoms and progress of this disorder, instead of enlarging so fully upon the methods of dealing with it, some of which are sufficiently obvious. What he has said respecting its phenomena, however, is enough to stamp it with a distinctive character, and, in a majority of cases, to insure its recognition. His description at once recalled to me certain cases which I had seen during my residence at the West Riding Asylum. On examining carefully my recollection of the cases thus recalled, it seemed to me, however, that they did not all conform exactly to Dr. Blandford's description; and that some of them, indeed, differed so materially from it as to render it unjustifiable to classify them under the term which had suggested the remembrance of them. All the cases which recurred to me in which the delirious element was present appeared on more minute scrutiny to arrange themselves in two groups, one of which presented all the features of acute delirious mania, and the other of which presented the features of another condition which I shall venture to call "acute delirious melancholia." Greisinger has said with great truth that a classification of mental diseases according to their nature—that is, according to the anatomical changes which

lie at their foundation—being at the present time impossible, our division of mental diseases must be symptomatological, being founded upon the variety of physiological or psychological phenomena which they present to our observation. If this is so, there can be no impropriety—nay, there may be much utility—in separating those cases of mental aberration which present a common delirious character into two classes, according as they are marked by mental exaltation or mental depression. For it may be that the distinct emotional conditions may be significant of distinct cerebral derangements, having distinct histories and courses and requiring distinct modes of treatment. Dr. Blandford seems to be on the verge of admitting all this, when he says, “I believe our prognosis may be materially affected by a careful consideration of the emotional state. On the one hand we find the panic-stricken, on the other the hilarious. When I see a patient laugh and frolic, however noisy and outrageous his or her delirium, I augur favorably concerning the termination. I believe that the gaiety indicates a reserve of force which does not exist in the others.”¹ Here we have an acknowledgment that different types of mental disorder correspond with different fundamental abnormal states, and signalise with nice precision the progress of pathological changes in the cerebrum. Surely when this is so it is desirable to make a clinical analysis of delirious ideas, and to differentiate those steeped in anguish, dejection, and gloom, from those inflated with hope, or exuberant mirthfulness.

I have here quoted from the West Riding Asylum case-books the reports of two cases which seem to me to be representative instances of what I have called acute delirious melancholia. Although the mental traits in these cases are not very minutely described, enough is said respecting them to leave no doubt that they were of a profoundly painful and tormenting character, and that they preserved that complexion from first to last. The bodily symptoms by which they were accompanied were singularly distinctive, and indicate a deep and serious involvement of the organism. They justify, indeed, the impression which we might have formed *à priori*, that the vital energies are more imperilled in cases of delirium where there is mental depression, than in

¹ ‘Insanity and its Treatment,’ by G. Fielding Blandford, M.D., Edinburgh, 1871, pp. 227.

those where there is mental exaltation. They suggest, also, that the disease, perhaps, really depends upon a state of septicaemia, upon some morbid poison in the blood, or disturbance in its constitution. As far as I am aware, the blood has never been chemically or microscopically examined in such cases, so that we have no information as to whether changes exist in its physical properties or composition; the symptoms, however, point to some toxic condition in the great nourishing and co-ordinating fluid, producing destructive effects throughout the system. The febrile condition, the general weakness and uneasiness which mark the outset of the disease, its sudden incursion and quick implication of all the secretions and excretions, the rapid and extreme expenditure of flesh and strength, and the tendency observed in some cases to multiple centres of inflammation or suppuration, are all compatible with a poisoned state of the blood, or the presence in it of effete or deleterious matter, and are difficult to explain on any other theory. The cases here given do not illustrate the tendency to the occurrence of abscesses or secondary or metastatical inflammation, but I am informed by those who have had more experience than myself in lunacy practice, that it is no uncommon thing to find, in cases of an identical description, numerous small abscesses, crops of boils or local irritations, such as erythema, especially at the close of the disease, when it has been of a virulent type. It is noteworthy, also, that even in the cases described in this paper there was an indication of the tendency to local foci of multiplication or elimination in the abscess which followed the hypodermic injection in the one, and in the congestion of the intestines in the other. In both of them the exceedingly offensive odour of the excrementitious matters gave evidence of putrefactive changes in the body.

The influence of the blood in the causation of insanity remains yet to be investigated. We know that the nervous centres are exquisitely sensitive to the slightest modification in the condition of the blood; but we have not yet been able to connect special modifications with special aberrations of nervous function.

CASE 1.—S. S—, æt. 26, admitted July 31st, 1868. Married. Housewife from Dewsbury.

History.—The cause of her insanity is said to be "grief," the nature of which

is not, however, specified. She has been insane for seven days, and this is the first attack. Ten days ago she suffered from severe quinsy, but displayed no change of character nor mental peculiarity of any kind until the evening of the third day of the tonsillitis, when suddenly, without premonition, she went mad, stripping herself, tearing out her hair, and moaning in a piteous manner. Since then she has been sleepless, restless, and greatly distressed. She has attempted to strangle herself, has refused food, and has become very weak. She is the mother of three children, the youngest of whom is two years old. No relatives have been insane, nor have intemperate habits ever been indulged in.

On admission—She is a woman of middle height, with brown hair, grey eyes, and flushed cheeks. She is in an exceedingly feeble and exhausted condition, and, indeed, looks as if she were dying. She mutters incoherently. Her face wears an expression of restless anxiety and alarm. Her pulse is quick and feeble, her skin feverish, and her lips dry and cracked. She is ordered beef tea and brandy.

August 1st.—Has not slept, but is more tranquil, and partakes freely of nourishment.

2nd.—Has been much agitated during the night, but lies now in a torpid, half-conscious condition, from which she wakes up occasionally and raves deliriously. Will not take food. Pulse 150. Temp. 100°.

3rd.—Nutrient enemata were tried this morning, but returned at once unchanged. Since their administration she has been purged. She speaks a few words, expressive of fear and suffering, from time to time, but for the most part lies still and drowsy. Pulse 120. Temp. 100°.

4th.—Has scarcely changed since yesterday, but now occasionally endeavours to get out of bed. Her tongue is dry and brown, and her teeth are covered with sordes. She has not again been purged. Her urine is scanty and high coloured. Pulse 120. Temp. 100°. She is ordered 5 grains of sesquicarbonate of ammonia, with 15 minims of chloric ether, every four hours.

6th.—Is still restless and agitated. Her face is flushed, and all her muscles are tremulous in their movements.

7th.—Very restless and anxious. Is taking 7 oz. of brandy daily. Pulse weak and fluttering, 110. Temp. 100°. No rash has been at any time discernible. Her bowels act regularly.

8th.—Moans and cries as if in mental anguish. Her face is much flushed. Bowels costive. There is a small abscess on the arm, which has appeared in the site of a hypodermic injection of morphia given before her admission to this asylum.

9th.—Is now so weak that she cannot raise herself in bed. Ordered—

Ammon. Sesquicarb., gr. xl;

Sodæ Sulphit., ℥iiss;

Infus. Calumb. ad ℥viij;

℥j ter die.

11th.—No urine having been voided for twenty-four hours, a catheter was passed last night, when two pints of dark-coloured urine were drawn off. This morning she lies in a state of stupor, waking up and weeping from time to time. Her cheeks are still flushed. Pulse 85. Skin cool and dry. Tongue dry, and covered

with sordes. The bowels have not acted for three days, and are tender on pressure. Partakes readily of food and stimulants.

12th.—Is now constantly crying and fretting—says that she wishes to die. Catheterism still required. Urine acid. Decubitus dorsal. Pulse 95. Temp. 98.

13th.—Is very despondent, but has spoken rationally once or twice. Now lies on her side. The sordes have left the tongue, which is now much furred. Pulse 95. Temp. 98½°. Catheterism still necessary. Ordered castor oil and an effervescent draught. The bowels have not acted for six days.

14th.—Still feeble and despondent. Pulse 85. Temp. 98°. Tongue moist and clean. The bowels have not acted for a week; enemata ordered. The urine, which is still drawn by the catheter, is dark coloured, and of a very offensive and ammoniacal odour.

15th.—The bowels have at length been opened, after a dose of compound jalap powder. She is unable to pass water.

17th.—Catheterism still required. An enema of soap and water has brought away an accumulation of scybalous masses. Cardiac sounds soft but normal. Urine cloudy and offensive in smell.

18th.—She is very lethargic, and will not answer questions. Urine has been passed to-day without help, and the bowels have acted spontaneously.

19th.—Bowels open to-day. She makes water freely.

22nd.—She is dull and listless, and sheds tears occasionally. Will not converse. Her urine is still offensive, albuminous, and clouded with mucus. Both legs are swollen, present a glistening, whitish appearance, and pit on pressure; but there is no œdema of the face or hands.

23rd.—Her relations have visited her to-day. She recognised them, but would not hold any communication with them. Ordered—

Decoct. Pareiræ, ʒviij.

Sp. Æther. Nitric., ʒiv.

ʒj ter die.

24th.—Is still oppressed and apathetic, and a little excited at night and in the early morning. The bowels operate regularly; but the urine is thick and offensive, and deposits a white sediment.

28th.—Appetite ravenous. Legs still slightly œdematous.

30th.—Less depressed, but dull and stupid. Gazes vaguely around her, and does not appear to understand what is said to her. Got up to-day for the first time. Water clearing.

September 1st.—Much less miserable. Her attention can now be roused, when she will answer a question rationally. The urine is clear and free from albumen.

8th.—Is greatly improved. Can talk sensibly, but still feels anxious and apprehensive at times, without any explicable cause. Does a little sewing. The legs are no longer swollen.

13th.—Slightly depressed at times, but, on the whole, much better. Asks to be sent home. Eats and sleeps well. Bowels act regularly, and urine is normal. Ordered Tinct. Ferri Mur. ʒxv ter die.

November 17th.—Has continued to improve steadily in mental and bodily condition. Is to-day discharged recovered.

CASE 2.—M. N—, æt. 40, admitted October 2nd, 1869. Single; weaver; from Bradford.

She has suffered from amenorrhea for two months past, but was undisturbed in mind until three weeks ago, when all at once she became intensely dejected and terrified, expressing the delusion that a second flood was about to destroy the world. Since then she has been perpetually depressed and apprehensive; has had little or no sleep, and has abstained from food, occasionally for prolonged periods. She has declared her determination to put an end to her own life, and has endeavoured to strangle herself with a cord. No cause can be assigned for her insanity. No member of her family has been insane. She is not epileptic, and has never had a previous attack of mental derangement.

On admission.—She is a tall woman, of bilious temperament, with iron-grey hair, swarthy complexion, flushed cheeks, and a careworn expression of countenance, now intensified into a wistful, suspicious, fearful gaze. She is emaciated, and in a state of great prostration, such as to call for the immediate administration of beef tea and brandy. She moans and wrings her hands, and says she is lost.

October 3rd.—She has lain in bed perfectly quiet since her admission, except when interfered with, when she moans and weeps. She has only spoken on one occasion, and that was to ask for a drink of water. She cannot now be induced to answer or pay the slightest attention to any question addressed to her. She resists all attempts to feed her. The facial expression is that of mental and bodily pain. The limbs have a tendency to remain in any position in which they are placed. The capillaries of the cheeks are much dilated. The first sound of the heart is rather soft at the base. The respiratory sounds are normal. Pulse 120, feeble, and compressible. Temperature 99°. The lips and mouth are dry, and the teeth are covered with sordes. The tongue is coated with a thick, dark, yellowish fur. The breath is not offensive. She vomited yesterday immediately after admission, and since then has rejected everything administered, with the exception of a few spoonfuls of milk and lime water. Retching goes on even when the stomach is empty. There is no tympanitis of the abdomen, but marked tenderness over the stomach and descending colon. She groans when pressure is applied over these. The bowels have acted once since her admission, and the stool had a healthy appearance. There is no rash anywhere visible.

4th.—Milk and lime water are being given in small doses at short intervals; also whiskey, beef tea and wine. Nutrient enemata are also being administered. The vomiting still continues. A mustard poultice has been applied to the epigastrium. Pulse 120. Temperature 98°.

5th.—Moaning and drowsy, sometimes muttering a little. Last night ½th of a grain of morphia was injected under the skin of the arm. She vomited twice during the night. This morning a mixture containing bismuth and hydrocyanic acid was ordered, but was vomited as soon as taken. Nепenthe in mx doses every four hours has since been ordered. The enemata are not now retained beyond a few minutes.

6th.—Last night was for a short time much excited, struggling and fighting with every one who approached her, and talking incoherently. Is to-day quiet and apathetic; has not vomited for twelve hours, and has retained four nutrient injections. Pulse 100. Temperature 98°.

7th.—Has vomited three times since last report. The bowels have acted three times. Two motions consisted of changed injections, the third was fecal in character, and contained a little blood. There were some black coagula in the vomited matter yesterday. There is still tenderness in the abdomen, to which warm linseed poultices are being applied. The nepoche seems to exert a good effect. It is never vomited, and food is retained better for a couple of hours after each dose of it.

8th.—Has not been sick at all to-day. Talks incoherently, and begs to go home; muscles tremulous.

9th.—A sudden change for the worse came over her last night, when symptoms of exhaustion set in. This morning she is partially comatose. Her eyelids droop, and her eyes are glazed. The breathing is rapid, and there are râles over the whole of the chest. Her face is pinched and anxious. Mustard poultices were applied to the chest. She sank and died at eight p.m.

Post-mortem examination forty-eight hours after death.—The body is fairly nourished, and is free from any mark, bruise, or abrasion. The skin has an icteric tint. The skull is of average thickness, but unsymmetrical, projecting to the left side posteriorly. The dura mater is not thickened, but is slightly adherent to the skull anteriorly. The arachnoid is normal, but the vessels of the pia mater are full of blood. The convolutions are plump and in close juxtaposition. The whole brain weighs $45\frac{1}{2}$ ozs. The puncta sanguinea are very numerous, and the white matter has a pinkish tinge. The grey matter is of a reddish tint, and its outer is darker than its deeper layers. The ventricles are empty. The fornix is soft and pulpy, and the choroids and velum interpositum are congested. The ganglia are plump, but of a reddish tinge throughout. The cerebellum, pons Varolii, and medulla oblongata weighs $5\frac{1}{2}$ ozs. *Thorax.*—The heart weighs $7\frac{1}{2}$ ozs. The mitral valve is incompetent to a very slight degree. The cavities, which are of average size, are occupied by dark fluid blood. The muscular substance is firm. The left lung weighs 17 ozs.; its anterior margin is emphysematous. Frothy mucus exudes from its bronchi when they are cut across. The right lung weighs 19 ozs. It is in the same condition as the left, but contains a few nodules of tubercle, and presents a few small cicatrices at its apex.

Abdomen.—The liver weighs 37 ozs. Its substance is rather harder than usual. The gall bladder is full of bile, and its duct patent. The spleen weighs 4 ozs., and is of firm consistence. The right kidney weighs 4 ozs., as does also the left. The capsules of both strip freely off, and are of average thickness. Their substance is somewhat dark-coloured and congested. There is considerable congestion of the mucous membrane of the stomach and duodenum. The mucous membrane at the cardiac end of the stomach is very thin, that at the pyloric extremity is much thickened. The mucous membrane of the cæcum is greatly congested, of a dark claret colour, and also thickened. That of the rectum is also congested, and there are several small round ulcers with clean-cut edges, and about the size of a pea. There is no trace of congestion in the ileum.

Little need be added by way of comment to what has been already said in introducing these cases. One consideration suggests itself, however, and that is, that the danger in acute

delirious melancholia seems to be in proportion to the involvement of the alimentary tract, and the length of time during which abstinence has been observed, rather than to the severity or prominence of the nervous symptoms. M. N—, who had been refusing food for some time previous to her admission, and who suffered from persistent nausea and vomiting, interfering with the administration of nutriment, died; whereas S. S—, who always took food freely, recovered, although in her the nervous symptoms were more serious than in M. N—. This being so, it is clear that adequate alimentation ought to be insisted on from the very beginning of the disease, and, therefore, that removal to an asylum ought to be at once resorted to in every case where a disinclination for food is manifest. No doubt lives are lost because food is permitted to be evaded or declined in the early stages of some mental diseases.

In connection with the theory advanced as to the influence of the blood in the production of acute delirious melancholia, it is interesting to remark that in the brain of M. N— there was irregular coloration of the cortical substance, and particularly a deep tint of its superficial layers—appearances which are frequently observed when death takes place from typhus fever.

The view of the pathology of acute delirious melancholia as suggested, would if adopted, of course influence treatment in a material degree. Supposing the train of symptoms observed to be due to the presence of some pernicious matter in the blood, it would become of paramount importance to aid in the expulsion or decomposition of that pernicious matter; and hence baths, warm, and especially Turkish, diaphoretics, aperients, diuretics, and all agents which would aid the excreting organs might be expected to be of great service. At the same time, means would be required to control the mischievous action of the pernicious matter upon the supreme centres so that chloral or bromide of potassium, or narcotics, would be necessary. Wine and other stimulants would be most salutary in their operation, by tranquillising the agitated nervous centres, at the same time that they sustained strength and vigour. Ample supplies of nourishment would be essential, in such form and as frequently as the digestive apparatus would allow,

to support the system during the struggle between health and disease. Animal broths, jellies, milk, and farinaceous liquids, given frequently in small quantities, would be particularly eligible articles of diet.

ERGOT OF RYE IN THE TREATMENT OF MENTAL DISEASES.

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HAVING critically watched the treatment of a large number of cases of mental disease by ergot of rye during my residence at the West Riding Asylum, and having become convinced of the substantial nature of the benefits derived from that treatment in the conditions referred to by Dr. Crichton Browne, in his article in 'The Practitioner' for June, 1871, I have thought that memoranda of a few cases, in which the effect of the remedy was peculiarly evident, might prove interesting and instructive. I shall not animadvert upon the theory advanced by Dr. Browne as to the mode in which ergot acts upon the brain and its functions, further than to say that it received considerable confirmation, in my mind, from a case of severe neuralgia, in which I saw it used, and in which excessive flushing and heat of the face and head disappeared consentaneously with the relief of the pain, which it seemed to secure almost at once.

* It appears important to mention that the liquid extract of ergot has now almost superseded the tincture in the practice of the West Riding Asylum. Experience has proved that that preparation is more to be relied upon for certainty and uniformity of action.

CASE 1.—M. L., female, æt. 80, admitted 4th October, 1866, from Great Preston, a widow. Second attack. No cause known. When admitted was in a state of great excitement, stripping herself, tearing her clothes, and talking continuously and incoherently.

During the last five years she has been visited by about three attacks of excitement annually. The intermediate periods of calmness separating these attacks

have varied somewhat in length; but the attacks themselves have been remarkably constant in length. The excitement has always abated punctually at the end of the sixth week, and no attack, except the last one, has had a shorter duration. Much embarrassment has been experienced in treating these attacks, each of which, of course, put in jeopardy the life of a patient at so advanced an age. Hyoscynamus was found to mitigate their severity, but not to curtail them. At first hesitation was felt in employing ergot, because the patient suffered from that peculiarly friable condition of the capillaries of the skin which is characteristic of *purpura senilis*, and from which petechiæ and ecchymoses resulted on the application of the slightest pressure. It was feared that this condition might favour the production of ergotism. But, as the therapeutic properties of *secale cornutum* became better known, this apprehension was no longer felt, and in the last attack of excitement it was resolved to give that remedy a cautious trial.

The attack commenced on the 6th of June, and was well developed on the 7th. The old woman had shaken off the torpidity of age, and was animated, unsettled, garrulous, rambling uninterruptedly through a conversational labyrinth without any clue.

On the 8th of June 3j of the liquid extract of ergot was ordered to be taken three times a day.

On the 9th it was noticed that the excitement was more subdued in character, and that little snatches of sleep were obtained. Throughout the remainder of the paroxysm the excitement preserved this subdued character. It was much more moderate in degree than it had been in any previous paroxysm, and never reached that point where there is confusion as to the identity of surrounding persons. In all former attacks the officers of the institution had been mistaken for relatives; in this one they were always addressed by their proper names. The excitement consisted simply in restlessness, talkativeness, and slight incoherence. At the end of three weeks it altogether ceased. The patient was tranquil and rational. In this case we may credit the ergot with general alleviation of the severity of the attack, and with its abridgement to the extent of three weeks, or one half of its average duration.

CASE 2.—L. H—, female, æt. 26, admitted 8th August, 1868, from Leeds; single. Has been epileptic from birth, and has latterly manifest great failure of her mental powers. When admitted she was described as a woman with dark hair and a florid complexion, apparently in robust physical health, but exhibiting that slowness in cerebration, clumsiness in manner, and hesitancy in speech, which are so familiar in the chronic epileptic. Up till the end of 1870 no great change was noticed in L. H—. She continued to be subject to epileptic fits from time to time, and to be ordinarily stupid and partially demented. Then, however, epileptic mania betrayed itself. After a succession of fits wild excitement came on, and since then a similar attack has occurred about once a month. Fits have happened every second or third day, and have culminated once a month in mania. In the present year attacks of mania came on, on January 2nd, February 4th, March 6th, March 30th, and April 28th. The first four of these were treated by bromide of potassium with sumbul. and a copious allowance of stimulants, which did not, however, appear to tell upon them in any way. They were all marked by disorderly, reckless muscular activity, screams, imprecations, blows, gradually merging

into stupidity and complete fatuity, which in a few days gave way to the habitual mental state of partial fatuity. The excitement and profound fatuity together never lasted for less than eight days. The last of the attacks enumerated, that on the 28th of April, was treated by the hypodermic injection of morphia. A quarter of a grain was injected under the skin of the arm at 9.30 a.m., and another quarter of a grain at 6 p.m. At 8.45 the patient was found in a state of deep coma, breathing stertorously once in every 30 seconds, with a scarcely perceptible pulse, cold extremities, a livid countenance, and fixed and contracted pupils. Three hours of artificial respiration, flagellation, galvanism, and diligent medical attention were required before recovery took place. After this the attack pursued the usual course, and lasted just eight days. The next attack of excitement was inaugurated on the 3rd of June, when ergot (3j of the liquid ergot every four hours) was at once prescribed, and with magical effect. The excitement vanished after the second dose, and the mind cleared up to its usual condition. The attack was not more deferred by the ergot which was taken for a fortnight, as no attack of excitement nor threatening thereof has since occurred up to the present time (July 10th).

CASE 3.—T. B., male, æt. 41, admitted 12th May, 1870, from Bradford, having been discharged about two months previously. For several years past he has suffered at wide intervals from outbreaks of furious excitement, in which he is destructive and dangerous. At the time of his admission he had just experienced one of these outbursts. The next came on on the 24th of December. It continued for nearly three weeks, and occasioned considerable damage to property, being but little affected by antimony and ipecachuana which were administered. Excitement again appeared suddenly at 3 a.m. on the morning of the 4th of June. The patient got out of bed, broke into fragments the window shutter and door of his room, and the furniture which it contained, and bellowed horribly and uninterruptedly. His complexion was scarlet, his pupils were contracted, his pulse bounding; while the superficial veins of his neck were raised like cords above the surface. Liquid ergot (in 3iss doses) was administered at 3 p.m., and again at 7 p.m. It seemed to soothe him immediately. During the night he was noisy at times, but the following morning, after two more doses, he was quiet and docile. In the afternoon he announced himself quite well, only a little tired and dizzy. The next day he returned to his usual occupation. He fully appreciated the effects of the ergot, and said that he "never felt anything take such a hold of his head."

CASE 4.—M. H., female, æt. 23, single, admitted 13th March, 1869, from Keighley. Has been epileptic for many years, and is much excited occasionally. When excited rushes and staggers about, kicking everything that comes in her way, and attempting suicide by tearing with her fingers at her throat. For some months after her admission these attacks of excitement, which recurred irregularly, were always of a week's duration. In July, 1869, ergot was tried in one of them, and cut it short in the most satisfactory manner in twelve hours. Since then it has been repeatedly employed under similar circumstances, and invariably with beneficial results. Not only does it interrupt the excitement, but it moderates its character, and seems to diminish its tendency to return. The attacks

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are less frequent, the efforts at self-destruction are less determined, and the process of mental degeneration appears to have been arrested.

CASE 5.—E. D—, female, æt. 67, admitted 10th December, 1866, from Wakefield. Was then in a state of subacute mania, restless, sleepless, and talking incoherently, chiefly upon religious subjects. She also presented symptoms of hepatic disease. Since then she has had repeated attacks of excitement and biliousness. The attacks have occurred about twice a year, and have continued for a couple of months each. Sedatives have been tried, but without any decided benefit. The age and infirmity of the patient were thought, until recently, to contraindicate the ergot treatment. One of the usual attacks made its advance on the 9th of June last in the ordinary way. The patient complained of a feeling of malaise, and harped in a shrill key and with vexatious iteration about her imagined wrongs and personal righteousness. 3i of ergot (liquid extract) was ordered three times a day. The next day the excitement was subdued. On the 16th of June the patient was perfectly quiet and well, so that the ergot was omitted. On the 18th she was again in a state of great excitement, turbulent, disorderly, and unmanageable. The ergot was resumed with the result of restoring tranquillity.

CASE 6.—E. B—, female, æt. 29, was admitted 10th March, 1860, from Carlton. She had attempted to injure her relatives, and was in a maniacal condition. During the eleven years of her residence here she has suffered from chronic mania, with occasional intervals of comparative lucidity. The pharmacopœia has been nearly exhausted in attempts to overcome her turbulence, but with very little success. For a time, some years ago, cannabis indica with bromide of potassium was beneficial, but ultimately it lost its effect. In the present year ergot has been employed with gratifying results. The excitement is now thoroughly controlled by a few doses of that drug. It has been noticed that since she began to take it, and since the excitement yielded to its influence, she has exhibited unusual somnolency, sometimes sleeping during the day for several hours, besides resting well at night.

I may add to these cases by way of remark, that I believe the full efficacy of ergot as a therapeutic agent in the treatment of cerebral derangements has not yet been indicated. I believe I have seen it secure rapid recovery from that singular and obscure condition, the status epilepticus. I gather also from an examination of the asylum books that much less of the status epilepticus has been seen since the ergot treatment was introduced, and I infer, therefore, that the ergot generally given during any maniacal outbreak to the worst class of epileptics—those most prone to pass into the status—has some power in warding off such hazardous complications. The same observations would apply to the status convulsions.

It has sometimes occurred to me that bromide of potassium, the value of which I would be far from depreciating, has a tendency, in some cases, to aggravate the attacks of epileptic mania. It seems to relieve the muscular at the expense of the mental element in the epileptic condition. The fits are reduced in number and severity, but the paroxysms of mental disturbance are intensified and prolonged. Under such circumstances, ergot becomes of the highest service; its use, alternated with that of the bromide of potassium, places the two phases of the malady under equal and powerful control.

In order that the beneficial action of ergot may be secured in recurrent mania, it is requisite that its use should be discontinued in the intervals between the attacks of excitement. Neither to prevent or postpone the recurrence of the attacks, nor to shorten or modify the excitement, is it requisite that the drug should be taken uninterruptedly for long periods.