Pathological and histological researches on inflammation of the nervous centres / by John Hughes Bennett.

PATHOLOGICAL AND HISTOLOGICAL

RESEARCHES

ON

INFLAMMATION OF THE NERVOUS CENTRES.

BY

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Nicht die Form zeigt euch die Wahrheit
Nicht der Stoff führt euch zur Klarheit;
Müsset beide gleich behandlen
Wollt ihr nicht im Irrthum wandeln.
GOETHE.

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PATHOLOGICAL AND HISTOLOGICAL RESEARCHES, &c.

On entering upon a field so new and unexplored as that of the morbid structural changes in organs discoverable by means of the microscope, it seems necessary for the inquirer to separate as much as possible the facts or actual appearances observed, from the suppositions and theoretical conclusions to which these may give rise. It has further appeared to me essential that the histological examination of diseased organs should be studied in relation with the symptoms and usual *post mortem* appearances observed; for if such inquiries are ever to be useful in a practical point of view, they can only be rendered so by connecting them with clinical observations. I have been guided by these views in investigating the subject of inflammation of the nervous centres, and have thus been enabled to arrive at results which appear to me sufficiently novel and important to justify their publication.

For the last twelvemonths I have neglected no opportunity which presented itself to me of examining microscopically the human brain and spinal cord. My observations have extended to 54 such cases, which for the most part were examined after death in the Royal Infirmary of Edinburgh. They are detailed at length in the hospital books, and in a more condensed form in the book of dissections kept by Dr Peacock, the prosector to the institution. I have myself observed the symptoms in many of these cases when living; have been present at the *post mortem* examination of all with the exception of five, and have examined with the microscope the cerebral structure in every instance.*

In many cases where death had been occasioned by chest or abdominal affections, no functional or organic lesions of the nervous

* I must here express my obligations to the different physicians and surgeons of the Royal Infirmary, who have permitted me to publish the details connected with their respective cases. My thanks are especially due to Dr Peacock, prosector to the institution, for the readiness and obliging manner with which he has at all times placed portions of structure at my command, and furnished me with information respecting the different cases. The cultivators of scientific medicine have every reason to feel gratified when such situations are filled by gentlemen who, themselves ardent investigators of disease, are yet willing to allow others all the advantages which their position furnishes.

centres could be discovered. In others, where death evidently depended upon disease of the brain or spinal cord, abnormal appearances could readily be observed, such as increased vascularity, effusion of lymph, hemorrhage, softening, tumours, &c. The structure of the nervous textures thus altered by disease was carefully examined with the microscope, and the results noted at the time. In other cases, again, where there had been violent head symptoms, and yet where nothing could be detected by ordinary vision, I was often enabled to show, by means of the microscope, decided structural alterations similar to those seen in more evident lesions. I shall therefore divide the cases to be detailed into two principal groups, in which were observed, 1. Well known lesions of the nervous centres, appreciable to ordinary sight; and 2. Lesions imperceptible to ordinary sight, detectable only by means of the microscope. In cases belonging to the first group it has occasionally happened that, in other portions of the nervous centres, microscopic evidence alone of disease has existed; but these will be pointed out and commented on in the remarks appended to each observation.

I.—Observations connected with well known lesions of the nervous centres, appreciable to ordinary sight.

Obs. I.—*Typhus Fever, Delirium, sudden Hemiplegia and loss of speech; contraction of the right arm, death in fifteen days, portion of the left hemiplegia involving the corpus striatum softened; nervous tubuli broken up; numerous exudation corpuscles and granules.*

Robert Fairgreave, aged 40, a labourer, much addicted to drink, was admitted into the Royal Infirmary, August 6th 1841, under Dr Alison. A week before admission he was seized with rigors, headach, sickness, loss of appetite, thirst, and hot skin. These symptoms, with the exception of rigors, still continued when he entered the house; the urine also was scanty and high-coloured. The pulse was 80, full and compressible, bowels regular. On the 8th, the pupils were contracted, and there was a considerable eruption on the skin. During the night of the 9th, there was some delirium; on the 11th, there was stupor and coldness of the extremities; pulse 108, feeble. (Wine and spirits.) On the 12th, pulse was still 108, but of good strength; pupils still contracted. There has been twitching of the mouth, which has now subsided. From this time he went on apparently improving until the 18th, when he was seized with hiccup; the surface became cold, and he fell into a state of insensibility; the mouth was drawn to one side; the right arm was paralyzed; urine passed in bed; pulse 98, of good strength. 19th, Continued speechless; still paralysis of the right arm, and distortion of the face; surface warm; stools passed in bed; pulse 92, of good strength. 20th, Hemiplegia of right side is complete; returning consciousness. 21st, Takes food, but does not speak; eruption has disappeared; skin becoming cold; some contraction of the right arm. 22d, Skin cold; respiration somewhat laboured.

24th, Less contraction of the arm; countenance more intelligent; tries to put out his tongue when asked. 28th, Still speechless; contraction of the arm has ceased; appears drowsy. 30th, Insensibility more profound. September 1st, Stools passed in bed; rigors this morning. 2d, Takes no food; rigidity of extremities. Died September 3d.

Sectio, September 4th.—On opening the cranium the membranes presented nothing abnormal. About the middle of the left hemispheres a circumscribed portion of the cerebral substance below the membranes appeared of a reddish hue. On cutting through this portion into the substance of the hemisphere, the medullary substance, together with the external portion of the left *corpus striatum*, was found softened to about the extent of a small hen's egg. The softening gradually extended towards the reddish portion on the surface previously noticed. The centre of the softened part, about the size of an almond, was of pultaceous consistence, and from this centre the cerebral substance grew more and more firm, until it attained its normal character. This centre also was of a dirty yellow, and the softened part surrounding it of a bright rose colour. ℥ss. of serum was collected from the ventricles by means of a pipette. Walls of the ventricles and other portions of brain healthy; other organs in a normal state.

Microscopic Examination.—The medullary matter towards the circumference of the softened portion was first examined. The varicose and cylindrical tubes of the brain were readily separated from each other and broken down; mixed with them and their debris were numerous granular bodies, considerably varying in shape and size. Some were perfectly round, others oval, and others again of irregular form, having one or more sides, and irregular indentations. In size they varied from $\frac{1}{100}$ to $\frac{1}{25}$ of a millimetre in diameter. Some of these bodies possessed an envelope in which the granules were enclosed, in others no envelope could be observed. In the former the edge of the corpuscle was abrupt, regular, and well-defined; in the latter ragged, irregular, and confused. They were generally of a brownish colour, some light, but others so dark as to appear almost black, and so opaque as to obstruct the passage of light. I could not in this instance detect any distinct nucleus in these bodies. There were also a number of granules floating loose amongst the tubes, similar to those contained in the corpuscles just described. These varied in size from $\frac{1}{600}$ to $\frac{1}{250}$ of a millimetre in diameter. When viewed thus isolated they appeared perfectly round and transparent, presenting a bright white central spot, with a black, abrupt, and well-defined edge. See Plate V. Fig. 1.

On examining a portion of the softened substance still nearer the centre, the same appearances were observed. The loose floating granules, however, appeared more numerous. In the yellow pultaceous centre itself the nervous tubes appeared utterly destroyed. Nothing could be seen of them but short fragments, and round and oval globules bounded by a distinct double line. They were highly elastic, and appeared to be separated varicose swellings of the tubes.

The granular corpuscles described had lost their regular shape. They were much smaller, apparently broken down, and scattered widely in the field of the microscope. The granules, on the other hand, were more numerous. Fig. 2.

On examining a portion of the brain which looked healthy, immediately at the edge of the softened portion, a few of the corpuscles still appeared, but they diminished in number, and were entirely absent half-an inch from the softened portion.* Fig. 3.

Remarks.—In this case the continued cephalalgia and contraction of the pupils at an early stage indicated strong congestion of the brain. The stupor which succeeded, the sudden loss of consciousness, paralysis of the right arm, and distortion of the face, followed by complete hemiplegia; then contraction of the right arm, return of consciousness, but continued loss of speech; and then relapse into a state of insensibility and rigidity of the extremities before death, constitute a group of symptoms highly characteristic of acute inflammatory softening. The softened cerebral substance after death, existing in the hemisphere opposite to the paralyzed side, the yellow pultaceous centre and surrounding pinkish inflammatory margin, could leave little doubt that it was the cause of the previous symptoms. The lesion, from being so well-marked and unequivocal an example of softening dependent on inflammation, offered the best opportunity for examining its histological elements. Here, it is worthy of remark, that the yellow centre, which all who examined it conceived to be purulent matter, presented none of the well-known structural appearances peculiar to that fluid.

The dark granular corpuscles described have been named compound inflammatory or aggregation globules (Gluge.) Exudation globules (Henle, Vogel, Gerber.) According to my observations these bodies are of two kinds—some being merely composed of numerous granules aggregated together, whilst others are enclosed in a distinct envelope. In future I shall denominate the former *exudation masses*, and the latter *exudation corpuscles.* The granules will be termed *exudation granules.* A more complete description of each, with their mode of formation, and the changes they undergo, will be given in a future part of this paper. In the meantime, these terms will prevent the necessity of repeating the descriptions of each in the subsequent observations.

* The microscope generally employed was a very excellent achromatic instrument, constructed under my own eye by Vincent Chevalier of Paris. Occasionally, however, I employed instruments manufactured by Oberheuiser and Brunner of Paris. The mode of examination consisted in simply placing minute portions of different parts of the cerebral structure between slips of glass, and pressing them so as to render the whole capable of being examined by transmitted light. The magnifying power usually employed was 300 linear diameters, which I have always found sufficient for such investigations, although I have often magnified the object 3000 linear diameters. At different times during the past year similar appearances to those described have been shown by me to several of the physicians of the infirmary, and of this city, and to the pupils attending my classes.

Obs. II.—*Hypertrophy of the heart with mitral disease; hemiplegia of the left side; loss of consciousness; return of intelligence; and partial diminution of paralysis; death six months after; softening of the right corpus striatum, and the cerebral substance surrounding it; nervous tubes broken up, mixed with exudation masses and corpuscles; vessels of the diseased part coated externally with exudation granules.*

Ellen Bayne, aged 25, admitted into the Royal Infirmary, June 8th 1841, under Dr Craigie: married. Six months ago she was attacked with pain in the heart and giddiness, followed by want of power in the whole of the left side of the body, and loss of speech. On the following day she became insensible, and remained so nearly a fortnight; at all events more than a week. She entered the hospital in Aberdeen, was bled and underwent other treatment, and has gradually improved until now. The symptoms on admission were, weakness in the left side and left extremity, with inability to place the left foot firmly on the ground. She has recovered the power of the left side of the face, and has considerable command over the left upper extremity; loss of appetite. (Bleeding, purgatives, and blister to the head.) She remained in this state until July 8th, when she complained of pain in the region of the heart. A sonorous rattle was heard in the chest; respiration not very audible; impulse of the heart was strong, and a rough rolling murmur with the first sound. (Bleeding to ℥xiv.; blister to cardiac region.) 14th. Cardiac action less violent; has little power over index-finger of left hand. On July 20th, she went out of the Infirmary by her own desire, but was brought back on the 25th, with the following symptoms: Surface of the body and extremities cold; pulse gone at both wrists; respiration laborious; sensible, recognized surrounding persons; voice feeble; difficulty in speaking; lips livid; general prostration. (Stimulants, blisters, turpentine enema.) Died 10 P.M. It is stated that she has had frequent miscarriages; that on leaving the house she slept on a cold floor, and caught cold; had constipation and fever, which increased with difficulty of breathing until her readmission.

Sectio, July 27th.—The subarachnoid cellular tissue was infiltrated with serous fluid, and the vessels of the *pia mater* much loaded with dark-coloured blood. On making sections into the hemispheres, much serum escaped. The ventricles were somewhat enlarged; ℥ss. of serum was taken from the right ventricle, and ℥ij. from the left one. The whole surface of the right *corpus striatum* was of a fawn colour, had lost its rounded convex appearance, and though smooth, was soft and pulpy in consistence. External to the right *corpus striatum*, the medullary matter was softened, and its texture broken up into a pulp. The colour of this softened portion was of a yellowish-red, its size about that of a hen's egg, and it grew more dense in consistence towards the periphery. The right Sylvian artery opaque, firm, friable, and contracted. Rest of the brain normal.

The heart was enlarged in all its dimensions, weighed ℥xiij. The right ventricle was enlarged half as much again as its usual size, and its parietes were thicker and firmer than natural. There were cartilaginous and bony depositions in the mitral valve, encroaching

considerably on the left auriculo-ventricular opening, The little finger could scarcely be introduced into it.

Microscopic Examination.—The varicose and medullary tubes throughout the whole of the softened portion readily broken down; more so towards the central pultaceous part. Numerous exudation corpuscles, granules, and masses scattered through the diseased structure. The latter varied much in shape, some being triangular, some having different sides, some more round, and others oval. Their size varied greatly. Some were formed of a congeries of two, three, or more granules, whilst others were composed of a hundred of these. Many of the intermediary and larger blood-vessels were coated externally with a thick layer of these granules. This layer was sometimes two or three times thicker than the vessel in connection with it, and was in many places cracked or split up, forming similar masses to those floating loose. The granules composing these masses were readily separable from blood-globules by their minute size, and by the absence of any central nucleus. The blood-globules might frequently be seen unchanged within the same vessels which were coated externally by the granules. Fig. 4.

Remarks.—The progress of the symptoms was more gradual in this case than in the last. If the statements of the patient were to be relied on, the cerebral affection commenced like certain forms of apoplexy. This is by no means uncommon in cases of softening, and I have myself seen this occur so frequently, that I some time ago described this change as one of the anatomical lesions producing that disease.* The phenomena connected with the first and last attacks were imperfectly observed, as she was at the time under no medical care. The absence, therefore, of contraction, mental confusion, and other symptoms in the report, are not to be considered as proofs of their non-existence. The dissection exhibited an anatomical lesion, referable to inflammation, although, instead of the bright rose-colour observed in the last case, it was of a brownish or yellowish tinge. Here it must be remembered, that in the first case the softening was only of fifteen days standing, whereas in the present one the morbid alteration had probably existed six months. A microscopic examination, however, showed it to be composed of the same histological elements, only that, instead of exudation corpuscles, exudation masses were more numerous. From the disposition of such masses as were connected with the vessels, together with the numerous granules coating them externally, the origin of these appearances was clearly indicated. It at once became evident that a portion of the fluid part of the blood had transuded through the vascular walls, and coagulated in the form of granules external to them.

Obs. III.—*Sudden loss of consciousness; hemiplegia of the right side; thickness of speech and obtuseness of intellect; death thirteen*

* Library of Practical Medicine, Art. Apoplexy, Vol. ii. p. 89.

months and a-half after the attack; left corpus striatum and surrounding cerebral substance softened; hypertrophy of the heart, with disease of the mitral and aortic valves; Bright's disease of the kidneys; exudation corpuscles in the softened portion.

Patrick Mackearnan, aged 33, admitted into the Royal Infirmary under Dr Craigie, June 15th 1841; by occupation a sawyer. About twelve days before admission, while engaged in sawing wood, he fell and struck his back against a block of timber. Much pain and difficulty of breathing were occasioned, to relieve which symptoms he took a considerable quantity of whisky. On the 12th of June, nine days after meeting with the above accident, he suddenly fell down insensible while at work, without having complained of headach previously, and on being assisted to rise, it was found that he had lost the power of speech, and that of motion over the right arm and leg. (Bled, purgatives, head shaved, and cold applied.)

On admission there was complete resolution of the right extremities, all sensibility and motor power in them being lost. His speech was thick, and he answered questions incoherently. The tongue, when protruded, was turned to the right side, and the apex was depressed. The pulse was 66, strong and full; the countenance much flushed, and the pupils somewhat contracted. He slept almost continually, but had no delirium. The cardiac beats more slow and distinct, and the last sound prolonged, and attended with a bellows murmur. 16th. There was no pain in the head, but some vertigo; other symptoms the same. (Large bleeding and purgatives.) 23d. The urine passed amounts to one pint in quantity, deposits a white sediment, and is of an ammoniacal odour. 25th. The paralysis unchanged; answers questions stupidly, and comprehends with difficulty. July 7th. No change, although he communicates more clearly that the right side has lost all sensibility. 15th. More intelligent; a slight return of command over the right leg. 26th. He answers questions in monosyllables, but seems to understand them better than formerly. Paralysis the same as at last report. The left angle of the mouth still drawn towards the ear. Complains of pain in the right arm, and an uneasy feeling over the whole of the right side when the limbs are moved or touched. (Strychnine internally.) August 4th. The whole of the skin of the right side of the head, right arm, chest and side, covered with a profuse perspiration, while, with the exception of the left side of the face, the left side is dry and natural. 13th. He complained of symptoms of pyrexia, and erysipelas now became developed, which first covered the left, and subsequently the right side of the head. He had completely recovered from this on the 31st, when he was found to have regained considerable command over the right leg, but none over the right arm. The mouth was still drawn on one side, and he continued to speak in monosyllables.

From September till June 1842, he had so far recovered as to be able to walk about the ward with the assistance of a stick. He was then seized with a fresh attack of erysipelas, during which he rambled more, and complained of pain in the head, in the right side, and in the leg, his arm during the whole of this time continued entirely powerless. From this time he remained in bed, gradually de-

clining in strength. His mind was throughout stupid and peevish; a fortnight before his death, the legs became œdematous; died suddenly on the 1st of August 1842.

Sectio, August 2d. The *dura mater*, more especially in the course of the longitudinal sinus, was opaque and thickened. A small mass of lymph, of a yellow colour and size of a sixpence, was found on the upper surface of the right posterior lobe, near the longitudinal fissure. Both ventricles were dilated; ℥iij. of fluid of a pale colour was removed from the right, and ℥j. from the left ventricle, which was fully three times the size of the opposite one, the septum being completely pushed over to the right side. This dilatation occupied chiefly its posterior and inferior cornua. The central portion of the left *corpus striatum* presented a patch about the size of a shilling, of a hard texture and dirty yellow colour, rough and irregular on the surface. On making an oblique section through this from within outwards, it was found to constitute the internal boundary of a softened space, about the size of a walnut, which extended to the external and lateral surface of the hemisphere, above the course of the *fissura Sylvii*. The convolutions which constituted the external boundary of this softened space were of pultaceous consistence, and the arachnoid covering them as well as the *pia mater*, were much thickened. The softening itself was so diffluent, that, after making the section, a cavity was left. Immediately surrounding this, the medullary texture was of a fawn colour and soft, gradually disappearing till it terminated in healthy brain.

The heart weighed 21 ounces, and was of unusually large size; the left ventricle was greatly hypertrophied and dilated; the mitral aperture was studded with warty growths, and the large fold of the valve was opaque and thick, having attached to it several large firm masses fully three-quarters of an inch in length. The aortic aperture was closed only by two valves; these were covered with irregular vegetations of irregular shapes; the right ventricle and auricle considerably dilated; a considerable aperture existed between them, admitting of considerable regurgitation; the aorta was considerably dilated throughout the whole of its thoracic portion; both kidneys were in the second stage of granular degeneration.

Microscopic Examination.—I was not present at the *post mortem* examination, and only examined on the subsequent day a portion of the softened cerebral substance kept for me by Dr Peacock. This contained numerous exudation corpuscles and granules, the latter coating the vessels in great numbers. Near the central cavity no trace of nervous tubes could be seen, the whole being broken down into a grumous granular mass, in which fragments of nervous tubes, exudation corpuscles, and their envelopes could be detected, with occasional fat and blood globules, Fig. 10.

Remarks.—The mental faculties are frequently affected in cases of softening, and that in a peculiar manner. The memory is weak and more or less abolished; the patients do not readily comprehend questions, and their replies are not to the point; the countenance has a stupid expression, and the speech is more or less

thick, slow, and embarrassed. Such appears to have been the state of this man for many months, combined with hemiplegia. No contraction or rigidity of the paralyzed parts, however, was at any time observed. It should be remarked, however, that he laboured under the disease three days before admission, during which time the symptoms were not well observed. I think it will be found that contraction and rigidity are symptoms of very acute softening at the commencement, or of irritation supervening upon chronic disease. In the present instance, the progress of the affection was slow. The primary suddenness of the attack, combined with the *post mortem* appearances, also gives rise to the suspicion, that it must have been accompanied with hemorrhage. May not the central cavity, and the hardness in some of the portions which bounded it, have been owing to the original presence of a coagulum, and to subsequent efforts made by nature to remove it? The usual colour generally found in old apoplectic cysts was wanting, but then the symptoms indicate that softening was connected with the coagulum from the commencement, which might have produced the unusual appearances. It is at least evident from this case, that the exudation corpuscles and masses which have been described not only exist in acute softening, but may be present in very chronic cases.

Obs. IV.*—*Cephalalgia; feebleness of intellect; hemiplegia; convulsions; complete resolution of the limbs; death ten days after attack of hemiplegia; left corpus striatum softened; right corpus striatum and portion of medullary substance softened; numerous exudation corpuscles presenting a nucleated character in softened substance of right hemisphere.*

Alexander Davidson, a mason, aged 56, of rather intemperate habits. Four years ago he had a severe fall, which was followed by a degree of paralysis of the face for some time afterwards. Otherwise he has ordinarily enjoyed good health, with the exception of occasional attacks of headach and giddiness. For the last three months he has given evidence of weakness of the mental faculties. On the 16th of January 1842, he was in good health. When getting up, however, on the morning of the 17th, his wife first observed that he could not without difficulty raise his left arm, and that in walking he dragged his left leg a little. When first seen on the 20th, his countenance was flushed, and had a stupid expression; the left corner of the mouth was sunk down; the left eyelid inclined to droop; pupils natural; conjunctivæ smeared with mucus; pulse 90, feeble. In walking, the left leg was dragged; the left arm lifted with difficulty; sensibility of the affected side unimpaired; no rigidity of the limbs; tongue well protruded. (Purgatives; blister to back of neck.) On the 22d, the pulse was 100 and firm; the left eyelid more drooping; deglutition difficult; restless night, with jactitation of limbs. (Bled from a large orifice to ℥xij., when syncope appeared. More blood es-

* Dr Ransford invited me to be present at the examination of this case, and to him I am indebted for the details regarding it.

caped from the opening during the night ; blood slightly buffed ; crassamentum firm.) 23d. Convulsions confined to the left side ; no control over the bladder ; deglutition more difficult ; ptosis of left eyelid. (Head shaved ; cold applications.) 24th. Complete resolution of the limbs ; generally drowsy, but sometimes appears sensible. He became more and more comatose, and died on the 27th.

Sectio, 25 hours after death. A considerable quantity of blood escaped on sawing through the occiptal portion of the cranium. Membranes rather more vascular than usual, with some patches of osseous deposit on the *dura mater* in the course of the longitudinal sinus. Subarachnoid serous effusion, more especially over the right hemisphere, which was broader than the left one. No fluid in the ventricles. The right *corpus striatum* was softened, in some portions much more so than in others, presenting somewhat of a cribiform appearance. The medullary matter external to it also softened to the extent of a hen's egg. It was of a reddish colour, and of a pultaceous consistence in the centre ; optic thalamus was healthy ; the left *corpus striatum* also softened in consistence, but unchanged in colour ; the softening was circumscribed to the *corpus striatum ;* the surrounding parts and other portions of the brain healthy.

Microscopic Examination.—The softening on the right side contained numerous exudation corpuscles, both floating loose and attached external to the vessels. In the central pultaceous portion the varicose and cylindrical tubes were much broken down, and numerous corpuscles and granules were floating among them. These corpuscles had distinct cellular walls, and contained a colourless, transparent, circular body, resembling the nuclei found in nucleated cells. Sometimes one cell contained two of these apparent nuclei. They varied much in size, constituting from $\frac{1}{6}$th to $\frac{2}{3}$ds of the whole corpuscle. The granules in these were situated between the nucleus and cell wall. In a few instances, two or three granules could be seen within such nuclei as were of large size, (nucleoli ?) In some cells no apparent nuclei could be seen, and they were more or less full of granules like those previously described. Similar nucleated and non-nucleated corpuscles were aggregated together, with numerous granules between the vascular net-works. Figs. 6 and 7. The *corpus striatum* on the left side contained no exudation corpuscles or granules.

Remarks.—The mental faculties were for some time in a similar state to what we observed in the last case, when paralysis of the left side suddenly appeared, followed by convulsions, coma, and death. The membranes were observed to be more vascular than usual, there also existed subarachnoid effusion. Should we ascribe to these changes in the meninges, the mental weakness, or the convulsions which preceded death ? Considering their recent character they presented, the latter opinion seems most probable. Lallemand always ascribed convulsions, in such cases, to inflammation of the arachnoid ; and it is further confirmatory of this view that the subarachnoid effusion was on the right side, and convulsions on the left.

Whilst the left side of the body only was paralyzed, softening was found on both sides of the brain. In the right hemisphere, however, the softening was more extensive than on the left, and from its red colour, appeared more acute and recent. The softening on the left side was scarcely to be distinguished from the natural colour of the *corpus striatum*. It is important to observe, in conjunction with the symptoms which have been described, as affecting the left side of the body, that the exudation corpuscles and granules were only found to exist in the right hemisphere. This curious fact will be dwelt on more at length subsequently, as also what may possibly be the nature of the softening in the left *corpus striatum*. The peculiar nucleated character of the corpuscles is also worthy of remark.

Obs. V.—*Apoplexy ; complete loss of consciousness ; perfect hemiplegia of the right side ; great rigidity of the muscles on the left side ; death in six hours ; hemorrhage into the left hemisphere of the brain ; an old apoplectic cyst, and small cavities containing softened cerebral substance in the right hemisphere ; numerous exudation corpuscles and granules in the softened tissue of right hemisphere.*

Alexander M'Ostridge, aged 40, admitted into the Royal Infirmary, October 15th 1841, under Dr Spittal ; a blacksmith. Twelve months ago he had an apoplectic seizure, for which he was profusely bled, and recovered in a few days with slight paralysis of the left side. This gradually disappeared, and he continued in tolerably good health until six weeks ago, when he is said to have frequently complained of headach. This morning he arose in good health, and after eating a hearty breakfast, went to work as usual. While engaged in his usual occupation, he fell down suddenly at half-past ten A. M. in a state of complete insensibility. He was brought into the infirmary an hour afterwards.

On admission there was total loss of consciousness. The respiration was laborious and stertorous, accompanied with a frothy excretion from the mouth, which was blown from the lips with considerable force ; pulse exceedingly full and strong, and about 110 in the minute ; face pale and stern, in a state of perspiration ; power of deglutition lost ; left arm and leg rigidly extended, and could not be flexed without using considerable force ; right extremities flaccid, in a state of complete resolution ; eyes glassy, the right pupil much contracted and totally insensible to light, but the left was rather less so, and contracted slightly when the flame of a candle was placed close to it. Bled from the arm and temporal artery to ℥xxx. ; large dose of croton oil internally. Breathing became less stertorous and laborious after the bleeding, although this symptom returned in paroxysms at intervals of ten minutes ; pulse less full and strong, but rather quicker. A cold clammy perspiration broke out over the body, more especially about the face and forehead. He continued in this state till half-past four P. M., when he died.

Sectio, October 17th. The convolutions of the brain presented a remarkably dry and flattened appearance. On slicing the left hemisphere, a large coagulum was found in its substance extending

from the anterior to the posterior lobe, and to within a short distance of the base of the brain, but did not communicate with the ventricle. The cerebral substance in immediate contact with the clot was soft and broken up. On slicing the right hemisphere a number of small cavities were found in the anterior lobe, lying close together, and lined by a loose flocculent membrane. Near to these was one the size of an almond, filled with a soft membranous or minute vascular tissue, of a pink or salmon colour. On cutting deeper into the hemisphere, an old apoplectic cyst, half-an-inch long, was discovered running parallel to the *corpus striatum*, and a quarter of an inch external to the ventricle; it contained no coagulum. Its walls were collapsed, of a dirty yellow colour, which extended a little distance into the surrounding medullary tissue. The substance of the cerebrum was harder than usual. The main trunk of the cerebral artery contained in its walls small nodosities of bone, and the basilar arteries and its branches were in a similar state.

The heart was much enlarged, weighed 21 ounces. A considerable quantity of serum in the pericardium. On cutting into the left ventricle its parietes were found much thickened and very firm. The cavity and *columnæ carneæ* larger than usual; the mitral valve a little thickened.

Microscopic Examination.—The cerebral tissue immediately surrounding the hemorrhagic effusion on the left side presented nothing abnormal. The walls of the old apoplectic cyst on the right side also presented under the microscope the normal appearance of brain. The pinkish softened matter within the small cavities, on the right side, presented numerous exudation corpuscles and granules, mingled with broken down varicose and cylindrical nervous tubes. The vessels ramifying in this substance were densely coated with exudation granules, several masses of which were seen breaking off. These granules were so crowded together in some places, and more especially between the interstices of the intermediary vessels, as to render the field almost opaque, and give it a black smutty appearance, in which no trace of organized structure could be discovered.

Remarks.—The progress of this case was exceedingly rapid, and it is one of great value, on account of the accurate details obtained respecting it. The man had an apoplectic seizure twelve months before admission, from which he recovered with slight paralysis of the left side. An old apoplectic cyst was discovered in the right hemisphere, with its walls collapsed, and of a rusty colour. There can be no doubt, both from its situation and appearance, that this was the remains of the hemorrhage which caused the first attack. It is stated that, six weeks previous to the last and fatal attack, he had frequently complained of headach, indicating a strong tendency to congestion of the cerebral vessels. The symptoms of this latter attack were peculiar, presenting complete paralysis and resolution of the right side, combined with great irritation and muscular rigidity of the left. These symptoms naturally indicated that the two central hemispheres were differently

affected, and pointed out the probable existence of hemorrhage on the left side, and inflammation or acute softening on the right. Now, whilst the dissection exhibited extensive hemorrhage into the left hemisphere, it left the existence of inflammation on the right side very doubtful. The walls of the old apoplectic cyst exhibited no appearance of acute action. The small cavities filled with the pinkish substance might have been by some considered the remains of small hemorrhagic effusions, and by others to be chronic softening advancing to a cure. There can be no doubt that they constitute the appearance described by Dr Sims, (Medico-Chirurgical Transactions, Vol. ix.) On examining them with the naked eye, no one could affirm that they bore any relation to acute softening, nor could inflammation be detected on that side of the brain. How, then, were the violent symptoms of irritation existing on the left side of the body to be accounted for? Attributing them to congestion or recent inflammation in the cerebral substance surrounding the old apoplectic cyst was evidently incorrect. The intervening substance of the brain was a little indurated, but every where healthy. The cause of the rigidity on the left side of the body, therefore, remained unexplained. Now it is important to remark, that the microscopic examination detected in the softened cellular substance, a very abundant formation of the same exudation corpuscles and granules, as I have previously described as existing in parts undoubtedly affected with acute inflammation. None of these were present in the central substance surrounding the clot on the left side, or the old apoplectic cyst on the right. It may now be asked if the presence of these bodies are alone a sufficient proof of inflammation, and capable of explaining the violent symptoms which have been described. I do not consider this observation in itself sufficient to produce conviction of this in the mind of the reader. Before proceeding, however, to detail other facts, I must request him to bear in remembrance the history of, and remarks on the last observation, No. III.

Obs. VI.—*Deafness and amaurosis on the left side; partial paralysis of the left side of the face; feebleness of intellect and gradual imbecility; sudden loss of consciousness and rigidity of the right extremities; death eight months from commencement of the symptoms; tumours in the pons varolii; atrophy of the left optic nerve; no apparent softening in the left hemisphere; numerous exudation corpuscles and granules in the left optic thalamus and corpus striatum.*

Abraham Dick, aged 33, a soldier. He states that when in Ceylon he fell asleep exposed to the sun, and has been deaf ever since. Four months previous to admission the deafness increased, and he experienced pain in the left eye, extending to the temple. On admission there was total loss of hearing on the left side, amaurosis of the left eye, with some degree of strabismus outwards, and dilatation of the pupil. The left eyelid drooped somewhat, and there was

loss of power and hanging down of that side of the mouth. He complained of shooting pains a little below the left eyelid, and some tenderness on pressure there. The intellectual faculties seemed obtuse. General feebleness of the limbs on both sides, but without paralysis. He could walk unassisted, and stand erect without difficulty. Pulse 57; bowels torpid. (Purgatives; abstraction of blood from behind the neck by cupping.) For a month he continued very nearly in the same state, during which period a seton was inserted in the neck, he was put under the influence of mercury, and was latterly ordered the hydriodate of potass and iodine. August 4th, The intellectual faculties more impaired. He answered questions without meaning, and he was scarcely intelligible. The ptosis and dilatation of the pupil diminished. He saw the hand placed between the eye and the light. October 8th, The intellectual powers have been gradually getting more feeble. He talks a good deal, but in no very intelligible manner. 10th. This morning there was sudden loss of consciousness, rigid extension of the right leg, and powerful contraction of the right arm, the right cheek flaccid and hanging down. 16th. Consciousness has partially returned; appears to recognize persons, but generally lies in a drowsy state. There has been perfect paralysis and resolution of the right arm for three days. 18th. Rigidity of the right arm has returned; he moves both lower extremities and the left arm. 20th. The right leg powerfully contracted towards the thigh, and the thigh towards the abdomen. When this extremity is forcibly extended, he appears to suffer pain, and on removing the extending force, it is again retracted. Still possesses some slight degree of consciousness. 21st. Pulse above 100, small and weak; both pupils dilated. In the evening he gave a feeble exclamation, moved the right leg spasmodically, and expired.

Sectio, 44 *hours after death*.—The cranium was somewhat thinner than usual; serum effused under the arachnoid; considerable venous congestion; bloody points on slicing the brain; the ventricles contained a small quantity of turbid fluid; the left optic nerve was much atrophied, and adherent to the pituitary body, and to the membranes surrounding the optic foramen. Towards the base of the brain, a little posterior to the clinoid processes, the medullary substance was softened to about the size of a nutmeg. The softened portion was of a straw-yellow colour, pultaceous consistence, and gelatinous appearance. The surrounding cerebral substance was healthy, without any vascularity or discoloration. A hard tubercle, about the size of a large hazelnut, was found imbedded in the *pons varolii*. It was irregular on the surface, presenting two prominences, the smaller of these a little to the right of the mesial line, the larger immediately above where the left *crus cerebri* came off. The root of the third nerve was hard and tumid, and more expanded than that of the right, which was healthy. The sixth and seventh nerves healthy. The internal ear was broken open, but nothing abnormal could be discovered. The other organs healthy.

Microscopic Examination.—As the structure of the tumour is in

no way connected with the present series of observations, I consider it unnecessary to describe it in this place. Throughout the substance of the optic thalamus and *corpus striatum* on the left side, numerous exudation corpuscles, masses, and granules were found. The two latter also were attached in great abundance to some of the vessels, (Fig. 5.) The straw-coloured softening in the medullary substance contained none of these bodies. The tubes, however, were readily separated from each other but not broken down.

Remarks.—The existence of a tumour at the base of the cranium was accurately diagnosed by Dr Henderson long before death. It would be foreign to the object of this memoir to enter into the analysis of the amaurosis, strabismus, ptosis, and other symptoms connected with this lesion. The peculiar state of the mental faculties, however, present in this case, has been previously noticed in connection with softening. In addition to this symptom, it is stated that the limbs were generally feeble. It is probable that this depended in some measure on the want of mental power. Ten days before death, there was sudden loss of consciousness, and powerful rigidity of the right extremities. The latter symptom disappeared in three days, leaving perfect paralysis of the right arm, but four days subsequently again returned. The intelligence, though very obtuse, was not absolutely lost. If these peculiar symptoms be compared with those detailed in Observation I. they will be found almost identical. In that instance, the *corpus striatum* and cerebral substance opposite the side affected, had undergone acute inflammatory softening. In the present case, however, there was no evident acute softening in the left hemisphere. I well remember that during the dissection the attention both of Dr Henderson (physician of the ward), and Dr Peacock (the prosector,) were attracted to the left *corpus striatum*, and yet in the different reports given by these gentlemen of the *post mortem* examination, no lesion whatever of this part of the brain is noticed. This is an important fact, inasmuch as it proves that persons well accustomed to morbid appearances could detect nothing abnormal in the *corpus striatum*, even after a strict and particular scrutiny of that body. An examination with the microscope, however, demonstrated both in the left *corpus striatum* and optic thalamus, numerous exudation corpuscles, and the same appearances as have been previously described, exist in undoubted acute softening.*

In this case, also, a straw-coloured gelatinous softening occurred in the medullary substance of the left hemisphere at the base of the brain. It contained no exudation corpuscles or granules, and none of the ordinary appearances of purulent matter. It may

* The exudation corpuscles and granules coating the vessels taken from the *corpus striatum* were shown by me on the following day to Drs John Reid, Duncan, and Mr Goodsir.

be asked what was the nature of this kind of softening? In a previous observation (Observation III.) we met with a softening in the left *corpus striatum*, apparently producing no symptoms, and containing none of the peculiar corpuscles found on the opposite side of the brain. Such also was the case in the present instance. In this kind of softening unattended with any formation of exudation corpuscles, the nervous tubes of the brain are demonstrated with the greatest facility, readily separating from one another, and extending unbroken for a considerable length.

It has long been considered that a form of softening takes place independent of inflammation. The circumstances on which this depends may be considered unknown. In the meantime, I am desirous of calling attention to a fact, which, as we shall see, is of some importance, viz. that there are two kinds of cerebral softening, the histological elements of which materially differ.

Obs. VII.—*Paralysis of the upper extremities; contraction of the left arm; convulsions; coma; convulsive action of particular muscles; death three months after commencement of the disease; several circumscribed portions of the brain and cerebellum softened; numerous exudation corpuscles and granules in the softened portions.*

Daniel M'Intosh, aged 58, admitted into the Royal Infirmary, May 25th 1842, under Dr Henderson. He is a painter, of temperate habits. He was in perfect health until three weeks before admission, when he experienced weakness first of the right hand, and immediately after of the left. There was also a sense of weight in the head, and vertigo on moving about. On admission, there was no pain in the head, but he complained of general weakness, languor, and drowsiness. He could grasp with the hands, but not forcibly; the left had least power. The sensibility was unaffected; pupils contractile on the approach of light. June 8th, Since last report, the left upper extremity has been growing more and more paralytic, so that he can neither bend or extend it fully. The fore-arm is contracted upon the fore-arm; when forcibly extended, it is brought without any effort of his own into the semiflexed position. Intelligence and sensation unaffected. The left pupil was a little more contracted than the right one. Had full command over the movements of the inferior extremity. Pulse 90 and full. 22d, Lies in a lethargic state, but answers questions when spoken to. Paralysis of both upper extremities complete; lower limbs freely moved in bed. Evacuations pass involuntarily. No pain in the head or paralysis of the tongue. Pulse 66. 27th, Was seized with an attack of partial convulsions on the 25th, again on the 26th, and he had a third last night. In the first two attacks, the right side of the face only was affected; in the last one, the right arm also. Otherwise the same. 29th, During last night the convulsions returned. This morning he was completely comatose. There are no signs of sensation; pricking the feet, however, caused twitchings in the limbs. 30th, The partial convulsions have returned. In these attacks the

right arm from the shoulder to the fingers is affected with short convulsive succussions, and on their ceasing, the left arm became similarly affected, and gradually the left side of the neck and abdominal muscles. The spasmodic action affected the extensors only; the limbs were never flexed by them. The right cheek is paralysed. July 1st, Has recovered sensation. Speaks when spoken to, and protrudes the tongue. The paralysis of the right cheek has disappeared. The sensibility both of the upper and lower extremities is perfect. 2d, The convulsions returned during the night, affecting both upper extremities. 3d, Loss of consciousness. Pulse 108. Respiration 40 in the minute. The convulsive succussions of single muscles continue; sometimes the left sterno-mastoid alone, sometimes the left pectoral or the right Trapezius, and the extensors of the wrists and fingers. The mouth is open, and the right cheek paralyzed. The iris retains its sensibility. Died at 4 P. M.

Sectio, July 4th. Body much emaciated. On the upper surface of the posterior lobe of the left hemisphere an abscess existed containing about ʒi. of turbid serum, and the adjacent substance was softened. On the surface of the outer and lateral portions of the same hemisphere there existed a softened portion about the size of a small nut. It was circumscribed, of a reddish tinge, and diffluent towards the centre. A similar lesion existed on the surface of the posterior lobe. There was a third on the surface of the left hemisphere, in a position similar to that on the right, and about the same size, and a fourth was found on the surface of the posterior lobe. On slicing the brain ʒiss. of fluid was found in each ventricle. In the substance of the brain a fifth circumscribed softened portion was found in the anterior lobe of the right hemisphere, near its inferior surface, one inch and a-half anterior to the Sylvian fossa. A sixth existed in the lower part of the left optic thalamus, a little above the extremity of the inferior cornu. Both these latter were about the size of a pea. A seventh was detected in the lateral portion of the same hemisphere, the size of a shilling. This was more pultaceous than the other softened portions in the substance of the brain, but not so much so as those on the surface. The left lobe of the cerebellum contained a similar circumscribed softened portion, about the size of a hazel-nut, a second smaller one behind it, and there was a third in the *tuber annulare* on its inferior surface. This latter extended a little more to the left of the mesial line than to the right. The vertebral arteries were much thickened, their coats studded with opaque deposits, and their calibres enlarged.

The smaller of the softened portions above-mentioned were distinctly circumscribed, generally round, and of a light-red colour. Their surface, as exposed by section, was granular and uneven. In the larger the circumscription was less definite, both as to colour and consistence. The central portions of these were reduced to pulp by the slightest handling. In some the cerebral texture was entirely destroyed, and reduced to a fluid consistence. In these the cavities were lined by a membrane, which displayed a ramification of vessels.

The heart was large, weighed 12½ ounces. No unusual dilatation of its cavities. Aorta of small calibre.

Microscopic Examination.—It would have been interesting to have examined the various softened portions in this case, and determined the differences existing between them. The inspection, however, took place when I was absent from town, and I had only the opportunity of examining one of the softened portions, which Dr Peacock was so good as to preserve for me in spirits. In this the softening was very circumscribed, and appeared to have been dug out of the healthy cerebral structure. It contained numerous exudation corpuscles, masses and granules, both isolated, and coating the vessels externally. The walls of the corpuscles were somewhat contracted and shrivelled, apparently from having been kept in spirits. The healthy-looking cerebral texture immediately surrounding this was normal in every respect.

Remarks.—In this case weakness of the hands was the first symptom observed, followed by gradual paralysis and contraction of the left arm. Then follows a state of lethargy, with paralysis confined to the upper extremities, spasmodic action of certain muscles, coma and death. Instead of finding a considerable part of one or both hemispheres softened, ten isolated softened portions, more or less circumscribed, were discovered. It may be asked how far do these isolated patches of softening explain the circumscription of the paralysis to the superior extremities, and the spasmodic action of particular muscles? It should be observed that, on the whole, the amount of softening on the right side of the brain was greater than that on the opposite one, which accounts so far for the paralysis and contraction having been first and most powerfully manifested on the left side. The microscopic examination was incomplete in this case; but I am assured that all the softened portions were of the same character. Dr Peacock also examined three or four of these with the microscope, and informed me that they all presented the same appearance of exudation corpuscles.

Obs. VIII.—*Mental weakness with incoherent speech; hemiplegia of the left side; orthopnœa; death about six weeks after appearance of the disease; extensive softening of the right hemisphere, and central parts of the brain; aneurism of the arch of the aorta; numerous exudation corpuscles and granules in the softened portion.*

Thomas Dodds, aged 60, admitted into the Royal Infirmary, July 4th 1842, under Dr Craigie. This man was of a copper-colour, a native of Bombay, but has been residing many years in Edinburgh.

The history of this man's case was, from accidental circumstances, not taken during life. The following particulars, however, were obtained from the nurse and his friends, subsequent to his decease. On admission he stated that he had been latterly labouring under fever. His intelligence was much affected; he answered questions at random and without meaning. He was sometimes restless and irritable, muttering to himself. The left arm and leg appeared pa-

ralyzed. In this state he continued several days. Latterly his respiration became much affected. For the last fortnight he laboured under orthopnœa, could not lie down, but reposed with his chest elevated, and lying towards the right side. Had alternate attacks of diarrhœa and constipation. Died August 9th.

Sectio, August 10th.—The head was remarkably small; body emaciated; the skull was of unusual thickness; the *dura mater* thick and opaque; there was slight subarachnoid effusion, elevating the membrane to the level of the convolutions; ʒii. of clear fluid were removed from the ventricles, and about ʒiii. from the base. The fornix and adjacent portions, together with a large central portion of the right hemisphere, were soft, of a white colour, and easily broken down by handling, and on pouring a stream of water over it. Somewhat in front of the fissure of Sylvius there existed a softening, involving the convolutions to about the size of a nutmeg, and extending internally about three-fourths of an inch. This softened portion was pultaceous and diffluent on the surface and in the centre, and became more consistent towards the periphery, gradually terminating in the healthy structure of brain. On the external surface of the right lobe of the cerebellum, there was a dark yellowish spot, the size of a sixpence. On division it was found to be the external portion of a tumour, which was about the size of a walnut, and of tolerably firm consistence. It presented all the characters of *fungus hæmatodes*, containing in its centre a small collection of pus.

The right lung was firmly adherent to the parietes of the chest by false membrane. An aneurism the size of a large orange arose from the aorta, about one-third between the origin of the innominata and heart, and pressing against the sternum, causing absorption of the bone; also compressing the right lung. The lining membrane of the aorta coated with osseous plates; the heart was large, and adherent to the pericardium by old adhesions; the right ventricle was firm in its coats, and its cavity small; both the walls and *columnæ carneæ* of the left ventricle were much hypertrophied; the mitral valve was opaque and thick, and on the free edges of the aortic valves were a few small warty vegetations. The stomach was small and contracted. The pyloric orifice in some degree strictured from hypertrophy of its cellular walls; intestines and other organs free from disease.

Microscopic Examination.—The whole of the white softening in the right hemisphere, fornix, &c. contained numerous exudation corpuscles. Fig. 9. In some parts numerous exudation granules were coating the vessels. There were tufts of vessels hanging loose in some parts of the pultaceous substance. Between the meshes of these were numerous granules and black-looking corpuscles, giving to the field of the microscope a smutty appearance. The vessels appeared colourless, and covered with loose minute black points. Fig 8. There were similar appearances also in the more circumscribed softening towards the surface of the right hemisphere. These were also very numerous in the substance of the cerebellum immediately surrounding the tumour, which presented the histological characters of some forms of *fungus hæmatodes*. The purulent

fluid in the centre presented, under the microscope, the usual corpuscles found in healthy pus.

Remarks.—The phenomena indicating softening in this case were imperfectly observed. Obtuseness of intellect and hemiplegia were present, but the mode in which these symptoms appeared, together with any particular changes or modifications they underwent, escaped observation. It is important, however, to remark that the central softening, which was perfectly white, and was considered by the prosector to be the result of *post mortem* changes, presented the same histological characters as we have seen exist in the red acute softening.

Obs. IX.*—*Acute hydrocephalus; vomiting; diarrhœa; fever; convulsions; rigid flexion of the thumbs and great toes; irides insensible; coma; death three months after the appearance of the first symptoms; effusion of serum into the subarachnoid membrane, and into the ventricles; softening of the central portions of the brain; tubercular meningitis.*

Jane Frazer, aged 12 months, of strumous family and appearance, was first seen on the 8th of July 1842. Three months ago she was attacked with vomiting and diarrhœa, accompanied with a state of pyrexia. These symptoms disappeared in a fortnight, apparently the result of active treatment. Three weeks ago the child became restless, had vomiting after taking food, and loss of appetite. A week subsequently it could not support the head. Some days afterwards it became insensible, and occasionally extended its extremities convulsively. When first visited the body was observed to be much emaciated and blanched; the scalp was hot; the cheek and extremities cool. There was perfect insensibility; occasional convulsions of the extremities. The thumbs and great toes were rigid, and remained permanently flexed. The eyes were distorted; pupils contracted and insensible to light. Takes no food; tongue furred; bowels open; pulse 140, thready and irregular. (Stimulants; warmth to extremities.) 9th, Slight abatement in the symptoms; pulse less frequent. 10th, Convulsion more violent and frequent. In the afternoon these ceased and profound coma ensued, an hour after which death took place.

Sectio, July 12th 1842.—Head large. The fontanelles were not elevated. Eleven drachms of fluid were collected, which apparently flowed out from the fissure of Bichat. On elevating the calvarium several drachms more escaped The ventricles, however, still contained five drachms of a slightly turbid serum. The ventricles and foramen of Monro were much dilated. Serum was effused under the lining membrane of the ventricles, giving it an œdematous appearance. The *septum lucidum*, fornix, and central portions of the brain were of a pultaceous consistence, and brilliant white colour. The gray masses were of natural consistence. The mem-

* For an account of the symptoms of this case I am indebted to Mr Bunce. The details of the dissection. and the opportunity of examining a portion of the brain, I owe to the kindness of my friend Dr Peacock.

branes of the base contained minute round bodies, of a light straw or yellow colour, and hard consistence. There was a layer of lymph effused into the subarachnoid cellular tissue in the course of the middle cerebral artery. Five drachms more of fluid were collected from the base, and some escaped from the spinal canal.

The upper lobe of the right lung was condensed and of a deep purple colour. Two tubercular masses, the size of a pea, were observed, one imbedded in the lung, the other in a bronchial gland. On slicing the condensed portion, it was found filled with tubercular depositions of different sizes. The heart was healthy. The serous coat of the spleen contained numerous tubercular spots. One of Peyer's patches near the cæcum had its edges elevated, and surface ulcerated ; other organs healthy.

Microscopic examination.—All the white central softened portions of the brain contained numerous exudation corpuscles. The most part of these were round, and exhibited the cell wall very distinctly, (Fig. 11.) Some were quite full of granules, in others there were only a few. By means of pressure the cell wall could easily be ruptured, and the granules caused to escape. These corpuscles were mixed with numerous granules, which also abundantly coated several of the vessels.

Remarks.—The peculiar symptoms of softening were in this case masked by the tubercular meningitis. To this latter cause may probably be attributed the vomiting, pyrexia, and insensibility with convulsions. The rigid flexion of the thumbs and great toes on both sides might be dependent on the softening ; but it is difficult to analyze symptoms in children so young, on account of their great irritability and want of intelligence. It is important to remark that here also the softening was white, and that the exudation corpuscles, as in the last case, were very abundant.

Obs. X. *Phthisis ; sudden impairment of the mental faculties and contraction of both arms ; convulsions ; coma ; death six weeks after the commencement of the cerebral symptoms ; arachnoid and pia mater adherent to the brain ; softening in both hemispheres with infiltration of blood ; effusion of scrofulous matter ; numerous exudation corpuscles and granules in the softened portions.*

Thomas Wood, aged 28, admitted into the Royal Infirmary, October 12th 1841, under Dr Spittal. At this time he had been labouring under phthisis for some months, which disease continued gradually to progress without any remarkable symptoms, until March 23d 1842. On this day he was suddenly seized with a violent fit of coughing, and pain in the head, neck, and chest, with prostration of strength. The eyes were incessantly turned towards the right side ; the pupils became dilated, and very slightly sensible to light. The left arm became motionless, lost its sensibility, while the fore-arm was rigidly flexed upon the arm. The right arm, also, was slightly contracted, but the power of motion was uninjured. The lower extremities were unaffected. The intellectual faculties were impaired, and he talked childishly. The pulse was 120, and the inspirations

36. 24th, He had several attacks of convulsions affecting the muscles of the four extremities. The pupils were dilated and nearly insensible. Pulse 96. 25th, He again became sensible, and the pupils were more contractile; pulse 112; tongue white. During the 26th, 27th, and 28th, he continued in a state of incessant restlessness and excitement, rendering it somewhat difficult to restrain him, and talking loudly and constantly. From this state, he gradually recovered; the head symptoms subsided; the chest affection gradually making progress. No particular symptoms occurred until May 12th, when he complained of pain in the upper and fore-part of the head; his intellectual faculties were also confused. (Leeches to the temples; head to be shaved, and blister applied). 14th, Little change; tremor of the extremities; pulse 112, weak. (Four ounces of red wine.) 16th, Lies in a lethargic state, but is restless at night, attempting to get out of bed. Pulse 112; still weaker than yesterday. Evacuations passed involuntarily. (Stimulants.) Continued to sink, and died on the 19th.

Sectio, May 21st.—Great flattening of the convolutions on the left side of the brain, and obliteration of the intervening spaces. The external surface was of a salmon-colour. The arachnoid and *pia mater* were adherent to each other and to the convolutions. At the lateral portion of the anterior lobe a dark opaque spot gave rise, on touching it, to a sensation of fluctuation. On slicing the brain, it was found that this spot communicated internally with a softened portion of brain, of about an inch and a half diameter. This softening contained much effused blood, which was sprinkled throughout its extent in the form of innumerable red dots, most aggregated together immediately round the centre, which was hard and semi-transparent-looking, from the apparent deposition of scrofulous matter. The white matter surrounding the softened portion was of a delicate straw-yellow colour, which gradually grew less externally, till it disappeared. A similar softened portion, although less in extent, and not so much spotted with blood, existed in the right lobe, above the posterior cornu of the lateral ventricle. The two ventricles together must have contained one ounce of serum. There was also considerable serous effusion at the base, and opacity and thickening of the membranes, especially about the optic commissure.

The lungs were adherent on both sides. The right was infiltrated with tuberculous matter, both in its superior and inferior lobes, and contained numerous cavities posteriorly. A considerable quantity of tubercular deposition in a miliary form also existed in the left lung, with some cavities and emphysema. The heart was healthy. Patches of lymph on the surface, and in the course of the vessels. There were adhesions between the reflected portions of the pericardium and the aorta.

At the upper portion of the ilium, tubercular matter was deposited in the vesicles of Peyer's glands, surrounded by an effusion of coagulable lymph, but without ulcerations. The cæcum was studded throughout its whole surface with ulcers, and many existed in the ascending, transverse, and descending colon. In the first, they

were of an irregular form, and sometimes an inch broad; in the last, they were small and oval. Some tubercular matter was effused on the surface of these ulcers, and in some of the solitary glands.

Microscopic Examination.—The softened cerebral substance, containing the dotted effusion of blood, on both sides presented under the microscope numerous exudation corpuscles. The medullary matter surrounding this on the left was not softened, and its minute structure was in every respect normal. The colourless scrofulous matter exuded into the centre of the softened portion was composed of numerous granules, with occasional loose fragments of broken down cells, similar to the tubercular matter found in the lungs and other textures.

Remarks.—In this case the cephalalgia, distortion of the eyes, dilatation of the pupil, convulsions, restlessness and excitement, indicated inflammation of the membranes, whilst the peculiar confusion of intellect, conjoined with paralysis and contraction of the extremities, indicated medullary softening. These symptoms disappeared for nearly a space of six weeks, then returned in an aggravated form and proved fatal. Considerable meningeal inflammation was found, and softening existed in both hemispheres, so far explaining why contraction and paralysis occurred in both arms. It is singular, however, that the inferior extremities should have entirely escaped. In conjunction with this fact let it be observed, that the organic lesion existed above and external to the *corpora striata* and *optic thalami*, neither of which were directly implicated. The infiltration of blood constitutes what Cruveilhier has denominated capillary apoplexy; that is to say, the blood, instead of being poured out from a large trunk, is effused from the capillaries,—a result which is frequently preceded and caused by softening. This softening contained the same microscopic corpuscles we have demonstrated in similar lesions dependent on inflammation. The hospital report states that the straw-yellow-coloured substance surrounding the hemorrhage was soft. I was careful in examining into this point, and could perceive no physical evidence of softening, in much of the substance so coloured. Microscopic examination evinced nothing abnormal except in its central portion. Is it not probable that the colour in this instance may be owing to the imbibition of the colouring matter of the blood into the cerebral texture surrounding the extravasation, similar to what occurs in the ecchymosis of other tissues? Is it not even likely that the yellow tinge surrounding many specimens of inflammatory softening is owing to this cause? At all events, the present case demonstrates that the extent of colour is no index to the extent of softening.

Obs. XI.—*Apoplexy; hemiplegia of the right side; death in seven days; large coagulum in the left hemisphere, the cerebral substance*

surrounding which was softened; exudation corpuscles, masses and granules in the softened portion.—Ann Campbell, about 60 years of age, admitted into the Royal Infirmary under Dr Traill. February 13th 1842, She was suddenly seized with apoplectic symptoms on entering a house, and fell down insensible. She was immediately bled, and then sent to the infirmary. When admitted it appeared that she had been drinking. Pulse 90; respiration quick but regular; there was complete paralysis of the right side; the face was drawn to one side; the iris moved naturally when stimulated by light. She could not speak, but was partially sensible; the fæces and urine were evacuated involuntarily. In this state she lingered, and died on the 20th, half-past 4 P. M.

Sectio, February 22. The vessels of the *dura mater* were much congested. Slight subarachnoid effusion; there was a large coagulum of blood, two and a-half inches in diameter, in the left hemisphere, extending to near the base, and situated immediately external to the wall of the left ventricle. The cerebral substance immediately surrounding the clot was softened, and of a rusty brown colour, extending in some places a quarter of an inch deep.

Microscopic Examination.—The softened portion surrounding the clot contained numerous exudation corpuscles, masses and granules, both isolated and attached externally to the vessels. The granules effused between the loop-like nets of the intermediary vessels were so numerous as to impede the passage of transmitted light.

Obs. XII.—*Sudden hemiplegia of the left side; death in five weeks; hemorrhage into the substance of the right thalamus; surrounding cerebral substance softened; exudation corpuscles, masses and granules in the softened portion.*

William Sutherland, aged 46, a mason, admitted into the Royal Infirmary April 13th 1842, under Dr Christison.

On the 15th of March he was suddenly seized with loss of power in the left arm, spreading rapidly to the corresponding leg, but without any general loss of sensibility or apoplectic symptoms. He was immediately bled freely from the arm, leeches were applied to the head, and other depleting measures had recourse to. On admission the left leg was more emaciated than the right. The sensibility was little affected, and he was able in some degree to move the ankle. The sensibility of the arm was more impaired, and he was only able to move the fingers very partially. The angle of the mouth was drawn to the right side, and the top of the tongue to the left. He passed his fæces and urine in bed, and had sores on the nates and hips. Pulse in the right arm firm and full, in the left small and weak. Died at half-past 1 P. M. on the 25th.

Sectio, March 26th. The membranes of the brain normal. One drachm of clear fluid existed in the two ventricles united. An extravasation about the size of a hen's egg was found in the substance of the right thalamus, passing partly into the *corpus striatum,* and deep into the substance of the brain, in the course of the inferior cornu of the ventricle. The coagulum was throughout of a brownish-red colour,

passing into yellow. The cerebral substance surrounding it was soft, pultaceous, and readily removeable by a current of water. In the under portion of the left *corpus striatum* there existed the remains of a small cyst. Some little fluid was found at the base. The arteries were healthy.

The opposite layers of the pericardium were adherent from effused lymph of old date. The left ventricle was very much hypertrophied, and its cavity small; the mitral valve was slightly opaque; the aortic valves were ossified at their attached margins; aorta somewhat dilated.

There were some few granular tubercles scattered in the lungs. Other organs healthy.

Microscopic Examination.—The softened substance surrounding the clot exhibited several exudation corpuscles, masses, and granules as in the last case. They were, however, not so numerous.

Remarks.—The two cases just given are very similar to each other. In both, the attack was sudden; in both, hemiplegia existed; in both, a large hemorrhagic extravasation occurred in the substance of the hemisphere opposite the paralysed side; in both, the cerebral substance around the clot was softened, and in both, this presented the same histological appearances. It should be observed, however, that in the first case the coagulum was much larger than in the second. That death occurred in the one, seven days, and in the other, five weeks after the hemorrhage, and that in the former the exudation corpuscles, &c. were more abundant in the softened matter. The absence of loss of consciousness also in the second case, notwithstanding the presence of so large a clot, is deserving of notice.

Obs. XIII.—*Concussion; loss of consciousness; partial recovery; occasional delirium; relapse; death fourteen days after the injury: hemorrhage into the cavity of the arachnoid covering the right anterior lobe; partial softening of the convolutions; small apoplectic cyst in the right cerebral lobe; fracture at the base of the cranium; exudation corpuscles and granules in the softened convolutions.*

George Clelland, aged 51, admitted into the Royal Infirmary, under Dr Paterson, July 25th 1842. When brought into the house he was insensible, in which state he had been found in the streets by the police. In the afternoon his consciousness returned, and he stated that, on the 21st, he fell down a stair, ten or twelve steps in height, and struck his head, after which he was partially insensible, and a quantity of blood flowed from his left ear. On the 24th, he felt better, and went out to walk, when he was found by the police, and brought to the hospital on the next morning. On admission he was suffering much from pain in the head, and a bloody fluid flowed from the left ear to the extent of a tablespoonful. He was partially insensible. August 2d. The preceding symptoms have gradually disappeared, and at the hour of visit he was quite sensible and felt strong. In the evening he became restless, and at times

delirious. 3d. To-day he dressed himself, and went to the top of the stairs, with the intention of going out into the garden. He was, however, persuaded to return to bed. He continued restless and rambling until two o'clock A. M. on the 4th, when he lost all consciousness. The pulse was 54, and he breathed stertorously. Bled to twenty-two ounces. At the visit the pulse was 72, and intermittent. Turpentine enema; blister to the scalp; died at half-past three P. M.

Sectio, August 5th. Cranium unusually thin. On the right side the *dura mater* was separated to a considerable extent from the *os frontis*. An extravasation of blood was found in the arachnoid cavity, extending over the anterior and lateral portions of the right hemisphere. The clot in contact with the *dura mater* was firm, decolorized, and formed membranous flakes, which could readily be torn off. Near the convolutions of the brain the clot was grumous, semifluid, of a chocolate or rusty brown colour. A superficial layer of the convolutions was broken down and pultaceous. In the course of the fissure of Sylvius, the brain to the extent of a small walnut was soft, and of cheesy consistence. The coats of the cerebral artery were thickened, and presented some opaque spots. A small apoplectic cyst, with a dark coagulum, the size of a hazel-nut, was found in the substance of the right hemisphere in its anterior lobe. Other portions of the brain healthy. The petrous portion of the left temporal bone was traversed by a fracture, extending two inches upwards and inwards, passing directly through the internal ear.

Microscopic Examination.—The grumous layer of blood and superficial softening of the cortical substance presented nothing but a granular mass, consisting of broken down blood globules and cineritious matter. The circumscribed softening in the course of the Sylvian fissure contained numerous exudation corpuscles and masses. Several of these were of very large size, measuring from one-twentieth to one-fifteenth of a millimetre in diameter. (Fig. 12.) The cerebral substance surrounding the small apoplectic effusion, also full of numerous exudation corpuscles, masses, and granules.

Remarks.—It is interesting to remark the great difference between the symptoms in this, and in the two last cases, in connection with the *post mortem* appearances. In the present instance there was no paralysis, the restlessness, delirium, but power of moving the limbs, indicating a lesion at the surface of the cerebrum. In the former cases the intellect comparatively was little affected, the principal symptoms being paralysis, and in these the lesion occupied the central portions of the brain. In this case should also be observed, that a superficial softening of the convolutions existed, arising apparently from infiltration of blood and serum, which contained no exudation corpuscles, and that another circumscribed softening contained them in abundance. It may be asked to which of these two lesions was the irritation and excitement owing? The fracture on the opposite side of the cranium arose from *contre-coup*.

Obs. XIV.*—*Hemiplegia of the left side; congestive headach; sudden apoplexy; profound coma; death two days after the attack; large extravasation of blood into the right hemisphere, surrounded by softened and pulpy brain; absence of exudation corpuscles or granules in the softened portion.*

Jane Chalmers, aged 72, living in the Charity workhouse as nurse. Five years ago she was seized with sudden loss of consciousness, and hemiplegia of the left side. From this she slowly recovered, the speech, however, remaining thick and impaired, the memory being somewhat defective, and the power of the left side diminished. She continued to enjoy tolerable health, and move about, only complaining of occasional headach, until twelve months ago, when she was seized with vertigo and confusion of intellect, threatening another attack. This, however, passed off, and she continued as formerly until August 4th 1842, when, on receiving some unpleasant news, she suddenly fell down in a state of coma. This soon became very profound. The pupils were dilated; there was perfect resolution of the limbs; respiration natural; pulse full, not frequent. In this state she continued until the 6th, and then expired.

Sectio, August 8th, two o'clock. The vessels of the *dura mater* were rigid and distended with blood. Venous congestion of the meninges; arachnoid dry; convolutions of the right side flattened and pressed together. The left ventricle was much dilated, and contained more than ℥i. of clear fluid. On looking into it from above, a clot the size of a walnut was seen protruding into it through the *septum lucidum*. On slicing the right hemisphere, the posterior and middle lobes were found to contain clotted blood, to the amount of nearly ℥iv. This had broken through the *septum lucidum* into the left hemisphere. The coagulated blood was of a dark-red colour, of firm consistence, and everywhere evidently recent. The cerebral substance immediately surrounding it was of a pulpy consistence, and in some places infiltrated with blood. The other portions of the cerebral substance were healthy. The basilar and other arteries at the base of the brain were rendered more or less rigid by calcareous depositions in their coats.

Microscopic Examination.—The softened cerebral substance surrounding the clot was carefully examined at numerous points, but there was no evidence of exudation corpuscles. The tubes of the brain, however, were readily separated from each other, and easily demonstrated.

Remarks.—The history of this case indicates a strong disposition to congestive attacks of the brain. The hemiplegia which had so long existed previous to the last fatal attack, probably depended on hemorrhagic effusion into the right hemisphere. The large clot discovered on dissection, however, was so extensive as probably to have obliterated all traces of it. The extent of this effusion, pressing on both hemispheres, explains the resolution of

* Dr Smith kindly invited me to be present at the examination of this case, and to him I am indebted for the details regarding it.

the extremities on both sides. The absence of delirium, convulsions, and all symptoms of irritation, indicates that inflammatory action had not occurred. In connection with this should be remarked the absence of exudation corpuscles in the softened cerebral substance, and the short time which elapsed between the occurrence of the attack, and the fatal result.

Obs. XV.—*Cephalalgia; loss of speech; convulsive action of the muscles of the face and neck; death five days after the attack; capillary apoplexy of the left corpus striatum and optic thalamus; softening of the septum lucidum, fornix, corpora striata, and optic thalami; absence of exudation corpuscles in the softened cerebral substance.*

Helen Morton, aged 18, admitted into the Royal Infirmary, September 6th 1841, under Dr Graham. This girl has never had any catamenial discharge, but has always enjoyed good health until about four months since, when she was attacked with severe pain in the frontal region of the head, which was increased by stooping. This was removed by the application of leeches to the temples. She remained well until September 2d, when the pain returned as before. She took some opening medicine, which was followed by purging on the morning of the 3d; vomiting supervened, and she brought up some slimy greenish matter. The cephalalgia, occasional vomiting, and purging continued until the evening of the 5th. She was then seized with insensibility and loss of speech. She continued in this state until she entered the Infirmary in the evening. On admission the face was flushed; temperature of the scalp was increased. There was some convulsive action of the muscles of the neck and face; leeches were applied to both temples. At 11 P. M. she was bled to ℥xii. which appeared to lessen the convulsive action somewhat. There was no buffy coat on the crassamentum of the blood. She continued in this state till 1 A. M. of the 7th, when she expired.

Sectio, September 8th.—The *dura mater* was tightly stretched over the convolutions, which were flattened and pressed together. The surface of the brain was of a waxy hue. Two drachms of serum in the ventricles. All the central portions of the brain, the *septum lucidum*, fornix, both *corpora striata* and optic thalami were softened, and in some places pultaceous. The *corpus striatum* and optic thalamus of the left side were of a port-wine colour, from the infiltration of blood. Towards the circumference, the red coloration was less intense, of a bright scarlet, and dependent on the greater or less aggregation of numerous minute circular dots. There was no distinct clot, or yellow coloration, the softening being of a pearly whiteness, All the other organs were healthy.

Microscopic examination.—Throughout the whole of the softened portion, no exudation corpuscles could be detected. Each little dot of blood, of which the extravasation was made up, consisted of nothing but numerous blood-globules, surrounded by the healthy structure of the brain.

Remarks.—In this case we observe a girl of eighteen years of

age, in whom the catamenia had not appeared, subject to strong congestive headachs. Two days before death apoplectic symptoms manifested themselves. The meagre details received in connection with this case leave much to be decided. Vomiting, for instance, occurred two days before the attack, but as this symptom followed the administration of a cathartic, and accompanied purging, it may probably be attributed to the medicine rather than to any serious lesion of the brain. Convulsions of the muscles of the neck and face were also mentioned; their nature, however, is not described, and they were too limited to have depended on extensive arachnitis, or central acute softening. The *post mortem* appearances found after death in the brain were sanguineous infiltration into the left *corpus striatum* and optic thalamus, with softening of those parts and of the central portions of the brain. We have observed a similar kind of capillary apoplexy in Observation IX., and similar white softening in Observations VII. and VIII. In these three cases, however, numerous exudation corpuscles existed in the softening, whereas it is important to observe, that, in the present instance, no such microscopic bodies could be detected. It is worthy of remark, also, that the softening was colourless, of a pearly white, similar to the eye to that described in Observations VII. and VIII.

Now, if the symptoms of this case be compared with Observations I. II. and III. or others where the *corpus striatum* and optic thalamus were equally involved, the absence of all paralysis will be at once remarked. If, again, the symptoms be compared with those of Observations VII. and VIII. where central softening existed, or with any other cases where this lesion existed to a similar extent, we shall be struck with the absence of the peculiar dulness of intellect, and of all rigidity in the limbs. The progress of the case, also, is very different from that usually accompanying inflammatory softening. There was no return of the intellectual faculties, no impairment of memory or comprehension, none of the phenomena characteristic of that disease. In short, the symptoms were those of sudden apoplexy alone, similar, with the exception of the limited convulsions, to what we have observed in simple hemorrhage into the brain, Observation XIV. The absence of delirium and convulsions of the extremities indicate freedom from meningitis, and the whole history of the case readily distinguishes it from inflammatory softening.

Obs. XVI.*—*Trismus; opisthotonos; death twenty days after the appearance of the tetanic symptoms; softening of the spinal cord; absence of exudation corpuscles in the softened portion.*

* For the particulars of this case I am indebted to Dr Douglas, at that time one of the surgical clerks.

Georgina Cumming, aged 27, admitted January 29th 1842, into the Royal Infirmary under Mr Syme. This woman is of a stout habit of body, and fat. She is stated to have previously laboured under violent hysterical symptoms. About a year ago she suffered from symptoms of phlebitis, which followed an operation for the obliteration of varicose veins. She subsequently fell into a state of melancholia, amounting to dementia, which continued a week or two, and then disappeared.

According to her own account, she has been exposed during the last three weeks to cold and fatigue. Ten days ago she had violent and continued rigors, loss of appetite, stiffness, and pain in the lower jaw, succeeded by pain and cramps in the shoulder and back. Has had no constipation.

On admission the symptoms were, flushed face, compressed lips, (*risus sardonicus*), anxiety of countenance, the sensation of a ball rising in the throat; paroxysms of weeping and moaning, caused by fear of "lock-jaw;" clammy perspiration; pulse 130, of moderate strength; there was perfect trismus. The jaws could only be separated so as to admit the point of the little finger. All the muscles of the back were very rigid. There was considerable tenderness over the maxillæ and the right scapula, but none over the spine. Occasional attacks of opisthotonos, during which the back was curved so as to rest upon the hips and shoulders. The articulation was indistinct. (Assafœtida and morphia; mercurial and belladonna ointment to be rubbed on the spine.) 30th. Face flushed; tetanus continues, with pain in the affected muscles. Slight pain on pressure over the seventh and fifth dorsal vertebræ; respiration laborious; spasms of opisthotonos recur at intervals; limbs not affected. (Blister to the spine; enemata of turpentine and assafœtida.) 31st. Slight remission of the symptoms. February 1st. Great anxiety of the countenance; respiration hurried; deglutition difficult; otherwise the same. (Tobacco injections every three hours.) After the first injection, there was a violent attack of opisthotonos, during which the extremities also were rigid. (Head to be shaved and ice applied to it and the spine.) February 4th. There has been a slight alleviation of the symptoms. To-day the spasms returned with violence. During the 5th and 6th there was little change. February 7th. This morning she had an unusually severe spasm. Since then the rigidity has continued; tracheal rale; pulse feeble; temperature of the surface low; mind unaffected; died at 6 P. M.

Sectio, 30 hours after death.—The brain and spinal cord were completely exposed. No lesion could be found except in the lower portion of the spinal cord, where opposite the 11th and 12th dorsal vertebræ, it was softened, and in some places broken down into a pultaceous mass, but of the natural colour. The lower lobe of both lungs was much congested and condensed, so as to sink in water.

Microscopic Examination.—The nervous tubuli of the spinal cord in its softened portion were in every respect healthy, and were easily demonstrated. No exudation corpuscles, masses, or granules

could be anywhere discovered. This examination was made very carefully at numerous points of the softened mass, both in its white and gray portions. Dr Peacock was present, and confirmed the results.

Remarks.—The symptoms at the commencement of this case were those of well-marked hysteria. There had been no indications of pain or abnormal sensations referable to the limbs. There was no paralysis of the trunk or inferior extremity, and absence of all local spinal symptoms corresponding to the lesion found after death. These circumstances are opposed to the existence of myelitis. Several cases, however, have been recorded where similar lesions have been found after death, without any symptoms which could be attributed to them. I have pointed out in another place,* that such lesions may most probably be attributed to *post mortem* violence in opening the spinal cord, having often seen them accidentally produced by the saw or chisel in the hands of very expert dissectors. It is highly probable that such was the case in the present instance, not only from the absence of any symptoms which could be attributed to such a lesion, but from the non-existence of those appearances which, as must have been previously observed, accompany every inflammatory softening. In another case, also, to which I shall subsequently allude, one of the assistants opened the spinal column, and produced spinal softening with the saw, which presented similar appearances both to the eye and under the microscope.

I am unwilling at this stage of the inquiry to advance any conclusions, from what may be considered insufficient data. Some of the facts which have been elicited, however, may be here indicated.

The preceding series of observations have confirmed the statements of Gluge and Valentin, regarding the presence of exudation corpuscles in softening of the brain. They have further demonstrated:

1*st*, That the microscopic bodies peculiar to cerebral softening may occur primarily in the form of granules, masses, and nucleated corpuscles.

2*d*, That these so-called exudation granules, masses, and nucleated corpuscles may be observed coating the blood-vessels externally, clearly indicating their origin.

3*d*, That they are found equally in the red, yellow, and white softenings of the brain: in what has been considered chronic as well as in acute softening.

4*th*, That the softenings in which these bodies have been de-

* Library of Medicine, Article Paralysis, Vol. ii. pp. 288 and 288.

tected, both from their appearance and from symptoms which have accompanied them, are of an inflammatory nature.

5th, That these bodies have been found in great abundance where no appearance of softening or inflammation was evident to the naked eye, yet where the symptoms of such lesions were well marked.

6th, That white and yellow softenings may exist without the presence of exudation corpuscles, masses or granules, but that the symptoms which accompany these are not those indicating inflammatory softening.

7th, That the red, yellow, or white softenings are in no way dependent upon or connected with the infiltration or presence of pus.

The importance of these facts, both as regards the pathology of softening, as well as respects our knowledge of the subject of inflammation, will be dwelt upon in a subsequent part of this paper.

(*To be Continued.*)

EXPLANATION OF PLATE V.

The figures represent different portions of inflamed brain, as seen under a magnifying power of 300 *linear diameters.*

Fig. 1. Exudation masses and corpuscles, as seen in the red softening of medullary matter, (Obs. I.)

Fig. 2. Exudation granules and broken down cells, as seen in the diffluent yellow softening of the *corpus striatum*. (Obs. I.)

Fig. 3. Exudation corpuscles in the medullary matter at the edge of the softened portion. (Obs. I.)

Fig. 4. Exudation masses and granules coating the blood-vessels in yellowish red softening of the *corpus striatum*. (Obs. II.)

Fig. 5. Exudation masses and granules, both loose and coating a blood-vessel in what appeared to the naked eye healthy medullary substance. (Obs. VI.)

Fig. 6. Exudation corpuscles of a nucleated character, both loose and attached to blood-vessels, in softened medullary substance. (Obs. IV.)

Fig. 7. Exudation corpuscles and granules, densely crowded together between the vascular ramifications. (Obs. IV.)

Fig. 8. Exudation corpuscles, masses, and granules crowded together in a similar manner, giving the field of the microscope a smutty appearance. (Obs. VIII.)

Fig. 9. Appearance of the softened medullary substance of a pultaceous consistence, (Obs. VIII.)

Fig. 10. Appearance of the medullary substance rendered diffluent. (Obs. III.)

Fig. 11. Exudation corpuscles with distinct cellular walls, found in white central softening of the brain. (Obs. IX.)

Fig. 12. Large exudation masses and corpuscles, found in cheesy softening of the convolutions. (Obs. XIII.)

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Obs. XVII.—*Hemiplegia on the left side of long standing; great dyspnœa; cardiac disease; circumscribed softening in the right cerebral hemisphere, like chalky milk, wholly composed of exudation corpuscles and granules; small circumscribed cheesy softening on the right lobe of the cerebellum containing exudation corpuscles; heart hypertrophied; mitral disease; aneurism of the left auricle.*

Archibald Robertson, aged 36, shoemaker, admitted into the Royal Infirmary under Dr Paterson, August 5th 1842. This man was in the house May, 1841, labouring under hemiplegia of the left side, at that time recent. For sixteen months, he has been affected with cough and dyspnœa, especially on ascending a height, and has sometimes had hæmoptysis. On one occasion, he spit up fully two pints of blood. On the 7th of August 1842, it is reported that the heart's impulse was strong, and that a murmur accompanied the first sound, which was loudest on the left side of the sternum. He could walk, but the power of motion in the left arm was much diminished. He left the house on the 23d of September, but returned on the 29th. He now laboured under great dyspnœa, accompanied at intervals with lancinating pain in the region of the heart. The lower extremities were slightly œdematous. The abdomen distended with fluid; urine scanty and highly-coloured; bowels confined; pulse 112, small and thready. October 5th. Increased dulness over the region of the heart on percussion, extending three inches below the nipple. The impulse corresponds to the pulse at the wrist. A loud murmur, almost rasping, heard three inches below the left nipple, but distinguishable over a larger space than usual. Distinct murmur and sonorous rales were heard under both clavicles. The symptoms gradually increased in severity. The dyspnœa became more intense, attended with a sense of constriction in the upper part of the chest and throat. The anasarca and ascites increased, and amount of urine diminished. Died October 19th.

Sectio, October 20th.—On removing the scull-cap, subarachnoid effusion was observed, elevating the membrane to a level with the convolutions. On the right side, under the arachnoid, there was a considerable layer of effused lymph, in which the branches of the Sylvian artery were imbedded. The coats of the main artery were

also thickened and opaque. The cerebral substance on section was of unusual firmness. In the right cerebral hemisphere, external to the ventricle, there was a softened portion, about the size of a hazel-nut, apparently composed of minute white granules, swimming in a thick fluid (*lait de chaux* of the French). The ventricles contained an ounce of fluid collected by the pipette, and some also escaped. There was also slight effusion at the base. On the surface of the right lobe of the cerebellum was a circumscribed cheesy softening, the size of a large pea, and of a fawn colour.

The lungs were œdematous, and the bronchi full of mucous fluid. The right lung was adherent to the ribs, and on the left there was considerable effusion of yellow-coloured serum in the pleural cavity.

The pericardium contained a considerable amount of dark-coloured fluid. The heart was large, weighing 1 lb. $1\frac{1}{2}$ ounce. The auriculo-ventricular opening on the left side was reduced to a slit, which would only admit the handle of a dissecting scalpel, caused by expansion and protrusion of the folds of the mitral valve. The left auricular appendix was of large size, and distended with a firm coagulum. This dilatation of the part communicated with the general cavity of the auricle by means of an opening as large as a shilling.

Microscopic Examination.—The softening in the cerebellum contained numerous exudation corpuscles and granules, both loose, and coating the vessels. The white softening in the right hemisphere, however, was somewhat peculiar in character. On pressing a small portion of it between slips of glass, it presented numerous exudation corpuscles, perfectly round, generally about $\frac{1}{300}$th of a millimetre in diameter, filled with granules, about $\frac{1}{4000}$th of a millimetre in diameter. Similar granules existed loose in large quantities between these corpuscles. There were no traces whatever of nervous structure, and the regular medium size of the exudation corpuscles and granules formed a strong contrast to the variations existing in this respect, as observed in other cases. See Plate VI., Fig. 1.

Remarks.—The nervous symptoms in this case were apparently confined to hemiplegia of the left side, which, it is stated, was recent in May 1841, and which, consequently, at the time of his death in October 1842, must have been between eighteen and nineteen months standing. The mode of its appearance is not alluded to. On examination, two softenings were discovered,—one on the surface of the cerebellum, the other in the substance of the right hemisphere. The latter was apparently recent, and, together with the arachnitis and effusion of lymph, seemed to have produced no symptoms, or, as is more probable, such only as were masked by the more urgent functional disturbance occasioned by the cardiac lesion. The long standing hemiplegia was evidently dependent on the softening found in the right hemisphere, a little external to the ventricle. This presented that peculiar character denominated milk of chalk, (*lait de chaux* by the French), a term sufficiently descriptive of its appearance. I have frequently had an opportunity of seeing this form of cerebral softening at the Salpé-

trière Hospital in Paris, where it is not uncommon. This, however, is the only instance which I have seen of it in Edinburgh, and I consequently examined it microscopically with great care. The description previously given will show that it differed considerably in its histological characters from any of the forms of softening I have described.

OBS. XVIII.—*Phthisis; sudden loss of consciousness, and paralysis of the right side; gradual recovery; fourteen days subsequently, a second attack, and paralysis of the left side; death three days after; softening of both corpora striata, most extensive on the left side; numerous exudation corpuscles in the left corpus striatum; vessels in the right corpus striatum coated with exudation granules and a few corpuscles.*

Ann Cameron, aged 39, admitted June 20, 1842, under Dr Paterson, labouring under all the symptoms of *phthisis pulmonalis* in its second stage. This disease continued to make progress, when, on the morning of October the 25th, on getting out of bed, she was suddenly seized with loss of speech and insensibility. Two hours after intelligence returned, but she continued speechless. There was complete paralysis of the right arm, but she could slightly move the right leg, and the sensibility, though impaired, was not absent. The mouth, on her attempting to speak, was drawn to the left side, and the tongue, when protruded, was turned to the right. She seemed to be suffering from cephalalgia, Pulse was 105, rather small, and the breathing slightly stertorous. The pupils were not affected, bowels open. October 26th, She can articulate a few words, and has recovered considerable command over the leg. She can also move the arm slightly. November 1st, The intellect and the power of speech are fully restored. She can also freely move the right arm and leg, and now only experiences in them slight weakness. The cough is very troublesome, and she expectorates about three ounces of muco-purulent fluid daily. The appetite is good, but she is rapidly wasting. No pain in the head or chest. Respiration easy. On the night of the 9th of November she experienced an attack similar to the one which occurred on the 25th of October. The breathing was stertorous, and 25 in the minute. The pulse 112, small and weak, and the power of speech and the intelligence were arrested, The left side was affected with paralysis, whilst the right continued as before. Two hours after the attack consciousness slightly returned, but coma gradually supervened, and continued till her death, which took place on the 12th.

Sectio, November 14th.—Considerable effusion in the subarachnoid cellular tissue, elevating the membrane to a level with the convolutions. On slicing the brain a larger number of red dots than usual were observed. The left *corpus striatum* was softened throughout, of a dirty-yellow colour, and its centre was so diffluent, that on making a section, a cavity the size of a hazel-nut was left in its interior. From this centre the softening became less and less, till it terminated in healthy structure. The upper surface of the right *corpus striatum* was also softened and slightly pultaceous. The

ventricles contained very little serum, not more than a teaspoonful, and their walls, as well as the other portions of the brain, were healthy.

There was great emaciation of the body. Both lungs were studded with tubercles in different stages of development. Heart small; mitral valve somewhat hard and thick in its folds. The liver was very large and somewhat fatty, weighing 4 lbs. 15 oz. Tubercular deposits existed in the solitary and aggregate glands in the lower part of the ileum; kidneys slightly granular.

Microscopic Examination.—The *corpus striatum* of the left side consisted of broken down cerebral substance, with multitudes of exudation corpuscles. The right *corpus striatum* contained few exudation corpuscles, but its vessels were coated with granules to a considerable extent.

Remarks.—The principal features in this case were two distinct attacks at an interval of fourteen days, the first causing paralysis of the right side, and the second that of the left. On examination, both *corpora striata* were found softened, the left, however, much more so than the right. It was also determined that whilst in the left *corpus striatum*, which was first affected, numerous exudation corpuscles and granules existed, in the right one, the former were few, and the latter principally coated the vessels. Here, then, the number of the corpuscles, and the isolated character of the granules are seen to bear direct reference to the duration and amount of the softening.

No notice is taken of the existence of contraction or rigidity of the extremities in this case.

Obs. XIX.—*Pulmonary tubercle; hemicrania; gastric fever; delirium; death on the 16th day of the fever; effusion into the ventricles; central white softening of the cerebral substance; absence of exudation corpuscles or granules.*

"My Dear Sir,—I beg to send you an abstract of the case which you told me you wished to make use of in your researches on inflammation, and which it will give me pleasure to learn may prove serviceable to you.

"A young lady of 17, of delicate frame, of irritable temperament, and recently exposed to causes of much mental disturbance, was attacked during last summer with suspicious chest symptoms, on account of which Dr Davidson and I were consulted about the middle of October last. We were so strongly inclined to the opinion that condensation had taken place in the upper part of the right lung, as to advise her removal to a warmer climate. Two days before her intended departure, she was seized with severe vomiting of all ingesta, some general fever, and urgent hemicranic headach, which had long been a frequent visitor. The vomiting was relieved by hydrocyanic acid. For ten days she continued to labour under frequency of the pulse, foulness of the tongue with elongated papillæ, tendency to sickness and occasional vomiting, sometimes slight tenderness in the epigastrium, complete loss of appetite, dis-

turbed sleep, and irregular attacks of chilliness and heat. She was considered by Dr Davidson and myself to suffer from gastric fever. About the close of that period, the headach being unusually severe, though still hemicranic, and information being communicated that, two months before we were consulted, she had been stunned for a minute or two by a fall from horseback, we thought it right to keep in view during the treatment the possibility of some idiopathic affection of the head being the source of her illness. The case, however, continued in the main to advance like one of severe gastric fever. On the night of the twelfth day there was mild delirium but no other change; on the night of the thirteenth rather more delirium. On the forenoon of the fifteenth day, the pulse, which previously ranged from 110 to 120, had risen to 132; but she felt more comfortable, and the tongue was apparently improving. During the night which followed, the delirium was greater than it had ever been, and her friends could not get a correct answer from her. Towards morning she became quiet, and was supposed to have fallen asleep, but about half-past seven she suddenly turned on her right side, gave one or two groans, and expired. There was never any contraction of the arms or any trace of paralysis.

"*Sectio*, 30 *hours after death*.—The upper lobe of both lungs was studded with minute tubercles. The *dura mater* was vascular; the arachnoid over the whole brain, even in front, minutely reticulated with red vessels. The convolutions on both upper external regions flattened and dry; the lateral ventricles distended with nearly two ounces of clear serosity, the septum lacerated, the parietes every where softened, but to no great extent, and without any change of colour. There was no lymph anywhere. The *medulla oblongata* and the spaces between it and the cerebellum were covered with a greenish yellow gelatinous exudation.—Yours, very truly,

To Dr Bennett. R. Christison."

Microscopic Examination.—I examined a portion of the softened cerebral substance which was removed by Dr Peacock, who conducted the examination. No exudation corpuscles or granules could anywhere be detected. The tubes were readily separated from each other but not broken down.

Remarks.—This case is one of by no means unfrequent occurrence in practice. There is fever, delirium supervenes, death takes place, and on examination effusion of fluid is found in the ventricles, with more or less central softening of the brain. Under such circumstances, the practitioner conceives the lesion to have been inflammatory, and reproaches himself with not having been more active in combating the cerebral symptoms. It is for this reason I have been particular in giving the case in Dr Christison's own words, because it must be evident from the details entered into by a practitioner so eminent, that some such ideas must have occurred to him. Now, it may be asked, is the softening in these cases truly inflammatory, or is it merely a *post mortem* phenomenon? To determine this question it will be necessary to

study the minute structure of the softening, and the accompanying symptoms of other cases in which the lesion was undoubtedly inflammatory. In every instance where inflammation was unequivocal, exudation corpuscles or granules were detected. These were entirely absent in the present case. In the first ten observations recorded, inflammatory softening of the cerebral substance existed. A reference to these will show, that in every instance there was either loss of consciousness succeeded by dulness of the intellect, convulsions, contractions, or paralysis. Obs. X. presented a similar lesion to the eye, but exudation corpuscles were found in the softened portions, and there were tonic spasms and profound coma. The patient, however, was only ten months old, and symptoms differ so much in infants and adults, that we can scarcely draw a correct analogy between them. Obs. XV. most resembles the present case. A girl, aged 18; considerable central softening existed, containing no exudation corpuscles, but combined with capillary apoplexy. Here there was loss of consciousness and convulsions. In the case under review there were no convulsions, contractions, or paralysis; no sudden loss of consciousness or dulness of intellect. None of the symptoms, in short, which we have seen to accompany central inflammation of the brain. The leading head symptoms were hemicrania and delirium Hemicrania has never been observed to be connected with cerebral softening. Delirium, when it occurs, is accidental, and dependent, as we shall afterwards see, upon changes occurring, not in the central but in the *peripheral* portions of the brain. There can be little doubt, therefore, whatever may be nature of the softening in this case, a point I shall more fully discuss hereafter, that it does not depend upon inflammation of the nervous tissue.

Obs. XX.—*Impaired intelligence; loss of speech; disorganization of the left eyeball; convulsions; coma; death in five weeks after receipt of the injury; abscesses and softening in the left anterior and middle lobes of the cerebrum, the latter containing numerous exudation corpuscles; extensive central softening of the brain and right hemisphere, with absence of exudation corpuscles.*

Alexander Blaker, aged 14, admitted into the Royal Infirmary, October 3d 1842, under Dr Paterson. Three weeks before admission he complained of pain in the head, which, from that time, underwent a gradual increase. A week subsequently, the left eye became actively inflamed. It was stated that he had received a blow over the eyes with the stroke of a whip, which was afterwards found to be incorrect.

On admission his intelligence was greatly impaired, and the eye was inflamed. Whilst in the Infirmary, no report was taken of his case, but the following seem to be the principal symptoms which were observed. During the whole time he was incapable of speaking, but made inarticulate sounds and signs, to indicate his want of food or drink; at the same time he passed his evacuations in bed.

He could, however, rise and walk as far as the fire, when he was observed to turn towards the left side. There was no paralysis of the arms; the eye became completely disorganized; the cornea sloughed, and a large portion of the iris protruded through the aperture. The vision of the other eye seemed also to be imperfect. Two days before death, he had a severe rigor while sitting by the fire, followed by vomiting. The next day it was stated that he had been seized with a convulsive fit. After this he became comatose, and died on the 15th.

Sectio, October 17th.—On elevating the vault of the cranium, the *dura mater* appeared healthy, except at the left side, corresponding to the squamous portion of the temporal bone. Here, for a space about the size of half-a-crown, it was rough from irregular deposits of lymph. On dividing the *dura mater* at this point, a large quantity of very thick greenish-coloured purulent matter escaped, half-an-ounce being collected, and at least double that amount being lost. The subarachnoid cellular tissue, covering the cerebral lobes superiorly, were deeply injected. The convolutions were greatly flattened, and the sulci almost obliterated.

On slicing the left hemisphere, a chain of abscesses, from the size of a shilling to that of half-a crown, communicating with each other, was found in the external portion of the left anterior and middle cerebral lobes. These were full of a greenish purulent matter, and extended to the base of the cranium. The cerebral matter surrounding the purulent collection was softened, of a somewhat cheesy consistence, and slight yellowish tinge. The fornix, *septum lucidum*, and white matter surrounding the ventricles, especially the medullary matter on the right side, were of pultaceous consistence, of a clear white, and would not bear the slightest handling. Both lateral ventricles were considerably dilated and distended with serum of a milky appearance, which escaped on making the section.

On removing the brain, a portion of the temporal bone and greater wing of the sphenoid bone were found carious.

Microscopic Examination.—The purulent matter contained in the abscesses was of normal character. The softened cerebral substance surrounding the purulent collection, which was of a cheesy consistence, contained numerous exudation corpuscles. Large exudation masses also coated the vessels, and filled up the spaces between them. The softened cerebral substance surrounding the ventricles, the fornix, *septum lucidum*, and medullary portion of the right hemisphere contained no exudation corpuscles or granules. The cylindrical and varicose tubes, however, were readily separated from each other, but not broken down, and the varicosities on some of the latter were unusually large.* In many places some of these terminated in a large oval *cul de sac*, bounded by double lines, which were continuous with those forming the boundaries of the nervous tube. These *cul de sacs*, with the exception of the narrow neck which united them

* Dr Peacock, Prosector to the Royal Infirmary, was present at the microscopic examination of this brain, and confirmed the results.

to the tube, were in every respect similar to the round and oval corpuscles so frequently observed floating loose.—See Plate VI. Fig. 3.

Remarks.—In this case there was disease of the osseous structure at the base of the cranium. Abscesses had formed in the substance of the left cerebral lobe, a morbid condition which rarely results independent of lesion in the bones. The softened brain surrounding these contained numerous exudation corpuscles. Now it is remarkable, that in the same brain extensive softening in the neighbourhood of the ventricles existed, in which none of these bodies were found. It should also be observed, that the fluid was of a milky aspect, an appearance which has hitherto been considered as indicative of inflammation. The body was examined fifty hours after death. The symptoms observed were evidently referable to the inflammatory action going on in the left hemisphere; the formation of abscesses and pressure upon or destruction of the nerves leading to the orbit. No decided paralysis was remarked, inasmuch as he could walk to and sit by the fire. His arms also were unaffected, and although he could not speak, he made movements to express his wants. The intelligence, however, is stated to have been impaired. In connection with these facts it should be remarked, that the abscesses and softening surrounding these were situated in the external portion of the left anterior and middle lobes. How different are the symptoms when the central organs are inflamed! It may be asked, did his bending towards the left side on walking indicate weakness on the right side of the body?

Obs. XXI.—*Concussion of the brain from a fall; death seven days after the receipt of the injury; softening of both anterior lobes of the cerebrum, and right lobe of the cerebellum to a limited extent, with extravasation of blood; exudation corpuscles and granules in the softened portions; nervous tubes in the diseased part of the cerebellum much broken up, presenting a peculiar appearance.*

Elizabeth Robertson, aged 22, admitted August 31st 1842, under Dr Duncan. This woman was brought to the house by the police, who stated that she had fallen down a stair backwards, when in a state of intoxication. On admission she was insensible, but appeared aware when an attempt was made to rouse her. The pulse was about 80, of good strength and regular; breathing laboured and stertorous; pupils rather contracted; temperature of the extremities natural. On examination a tumour was found on the left of the occipital protuberance; pretty copious bleeding took place from the right ear. In about five hours after admission sensibility returned. The pupils were rather dilated, but the breathing was still laboured and stertorous. Pulse increased in frequency and full. (V. s. ad ℥xxv.) September 1st, Headach; pulse 85, of good strength. (℥viii. of blood taken from the temporal artery.) September 2d, Headach not being relieved, arteriotomy was

again had recourse to. September 4th, Headach, *tinnitus aurium*, intolerance of light; pulse firm and slow. (18 leeches to the head.) September 5th, Stertorous breathing; restlessness and profound coma; pupils dilated and insensible; pulse 65, firm. V. S. ad ℥xvi. Pulse rose and became fuller with the bleeding. Blister to the head. September 6th, Coma continues; had slight return of consciousness this morning; respiration laborious and hurried; pulse quick; some inversion of the left eye. Died at 12 P. M.

Sectio, September 8th.—Extravasation of blood beneath the pericranium. On removing the *dura mater*, the arachnoid was found elevated in various places by a greenish solid exudation, which coated the *pia mater*, and followed its reflexions, even so far as the *plexus choroides* of the ventricles. The veins of the hemispheres were turgid with blood, and slight extravasation existed in various places. On the anterior surface of both anterior lobes a portion of the cerebral substance was softened. The diseased parts looked as if the textures had been lacerated or broken up, and infiltrated with blood. This last was in several places of a dark-purple colour, and resembled the lees of port wine. The softened portions were each about the size of half-a crown. A similar softening existed on the inferior surface of the left lobe of the cerebellum. The *dura mater* in the right fossa of the cerebellum was lacerated about one and a-half inches in length. The posterior wall of the lateral sinus was also divided where it lay on the fossa beneath the petrous portion of the temporal bone. There was an extensive fracture at the base of the cranium, traversing the petrous portion of the temporal bone. The *membrana tympani* was lacerated, thus affording a ready exit for the blood by the external ear. Blood was also extravasated into the cancellar texture of the bone, and over the right side of the base of the cranium between the *dura mater* and bone. The other organs were healthy.

Microscopic Examination.—The softened portions of the anterior lobes contained numerous exudation corpuscles, many of them nucleated. The nervous tubes were also considerably broken up. Those in the softened portion of the cerebellum resembled numerous round hollow corpuscles of various sizes, bounded by distinct double lines. See Plate VI. Fig. 2. In some places these might be seen continuous with a varicose tube, as in Obs. XX. In the gray substance of the convolutions, which were covered with lymph, the terminal loops of the capillary vessels were coated with exudation granules.

Remarks.—In this case the usual symptoms of concussion of the brain were present. Consciousness returned after the shock of the injury had passed; coma succeeded, which terminated in death. Independent of considerable extravasation of blood, the cerebral substance was soft, broken up and lacerated in three places. Blood was infiltrated into the nervous texture, and numerous exudation corpuscles and granules existed in the softened portions. The nervous tubes were so broken up, as to present the appearance of distinct corpuscles. In these cases it would appear

that the varicose tubes undergo a change; that the swellings upon them become larger, at the expense of the tubular portions, and that, when ruptured across, their extremities have the property of reuniting, so as to form independent round or oval corpuscles, which are hollow and highly elastic.

The existence of contraction or paralysis is not noticed in this case, and we should observe that the central portions of the brain were healthy, and that the lesions were confined to the periphery of the organ.

Obs. XXII.—*Hemiplegia of the left side, with contraction of the left arm; rigidity of the muscles of the neck; hemiplegia of the right side; dulness of intellect; resolution of the left extremity; death ten days after the attack; supposed softening of the right corpus striatum; softening in the centre of the Pons Varolii, containing numerous exudation corpuscles and granules.*

Andrew Thomson, aged 25, by trade a butcher, of somewhat intemperate habits, admitted November 15, 1842, under Dr Paterson. He has enjoyed good health, with the exception of occasional dizziness of head, and bleeding from the nose, until eight days before admission, at which period, when following his occupation, he was seized with loss of power over the left side, but without any affection of the intellect. He was able to speak, and complained of giddiness and noise in the head. The side was destitute of sensibility, and his mouth was drawn to the left. He was bled, and took purgative medicines, but without relief, and the symptoms continued until the morning of his admission, when he lost the power of speech, and the right side became completely powerless.

On admission, he was able to move the right arm slightly, and made the attempt when desired to do so. The left arm was flexed upon the chest, and rigid, so as only to be extended by the exertion of force. The legs were completely paralyzed and relaxed. The mouth was firmly closed, and the head drawn backwards from tonic spasms of the muscles. All the paralyzed parts were devoid of sensibility. The urine and feces passed involuntarily. The pupils were somewhat dilated, and sparingly sensible to light. The intellectual powers seemed slightly, if at all impaired. The breathing was quick, laboured and stertorous, and the pulse 108. (Twenty leeches to the temples; blisters to the head; two drops of croton oil to be placed upon the tongue.) November 16th, No improvement, notwithstanding the powerful operation of the remedies ordered. Is less intelligent than before, and has less command over the right arm. The resolution of the inferior extremities, contraction of the left arm, and muscular rigidity of the mouth and neck continue. Pulse 120, more full. The face is flushed, and the breathing is more hurried and stertorous. Nov. 17, The intellect more obtuse. The left arm is no longer rigid, but completely resolved. The mouth admits of being partially opened. The neck continues rigid. In the evening became comatose. V. s. ad $\frac{\text{z}}{\text{ʒ}}$xv. Died at half-past five on the morning of the 18th.

Sectio, November 19th.—The arachnoid was elevated by an opaline gelatinous exudation, found in the subarachnoid cellular tissue. Posteriorly this membrane was elevated above the level of the convolutions. It was also studded with small opaque white spots, apparently from the deposit of lymph on its attached surface. The large veins on the surface of the hemispheres were turgid with blood. On section the cerebral substance appeared unusually vascular. Three drachms of clear serum were found in the ventricles, and a small undetermined quantity existed in the base. The right *corpus striatum* was also softened, probably the result of mechanical injury. The *Pons Varolii*, near its centre, was found softened, to about the size of a hazel-nut. The lesion was more on the right than the left of the mesial line, and the texture of the part was not pultaceous, or altered in colour. *Medulla oblongata* normal.

Microscopic Examination.—The softened *corpus striatum* contained no exudation corpuscles. They were abundant, however, in the softened portion of the *Pons Varolii*, and more so on the right than the left side of the mesial line.

Remarks.—This is an exceedingly valuable and well-marked case, and illustrates the necessity of employing the microscope in our *post mortem* examinations. All the symptoms of acute softening were present, paralysis of the left side, including rigidity and contraction of the left arm, dulness of intellect, and tonic spasms of the muscles of the mouth and neck. The right side was also affected, but in a slighter degree. As the case excited considerable interest, great care was taken in examining the brain. When the lateral ventricles were opened, it became a question whether the right *corpus striatum* was softened. Several persons applied their fingers, and endeavoured to ascertain the point. As the manual examination proceeded the normal consistence of the part diminished, until at length it presented all the appearance of pultaceous softening. In this state it was shown to Dr Paterson, who naturally enough considered it to be the result of disease. I differed from him in opinion, first, because I had carefully observed the gradual increase of the softening in the manner alluded to; and secondly, because disease of the *corpus striatum* could not have explained the well-marked symptoms which existed on both sides of the body. When the *Pons Varolii* was bisected, Dr Peacock, who conducted the examination, conceived it to be softened; others who examined it could observe no difference in the texture; its colour and consistence were unchanged. Reasoning from the symptoms, the lesion was very likely to exist. But how, it was argued, could a judgment be formed? We ought to reason from facts not from theories. Here, then, was an evident lesion of the *corpus striatum*, which explained nothing, and a problematical lesion of the *Pons Varolii*, which, however, did it exist, would satisfactorily account for the symptoms. In this state of uncer-

tainty the microscope was sent for, and it was demonstrated, and made evident to Drs Paterson, Peacock, and all the students present, that the *corpus striatum* contained no exudation corpuscles, whilst in the *Pons Varolii* they were very abundant.

I have endeavoured to describe exactly what took place on this occasion, from which it must be evident that, had not the microscope been appealed to, the right *corpus striatum* would have been pronounced softened, whilst the real lesion in the *Pons Varolii* might have escaped observation. Under such circumstances, this case would have added another to the inexplicable observations with which the records of nervous diseases abound. By means of the microscope, however, it was established satisfactorily that nothing morbid existed in the *corpus striatum*, and that it was most probably the result of mechanical lesion. On the other hand, it was demonstrated that the central portion of the *Pons Varolii* contained the same bodies which we have so frequently seen connected with inflammation in other cases. It was also shown that these were more numerous on the right than on the left of the mesial line, thus not only explaining the general symptoms of the case, but pointing out why the paralysis and contraction were better marked on the left side of the body.

Obs. XXIII.—*Apoplexy; hemiplegia of the right side; death in eight days; extensive hemorrhage into the left cerebral hemisphere; absence of exudation granules or corpuscles.*

Walter T——* aged 75, enjoying good health, with the exception of occasional headach, was sitting down to supper on the evening of November 12th 1842, when he suddenly put his hand to his head, saying that he could not see, and that he thought he was dying. He gradually sunk into complete coma; the respiration was stertorous; complete resolution of the right side; pupils contracted. Latterly there was no command over the sphincters; there was never any rigidity or contraction of the extremities. Death took place on the 20th inst.

Sectio, November 22d.—There was a very large coagulum in the left cerebral hemisphere, filling up the ventricle, encroaching considerably on the right side. The cerebral substance surrounding it was broken up, pultaceous, and of a rusty-brown colour. Between six and seven ounces of blood must have been extravasated.

Microscopic Examination.—The softened cerebral substance contained fragments of tubes, blood globules, and coagulated masses of blood in large quantities, but no exudation granules or corpuscles could be discovered.

Remarks.—This case is interesting from its similarity to Obs. XI. in which nearly the same symptoms occurred, death took place at nearly the same time after the attack, and in both a large coa-

* Dr Ransford kindly invited me to be present at the *post mortem* examination of this case, which occurred in his private practice.

gulum existed; yet in the one the softened substance surrounding the clot contained evidences of inflammation, whereas in the other none of these could be found.

Obs. XXIV.—*Apoplexy; hemiplegia of the right side; partial recovery; sudden return of attack, with rigidity and contraction of right leg; death one month after the apoplectic attack; clot of blood in the left hemisphere, with softening; numerous exudation corpuscles; masses and granules in the softened portion.*

William Clarke, aged 41, admitted into the Royal Infirmary, under Dr Paterson, January 27, 1843, by trade a blacksmith, of intemperate habits, was seized on the 3d with apoplexy, followed by paralysis of the right side of the body. The attack had been preceded by cephalalgia. On admission there was hemiplegia of the right side. The mouth was drawn to the left side, and the tongue to the right. The articulation was indistinct. After bleeding, cupping, and purging, he recovered the use of his limbs so far as to feed himself, and even to walk. He had, however, occasional twitchings of the right side of the face. In this state he continued until January 30th, when he was suddenly seized with loss of consciousness, and tonic spasms of the right side of the body. (Venesection, and blisters to the head.) January 31st, To-day complete resolution of the right arm, but rigidity, and contraction of the right thigh, which was permanently flexed on the abdomen. Consciousness has returned, and he complains much on any attempt to straighten the rigid limbs. In the evening he became comatose; pupils much contracted. February 1st, Rigidity has disappeared; lies in a comatose state. In this condition he continued. The teeth and lips became covered with sordes, and he died at 10 A. M., February 3d.

Sectio, February 4th.—On elevating the skull-cap considerable subarachnoid effusion was discovered, which posteriorly elevated the membrane above the level of the convolutions. On the left side, about the middle of the superior hemisphere, there existed a slight depression, on making a section through which a clot was found in the cerebral substance above the lateral ventricle. The clot was about the size of a pigeon's egg. It was firmly coagulated, of a brownish colour, and surrounded by a quantity of thin brown fluid. The cerebral substance in its neighbourhood was much softened, the lesion, in some places, extending to the depth of one inch into the white matter. Two drachms of clear fluid were found in the ventricles. Other portions of the brain healthy.

The heart was large, weighing 11 oz. Left ventricle much hypertrophied. Small vegetations on the aortic valves. Right lung much inflamed and hepatized. The spleen was much hypertrophied, weighing 2 lbs. 10½ oz. The liver was somewhat mottled on the surface; kidneys large; other organs healthy.

Microscopic Examination.—The softened cerebral substance surrounding the clot contained exudation corpuscles and granules. Large exudation masses were also found coating and lying between the vessels.

Remarks.—How different are the symptoms in this case to

those recorded in the last observation. Here, also, an apoplexy followed by hemiplegia was occasioned by an extravasation of blood. It was, however, not larger, but acted apparently as an irritating body, producing at a later period inflammation around it. After a time the same symptoms that we have previously so often noticed connected with cerebral inflammatory softening were developed, including rigid contraction of the inferior extremity, and after death numerous exudation corpuscles, masses and granules were found in the softened portions surrounding the clot. In this instance death took place a month after the apoplectic attack, and the softening extended deep into the brain. In Obs. XII. a similar lesion, with the same histological appearances were found. Death took place five weeks after the apoplectic attack, but no contraction or rigidity of the limbs were observed. In that case, however, the man had been only ten days in the Infirmary, and some of the symptoms might, therefore, have escaped observation. Moreover, the softening surrounding the clot was comparatively trifling, and the exudation corpuscles, masses, and granules not so numerous.

Obs. XXV.—*Arm torn off by machinery, with laceration of the shoulder; trismus; opisthotonos; death four days after the appearance of the tetanic symptoms; blood extravasated within the spinal column, external to the dura mater; softening of the spinal cord in its dorsal portion; absence of exudation corpuscles or granules.*

Thomas M'Ewan, aged 18, admitted into the Royal Infirmary under Dr Duncan, December 7, 1842. About five hours before admission this lad's right arm was entangled in the machinery of a paper-mill. The arm was torn off, the humerus giving way a little above its middle. The stump left was of a conical form. The muscles were much lacerated, and the skin extensively torn from the shoulder. The divided humeral artery and nerves were found among the lacerated muscles, the former firmly closed by a firm clot. The state of the parts was such as to render amputation unadvisable, as no sufficient covering could be procured from the extensive laceration. The patient had also lost a considerable quantity of blood; the surface was exanguine; he talked incoherently, and the pulse was soft, compressible, and fluttering. It was determined, therefore, to see what the powers of nature could perform, deferring any attempts at improving the state of the stump by removal of any part of it, until the suppurative stage had terminated. (Stump enveloped in lint, steeped in warm water, opiates and antimonials.) December 19th, Up to yesterday the patient continued to do remarkably well. Suppuration was fairly established in the stump, the sloughing was inconsiderable, and the discharge was healthy; the constitutional symptoms were relieved; the appetite returned; the pulse ranged from 90 to 110. Last night he complained of some difficulty of swallowing. This morning he was unable to open the jaws to their full extent. At the visit the teeth of both jaws could only be separated to the extent of one inch and a-half. The

head was held in a constrained position from rigidity, which existed in the muscles of the neck. (Purgatives, opiates, tobacco enemata.) In the evening he had several startings of the stump, which caused him to scream out. December 20th, The jaw can now scarcely be opened in any way, and the rigidity of the neck is increased. During the night has had several twitchings of the stump, and injured his tongue no less than seven times, causing him to scream out. The surface of stump has taken on an unhealthy aspect, the healthy granulations have disappeared. Several sharp spiculæ of bone were removed. Rigidity of jaws and neck continues; countenance contracted; *risus sardonicus.* (Quinine and morphia.) December 21st, Passed a more tranquil night. This morning had a violent spasm, during which the head and trunk were drawn backwards. There was also dyspnœa. A similar spasm occurred in the evening. During the night the spasms became more frequent, and assumed all the characters of complete opisthotonos. He expired during a violent spasm betwixt 11 and 12 A. M. on the 22d.

Sectio, December 24th.—The brain was healthy. On laying open the spinal cord, a mass of coagulated blood, partly decolorized, was found extending over a considerable portion of the dorsal region external to the *dura mater.* On dividing this membrane the spinal cord presented no appearance of disease, with the exception of a circumscribed swelling in the lower portion of the dorsal region, which, on section was found of a pultaceous consistence. The extremity of the median nerve on the stump, where it had been torn across, was somewhat thickened and swollen. The other internal organs were healthy, with the exception of the bronchi, which contained a considerable quantity of mucus.

Microscopic Examination.—The varicose tubes of the spinal cord where it was softened were readily separated from each other by pressure. Many of them were broken down, forming the globules with double lines, similar to those observed in Obs. XXI. Other portions of the cord, previously ascertained to be healthy, were, by my friend, Dr Peacock, mechanically broken up with the scissors, so as to produce a pulpy softening, and when examined microscopically presented the same appearance. No exudation corpuscles or granules were to be seen.

Remarks.—This case of tetanus differs from that of Obs. XVI. in being traumatic and more acute. There was here also an extravasation of blood between the bones and *dura mater.* Was this extravasation in any way connected with the production of tetanus? It is curious, however, that in this instance also softening of the spinal cord should have been found. In the remarks appended to Obs. XVI., I stated that the softening was most probably the result of *post mortem* violence employed in opening the spinal column. In the present case another portion of the spinal cord was mechanically broken up, in order to determine whether similar softenings could thus be produced. The result was, that,

when examined by the naked eye, or by the microscope, they appeared identical. This circumstance, with the absence of exudation corpuscles and granules, leave little doubt in my mind that the circumscribed softenings so frequently recorded as the proximate cause of tetanus, have, in point of fact, never existed during the life of the individual. In the same manner may probably be explained those marvellous cases where the individuals have preserved the perfect use of their inferior extremities, notwithstanding extensive softening of the cord.*

II.—Observations connected with lesions of the nervous centres, detectable only by means of the microscope.

For striking examples of the existence of inflammation in the brain, without its being detectable by ordinary sight, I refer to Obs. IV., XX., and XXII. In those instances, however, more evident lesions were also present. In the following cases no morbid change whatever could be found in the brain.

Obs. XXVI.—*Acute hydrocephalus; death ten days after the commencement of the disease; nothing anormal in the brain; vessels of the convolutions abundantly coated with exudation granules.*

John Smith, aged 3 years, admitted into the Royal Infirmary under Dr Traill, February 12, 1842.

According to the mother's account, he awoke during the night of the 3d instant with a loud scream, and, by pointing to his head, seemed to indicate that he felt pain there. On the following day he vomited repeatedly, and he has since refused all food. On admission there was constant rolling of the head; pupils contracted on the approach of light; pulse quick and sharp; bowels regular. Two leeches to the head; powders of calomel and sugar.

February 13th. Vomited powder; passed a restless night; some tremor observed in the limbs. Blister to the head; clyster; became restless, and died during the night.

Sectio, February 15th.—The membranes covering the brain displayed no unusual vascularity. The ventricles contained no fluid, nor was the consistence of the cerebral substance in any way altered.

Microscopic Examination.—The vessels of the convolutions were in many places slightly coated with exudation granules. The fornix and central medullary parts of the brain presented a similar appearance. The coating of granules here, however, was frequently two, and even three times thicker than the vessel to which it was attached, and contained here and there clear, round, white spots, similar to the nuclei of the exudation corpuscles. See Plate VI. Fig. 4.

Remarks.—This case presented the usual symptoms of acute

* See Lib. of Prac. Med. Vol. ii. p. 287.

hydrocephalus in children, yet after death no morbid lesion of any consequence was to be discovered. This is a circumstance of by no means unusual occurrence. A more minute examination, however, determined that the capillaries of the central substance of the brain were coated with exudation granules to a very great extent, and that these granules contained among them numerous bodies similar to the corpuscular nuclei. That the exudation in this case should have presented this condition, notwithstanding the violent symptoms, is very curious, and, in an histological point of view, exceedingly interesting. It furnishes us with an intermediate stage in the development of the exudation corpuscle, as seen in many of the preceding cases on the one hand, and those which are to follow on the other.

Obs. XXVII.—*Delirium tremens; death; slight subarachnoid effusion; brain otherwise healthy; capillary vessels throughout the gray substance of the convolutions, partially coated with exudation granules.*

William Johnston, aged 26, a tavern waiter, a strong muscular man, admitted into the Royal Infirmary, March 6th 1842, under Dr Craigie.

For the last three years he has seldom gone to bed sober, and during the last six months, he has frequently been intoxicated during the day. Ten days ago he was dismissed from his situation. Last night he was found by a policeman in the street, in a state of great excitement, and brought to the hospital in the morning. On admission there was much agitation, and constant tremor of the hands. The face was flushed, the surface bedewed with perspiration, and on the legs and arms were numerous ecchymosed spots, the result of external violence. There was increased sensibility of the surface, and a tendency to move from one place to another. Tongue foul; pulse frequent. This is the first attack of *delirium tremens*, but he has often had fulness of the head, flushed face, and injected conjunctiva, for which he has frequently been bled with relief. (*Calomel.* gr. iv. *Pulv. Jalap.* ℈i. enema.) In the evening he became delirious, speaking to guests in the tavern, &c. March 7th, The head symptoms are more intense. (*Antim. Tart.* 7½ grains; head to be shaved and cold applied.) In the afternoon the countenance became livid and haggard, and the delirium increased. In the evening slept a little, and the hands were not so tremulous. Died on the morning of the 8th.

Sectio, March 10th.—Some degree of subarachnoid effusion, but not sufficient to elevate the membrane above the convolutions. The brain on section was firm, with rather more red dots than usual. No appreciable amount of fluid in the ventricles; the choroid plexus was congested; a small quantity of effusion existed at the base.

The lungs were voluminous and congested; the heart was large, and weighed 13 ounces. There was slight thickening of the mitral and aortic valves; the coats of the stomach were healthy. The

liver was large, of a yellowish colour and granulated appearance, with the lobules distinct. The kidneys were healthy ; spleen small.

Microscopic Examination.—I made a most careful examination of this brain. Throughout the gray substance of the convolutions covering both the cerebrum and cerebellum, the capillaries were partially coated with exudation granules. This appearance was nowhere to be detected in the white substance. See Plate VI. Fig. 5.

Obs. XXVIII.—*Delirium tremens ; death in* 13 *days ; slight effusion into the subarachnoid cavity and lateral ventricles ; capillaries of the convolutions partially coated with exudation granules.*

William Davidson, aged 37, a strong and powerfully-built man, admitted into the Royal Infirmary, April 7, 1842, under Dr Spittal.

For two years this man has been connected with a brewery, and taken habitually two and a-half bottles of ale per day. To this he has occasionally added a gill of whisky, and sometimes drunk to perfect intoxication. Eleven days before admission he omitted to take his usual draughts, and he complained of general exhaustion, loss of appetite, and mental confusion. These symptoms continued to increase, and within the last two days, tremors of the extremities have been superadded. On admission the face was flushed, temperature of the surface normal ; slight injection of the conjunctivæ ; trembling of the lips and extremities. Answers questions confusedly, but no decided delirium. Tongue clean ; pulse between 70 and 80, full, and of good strength ; bowels open. (Calomel and colocynth pills ; *Antim. Tart.* gr. iv. and *Sol. Morphiæ* ℥ii. every hour.) In the evening he became very restless, and was covered with a profuse perspiration. Cold douche to the head. April 8th, During the night he became violent, and laboured under hallucinations of something attacking his face. Towards morning he became more tranquil. At the visit the pulse was 135, soft ; tongue slightly foul ; muttering incoherently. Slept in the afternoon for five hours ; in the evening became drowsy. Sordes collected on the teeth and gums. Turpentine enema. Died April 9th.

Sectio, April 11*th.*—Subarachnoid effusion and venous engorgement on the surface of the hemispheres. On slicing the brain numerous bloody points appeared in the medullary portion. There were ℥iiss. of transparent fluid in both lateral ventricles, besides a considerable quantity collected at the base. Pleural adhesions of both lungs ; heart enlarged ; the mucous membrane of the stomach was readily separated ; liver and kidneys engorged with blood, otherwise healthy.

Microscopic Examination.—Almost the same appearances as were described in the last case.

Obs. XXIX.—*Cerebral typhus ; delirium ; coma ; death on the* 14*th day ; effusion of serum into the ventricles, otherwise nothing anormal ; vessels of the convolutions partially coated with exudation granules.*

Mrs Spence, aged 36, admitted into the Royal Infirmary, March

10th 1842, under Dr Traill. A week previous to admission she was seized with pains in the head and back, violent shivering and weakness of the joints. Has had no vomiting. On the evening of admission she had considerable delirium; the abdomen was tense, with pain on pressure; she passed no urine, and a small quantity was drawn by the catheter. The eyes were suffused; bowels open; tongue brown and furred in the centre; skin dry; pulse small and quick. March 12th, Eyes still suffused; the tongue is very dry and brown in the centre; skin hot; no urine is secreted, none passes on introducing the catheter; can bear pressure in the hypogastrium. March 14th, The hearing is very dull; skin cool; pulse feeble; tongue dry; passes urine freely. March 15th, Some confusion of the intellect. March 16th, Last night considerable stupor; pulse very feeble. March 17th, Pulse feeble; coma profound; sordes on lips and teeth. Died.

Sectio, March 19th.—Slight effusion below the arachnoid; ventricles filled with serum; small cysts in the choroid plexus; otherwise nothing anormal.

Microscopic Examination.—The capillary vessels in the gray matter of the convolutions were lined with exudation granules, here and there in patches, but to no great extent.

Obs. XXX.—*Cerebral typhus; delirium; coma; death on the 14th day; slight extravasation of blood on the dura mater; slight effusion of serum into the subarachnoid cavity and lateral ventricles; capillaries of the convolutions partially coated with exudation granules.*

Widow M'Conochie, aged 52, admitted into the Royal Infirmary, February 10th 1842, under Dr Craigie. For six months previous to admission she has been labouring under debility and boils in the back, which she ascribes to want of food. On entering the house she laboured under headach, vertigo, sickness, and general prostration. These symptoms disappeared in a week. Fourteen days previous to her death febrile symptoms again made their appearance, accompanied with marked head affection. There was violent delirium for ten days, latterly sinking into low muttering. There was an abundant typhoid eruption. During the last two days she became comatose, and the evacuations were passed involuntarily. Died at 10 A. M., March 25th.

Sectio, March 26th.—On elevating the *dura mater* its inferior surface displayed a thin coating of coagulated blood. There was considerable subarachnoid effusion, and numerous red dots on slicing the brain. Three drachms of fluid in both ventricles, otherwise healthy.

Microscopic Examination.—Many of the capillaries in the convolutions, covering the superior portion of the hemispheres, were coated with exudation granules.

Obs. XXXI.—*Erysipelas of the head; delirium; brain apparently healthy; exudation granules coating the capillaries in the gray substance of convolutions.*

George Wardlaw, aged 38 ; admitted into the Royal Infirmary, August 17th 1842, under Dr Paterson. On admission he was found labouring under erysipelas of the head, for which he had been bled. August 19th, Passed a restless night, with raving ; he was also noisy and violent. The delirium increased during the night, and he was again bled. Died 4 A. M. on the 20th.

Sectio, August 21st.—The arachnoid was slightly elevated by fluid at the posterior part of the hemispheres. Some turgescence of the external hemispheres ; substance of the brain unusually firm ; very little fluid in the ventricles or at the base ; other viscera healthy.

Microscopic Examination.—The same appearances were found as in the last case.

Remarks.—The same observations apply to the five preceding cases, and to numerous others which I have not thought it necessary to give in detail. In all there was considerable mental excitement or delirium, terminating in coma and death ; and in all the capillaries of the convolutions were found more or less coated with exudation granules. I have no doubt that this appearance is the commencement of the more evident lesions resulting from inflammation, and it is probable that the symptoms in such cases are referable to the extension, rather than to the intensity of the morbid process. Such appearances, however, are very common in the brain, and when we consider that, in the majority of individuals, either slight delirium or coma precede death, we may readily understand how, in such cases, slight exudation is likely to arise from any vascular congestion which may, under such circumstances, take place.

Before proceeding to discuss the pathological conclusions which may be drawn from the foregoing observations, it will be well to describe the physical properties and mode of formation of the minute structures which have so often come under review—that is, so far as the numerous examinations I have made will enable me to determine them.

On the physical properties and mode of formation of the exudation corpuscle.

This subject may be described under the heads of, 1*st*, The effects of pressure and friction. 2*dly*, The effects of chemical reagents ; and 3*dly*, the theory of its formation.

Effects of Pressure and Friction on the Exudation Corpuscle.—On gradually pressing the perfect corpuscle, either with the hands between slips of glass, or by means of Chevalier's compressor, large drops like oil may sometimes be made to appear within the cell wall, or to exude through it, which subsequently becomes

more or less collapsed, (Plate VI. Fig. 7.) At others the cell is thus ruptured, and the granules escape. Sometimes one globule is thus separated, which is apparently of more dense materials than the other granules, leaving a white spot in the corpuscle, (Fig. 8, *a.*) On employing strong friction, the granules may be dispersed, but the separated globule remains for a considerable time unaffected, and occasionally it is impossible to break it down, (Fig. 8, *b. c.*)

2. *Effects of Chemical Reagents on the Exudation Corpuscle.*—It is difficult to determine the effect of chemical reagents on corpuscles, when they are found in a soft adhesive mass like that of brain. When they exist in fluids, as in blood or purulent matter, a drop of any chemical reagent mixes readily with it, and its effects can be easily ascertained : or a thin glass may be laid over the fluid examined, and a drop of the reagent placed upon its edge, as Mandl advised. In this way the latter gradually diffuses itself through the former, and the effect may be observed with great accuracy. Neither method, however, can be adopted where the tissue is dense or thick. The cells must then be separated and kept apart in water. When the nervous substance is softened, this is readily accomplished, by shaking in a test tube a small portion of the morbid structure with water. In this way a turbid milky fluid is produced, on examining which under the microscope, it is found to contain numerous fragments of nervous tubes, granules, globules with double lines, oil globules, and exudation corpuscles. The latter are seen apparently unchanged, rolling freely, and continually turning round in the fluid. Chemical reagents now added, come into immediate contact with the corpuscle, and its effects can be readily ascertained.

Water produces no change in these bodies. The cell wall appears loose and flaccid, and the whole rolls freely over and over, showing its continuous structure, and the granules contained within it.

Acetic acid sometimes produces no change ; at others the cell wall is rendered a little more transparent, but this has often been so slight and undetermined as to preclude making a positive statement to this effect.

Solutions of nitrate of silver and chromic acid, (℥j. to ℥ss.) cause the albuminous matter of the brain to coagulate in dense opaque masses. The corpuscles are contracted; their form is rendered irregular ; they become more opaque, and their edge more distinct and thick.

Liquor ammoniæ causes the corpuscle to dissolve gradually, and enables it to be readily broken down, and the granules dispersed by friction.

Liquor potassæ entirely dissolves the corpuscle, leaving no trace whatever of its existence.

Sulphuric æther in excess also dissolves the corpuscle, leaving behind an amorphous mass.

3. *Theory of the formation of the Exudation Corpuscle.*—Gluge was the first to point out, not only in softening of the brain, but that, in certain stages of inflammation generally, corpuscles are produced, which he has denominated compound inflammation globules. He observes, "Under certain circumstances, the blood in the capillary vessels stands still, and the blood globules are changed in the following manner, as I have directly observed with the microscope. They lose their coverings and colour, only their nuclei remain. These, however, do not remain isolated, but become agglomerated by means of a white connecting mass, and form thick, opaque, round bodies, which consist, on an average, of from twenty to thirty small granules, which, when examined singly, are perfectly clear and transparent. By pressure, as well as by the action of acetic acid, the granular bodies are broken up, and we are enabled to see that the opacity depends on their agglomeration. The longer granular bodies have a diameter of from $\frac{1}{300}$th to $\frac{1}{350}$th of a millimetre, the single granules from $\frac{1}{400}$th to $\frac{1}{500}$th of a millimetre. This measurement corresponds with that of the blood nuclei. These agglomerated bodies I have directly seen in the vessels, so that we have not here to do with a fluid, which first exudes through the walls of the vessel, and thus changes into granules." He further observes, with respect to softening of the brain, "that the effused serum of the blood produces a true maceration of the cerebral substance. Later the capillary vessels are torn, and the agglomerated bodies are then found in the parenchyma of the affected organs." *

It is singular, that, whilst Gluge has accurately described the granular structure and size of these bodies, the existence of a nucleus and cell wall should have entirely escaped him. Henle, however, states that these globules are surrounded by a membrane containing the granules and a pale nucleus. He points out that they most resemble pigment cells; that corpuscles so large cannot form in the capillary vessels, and is led to consider them identical with those cells he has denominated primary.† In this opinion both Valentin ‡ and Vogel § seem to concur, and it must be evident, from the observations previously detailed, that this is the correct view. Gerber does not seem to have noticed these bodies. He speaks, indeed, of exudation corpuscles, but neither from his description or figures can we suppose that he refers to the bodies found in inflamed parenchymatous tissues. He evidently alludes

* Anat. Mikroscopische Untersuchungen, pp. 12, 13.
† Muller's Archives, 1839, p. 24.
‡ See Vogel, ueber die Erweichung des Gehirns, p. 72.
§ Wagner, Handworterbuch der Physiologie, Art. Entzundung.

to the corpuscles found in the plastic lymph, produced on the surface of serous membranes, which, in my opinion, is a different structure, and has no connection whatever to the bodies now under consideration.*

From the different microscopic examinations I have detailed, the mode in which the exudation corpuscle is developed may readily be deduced. The blood *plasma*, or *liquor sanguinis*, which exudes through the walls of the blood-vessels, after a time, which may be shorter or longer, according to circumstances, coagulates in the form of minute granules. These may be seen coating the vessels, and filling up the spaces between them in masses more or less dense. If a small quantity only be exuded, the granules occur in small patches at irregular intervals, as in Obs. XXVII.—XXXI., Plate VI. Fig. 5. This appears to arise from a comparatively slight degree of congestion, which, however, may produce very intense symptoms from its diffusion over a large surface, as in cases of fever, delirium tremens, &c. When, on the other hand, the congestion is more intense in certain places, the exudation is more abundant, and the granules accumulate in a dense mass outside the vessels, or in the interstices of the elementary structures of the organ, (Plate VI. Fig. 4.) This exudation serves as a blastema for the production and nourishment of nucleated cells. These may either be formed directly from the fluid *liquor sanguinis*, or subsequent to its coagulation. In the former case they may be seen coating the blood-vessels, (see Journal, No. 153, Plate V. Fig. 6,) in the latter imbedded in the granular solid mass, (Figs. 7 and 8.) In parenchymatous tissues, where the whole exudation passes into solid coagulation, it is the growth and development of these corpuscles which causes it to break up, and gradually to become more and more soft. Thus we have uniformly seen that when the softening is diffluent, perfect corpuscles are few, and that the granules are numerous and loose; when it is pultaceous only the corpuscles are numerous, and the granules less so, and when the diseased part retains to a considerable degree its resistance, or is unchanged, the corpuscles are few, whilst the granules, instead of floating loose, are attached to, and coat the blood-vessels. During the progress of disintegration, it frequently happens that portions of the solid exudation are broken up into masses of greater or less size, which are frequently seen of irregular shape, both attached to the vascular walls, and floating loose in the field of the microscope.

The exudation corpuscle is formed like all other primary cells, a nucleus is produced, from which a cell wall arises. During, or subsequent to its full growth, granules are formed between the nucleus and cell wall. These become more and more numerous,

* Gerber's Elements of Anatomy, p. 83.

until at length the nucleus is obscured, and the whole cell appears full of, and distended with granules. It presents different appearances at different periods of its growth. At an early period it is very delicate and transparent; the nucleus is very distinct, like a white spot, and the granules exceedingly minute, and few in number. As the development proceeds, the granules become larger and more numerous, the corpuscle assumes a brownish colour, and becomes more or less opaque. Sometimes it entirely obstructs the rays of light, and looks black. In the observation where the softening resembled chalky milk, the whole cell was full of granules, of a large size, each of which were perfectly round and transparent, (Plate VI. Fig. 1.)

When the exudation corpuscle is distended with granules, it appears to have reached its furthest stage of development, the cell wall now bursts, and its contents escape, (Plate VI. Fig. 9.) This occurring in numerous corpuscles, causes the coagulated exudation to become soft, pultaceous, or even diffluent. When, by the process of organization thus described, the exuded mass is broken down, it appears probable that the minute granules or molecules, of which it now principally consists, may be reabsorbed, the structures of the organ set free from the pressure the exudation produced, and thus the part return to a healthy state. Gruby tells us that he has seen the mollecules thus produced by the breaking down of pus cells, permeate the coats of the intermediary and capillary vessels, and mix with the blood.* This is the process by which it seems probable that hepatization of the lungs is removed. It is impossible, however, to know with certainty whether a similar process takes place in the brain, because the symptoms of exudation into that organ are by no means so unequivocal, but it is highly probable. More generally, absorption either does not take place, or is not in proportion to the amount of exudation poured out, and the ultimate structure of the organ is also at length broken up and disorganized. Thus, when inflammatory softening of the brain is diffluent, not only is the exudation mass reduced to granules, but the cylindrical and varicose nervous tubes are broken up into fragments more or less long.

Dr Henderson, in an interesting paper on pneumonia,† was the first to point out a distinction between the different granular bodies resulting from exudation, as he had observed them in inflamed lungs. He says, "they do not always present in their agglomerated form the figure described by Gluge, but are variously shaped according to the state of perfection in which they may happen to be. While some are globular, and exhibit a circular outline, others appear deeply indented and defective, as if a portion of their substance had been removed; and others have nothing of

* Obs. Microscopicæ, p. 55. † Lond. and Ed. Monthly Journ. October 1841.

their original round figure remaining." I think it will appear that these differences do not arise from the stages of development of the exudation corpuscle, as Dr Henderson supposes, but are caused by the coagulated blood-plasma breaking up into different sized masses. I have frequently, by means of friction, caused such portions of coagulated exudation to separate, to peel off, as it were, from the exterior of the vessels, and float loose amongst the granules and corpuscles. These bodies I have distinguished by the term exudation *masses*.

We have seen that softening has probably been present for several months, and yet, on examination, the same perfect corpuscles have been found as when the lesion only existed a few days. Now, are we to suppose that exudation has been proceeding all this time, that new corpuscles are continually produced and developed, and their granules absorbed? On the other hand, are we to conclude that in these chronic cases the corpuscles do not originate only from the exuded *liquor sanguinis*, but are reproduced by the granules escaping from the parent cell, in the manner known to take place in similar organisms? This point is undoubtedly a difficult one to decide, for we have no means of judging from actual inspection in the animal textures whether such cells have the power of reproduction, or whether their life terminates with the rupture of the cell wall. Judging from analogy, however, I am inclined to consider the latter the most probable view, because, did reproduction proceed from the granules contained in each primary cell, the amount of morbid tissue would be very considerably increased, which is what we never observe in connection with exudation corpuscles.

There is another point in connection with my observations which, it appears to me, deserves attention. We have seen that pressure causes globules, like those of oil, to exude through the cell wall, and that, from the application of chemical reagents, it would appear that oily matter enters largely into the constitution of those exudation corpuscles. Dr Ascherson was the first to point out the important part played by oil in the formation of every organism,* and that it enters largely into the constitution of every primary cell and tissue is a well-known fact, and may be readily demonstrated. Whether every cell is, as he supposes, formed by the union of oil and albumen, however probable, is still a matter of question. No doubt these chemical principles enter largely, not only into the constitution of the elementary tissues, but into the products of inflammation, as in purulent matter, lymph, &c. That they are essential to the process of nutrition is well known. There can be no doubt, also, of the fact pointed out by Ascherson, that fluid fat or oil brought into contact with albu-

* See the writer's Treatise on the Ol. Jecoris Aselli, p. 53, et seq.

men, causes the latter to coagulate. Now fluid fat exists in various proportions in all the textures; in the brain we know it to be very abundant. May we not therefore suppose that it is the presence of the oil in living tissues which causes the fibrin and albumen of the blood to assume the granular form which we have uniformly seen to exist in inflammatory exudation? Many facts and arguments might be brought forward in support of this hypothesis; but I forbear entering upon a view which, in the present state of science, must be regarded as altogether speculative.

(*To be continued.*)

EXPLANATION OF PLATE VI.

All the figures represent structures, as seen under a magnifying power of 300 linear diameters.

Fig. 1. Exudation corpuscles and granules, as seen in the softening resembling chalky milk. (Obs. XVII.)

Fig. 2. Varicose tubes broken down, constituting globules with double lines. (Obs. XXI.)

Fig. 3. Varicose tubes, with the varicosities much enlarged. (Obs. XX.)

Fig. 4. Vessels extensively coated with exudation granules. (Obs. XXVI.)

Fig. 5. Vessels slightly coated with exudation granules. (Obs. XXVII.)

Fig. 6. Exudation masses, some containing transparent globules, resembling nuclei or drops of oil.

Fig. 7. Exudation corpuscles, showing the effects of pressure.

Fig. 8. A nucleated exudation corpuscle gradually broken down by strong friction.

Fig. 9. Different exudation corpuscles after being fully developed. The contained granules are discharged, and the cell wall disappears.

(*From the Edin. Med. and Surg. Journal, No.* 157.)

The two following observations are valuable in many points of view, and tend to confirm the results previously arrived at.

Obs. XXXII.—*Fever ; Cephalalgia ; Delirium ; Fungoid tumour at the base of the orbit ; death in thirty-six days ; abscess in the left anterior lobe, surrounded by fawn-coloured softening, containing numerous exudation corpuscles ; yellow softening of the central substance of left hemisphere containing neither purulent matter or exudation corpuscles.*

John Vallence, aged 24, an iron-founder, admitted into the Royal Infirmary, under Dr Craigie, March 2d 1843. Eight days previously he had been seized, after exposure to cold, with pain, swelling, redness of the left eye, and pain in the forehead. On admission the eye-ball was swollen, red and tense. There was great sensibility to light, with chemosis, and increased discharge from the left nostril. The vascularity of the right eye was also increased. The tongue was loaded, and there existed a typhoid eruption on the skin over the back and chest. Pulse 100, full and hard. (*Venesect. ad* ℥xij. *Saline Mist.*) The bleeding produced considerable relief ; pulse fell to 92. March 4th, The bleeding was repeated to ℥xvj. and again caused diminution of the pain in the eye and forehead. There is a profuse discharge from the eye and left nostril. A tumefaction with obscure fluctuation is perceptible in the forehead, above the left eyebrow. He has passed a restless night with muttering and delirium. March 6th, The swelling in the forehead was opened yesterday, and a small quantity of matter evacuated. Complains much of debility. March 7th, There is a purulent discharge from the incision and from the left nostril. The delirium and constitutional symptoms are abated. The eye now became daily more and more protruded from the socket. The eyelids continuing very tense and swollen. They were occasionally punctured with relief. He always complained of more or less pain in the forehead, and the discharge continued up to the time of his death. On the 30th of March, after drinking largely of tea, he complained of cold shivering, which was soon after followed by coma and stertorous breathing, and he died in about twenty minutes, at half-past five P. M.

Sectio, April 1st 1843.—On removing the skull-cap, the hemispheres anteriorly were found somewhat flattened, and the convolutions pressed together. An abscess the size of a hen's egg existed in the

left anterior lobe of the brain, anterior to the *corpus striatum*, lined by a yellow membrane. This abscess communicated with the base of the cranium, and extended somewhat into the right anterior lobe, both lobes being adherent. Superiorly it was connected with a fungoid tumour involving the bone at the inner side of the orbit; internally encroaching on the nasal cavities, and externally pushing out the eyeball and stretching the optic nerve. The cerebral substance surrounding the abscess was softened and of a fawn colour. The central medullary substance, on the left side, was much diminished in consistence, and even pulpy towards the centre of the hemisphere. It was of a light straw-colour, in every way resembling purulent infiltration.

The other organs were not allowed to be examined.

Microscopic Examination.—The abscess was composed of normal purulent matter. The fawn-coloured softening surrounding it contained numerous exudation corpuscles and granules. The straw-coloured softening, in the central medullary substance of the hemisphere, was wholly composed of the medullary and varicose tubes, very much broken down, without any trace of purulent matter or exudation corpuscles.

Remarks.—In this case intense cephalalgia and delirium were the leading cerebral symptoms. After death an abscess surrounded by an inflammatory softening existed in the left anterior lobe, to which these symptoms may be ascribed. The medullary substance of the hemisphere, however, was also softened and of a light straw-colour, exactly resembling to the naked eye, a purulent infiltration. Dr Craigie pronounced it to be the yellow inflammatory softening described by all pathologists, which it undoubtedly was. Yet, on examination, it contained no purulent matter or exudation corpuscles, or presented any traces of inflammation, and when compared with the softening surrounding the abscess, it became evident, was of a nature totally different.* Now if we regard the symptoms, and mark the absence of paralysis, contraction, and the other signs, which, in numerous instances, we have seen to characterize inflammatory softening of the central medullary substance, we cannot, for a moment, suppose that this lesion was the result of inflammation.

I attach great value to this case. 1st, Because the lesion, to the naked eye, was so characteristic of yellow softening, exactly corresponding with the descriptions of Rostan, Lallemand, and others. 2*d*, Because a pathologist, in every way so candid and deserving of confidence as Dr Craigie, pronounced it to be inflammatory, which it would certainly have been considered by every pathologist without an appeal to the microscope. 3*d*, Because, on comparing it with a really inflammatory softening existing in another portion of the brain, the histological differences we have pre-

* Drs Craigie, Watson, and Peacock were present, and acknowledged the truth of this, on seeing the demonstrations under the microscope.

viously pointed out became evident, as was acknowledged by all present.

Obs. XXXIII.*—*Hemiplegia of the right side; loss of consciousness; convulsions of the superior extremities; death in thirteen hours; capillary hemorrhage into both corpora striata, but to the greatest extent on the left side; central medullary softening; absence of exudation corpuscles and granules.*

Sarah Ford, aged 21, a milliner, was seized at about 8 o'clock A. M. on the morning of August 2, 1843, when getting out of bed, with paralysis of the right arm and leg. She was immediately put to bed, when she exclaimed "Oh dear," lost all consciousness, and was attacked with convulsions of the superior extremities. When seen at two P. M., she was still unconscious, and the superior extremities were convulsed. There was also grinding of the teeth, and foaming at the mouth. The pupils were dilated, but contracted on the application of light. The impulse of the heart was felt all over the chest. Action of the arteries very violent; pulse 120; bowels confined. (Venesectio; leeches to the temples; blister to the nape of neck; enemata.) The convulsions ceased after the bleeding. She continued, however, insensible, and died at 9 P. M.

The patient had been out walking on the day previous to the attack with some friends, and was considered by them to be more cheerful than usual. She menstruated regularly every fourth week. She had, however, occasionally complained of headach, and caused her mother to notice, a week previous to the seizure, a more than usual pulsation in the carotids.

Sectio, 36 hours after death.—On removing the *dura mater* the convolutions of the surface of the hemispheres were found much flattened, and the arachnoid was somewhat dry. The vessels of the *pia mater* displayed an unusual turgescence. The ventricles contained about ℥iij. of bloody serum. The *plexus choroides* on both sides enlarged from an extravasation of blood into its texture. The *corpora striata* were infiltrated throughout their substance with numerous and very minute dark-coloured extravasations of blood,—that of the left side was rendered completely pultaceous and broken up, resembling lees of wine. The extravasation appeared to be confined to the gray matter, the adjacent medullary substance presenting its normal colour and vascularity, although its consistence was somewhat diminished. Lungs healthy. Heart flaccid, and its lining membrane dyed, probably from exudation, the body being much decomposed. Abdominal organs healthy.

Microscopic Examination.—The nervous tubes were readily separated from each other, but neither in the medullary or gray matter were any exudation corpuscles or granules apparent.

Remarks.—This case is very similar to Obs. XV. Sudden apoplexy, preceded by cephalalgia, convulsions, but no contraction,

* For the particulars of this case I am indebted to the kindness of Dr M'Cormac, Physician to the Canongate Dispensary.

and death in a short period. The medullary substance, though softened, in neither case presented exudation corpuscles or granules; and it is worthy of remark that here also there were none of the symptoms of inflammatory softening. These results are very important, as it has lately been stated by M. Durand-Fardel, that softening connected with sanguineous infiltration, is a proof of inflammation. The consideration of this question, however, will be found in a subsequent part of the paper.

In consulting works with a view of determining how far the labours of others might serve to assist in this inquiry, I can only discover twelve observations of inflammation of the brain recorded, where the diseased structures have been examined microscopically. These, unfortunately, are very imperfect, and can only be partially taken into consideration. I shall avail myself of them, however, as far as the facts recorded will allow. In order to afford others also in this field of inquiry all the information that exists on the subject, I shall now combine these observations with my own, numbering them consecutively to facilitate subsequent references.

Eleven observations have been published by Dr Gluge in the Oestreichische Medicinishe Wochenplatt. Unfortunately, I have not been able to procure the original memoir, and am indebted to the Provincial Medical Journal, for November 1842, for the following account.

Obs. XXXIV.—*Female; paralysis; pultaceous softening of several points of the cerebrum and cerebellum, both in the gray and white substances.*

Microscopic Appearances.—The nervous canals were broken up into fragments, but not changed in appearance; these fragments were mixed up with spherical, opaque corpuscles, ten times larger than purulent matter globules, and enveloped by numerous small globules, which were easily separated by slight pressure; the latter were spherical and transparent. When the scalpel was dipped into the softened mass, the drops which fell from it contained a great number of the above-mentioned corpuscles mixed with fragments of nerve tubes. The healthy portions of the brain did not contain a trace of them.

Obs. XXXV.—*Male; cerebral symptoms without paralysis; softening to the extent of a few inches of the anterior lobe of the cerebrum.*

The softened mass contained a few fragments of nerve tubes with a great number of the globules already mentioned, agglomerated together.

Obs. XXXVI.—*Female; apoplexy; paralysis of left side; recent attack within fourteen days; extensive softening of the right hemisphere, which was of a mixed red and gray colour; left hemi-*

sphere injected, but of a natural consistency ; apoplectic clots in both, and a reddish-coloured fluid in both ventricles.

The latter contained agglomerated globules, and fragments of nerve tubes ; and the coagulated blood enclosed similar fragments. An enormous number of agglomerated globules were found in the substance of the right hemisphere, and but very few on the left side. Nerve tubes could not be discovered in the coagula.

Obs. XXXVII.—*Male ; paralysis of the left side for several months ; red softening of the right hemisphere ; great congestion of the capillary membrane.*

The nervous tubes are shrunken, or not easily discovered, and only small fragments of them can be found in the softened portions of the brain ; in the remainder they are unchanged. The agglomerated globules exist in great quantity in the white and gray softened parts.

Obs. XXXVIII.—*Female ; sudden attack four weeks before death ; paralysis of right side, and contraction of limbs ; effusion of blood into, and softening of right ventricle.*

The softened mass contained nothing but fragments of nerve tubes, mixed with a great number of agglomerated globules in the white and gray substance, the capillary net-work round the softened parts were deeply injected.

Obs. XXXIX.—*Male ; constant delirium ; excessive sensitiveness of the skin ; contraction of right arm ; no paralysis ; deep-red softening of right hemisphere ; some straw-coloured fluid in left ventricle ; upper surface of corpus striatum softened ; white softening of pons and corpus callosum ; gray red softening in the cerebellum.*

The fluid of the ventricles contained some blood corpuscles and agglomerated globules. In the portions of nervous substance affected with white softening were some fragments of nerve tubes, which were scarcely recognizable, and some globules, an immense quantity of which existed in the red softened parts. In the middle of the cerebellum was a softened gelatinous spot, about the size of a halfpenny ; here the nervous tubes were easily distinguished with several agglomerated globules and numerous pus globules, from the admixture of which arose the gelatinous appearance.

Obs. XL.—*Female, 40 years ; had an apoplectic attack six weeks previously ; paralysis of left side. The posterior portion of the right hemisphere exhibited every gradation of red softening up to yellow points, but the softened parts were not diffluent ; in a small portion there was white softening, without any change of colour whatever.*

In this part the nerve canals were collected into bundles and shortened, and a white amorphous substance was interposed between the fragments of the tubes ; no trace of agglomerated globules, which, on the contrary, were numerous in the points of red softening. Here the tubes had either disappeared or were reduced to mere striæ ; the yellow points looked under the microscope like masses of fat globules.

Obs. XLI.—*The patient had complained for a long time of headach, stupor, and creeping sensations in the limbs ; cavities in the hemisphere, and pons lined with a species of reddish membrane.*

The surrounding nervous substance was softened, and here was a large quantity of agglomerated globules.

Obs. XLII.—*Fall from a height ; fracture of skull ; death ; effusion of blood at the base of the cerebellum in both ventricles, and in various parts of brain ; pultaceous softening of several points, with fragments of nerve tubes, but no trace of agglomerated globules ; fragments of the tubes and of the cellular net-work in the coagula.*

This case furnishes an example of mechanical softening from effusion of blood.

Obs. XLIII.—*Apoplectic softening without any product of inflammation.*

Numerous fragments of lacerated cellular net-work, and unaltered nerve tubes in the apoplectic cell, and no trace of globules in the softened mass around it.

Obs. XLIV.—*Girl, 16 years old ; apoplectic clot in the pons ; death on the day of attack ; the patient had merely complained of headach. Throughout the medullary substance the net-work of fine cellular tissue strongly injected ; in the coagula lacerated nerve tubes.* Ostr. Med. Woch. Jan. 22 1842. Prov. Med. Journ., No. 113, November 26th 1842.

Remarks.—The foregoing observations appear to be mere notes made from time to time so as to assist the memory, rather than to give such information as was desired. Neither the age of the patient, or the symptoms, the *post mortem* or microscopic appearances are given with sufficient exactitude to enable us to draw from them any very satisfactory conclusions. Yet it is evident that Gluge saw exudation corpuscles in many cases of inflammatory softening, (Obs. XXXIII. to XL.) and that in other instances where the brain was also softened, he found none. (Obs. XLI. to XLIII.) Obs. XXXVIII. is interesting in many points of view, although the looseness of detail leaves much to be desired. For instance, neither the duration of the disease nor the extent of the red softening is mentioned. But the difference in structure between this red softening of the hemisphere and the white softening of the central portions is noticed. The gelatinous spot containing pus globules in the centre of the cerebellum was probably an abscess. In Obs. XXXIX. also, the different structure between the inflammatory and non-inflammatory softening is noticed ; but the nerve canals being collected into bundles and shortened, &c., probably arose from something unusual in the demonstration. I have frequently seen such appearances, but on endeavouring to reproduce them, have failed.

Hence, I have always attributed them to some peculiarity of size or shape in the portion of brain examined, or to the mode of squeezing it between the glasses. In Obs. XL. it is shown that inflammatory softening sometimes surrounds old apoplectic cysts, as has previously been noticed, (Obs. XI. XII. XIII. and XXIV.) In the three last cases he has pointed out that softening produced by mechanical injury and by apoplexy proving suddenly fatal, contains no exudation corpuscles, confirming the results previously given, (Obs. XIV. XV. and XXI.)

Since the above was written I have seen in the work of M. Durand-Fardel,* another analysis of Gluge's memoir, which appears to have been originally published in the *Archives de la Médécine Belye, Janvier et Fevrier* 1840, and copied into *l'Experience, 30th Avril* 1840. Neither of these journals has it been possible for me to procure in Edinburgh. It would seem, however, from the account of M. Durand-Fardel, that the eleven observations now given are the same which constitute the basis of his original memoir, although he states that in his 10th case (Obs. XLII.) globules of purulent matter were present in the softening; a circumstance which appears to me very improbable, and is quite opposed to all the observations I have hitherto made. The following, also, are given as the conclusions arrived at by M. Gluge. "1*st*, White softening contains purulent matter in a great number of cases; 2*d*, The coloured softening, without extravasation of blood, presents the products of one of the first degrees of inflammation, formation of compound globules; 3*d*, The coloured softening with extravasation of blood may present the preceding products, or only the mechanical imbibition of sanguinolent serum. This is ordinarily the case in recent apoplexies." I shall refer more particularly to the error of the first conclusion, when alluding to the colour of softenings.

The only other observation with which I am acquainted, is recorded by Vogt,† in his work on Softening of the Brain and Spinal Marrow. It is as follows:

Obs. XLIV.—"Not long ago there died in the Clinical Hospital a child with all the symptoms of acute hydrocephalus. At first there were frequent attacks of convulsive trembling of the limbs, incurvation of the thumbs, contractions in the fingers with tetanic rigidity of the inferior extremities, and in the muscles of the back. The speech was entirely lost, and, notwithstanding soporose attacks, especially in the night, during which the inferior segment of the cornea of both eyes became dry, and latterly quite turbid, yet the

* Traité du Ramollissement du Cerveau, par Max. Durand-Fardel. Paris, 1843.

† Ueber die Erweichung des Gehirns und des Rückenmarks, von. Dr. Ph. Fr. Wilh. Vogt, pp. 81 and 82.

organs of sense were in such a state as to enable the child to hear to make movements with its trembling hands according as objects were presented to it, to distinguish drinks, &c. A short time before death the senses became extinguished, and symptoms of pressure on the brain became manifest. The convulsive and tetanic symptoms were always more severe on the right side. At the autopsy, independent of congestion, we found no change in the membranes of the brain, neither effusion in the ventricles, neither were these or the fornix softened. On the other hand, the whole brain was more moist and swollen, and became prominent (springing forward *hervor quellend*) on removing the skull-cap. Both *corpora striata* were softened. In the left *corpus striatum*, a spot the size of a bean was quite diffluent, and the parts surrounding it were softened to an inferior degree. On the right side the softening had only reached this lesser degree. All present at the section agreed that the pathological changes might readily have been overlooked, had not the examination been made with great care. Here was also seen under the microscope all the phenomena of Valentin's so-called second stage of softening, with the well-known corpuscles."

Remarks.—We here find inflammatory softening of both *corpora striata* causing tetanic convulsions and latterly resolution in the limbs. The phenomena were more marked on the right side, and the lesion was further advanced in the left *corpus striatum* than in the opposite one. The age of the patient is not given. It is worthy of remark, however, that in this instance only, the *corpora striata* were affected, whilst the central white portion of the brain was healthy. On the other hand, in a somewhat similar case previously recorded, (Obs. IX.) the gray masses were healthy, whilst the lesion was confined to the white matter. Why it should have struck all present, that a softening in the *corpus striatum*, containing in its centre a diffluent portion the size of a bean, would have escaped observation without extreme care, is to me inexplicable. If this be correct, it merely argues that the *post mortem* examinations in the clinical hospital at Bern must be conducted in a very loose manner.

Vogt tells us that the corpuscles described by Valentin as characterizing the second stage of softening were present. In other parts of his work also he alludes to observations made by Valentin. But in no place does he refer to where such observations have been published, nor does he even state that they have ever been placed on record. Here it must be remembered that they are both professors in the same university. Still, from his allusion to the opinions of Valentin, I ascribed to that anatomist the merit of having observed and described these bodies in inflammatory softening f the brain, (Journ. No. 153, p. 395), although I am only acqainted with his opinions through the statements of Vogt.

On the Nature of Softenings of the Nervous Centres.

The nature of softenings has been much disputed. Some attribute them entirely to chronic or acute inflammation, others, while they acknowledge that some softenings are undoubtedly thus produced, are also of opinion that they may occasionally depend upon other causes. Thus softening has been considered a lesion *sui generis* similar to what occurs in ataxic fever, (Recamier); to *gangrena senilis*, (Rostan, Abercrombie); to obliteration of the arteries, (Bright, Carswell); or to a diminution of nutrition, (Delaberge, Monneret.) It has also been referred to *post mortem* maceration, (Carswell, Paterson of Leith), and is undoubtedly often produced by mechanical violence after death. The difficulty hitherto has been how to distinguish with precision one kind of softening from another.

The observations detailed have shown that two varieties of softening undoubtedly occur. In the one the products of inflammatory exudation may be detected, in the other these are not present. It is necessary to determine with exactitude the distinguishing characters of these two kinds of softening, which may be denominated inflammatory and non-inflammatory softenings.

1. *Character of inflammatory softening.*—On placing a minute portion of the inflamed nervous structure between two slips of glass, then pressing them, so as to render it visible by transmitted light, and examining it with a magnifying power of 300 linear diameters, the following appearances will be observed. Besides the normal, tubular, and granular structure of the parts examined, there will be found, 1*st*, exudation granules coating the vessels, or floating loose, either isolated, or in the form of masses; 2*dly*, exudation corpuscles, with distinct cell walls, sometimes nucleated as formerly described. The more pultaceous and diffluent the softening is, the more numerous are the granules and corpuscles. The nervous tubes and normal structures also then become more and more broken down.

The nature of inflammatory softening will become evident from what has formerly been stated. (Journ. No. 135.) It results from the active growth, development, and breaking down of nucleated cells, (exudation corpuscles,) in the effused blood plasma. It is not a mere maceration of the textures in serum. No doubt the serum performs an essential part in the process, inasmuch as moisture is necessary for every species of growth. But we are of opinion that softening cannot be considered as dependent on inflammation without the existence of these bodies. So far from being connected, as some have supposed, with diminished nutrition, it is, in point of fact, an increased nutrition in the excess of blood plasma effused. It would be out of place to enter upon the consideration of the facts which have led us to this conclusion. They

could only be appreciated by alluding to all the phenomena of inflammation, and discussing what we are really to understand by that term. I hope shortly to be enabled to lay my views on this subject in detail before the public.*

2. *Character of non-inflammatory Softening.*—Following the same mode of demonstration as that just described, we find that the cylindrical and varicose tubes of the part are rendered more soft and easily separable from each other. They have more or less lost their natural firmness and consistence; are readily torn across; the varicosities are easily enlarged by pressure, and, when separated or broken off, assume a globular form. The tubes also are more or less broken down into fragments. No exudation granules, masses, or corpuscles are to be detected.

The nature of non-inflammatory softening varies according to circumstances. It would seem to arise from four causes; 1*st*, From mechanical violence in exposing the nervous centres, (Obs. XVI., XXII., XXVI.) 2*d*, From a mechanical breaking up of the nervous tissue, by hemorrhagic extravasations, whether in mass, (Obs. V., XIV., XXIII.) or when infiltrated in small isolated points, constituting capillary apoplexy. (Obs. XV., XXXIII.) 3*d*, From the mere imbibition of effused serum, which loosens the connection between the nervous tubes, and diminishes the consistence of the nervous tissue. (Obs. XIX., XX., XXXII.) 4*th* From the process of putrefaction.

Dr Paterson of Leith, in a paper on Pseudo-morbid softenings,† after alluding to the frequency of these without any symptoms indicating their presence, has shown by a series of experiments that the brain rapidly imbibes fluid, and becomes, in consequence, unusually soft. The facts he has communicated with reference to this subject are very valuable. But the manner in which he endeavours to separate the inflammatory from the non-inflammatory softening is most unsatisfactory, and might be shown from the result of our researches to be erroneous. For instance, he observes "softenings may be considered then the result of inflammatory action, when they are surrounded by a zone of red vessels with small coagula, or if the softened portions are infiltrated with purulent matter." Now the zone of red vessels is very rarely seen in inflammatory softenings, and the infiltration with purulent matter, to which, following Lallemand, Dr Paterson alludes, has no real existence so far as my observations have hitherto gone. On the other hand, the circumstances he mentions as characteristic of pseudo-morbid softening, we have seen to occur in Obs. VIII and IX. although the lesion was undoubtedly inflammatory. It is only

* An abstract of these will be found in the Lond. and Edinb. Med. Journ., December 1842, and Microscopic Journal, Vol. ii.

† Ed. Med. and Surg. Journ., Vol. lvii. p. 110.

the microscope, then, that can enable us to distinguish with certainty one from the other.

As regards the difference supposed by some to exist between the softening in adults and that in old persons, I fully agree with M. Durand-Fardel, when he observes, "that cerebral ramollissement is the same malady in old persons as in adults; that it presents no other differences than the modifications which a great difference in age always produces, connected only with the form and not with the nature of the lesion." (Op. cit. p. 166.)

The previous observations offer no argument or proof in favour of the opinions which attribute softening to a lesion *sui generis*, to diminution of nutrition, to gangrene, obstruction of arteries, &c. all which explanations appear to us hypothetical in the highest degree.

The details entered into in the different observations not only demonstrate the existence of inflammatory and non-inflammatory softening histologically, but indicate that the symptoms which accompany them are widely different. Thus in the twenty four observations hitherto recorded, in which cerebral softening was observed, exudation corpuscles were present in eighteen, whilst in six no trace of these bodies could be found. Again, in the eighteen cases of inflammatory softening, there are four in which there also existed in another part of the brain non-inflammatory softening. On analyzing the symptoms of these cases, we shall find a marked difference between those accompanying the one lesion or the other. Thus in the fourteen cases where only inflammatory softening was present, well-marked symptoms invariably existed, such as loss of consciousness, preceded or followed by dulness of intellect, contraction and rigidity of the extremities, or paralysis.

Very different were the symptoms in the six cases where the lesion presented the characters of non-inflammatory softening. In three of these there was a large extravasation into one side of the brain, followed by sudden coma and hemiplegia, (Obs. XIII. XIV. XXIII.) In the fourth and fifth cases there was sudden loss of consciousness, with convulsions, but no paralysis or contraction, and on dissection capillary apoplexy with central softening was found, (Obs. XV. XXXIII.) In the sixth case there was also extensive softening without any effusion of blood whatever, and no disturbance of the intellect, no contraction or paralysis, (Obs. XIX.) I consider, then, that the softening was occasioned by mechanical destruction of the tissue in the first three cases, and by *post mortem* action in the three last. That this conclusion is the correct one will further appear from the following considerations.

Of the four cases where both kinds of softening existed, in the

first, hemiplegia was present on the left side only. After death softening was found in both *corpora striata*, yet exudation corpuscles were only detected in the lesion of the right side, the one opposite to the paralysis, (Obs. IV.) In the second case there was loss of speech, disorganization of the eye, and convulsions before death. There was no paralysis; the man could walk without assistance. Abscesses surrounded by inflammatory softening existed in one hemisphere, explaining the symptoms present. But the central parts of the brain were also softened, causing no symptoms whatever, and on examination this lesion was found to be non-inflammatory, (Obs. XX.) In the third case there was paralysis of both arms, contraction of the right, and tetanic spasms of the muscles of the mouth and neck. Inflammatory softening existed in the *pons Varolii*, extending more to the left side, which perfectly explained the symptoms. There was also softening of the right *corpus striatum*, probably mechanical, certainly non-inflammatory, connected with which no symptoms existed, (Obs. XXII.) In the fourth case there was cephalalgia, prominence of the eye-ball and coma before death; there was no paralysis. After death a fungoid tumour was found at the base of the orbit, and an abscess in the anterior lobe of the brain, surrounded by inflammatory softening. There was also central yellow softening of the left hemisphere, producing no symptoms, (Obs. XXXII.)

An analysis of these ten cases, therefore, leads to the conclusion, that the two kinds of softening we have endeavoured to establish are alike distinguishable, both by their intimate structure and the symptoms accompanying them during life.

Sources of Fallacy in the present method of examining Lesions of the Nervous Centres.

I shall now inquire how far the observations tend to elucidate the obscurity which confessedly surrounds the pathology of inflammation of the nervous centres. All practical men agree in considering it a matter of extreme difficulty, to reconcile with any certainty the morbid appearances found in the brain, with the symptoms previously observed. The microscopic examinations described serve, in my opinion, to demonstrate some of the sources of error connected with this subject, which in future may readily be avoided. For instance, softening of the *fornix*, *septum lucidum*, and central parts of the brain, may exist in two cases; to the naked eye they may be in every respect identical, and yet the microscope enables us to determine that the one contains exudation corpuscles, whilst in the other not one of these bodies is to be found. It becomes evident, then, that we have hitherto been confounding two distinct lesions, and that a different train of symptoms should, under such circumstances, be occasioned, is on-

ly to be expected. Again, it has frequently excited surprize that, notwithstanding the existence of well-marked symptoms of softening, nothing was to be discovered after death. Now it has been shown in several instances, that although to the naked sight no morbid lesion was apparent, still, portions of brain might contain the same exudation corpuscles as are to be seen in more apparent lesions, and that, by considering such parts diseased, all the symptoms might be explained. By excluding these sources of error, therefore, and by being enabled at once to distinguish the lesion dependent on inflammation, from others which simulate it, we shall be enabled to obtain more exact data for future investigations.

It is not enough, however, to allude to these sources of error, as being *probable* occurrences ; it becomes important to establish the two following propositions :

1*st*, *That pathologists have hitherto confounded softening dependent on inflammation, with softening occasioned by post mortem changes or mechanical violence.*

2*dly*, *That, notwithstanding the most anxious search, and the existence during life of the most decided symptoms of softening, inflammation, though really present, has escaped observation.*

With respect to the first proposition it may be observed, that, in many cases where no symptoms were present during life, extensive softening of the brain has been found after death. This is a well-known fact, and is one which tends in no small degree to throw confusion on the pathology of nervous diseases. Thus

In Obs. XV. there was extensive softening of the central portion of the brain, *corpora striata*, and optic thalami, which, however, contained no exudation corpuscles. There was also capillary apoplexy. The symptoms were sudden insensibility and convulsions. There was no paralysis or contraction observed.

In Obs. XVI. and XXV. there was circumscribed pultaceous softening of the spinal chord, with absence of exudation corpuscles. There was no paralysis, and the symptoms were those of general tetanus.

In Obs. XIX. there was extensive softening of the central parts of the brain, with absence of exudation corpuscles. The only nervous symptoms were hemicrania and delirium ; no paralysis or contraction.

In Obs. XXXIII. there was softening of the central white substance, and the *corpora strata* were broken up by sanguineous infiltration. No exudation corpuscles or granules were present, and the symptoms were, sudden insensibility, convulsions, coma, and death, without paralysis or contraction.

Now, in all these five cases there was an extensive softening, which it was impossible for any one to distinguish positively by

unaided sight, from inflammatory softening. In neither did exudation corpuscles exist, and it is curious that in neither did those symptoms occur which we shall afterwards find are peculiar to similar softenings produced by inflammation.

Here again I may allude to the four cases formerly noticed, (Obs. IV., XX., XXII., XXXII.) where, conjoined with an inflammatory softening, producing particular symptoms, there was also non-inflammatory softening, occasioning no symptoms whatever. The circumstances attendant on these nine cases, then, must convince us that softenings, produced mechanically, or by *post mortem* changes, have frequently been mistaken for those dependent on inflammation, and must necessarily be so, so long as unaided sight is made the sole means of forming a judgment with respect to their nature.

These cases, therefore, I think sufficient to establish the first proposition, viz. that pathologists have confounded softening dependent on inflammation with softening occasioned by *post mortem* changes.

The second proposition, namely, that, notwithstanding the most decided symptoms of inflammatory softening were present during life, and the most careful examination after death, the morbid lesion, though really present, has frequently escaped observation, is clearly established by the following facts.

In Obs. V. a man had paralysis with complete resolution of the limbs on the right side, and intense rigidity of them on the left. Death occurred in six hours. On dissection, a large coagulum of blood was found effused into the left hemisphere, thus explaining the paralysis on the right side. In the right hemisphere an old apoplectic cyst was found, and a number of small cavities, described by Dr Sims as chronic softening undergoing a cure. Here, then, there was nothing acute, nothing to explain the intense rigidity. A microscopic examination demonstrated that these cavities were filled with numerous exudation corpuscles and granules, similar to those found in undoubted inflammatory softening.

In Obs. VI. a man, who had long suffered from a tumour at the base of the brain, was seized, ten days before death, with loss of consciousness, and powerful rigidity of the right extremities. The latter symptoms disappeared in three days, leaving perfect paralysis of the right arm, but, four days subsequently, again returned. On dissection nothing could be observed in the left hemisphere, after the most careful examination, and yet the microscope enabled us to discover numerous exudation corpuscles in the left *optic thalamus* and *corpus striatum*, showing that these bodies were inflamed.

In Obs. XXII. there was hemiplegia of the left side with contraction of the arm, followed by hemiplegia of the left side. There

were also trismus and tetanic spasms of the neck. It was very doubtful on making a section of the *pons Varolii ;* whether it was softened or not, its colour and consistence were apparently unchanged. Yet here, again, the microscope demonstrated to all present that numerous exudation corpuscles existed in the part.

What renders these cases so remarkable and satisfactory is, that they are not instances where the dissection was performed in a hurried manner, and by incompetent persons. On the contrary, from the particular symptoms connected with them during life, the *post mortem* examination was in all conducted with extreme care. Drs Spittal, Henderson, and Paterson were each present during the dissection of their respective cases. Dr Peacock conducted the examinations which were witnessed by myself, several clerks, and numerous students, and I may say that we were all in doubt until the microscope cleared up the difficulty.

These observations, therefore, sufficiently demonstrate that the naked sight is positively unable to detect lesions, even although they are directly indicated by the symptoms, and carefully looked for by experienced morbid anatomists.

If, then, the two propositions formerly stated have been satisfactorily proved, and it is agreed that pathologists have been confounding inflammatory with non-inflammatory softening, and overlooking the former although undoubtedly present, it must be evident that many of the contradictions which have existed in connection with the pathology of nervous diseases may be accounted for. It must also be clear, that no confidence can be placed in the analysis of cases, however numerous, when the sources of error now indicated have not been carefully excluded.

The next step in the inquiry is evidently to determine what results may be derived from the thirty-three observations I have furnished, in conjunction with the twelve others recorded by Gluge and Vogel. An analysis of these might, if carried out, give rise in some instances to useful results, but would extend the limits of this paper to a great length. By some the number of observations may be considered as capable of forming the basis of a new inquiry into the subject, yet I have found, on making the attempt, that they are by no means sufficiently extensive to merit confidence, more especially in a semiological point of view. Reflection also has convinced me that it will be useless to proceed farther in any researches respecting inflammation in any particular organ of the body, without first having determined the nature and observed the phenomena of inflammation itself in a general rather than in a special manner. For the present, therefore, I shall content myself with making a few remarks on certain points only, which the preceding observations appear to me capable of eluci-

dating. These are, 1*st*, The colour of softenings; 2*d*, General relation between the symptoms and the seat of the lesion; 3*d*, Contraction of the limbs as a symptom of inflammatory softening; 4*th*, Curability of softening; 5*th*, The connection between softening and hemorrhage.

1. *Colour of Cerebral and Spinal Softenings.*—Softening of the nervous centres may be tinged red, yellow, white or gray, and present numerous intermediate shades of these. These distinctions, however, indicate no essential difference between them, as far as structure is concerned, for we have seen that all these coloured softenings present the same histological characters. As a general rule the red may be considered as acute, the yellow as subacute, and the white or gray as chronic softening. But this is by no means invariable, for we have seen one white softening to be acute, (Obs. IX.)

On what does the difference in colour depend? The red and yellow softenings are evidently connected with the presence of blood, or the greater or less imbibition of its colouring matter. In some cases blood becomes directly effused into the cerebral substance, constituting capillary apoplexy (Cruveilhier), or sanguineous infiltration (Durand-Fardel). In this case it may be of a bright vermilion colour, (Obs. XV. and XXXIII.) or of a purple colour, resembling port-wine lees, (Obs. XXI.) Sometimes a bright rosy blush is spread over a limited surface of the white matter, becoming gradually less towards the circumference, (Obs. I.) This depends upon congestion of the vessels of the part. Occasionally the redness is surrounded by a straw-yellow colour (Obs. X.), or it may be of a rusty-yellow or ochry tinge, as seen surrounding apoplectic extravasations, (Obs. XII. and XIII.) In this case, the blood-corpuscles being broken down, the colouring matter tinges the serous fluid, and gradually permeates the surrounding tissue, (Carswell.)

It may not perhaps occur to many that the real colour of the blood is yellow, yet that this is the case will become evident on examining an isolated blood-corpuscle under the microscope. It is only the number of the corpuscles, or, in other words, the intensity of the yellow which gives it the appearance of redness, as occurs with the tincture or syrup of saffron. The colour which is apparent to the eye is often different from what really exists. Thus a deep-green or Prussian-blue looks black. It is only when diluted that the real colour becomes evident. Hence why, when blood is diluted or diffused over a considerable space, the parts assume a yellow tint, more or less intense.

Sometimes the yellow softening is contained within the reddened portion, and somewhat resembles a purulent collection, (Obs.

I.) At others it surrounds the extravasation of blood as is most common. Occasionally we find considerable portions of the white matter tinged of a straw colour, either in connection with extravasated blood, (Obs. X.) or with an abscess (Obs. XXXII.) Lallemand and many others have supposed that yellow softening is caused by the presence of purulent matter, and to the naked eye the resemblance to a purulent infiltration is often very great. In none of the observations detailed, however, does it appear that the colour or consistence of the softening is in any way connected with the presence of purulent matter. I have never yet seen a pus corpuscle in softened brain or spinal marrow. M. Durand-Fardel maintains that the colour is always derived from the blood. It is difficult, however, to account for it when no blood is extravasated, (Obs. XXXII.) In cases where it is conjoined with an abscess, may not the colouring matter of pus be also absorbed?

Fawn-coloured softenings are frequently observed, independent of extravasated blood. As they are generally subacute or chronic, it is of course impossible to determine how far the tint is dependent on the admixture of blood. I have always found exudation corpuscles in these softenings, and think it very probable that the fawn tint occurring in the medullary matter is attributable to the presence of these bodies, which are usually of a brownish or blackish colour.

The softening may be brilliant white, and yet contain numerous exudation corpuscles, which, however, in this case are colourless. (Obs. IX.) In the softening which resembles chalky milk, the white has a dull appearance, and the granules of the exudation corpuscles are large, equal in size, and very transparent. (Obs. XVII.) I have never yet seen a pus corpuscle in them,—a result entirely opposed to the opinion of Gluge, who considers this a common occurrence. His statement, however, is not supported even by his own cases. White softenings in the great majority of instances are non-inflammatory.

II. *General relation between the symptoms and the seat of the inflammatory softening.*—Deducting all the cases of non-inflammatory softening with which no symptoms were connected, and those also of simple hemorrhage, we may divide the remaining 20 observations into three groups.

1. Lesions of the central parts of the brain on one side, ten cases, (Obs. I. II. III. IV. VI. VIII. XI. XII. XIV. XVII.)

2. Lesions of the central parts on both sides, six cases, (Obs. V. VII. IX. X. XVIII. XXII.) In this group is included the case of softening of the *pons Varolii*, (Obs. XXII.)

3. Lesions only of the peripheral parts. On one side three cases,

(Obs. XVIII. XX. XXXI. On both sides, one case, Obs. XXI.)

Each of these groups will be found connected with a particular train of symptoms. Thus, the first group is characterized by contraction or paralysis of the extremities on the opposite side of the lesion. The second group is characterized by the same symptoms on both sides, and the third group is characterized by absence of contraction or paralysis in the extremities and by either delirium or coma.

This analysis, therefore, favours the view which supposes the central parts and base of the brain to be connected with motion and sensation, and the peripheral parts to be connected with intelligence. With respect to the influence of more circumscribed parts, such as the optic thalamus and *corpus striatum*, no positive deductions can be drawn. For this purpose I consider the observations too few, and the microscopic examinations with respect to them not sufficiently exact.

I regret that the want of detail which accompanies Gluge's cases, precludes the possibility of drawing any conclusion from them with respect to the relation between the symptoms, and the seat of the lesion. Obs. XXXIV., for instance, is as follows: "Female, paralysis; pultaceous softening of several points of the cerebrum and cerebellum, both in the gray and white substances."

III. *Contraction of the limbs in inflammatory softening and in hemorrhage.*—Whilst by some more or less contraction and rigidity of the limbs has been considered as highly characteristic of inflammatory softening,—others have maintained that it is altogether incidental, that it often exists when no softening can be found, and that it is as often absent when softening is present. It has also been known to accompany hemorrhages, apparently unconnected with softening. May not this confusion be dependent on the two propositions which we have endeavoured to establish not having been known? Let us then examine what result an analysis of the observations will afford us in connection with this point.

Cerebral and spinal softening was observed in 26 cases. Of these 19 were inflammatory, and 7 non-inflammatory. Of the 19 cases of inflammatory softening, 16 were acute, and 3 chronic. If from the 16 cases we subtract 2 of apoplexy, (Obs. XI., XII.) and 4, connected with external lesions, (Obs. XIII., XX., XXI., XXXII.,) there remains 10 cases of idiopathic inflammatory softening. Of these 7 cases presented well-marked contraction, and in 3 this symptom was not observed, (Obs. IV., VIII., XVIII.) But in the first of these three cases, three days elapsed before the medical man was called in. In the second case, the symptoms

were avowedly not accurately observed, and in the third case no mention whatever is made either of the presence or absence of contraction. It may be argued, however, that as this last case, (Obs. XVIII.) was in the Infirmary some time previous to the cerebral attack, this symptom, if present, could not have escaped observation. Be this as it may, it offers the only doubtful exception to the occurrence of contraction in acute inflammatory softening. This analysis, therefore, indicates that contraction is a more frequent symptom of inflammatory softening than many suppose.

This result becomes more important when we find it stated that contraction is a frequent phenomenon in cerebral hemorrhage. * In eight cases of this lesion, recorded among the foregoing observations, contraction was not once observed. M. Boudet has laid down the following proposition : † viz. " every time a hemorrhage takes place in the cerebral substance, contraction is not manifested so long as no inflammation is occasioned round the clot. But when to a lesion of the cerebral substance is joined a rupture of the walls of the ventricles, and an extravasation of blood into their cavities, or on the surface of the brain, contraction appears." Durand-Fardel admits that this is frequently the case, but not always. In Obs. XIV. there was hemorrhage into both ventricles, and in Obs. XXIII. into the left ventricle, yet in neither of these cases was contraction present. Again, in Obs. XIII. there was considerable hemorrhage into the arachnoid cavity, with the same absence of contraction. All three observations, therefore, are opposed to the proposition of MM. Boudet and Durand-Fardel.

The latter author, however, has recorded sixteen observations, where contraction was well-marked during life, and where cerebral hemorrhage was found after death. He says nothing, however, of the nature of the lesion surrounding the extravasations, and it is possible that in those cases the hemorrhage may have been preceded or accompanied by an inflammatory softening. This is a point which could only be determined by a microscopic examination. In the eleven cases mentioned by Gluge, the occurrence of contraction is only mentioned twice. In one there was extravasation of blood into, and softening of the left ventricle, (Obs. XXXVII.) But it is distinctly said that exudation corpuscles in great quantity were present. In the other case, (Obs. XXXVIII.) there was deep-red softening of the right hemisphere, also containing exudation corpuscles. We are of opinion that the contraction in both instances is attributable to the inflammation, and not to the accompanying hemorrhage. Without, therefore, denying the possibility of the occurrence of contraction

* Durand-Fardel, Archiv. Gen. de. Med. Juilliet, 1843.
† Memoire sur l'Hemorrhagie des Meninges, 1839.

from simple hemorrhage into the brain, it still does not appear to me that the absence of inflammation in the cases given by Durand-Fardel has been demonstrated.

IV.—*The curability of Cerebral and Spinal Softenings.*—Durand-Fardel observes that the curability of cerebral ramollissement is a fact of which we can no more entertain disbelief in the present day, than we can of the curability of pulmonary tubercle. There can be little doubt that the observations of Rostan, Cruveilhier, Sims, Dechambre, and Durand-Fardel have fully established the possibility of this occurrence. Besides, why should not exudation of blood-plasma into the brain, and the softening there produced by the formation and development of exudation cells, lead to absorption in that organ, as well as in the lungs? We cannot help thinking, however, that the anatomical marks or appearances, by means of which pathologists have endeavoured to *demonstrate* the curability of a softening are very fallacious. The slight indurations occasionally met with in the nervous substance are spoken of by some authors as *cicatrices*,—a term we think wholly inapplicable to them. Durand-Fardel alludes to the softening resembling chalky milk as a proof of the passage of the lesion into a state of cure, and Dr Sims speaks of the fawn-coloured cavities as evincing the same fact. Now, we have seen (Obs. XVII.) that the chalky milk softening contains exudation granules and corpuscles, and that both presented a peculiar appearance. This was a very chronic case, and the symptoms exhibit that the lesion was connected with a hemiplegia of long standing. It is certainly probable, therefore, that the opinion of M. Durand-Fardel is correct, and that the granules composing the softening were undergoing absorption. On the other hand, the lesion described by Dr Sims we have seen (Obs. V.) also to present exudation corpuscles, exactly resembling those in acute inflammations. In this case there was intense rigidity of the opposite side of the body, without any other lesion but the one under consideration, which could have produced it. So far as one observation goes, therefore, the appearance described by Dr Sims cannot be regarded as a trace of cured cerebral softening; and we are further inclined to think that a critical analysis of his cases will not support such a view, even as regards a diagnosis of the disease. At present, however, I content myself, in the absence of further facts, with pointing out the above discrepancy.

V. *The connection between Softening and Hemorrhage.*—The relation between softening of the nervous tissue and hemorrhage has excited much attention. Does the hemorrhage precede and cause the softening, or, on the other hand, does softening ever precede and induce hemorrhage? There are eight cases which

bear reference to this question, (Obs. V. XI. XII. XIII. XIV. XV. XXIII. XXXIII.) Three of these were well-marked cases of sudden hemorrhage into one hemisphere of the brain, causing complete hemiplegia on the opposite side of the body, (Obs. V. XIV. XXIII.) In these cases death took place respectively in six hours, two days, and eight days after the attack. Surrounding the coagulum, the cerebral substance was soft and broken up, apparently from mechanical violence, and contained no exudation corpuscles. In two other cases, similar symptoms were occasioned, and similar lesions found after death, (Obs. XI. XII.) In these death took place respectively in seven days and five weeks. Here also the cerebral substance surrounding the clot was soft and broken up, but contained numerous exudation corpuscles and granules. Thus it would appear necessary for a certain time to elapse before a coagulum of blood can excite consecutive inflammation. In the five preceding cases the hemorrhage occurred into the ventricles, or involved the optic thalamus and *corpus striatum*, producing hemiplegia on the opposite side of the body. In the sixth case, on the other hand, where the hemorrhage followed a blow on the head, the arachnoid cavity was the seat of the lesion. Here there was no paralysis, the man walked perfectly the day before his death. There was, however, great restlessness and delirium, and the periphery of the brain in contact with the clot, was found softened, and contained exudation corpuscles. Death took place thirteen days after the accident. The seventh and eighth cases are instances of capillary apoplexy combined with central softening, which, however, was non-inflammatory.

On examining the mode of accession in the eight cases, we can perceive no reason for supposing that softening or other organic lesion preceded the hemorrhage. In Obs. XV. the apoplectic attack was ushered in by severe cephalalgia, more or less intense, during a period of four months. This, however, occurring in a young girl, was evidently congestive, in no way accompanied by inflammation, and the softening discovered after death contained no exudation corpuscles or granules. In the other seven cases the attack was sudden. We cannot doubt, therefore, that the inflammatory as well as the non-inflammatory softening surrounding the hemorrhagic extravasations in these cases were in all of them consecutive.

It has long been a question how far the softenings, which usually accompany capillary apoplexy, are dependent on inflammation. In his Thesis, M. Durand-Fardel thus expresses himself, "In the same manner that redness is the most certain sign which can aid us in distinguishing acute from chronic softening, in the same manner diminution of consistence is the most positive proof of the presence of inflammation in a sanguineous infiltration, and even the necessary condition, in order that its existence can be ad-

mitted.*" Again, in his recent work, he tells us, "if the softening extends beyond the precise limits of the sanguineous infiltration, if redness surround it, above all, if the blood infiltrated be not in sufficient quantity to have mechanically produced a diminution of consistence, there will be every probability that we have to do with a 'ramollissement,' properly so called, accompanied by sanguineous infiltration, that is to say, an inflammatory affection, and not one merely hemorrhagic. But if, on the contrary, the diminution be slight, and altogether limited to a sanguineous infiltration, if there be an adhesion of the meninges, if the surrounding parts appear perfectly healthy, there is only, doubtless, a simple and primitive sanguineous infiltration, as in the case where the consistence of the brain has remained normal.†" Now, in the two cases we have reported of this lesion, we find in one (Obs. XV.) that all the central white portions of the brain were very soft, and were diffluent. In the second case, (Obs. XXXIII.) the infiltration was more limited, although more intense, and the softening of the medullary substance not so great. Here, probably, M. Durand-Fardel would have considered that a simple or primary sanguineous infiltration only was present. But the distinctions by which this author endeavours to separate the inflammatory from non-inflammatory softening in these cases are very vague; its extent, more or less, the colour, adhesions of the membrane, these, certainly, are not marks which will enable the morbid anatomist to speak with precision on these points. On the other hand, let us regard the microscopic examination, and we find that the lesion in both cases adduced are identical. That there are none of the corpuscles we have invariably found in unequivocal inflammatory softening, and, therefore, we hold the lesion to be non-inflammatory. Then, when we regard the symptoms, we only find from the similarity of both, and absence of those which accompany inflammatory softening, a further confirmation of the same truth.

No doubt the observations which have been detailed are capable of furnishing data for many other discussions connected with inflammation of the nervous centres. There are also other lesions dependent on this morbid process, such as induration, the occurrence of abscesses and tumours, which have received little attention. The subject of arachnitis and the exudation of lymph has also been purposely avoided, as I consider such lesions to be more connected with inflammation of the serous membranes than of the nervous centres. As I am far, however, from considering the inquiry perfect, I shall now pause, with the intention of resuming it at a subsequent period.

The following conclusions may, I think, be drawn from the foregoing observations.

1. That two kinds of cerebral and spinal softening exist, an in-

* Thése, 1840, p. 92. † Traité du Ramollissement du Cerveau, 1843, pp. 71–2.

flammatory and a non-inflammatory, which may always be distinguished from each other by means of the microscope.

2. That inflammatory softening is characterized by the presence of exudation corpuscles and granules, whilst in non-inflammatory softening these bodies are never found.

3. That the nature of inflammatory softening consists in the formation and development of nucleated cells in exuded blood plasma; whilst the nature of non-inflammatory softening consists in the mechanical destruction or maceration of the nervous tissue in serum, or is the result of putrefaction.

4. That non-inflammatory softening, unaccompanied by hemorrhage, is usually *post mortem*, and causes no symptoms; whilst uncomplicated inflammatory softening always causes marked symptoms, which, however, vary according to the seat of the lesion.

5. That the inflammatory and non-inflammatory softenings have frequently been confounded together by morbid anatomists, it being impossible to distinguish one from the other, with any certainty, by the naked eye.

6. That inflammation in the nervous centres has, in several instances, been demonstrated by means of the microscope, after it had escaped the search of good morbid anatomists, and been indicated by the most unequivocal symptoms.

7. That every different coloured softening has, at various times, been found to be connected with inflammation, but that yellow and white softenings are most frequently non-inflammatory, whilst the fawn-coloured softening is commonly inflammatory.

8. That red softenings usually depend on congestion, or the direct extravasation of blood; yellow softenings, on the imbibition of the colouring matter of the blood; fawn and gray-coloured softenings on the presence of brown exudation corpuscles; and white softenings, in the great majority of cases, are *post mortem* and the result of maceration in serum.

9. In no single instance has softening of the nervous centres been traced to the presence or infiltration of pus.

10. That inflammation of the central parts of the brain generally produce well-marked lesions of sensation and motion, whilst, in inflammation of the peripheral portions, lesions of intelligence are commonly well pronounced.

11. That in idiopathic inflammatory softening of the brain, contraction in one or more limbs is a common symptom.

12. That the fawn-coloured spots described by Dr Sims are no evidence of the cure of inflammatory softening.

13. That inflammation accompanying hemorrhages is usually consecutive.

14. The softening surrounding apoplectic clots or sanguineous infiltration is no proof of inflammatory action.

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PLATE V.

Fig. 1

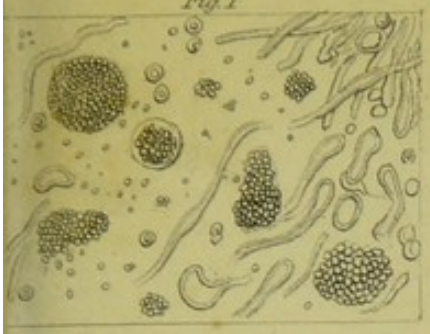

Fig. 2

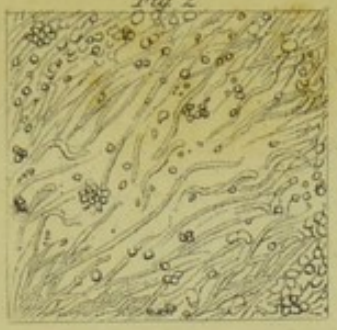

Fig. 3

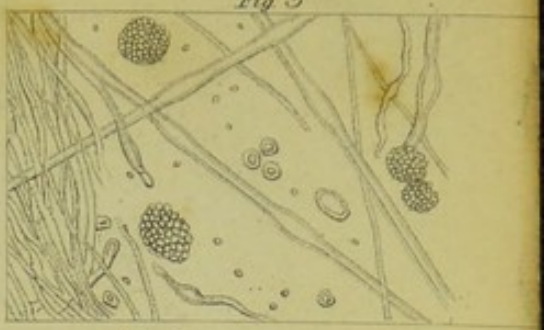

Fig. 4

Fig. 5

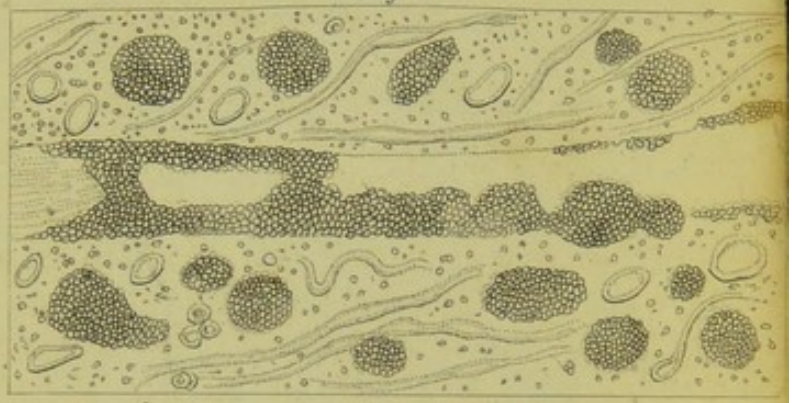

Fig. 6

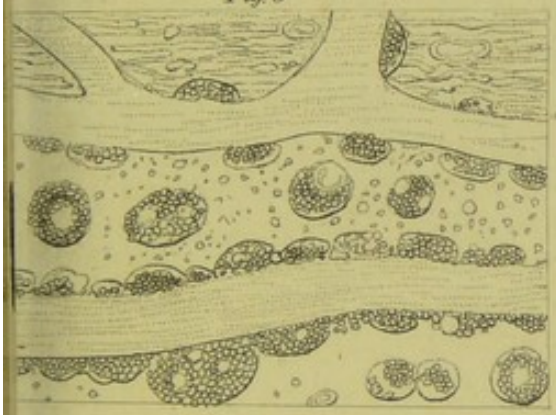

Fig. 7

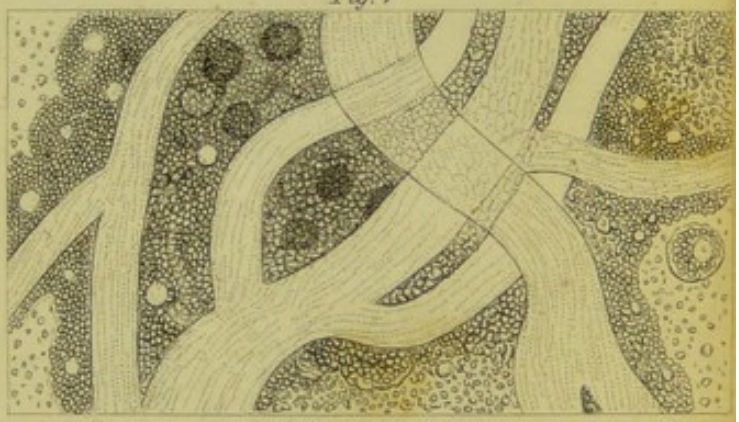

Fig. 8

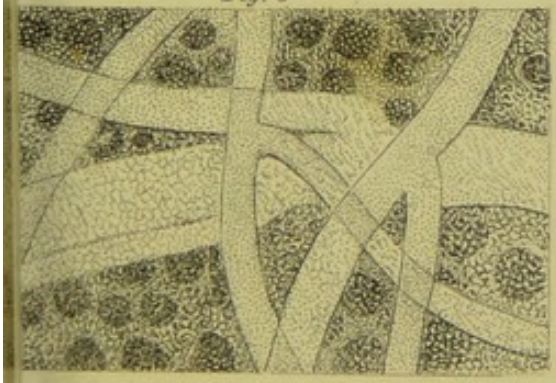

Fig. 9

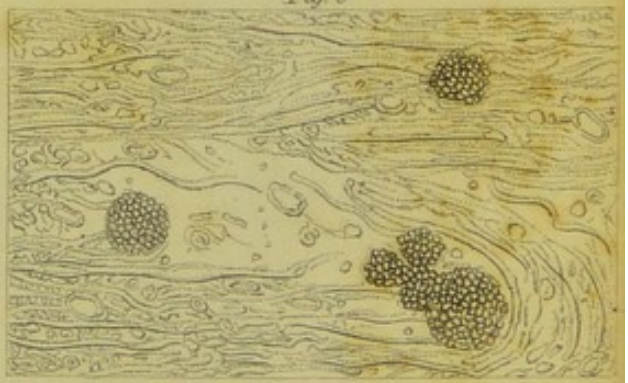

Fig. 10

Fig. 11

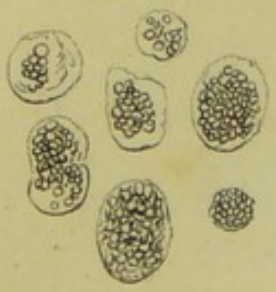

Fig. 12

Dr Bennett on inflammation of the Nervous Centres.

PLATE VI.

Fig 1.

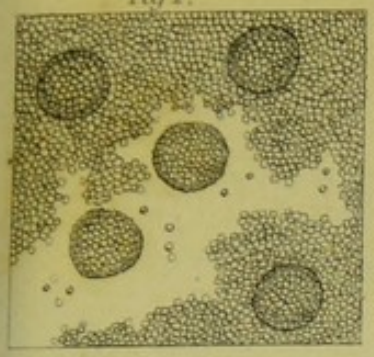

Fig. 2

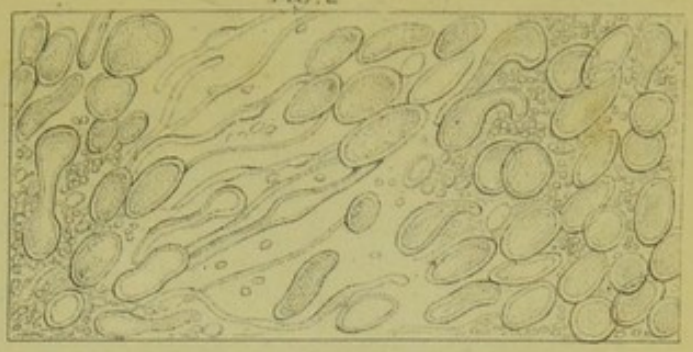

Fig. 3

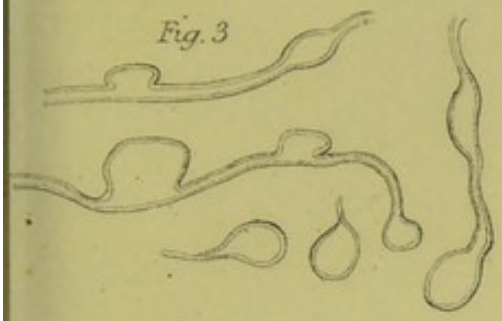

Fig. 4

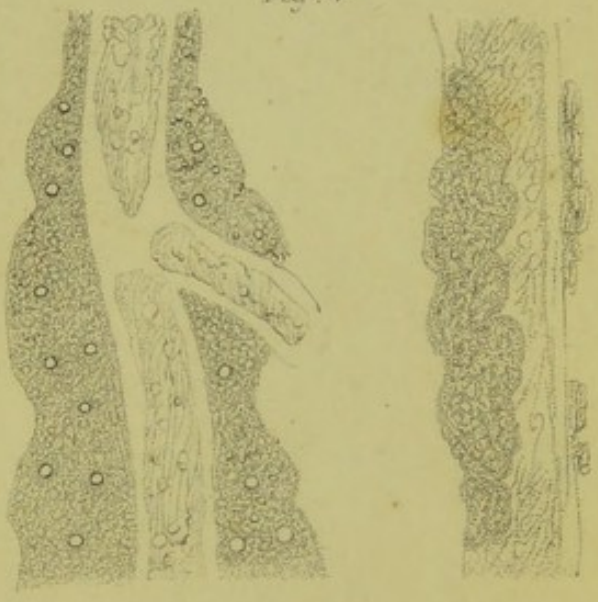

Fig. 5

Fig. 7

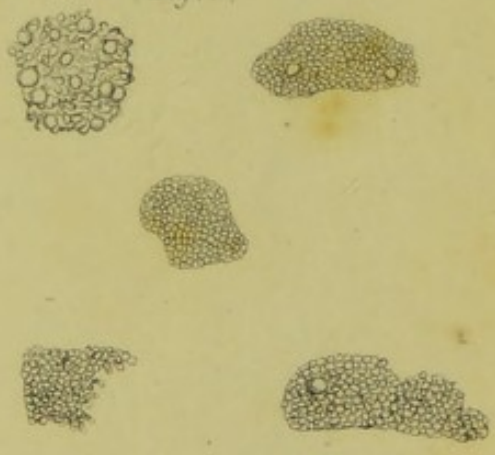

Fig. 6.

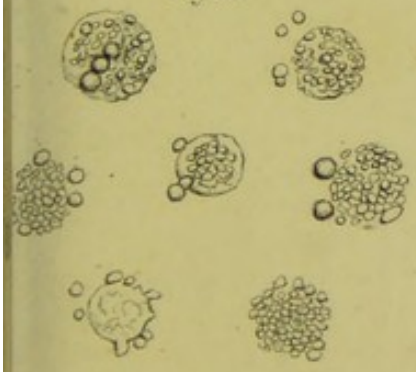

Fig. 9.

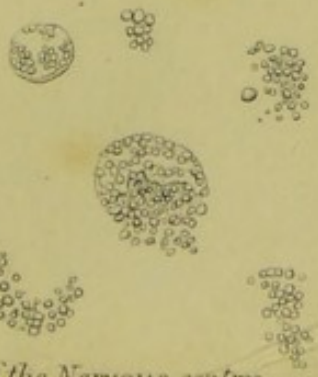

Fig. 8.