CASE OF

MOLLITIES AND FRAGILITAS OSSIUM,

ACCOMPANIED WITH URINE STRONGLY CHARGED WITH ANIMAL MATTER.

BY

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Received February 4th.—Read April 9th, 1850.

Mr. M——, a highly respectable tradesman, aged 45, placed himself under my care on the 30th of October, 1845. He was then confined to the house by excruciating pains of the chest, back, and loins, from which he had been suffering, more or less, for upwards of twelve months. On taking charge of the case, and on several occasions subsequently, I had the advantage of meeting Dr. Watson, whom the patient had consulted at the beginning of the preceding summer, and once or twice more recently.

Mr. M. was now much emaciated: his face was thin and sallow; his aspect expressive of suffering, though, when not actually under the influence of pain, he maintained his natural composure and habitual cheerfulness. The heat of the surface was below the natural standard, the pulse 86, and deficient in strength; the tongue furred; the appetite keen, often voracious, but the thirst not inordinate. The bowels were stated to be generally sluggish, but easily excited to diarrhœa, and the urine was reported to be natural in appearance and quantity.

For some days previous to our visit, the pain, which had usually occupied the trunk generally, became fixed in the left lumbar and iliac regions, obliging the patient to observe

a semi-bent posture, on account of the agony caused by every attempt at movement of the body upon the thighs. Pressure along the course of the spine did not create much uneasiness, but when made at the brim of the pelvis in front, on either side, where the iliacus and psoas muscles pass out to their insertion, the most exquisite tenderness was experienced. There was some painful retraction of the testicle, but no redness or swelling observed either in the groin or track of the cord. Irregular wandering pains about the chest and shoulders were complained of, but these were now reckoned comparatively trifling, as they had, at an early period of the illness, been extremely severe. The extremities, upper and lower, though much wasted, were free from pain, and could be exercised without difficulty or discomfort, provided their movements did not involve those of the trunk.

The abdomen was tumid from intestinal flatus, and the liver was judged to be of augmented volume; but in no other part of this cavity could any tumour or special enlargement be detected.

The chest presented the emaciated appearance observable in the rest of the body, with some flattening superiorly in front, on both sides. The breathing was unembarrassed, and, beyond some amount of mucous rhonci, the stethoscope gave no note of pulmonary lesion. Percussion elicited a clear sound everywhere, except in the precordial space, which was dull over a larger extent than natural, and the cardiac impulse was stronger than it ordinarily is in health, but no abnormal sounds were audible either in the region of the heart or in the course of the great vessels. It was observed that percussion, when forcibly performed, caused pain, but the circumstance did not, at the time, attract much attention, it being not unusual for sensitive patients to flinch under the gentlest tap.

The only positive information gained by the examination of the thorax was, that the heart was not in a satisfactory state. The exploration of this region was undertaken with some interest, and conducted with care, in consequence of the

patient ascribing his illness to a violent strain which he sustained fourteen months before, in vaulting out of an underground cavern. On coming to the ground, he instantly felt as if something had snapped or given way within the chest, and for some minutes he lay in intense agony, unable to stir. The violence of the pain having somewhat abated, he was able to walk to a neighbouring inn, and, after a night's repose, felt no inconvenience beyond some soreness and stiffness, which, however, he made light of, as he had for some time previously been subject to wandering pains at the breast and shoulders.

The accident just related occurred in September, 1844, while he was in the country, where he had gone for recreation and to recruit his strength, which had been impaired by close attention to business and much anxiety about a member of his family who had, a short time before, passed through a dangerous and protracted illness. Towards the end of the month, after his return to town, he consulted me respecting some dyspeptic troubles, mentioning, incidentally, the hurt he had received, and his being still incommoded by pain and stiffness of the chest, chiefly felt when he raised or flung back his arms. There was at that time no external mark of injury, nor any cough or dyspnœa. He was so much relieved by the application of a strengthening plaster to the chest, and carefully abstaining from bodily exertion, that, after the lapse of ten days, he discontinued his visits to me, and resumed his ordinary avocations. It appears, however, that, about three weeks or a month afterwards, he was seized suddenly, and without any evident cause, with acute pain in the chest and difficulty of breathing, for which he applied to a surgeon, who found it necessary to take blood from the arm to the amount of a pound, and to apply leeches and blisters topically. The abstraction of blood, he said, abated the pain, but was followed by great weakness, from which he did not rally for two or three months. In the following spring he had another severe attack, which was considered to be pleuritic, and treated by cupping. The pain, which in

this second attack was not in the chest but in the right side, between the ribs and hip joint, was not materially mitigated by the treatment, while the prostration of strength that followed the loss of blood was much greater than on the former occasion, and went on progressively increasing, with wasting, loss of colour, and slight puffiness of the face and ankles.

In this state the patient consulted Dr. Watson, who put him upon a course of steel and quinine. Under this treatment he improved rapidly; the pains became daily less severe, and by the middle of summer he had recovered so much that he was able to travel to Scotland. There, on the sea-coast, the improvement advanced, and for some time he was capable of taking active exercise on foot during the greater part of the day, bounding over the hills, to use his own expression, as nimbly as any of his companions. His appetite, which had at no time failed, became extremely keen, and he indulged it without restriction, particularly with the article of fish. This progress towards recovery was, however, suddenly checked by an attack of diarrhœa, which proved obstinate, and reduced his strength considerably. In September he returned to London, in a very debilitated state, but free from the excruciating pains which had tortured him during the spring and early part of the summer. He was again put by Dr. Watson on a course of tonics, and seemed to be gradually improving, when he was seized, a few days before I saw him, with the lumbar and sciatic pains, under which we found him suffering so severely.

With the view of meeting the prominent and most urgent symptoms of the case, the warm bath was prescribed, with Dover's powder at bedtime, and the acetate of ammonia, camphor julap, and compound tincture of camphor every five or six hours.

As some amount of œdema had been observed at one period during the progress of the patient's illness, I procured a portion of his urine for examination. This specimen was opaque, acid, and of high density, the specific gravity being

1035°, but it gave no indication of the presence of sugar to Trômers or to Moore and Palmer's tests. Treated by heat to ebullition, but not under that point, it was found to abound in animal matter, which, when isolated in this way, exhibited all the characters of albumen. With nitric acid, however, this urine displayed anomalies of a remarkable kind. On the addition of the acid no immediate precipitation took place; on the contrary, the urine, previously cloudy or turbid, became instantly clear, and retained its transparency for an hour or an hour and a half, when it was found to have formed into a firm yellow mass, which, unlike the coagulum resulting from the action of nitric acid upon serum sanguinis or ordinary albuminous urine, underwent complete solution on the application of heat, but again consolidated on cooling. Such were the effects when operating with the acid at the ordinary temperature of the atmosphere. When, however, the urine was previously heated to ebullition and, while still fluid, allowed to cool down a few points, the coagulum was almost instantly obtained, and like that resulting from the slow operation in the cold, suffered redissolution on the temperature being raised to the boiling point.

Oxalic acid threw down a copious white precipitate from the urine, and tannin and tincture of galls turned the whole into a tough mass.

The exertion of getting into the bath had been found productive of such acute suffering, that its use was discontinued, and as a slight catarrh, attended with some febrile movement, came on, tartrate of potash, with ipecacuanha, was substituted for the acetate of ammonia. The Dover's powder procured better nights, but during the day every motion of the trunk was attended with excruciating pain, great care and no little cautious manœuvring on the patient's part being required to enable him to get in and out of bed on all-fours. The urine became more abundant under the use of the neutral saline, and deposited a copious sediment of triple phosphates. It still reddened litmus paper, maintained its high specific gravity, and continued

to exhibit the same behaviour towards heat and nitric acid.

On the 3d of November, Dr. Prout joined Dr. Watson and myself in consultation. The slight febrile attack just noticed had passed away, but the patient was weaker, and confined to bed from inability to keep the erect or sitting posture. There was much flatulence of the abdomen, and marked fulness and hardness in the region of the liver. The pains had quitted the left side, and now occupied the right hypochondre, and the right lumbar region. The urine was found, on this occasion, to exhibit chemical reactions precisely similar to those already described.

It was agreed to resume the citrate of iron and quinine, to continue the opiate, and to have recourse, from time to time, to vesicatories and counter-irritants.

On the 9th the urine presented an altered appearance, being turbid and thick, like pea soup. The phosphates had given place to an enormous quantity of lithates which, owing to the great density of the urine (1040°), remained for hours suspended. Coincident with this altered state of the urine, an improvement was observable in the condition of the patient, who had slept well for two nights, and was able to sit up and to walk about his room, feeling little of the racking pains which had formerly crippled him. The urine, however, contained the same amount of animal matter, and its peculiar properties continued unchanged, except that more prolonged ebullition was now required to reduce it to the solid state.

The improvement did not last long; on the 11th the patient reported a bad night from an oppression caused by phlegm in the chest, and consequent cough, which raised a pain in the right hip and region of the kidney. He had also an attack of diarrhœa, brought on by a dose of rhubarb and soda given to correct flatulence, the urine was now more copious, less loaded with lithates, and reduced in density to 1034°. It bore brisk ebullition for several minutes without coagulating, but on being withdrawn from the flame

of the lamp, coagulated instantly into a uniform mass resembling blanc-mange in colour and consistence. The coagulum did not, however, melt on the renewed application of heat, nor by boiling in water.

Dover's powder, with aromatic cretaceous mixture, and a blister over the kidney, were prescribed.

On the 13th, a better night was reported, undisturbed by cough or diarrhœa, but the patient, though easier, was weaker, and looked more anæmic. The urine had again become loaded with lithates, presenting the appearance of thick gruel; it was acid, very spumous and glutinous, and its specific gravity had risen to 1040°.

On the 15th, Dr. Bence Jones, who had been for some time engaged in examining the composition of the patient's urine, met us in consultation. At his suggestion, alum was added to the tonics in use, with the view of checking the exhausting excretion of animal matter; and for several days a hope was entertained that this object might be realized. The urine was found to vary more in density than it had yet done, fluctuating between 1035° and 1026°, with a correspondent reduction in the amount of animal matter yielded to heat, but the reactions with nitric acid were exactly the same as before.

Under the diminished waste by the kidneys a temporary improvement took place; the pains were more tolerable, the patient was able to sit up daily for an hour or two, and continued to enjoy his food; but towards the end of November he again became weak and languid, and on the 7th of December he experienced a dreadful aggravation of lumbar pains. Crude opium and the preparations of morphia were severally tried, but they not only failed to procure sleep or relief, but disturbed his rest and confused his head. They were consequently discontinued. Some mitigation of suffering took place under the liberal use of Dover's powder with the guaiacum mixture, and the external application of the alcoholic tincture of aconite; but progressive weakness and emaciation went on with accelerated pace, and the

patient, now almost constantly racked with pain, was unable to leave his bed; he lost his appetite, took scarcely any nourishment, and on the 1st of January died exhausted, in the full possession of his mental faculties, and evincing, in his supreme hour of suffering, the same admirable fortitude and patient endurance which he had displayed throughout the whole course of his trying illness.

On the 28th of December the specific gravity of the urine, which for several days had been permanently high, sometimes 1040°, was found to have fallen to 1022°, but on the two following days it had mounted to 1036° and 1038°; when of the comparatively low density just mentioned, it coagulated, under heat, into a loose diffluent mass, like custard.

INSPECTION.—The post-mortem examination was made, thirty-six hours after death, by Mr. Shaw, in the presence of Dr. Watson, Dr. Bence Jones, Dr. Ridge, and myself. The body had undergone no remarkable amount of decomposition, but presented great emaciation.

Thorax.—The upper region of the chest appeared somewhat flattened, and below the clavicles, sunken. The muscles on being exposed were observed to be flabby, of a grayish colour, and bloodless.

On dividing the cartilages at the usual place, it was found that the adjoining extremities of the osseous ribs crumbled under the heel of the scalpel, and on prosecuting the dissection it was discovered, that all the ribs, throughout their whole length, were soft and brittle, so that they could be easily cut by the knife, and readily broken, at any point, by the exertion of a very moderate force. They had evidently lost much in size and weight, as well as in consistence and tenacity; their outer encasement, or laminated portion, was very thin, loose and fragile, yielding and crackling when pressed between the fingers and thumb; their interior was charged with a soft gelatiniform substance of a blood-red colour and unctuous feel. The sternum was in a similar state of softening and fragility, first bending, and then

snapping across when raised and turned back; but its under surface presented a deeper and more extensive redness, and its cancellated structure was more loaded with the coloured matter. The appearance of this bone may be seen almost exactly pictured in Mr. Solly's plate of the sternum of Sarah Newbury, whose case of mollities ossium he has detailed in the 'Transactions of the Society,' the only difference being, that it did not present to the same extent as Newbury's the cell-like character.[1]

The lungs showed no serious lesion; here and there they were emphysematous, and partially adherent to the costal pleura by weak and slender membranous filaments; but they were quite free from tubercular and other deposit.

The pericardium was of healthy structure. It contained about two ounces of clear serum, and its capacity appeared large in proportion to the size of the heart, which was rather under the normal dimensions and firmly contracted. The left ventricle embraced a small coagulum; the right contained one somewhat larger and partly fibrinous. The valves at the outlets of the heart were very thin, but no other morbid appearance was observed in this organ, and the great vessels were sound.

Abdomen.—On opening this cavity the stomach presented itself of great dimensions, occupying the whole of the epigastrium, both hypochondres, and half the umbilical region. Its walls were of natural thickness, and neither exteriorly nor interiorly was there any trace of inflammation, but some of the vessels ramifying on the surface were unusually large.

The liver was voluminous, but of healthy structure; the gall bladder was full of bile; the pancreas and spleen were sound.

The right kidney was of normal volume and shape; its proper tunic was of the usual fine texture, and easily separated. The surface of the organ was smooth and of natural colour, without the slightest appearance of mottling. On section it was found to be somewhat congested, but in other

[1] Medico-Chirurgical Transactions, Vol. XXVII, 1844.

respects perfectly healthy. Neither with the naked eye, nor by the aid of a glass, could the smallest trace of granular degeneration be detected, nor, indeed, the least deviation from the natural organization and arrangement of its several portions. The left kidney was rather larger than the right, but equally sound as its fellow. The urinary bladder was healthy.

The intestines were nearly empty, and presented no unusual appearance. The mesenteric glands were free from disease.

Spine.—After the thoracic, abdominal, and pelvic viscera were removed, the spine was examined. The three upper divisions of the column were found to have undergone, more or less, the same morbid change of structure which was discovered in the ribs and sternum. All presented the same characters of softness and brittleness, but the dorsal and lumbar had evidently suffered most from morbid degeneration and interstitial absorption, their bodies scarcely equalling those of the cervical in thickness.

With the lumbar vertebræ disappeared the characters of active disease and disorganization. The sacrum and flat bones of the pelvis were unyielding and impenetrable by the knife, but in colour they exhibited, it was thought, an unnaturally grey tint. Beyond this the examination was not prosecuted, as the cylindrical bones of the extremities were found to resist all efforts to bend or break them by manual force.

From the foregoing details it will be seen, that although this case was stamped with characters of the most striking and aggravated kind, its real nature remained unknown to the last. The affection to which it bore the nearest resemblance was a severe attack of lumbago or sciatica; but it was evident from more than one feature of the complaint, that sufferings so intense must have a deeper seat and more formidable cause than mere muscular or neuralgic rheumatism. In particular, it was ascertained, that the patient

had lately lost strength and wasted rapidly, although his appetite continued keen, and he was consuming a much greater amount of solid animal food than he ever had been in the habit of taking when in perfect health.

The discovery of albuminous matter in the urine naturally suggested the existence of Bright's disease; but that supposition was abandoned, on a closer consideration of the character of the symptoms and the peculiar condition of the renal excretion. The leading symptoms were not such as usually accompany that affection. Atrocious pains, like those which assailed our patient, constitute no part of Bright's disease, while two of its most constant attendants, dropsy and cerebral disturbance, were absent. The presence in the urine of an animal principle alien to it in a normal state, might, it was at one time supposed, be attributable to erroneous vital chemistry, involving a perversion of the primary or secondary assimilating processes. This explanation was, however, deemed far from adequate; for, admitting the probability of these functions being in fault, the question as to what particular organ was affected, and what the special lesion that could give rise to a pathological condition so very anomalous, remained unanswered, and the case closed amid the uncertainty and doubt which had surrounded it from the beginning.

But the information denied to the most anxious inquiries, prompted, alike, by the obscurity of the complaint and sympathy with the sufferer was yielded to the first touch of the anatomist's knife. The crumbling ribs proclaimed the presence of a disease of the osseous system, not more remarkable for its phenomena than terrible in its effects. Mollities and fragilitas ossium is, fortunately, not a common disease, but almost all the records of it which we possess agree in representing it as one scarcely paralleled for the amount of pain and misery which it inflicts. There was, therefore, little hesitation felt, even on the threshold of the post-mortem investigation, in connecting this early announcement with the antecedent history of the case, as well as its most unac-

countable accessory—the peculiar condition of the urine. Every successive step in the investigation led to the same conclusion, by disclosing a similar disorganization of structure in other districts of the body, which had, during life, been the seat of suffering.

The bones were not subjected to chemical analysis, but their diminished bulk, their lightness, flexibility and brittleness sufficiently attested their having been, in great measure, despoiled of their natural constituents, both animal and earthy,—in that condition, in short, which Mr. Solly has appropriately denominated "Osteo-malacia fragilis rubra." The identity of the two cases was further established by the minute morbid anatomy of the diseased structures in each. Mr. Dalrymple, who, in our case, kindly undertook the microscopical examination of two of the affected bones (a rib and two lumbar vertebræ), has given the result of his observations in an interesting paper, communicated to the 'Dublin Quarterly Journal of Medical Science,' for June 1846. It would appear from this investigation, that the disease had commenced in the cancellated structure, but that the external laminæ were also involved, being much reddened and atrophied. The material filling the large cancellous cavities in the interior was found to be composed of granular matter, oil globules, nucleated cells, constituting the bulk of the mass,—a few caudate cells and blood disks extravasated largely amongst the other cells, and giving the red colour to the gelatiniform mass.

This account accords very much with Mr. Birkett's description (given in Mr. Solly's paper) of the microscopic anatomy of a bone affected with mollities ossium, and seems to point to a disease essentially malignant in its nature, but differing, according to Mr. Dalrymple, in some special particulars from the true malignant disease of bone as we are accustomed to regard it. Instead of progressively reproducing and developing themselves without limitation, the new and morbid formation which replaced the original and sound structure seem to have been, at an early stage of their

existence, removed by absorption and carried out of the system.

The disease, in the present case, could not be traced to any direct exciting cause. The patient was of temperate habits and exemplary conduct; he married early, had a numerous offspring, and, with the exception of two or three severe attacks of frontal neuralgia, enjoyed uninterrupted good health, till within a year of the first date of this illness, when he was observed by his family to be easily fatigued, and to stoop in walking. I have also been informed by a male relative, that he complained at that time of being incommoded by frequent calls to make water, and was much disconcerted by finding his body-linen stiffened by his urine, although there was not the least urethral discharge. From these circumstances it may be inferred, that the malady had made considerable progress at the period of the accident, which probably caused a breach of continuity in the already fragile case of the diseased sternum and ribs, the consequence of which would necessarily be the immediate and subsequent agonies which he suffered.

With reference to predisposition, and certain alleged causes of the disease, I must not omit mentioning, that the patient's father died, at no very advanced age, a martyr to gout, and his mother, rather suddenly and unaccountably, a few days after undergoing extirpation of a scirrhous tumour from the breast, performed by a distinguished London surgeon.

While the case came to the same fatal conclusion as all recorded examples of this formidable malady, it is not unimportant, in a practical point of view, to note that the juvantia and lædentia corresponded very closely with the experience of preceding observers. Whatever amount of improvement was at any time remarked, took place, under corroborating therapeutic measures, whilst an aggravation of suffering invariably followed depressing remedies, or exhausting influences. Twice was the disease seen to make a start after the loss of blood; and on the second occasion its career was arrested in a remarkable manner by a powerful tonic,

and the invigorating influence of country air; the accidental supervention of diarrhœa gave it renewed and resistless impetus, the few temporary checks and mitigations which it received in its subsequent course, occurring under the use of means directed to uphold the constitutional powers. In the case detailed by Mr. Howship, sanguine hopes of recovery were at one time entertained from the great amelioration which took place from the conjoint influence of Peruvian bark and sea air. These facts are not without their practical application, and might be more valuable if we could detect the disease in an early stage, when it may be presumed to be more amenable to appropriate treatment. On this point, the remark of Mr. Curling is not to be disregarded, viz. that we should bear this disease in mind when treating pains of the limbs of an obscure and intractable character.

That the disease, in the present instance, was so long under observation without being recognised, arose from the circumstance of its having been limited to a district of the body in which the bones are not often subjected to the effects of violent muscular exertion or external force. Like many other severe and fatal maladies, the affection is obscure in its origin, and insidious in its progress. In no recorded case with which I am acquainted was it discovered, or even suspected, till curvature, displacement, or actual fracture of a cylindrical bone had occurred, and unequivocally declared its presence. Down to some such deplorable incident in the history of these cases, the patients were supposed to be labouring under some grievous form of gout, indomitable rheumatism, or syphilitic contamination; notwithstanding the expressive character of many of its leading features, there is reason to fear that, without some supplemental token of more definite and distinctive significance, the disease will continue to elude detection, till it has arrived at its stage of full development and incurability. It is this consideration that, in my mind, invests the properties of the urine, voided by this patient, with their chiefest interest.

Amongst the striking phenomena presented by mollities

ossium, whether occurring as simple softening, or softening conjoined with brittleness of the bones, an altered condition of the urine has been very generally observed. The alteration hitherto noted has been an augmented proportion of the earthy constituents of that fluid. In some cases, as in that of Sarah Newbury, this has been demonstrated by chemical analysis only. In other instances the calcareous matter has been deposited in a palpable form, and to an enormous amount, as in the celebrated case of Madame Supiot, which was an example of pure softening, and in the instance recorded by Mr. Thomson, which was one of softening and fragility. Even when nothing peculiar has been observed in the appearance of the urine, there have been found, after death, calcareous depositions in various structures, as in Mr. Curling's case, where the deposit was in the lumbar and iliac glands, and in Mr. Solly's second case, where, although earthy matter does not appear to have been present in the form of a sediment, the urine, on analysis, yielded three times the quantity of healthy urine, and on dissection, phosphate of lime was found clogging up the calices and pelvis of the kidney, forming there a solid calculus.

These facts justify the general belief, that in mollities ossium the earthy parts, so remarkably deficient in the affected bones, are in the first instance taken up by the absorbents, then separated from the circulation by the kidneys, and finally swept away with the urine, as the debris, so to speak, of a dilapidated and mouldering structure. Assuming this to be the process going on in *softening* of the bones, we should be led by analogy to infer, that in an opposite condition—fragility—their animal constituents, the albumen, fibrin, and gelatine, to which they owe their natural cohesion and tenacity, would in like manner be taken up by the absorbents, and thrown out of the system by the kidneys. Hitherto, however, there has not been, so far as I know, any positive evidence adduced that such is the fact. It is true, that in Mr. Howship's case we find mention made, on two occasions, of the urine being loaded with albumen, but the

agency by which the presence of this material was ascertained is not stated; and the account given by that writer is not altogether decisive of the nature of the deposit which he denominates albumen.—"The urine, on examination," he says, "was loaded with albuminous matter, which, on cooling, formed a sediment; but when, by the obliging attention of Professor Brande, it was submitted to analysis, nothing decidedly singular in its constitution was ascertained." Again, he says, "the urine passed this morning was scanty and of the former brown colour, but deposited a fine albuminous sediment, a shade lighter in colour than the fluid itself." This account would imply, that the albuminous deposition took place spontaneously, a mode of separating not met with except when the albumen occurs as a component of purulent or muco-purulent matter mingled with the urine, not in chemical union as in ordinary albuminuria and the case before us. From the fact of the deposit not taking place till the urine cooled, it is possible, that Mr. Howship, trusting to inspection alone, may have mistaken for albumen a copious sediment of the triple phosphates, or of pale lithates, which, without the aid of tests, cannot be easily discriminated from deposit of pus or mucus. At all events, this passing notice of the presence of albumen, does not appear to have attracted the attention of subsequent observers, for we find Miescher,[1] one of the latest systematic writers on diseases of the bones, suggesting a breaking up and absorption of their animal constituents as the true explanation or "ratio symptomatum," of fragility. After stating the familiar fact, that in softening the earthy matter is absorbed and excreted with the urine in the form of a cretacean sediment, he proceeds to observe, with respect to fragility—"causa proxima fragilitatis quesita est in resolutione partium ossis animalium, qualem ars ossa in machina Papiana coquendo, vel calcinatione efficit, earundumque resorptione; quanquam chemia hanc opinionem nondum

[1] De Inflammatione Ossium, eorum q. Anatomia generali. 4to.—Berol., 1836.

comprobavit." Whether the desired demonstration be found in the case just submitted to the Society, must be decided by future and more extended observation of this remarkable disease. In the meanwhile, as far as the evidence of a single example avails, we have undoubted proof of the discharge from the body of an amount of animal matter, apparently equivalent to what was missed from the bones. It would, however, be premature, and not strictly accordant with the analogy afforded by other diseases, to assume the invariable concurrence of these two conditions in mollities and fragilitas ossium. Nature does not always rid the system of morbid products, and, when disposed to do so, she has a choice of emunctories whereby to eliminate effete and excrementitious materials. Indeed, evidence to this effect, of no equivocal character, is supplied by the strange symptoms which have been frequently seen to attend the disease. Besides the deposition of a chalky sediment in the urine very generally observed, the cutaneous and other excretories have in some cases been actively employed in throwing off products of an unnatural kind. In one instance the urine, it is said, was high coloured, turbid and fetid, and the hands and feet were constantly covered with an unctuous humour, which, as it dried, thickened into scales; in another case, the perspiration was abundant, and possessed an unusual fetid odour; in a third, there were copious sweats, and almost incessant salivation; and in the extraordinary case of Madame Supiot, the saliva as well as the urine stained the linen black. Mr. Curling, in noticing these facts, makes a remark, the justice of which cannot, I think, be questioned:—"Now all these circumstances would seem to indicate, that the blood was loaded with something which it was glad to get rid of by any of its natural outlets.[1] In the instance before us, it would seem that the kidneys had been selected for this purpose, and had not only proved equal to the novel office assigned them, but, what is more extraordinary,

[1] On some of the Forms of Atrophy of Bone.—Medico-Chirurgical Transactions, Vol. XX, p. 391.

had discharged the task without sustaining, on their part, the slightest danger. During the two months that the case was under my eye, the solid animal matter daily cast out of the body in this manner was roughly estimated, from repeated observations, as not much less than a moiety of the entire quantity of urine excreted. Thus on the 4th of November, when the patient was passing forty ounces, the daily average, sixteen ounces of it, having a sp. gr. of 1038°, yielded, on boiling, a firm coagulum weighing nine oz. and two dr., while the residual liquor which had resisted coagulation, with an additional quantity supplied by slow exudation from the clot, amounting altogether to eight ounces, was found to exhibit a correspondent reduction in density, its sp. gr. being only 1022°.

But enormous as was the quantity of animal matter thus shown to have been incorporated with the urine, its presence had nearly escaped observation. It is true that its discovery was effected by means of heat and nitric acid, the tests commonly employed, singly or conjointly, for displaying albumen when it exists either as a natural constituent of animal fluids, or as a morbid component of urine; but in the present instance these agents, when employed in the usual way, failed entirely as tests, and it was not till they were applied in a modified manner, that they succeeded in detecting and disengaging the alien ingredient, displaying at the same time a set of novel and remarkable reactions which seemed to bespeak the existence of some special disease bearing but a distant relation to any of those derangements of function or structure which we are accustomed to associate, in a pathological sense, with ordinary albuminuria.

The most striking peculiarity which distinguished this from any other specimen of urine I ever examined, and in an especial manner from that excreted in Bright's disease, was its behaviour with nitric acid. The reaction of nitric acid and ordinary albuminous urine are so uniform and constant, that they are received as the most trustworthy evidence of the presence of albumen, the acid never failing to produce an

immediate and notable coagulation in urine containing the foreign ingredient. But in our patient this familiar and convenient test failed, like heat, to give any immediate intimation of the presence of animal matter. On the contrary, the absence of albumen was, in the first trials, not unnaturally inferred from the circumstance of the urine, previously hazy, becoming instantly clear on dropping the nitric acid into it; and it was only on inspecting the test tube some hours afterwards, that its contents were seen to have undergone the remarkable change already described. I was at first inclined to think that some mistake had occurred, but on repeated trials with other specimens, and closely watching their course, the results were always found to be the same. A slight yellowish opacity was the first announcement of a change going on in the mixture; this gradually deepened in tint, with increasing consistency of the fluid, till the whole congealed into a bright and somewhat resplendent mass, presenting very much the appearance of a heap of nitrate of urea scales blocking up the tube. It further resembled that substance in liquefying on the application of heat and again concreting on cooling; but no true crystalline arrangement could be perceived, the sparkling appearance being evidently due to numerous air-bubbles entangled in the mass. Perfect redissolution took place when the tube was held for a few minutes in the flame of a spirit-lamp, or plunged into hot water at 160° or 170°, the ordinary coagulating point of albumen; and the fluidity thus acquired persisted under ebullition, however prolonged.

Not less interesting was the modifying influence of temperature in another particular—viz., the time required to bring about the change in question. An hour was the shortest period in which coagulation was effected by the acid when the experiment was carried on at the ordinary temperature of the atmosphere, whilst the same result was almost immediately obtained, if the urine were previously boiled and suffered to cool. A rather pretty variation of the experiment, exhibiting this modifying influence, consisted in

heating to ebullition the upper portion of urine contained in a tall test-tube, and then adding the nitric acid: the acid instantly discharged a slight opacity of the hot fluid due to the presence of phosphates, but as soon as it reached the cold stratum below, a production of yellow coagulum was seen to take place, and continue to form in the track of the acid as it traversed the fluid to the bottom. Every successive drop thus added was followed in descending by a slender yellow trail resembling a string of vermicelli, till, by their accumulating, they occupied the whole of the lower division of the tube, like a plug of yellow butter, contrasting strikingly, at the moment, with the clear fluid above. The contrast did not, however, last long, for as the upper stratum of urine cooled, it became first turbid, then opaque and yellow, the entire contents of the tube soon presenting one homogeneous mass of golden hue. This, like the coagulum obtained in the previous experiments, melted on being heated, and reformed on cooling.

It cannot be doubted, I presume, that reactions such as I have described must have belonged to a peculiar kind of morbid urine. It must, however, be a peculiarity of rare occurrence, for I have not, in the course of my reading, met with any notice of albuminous urine presenting reactions precisely similar. The nearest approach to it I find briefly mentioned in Solon's Treatise, p. 423.[1] It occurred in the case of a young rheumatic subject, who was attacked with endo-carditis, and was improving under sanguinous depletion. For the space of two days this patient, it is said, voided albuminous urine presenting some remarkable characters. It yielded a copious coagulum both to heat and nitric acid, but that resulting from the latter on being heated suffered redissolution. The appearance, here, was temporary, and Solon was inclined to consider it analogous to what takes place in simply precipitable urines, or when nitric acid is added in large excess to a feeble albuminous precipitate.

[1] De l'Albuminurie. Par Martin Solon, D.M.—Paris, 1838.

It was, of course, an object of considerable interest in our case to determine what was the precise nature of the substance resulting from the action of the nitric acid on the urine—whether a peculiar modification of albumen, pre-existing in the urine as a morbid ingredient, and liberated from it in the form of a precipitate or a new compound evolved during the experiments, under the play of chemical affinities. The task of investigating this point fell into able hands. In one of the first procured specimens of the urine, Dr. Prout found the urea and lithic acid in about the usual proportion; and from the whole of the phenomena exhibited in the course of the inquiry, he pronounced the animal matter present to be albumen in some peculiar state of combination or condition. In a note with which he favoured me at the time he says—"I have found albumen in this state before, but never in such large quantity. I regard it as the material which, if the kidney had done its duty, would have been converted into lithate of ammonia."

The more elaborate analysis by Dr. Bence Jones, the result of which was communicated to the Royal Society in April 1847, and published in the 'Philosophical Transactions,' Part i, for 1848, confirm the view entertained by Dr. Prout. He succeeded in separating from the urine and from a quantity of combined ordinary albumen a substance displaying, among other characters, the peculiar reactions with nitric acid so strikingly seen in the original experiments. This substance, he ascertained, on ultimate analysis, to be an oxide of albumen, the hydrated deutoxide; and by the same reaction—the solubility of the nitric acid precipitate when cold—a similar substance in small quantity may be detected, he tells us, in pus and in the secretion from the vesiculæ seminales.

The limits of a paper do not permit me to refer more at length to Dr. Jones's researches and corollaries, which are highly interesting; but they are doubtless well known to most of the members of this Society, and are accessible to all in the 'Philosophical Transactions' and medical periodicals. My own share in this part of the inquiry, it must have been

seen, was very humble; but the ordinary means of examination at the command of the practical physician unversed in the nice processes of analytical chemistry, were sufficient to bring me acquainted with physical properties and chemical reaction, which, independently of their apparent direct relation to the disease which destroyed the patient, seemed to me deserving of a detailed account; and I shall be content if I have succeeded in pointing out to future observers, gifted with the requisite qualifications for conducting researches of a higher order, certain definite and distinctive characters by which a peculiar and hitherto unrecorded pathological condition of the urine may be recognised and identified.