DESCRIPTION
OF AN
URINARY CALCULUS,
COMPOSED OF THE
LITHATE OR URATE OF AMMONIA.

By WILLIAM PROUT, M.D. F.R.S.

Read June 22, 1819.

M. FOURCROY had stated that the Lithate of Ammonia not only frequently enters into the composition of urinary calculi, but sometimes constitutes entire concretions*. Mr. Brande, some years afterwards, called this statement in question, and was induced to conclude from his experiments, “that no substance which can be called urate of ammonia exists in calculi.” In this latter opinion I believe most British chemists have acquiesced, and Dr. Marcet, in his recent work on this subject, observes, “the presence of this substance (lithate of ammonia) in urinary calculi I still think very doubtful, especially because, since it is so easily discoverable in the excrements of the Boa Con-

* *Système des Connaissances Chimiques*, tom. x. p. 224.

† *Philos. Trans.* vol. xcvi. p. 231.

strictor, it is not probable that the English chemists would have overlooked it so long in the human calculi, which they have so often and so successfully submitted to chemical examination*.

From these decided opinions of such eminent chemists we must conclude that this variety of calculus is extremely rare: to obviate, however, the belief that it does not exist at all, I have been induced to draw up the present account, the object of which is to describe a calculus composed almost entirely of the substance in question.

This calculus, for which I am indebted to my friend Dr. Elliotson, was extracted in April last by Mr. Cline, jun. from a boy about two years of age, in St. Thomas's Hospital; when entire it weighed about fifty grains; its general shape was ovoid a little flattened; its external surface was smooth and of a greenish clay colour (corresponding nearly to the *wax-yellow* of Werner†). It was composed of thin concentric layers, easily separable from one another, and readily breaking into sharp angular pieces, with a compact earthy fracture. Its general colour internally differed both in shade and intensity from that of its external surface: it might be denominated a pale reddish

* Essay on the Chemical History and Medical Treatment of Calculous Disorders, p. 140, first edition. See also Dr. Henry's Paper in the first Part of the present Volume.

† See Werner's Nomenclature of Colours, by Patrick Syme.

clay colour (corresponding nearly to the *wood-brown* of Werner*). The different layers, however, differed somewhat in intensity, which caused the laminated structure to be visible to the eye. Between some of the layers also there were minute depositions of the earthy phosphates, which rendered this structure still more sensible. The nucleus exhibited the same general appearance as the rest of the calculus, except that it appeared to be made up of a fine powder and a few larger grains, loosely agglutinated together.

It was sparingly soluble in cold water†, but it dissolved readily in boiling water, (especially when in a state of fine powder,) requiring only about three hundred times its weight for that purpose. On cooling, the calculous matter did not immediately separate, but after some days a great part of it was deposited.

It readily dissolved in solutions of the fixed alkalies, and at the same time a strong smell of ammonia was exhaled. When muriatic acid was

* See Werner's Nomenclature of Colours, by Patrick Syme.

† One part of the excrements of the *Boa Constrictor* (which is lithate of ammonia) at 60° required about 480 parts of water to dissolve it.

at 90°300

at 212°240

But the calculus above described was found to be somewhat less soluble than this substance, probably on account of its compact state of aggregation.

added to this solution lithic acid was precipitated.

In nitric acid it dissolved readily, especially with the assistance of heat, exhibiting the same phenomena as lithic acid when similarly treated.

Muriatic acid, in which it had been digested, was found to be converted into muriate of ammonia.

Exposed to the action of heat by means of the blowpipe, it decrepitated so strongly that it was difficult to ascertain the effects produced by this agent. When reduced to powder, and exposed to heat, it first appeared to give off ammonia, and afterwards to burn with the same phenomena as lithic acid. It left a minute residuum, which strongly reddened turmeric paper, and appeared to consist partly of lime (and alkali) and partly of the earthy phosphates.

From these proportions it is evident that this calculus consisted principally of the lithate of ammonia*.

* The following is Fourcroy's description of this species of calculus, which does not differ much from the above. " Les calculs d'urate d'ammoniaque, bien caractérisés par leur dissolubilité dans les lessives d'alcalis fixes caustiques, mais avec un dégagement abondant d'ammoniaque, sont ordinairement petits, d'une couleur pâle de café au lait, ou d'un gris tirant sur cette nuance, formés de couches fines qu'on détache facilement les
unes

The boy from whom this calculus was taken suffered extreme irritation, and his general health was much deranged. Two or three weeks before it was extracted, I had an opportunity of examining his urine; it was pale-coloured, and exhibited the appearance it usually assumes when a calculus is present in the bladder, or when the functions of the inner coat of that viscus are otherwise deranged. Its specific gravity was 1023.8, and it abounded in urea and the triple phosphate of magnesia and ammonia. It reddened turmeric paper, but as it had been kept for some days before I had an opportunity of examining it, this property might have been acquired after it was voided from the bladder.

I possess a fragment of another small calculus, having precisely the same colour and properties

unes des autres, et qui sont lisses par les surfaces qui se touchent; presque toujours contenant un noyau dont on sépare aisément l'enveloppe. Leur forme la plus ordinaire, est sphéroïdale, alongée, comprimée, quelquefois amygdaloïde; leur surface est ordinairement lisse, jamais tuberculeuse, quelquefois brillante et cristalline; leur pesanteur spécifique va de 1.225 à 1.720, l'eau seule les dissout, surtout quand elle est chaude, et quand ils sont divisés et en poussière fine. Les acides, le muriatique surtout, leur enlèvent l'ammoniaque, et laissent seul l'acide urique, qui se dissout ensuite dans la potasse sans effervescence: ils se trouvent quelquefois recouverts d'acide urique pur: la couche extérieure de celui-ci est ordinairement peu épaisse, et la plus grande quantité du calcul est de l'urate d'ammoniaque. Sur les 600 calculs examinés la proportion du nombre d'individus de cette espèce a été une des plus faibles." Op. cit. p. 237.

as that above described. It was likewise taken from a boy under the age of puberty, and was accompanied by great irritation. This fragment, which is about one-tenth of an inch in thickness, appears to have constituted a part of the outer crust. Its external surface is rough, and covered with mamillary protuberancies. To a part of its internal surface there is adhering a portion of a common lithic acid calculus ; probably, therefore, the whole of its centre was composed of that substance. This boy, as well as the former, recovered from the operation, and I believe neither has ever had any return of the complaint.

The characteristic properties of this species of calculus appear then to be the following :—1st, their colour and general appearance, which are peculiar ; 2dly, their solubility in water ; 3dly, their yielding ammonia when treated with the fixed caustic alkalies. To which, perhaps, may be added, 4thly, their property of decrepitating before the blow-pipe*.

There are also strong reasons for concluding, from the smallness of their size, and other circumstances, that this species of calculus, in its pure

* I am aware that decrepitating calculi are usually said to contain a little oxalate of lime, and this was perhaps the case in both the above instances. In these instances, however, the decrepitation appeared to me rather to depend on the escape of ammonia.

state, is peculiar to children under puberty*, and that it is accompanied by great derangement of the general health, and the most distressing irritation.

With respect to the *medical treatment* of this variety of calculus, it ought probably to differ in no respect from that adopted in ordinary cases of the lithic acid calculus ; certainly not at least in a *chemical* point of view.

* The morbid urine of children generally contains an excess of the phosphates, but in some rare instances a peculiar clay-coloured deposition takes place after the urine has cooled, which, if I am not mistaken, consists partly of lithate of ammonia.