XXVII.—*On the Solubility of Xanthine (Uric Oxide) in dilute Hydrochloric Acid.*

By H. BENCE JONES, M.D., F.R.S.

IN the Journal of the Chemical Society, vol. xv., 1862, p. 78, I have published a note on a deposit of crystallised xanthine in human urine.

The deposit dissolved in dilute hydrochloric acid, and when evaporated to dryness gave microscopical six-sided laminar crystals, which were so remarkable, that a sketch of some of them was given.

The solubility of the crystalline deposit in hydrochloric acid led to a doubt whether the substance really was xanthine, for in many chemical books xanthine was said to be insoluble in hydrochloric acid. Liebig and Gmelin* say, "in hydrochloric or oxalic acid, xanthine is not soluble, or only very slightly, and by this it may be distinguished from cystine." Berzelius in his Chemistry repeats this statement on the above authority. Dr. Golding Bird, in his book on Urinary Deposits, 1844, p. 103, says, "uric oxide is insoluble in hydrochloric acid," and Professor Fownes, in the first edition of his Chemistry, p. 525, says, "xanthic oxide is not soluble in hydrochloric acid." Lehmann (Physiological Chemistry, vol. i. p. 145), says it is distinguished from cystine by its insolubility in hydrochloric acid.

On the other side, Dr. Marcet, the discoverer of this substance, in his book on calculous disorders, p. 106, says, "the mineral acids also dissolve it, though not near so readily as the alkalies. The residues of its solution in the muriatic and sulphuric acids are white." Schlossberger, in his Chemistry (fifth edition, p. 580), says, "contrary to what has been stated, it dissolves in mineral acids, freely in hot hydrochloric acid, and on cooling the combination with hydrochloric acid is deposited in a crystalline form."

A section of a calculus of this substance weighing 19 grains, removed from a boy four years old in the Punjaub, having been discovered by Mr. T. Taylor, in the collection of the College of Surgeons, a very small portion was given to me to determine whether it was soluble in hydrochloric acid, and whether it would give the six-sided crystals which I have described in the Journal of the Chemical Society (vol. xv, p. 78).

* Ann. Ch. Pharm. xxvi, 340.

The stone consisted entirely of dark brick-coloured xanthine. It gave the characteristic yellow reaction with nitric acid becoming reddish with ammonia or potash. It was distinctly soluble in dilute hydrochloric acid, even in the cold; it dissolved much more rapidly when heated; and on evaporating the solution to dryness, it gave the most characteristic, microscopic, six-sided crystals, soluble in water.

The calculus dissolved in dilute sulphuric acid, and on evaporating the liquid, and examining the residue by the microscope, very distinctive tufts of acicular crystals were obtained.

The solution in nitric acid also gave microscopic crystals; but these were much less distinctive than the crystals from the hydrochloric or sulphuric acid solutions. They had more resemblance to the crystals of xanthine that were met with in the urine, of which a drawing is given in my former note.

Having thus found that, as regards the solubility in hydrochloric acid, and the form of the crystals deposited on evaporating the solution, xanthine agreed perfectly with the deposit which I have described, I endeavoured to obtain the same crystals that I found in the urine, by dissolving the powdered xanthine in healthy urine.

The xanthine dissolved slightly in healthy acid urine by the aid of heat, but on allowing the solution to evaporate, no crystalline deposit was obtained.

When the xanthine was dissolved in urine rendered slightly alkaline by ammonia or soda, no crystalline deposit formed on standing or on evaporating.

These experiments were frequently repeated, but I failed to reproduce artificially the crystals of xanthine which occurred naturally in the urine. Still the solubility in hydrochloric acid, and the form of the crystals obtained on evaporating the solution, leaves no doubt whatever that the crystalline deposit which I observed in the urine was xanthine.

It is by no means impossible that such crystals have often been considered, from microscopic examination alone, to be uric acid. At least, long since, the solubility of similar crystals on the application of heat has been passed over by me as remarkable.

From the occurrence of the xanthine in Langenbeck's boy, in the Punjaub boy, and in my boy, it is probable that these crystals are most likely to be found in the urine of children.