

ACCOUNT
OF A
CHEMICAL EXAMINATION
OF THE
URINE AND SERUM OF THE BLOOD OF A PERSON
WHO HAD BEEN
TAKING LARGE QUANTITIES OF SODA.
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A YOUNG lady, who was suffering under symptoms which threatened pulmonary consumption, was recommended to take large quantities of soda. After she had continued this plan for some months, with an unusual degree of perseverance, I had an opportunity of examining the changes which had been produced in the urine and the serum, and I propose to submit to the Society the analyses which I made of the fluids. The patient began with ʒss. of the subcarbonate of soda daily, which she progressively increased to ʒiiss. ʒij. ʒiiss. and finally to ʒiiij. She was not, however, able to persevere in this quantity for more than a few days, in consequence of the vomiting which it excited, but she continued to take ʒiiss. daily, for a consi-

derable length of time ; it was during this period that I made my experiments. Each ounce of the salt was dissolved in about a pint of water, and she drank two or three quarts of water during the course of the day. The urine was rendered very copious, and the appetite and strength were much improved; the medicine does not appear to have produced any other sensible effect.

Analysis of the Urine.

1. The urine of this patient was of a dull primrose colour, nearly transparent, and without any sediment ; the odour was urinous, but not strongly so ; it was decidedly alkaline ; its specific gravity was 1.016.

2. A portion of the urine had a quantity of potash added ; it became slightly opake, the odour more urinous, and after two days a small quantity of precipitate was formed.

3. Equal parts of the urine and lime-water caused the formation of a small quantity of precipitate.

4. One-twelfth of its bulk of a saturated solution of the oxymuriate of mercury produced a copious precipitate ; the precipitate, when dried, was found to be in the proportion of about 2 grs. to the ounce.

5. One-twelfth of its bulk of the saturated solution of the muriate of barytes produced a copious dense precipitate, which quickly subsided ; when dried it was found to be in the proportion of about 3 grs. to the ounce.

6. The solution of the superacetate of lead produced a precipitate of about 6 grs. to the ounce.

7. The nitric and muriatic acids produced considerable effervescence, and changed the colour of the urine to a reddish brown ; but no precipitate was formed.

8. The solid contents of the urine were found by evaporation to amount to about $\frac{1}{40}$ th of its weight.

9. A quantity of the urine was subjected to the boiling temperature: it became opaque, frothed very much, and a white, curdy precipitate gradually subsided from it.

10. Acetic acid, of the specific gravity of 1.007, was gradually added, until the alkali in the urine was saturated ; it required for this purpose about $\frac{1}{12}$ th of the weight of the urine: this mixture did not become putrid so quickly as the natural urine.

11. The extract produced by evaporating the urine differed from the extract of healthy urine in not assuming the granulated appearance.

12. A portion of the urine, which was kept in a corked phial, soon began to grow muddy, and to deposit white flakes; in two days it acquired a very putrid odour. Another portion, that had been exposed to the atmosphere, had undergone less change, and that which had been boiled remained a long time without alteration.

13. The nitrate of copper was added to the three portions of urine: the corked, the uncorked and the boiled. In all of them there was a considerable effervescence, and a copious white precipitate; the fluid from the corked phial became of a deep blue, that from the uncorked phial of a light blue, and that which had been boiled of a light verdigris colour. When the same proportion of nitrate of copper was added to healthy urine, the fluid was converted to a dull olive, and a slight brown precipitate was produced.

14. The precipitate that had been formed in the urine by boiling remained a considerable time without any change; the fluid being poured off, it was readily dissolved by potash, and copiously precipitated by sulphuric acid.

15. To a portion of the evaporated extract nitric acid and water were added; a very considerable effervescence was excited, and the whole was reduced to a white, spongy mass.

gested in alcohol ; the alcohol assumed a bright orange colour, and was strongly alkaline.

17. A quantity of a whitish matter was left undissolved by the alcohol, upon which water was digested; a part of it remained undissolved, which, when dried, weighed $5\frac{1}{2}$ grs. The aqueous solution was strongly alkaline.

18. The alcoholic solution was slowly evaporated to about $\frac{1}{10}$ of its bulk, and was then cooled. It was converted into a brown substance of the consistence of a thick syrup, in which was a network of fine spicular crystals.

19. The fluid was drained from the crystals, which were thus left nearly pure, they did not deliquesce, but were very soluble in water.

20. The aqueous solution in No. 17. was slowly evaporated and then cooled ; an irregular mass of crystals was left, in which were observable a number of cubes ; the mass, when dried, weighed $37\frac{1}{2}$ grs. It deliquesced by exposure to the atmosphere.

21. The syrupy substance in No. 18. was strongly alkaline, and rapidly attracted water from the atmosphere.

22. A quantity of the purified urea had nitric

acid added to it; a great effervescence was produced, but no scaly crystals were formed. After some days it was converted into a brown fluid, and smelled of Prussic acid.

23. The insoluble residuum in No. 17. was readily dissolved in muriatic acid, except a few grey particles, that seemed to be an accidental impurity. The solution was copiously precipitated by pure ammonia; the fluid poured from this precipitate was not affected by carbonate of ammonia.

24. The solution in No. 19. was very slightly alkaline, a copious precipitate was produced in it by nitrate of silver; by the addition of potash ammoniacal vapour was engaged, and the sulphate of copper produced a rich blue colour in the fluid.

Remarks on the experiments.

1. These experiments prove that the urine of this patient contained a quantity of uncombined alkali, and this probably in the carbonated state. See Nos. 1. 7. and 10.

2. The alkalescence seemed to be attached to the urea, as the solutions of this substance, both in water and in alcohol, still exhibited the excess of alkali. See Nos. 16. and 17.

3. The urine contained an albuminous matter. See Nos. 4. 9. 13. and 14.

4. The urine had a strong tendency to the putrefactive fermentation and the generation of ammonia. This appears to have been *immediately* caused by the presence of the albumen, and *indirectly* by the union of the albumen with the uncombined alkali. This circumstance may be thought to shew some connection between an alkaline and a putrid tendency in the animal fluids. See Nos. 12. and 13.

5. The urine contained the muriatic and phosphoric salts in about the usual quantity and proportion. See Nos. 5. and 6.

6. It also contained the phosphate of lime, although in less proportion than natural; a fact, which deserves to be noticed, as under ordinary circumstances the existence of phosphate of lime and an uncombined alkali in the same fluid is impossible. Can this depend upon the alkali attaching itself more particularly to the urea, so as still to permit the urine to dissolve the phosphate of lime? See Nos. 3. 17. and 23.

7. It contained urea, but it could not be separated from the alkali, and was not capable of being granulated, nor was it acted upon in the usual manner by nitric acid; the quantity of the urea

was probably rather less than the average. See Nos. 8. 11. 15. 16. 18. and 22.

8. The spicular crystals which formed in the purified urea, were muriate of ammonia, a salt said to exist in small quantity in urine, but which, in this instance, amounted to a much greater quantity than usual. See Nos. 18. 19. and 24.

9. The composition of the urine will be nearly as follows,

ENTIRE URINE.		SOLID CONTENTS.	
Water . . .	750		
Urea united to a fixed	}	142.5	— 57
alkali . . .			
Muriate of ammonia			
Phosphate of Soda	}	93.75	— 37.5
Muriate of Soda			
Phosphate of Lime	}	13.75	— 5.5
Albumen . . .			
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	1000.00		100.0
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Analysis of the Serum.

1. The fluid was of a deep lemon colour, with a shade of brown. Its specific gravity was 1.029 ; it was strongly alkaline, much more so than ordi-

nary; when the alkali was supersaturated with acetous acid the colour remained unchanged.

2. The boiling temperature converted the albumen into a firm coagulum, it was quite transparent, and in appearance very like orange jelly.

3. When cut into small pieces a few drops of fluid gradually oozed out, which was less alkaline than the entire serum.

4. The serum left by evaporation $\frac{1}{9}$ of its weight of solid contents.

5. 400 grs. of the serum, diluted with an equal bulk of water, had 20 grs. of muriatic acid added, by which the alkali was slightly supersaturated. It was then exposed for some time to the boiling temperature; a considerable quantity of gas was extricated, and continued to rise through it for some time. A pulpy mass was produced, which slowly subsided and was separated by the filter. The fluid passed through transparent, and of a light brown colour; the pulpy mass was of a verditer green, and when dried, became converted into a transparent brittle substance of a deep grass green colour.

6. The oxymuriate of mercury converted the serum into a thick cream, without forming any solid coagulum. It was reduced by boiling to a

firm coagulum of a spongy texture, which, when dried, was friable, and of a light verditer colour,

7. The nitrate of silver added to the serum threw down a coagulum in the form of dense flakes.

8. Some of the green coagulum formed by muriatic acid, was digested with alcohol. The alcohol acquired an olive tinge, and upon the addition of water became completely opaque.

9. The alcohol being evaporated left a grey viscid substance; this substance when gently heated on bibulous paper, communicated to it a greasy stain; by increasing the heat, it consumed, leaving a carbonaceous residuum.

10. By a heat of 150° , the substance was softened but not melted; by continuing the heat, it dried up into a brown membranous substance.

11. When the substance was rubbed with water, it was converted into a pulpy mass, and was, for a considerable time, suspended in the fluid; but it gradually subsided, and by filtration the water was rendered perfectly transparent. The fluid was not rendered alkaline.

12. The substance was readily dissolved by potash at the boiling temperature, and a saponaceous

fluid was formed ; the sulphuric and muriatic acids precipitated the substance from the potash in the form of grey flakes.

13. The muriatic acid was added to the dried green albumen in No. 5. ; it soon began to turn it black, and very much to increase its bulk, while the fluid acquired a dull reddish brown colour. After long digestion in a gentle heat, the albumen was partly broken down, and the fluid gradually acquired nearly the appearance of ink.

14. When saturated with potash, the colour was diminished by the dilution, but did not appear to be otherwise affected ; a very minute brown precipitate was produced.

15. The nitric acid softened the dried albumen, and converted the green colour into a bright yellow; the fluid when saturated with potash became of a deep orange, a slight precipitate was thrown down, and yellow crystals were produced by evaporation.

16. After the serum had remained a few days in a close phial, a creamy substance began to collect on its surface, and the whole acquired a nauseous smell. In the course of two months this creamy substance had acquired a considerable thickness, and some flakes of coagulum were also deposited at the bottom of the vessel.

17. The nitrate of copper converted the whole into a mass of soft coagulum of a light verditer colour.

18. The creamy substance was instantly dissolved by potash, and reproduced by the muriatic acid.

19. A quantity of the serum was left in an open phial for several months; it became extremely foetid, and the vessel was lined with a film of a brown colour and metallic appearance; the fluid was no longer alkaline.

20. The crassamentum belonging to this serum was much capped, and was covered with a strong buffy coat. The colour of the clot was very dark, and it was not rendered florid by exposure to the air. The buff separated from the clot in the form of a white compact membrane.

The peculiarities of this blood were the unusual quantity of uncombined alkali; the unusual colour of the serum, especially after coagulation, and the action of the muriatic acid and the oxymuriate of mercury upon it; the existence of a substance, which has not before been observed in blood, of an adipoceros nature, and of the creamy substance which was separated from the serum when it began to putrefy, which both in its sensible and chemical properties, very much resembled pus.

Notwithstanding the alkaline nature of this blood, it was in a highly inflamed state.

After an interval of five months, when the patient was taking only a moderate quantity of the soda daily, I performed some experiments upon a second specimen of the blood. It resembled the first specimen for the most part in its external characters, except that the colour was less bright, being rather brown than yellow. Its specific gravity was 1.03, and it was less alkaline, 400 grains of the serum requiring for saturation only $3\frac{1}{2}$ grains of the muriatic acid. The crassamentum was, as before, much capped and buffed, but the buffy coat was rather less tenacious, and the clot much less black. There appeared to be rather more serosity in the coagulated albumen. The muriatic acid produced nearly the same green colour as in the former instance, but the colour produced by the oxymuriate of mercury had a bluish tinge.