A SIMPLE APPARATUS FOR THE RAPID ESTIMATION OF UREA.

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Of the many methods that have been suggested for the estimation of this most important constituent of urine only two have practically survived. Liebig's method of precipitating the urea with mercuric nitrate and Davey's of decomposing the urea with sodium hypochlorite, the latter subsequently modified by Knop, who used sodium hypobromite, are the only ones that we find given in works on urniary analysis of recent date. It is not so much on account of their superiority but of their convenience, that these have outlived other processes. Next to the determination of the presence or absence of albumen and sugar there is no one constituent the variation of whose excretion it is more important to know than that of the urea. This is especially the case since we have no exact, rapid method of ascertaining the quantity of albumen voided, and, in cases of Bright's disease a determination of the elimination of the urea becomes a matter of moment.

For several years past the modification of Davey's method suggested by Dr. Williams has been in use in the laboratory of the Bellevue Hospital Medical College. The apparatus is very simple, consisting of a graduated burette connected with a double bulb apparatus by a rubber tube. A measured quantity of urine is placed in one bulb and several times its volume of hypobromite in the other. The bulb apparatus is then connected with the burette which is placed in a tall jar of water.

The level of the water inside the burette and out is equalized and the point at which it stands noted. The urine is then gradually mixed with the hypobromite and the increase in volume of gas in the apparatus, due to the evolution of nitrogen, measured on the burette. The multiplication of the number of cubic centimeters by the factor 0.0027 gives the weight of urea in grams. A further calculation gives either the percentage or the total quantity voided in 24 hours.

To lessen the cost of an outfit for urinary analysis the above apparatus was arranged in such a way that only one piece, the bulb part, was exclusively used for this determination. The burette served as a measure for all quantitative volumetric operations as did also the graduate jar. But the apparatus, simple as it is, has

its inconveniences as any one would soon ascertain in the practical use of it in laboratory instruction. For the practitioner of medicine it is not always in order and the determination takes time. A calculation is necessary even though a table is frequently given to which the operator may refer. The leveling of the water is annoying and though the determination can be made more accurately when corrections for temperature and pressure are used in the calculation than with the process to be described, as it is practically carried out, there is scarcely any advantage.

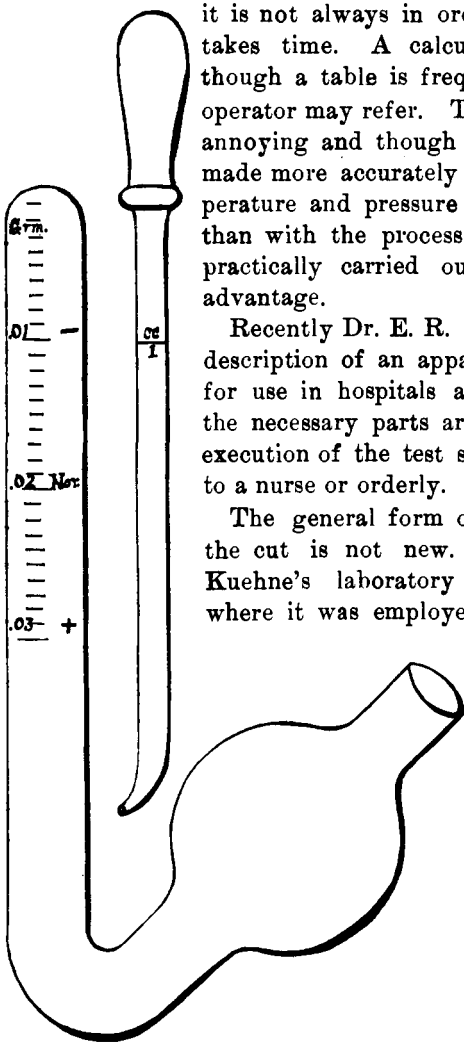

FIG. 9.

Recently Dr. E. R. Squibbs * has published a description of an apparatus which he commends for use in hospitals and private practice since the necessary parts are easily obtained and the execution of the test simple enough to entrust it to a nurse or orderly.

The general form of the apparatus shown in the cut is not new. It was in use in Prof. Kuehne's laboratory in Heidelberg in 1871, where it was employed in the detection of fermentable sugars by introducing some yeast in the liquid and setting the tube in a warm place. The carbon dioxide evolved collected in the long arm.

Since then it has been given in works on animal chemistry.

Rough trials with an extemporized apparatus led to the ordering of a tube graduated in cubic centimeters. Further experiments with this caused the change in the graduation, which is now made to read either fractions of a gram of urea in a cubic centimeter of urine or the number of grains per fluid ounce of urine.

* Ephemeris, Vol. II., p. 488, 1884.

Dr. Geo. B. Fowler's method † which needs but a urinometer for the measurement of the loss of gravity a urine mixed with hypobromite or hypochlorite sustains by the escape of nitrogen, is extremely simple, but requires time for the execution of the test and a calculation, which, to the average medical man, is repugnant.

A solution of sodium hydrate, made by dissolving 100 grams of the solid in 250 c. c. of water (or, for those who prefer the apothecary's measures, 6 oz. to the pint of water), is kept on hand in a bottle with a paraffined or rubber stopper.

With this a solution of hypobromite is freshly made by adding 25 c. c. of bromine, cooling and diluting to 500 c. c. with water. Enough of the hypobromite is poured into the bulb of the ureometer to fill the long arm and the bend when the apparatus is tilted.

1 c. c. of urine is drawn into the nipple pipette and delivered slowly, by pressing the nipple, through the hypobromite into the long arm of the ureometer. The urine rises through the hypobromite and the decomposition of the urea is instantly affected. With good hypobromite very little gas either escapes from the long arm or is disengaged after three or four minutes standing. The reading of the instrument gives at once the quantity of urea, if in grams, in 1 c. c. of urine, if in grains, then per fluid ounce.

When the centesimal scale is used, multiplying the result by 100 gives the so-called percentage. This is really not correct but is the weight of urea in 100 c. c. of urine. When the Sp. Gr. of the urine is known, the percentage by weight may be quickly calculated.

The graduation of the instrument to indicate weight of urea does away with tables or calculations. Usually the test is sufficiently accurate not to require the reading of the temperature or the lowering of the ureometer in water, to eliminate the error due to difference in level in the liquid in the two arms of the apparatus. The instrument is graduated on the practical basis ascertained by Russell and West * for 65° F.

As the hypobromite deteriorates, it is wise to make up small quantities at a time. For this purpose one volume of bromine is added to 10 volumes of sodium hydrate and subsequently mixed with 10 of water.

For convenience the ureometer may be filled to the mark = with sodium hydrate, 1 c. c. of bromine is then added by means of the

† *N. Y. Med. Jour.*, June, 1877.

nipple pipette and, when it has combined with the soda, enough water is added to fill the long arm and bend of the ureometer.

Other solutions which decompose urea with evolution of either nitrogen or nitrogen and carbon dioxide may be employed instead of the hypobromite but offer no practical advantage.

In hospitals a fresh daily supply of hypobromite can be ordered for general use and perhaps through the use of some such speedy yet fairly accurate method as this our information concerning the elimination of what is, by all odds, the most important constituent of the urine will be largely increased. To the office practitioner it offers a ready, cleanly and rapid method of analysis and to the general practioner, a substitute for even so simple a test for urea as the mere addition of nitric acid, one which commends itself at least on the score of rapidity and approximate accuracy.

*Jour. Chem. Soc., **12**, 1874, 749.