thalmoscope has failed in either of those cases to reveal the presence of anything abnormal in the discs and retina.

The myxodematous changes are very generally distributed. Although I have no anatomical proof, I imagine that the sympathetic ganglia become involved in the process. The movements of the heart and intestines, and the function of respiration, all become delayed. The interruption in the respiratory rhythm, too, is noteworthy. It was noticed in both cases that the inspiratory murmur, which was full and prolonged, suddenly became quiescent; nothing was heard for a few seconds, and then came the expiratory. Those of you who were not careful when examining the chest will remember the trap into which you fell by regarding the expiratory murmur as an indication of a renewed act of inspiration. What we really had was this—inspiration; interval of quiescence, lasting as long as the period of inspiration itself; then expiration—a point which seems to show that the terminations of internal sensory nerve-fibres are probably also the seat of myxodema. This expiratory delay owns the same explanation as the imperfect peripheral perception. The stimulus to inspiration is, briefly, the action of blood containing carbonic acid on the respiratory centre, and the sense of collapse of the lung conveyed thereto by the inspiratory pulmonary fibres of the pneumogastric. This accomplished, expiration is brought about, setting aside laryngeal fibres, through the expiratory fibres of the pneumogastric conveying to the centre a sense of distension of the lung. It is this sense of distension, that is not quickly received, transmitted to, and transformed at, the respiratory centre; and hence the lungs remain in a state of distension for a short period—one of entire quiescence, and not attended by discomfort to the patient, and which forms a distinct break in the respiratory rhythm between inspiration and expiration. I am inclined to think that the slow action of the heart owes a similar explanation.

Once the disease is established, it seems to pursue a downward course. The tendency is for the myxosis to encroach upon blood-vessels and glandular structures, and the termination is Bright's disease; albumen suddenly appearing in the urine, other symptoms of renal disease appearing, and the patient dying comatose.

It being regarded hitherto chiefly in the light of a peripheral lesion, baths, diaphoretics, and tonics have been prescribed. My patients were benefited for a time by the use of iron and liquor ammoniac acetatis. At Dr. Ord's suggestion, I have been trying thirty-minim doses of tincture of jaborandi thrice daily; and I may state that, under its use, both patients have improved. The skin of the hands has become softer, and the numbness has diminished; but they are still far from well. Phosphorus I intend to try. Nitro-glycerine has been used by others, and, I believe, with benefit; but, as I have never been able to satisfy myself about the existence of high arterial tension in these cases, I have not given it a trial. High arterial tension, if it existed, I should have regarded rather as the effect than as the cause of the disease.

Two points require consideration. You have to remember that, when myxodema has existed for a time, there is an enormous overgrowth of connective tissue, and a filling up of the intercellular spaces by a large quantity of mucoid material. These two things give rise to all the special symptoms of the disease in question; they constitute its pathognomonic features; but, after all, they are not the disease itself. The diseased conditions which antedated these—be they failure in nutrition by loss of nerve-power, be they alteration in those chemical and physical processes which underlie metabolism and metastasis—these are the conditions we must try to know; and, knowing them, it will be an easier matter to place the treatment of myxodema upon a scientific basis.

BEQUESTS AND DONATIONS.—The Sussex County Hospital, Brighton, has received £1,469 5s. 5d. in cash, and £1,975 4s. 8d. in 3 per cent. Consols. under the will of Mr. Joseph Collinson; and £180 under that of Mr. Burwood Godlee.—The Birmingham and Midland Hospital for Women has received £100 anonymously, in commemoration of a golden wedding, per Miss Webster; and £100 under the will of Mr. William Davis of Edgbaston.—The Royal Hospital for Children and Women has received £200, less duty, under the will of Mrs. Eleanor Bailey.—Miss Rawson, of Nydd Hall, has given £105 to the Bradford Infirmary.—The Grocers' Company have given £100 to Miss Mary Wardell's Convalescent Home for Scarlet Fever.—Mr. Quintin Hogg has given £52 10s. to the general fund, and £52 10s. to the Seaside Branch, of the Metropolitan Convalescent Institution.

The Eccleshall Bierlow guardians have, with the sanction of the Local Government Board, formed the townships of Dore and Totley into a separate medical district, and appointed Dr. George H. H. de Wolfe the medical officer.

ON PICRIC ACID AS A TEST FOR ALBUMEN AND SUGAR IN THE URINE.*

By GEORGE JOHNSON, M.D., F.R.S.,

Physician to King's College Hospital and Professor of Clinical Medicine in King's College.

DURING a period of about two years, I have been in the habit of using picric acid as a test for albumen in the urine. I was induced to employ this test by my son, G. Stillingfleet Johnson, one of the Demonstrators of Chemistry at King's College, who, while working at the compounds of albumen with the mineral acids, the results of which he published in the journal of the Chemical Society (August 1874), found that picric acid caused coagulation in all the acid compounds of albumen; and he therefore suggested that it might be found a valuable test for albumen in the urine. At that time, we were not aware that it had ever been employed as a test for albumen; and in a communication to the *Lancet* (November 4th, 1882), I spoke of it as a new test; but, a few days after the publication of my paper, I chanced to come upon a leading article in the *Medical Times and Gazette* (vol. ii for 1874, p. 366), in which picric acid is mentioned as having been recommended as a test for albumen by a French physician, M. Galippe. There is, therefore, no novelty in the suggestion; but, so far as I can learn, the true value of the test has not hitherto been appreciated, and therefore it has not come into general use. The test may be used in the form of a saturated aqueous solution, or in the form of powder or crystals. The aqueous solution is most suitable for home use, while the powder or crystals may conveniently be carried in a urinary pocket test-case.† A saturated aqueous solution may be quickly made by adding about fifty times their bulk of boiling distilled or rain water to the powder or crystals; a portion of the acid will crystallise out on cooling, leaving a transparent yellow supernatant liquid. This solution, being added to an equal volume of albuminous urine in a test-tube, immediately coagulates the albumen. The coagulated picrate of albumen is soluble in alkalis; if, therefore, the urine be highly alkaline, it must be acidulated by a vegetable or a mineral acid before adding the picric acid solution. In my numerous testings for albumen with picric acid, I have not once found it necessary to acidulate the urine. The picric acid solution is itself sufficiently acid to dissolve the phosphatic sediment which results from boiling a neutral or alkaline specimen of urine.

To detect a very minute quantity of albumen, the following method is the best. Into a test-tube about six inches long, the urine is poured to within two inches of the top; then, the tube being held in a slanting position, about an inch of the picric acid solution is gently poured on the surface of the urine, where, in consequence of its low specific gravity (1003), it only partly mixes with the upper layer of the urine; and, as far as the yellow colour of the picric solution extends, there will be more or less turbidity from coagulated albumen, contrasting with the pellucid unstained urine below. If, then, the tube be placed in a stand, the coagulated albumen will gradually subside, and form a delicate horizontal film at the junction of the coloured and the unstained stratum of urine; the yellow liquid above and the uncoloured urine below being quite free from turbidity. If the urine should be turbid with urates, it must be cleared by heat before the addition of the picric acid solution.

As a result of numerous careful observations, I have arrived at the conclusion that picric acid applied in this way is a more delicate, and, therefore, more trustworthy, test for albumen than nitric acid in cold urine, whether the latter be employed by the method of dropping the acid into the cold urine, or by pouring the urine on the acid previously placed in the tube. The simplest and most satisfactory mode of comparing the two tests as regards their relative delicacy, is to dilute a specimen of albuminous urine until one or the other test fails to act; and it will be found that the picric acid solution shows the presence of albumen in a specimen diluted considerably beyond the point at which the nitric acid fails to give any indication. The picric acid, too, often causes an immediate albuminous opalescence in specimens in which nitric acid only slowly, and after an interval of some minutes, gives a similar, but sometimes a doubtful, indication.

It scarcely need be insisted on that, for example, during convalescence from acute albuminuria, it is of the greatest practical importance to be assured that no trace of albumen remains.

Here it may be well to mention that the albuminous opalescence

* Communicated to the Clinical Society, March 9th, 1883.

† Such a case has been made for me by Hawksley, 357, Oxford Street.

with picric acid which always occurs immediately, if at all, may readily be distinguished from the coarse granular particles of urate of soda, which, after a delay of some minutes, sometimes result from the acidity of the picric solution. These granular masses of urate, sometimes mixed with crystals of free uric acid, quickly fall to the bottom of the test-tube, and carry with them so much of the picric colouring matter, that, when placed under the microscope, they are so opaque as to appear almost black.

In testing with the powder or crystals, as much as is equal in bulk to a peppercorn may be shaken up in a test-tube, with a column of urine about an inch in height. As the powder dissolves, the urine becomes turbid with coagulated albumen. The object is to add as much of the test as the urine will dissolve, and no more. The solution of the picric acid in the urine, and the coagulation of the albumen, are quickened by heating the tube over a spirit-lamp or a candle, or by immersing the tube in hot water.

Another convenient mode of using the powder or crystals is to add fifteen or twenty minims of water to the peppercorn bulk of the acid in a tube, and quicken the solution by the application of heat; an equal bulk of urine is then gradually added to the hot solution, when albumen, if present, is at once detected.

The value of picric acid, as a test for clinical use, is much increased by the fact that, when boiled with a solution of potash, it forms a most delicate test for glucose. As I have stated, in a letter which I addressed to the *Lancet* (November 18th, 1882), I stumbled upon this fact by adding some picric acid solution to a boiling specimen of saccharine urine, which had previously been mixed with half its volume of liquor potassæ. I was at that time not aware of the fact, that the reaction of picric acid with grape sugar had been observed by Braun, a German chemist, nearly twenty years ago. I am indebted to Dr. Pavy for a reference to Braun's paper (*Ueber die Umwandlung der Pikrinsäure in Pikramminsäure, und ueber die Nachweisung der Trauben-Zucker*. C. D. Braun. *Zeitschrift für Chemie*, 1865). In this paper, it is shown that grape-sugar, when boiled with picric acid and potash, reduces the yellow picric acid to the deep red picramic acid, the depth of colour depending on the amount of sugar present. I am not aware that hitherto any attempt has been made to utilise this as a qualitative clinical test for sugar in the urine, or as a means of accurately estimating the amount of sugar in a saccharine solution. I trust, however, to be able to establish its value for both purposes.

Take a fluid drachm of a solution of grape-sugar, in the proportion of a grain to the fluid ounce; mix it with half a drachm of liquor potassæ (*P.B.*), and ten minims of a saturated solution of picric acid; and make up the mixture to four drachms with distilled water. The mixture is conveniently made in a boiling tube, ten inches long and three-fourths of an inch in diameter, which may be marked below at the height of two and four drachms. With a long boiling tube, there is little risk of the liquid boiling over; and, the steam, condensing in the upper cool part of the tube, flows back as liquid, so that there is little loss by evaporation. The liquid is now raised to the boiling point, and the boiling is continued for sixty seconds by the watch, so as to insure the complete reaction between the sugar and the picric acid. During the process of boiling, the pale yellow colour of the liquid is changed to a beautiful claret red.

The liquid having been cooled, by cautiously immersing the tube in cold water, and it having been ascertained that its level is that of the four-drachm mark on the tube, or, if below the mark, it having been brought up to it by the addition of distilled water, the colour is that which results from decomposition of picric acid, by a grain of sugar to the ounce, four times diluted; in other words, it indicates one-fourth of a grain of sugar to the ounce; and this colour is a convenient standard for comparison in making a volumetric analysis. The picramic acid solution, however, on exposure to light, even for a few hours, becomes paler; but the colour may be exactly imitated by a solution of ferric acetate, with a slight excess of acetic acid and an excess of ferric chloride. The iron solution, we have found to retain its colour unchanged for a fortnight, even when exposed to a strong light; and we expect that, when light is excluded, it may be kept for an indefinite period; and it is, therefore, a convenient standard for comparison.*

If, now, a drachm of a solution of grape-sugar, containing two grains to the ounce, be mixed with the same quantity of liquor

potassæ (half-a-drachm) as before, but with double the amount of picric acid (*i.e.*, twenty minims), and made up to four drachms in the boiling tube, the result of boiling the mixture as before for sixty seconds, will be the production of a much darker colour than when the one-grain solution was acted upon; but if now the dark liquid be diluted with its own volume of water, the colour will be the same as that of the one-grain solution.

The dilution is accurately done in a stoppered tube, twelve inches

The picro-saccharimeter, as described in the text. The shading of the side tube indicates the ferric acetate standard. The darker shading at the bottom of the graduated tube shows the saccharine fluid, darkened by boiling with picric acid and potash, and occupying ten divisions before dilution.

long and three quarters of an inch in diameter, graduated into $\frac{1}{10}$ and $\frac{1}{20}$ equal divisions. By the side of this tube, and held in position by an S-shaped band of metal, is a stoppered tube of equal diameter, and about six inches long, containing the standard iron solution.*

Sufficient of the dark saccharine liquid to be analysed is poured in to occupy exactly ten divisions of the graduated tube. Distilled water is then added cautiously, until the colour approaches that of the standard. The level of the liquid is then read off and noted. A more exact comparison of the saccharine liquid with the standard is made by pouring into a flat-bottomed colourless tube, about six inches long and an inch in diameter, as much of the standard as will form a column of liquid about an inch in height, and an exactly equal column of the saccharine liquid in a precisely similar tube. The operator then looks down, through both tubes at once, one being held in each hand, upon the surface of a white porcelain slab, or a piece of white paper. In this way a slight difference of tint is readily recognised, and if the liquid to be analysed be found to be darker than the standard, it is returned to the graduated tube, and diluted until the two liquids are found to be identical in colour, when the final reading is taken. The saccharine liquid having been diluted four times before it was boiled, a colour equal to that of the quarter-grain standard would indicate one grain of sugar per fluid ounce. If further dilution were required—say from ten to twenty divisions—the proportion of sugar would be two grains per ounce, and so on to thirty or forty or upwards, or to intermediate divisions. Thus dilution, from ten to thirty-five divisions, would indicate 3.5 grains of sugar per ounce.

* I hope and believe that our friends and fellow-workers, the pharmaceutical chemists, will prepare standard sugar solutions, and also the ferric acetate standard for those who require them. We have made the ferric acetate by adding ferric chloride to ammonium acetate. It is of primary importance that the standard be correct.

* This picro-saccharimeter was made for me by E. Cetti, 36, Brooke Street, Holborn, E.C.

We have found, by experiment, that ten minims of a cold saturated solution of picric acid are rather more than sufficient for decomposition by one drachm of a solution of grape sugar in the proportion of one grain to the ounce. A drachm of the solution would, of course, contain one-eighth of a grain of sugar. In making an analysis, the picric acid must be added in proportion to the amount of sugar. If the proportion of sugar be as high as six grains per ounce, a drachm of the picric acid solution will be required. If the proportion of sugar be higher than this, the saccharine fluid should be diluted with distilled water in a definite proportion before commencing the analysis, and the product of the analysis of the diluted fluid is then to be multiplied by the degree of dilution—two, five, or ten, as the case may be, to which the original liquid has been subjected.

Distilled water, or clear rain-water, should be used for diluting. Hard water, containing salts of lime, is rendered turbid by the carbonate of lime precipitated by mixture with caustic potash, and any turbidity in the liquid interferes with the estimation of the depth of colour. In testing undiluted urine, a slight turbidity often results from separation of phosphates by the potash. This turbidity may be removed by allowing the phosphates to form a sediment, or more speedily by filtration. When a highly saccharine liquid is diluted five or ten times before mixture with the testing materials, no phosphatic turbidity occurs. In making a volumetric analysis, care must, of course, be taken that the measurements and dilutions are accurately made.

The preliminary dilution of a strongly saccharine specimen may be made in the graduated tube; or into a flask graduated to contain fifty cubic centimetres; five or ten cubic centimetres of the saccharine liquid may be delivered from a graduated pipette; then, the flask being filled up to the graduation with distilled water, the dilution will be ten times with five cubic centimetres, and five times with ten cubic centimetres of the liquid to be analysed.

Another important point is that, while the amount of potash remains the same, the picric acid must be in proportion to the amount of sugar in solution. It has already been mentioned that ten minims of the picric acid solution are more than equal to one-eighth of a grain of glucose, which is the amount contained in one drachm of a solution, in the proportion of a grain to a fluid ounce. A slight or even a considerable excess of picric acid does not appreciably affect the colour of the picramic acid, while a deficiency would, of course, lead to an underestimate of the amount of sugar. If an analysis with thirty minims of picric acid solution indicate, say, from three to four grains of sugar, it is probable that some sugar has been left undecomposed, and a second analysis, with a larger proportion of picric acid, might therefore give a higher and a more correct result. If, on the other hand, a second analysis, with a larger proportion of picric acid, give an identical result, we may feel certain that the whole of the sugar has been decomposed, and the amount indicated by the resulting picramic coloration. In any case, when the amount of sugar indicated is less than would suffice to react upon the amount of picric acid employed, the result may be relied upon as correct.

The presence of albumen, even in large amount, has but little influence on the picric acid test for sugar. In illustration of this, the following experiments will suffice. A specimen of urine, normal as regards the amount of saccharine or saccharoid material, but containing a large amount of albumen, was boiled with picric acid and potash with sufficient water to dilute the urine by its own volume of liquid. A second portion was treated in the same way after the separation of the albumen by boiling and filtration, and the first specimen gave a darker tint than the second to a degree that might be considered to indicate one-tenth of a grain of sugar per ounce. Another portion of the urine was decolorised by repeated filtering through charcoal; and, of this, one specimen was tested while it retained its albumen, another after the separation of the albumen—the result being that both yielded identical tints of colour, and this was very slightly paler than that of the specimen which was tested after having been deprived of its albumen without previous decolorisation by charcoal. The explanation is, that pure albumen has no reducing influence on picric acid when boiled with dilute potash, such as is used in testing for sugar; but with ser-albumen, as with white of egg, there is associated a colouring matter which is partly separated by filtering off the coagulated albumen, and entirely removed by repeated filtering through charcoal. The colouring matter in question has a reducing influence on picric acid, although the colouring matter of normal urine has been found to have none. The coagulated albumen collected on the filter, after being thoroughly washed, gives no red reaction when boiled with picric acid and potash diluted in the same proportion as that em-

ployed in testing for sugar. This has been proved by repeated experiments.*

The accuracy of the picric acid method of volumetric sugar analysis has been fully and fairly tested. Our plan has been to compare the results of this process with those obtained by Dr. Pavy's beautiful and accurate ammonio-cupric method. We have analysed the same specimens, many of them albuminous as well as saccharine, by the two processes, my son employing Dr. Pavy's method in the laboratory at King's College, and I the picric acid process at home; and our results are found to be practically identical, the differences being only such as are due to unavoidable slight errors in conducting an experiment. Both methods, in fact, are based upon the same chemical principle—namely, that glucose, when heated with potash in the presence of an oxidising agent, has a tendency to rob it of its oxygen. In the one process, the reducing action of the sugar is exerted upon an oxide of copper; in the other, upon picric acid. A definite weight of sugar reduces, in the one case, a proportional amount of cupric oxide, and in the other an equivalent proportion of picric acid, with resulting picramic acid, and a corresponding measurable intensity of colour.

The proportion of sugar in the specimens analysed has varied from one grain to fifty grains per fluid ounce. The following may be taken as examples of practically identical results.

Ammonio-Cupric Method.	Picric Acid Method.
1. 13.5 grs. per fluid oz.	13.5 grs. per fluid oz.
2. 33 " " " " " " " "	32 " " " "
3. 31.2 " " " " " " " "	30.5 " " " "
4. 36.4 " " " " " " " "	36 " " " "
5. 10.3 " " " " " " " "	9.5 " " " "
6. 1.28 " " " " " " " "	1 " " " "
7. 11.5 " " " " " " " "	11 " " " "
8. 36.4 " " " " " " " "	36 " " " "
9. 2.57 " " " " " " " "	2.5 " " " "
10. 3.1 " " " " " " " "	2.9 " " " "
11. 7.27 " " " " " " " "	7 " " " "
12. 16.8 " " " " " " " "	16 " " " "
13. 48.5 " " " " " " " "	47.5 " " " "
14. 27.7 " " " " " " " "	27 " " " "
15. 48.4 " " " " " " " "	48 " " " "
16. 17.47 " " " " " " " "	17 " " " "
17. 49.6 " " " " " " " "	49 " " " "
18. 9.3 " " " " " " " "	8.5 " " " "
19. 9.9 " " " " " " " "	10 " " " "
20. 6.05 " " " " " " " "	6 " " " "

It will be seen that, in the majority of cases, the ammonio-cupric process gives results slightly in excess of the picric acid method. This excess is due to some non-saccharine ingredients in the urine, which reduce cupric oxide, but not picric acid.

During the last three months, I have tested with the picric acid and potash a large number of specimens of normal urine (about 300), with the almost uniform result of a depth of colour indicating the proportion of 0.6 grain of sugar in the fluid ounce, the indications usually varying between the limits 0.5 and 0.7 grain in the fluid ounce. In a considerable number of cases, my son has tested the same specimens by the ammonio-cupric method, with the indication usually of from 0.7 grain to 0.9 grain in the fluid ounce; i.e., an excess of that obtained by picric acid of from 0.1 to 0.3 grain in the fluid ounce.

The following have been the proportions of the various liquids: a drachm of urine, half a drachm of liquor potassæ, ten minims of picric acid solution, made up to two drachms with distilled water. The mixture is kept boiling for a minute, and, when cooled, is compared with the standard. The urine having been diluted by its own volume, a depth of colour equal to that of the standard would indicate 0.5 grain of sugar; but in nearly every case I have found it so much darker than the standard, as to require further dilution equal to 0.1 grain before the standard colour is reached, thus giving an indication of 0.6 grain.

So constant is this degree of colouration with normal urine that if, instead of diluting up to two drachms, the dilution be carried further by twenty-four minims, the resulting colour might be taken as an approximation to an exact quarter-grain standard, and, in the ab-

* The chemical result of boiling albumen with potash, and the question of the formation of an alkaline sulphide, was discussed at some length in the columns of the *Lancet* during the months of December and January last. For the final communication from my son, in which he demonstrates that the apparently contradictory results obtained by different observers are explained by the varying proportions of the caustic potash employed, the *Lancet* could not find space, but it is published in the *Chemical News*, February 23rd, 1883, page 87.

sence of a more exact standard, might be used for making an analysis. The question arises—Does normal urine contain as much as 0.6 to 0.7 grain of glucose in the fluid ounce? We are not prepared to assert this without further evidence than we have as yet been able to obtain; but, if it be not glucose which gives these almost identical analytical results with the two processes, it must surely be some nearly allied substance.

There are certain facts connected with the behaviour of this reducing agent so constantly found, and in such constant quantities in normal urine, which point to its saccharine nature. 1. Its reducing effect upon both cupric oxide and picric acid is equal to that which would be exhibited by an equal weight of pure glucose. This is remarkable, since any other substance than glucose or an isomeric sugar would probably reduce more or less either of the picric acid or of the cupric oxide. 2. It is completely destroyed by prolonged ebullition with dilute caustic alkalis. On the other hand, we are unable to assert positively that it is glucose, since it is unfermentable by yeast, and the most careful analyses have failed to produce more than those traces of grape-sugar from normal urine which were obtained by Brücke and Bence Jones (one-fiftieth of a grain per fluid ounce). The results of careful analyses of normal urines tend to show that the secretion of the healthy human kidney contains two distinct classes of cupric oxide-reducing substances, viz., (1.) such substances as uric acid, etc., which are not destroyed by boiling with dilute caustic potash; and (2.) what may be described as saccharoid bodies which are disintegrated by such treatment. Moreover, it appears that picric acid is reduced only by the second, or saccharoid group of normal urinary constituents; for the results of analyses by the ammonio-cupric method of healthy urine, which has undergone sufficiently prolonged boiling with dilute potash to completely destroy everything which is capable of reducing picric acid—i.e., everything belonging to group 2, or the saccharoids—invariably show the presence of more or less cupric oxide-reducing substance which has escaped disintegration by the boiling alkali; and on deducting this reduction from the total cupric oxide reduction effected by the original urine, an indication of (?) glucose is obtained equal to that given by the picric acid method with the original urine.

The results of some such analyses are tabulated below, in which all reduction is expressed in grains of glucose in the fluid ounce.

I. Total indication by Picric Acid.	II. Total indication by Ammonio-cupric method.	III. Indication by Am- monio-cupric method after boil- with Potash.	IV. Difference between II and III, Saccharoid sub- stance.
(1.) 0.6 gr. per fl. 3	0.909 gr. per fl. 3	0.276 gr. per fl. 3	0.63 gr. per fl. 3
(2.) 0.5 " " "	0.607 " " "	0.09 " " "	0.517 " " "
(3.) 0.35 " " "	0.546 " " "	0.145 " " "	0.401 " " "
(4.) 0.3 " " "	1.245 " " "	0.437 " " "	0.808 " " "

All reductions expressed as grains of glucose per fluid ounce.

These results are explained by the fact that those ingredients of healthy urine which reduce cupric oxide, and are not destroyed by boiling with potash, such as uric acid and urates, have been found to exert no reducing action upon picric acid.

There are at least two undoubted sugars, viz., sorbite and eucalin, which reduce cupric oxide from potassio-cupric tartrate, and are destroyed by boiling with dilute potash, but do not undergo the vinous fermentation under the influence of yeast; and both these sugars are isomeric with glucose. Hence, though the evidence of the identity of the saccharoid ingredient of normal human urine with glucose is incomplete, it is at least probable from its behaviour and reactions that it may be a true sugar.

I trust that the method of saccharimetry which I have described, will enable every practitioner who has the will, to estimate with ease and accuracy the amount of sugar in any specimen of urine.

NAPHTHOL POMMADE.—The naphthol pomma used by Professor Hardy (*Chemist and Druggist*) is made by dissolving one part of purified naphthol in one part of ether, then adding three parts of vaseline, heating in a water-bath until the ether has all been driven off, and, finally, stirring well with seven more parts of vaseline until cool. If the ordinary naphthol of commerce be employed, the pomma will shortly semi-liquefy. To purify the naphthol it must be powdered and treated with about one and a half times its weight of chloroform, the insoluble naphthol being then separated by filtration, and kept in a state of fusion until the odour of the chloroform has quite passed off.

ABSTRACT OF A REPORT ON THE RELATION OF MICRO-ORGANISMS TO TUBERCULOSIS.

Presented to the Association for the Advancement of Medicine by Research, on February 1st, 1883.

By W. WATSON CHEYNE, M.B., F.R.C.S.,

Assistant-Surgeon to King's College Hospital, etc.

A VISIT was paid to Professor Toussaint at Toulouse, and to Dr. Koch at Berlin, with a view of seeing their methods of experimentation, and the results which they had obtained. Various experiments were seen, and a quantity of material was brought back to England for more detailed examination. The result of the visits, and a full account of the observations made, will be found in the complete report, which will be published in the April number of the *Practitioner*.

It was thought advisable, in the first instance, to repeat some of the experiments which have led observers, more especially in this country, to object to the view of the specific origin of tuberculosis, and to hold that, in rodents at least, any irritation might produce that disease. The present series of experiments were performed under the best hygienic conditions, with complete isolation of the animals from each other, and thorough disinfection of the instruments employed. In six cases, setons of various kinds were introduced, both subcutaneously and into the anterior chamber of the eye; in ten, vaccine-lymph, both from the calf and from man, was employed; in three, pyæmic pus was injected (1) into the eye, (2) subcutaneously, and (3) into the abdominal cavity; and in six, various materials (cork, tubercle hardened in alcohol, and worsted thread) were introduced into the abdominal cavity. None of these twenty-five animals became tuberculous. Some experiments are also cited in the report in which wounds in rodents have been stitched up with cotton thread, and others in which abscesses have been produced in various ways; but in none of these cases did tuberculosis ensue. In explanation of the former results, it is pointed out that, at the time the early experiments on this subject were made, the communicability of tubercle by mediate contagion was not recognised, and, as the precautions necessary for disinfection of instruments had not, at that time, been made out, the channels for the introduction of specific micro-organisms were left unguarded.

Two tubes of serum containing micrococci were obtained from M. Toussaint, who holds that micrococci are the cause of the disease. Toussaint obtains these organisms by inoculation of flasks containing serum and infusion of rabbit, with the blood of tuberculous animals, and he has in some cases succeeded in producing tuberculosis by the injection of these cultivations into other animals. The material obtained from M. Toussaint was injected into three rabbits, two guinea-pigs, one cat, and one mouse; and of these seven animals, six were under observation for a sufficient length of time for the development at least of a local tuberculosis. In no instance did tuberculosis occur. (In all the experiments detailed in this report, inoculation was made into the anterior chamber of the eye, whenever this was practicable. Syringes purified by heat were employed for the purpose.) Cultivations of these micrococci were also made, and injected into nine rabbits and three guinea-pigs. Of these, four rabbits and three guinea-pigs were under observation for a considerable time without the development of tuberculosis in any case. The total result is, that thirteen animals were inoculated with the micrococci with which Toussaint works, and obtained from Toussaint himself, and in no case did tuberculosis occur.

A number of tuberculous organs from animals experimented on by M. Toussaint were also obtained, some of the animals having become tuberculous after the injection of his micrococcal fluid. Careful examination of these organs has shown the presence, often in large number, of the tubercle bacillus described by Dr. Koch, but no micrococci have been found. The conclusion arrived at is that the micrococci described by Professor Toussaint are not the cause of tuberculosis. One of the possible explanations of the results which should not be left out of account, is the following. Professor Toussaint trusts greatly to carbolic acid as a disinfecting agent for the purification of the instruments employed in inoculation. This antiseptic, though effectual for the destruction of the ordinary forms of micro-organisms, as evidenced by the satisfactory results obtained from its use in aseptic surgery has been shown to be ineffectual against the spores of bacilli, unless it acts for a long time. The bacillus of tubercle apparently produces spores, and there is no reason to suppose that these are less resistant than those of bacillus anthracis, and other bacilli. An experiment is given