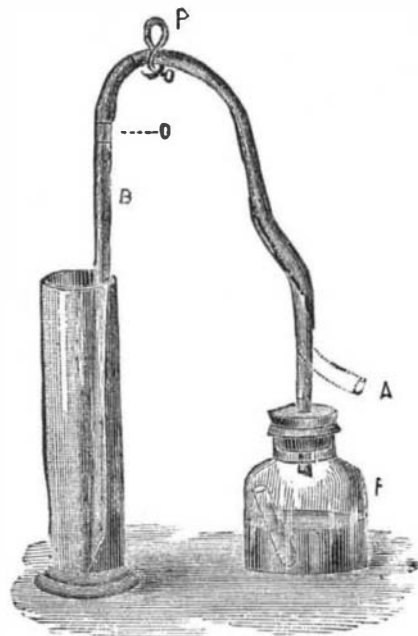


thoroughly shaken, and set for some time (from one to two hours) in a vessel of water of the same temperature. On standing, the ether will rise to the top, and will contain all the milk-fat in solution. By gentle blowing with the bulb, C, the ethereal layer is driven through the tube, D, into the glass tube, B, where it will cause the lactometer to float as soon as a sufficient quantity has entered. The pinch cock in the flexible tube, D, having then been closed, the tube, B, is likewise closed with a stopper. To preserve the temperature of the ether liquid, the wide outer tube, A, is previously filled with water. As soon as the spindle floats freely, and the temperature is correct, the degree on the scale is read off, for which purpose the lower curve of the meniscus is observed. If the above temperature cannot be obtained, it is necessary to add, for each degree of temperature above 17° C., one degree on the scale, and for every degree of temperature below 17° C., to deduct one degree on the scale. After the experiment the apparatus is washed out with ether and dried.

The reliability of the results obtained with this apparatus is shown by the fact that they differed from those obtained by gravimetric methods by only 0.07 per cent. The given proportions and temperature have been chosen after careful comparison with others, as those which are the most favorable to accurate results.—*Chemiker Zeitung*.

#### A NEW UREOMETER.

MR. CHAS. RENSON, JR., of Louvain, has devised the apparatus here described. Into a long, straight glass cylinder, E, a plain burette, B, divided in 50 c.c., and without stop-cock, is introduced, and its upper end connected with a rubber tube, provided with a pinch-cock, P. This tube is intended to be attached to a glass tube, V, projecting from the flask in which the reaction takes place. When using the apparatus, the cylinder, E, is nearly filled with water, and by gently releasing the pinch-cock, and by suction through the open end of the rubber tube, the water is caused to rise in the burette until it stands on a level with the 0 mark. The pinch-cock is then closed and the tube connected with the flask, F, which has previously been charged with a solution of hypobromite and a rubber tube containing a measured solution (5 c.c. or 10 c.c.) of the urine to be tested. The hypobromite solution is made by dissolving 65 gm. of caustic soda in 1,000 gm. of water, and



RENSON'S UREOMETER.

adding gradually 60 gm. of bromine. When everything is ready, the pinch cock is first released, whereupon the column of water in the burette will slightly fall below the mark 0. The author directs that this diminution, provided it remain constant, should not be taken into account, but that, after the reaction has ceased, the volume of gas should be read off, beginning from the 0 mark. The reaction is brought about by the upsetting of the rubber tube containing the urea-solution, whereby the urea is decomposed with the evolution of nitrogen. When reading off the number of c.c. on the burette, the latter is to be lifted up until the water outside is on a level with that inside. The percentage of urea is calculated in the usual manner, but the author directs that 4.5 per cent be deducted from the result, as a correction for products of decomposition which accompany the nitrogen.—*Jour. de Pharm. d'Ann.*

#### EXPERIMENTAL DETERMINATION OF THE VELOCITY OF WHITE AND COLORED LIGHT.\*

By DR. J. YOUNG, F.R.S., and Professor G. FORBES.

THE method employed in this research to measure the velocity of light resembled the method of M. Fizeau, subsequently employed by M. Cornu. A revolving toothed wheel is employed in the same way to alter the intensity of the light reflected from a distance. In the present method, however, there are two distinct reflectors instead of only one. They are separated by a distance of a quarter of a mile. The observing telescope and the two reflectors are almost in the same line. The observer sees two stars of light, which go through their phases with different periods as the toothed wheel is revolved at increasing speeds. One star is increasing, while the other is diminishing in intensity, with the increase of speed of the toothed wheel. The speed required to produce equality of the lights is determined by means of a chronograph.

By choosing such a speed as gives a maximum of one star at the same speed as a minimum of the other, a pair of observations eliminates all cause of doubt arising from varying brightness in the stars, and ratio of the width of a tooth to the width of a space. The distances were observed by triangulation with the Ordnance Survey eighteen-inch theodolite, using as a base line a side of one of the Ordnance Survey triangles. The source of light was an electric lamp. The ve-

locities (uncorrected for rate of clock, and reduction to a vacuum) measured as follows:

187,707
188,405
187,676
186,457
185,788
186,495
187,003
186,190
186,830
187,266
188,110
188,079

Mean.... 187,167 miles a second.

The correction to vacuum is + 54 miles a second. The correction for rate of clock to a mean solar time is + 52 miles a second.

The final results for the velocity of the light from an electric lamp *in vacuo* is 187,273 miles a second, or 301,382 kilometers a second.

Using Struve's constant of aberration 20.445", we obtain for the solar parallax the value 8.77", and for the mean distance of the sun 93,223,000 miles.

On February 11, 1881, the reflected stars were seen to be colored, one reddish, the other bluish. The particular color of a particular star depended upon the speed of rotation of the toothed wheel. That star which was increasing with increase of speed of the toothed wheel was reddish, that one which was diminishing with increase of speed was bluish. This seems to be caused by the fact that blue rays travel quicker than red rays.

A number of tests were made to judge of the accuracy of this conclusion, and they confirmed it. In the final arrangements, the electric light was acted upon by a bisulphide of carbon prism, and part of a pure spectrum was used. Differential measurements were then made to find the difference in velocity of rotation of the toothed wheel, required to produce equality of red and of blue lights. The most convenient method was to use a driving weight slightly in excess of that required to produce equality of the light, then to fix to the pulley carrying the weights one end of a piece of stout India-rubber tubing, the other end being fixed to a point above. This gradually diminished the effective driving weight. The equality of red lights was first noted, the color of the light was changed, and the interval of time until the blue lights were equal was measured. The rate at which the India-rubber diminished the speed was afterward measured by the aid of the chronograph, and thus the difference of speed determined. The mean of thirty-seven determinations in this and other ways gave the result that the difference in velocity between red and blue lights is about one-eighth per cent. of the whole velocity, blue traveling most rapidly.

The general conclusion seems to be supported by a comparison of the velocity of light measured by M. Cornu and Mr. Michelson, where the source of light usually employed is taken into consideration. These are the only accurate measurements of the velocity of light hitherto published. They give us the following results:

	Usual source of Light.	Velocity in kilos a second.
Michelson's research...	The sun near horizon,	299,940
Cornu's " "	Lime light,	300,400
The present " "	Electric light,	301,382

Classifying the sources of light used by Cornu, we get the following approximate relative velocities:

Source of Light.	No. of Observations.	Approximate Relative Velocity.
Petroleum.....	20	298,776 kilos.
Sun near horizon ....	77	300,242 "
Lime light .....	449	300,290 "

All these results seem to support the view that the more refrangible the source of light, the greater is the velocity. But the evidence of the present observations, indicating an excess of velocity for blue over red light, seeming to exceed one per cent. of the whole, must rest upon the merit of the present observations themselves.

#### MUSCULAR ACTIVITY AND DECOMPOSITION OF MATTER.

By DR. O. KELLNER.

THE requirement of an organism for the exertion of energy can become a cause of the decomposition of the components of the nutrient and of the body. Non-azotized materials are first attacked, and if such are insufficient or have been consumed a decomposition of the organized albumen takes place. This decomposition of the albumen of the body can only be arrested by an increase of food, especially of its non-nitrogenous portion. Even a very abundant supply of albumen cannot prevent the destruction of organized albumen if the total quantity of nourishment is not sufficient for the requirements of the force to be exerted. It is possible and probable that in consequence of the increased demand for oxygen during work a larger quantity of circulating albumen is necessary than the minimum required by the organism when at rest.

#### WICKERSHEIM'S PROCESS FOR THE PRESERVATION OF ORGANIC SUBSTANCES.

By H. STRUVE AND O. JACOBSEN.

THE original formula was 100 c.c. water, 40 c.c. glycerin, 10 c.c. methylic alcohol, 3.33 grammes alum, 0.83 gramme common salt, 0.40 gramme saltpeter, 2 grammes potash, and 0.66 gramme arsenious acid. The author points out that the alumina will be completely precipitated by the potash, and proposes in place of both alum and potash an equivalent quantity of potassium sulphate. The following two modifications of the fluid are now in use, the former for injections and the latter for steeping objects to be preserved:

Arsenious acid.....	16 grammes.	12 grammes.
Sodium chloride.....	80 "	60 "
Potassium sulphate.....	200 "	150 "
Potassium nitrate.....	25 "	18 "
Potassium carbonate....	20 "	15 "
Water.....	10 liters.	10 liters.
Glycerine.....	4 "	4 "
Common methylic alcohol.¼	"	½ "

#### WHAT IS GLUCOSE?

GLUCOSE is the sugar of the future. Oppose it as you will, it is daily increasing in importance and in the number of its uses. In climates where the sugar cane will not grow, and in countries where the sugar-beet cannot be cultivated with profit, there is a wide field for glucose. Wherever corn, grain, or potatoes thrive, there glucose factories will flourish. Glucose differs as much from cane sugar as tallow from lard, or butter from oleomargarine. Both kinds of sugar are sweet, although in a very different degree, and for many purposes one can be substituted for the other without the consumer being aware of the fact.

The manufacturers limit the term "glucose" to the thick sirup which neither solidifies nor crystallizes on long standing. The same substance in a solid state is called "grape sugar," but there is no chemical difference between the two. The name "grape sugar" owes its origin to the fact that a kind of sugar found in grapes and other sweet fruits has the same chemical composition as that made from starch by methods that we shall presently describe. This real grape sugar is often seen as an incrustation on raisins and figs. Honey also contains grape sugar, and it was there it was first discovered by Lowitz in 1792.

Cane sugar, whether obtained from the cane, from sorghum, from corn stalks, from the maple-tree, or from the sugar-beet, is identically the same, and when perfectly pure its origin cannot be determined by chemical or physical tests. Its composition is expressed by the formula  $C_{12}H_{22}O_{11}$ . It forms large crystals belonging to the monoclinic system, as is beautifully shown in rock candy. It is exceedingly permanent, and is incapable of undergoing fermentation until it has first been converted into glucose. In all these respects it differs from grape sugar. The latter has for its formula  $C_6H_{12}O_6$ . It crystallizes with more difficulty, and usually in warty masses. It readily undergoes fermentation, splitting up into alcohol and carbon dioxide. It possesses the power of reducing copper, silver, and other salts, which cane sugar does not; yet it resists the action of cold oil of vitriol, which chars cane sugar at once. It is less soluble than cane sugar and about one-third as sweet.

Glucose can be made from any of the carbo-hydrates, starch, dextrine, cellulose, etc., but is generally prepared from starch. In this country corn starch is used, while abroad potato starch is preferred because it is cheaper.

In the manufacture of beer and spirits from grain of any sort the first operation consists in converting the starch of the grain into grape sugar, which is most readily accomplished by allowing the grain to germinate. The diastase then produced effects the desired conversion. Dilute acids have the same action on starch, and while almost any acid can be employed, even carbonic acid, glucose manufacturers generally prefer sulphuric acid.

The first part of the operation is essentially the same as in the manufacture of starch. The corn is soaked in water or dilute alkali, then crushed and washed on sieves as long as the water runs off milky. The starch is then allowed to settle, and the supernatant water drawn off. The next operation in making starch consists in drying it, but where the starch is to be converted into glucose this part of the operation can of course be omitted. The starch is next subjected to the action of very dilute sulphuric acid, in the proportion of two pounds of acid to 100 pounds of starch, and 300 to 400 of water. The water is first heated to boiling; the acid, diluted with three times its weight of water, is then poured in; and afterward the milky mixture of starch suspended in water is allowed to flow into the boiling acid. The first change that the starch undergoes is a conversion into dextrine. By long-continued boiling this is changed into glucose. When one part of the liquid mixed with six parts of absolute alcohol no longer gives any precipitate of dextrine the boiling is stopped.

The next step in the operation is to neutralize the free acid. For this purpose lime, chalk, whiting, or marble dust may be employed. An insoluble sulphate of lime is formed, which is easily removed. It has been proposed to use barium carbonate for neutralizing the acid, as its sulphate is totally insoluble, whereas some of the sulphate of lime stays in solution. The cost of barium carbonate is an insuperable objection, and, being poisonous, its presence is less desirable than that of lime.

The sirup is now evaporated in shallow pans until it reaches a density of 1.12 (16° Baumé), which causes the sulphate of lime to be precipitated, while the other impurities rise as scum to the top. It is afterward filtered through bone-coal, and then evaporated to a greater or less extent, according as a sirup or a solid is desired. About twice as much acid is employed for making grape sugar as when glucose sirup is desired.

From the above description it will be seen that glucose, properly made, is in no way an objectionable article. It may disagree with some people, just as honey does, and for the same reasons. Persons who are troubled with dyspepsia, sour stomach, etc., often find difficulty in partaking of glucose, because it ferments so quickly in the stomach, as might have been expected. A German professor, Dr. J. Nessler, of Baden, has attempted to prove that glucose from potato starch contains a poisonous substance, but his method of isolating it might equally well have produced it. To remove all the glucose he added yeast to set up a fermentation, and when that was ended expelled the alcohol by boiling. His experiments were made with the unfermentable residue. Another gentleman, Mr. W. H. Langbeck, has proved that a bitter substance resembling colchicine is sometimes formed during fermentation. He has even succeeded in separating and crystallizing this bitter substance, and has described its reactions.

Some chemists claim to have discovered all sorts of poisonous substances in glucose, such as lead, tin, sulphuric acid, etc. We have not been so fortunate as to make any such startling discoveries. Of course, like every other manufactured article, much depends on the care taken in its preparation. The presence of sulphate of lime in very small quantities might be expected. Dextrine is often present in considerable quantity, but this is both sweet and wholesome, in fact highly nutritious.

The uses of glucose are very numerous, although it is seldom sold to the public under its real name; but under the alias of "golden drops," "sugar-house sirup," "strained honey," and even Vermont maple sirup, its sale is very extensive. It is largely employed by confectioners for making candies, by wine-dealers for strengthening wine, by brewers to add body to their beer. Dr. Kedzie, of the Michigan Board of Health, reports that of seventeen samples of table sirup tested by him, fifteen contained glucose. Of twenty samples analyzed in Chicago, only one was unadulterated.

We give below the result of our own analyses of two specimens of American grape sugar obtained in New York city, and of two samples of candy obtained in Boston, one of

\* Abstract of a paper read before the Royal Society, March 19, 1881.—*Chem. News*.