The Examination of Urine.

The importance to pharmacists of a general knowledge of urinary analysis is now universally admitted, whilst increased attention is being paid to the subject by the medical profession. The tendency, therefore, should be, and in a measure is, towards the busy practitioner and consulting physician depending more and more upon the chemical training of the pharmacist to relieve them of detail work, for which they have neither time nor inclination. A recent edition of a standard work on the subject contains the following: "No account of the method of making standard solutions will be given, as this preparation requires a greater knowledge of chemistry than is usually possessed by the clinical (medical) student. For the same reason, no details have been introduced which require the use of a balance." This absence of chemical training in the average medical man is surely the pharmacist's opportunity. Moreover, the cultivation of this branch of analytical chemistry cannot fail to improve the status of pharmacists, as well as prove an extra source of remuneration.

It is the object of the present article to give, in a concise manner, an outline of some of the methods which have been proved in practice to be most useful and convenient. Although the matter will be largely selective, the opportunity will be taken to draw attention to some of the latest tests, and also to recent developments in physiological chemistry.

A caution may well be given here against the employment of single tests—a method of analysis much employed by medical men, but which is often unreliable. The pharmacists should always employ two or three controlling tests, and so make sure of his results.

It will be more convenient, perhaps, to divide the subject into "General Qualitative Examination," and "Quantitative Determination of Constituents."

GENERAL QUALITATIVE EXAMINATION.

This is best conducted, according to a definite plan, as follows: 1. Note the color, opacity, and translucency of the sample. 2. Ascertain the specific gravity and volume. 3. Reaction to test papers. 4. Test for albumin. 5. Test for sugar. 6. Test for biliary salts and pigments. 7. Examine the sediment, both chemically and microscopically.

COLOR.—The normal color of urine may be affected by disease, or by the ingestion of drugs. In diabetes, hysterical affections, anæmia, etc., the urine is usually very pale. Dark-colored urine may be due to fever, biliary pigments, blood, etc. If due to fever, the specific gravity will be high, the volume excreted small, and the presence of urobilin highly probable. Urine containing blood from the kidneys has a smoky-brown appearance, and deposits a sediment of pigments and blood corpuscles. Santonin, rhubarb, and senna give orange-colored urine, rendered red by the addition of alkali. Logwood internally communicates a reddish tinge, and carbolic acid and creosote turn the urine blackish. Healthy urine is quite clear when voided, but on standing a small quantity of mucus and urates are frequently deposited.

VOLUME.—If the whole of the excretion of twenty-four hours has been sent, it should be measured and recorded. The average amount passed daily in health is about 1,500 c.c., or 52 fl. ozs., but it varies widely. The amount is considerably increased in diabetes, where the excessive thirst is one of the distressing features of the disease. In fevers the volume is very much reduced.

SPECIFIC GRAVITY.—This is ascertained by the form of glass hydrometer known as urinometer. It is as well to check the accuracy of this little instrument by means of the ordinary specific gravity bottle. Frequent errors are made in taking specific gravities. The temperature of the liquid should be 60° F. (15.5° C.), and the eye on a level with the surface of the urine. The degree should then be taken which coincides with the lower edge of the capillary elevation. Normal urine varies from about 1.015 to 1.025. Lower gravity than 1.010 occurs after drinking fluids freely, or as the result of cold diuretics, etc. High gravity may be due to excess of urea or sugar. Note that a low specific gravity may sometimes occur even in diabetes, as shown last year by Sir Edward Sieveking.

REACTION.—Urine is usually acid from the presence of acid sodium phosphate; rarely from free acids. After a full meal it is frequently alkaline. In acute diseases it is often highly acid. Excessive alkalinity may be due to the administration of alkalies or to decomposition, when urea has been converted into ammonia. To determine which of these two may be the cause, red litmus paper should be immersed in the sample, and gently warmed until dry. If fixed alkalies are present, the test paper remains permanently blue.

ALBUMIN.—A large number of tests for the detection of albumin in urine have been proposed. Many of these are excessively delicate, perhaps too much so, as they generally precipitate other substances as well. In acute fevers albumin is often present, but disappears after the fever has subsided. The most serious form of albuminuria is known as Bright's disease.

Heat and Acid Test.—Filter a small quantity of the urine, if not bright and clear. Fill a test tube two-thirds full with the sample, and heat the *upper* part of the urine until it boils, and then add two drops of strong acetic acid. Any coagulation or cloudiness, which is permanent, is due to albumin, whilst a turbidity, which might be due to precipitated phosphates, will be dissolved by the acid. The only possible error is the precipitation of mucin in neutral or alkaline urine. If the sample is acid, and has stood some time, all the mucin will be separated by filtration. If neutral, or alkaline, it should first be carefully acidified and filtered, or tests for mucin may be tried.

Cold Nitric Acid Test.—A delicate method is that suggested by Sir William Roberts. One volume of concentrated nitric acid is mixed with three volumes of a saturated solution of magnesium sulphate. Place a small quantity of this solution in a test tube, and add the urine very carefully from a pipette, inclining the tube so that the urine flows gently on to the surface of the denser liquid. If albumin be present in considerable amount, a white zone is formed at the junction of the liquids, whilst, if only traces are present, it may require to stand some time before a haze appears. The test is not so satisfactory as the heat and acid, as uric acid and urea nitrate in concentrated urine may react, whilst copaiba, balsam of tolu, etc., taken internally, give a similar appearance to albumin, but redissolve on shaking with more acid or some alcohol. The test of acidulating with strong nitric acid, and boiling, although in very common use, must be condemned. It is almost certain to convert a large proportion of the albumin into soluble acid-albumin, which is not precipitated on boiling.

Picric Acid Test.—A saturated solution is employed. Coagulation takes place at the point of junction if the contact-method as above described is used. This is increased by rotation of the test-tube. It should be carefully noted that picric acid precipitates peptones and alkaloids as well as albumin. On heating, however, the former bodies redissolve.

Trichloracetic Acid Test.—A very sensitive reagent, detecting 1 part of albumin in 100,000 parts of urine. It precipitates alkaloids, but they dissolve again on adding excess of the reagent. True peptone is not precipitated, but proteoses or albumoses (intermediate bodies between albumin and peptone) are coagulated, but redissolve on warming.

SUGAR.—When testing for sugar, it is very advisable to remove any albumin that may be present by boiling and acidulating with acetic acid and subsequently filtering. Urates should also be filtered out if in considerable amount, or the urine decanted.

Fehling's Test.—This test is so well known as to require but little description. The pharmacopœial solutions may be employed, and it should be remembered that if kept ready mixed it is liable to reduction in time, and so prove unreliable. This is easily ascertainable, as it should undergo no change when boiled. Fill a test-tube about one-fourth full with the test solution, and boil. If no change occurs the test is reliable, and a few drops of urine should be added and the contents boiled again. If there is still no alteration, continue adding a little more urine and boiling until an equal volume of urine has been added to the test. If no precipitation has taken place, sugar is absent. In many instances, however, a change takes place giving a greenish-color