Urinalysis for dummies.

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Early in the history of medicine, urine played an important part in the physician's diagnostic kit.

At first, uroscopy or the diagnostic analysis of urine, was achieved mostly by inspection, and interpretation of smell.
In the late 16th century a scientist by the name of Leonhardt Thurneiser (130-1595) considered that urine collected important information on the functioning of the body, picking up particles from all parts as it flowed through it.
In order to interpret this information a device known as an *anatomical furnace* was produced to boil the urine. Fumes and splatterings would erupt from the furnace, adhering to an external surface of the device corresponding to the anatomical ailment or the 'locus morbiâ'.

Today urinalysis can be performed manually with a dipstick or via an automated machine. Here are a few pointers on urinalysis interpretation:

Urinalysis:

1. ALWAYS wear gloves whilst messing about with another person's pee.
   Eye protection is a pretty good idea too. Those dipsticks make a pretty good catapult to fling drops of eyeball-seeking urine.
2. Use a 2 ml sterile syringe to draw up some of the urine specimen and then lay it down the length of the dipstick so it beads over each individual test pad. Tap the stick edge-on gently against a paper towel or waste container to remove the excess urine.
3. Take your time. Some of the reactions can take up to 2 minutes to cook. Many nurses simply dip, pause, read; potentially missing abnormal results.

Smell:

The normal smell of urine can be described as *urinoid*.
Other smells of interest include:

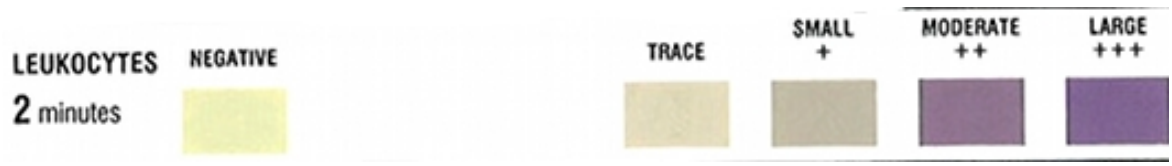
- Faecal smell: gastrointestinal-bladder fistula
- Fruity or sweet smell: diabetic ketoacidosis
- Smell of ammonia: alkaline fermentation.
- Smell of asparagus: distinctive pungent smell - eating a lot of asparagus.

Colour:

Normal urine colour is often described as straw, yellow or amber. This colour may be altered by medications, food sources or disease.
Vitamin tablets often result in a bright yellow urine, as does the presence of bilirubin (a bile pigment).
Red urine may be due to blood, haemoglobin, or beetroot.
Iron supplements may cause a dark brown specimen, as might amounts of prophobilin or urobilin (a chemical produced in the intestines)

Normal urine is also transparent. Turbid or cloudy urine may result from infection the presence of blood cells, bacteria or yeast (eg Candida).
A foamy urine may indicate either the presence of glucose or protein.

Leukocytes:

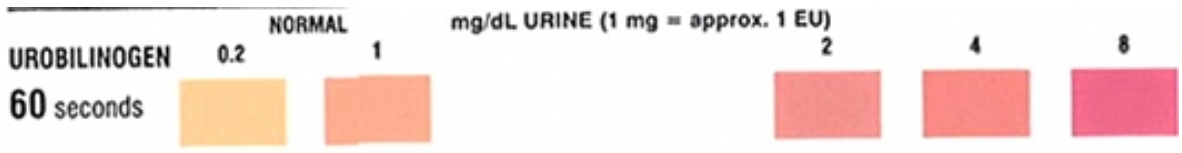


Detects white cells in the urine (pyuria) which is associated with urinary tract infection.

Nitrites:

Nitrites are formed by the breakdown of urinary nitrates. This is usually caused by Gram-negative and some Gram-positive bacteria.
So the presence of nitrites suggests bacterial infection such as E. coli, Staphylococcus and Klebsiellosis.
Commonly found during a urinary tract infection.

Urobilinogen:

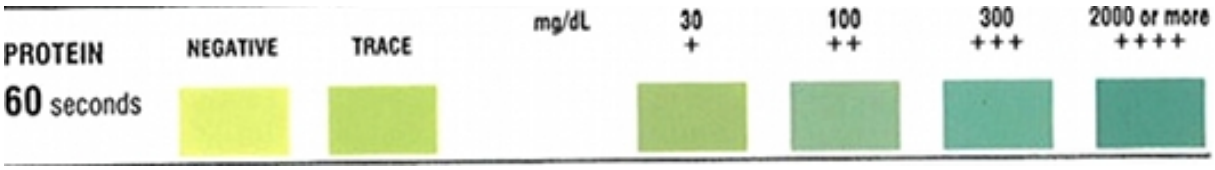


Normally present in the urine in small quantity. Less than 1% of urobilinogen is passed by the kidneys the remainder is excreted in the faeces or transported back to the liver and converted into bile.

Raised levels may be due to:

- Cirrhosis
- Hepatitis
- Hepatic necrosis
- Haemolytic and pernicious anaemia
- Malaria

Protein:

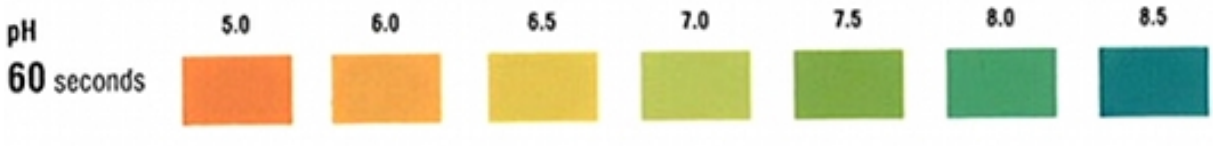


This is measuring the amount of albumin in the urine. Normally there should be no detectable quantities.
Elevated protein levels are known as proteinuria. Albumin is one of the smaller proteins, and if the kidneys begin to dysfunction it may show an early sign of kidney disease.

Other conditions which may lead to protein in the urine include:

- Injury to the urinary tract, bladder or urethra
- Inflammation, malignancies.
- Multiple myeloma.

pH:



Measures the hydrogen ion concentration of the urine.
It is important that a fresh sample be used as urine becomes more alkaline over time

as bacteria convert urea to ammonia (which is very alkaline).
Urine is normally acidic but its normal pH ranges from 4.5 to 8.

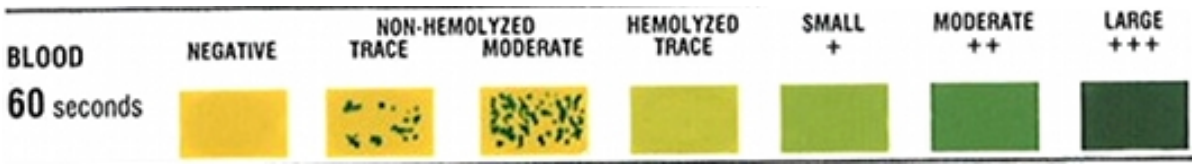
Low pH (acidic):

- Foods such as acidic fruits (cranberries) can lower the pH, as can high a high protein diet.
- As urine generally reflects the blood pH, metabolic or respiratory acidosis can make it more acidic.
- Other causes of acidic urine include diabetes, diarrhoea and starvation.

High pH (alkaline):

- Low carb or vegetarian diet
- May be associated with renal calculi.
- Respiratory or metabolic alkalosis
- Urinary tract infection

Haematuria:



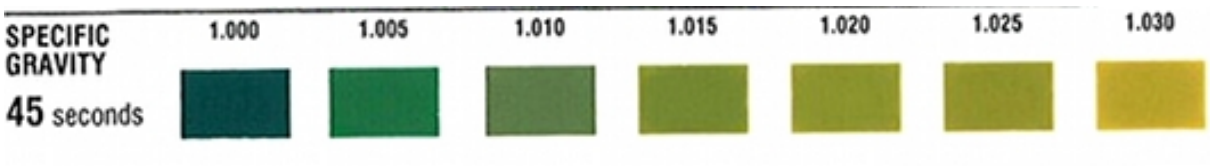
Classified as microscopic or macroscopic. Microscopic means that the blood is not visible with the naked eye.
Blood may be present in the urine following trauma, smoking, infection, renal calculi or strenuous exercise.

It may also be present with:

- Urinary tract infections.
- Damage to the glomerulus or tumours which erode the urinary tract.
- Acute tubular necrosis.
- Traumatic catheterisation.
- Damage caused by the passage of kidney stones.
- Contamination from the vagina during menstruation.

The presence of myoglobin (myoglobinuria) after muscle injury will also cause the reagent strip to indicate blood.

Specific Gravity:



The specific gravity (SG) of urine signifies the concentration of dissolved solutes and reflects the effectiveness of the renal tubules to concentrate it (when the body needs to conserve fluid). If there were no solutes present the urines SG would be 1.000, the same as pure water.
The SG of urine is around 1.010 but can vary greatly:

Decreased SG may be due to:

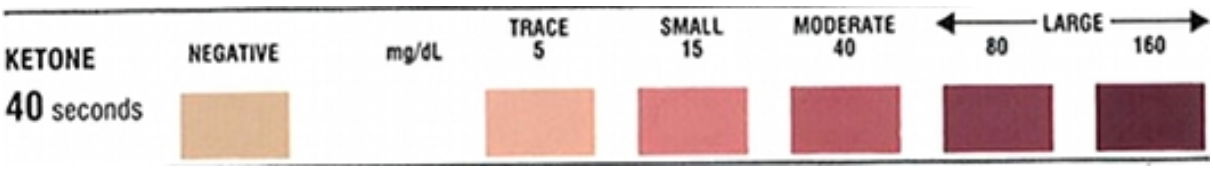
- Excessive fluid intake (oral or IV fluids)
- Renal failure
- Acute glomerulonephritis, pyelonephritis, acute tubular necrosis
- Diabetes insipidus

Increased SG may be due to:

- Dehydration due to poor fluid intake, vomiting or diarrhoea
- Heart failure
- Liver failure
- Inappropriate antidiuretic hormone secretion

It also reflects a high solute concentration which may be from glucose (diabetes or IV glucose) or protein.

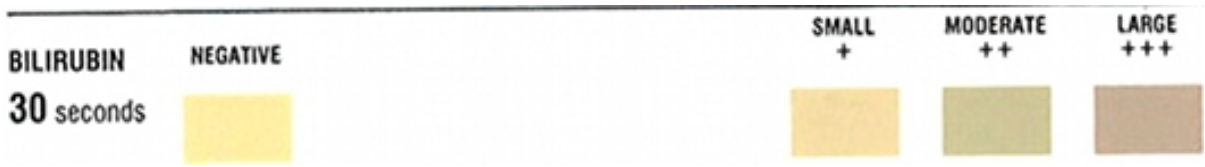
Ketones:



Not normally found in the urine, ketones are produced during fat metabolism.
Presence of ketones may indicate:

- diabetes
- alcoholism
- eclampsia
- a state of starvation
- pregnancy

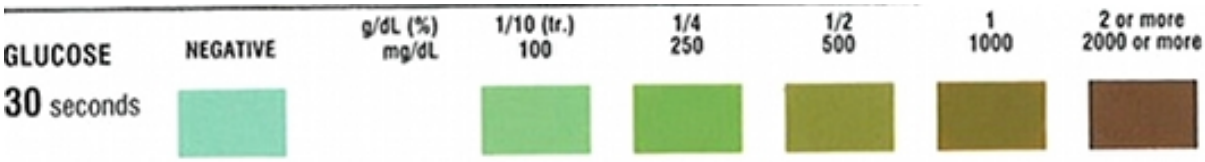
Bilirubin:



Produced as a by-product during the degradation of RBC in the liver and normally excreted in the bile. Once in the intestine it is excreted in the faeces (as stercobilin) or by the kidneys (as urobilinogen).
Presence of bilirubin in the urine may therefore indicate:

- liver disease
- biliary tract infection
- pancreatic causes of obstructive jaundice.

Glucose:



Glucose is not normally present in the urine.
Once the level of glucose in the blood reaches a renal threshold the kidneys begin to excrete it into the urine in an attempt to decrease the blood concentration. So high blood concentrations lead to glycosuria, as does conditions that may reduce this renal threshold.

- Diabetes
- Liver disease
- Medications such as tetracycline, lithium, penicillin, cephalosporins
- Pregnancy.

Ian Miller