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INTRODUCTION

- General Urine Test
- Urine analysis, also called Urinalysis –

Also knows as Urine R&M (routine & microscopy), one of the oldest laboratory procedures in the practice of medicine.

- General evaluation of health
- Diagnosis of disease or disorders of the kidneys or urinary tract
- Monitoring of patients with diabetes

When is Urinalysis performed?

The General Urine Test is useful in many cases. For example:

- As routine check-up in adults and children

- When there are symptoms of some urinary tract infection (UTI)

(dysurea, urinary frequency)

- When there is hematuria (Hematuria : the presence of red blood cells in the urine).

Urine Specimen Collection

Specimens that are provided to the laboratory for testing include:

- **Random specimens:** random specimens can be collected at any time.

- **First morning specimen** (also known as an eight-hour specimen). The urine is generally more concentrated in this type of specimen because it has been in the bladder for an extended period of time.

- **Midstream clean-catch specimens:**

- **Urinary Catheter**

- **Suprapubic transabdominal needle aspiration of the bladder.**

Urinalysis

A-physical Examination

- -Volume
- -Color
- -Odor
- -Reaction (pH)
- -Specific gravity

B-Chemical analysis

- -Glucose
- -Bilirubin
- -Ketones
- -Blood
- -Protein

C-Microscopic Examination

- -Red blood cells (RBCs)
- -White blood cells (WBCs)
- -Mucus
- -Various Epithelial cells
- -Various Crystals
- -Casts
- -Bacteria
- -Fungi

PHYSICAL EXAMINATION OF URINE:

Examination of physical characteristics:

- Volume
- Color
- Odor
- pH and
- Specific gravity

1. VOLUME

♣ Normal- 1-2.5 L/day

♣ Oliguria- Urine Output < 400ml/day

Seen in

– Dehydration

– Shock

– Acute glomerulonephritis

– Renal Failure

♣ Polyuria- Urine Output > 2.5 L/day

Seen in

– Increased water ingestion

– Diabetes mellitus and insipidus.

♣ Anuria- Urine output < 100ml/day

Seen in renal shut down

2. COLOUR

Normal urine has a light yellow to dark amber color

♣ Normal- color due to pigments urochrome, urobilin and uroerythrin.

Abnormal colors:

- Colorless – diabetes, diuretics.
- Deep Yellow – concentrated urine, excess bile pigments, jaundice

3. ODOUR

Urine normally does not have a very strong smell.

- Normal - aromatic due to the volatile fatty acids.

- Abnormal odor – aromatic odor of ketone bodies (sweet fruit odor) as in starvation and diabetes. In UTI the odor of urine is bad smell.

4. pH:

• Reflects ability of kidney to maintain normal hydrogen ion concentration in plasma & extracellular fluid (ECF).

• The normal hydrogen ion (pH) concentration, in the urine (5-8) depends on the type of diet. Vegetable diet, citrus fruits (also bacterial infections) produce alkaline urine,

• while high protein diet (also blood acidosis where PH<7.35, some microbial infections, ketones elevation due to diabetes or aspirin intake) produce acidic urine.

• Tested by:

–litmus paper

– pH paper

– dipsticks

5-Specific gravity (SG)

•Specific gravity measures urine density, or the ability of the kidney to concentrate or dilute the urine over that of plasma.

• **Specific gravity (SG):** determined by refractometer and indicator paper stripes. Normal value in Man **1.010 – 1.030**(Average normal = 1.025).

depending on SG the urine will be diluted (SG< 1.002) or concentrated (SG>1.065) depend on the solvents in urine.

SG used to determine the kidney efficiency keeping water balance in urine.

MICROSCOPIC EXAMINATION OF URINE:

• A sample of well-mixed urine (usually 10-15 ml) is centrifuged in a test tube at relatively low speed (about 2000-3,000 rpm) for 5-10 minutes which produces a concentration of sediment (cellular matter) at the bottom of the tube.

• A drop of sediment is poured onto a glass slide, a thin slice of glass (a coverslip) is place over it and observed under microscope.

A variety of normal and abnormal cellular elements may be seen in urine sediment such as:

- Red blood cells
- White blood cells
- Mucus
- Various epithelial cells
- Various crystals
- Bacteria
- Casts

• **Hematuria** is the presence of abnormal numbers of red cells in urine due to any of several possible causes.

– glomerular damage,

– tumors which erode the urinary tract anywhere along its length,

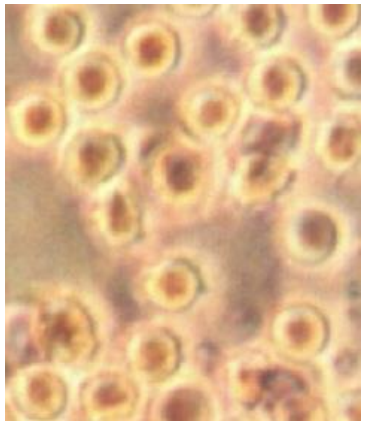
– kidney trauma,

– urinary tract stones,

– acute tubular necrosis,

– upper and lower urinary tract infections,

• Red cells may also contaminate the urine from the vagina in menstruating women.



White Blood Cells

Pyuria refers to the presence of abnormal numbers of leukocytes that may appear with infection in either the upper or lower urinary tract or with acute glomerulonephritis.

Usually, the WBC's are granulocytes.
White cells from the vagina, especially in the presence of vaginal and cervical infections, or the external urethral meatus in men and women may contaminate the urine.
If two or more leukocytes per each high power field appear in non-contaminated urine, the specimen is probably abnormal.
Leukocytes have lobed nuclei and granular cytoplasm.

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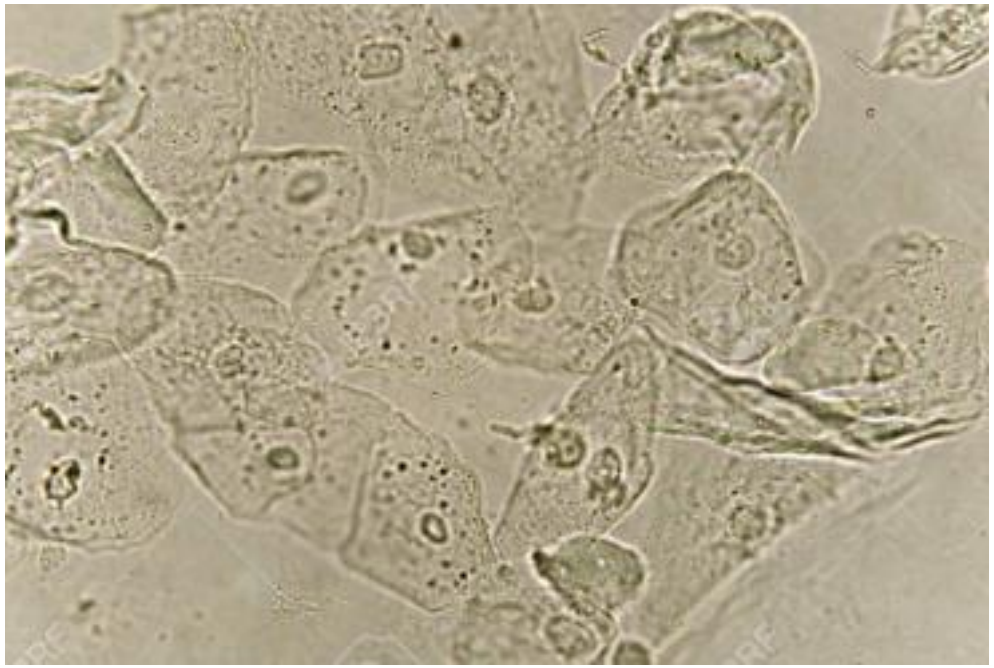
Epithelial Cells

. normally due to sloughing the lining layer of urinary tubules, bladder and urethra or because of some renal diseases.

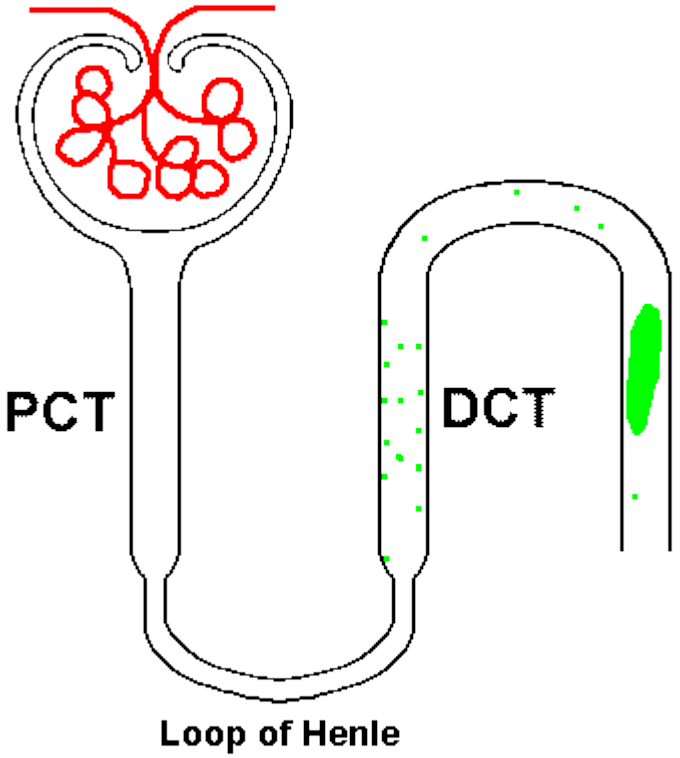
. It's normal to have a small amount of **epithelial** cells in the **urine**. A large amount may indicate an infection, kidney disease, or other serious medical condition



Casts

They are solid and cylindrical structures formed by precipitation of debris in the renal tubules.

- Urinary casts are formed only in the distal convoluted tubule (DCT) or the collecting duct (distal nephron). The proximal convoluted tubule (PCT) and loop of Henle are not locations for cast formation.

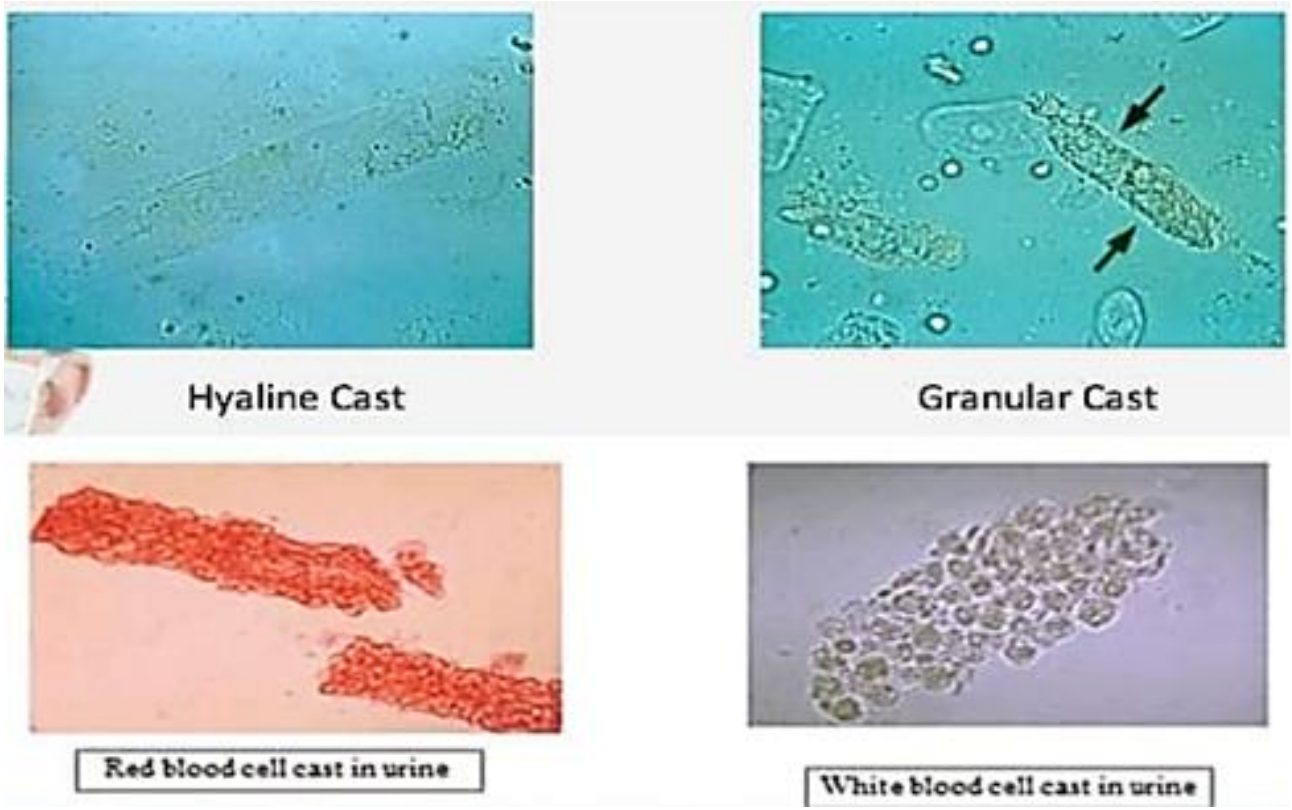


•**Hyaline casts are** composed primarily of a mucoprotein secreted by tubule cells, hyalincast are seen in healthy individuals.

•**RBCs casts** are formed when RBCs stick together and in glomerular disease.

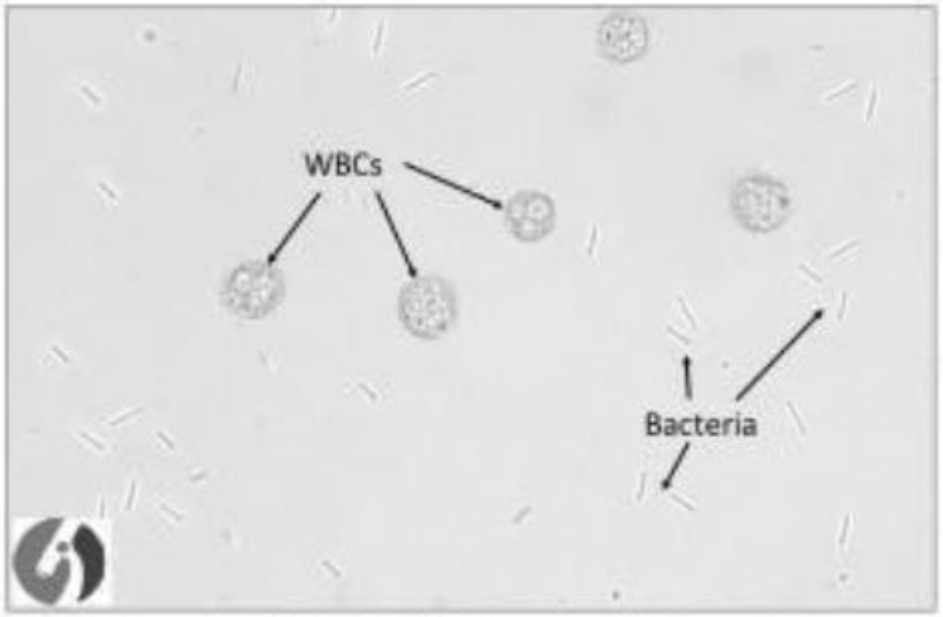
•**WBCs casts** are seen in acute pyelonephritis and glomerulonephritis.

•**Granular and waxy casts** are seen in nephrotic syndrome.



Bacteria

Bacteria are common in urine specimens because of the abundant normal microbial flora of the vagina or external urethral meatus and because of their ability to rapidly multiply in urine standing at room temperature. Therefore, microbial organisms found in all but the most scrupulously collected urines should be interpreted in view of clinical symptoms.



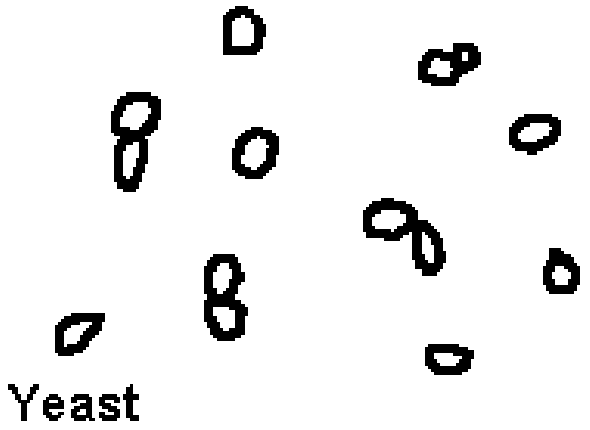
White blood cells (WBC) and bacteria

Diagnosis of bacteriuria in a case of suspected urinary tract infection requires culture.

Yeast

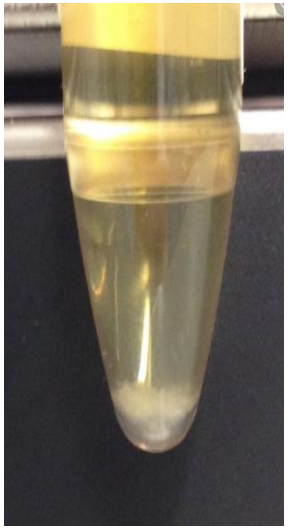
They are often difficult to distinguish from red cells and amorphous crystals but are distinguished by their tendency to bud.

Most often they are Candida, which may colonize bladder, urethra, or vagina.

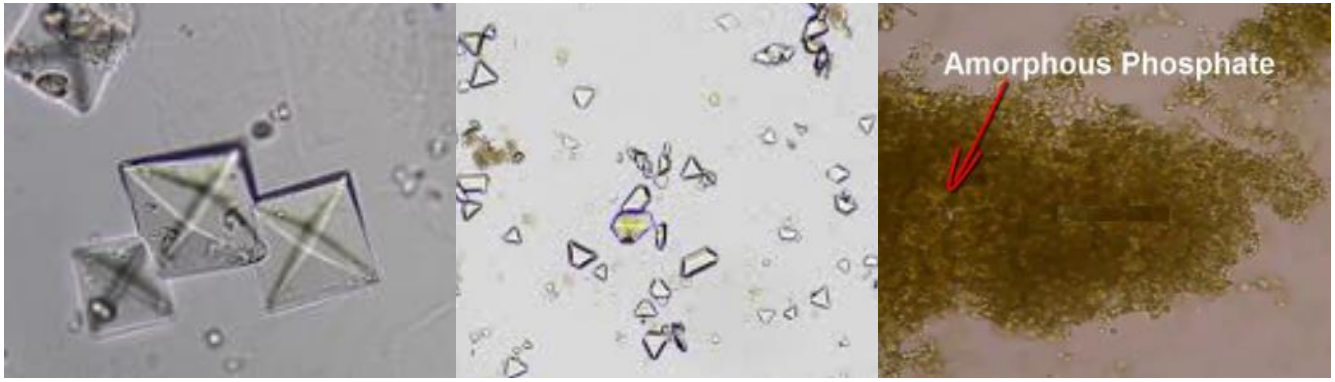


Crystals

Chemicals are formed in the urine and, if considerably grown, they may form stones in the urinary tract



Common crystals seen include calcium oxalate, triple phosphate crystals and amorphous phosphates.



CHEMICAL ANALYSIS OF URINE:

• The chemical analysis of urine us undertaken to evaluate the levels of the following component:

– Protein
– Glucose
– Ketones
– Occult blood
– Bilirubin
– Bile salts

• The presence of normal and abnormal chemical elements in the urine are detected using dry reagent strips called dipsticks.

• When the test strip is dipped in urine the reagents are activated and a chemical reaction occurs.

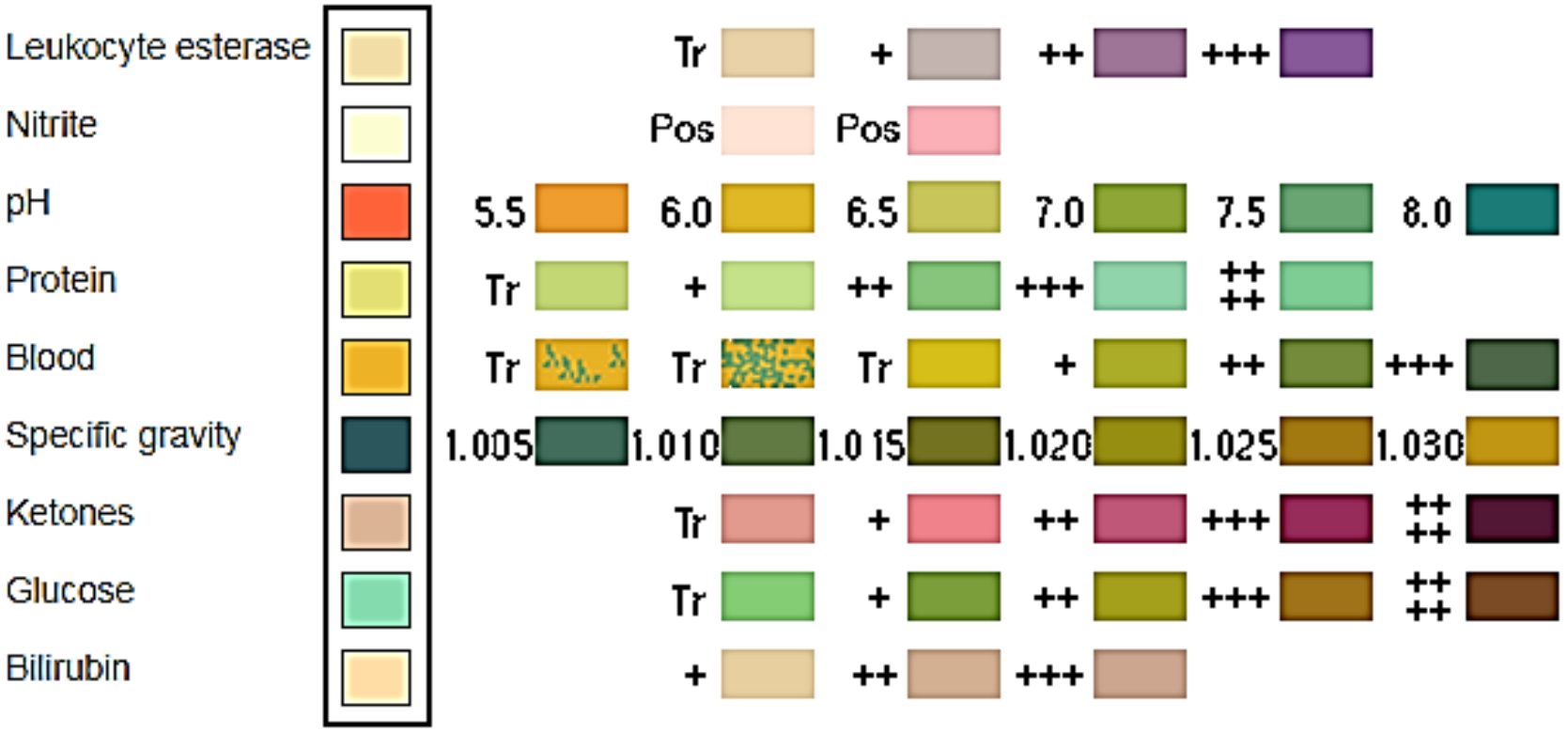
• The chemical reaction results in a specific color change.

• After a specific amount of time has elapse, this color change is compared against a reference color chart provided.

URINE DIPSTICK CHEMICAL ANALYSIS

Overview

A dipstick is a paper strip with patches impregnated with chemicals that undergo a color change when certain constituents of the urine are present or in a certain concentration. The strip is dipped into the urine sample, and after the appropriate number of seconds, the color change is compared to a standard chart to determine the findings.



The test strip for leukocyte esterase/nitrate reduction. The strip is dipped into the urine specimen **Any pink colour is a positive** reaction indicating the presence of leukocyte esterase and/or bacteria in excess of 105 per ml. Urine samples that are positive in the screening test should be cultured as soon as possible to prevent possible overgrowth by no significant bacteria. If the strip does not develop a pink colour it is interpreted as a negative screening test, is so reported, and no culture is indicated.

-**Proteins of urine:** a little quantity, of protein are found normally in urine (150 mg/day)any access in protein called proteinuria which is an indication for many diseases like kidney diseases , fever and pregnancy. Types of protein in urine:

1-Albumine: is the first protein appearing in urine due to its low molecular weight and size (albuminuria), this protein appears in Diabetes and hypertension.

2- Immunoglobulins: appear in urine due to inflammations and microbial infections

3-Hemoglobine:found in urine due to blood hemolysis.

-Glucose in urine:

No glucose is present in the urine normally which passes glomerular filter, because it is completely absorbed in the tubules. It present when the blood glucose level elevated to(**180mg/m**l) which is called renal threshold, when blood glucose elevated the glucose present in urine as in diabetes.

Acetone (Ketone body) (ketones):
The ketone bodies include acetone, acetoacetic acid (diacetic acid) and betahydroxybutric acid.

A state in which these substances are present in increased amount in the blood and urine is called **ketosis.**

These bodies accumulate in the blood and are excreted in the urine (**ketonuria).**

These bodies present in urine in starvation or low blood glucose levels.

Thanks