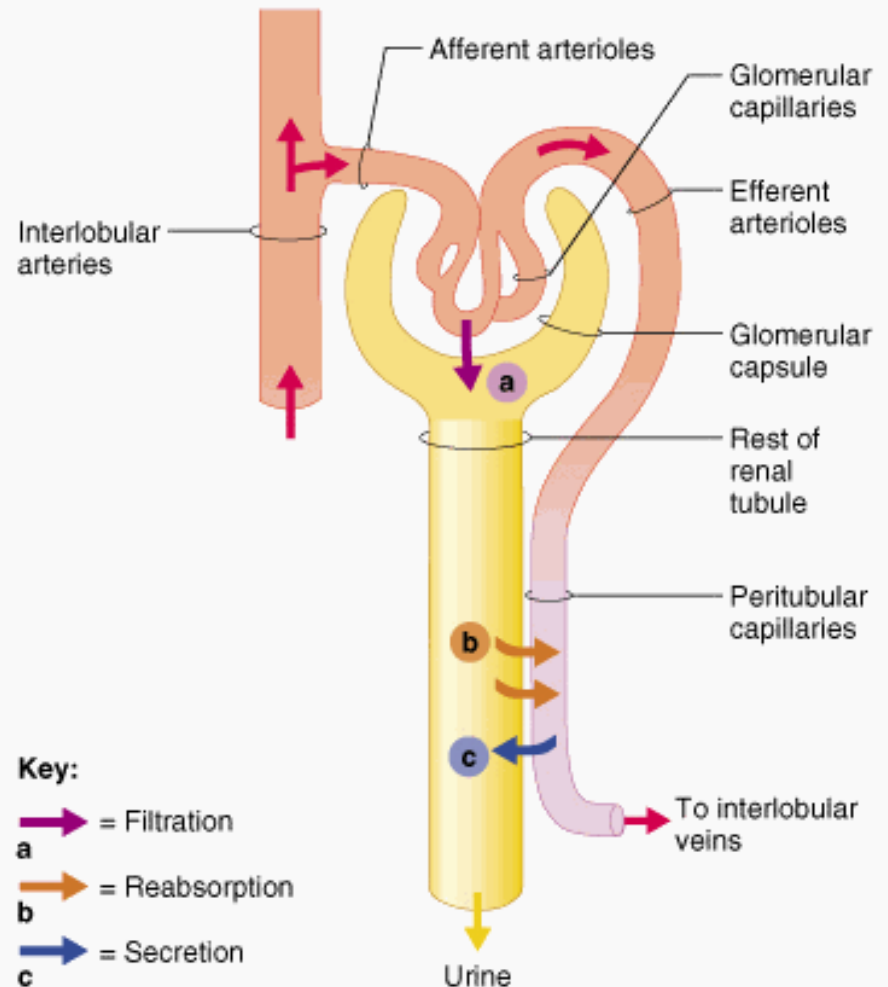
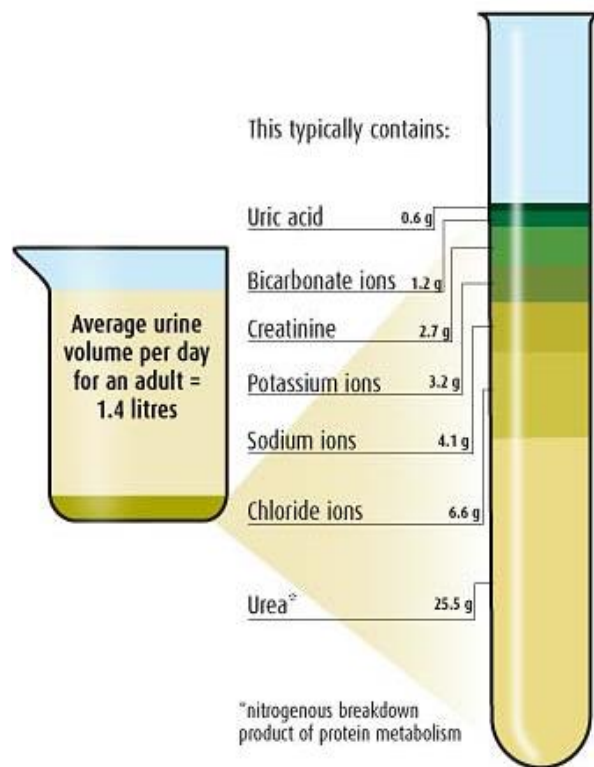


Physical properties and detection of normal constituents of urine



Lecture overview

Normal urine consistent

Urinary System

Urine
Formation

Filtration

Tubular Re
absorption

Tubular
Excretion

Urine analysis

Types of urine
specimen

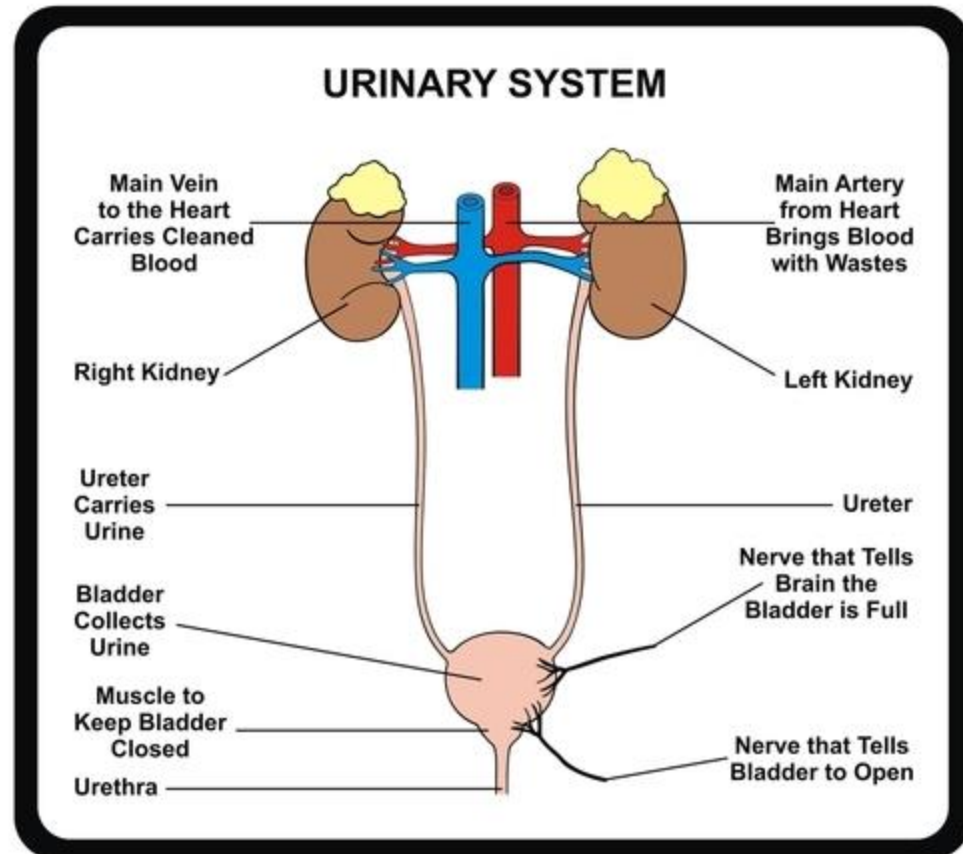
Physical
analysis

Biochemical
analysis

Micro/Macro
analysis

Urinary System

- The urinary **system** **works** with the lungs, skin and intestines to maintain the balance of chemicals and water in the body.



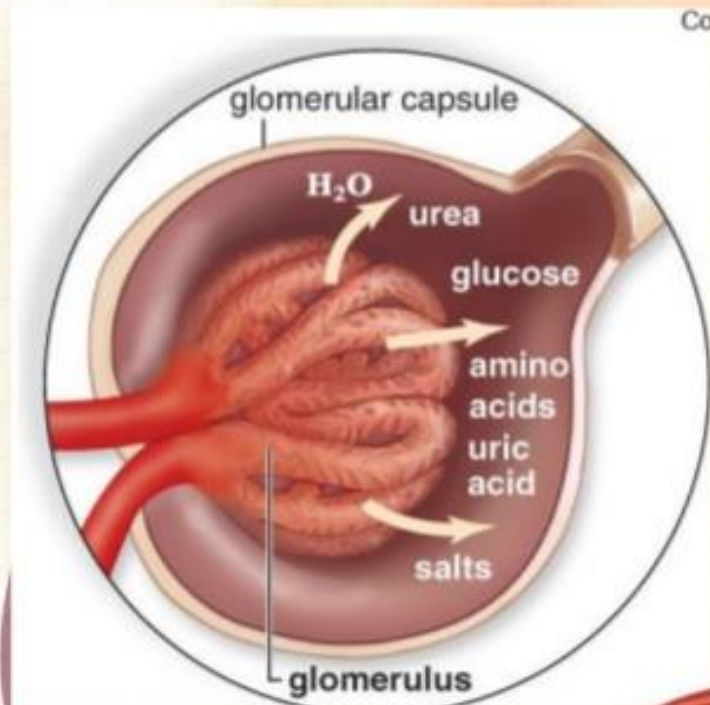
Urine Formation

- The kidneys remove waste product formed from the blood through small filtering units called nephrons.
- Each nephron consists of a ball of small blood capillaries, called a glomerulus, and a small tube called a renal tubule.
- Urea, together with water and other waste substances, forms the urine as it passes through the nephrons and down the renal tubules of the kidney.

- Muscles in the ureter walls continuously tighten and relax to force urine away from the kidneys. A backup of urine can cause a kidney infection. Small amounts of urine are emptied into the bladder from the ureters about every 10 to 15 seconds.
- The bladder is a hollow muscular organ shaped like a balloon. It sits in the pelvis and is held in place by ligaments attached to other organs and the pelvic bones. The bladder stores urine until ready to empty it. A normal, healthy bladder can hold up to 16 ounces (almost half a liter) of urine comfortably for 2 to 5 hours

Stages of urine formation:

1. filtration

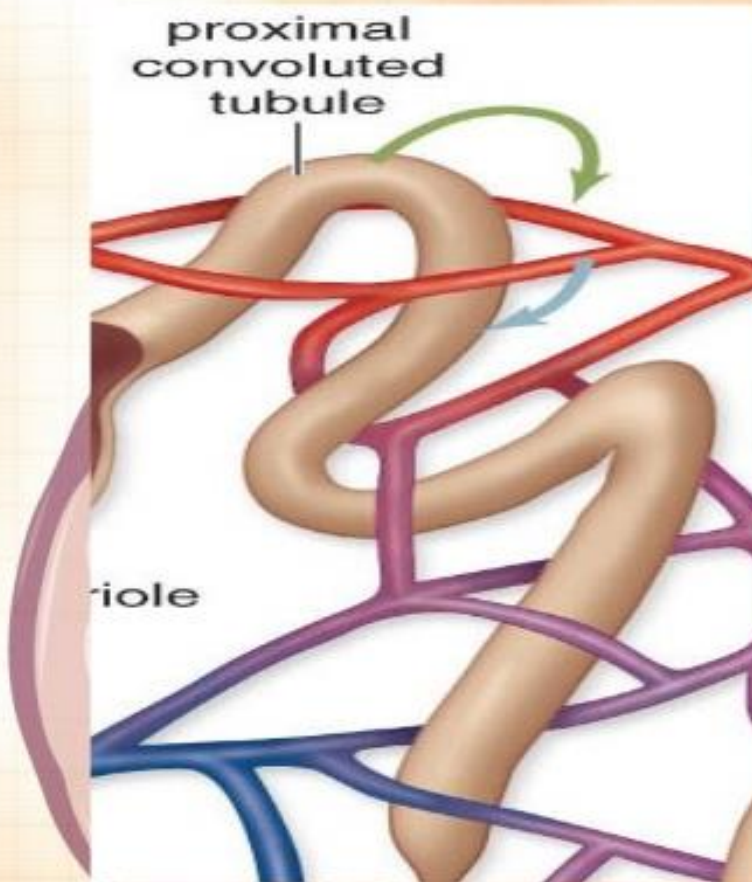


**-blood pressure forces
small molecules
from the
glomerulus to the capsule**

**Filtrates:
glucose, amino acids
uric acid, urea**

Stages of urine formation:

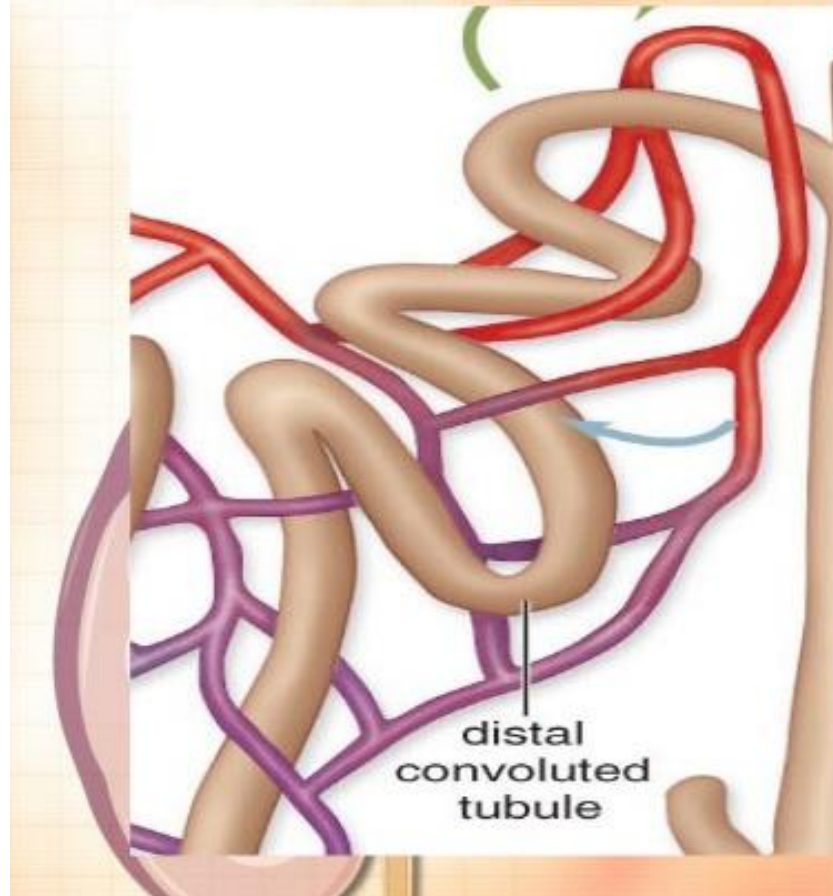
2. Tubular Reabsorption



**-return of filtrates
from blood
at the proximal tubule
through diffusion
and active transport**

Stages of urine formation:

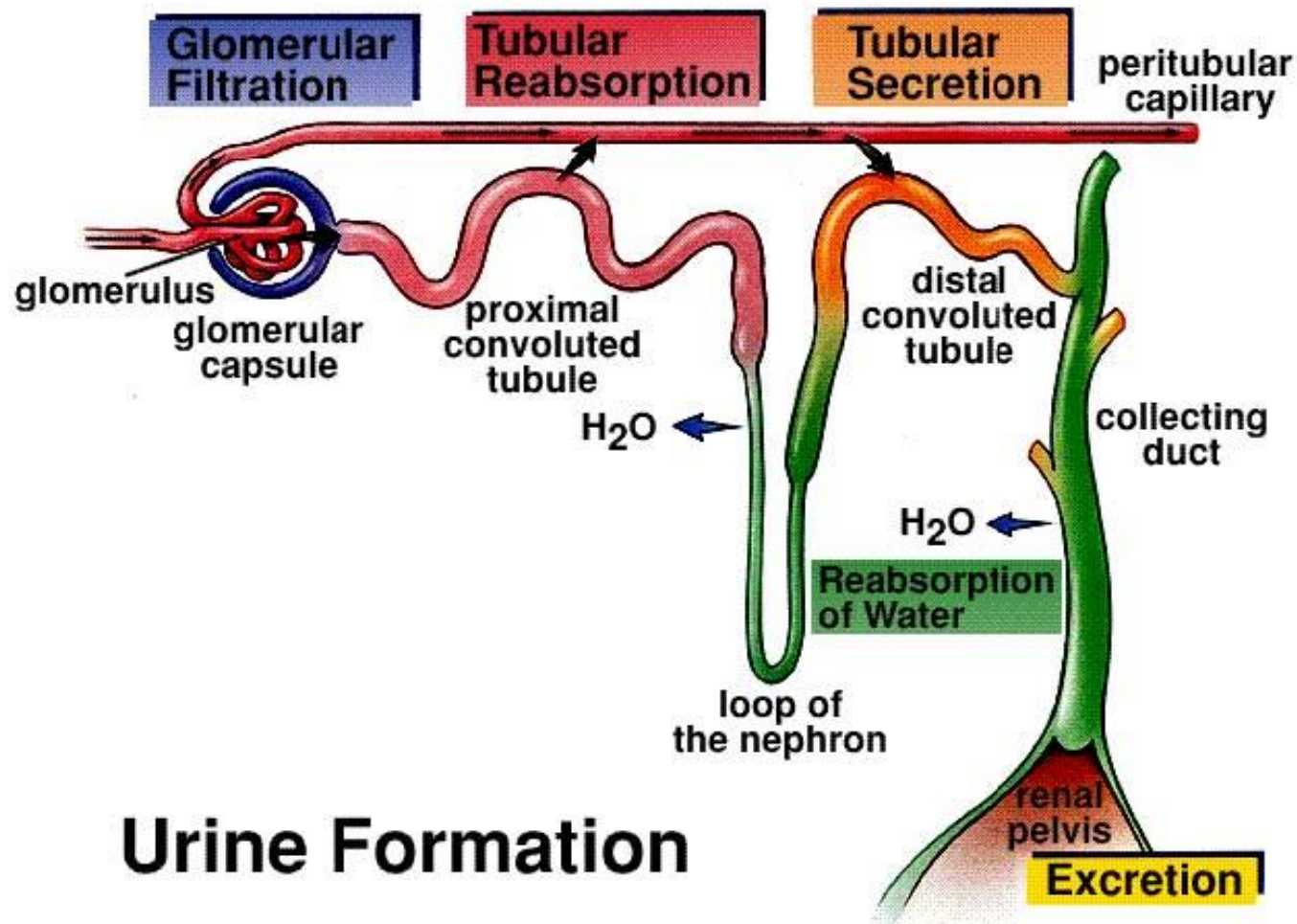
3. Tubular Secretion



**-movement of molecules
from blood
into the
distal convoluted tubule**

**Molecules:
drugs and toxins**

Stages of urine formation:



Urine analysis

Types of urine specimens:

- type of specimen and collection procedure are determined by physician and depend on the tests to be performed.

There are basically four types of urine specimens:

Types of urine sample

Sample type	Sampling	Purpose
Random specimen	No specific time most common, taken anytime of day	Routine screening, chemical
Morning sample	First urine in the morning, most concentrated	Pregnancy test, microscopic test
Clean catch midstream	Discard first few ml, collect the rest	Culture
24 hours	All the urine passed during the day and night and next day 1 st sample is collected.	used for quantitative and qualitative analysis of substances

A-Physical analysis

(A)Volume : The normal 24 hours urine volume of an adult is between 750 and 2000 ml.

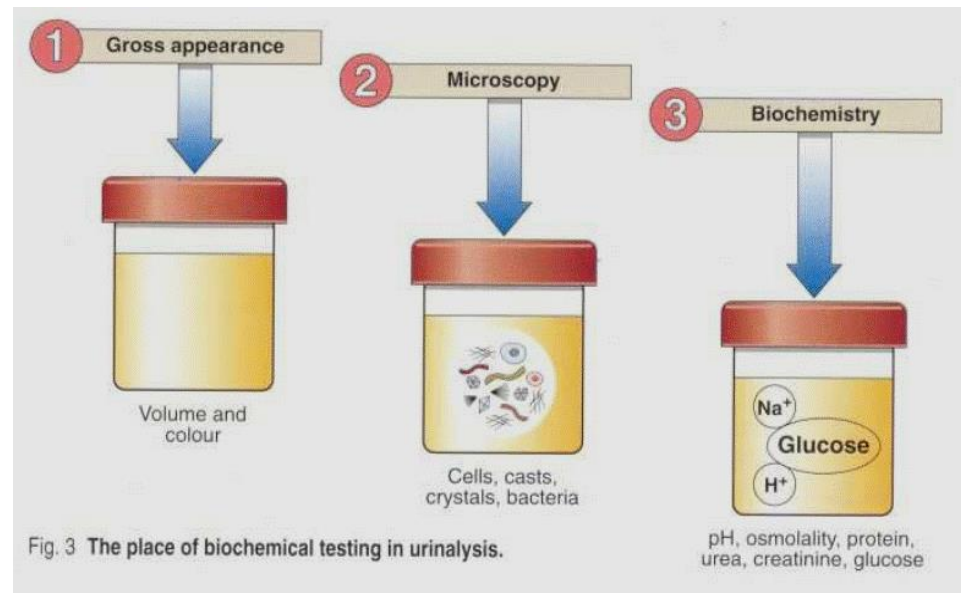
There are several Factors will affected on urinary output : (Generally divided on two types)

- 1)Physiological factors
- 2)Pathological factors

1) Physiological : depends on the fluid intake (which is usually a matter of habit) and on the loss of fluid by other routes (primarily sweating which, in absence of fever, depends on physical activity and on the external temperature).

(A) Increase concentration (amount) of salt : will lead to decrease the volume of urine (output) , it will be low than 500 ml/day

(B) Diuretics : will lead to increase the urinary output (more than 2000ml/day) Like ; coffee , Beer , Cola (c) Increase water intake : increase urinary output



(2) Pathological:

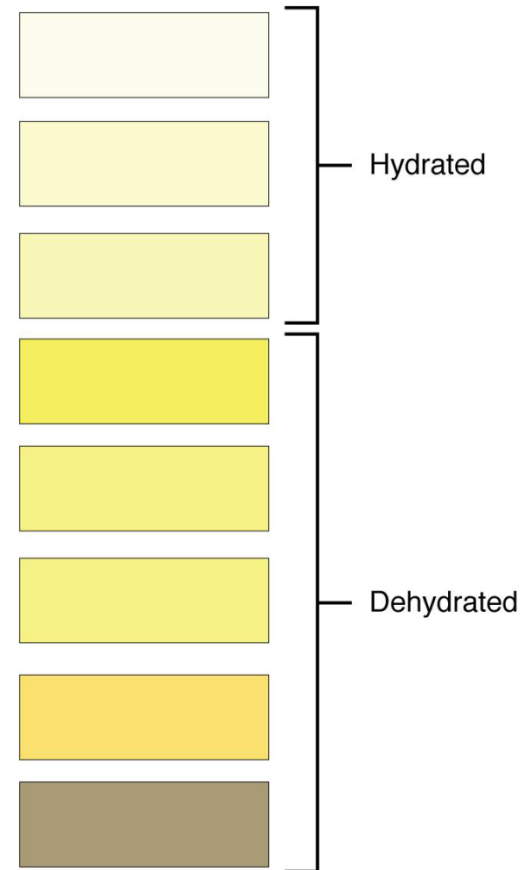
(A) Diabetes Mellitus : huge amount of urine (3500ml/day)

- **Polyuria** : If the urinary output $> 2000\text{ml/day}$
- **Oliguria** : If the urinary output from 500 – 200 ml/day
- **Anuria** : If the urinary output from 0 – 125 ml /day , this condition occurs in Obstructive collected adduct due to a stone or tumor . Note : the polyuria and oligouria can observeing in Physiological and Pathological condition but the anuria only observing in Pathological condition

(B)Color: Normally ; it is Pale to dark yellow

the urine has yellow color due to excretion of the normal urine pigments (urochromas)

Colored urines occur in certain diseases or metabolic disorders, and after the administration of many drugs



(D) Odour or smell :

- urine which had a normal odour on arrival at the laboratory

(E) PH :

On a normal pH between 5.5 and 8.0, *Normally : A vegetarian diet which causes a tendency to alkalosis, thereby produces an alkaline urine. - Important of PH of urine : The pH of the urine in disease may reflect both the acid-base status of the plasma, and the function of the renal tubules.*

(F) Specific Gravity (SG) :

- The normal specific gravity (correctly called relative density) of a pooled 24 hour urine sample is between 1.025 and 1.010
- There are direct relation ship between concentration of substance in urine (Concentration of urine) and SG.
- **The concentration of urine is highest in the a morning specimen (overnight urine) and is lowest in a specimen passed an hour after much
- fluid has been taken.

Objectives:

- 1- The simple examination of urine.
- 2- To detect some of the normal organic constituents of urine.(Qualitative)
- 3- To detect some of the normal inorganic ions present in urine. .(Qualitative)

Note:

All the examination **in 24 hour collection of urine**

A-Physical analysis

physical Properties of normal urine

- 1- **Volume**: Measure the volume of the 24 hour collection of normal urine.
- 2- **Color**: Visually examine its colour.
- 3- **Appearance**: State whether it is clear, cloudy or whether deposits or precipitates are present.
- 4- **Odour**: State whether it is normal urine like ammonical, or not.
- 5- **pH**: Record the pH of the sample.
- 6- **Specific gravity**



Urine dipstick / Urine test strips

How to test your urine(visual read)?



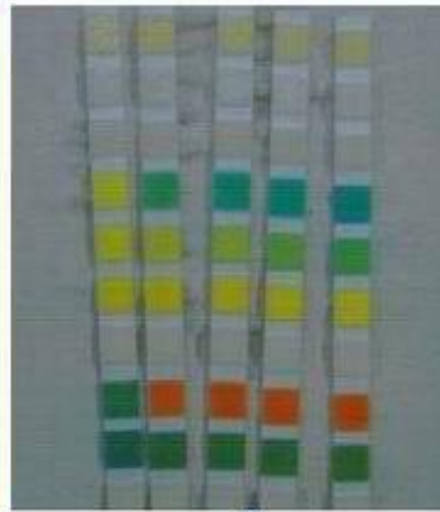
A

Prepare some fresh urine sample.



B

Dip the dry strip into the urine.



C

Absorb the excess urine with absorbent paper.



D

Contrast color chart, close to which color?

B-Biochemical analysis

Detect of some **Organic** constituent of urine

- **1- Creatinine:**
- Put 5 ml of urine + 1 ml of a saturated solution of picric acid + 1 ml of 10% sodium hydroxide solution.
- A deep red color or orange due to creatinine picrate appears. On acidification, with 2N HCl, the color changes to yellow.
- **2- Uric acid:**
- Put 2 ml of urine + 1 ml of Benedict reagent , then heated in a boiling water bath for three minutes .
- *White precipitate indicates the presence of uric acid.*



Detect of some **Inorganic** constituent of urine

1) **Chlorides**: Add 5 ml of urine+ 5 drops of 2N nitric acid + + 3 drops of 2N silver nitrate solution.

A white precipitate of silver chloride is formed which dissolves in 2N ammonium hydroxide solution.

2) **Phosphates**: Add 5 ml of concentrated nitric acid + 5 ml of urine+ 4 ml of saturated ammonium molybdate solution.

A yellow crystalline precipitate of ammonium phospho-molybdate appears.

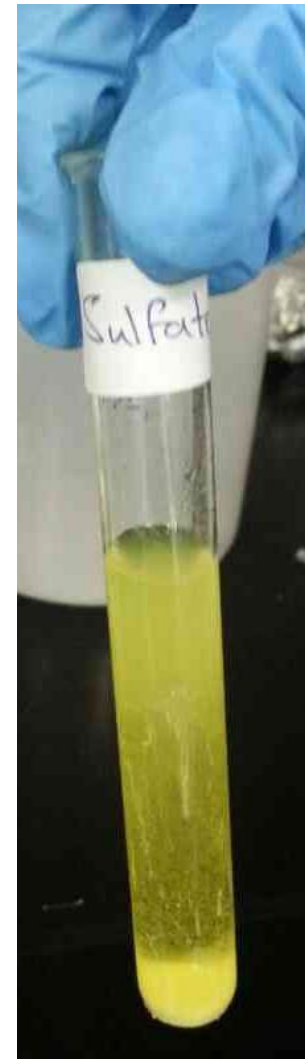


3) **Bicarbonate**: Add 4 drops of concentrate HCl + 5 ml of urine. A slight effervescence occurs due to CO₂ evolution.

4) **Sulphates** : Acidify 10 ml of urine + 1 ml dilute HCl+ 4 drops of 5% barium chloride solution.

- A white precipitate of barium sulphate is formed.

5) **Ammonia**: Add 1 ml of 10% sodium hydroxide solution + 5 ml of urine. Boil. The ammonia may be detected by its occur in confirmed by turning moist red litmus paper to blue.



C-Micro/Macro analysis

Casts negative: occasional hyaline casts

Red blood cells: negative or rare

Crystals: negative (none)

Protein: negative

White blood cells: negative or rare

Epithelial cells: negative or rare

References

- <http://www.livescience.com/27012-urinary-system.html>
- <http://www.slideshare.net/pen22cute/kidney-urine>