



Biochemistry of biological fluids (BIOCH 472)

DR. MANSOUR GATASHEH

*Biochemistry Department, Science College
King Saud University*

Class 6:

**Urinalysis:
Urine Examination**

Objectives for this lecture

- Discuss the significance of physical examination.
- State the clinical significance of urine test results.
- Discuss the significance of chemical examination.
- List the pathologic and nonpathologic causes of some urine results.

Urine Analysis

Type of analysis:

- *microscopic examination:* urine sediment is examined under microscope to identify the components of the urinary sediments.
- *macroscopic analysis:* - Physical characteristics
- - Chemical characteristics

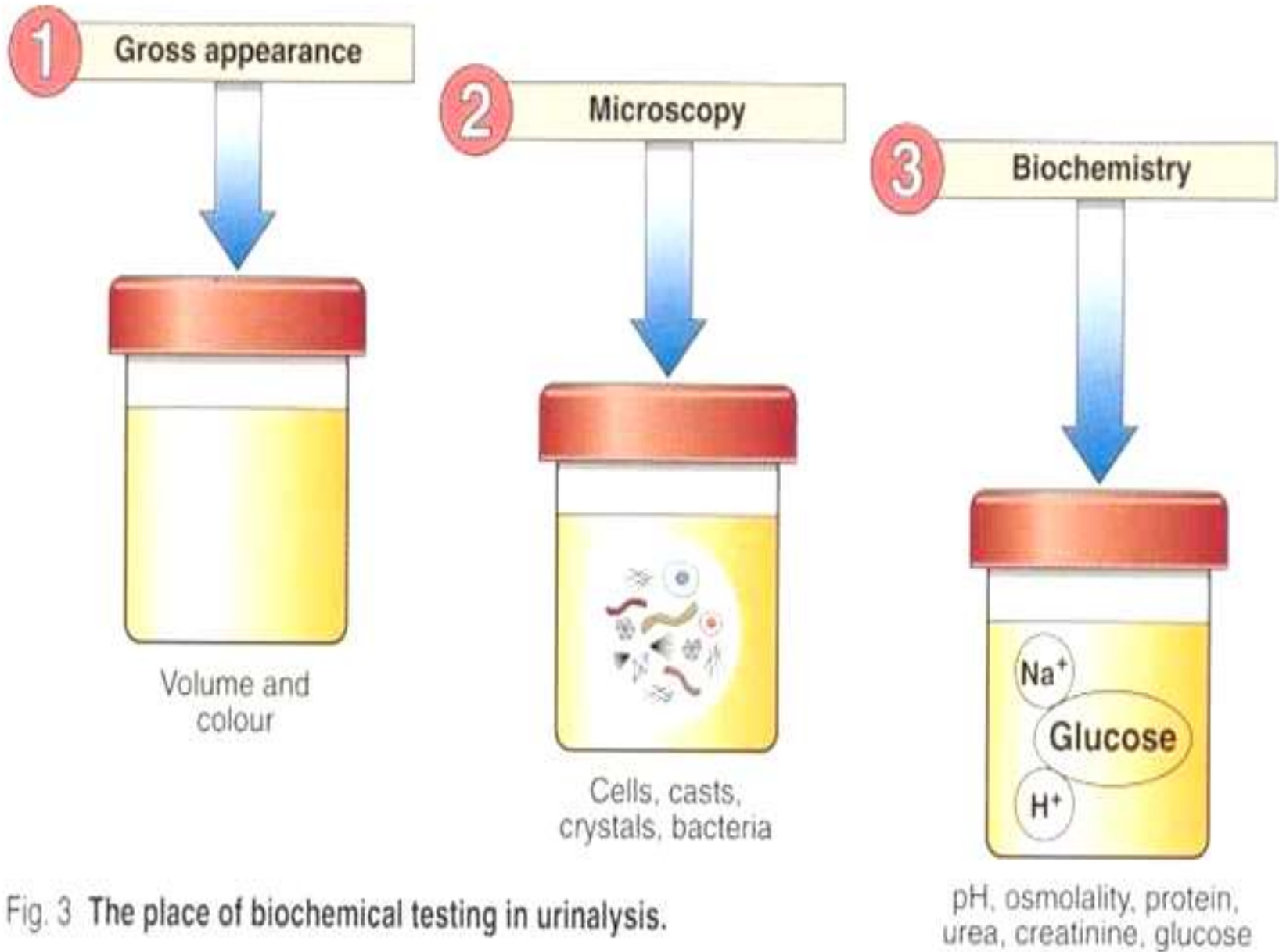


Fig. 3 The place of biochemical testing in urinalysis.

Physical Examination of Urine

- provides information on disorders such as glomerular bleeding, liver disease, inborn errors of metabolism, and urinary tract infection.
- *Physical examination involves:*
 - 1- Color
 - 2- Transparency
 - 3- Odour
 - 4- Volume
 - 5- pH
 - 6- Specific gravity

Physical Examination - Color

- Urine color is affected by metabolic functions, physical activity, ingested materials, or pathologic conditions.
- Normal Urine Color pale yellow, yellow, dark yellow, and amber.
- yellow color of urine is caused by the presence of *urochrome*.

Urine color

- Colorless Recent fluid consumption
- Pale yellow Polyuria or diabetes Dilute specimen
- Dark yellow Concentrated specimen
- Orange Bilirubin, acriflavine, medicatin
- Yellow-green/brown Bilirubin oxidized to biliverdin
- Green *Pseudomonas* infection
- Blue-green Amitriptyline, Phenol, Indican
- Red RBCs, Hemoglobin
- Brown Black Methemoglobin, Melanin, Methyldopa

Physical Examination - *Clarity*

- refers to the transparency/turbidity of a urine specimen.
- Freshly voided normal urine is usually clear.

Urine Clarity (Transparency)

- **Clear** No visible particulates, transparent.
- **Hazy** particulates, print easily seen through urine.
precipitation of amorphous phosphates and carbonates may cause a white cloudiness (ref.).
- **Cloudy** Many particulates, print blurred through urine.
- **Turbid** Print cannot be seen through urine.
epithelial cells and mucus if specimens from women.
Semen, fecal contamination.
- **Milky** May precipitate or be clotted.

Pathologic Turbidity

- RBCs, WBCs, and bacteria caused by infection or a systemic organ disorder.
- Epithelial cells, yeast, abnormal crystals, lymph fluid, and lipids.

Physical Examination - *Odor*

- not a part of the routine urinalysis, it is a noticeable physical property.
- Freshly urine has a faint aromatic odor.
- Breakdown of urea is responsible for the ammonia odor.

Common Causes of Urine Odor

- Aromatic Normal
- Foul, ammonia-like Bacterial decomposition, urinary tract infection
- Fruity, sweet Ketones (diabetes mellitus, starvation, vomiting)
- Maple syrup Maple syrup urine disease
- Mousy Phenylketonuria
- Rancid Tyrosinemia
- Sweaty feet Isovaleric acidemia
- Bleach Contamination

Chemical Examination of Urine

- At the early days we have the development of the *reagent strip method* for chemical analysis.
- It is simple, rapid
- Perform chemical analysis of urine for pH, protein, glucose, ketones, blood, ***bilirubin***, ***urobilinogen***, nitrite, leukocytes, and SG.
- Chemical-impregnated absorbent pads attached to a plastic strip.

Chemical Examination

- *pH*

- pH of normal samples range from 4.5 to 8.0.
- pH help in the identification of **crystals** during microscopic examination.
- Urine acid-base condition is affected by respiratory or metabolic system, ***if not then*** this is an indication of kidneys disorder.
- Urinary pH is controlled by dietary regulation:
 - ***high-protein produce acidic urine.***
 - ***vegetarians produce alkaline urine.***

Chemical Examination

- *Protein*

- *Proteinuria* is associated with renal disease.
- Normal urine contains less than 10 mg/dL.
 - *Prerenal* - infection and inflammation (e.g. vascular hemolysis, muscle injury, myeloma)
 - *Renal* - true renal disease
- *Postrenal* - ureters, bladder, prostate, vagina

Chemical Examination

- *Glucose*

- detection and monitoring of diabetes mellitus.
- blood and urine glucose tests are included in all Glucose Tolerance Test (GTT).
- *Hypoglycemia:*
 - ✓ Diabetes mellitus.
 - ✓ meal with a high glucose content.
 - ✓ Pregnancy (placenta hormone block insulin).
 - ✓ Hyperthyroidism, acromegaly, Cushing syndrome.
 - ✓ Stress.

Chemical Examination

- *Ketones*

- ketones represents: *acetone, acetoacetic acid, and beta-hydroxybutyric acid.*
- *Ketonuria* is detected when body stores of *fat* metabolized to supply energy:
 - Diabetes mellitus (type-I)
 - Starvation.
 - malabsorption.
 - Vomiting.
- Ketones leads to dehydration, acidosis, coma.

Chemical Examination

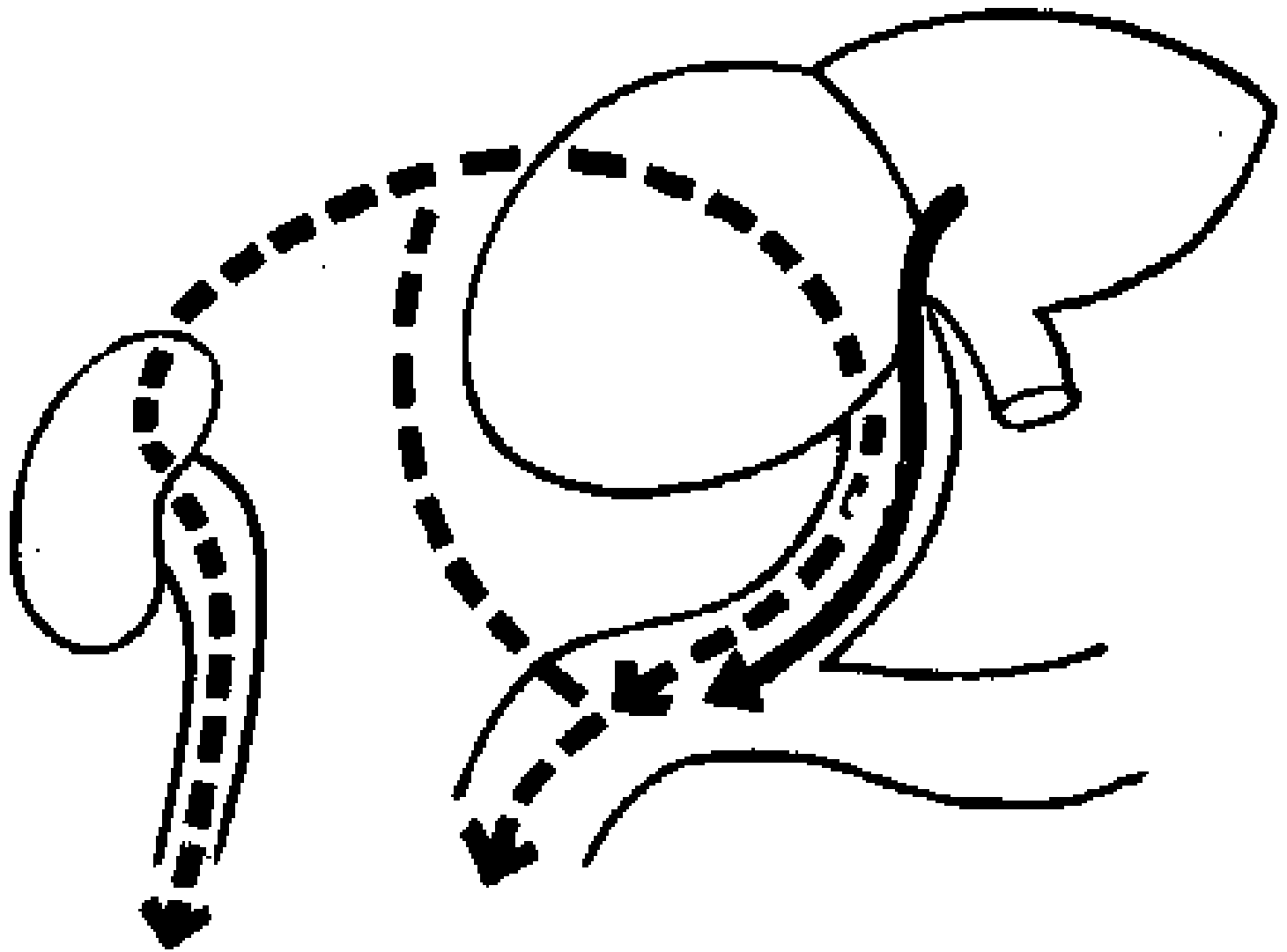
- *Blood*

- *Hematuria* is related to disorders of renal by:
 - ✓ renal calculi
 - ✓ glomerular diseases
 - ✓ tumors,
 - ✓ exposure to toxic chemicals
 - ✓ Anticoagulant therapy
 - ✓ Strenuous exercise

Chemical Examination

- *Bilirubin*

- Early indication of liver disease (*jaundice*).
- *Conjugated bilirubin* appears in the urine:
 - obstruction of bile duct (gallstones).
 - liver damage (Hepatitis and cirrhosis)
- hemolysis of RBCs does not produce *bilirubinuria*, because the serum bilirubin is water insoluble.



Chemical Examination

- *Urobilinogen*

- the intestinal bacteria convert the bilirubin to:
 - *Urobilinogen* (reabsorbed into blood and filtered by the glomerulus)
 - *Stercobilinogen* (oxidized to *urobilin* and excreted in the feces)
- **Increase** urine: liver disease, hemolytic disorders.
- **Absence** urine: obstruction of the bile duct.

Chemical Examination

- *Nitrite*

- Detect initial bladder infection (cystitis).
- It is a good for:
 - Detect the need for urine culture.
 - Detect Bacteriuria.
 - Evaluate the success of antibiotic.

Chemical Examination

– *Leukocyte Esterase*

- Detects the presence of **leukocytes**, and also that have been **lysed** in dilute alkaline urine, and would not appear in the microscopic examination.
- positive result is accompanied by the presence of bacteria, yeast, *Trichomonas*, renal inflammation.

Macroscopic Examination of Urine

- detect and to identify insoluble materials present in the urine.
- Abnormalities in the physical and chemical urinalysis give decision to perform a microscopic analysis.