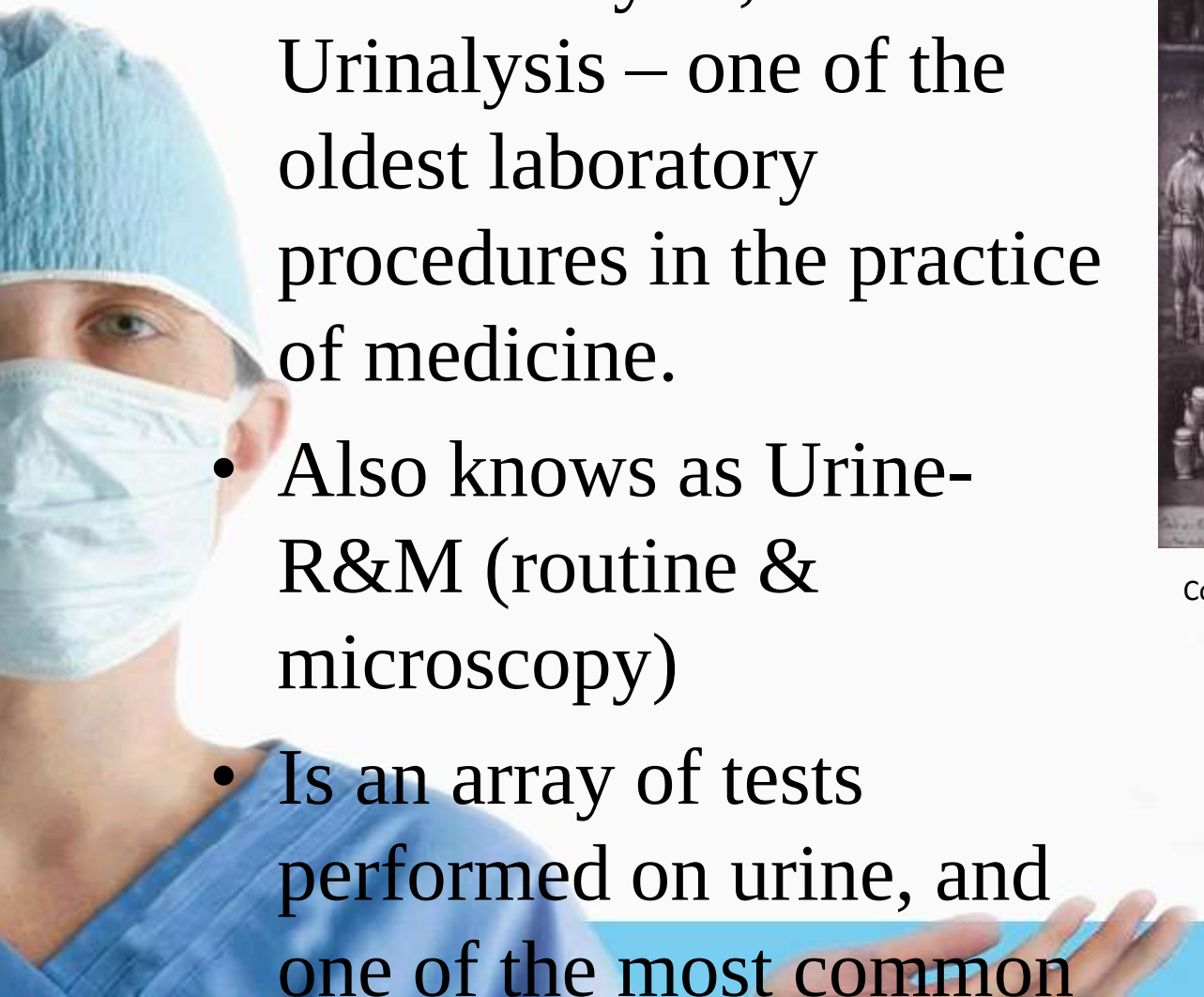
URINE ANALYSIS

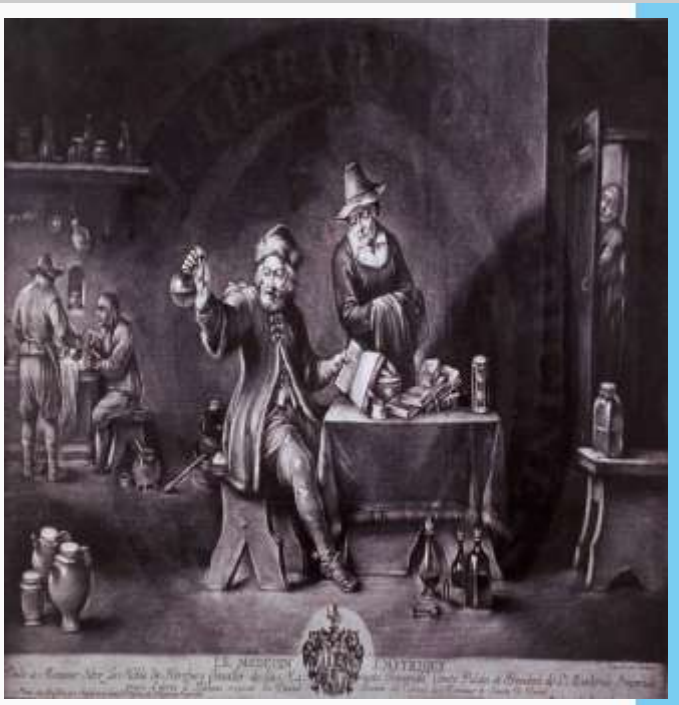
POWERPOINT SEMINAR SLIDE PRESENTATION PREPARED BY

DR. ANWAR HASAN SIDDIQUI, SENIOR RESIDENT, DEP'T OF PHYSIOLOGY, JNMC, AMU, ALIGARH

What is urine analysis?

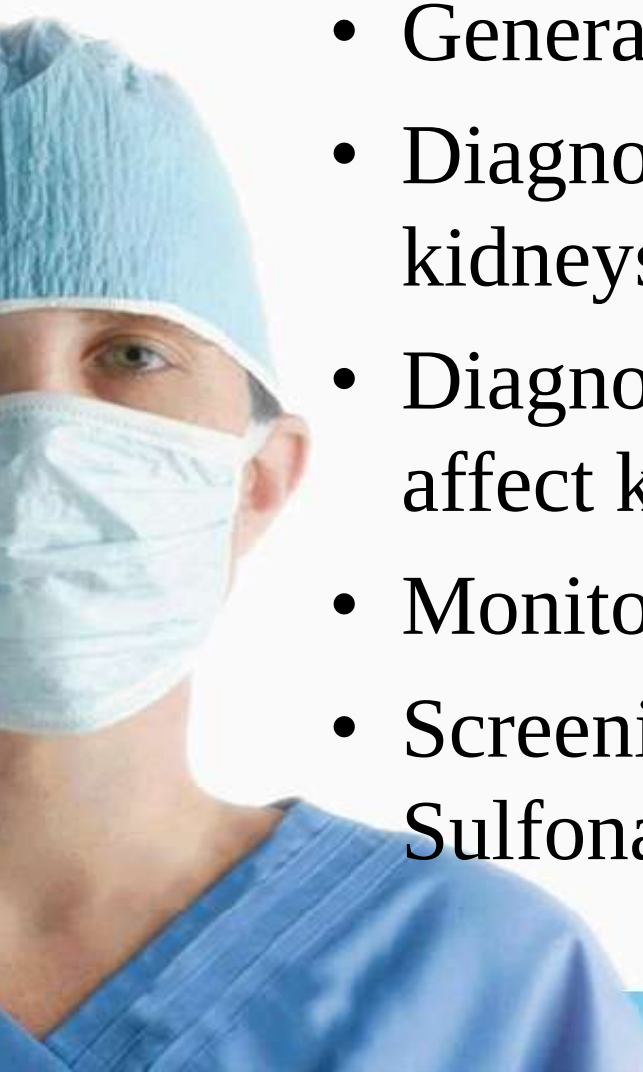


- Urine analysis, also called Urinalysis – one of the oldest laboratory procedures in the practice of medicine.
- Also knows as Urine-R&M (routine & microscopy)
- Is an array of tests performed on urine, and one of the most common



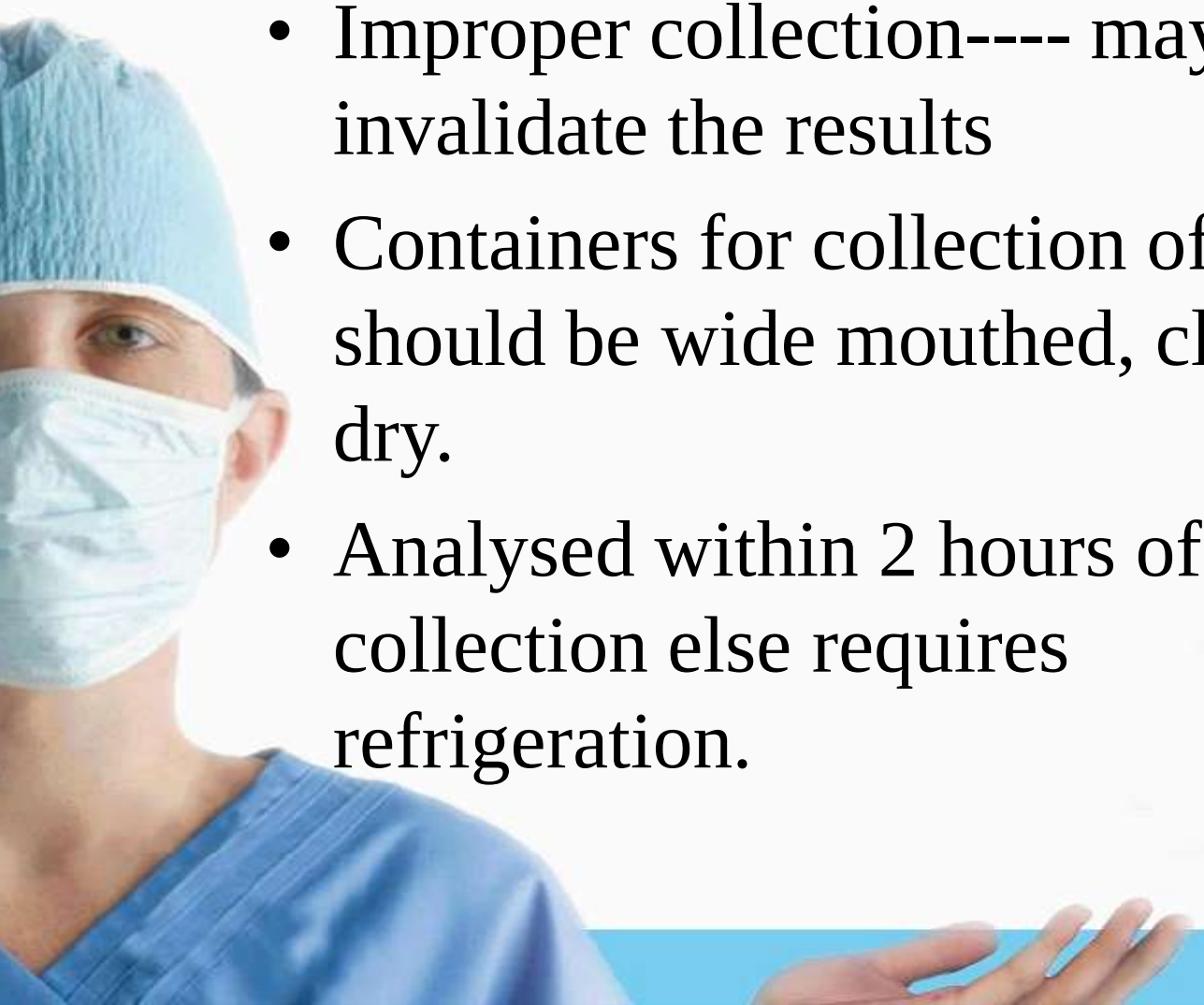
Courtesy of the National Library of Medicine

Why urinalysis?



- General evaluation of health
- Diagnosis of disease or disorders of the kidneys or urinary tract
- Diagnosis of other systemic disease that affect kidney function
- Monitoring of patients with diabetes
- Screening for drug abuse (eg. Sulfonamide or aminoglycosides)

Collection of urine specimens

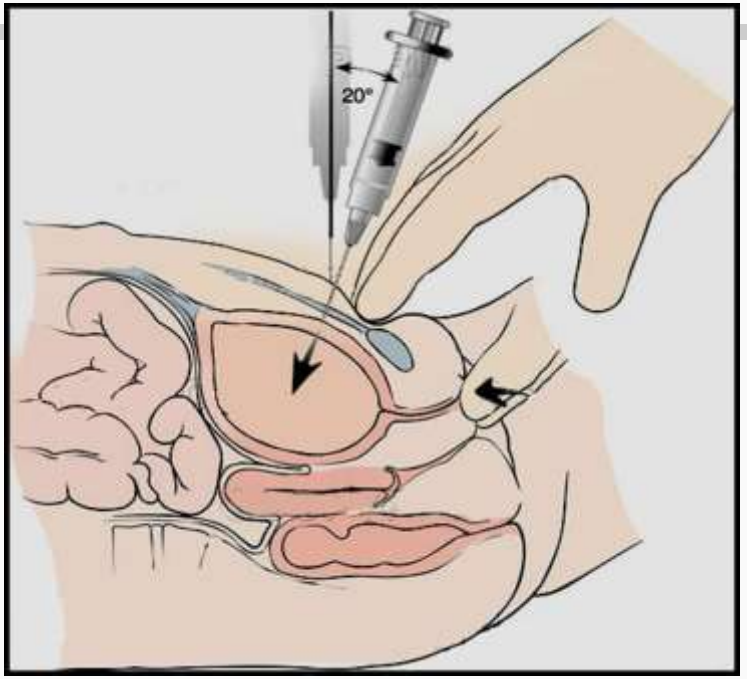


- Improper collection---- may invalidate the results
- Containers for collection of urine should be wide mouthed, clean and dry.
- Analysed within 2 hours of collection else requires refrigeration.

Types of urine sample

Sample type	Sampling	Purpose
Random specimen	No specific time most common, taken anytime of day	Routine screening, chemical & FEME
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 Ist sample is collected.	used for quantitative and qualitative analysis of substances
Postprandial	2 hours after meal	Determine glucose in diabetic monitoring
Supra-pubic aspired	Needle aspiration	Obtaining sterile urine

a



b

c

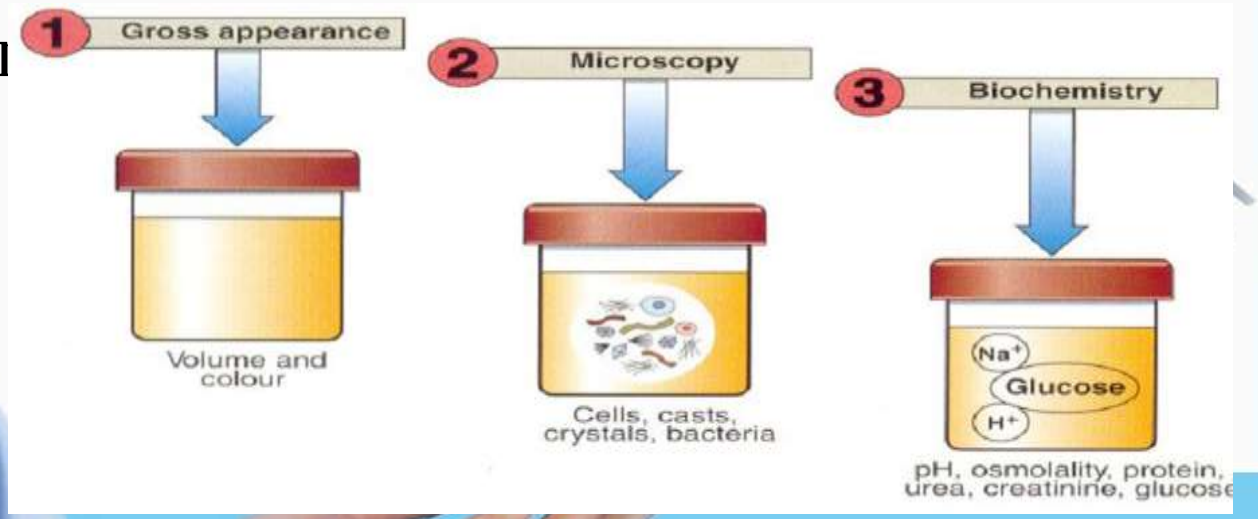
a: clean catch urine collection method in children

b: Suprapubic aspiration of urine.

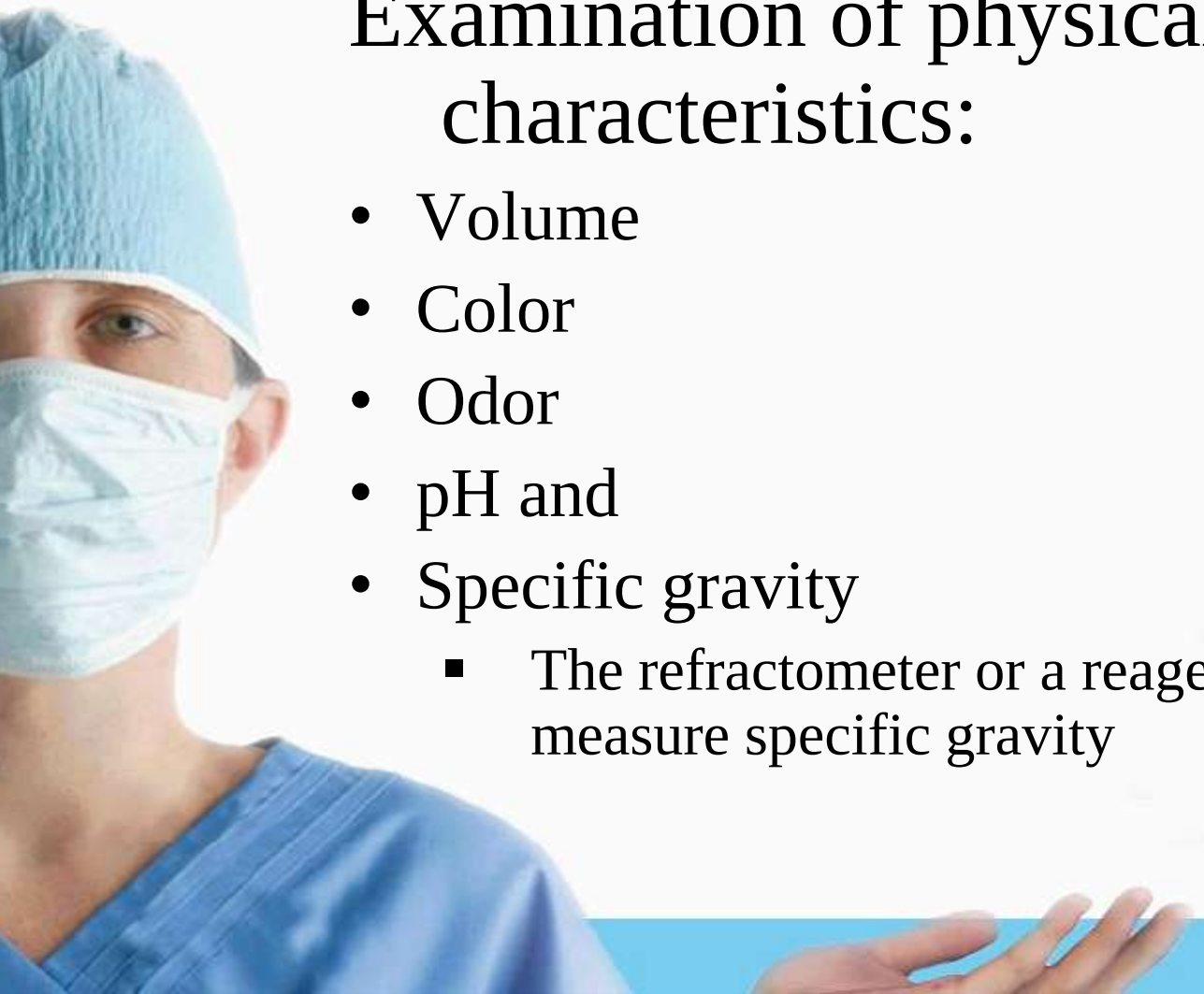
c: Urine storage and transportation kit

Urinalysis ;What to look for?

- Urinalysis consists of the following measurements:
  - Macroscopic or physical examination
  - Chemical examination
  - Microscopic examination of the sediment
  - Urii



Physical examination of urine

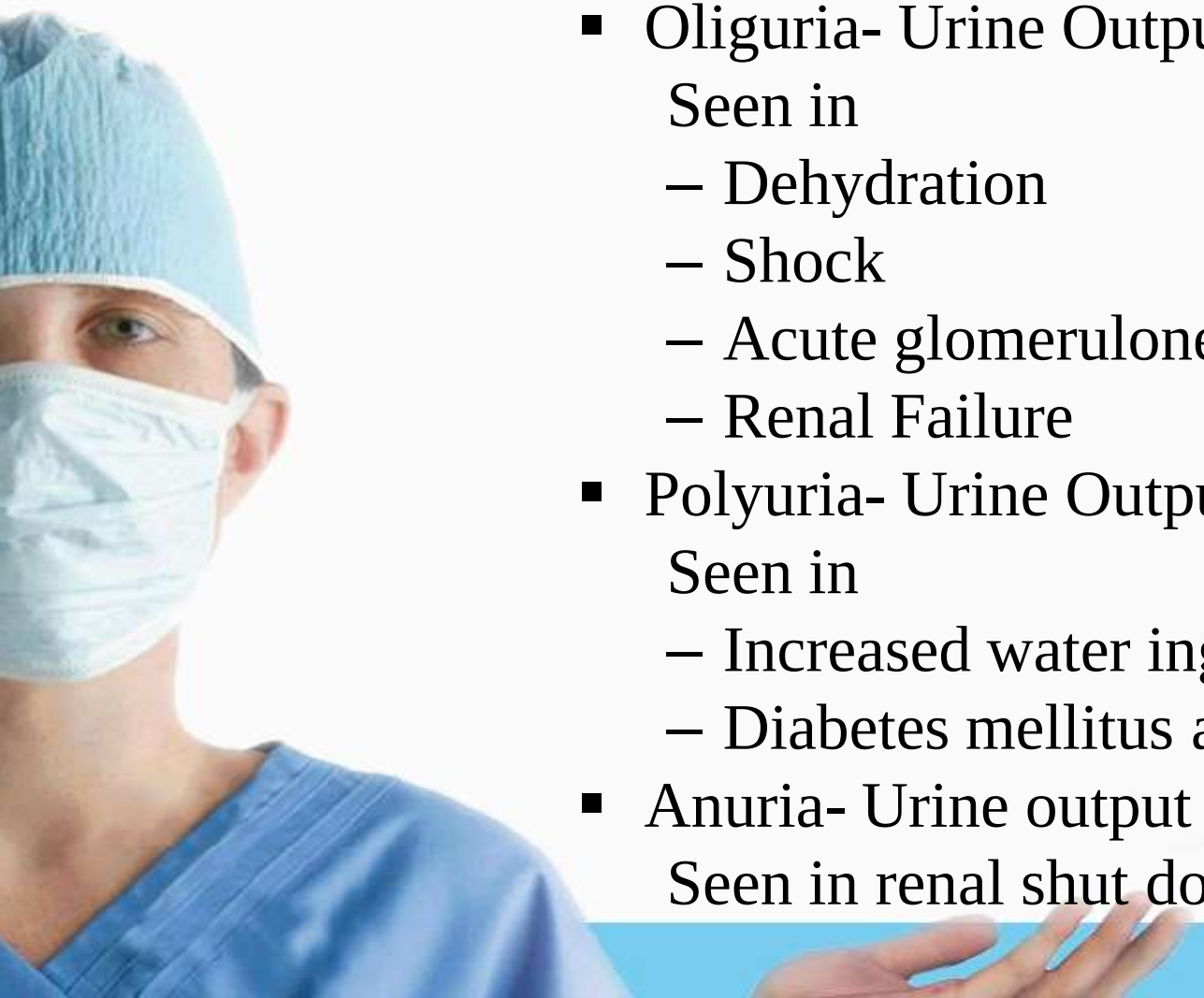


Examination of physical characteristics:

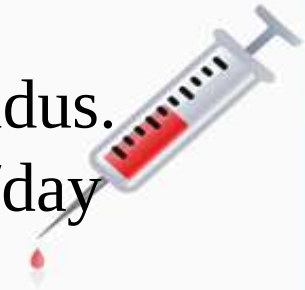
- Volume
- Color
- Odor
- pH and
- Specific gravity
  - The refractometer or a reagent strip is used to measure specific gravity

Physical examination continued…

Volume



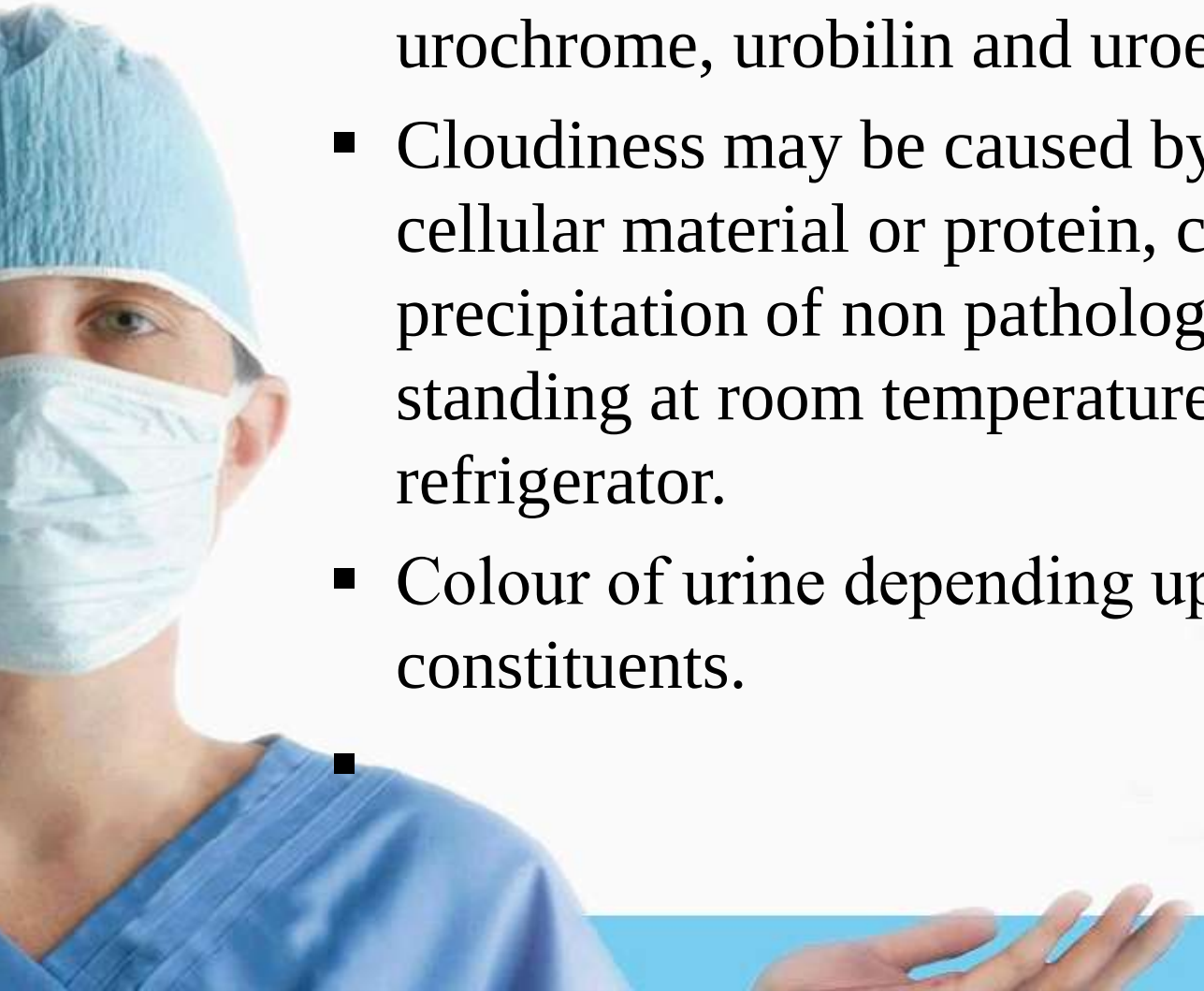
- Normal- 1-2.5 L/day
- Oliguria- Urine Output < 400ml/day
  Seen in
  - Dehydration
  - Shock
  - Acute glomerulonephritis
  - Renal Failure
- Polyuria- Urine Output > 2.5 L/day
  Seen in
  - Increased water ingestion
  - Diabetes mellitus and insipidus.
- Anuria- Urine output < 100ml/day
  Seen in renal shut down



Physical examination continued…

Color

- Normal- pale yellow in color due to pigments urochrome, urobilin and uroerythrin.
- Cloudiness may be caused by excessive cellular material or protein, crystallization or precipitation of non pathological salts upon standing at room temperature or in the refrigerator.
- Colour of urine depending upon it's constituents.
-



Physical examination continued…

Color

- Abnormal colors:
  - Colorless – diabetes, diuretics
  - Deep Yellow – concentrated u

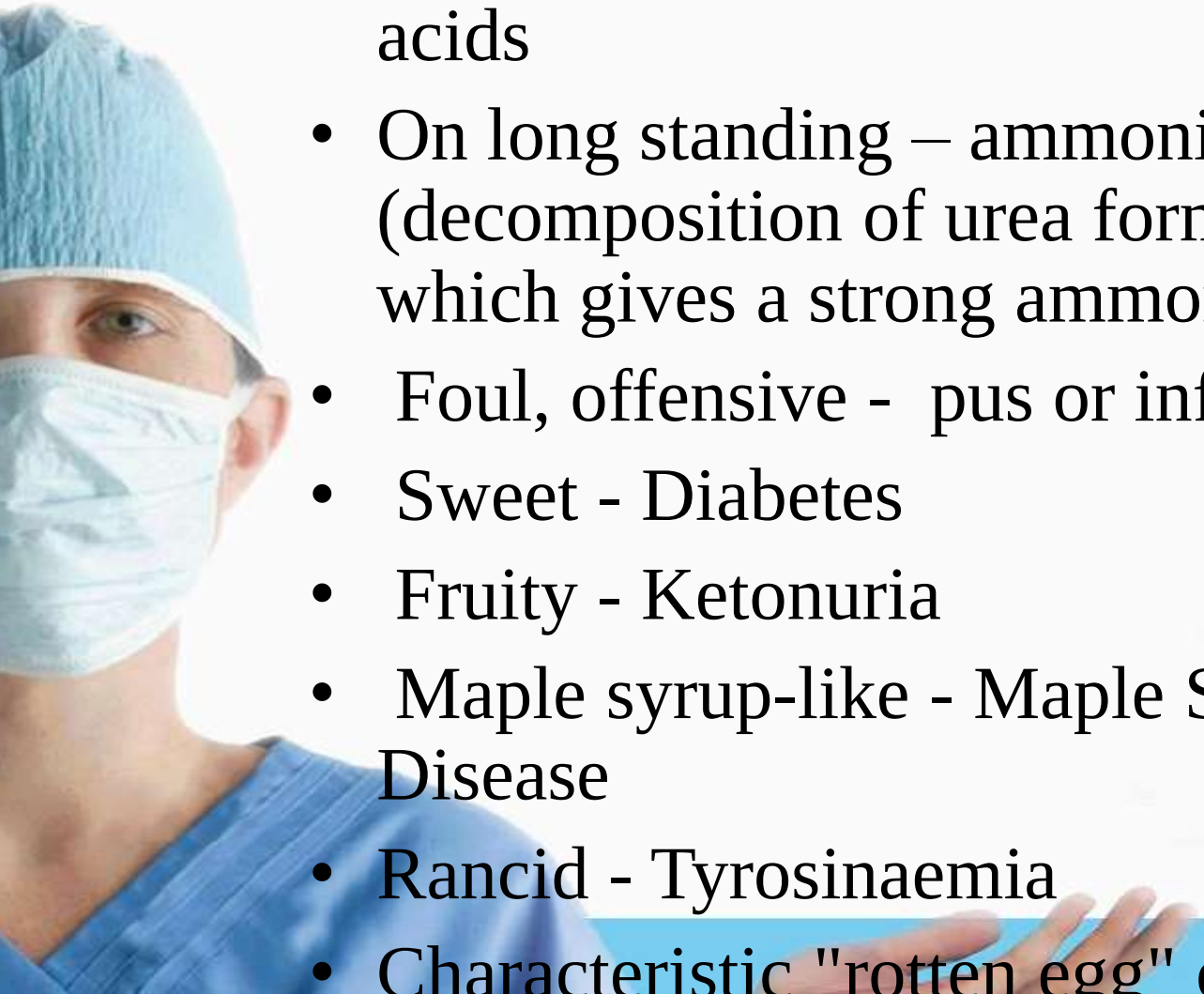
excess bile pigments, jaundice

Blue Green	Pink-Orange-Red	Red-brown-black
Methylene Blue	Haemoglobin	Haemoglobin
Pseudomonas	Myoglobin	Myoglobin
Riboflavin	Phenolpthalein	Red blood cells
	Porphyrins	Homogentisic Acid
	Rifampicin	L -DOPA
		Melanin
		Methyldopa

Physical examination continued…

Odour

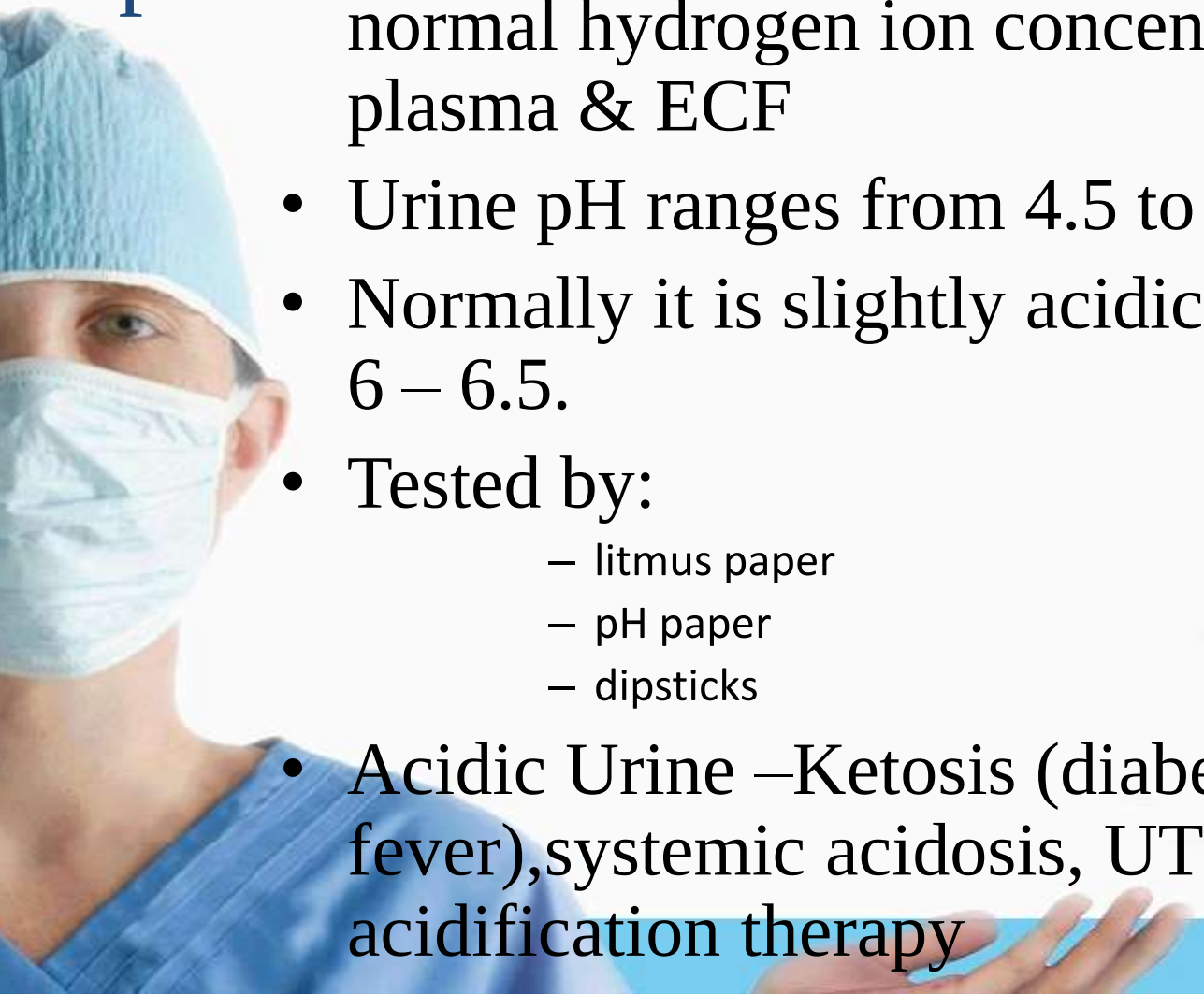
- Normal - aromatic due to the volatile fatty acids
- On long standing – ammonical (decomposition of urea forming ammonia which gives a strong ammonical smell)
- Foul, offensive - pus or inflammation
- Sweet - Diabetes
- Fruity - Ketonuria
- Maple syrup-like - Maple Syrup Urine Disease
- Rancid - Tyrosinaemia
- Characteristic "rotten egg" odor -



Physical examination continued…

pH

- Reflects ability of kidney to maintain normal hydrogen ion concentration in plasma & ECF
- Urine pH ranges from 4.5 to 8
- Normally it is slightly acidic lying between 6 – 6.5.
- Tested by:
  - litmus paper
  - pH paper
  - dipsticks
- Acidic Urine –Ketosis (diabetes, starvation, fever),systemic acidosis, UTI- E.coli, acidification therapy



Physical examination continued…

Specific gravity

- It is measurement of urine density which reflects the ability of the kidney to concentrate or dilute the urine relative to the plasma from which it is filtered.
- Measured by:
  - urinometer
  - refractometer
  - dipsticks

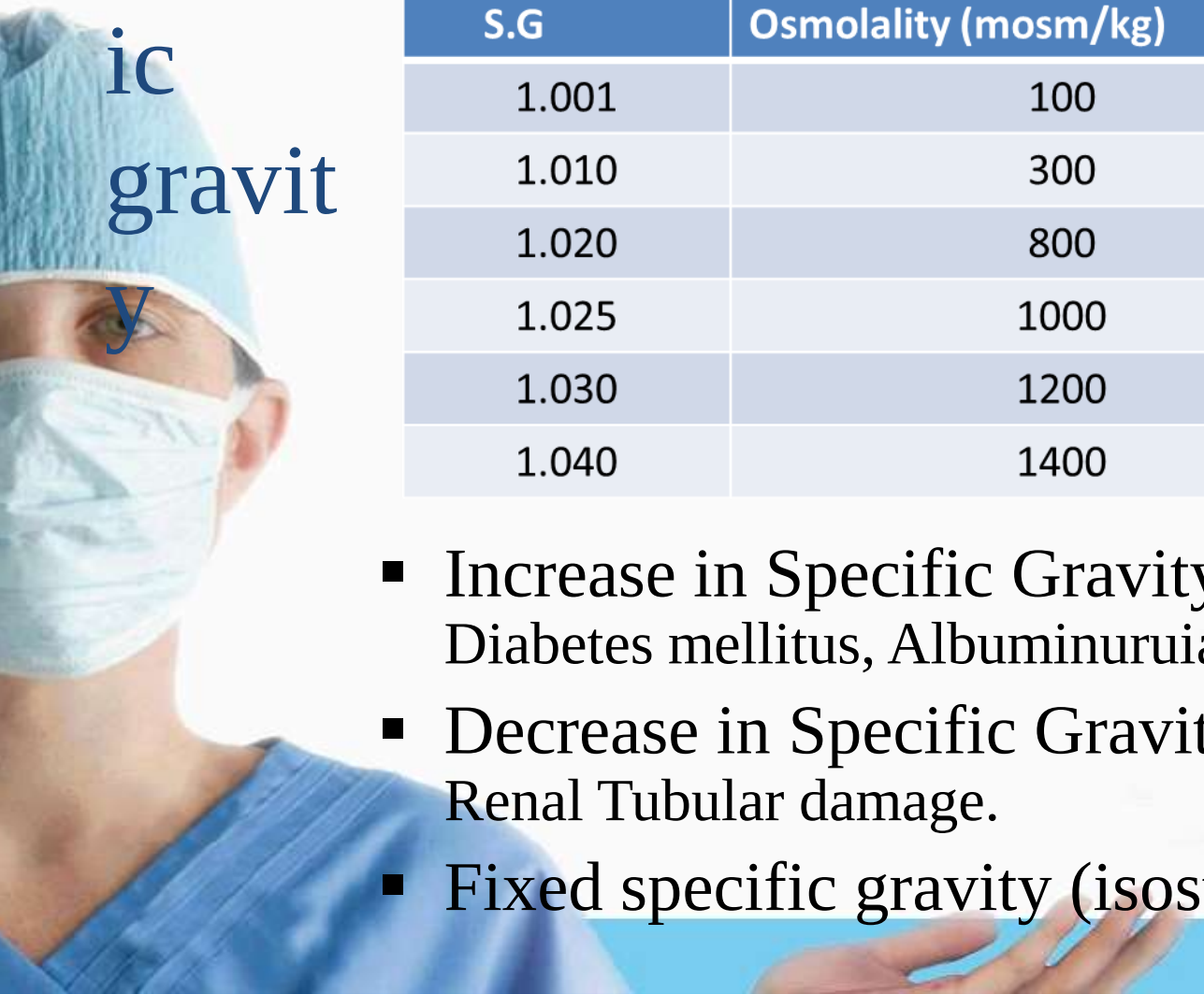
Physical examination continued…

Specific gravity

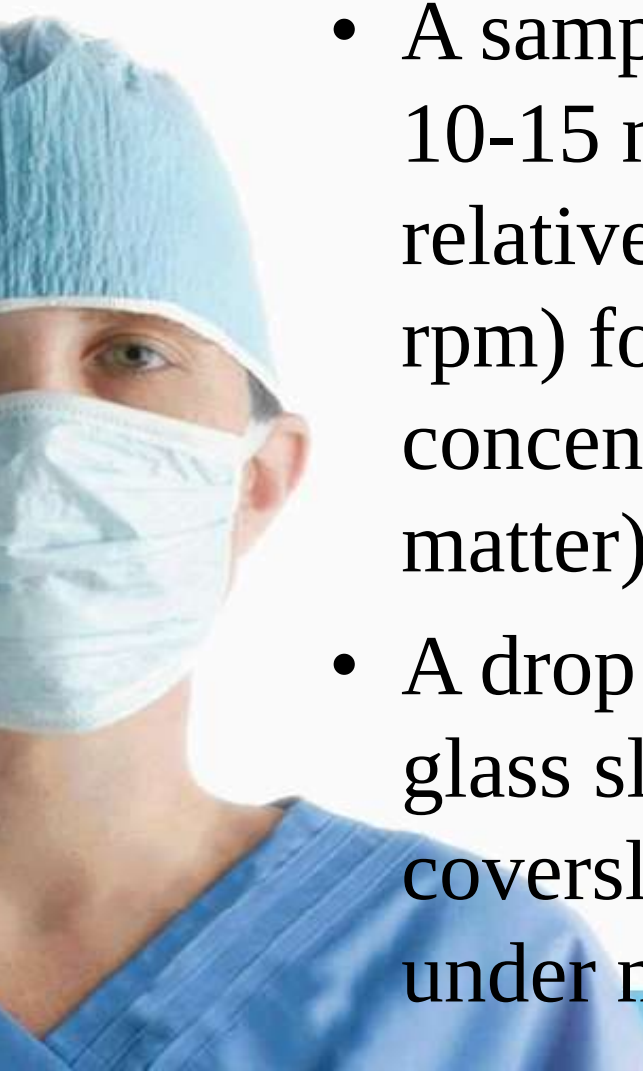
- Normal :- 1.001- 1.040.

S.G	Osmolality (mosm/kg)
1.001	100
1.010	300
1.020	800
1.025	1000
1.030	1200
1.040	1400

- Increase in Specific Gravity - Low water intake, Diabetes mellitus, Albuminuruia, Acute nephritis.
- Decrease in Specific Gravity - Absence of ADH, Renal Tubular damage.
- Fixed specific gravity (isosthenuria)=1.010



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 ond observed under microscope

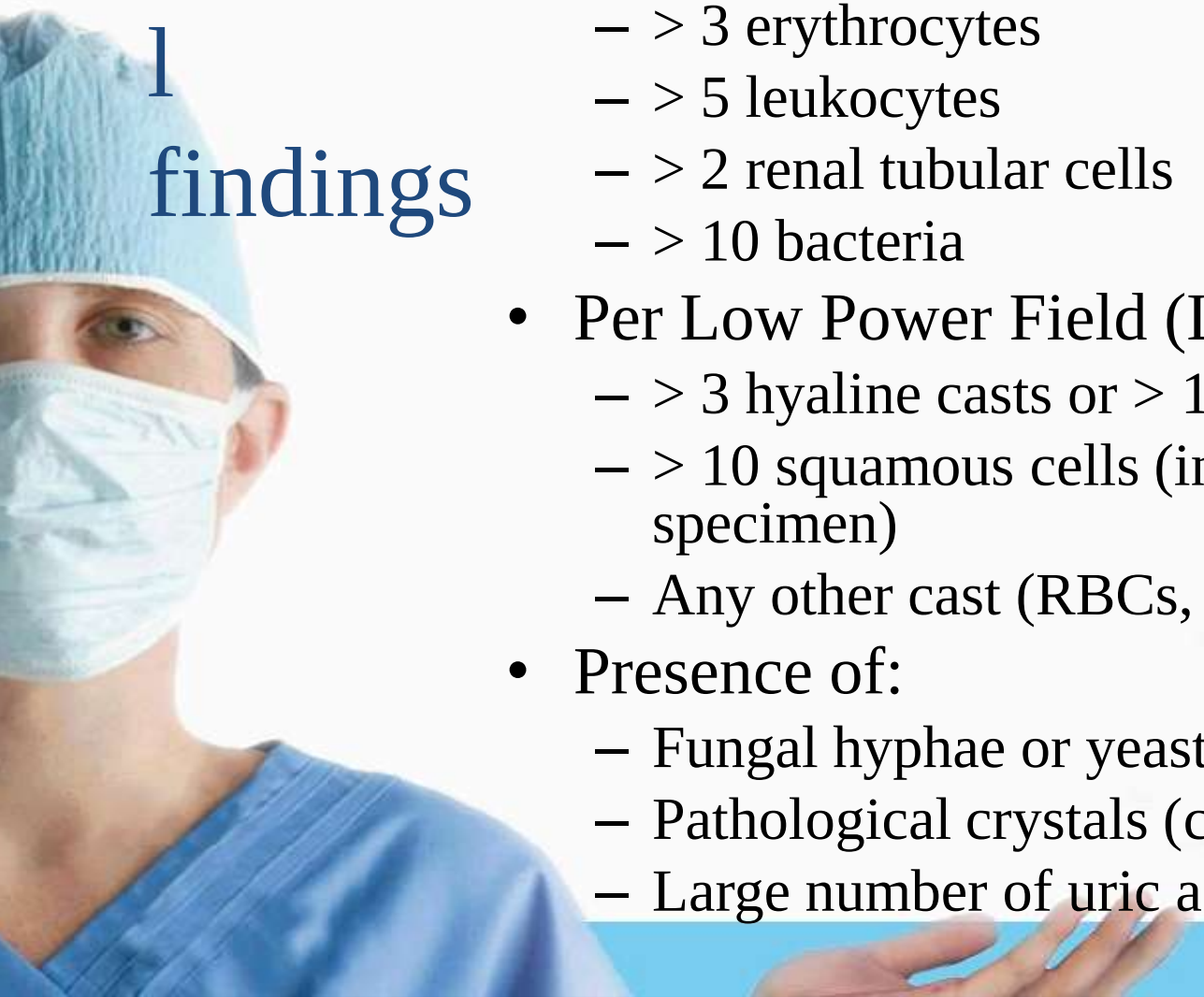
Microscopic examination of urine

- 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

Microscopic examination of urine

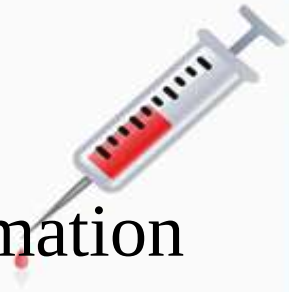
Abnormal findings

- Per High Power Field (HPF) (400x)
  - > 3 erythrocytes
  - > 5 leukocytes
  - > 2 renal tubular cells
  - > 10 bacteria
- Per Low Power Field (LPF) (200x)
  - > 3 hyaline casts or > 1 granular cast
  - > 10 squamous cells (indicative of contaminated specimen)
  - Any other cast (RBCs, WBCs)
- Presence of:
  - Fungal hyphae or yeast, parasite, viral inclusion
  - Pathological crystals (cystine, leucine, tyrosine)
  - Large number of uric acid or calcium oxalate cr

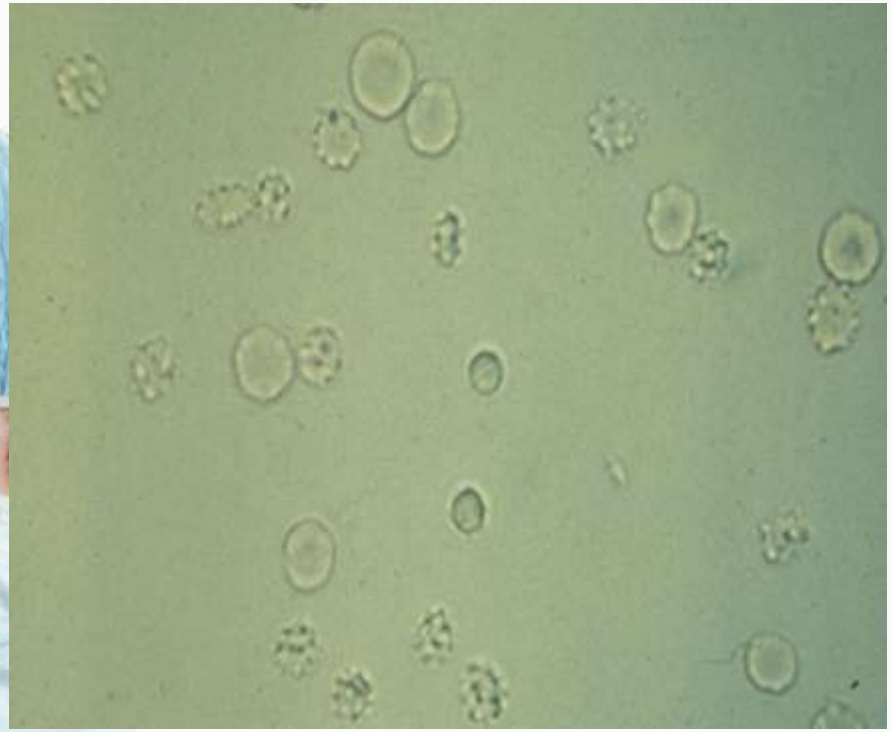


Microscopic examination of urine

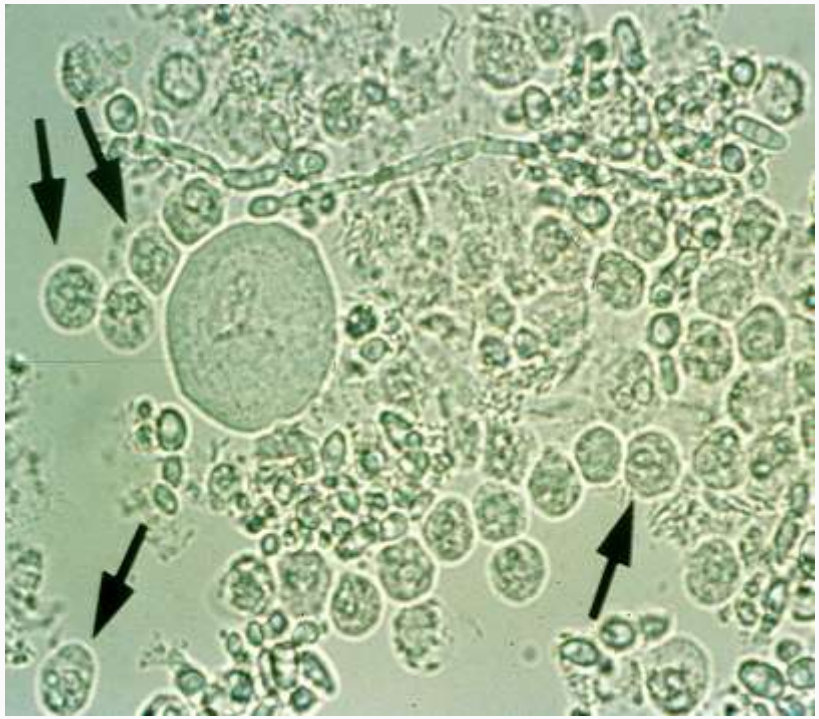
- Hematuria is the presence of abnormal numbers of red cells in urine due to any of several possible causes.
  - glomerular damage,
  - tumors which erode the urinary tract anywhere along its length,
  - kidney trauma,
  - urinary tract stones,
  - acute tubular necrosis,
  - upper and lower urinary tract infections,
  - nephrotoxins
- WBC in high numbers indicate inflammation or infection somewhere along the urinary or genital tract.



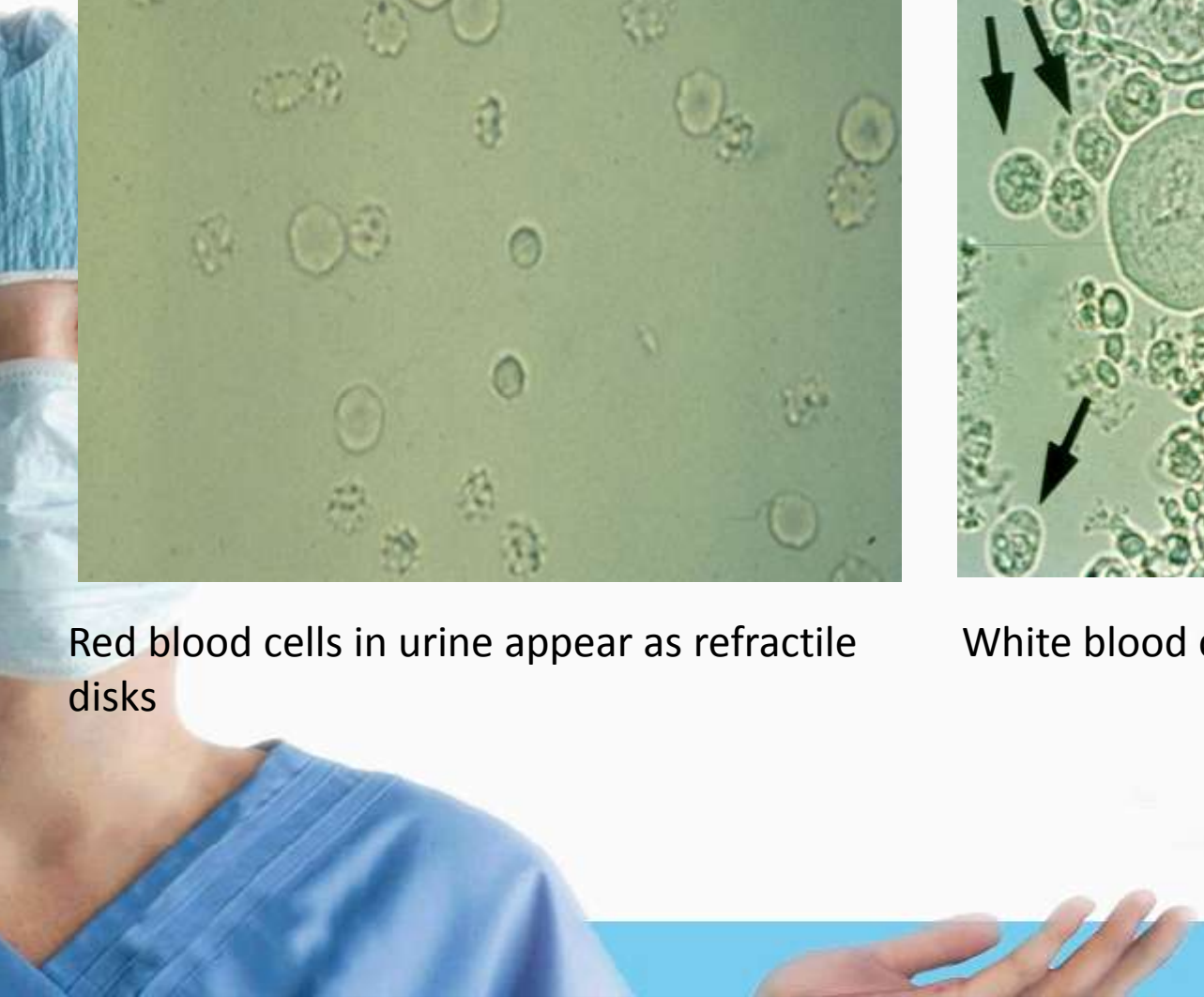
Microscopic examination of urine



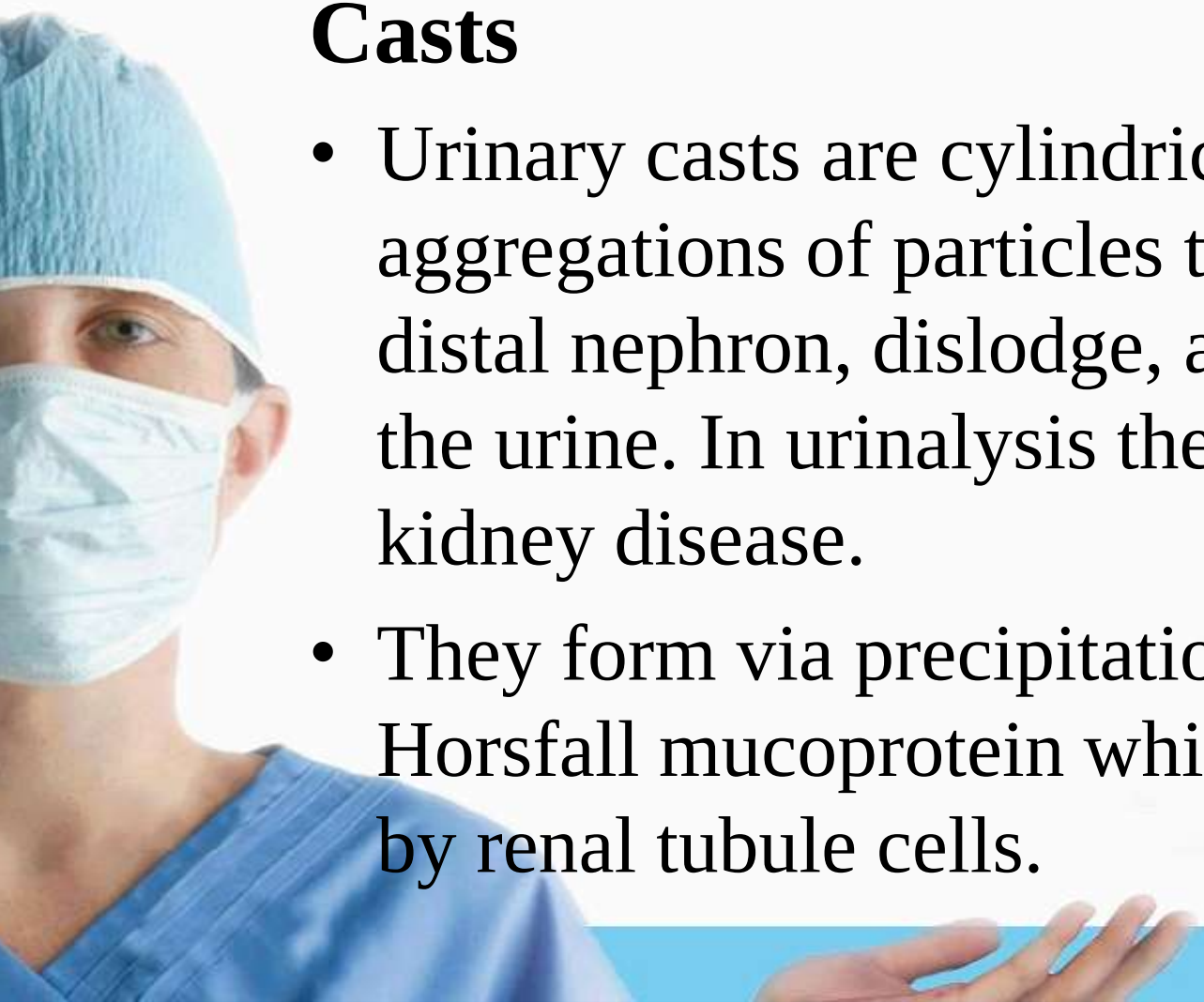
Red blood cells in urine appear as refractile disks



White blood cells in urine



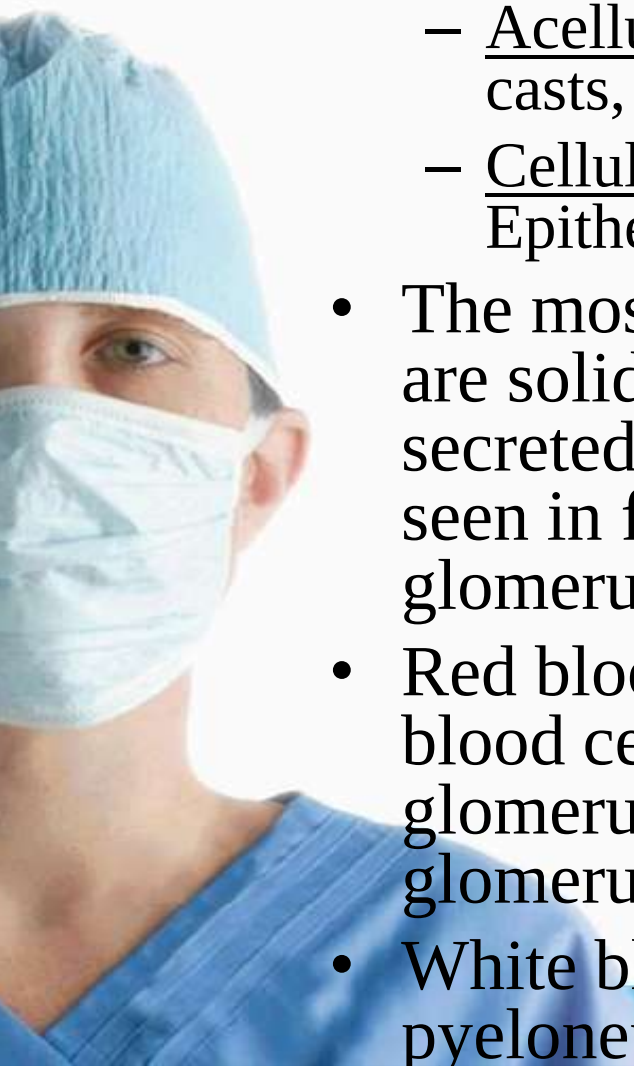
Microscopic examination of urine



Casts

- Urinary casts are cylindrical aggregations of particles that form in the distal nephron, dislodge, and pass into the urine. In urinalysis they indicate kidney disease.
- They form via precipitation of Tamm-Horsfall mucoprotein which is secreted by renal tubule cells.

Microscopic examination of urine

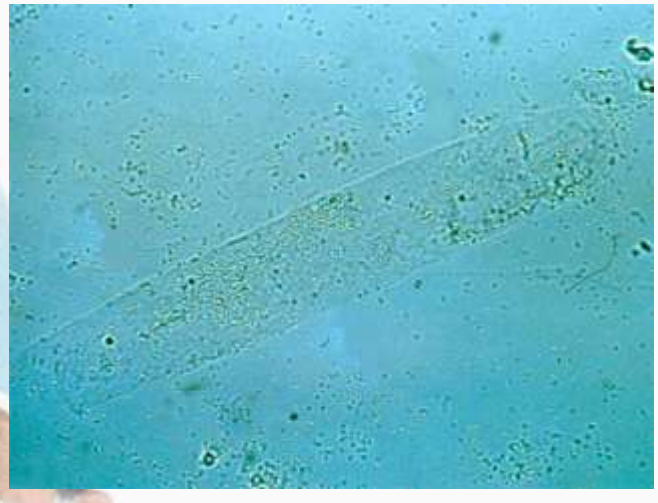


Types of cast seen :

- Acellular cast: Hyaline casts, Granular casts, Waxy casts, Fatty casts, Pigment casts, Crystal casts.
- Cellular cast: Red cell casts, White cell casts, Epithelial cell cast

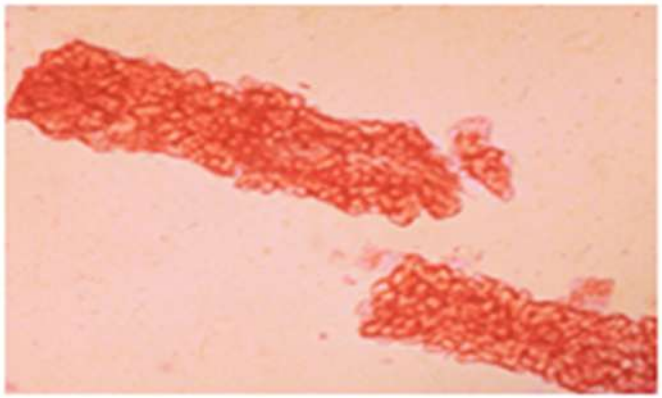
- The most common type of cast- hyaline casts are solidified Tamm-Horsfall mucoprotein secreted from the tubular epithelial cells and seen in fever, strenuous exercise, damage to the glomerular capillary.
- Red blood cells may stick together and form red blood cell casts. Such casts are indicative of glomerulonephritis, with leakage of RBC's from glomeruli, or severe tubular damage
- White blood cell casts are most typical for acute pyelonephritis, but they may also be present

Microscopic examination of urine

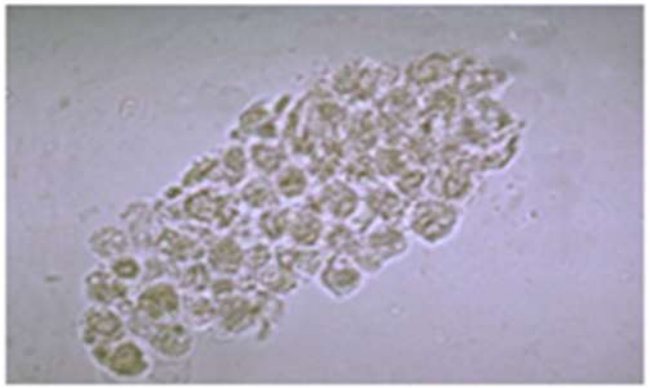


Hyaline Cast

Granular Cast

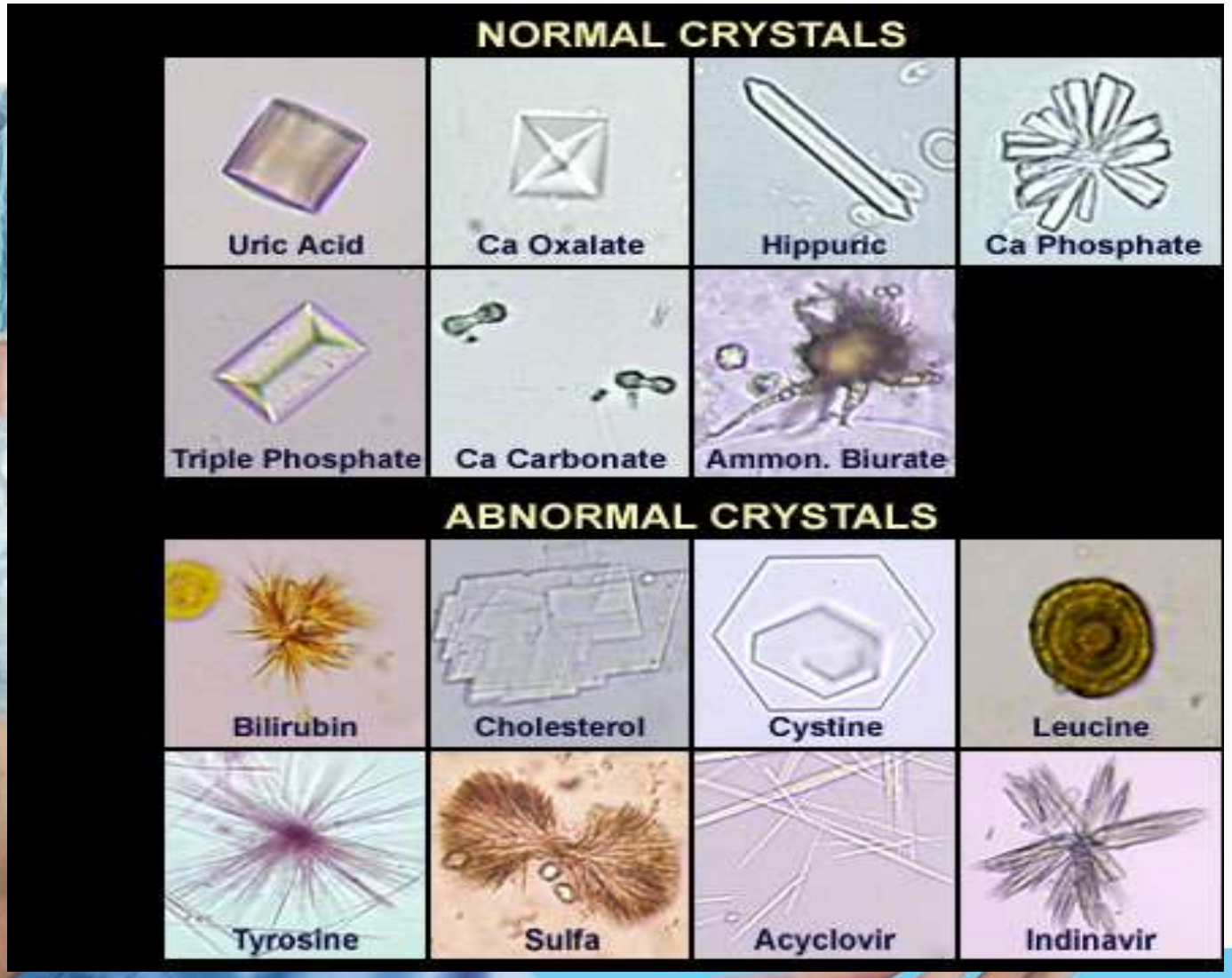


Red blood cell cast in urine



White blood cell cast in urine

Microscopic examination of urine



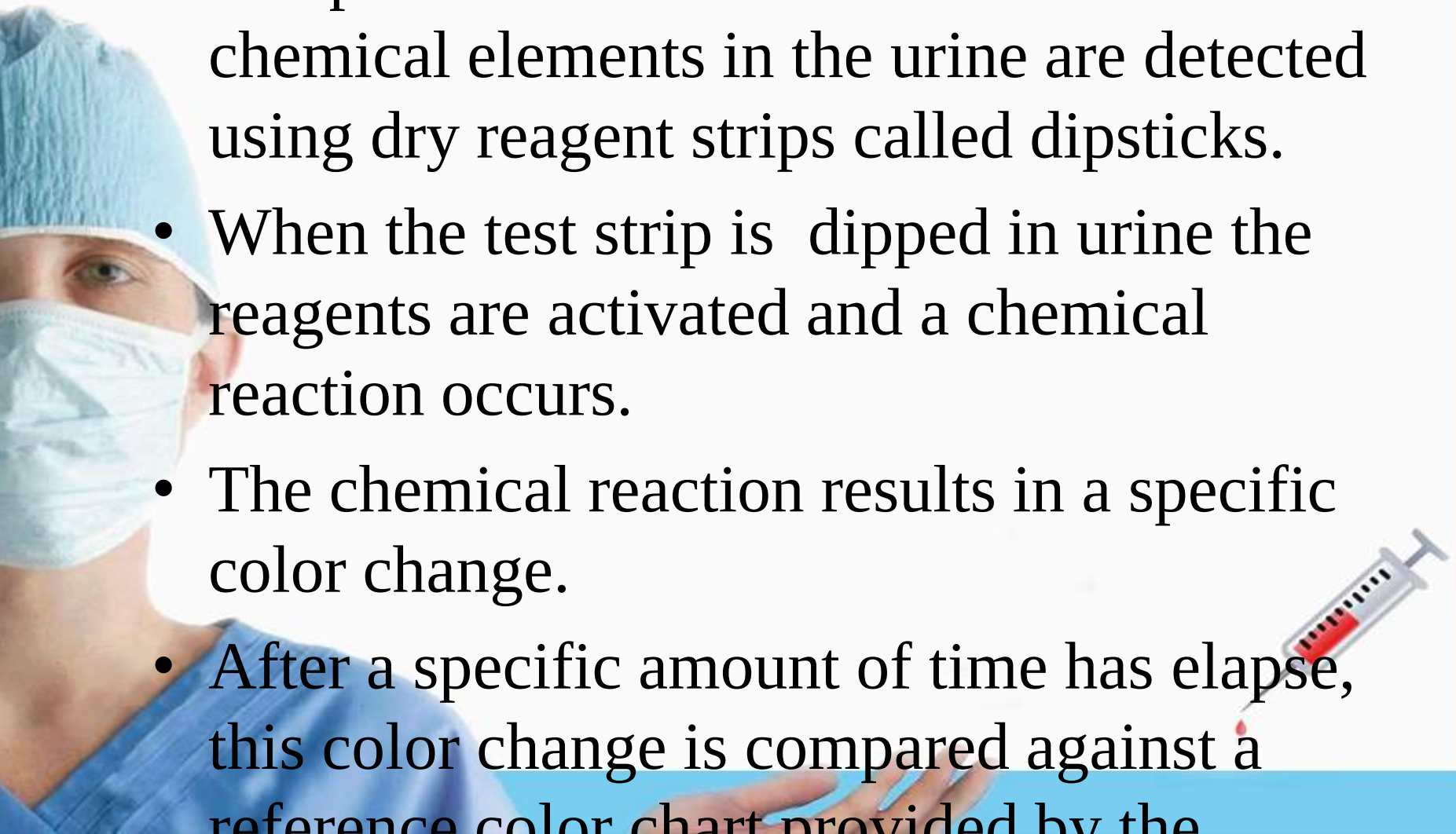
A variety of normal and abnormal crystals may be present in the urine sediment

Chemical analysis of urine

- The chemical analysis of urine us undertaken to evaluate the levels of the following componen:
  - Protein
  - Glucose
  - Ketones
  - Occult blood
  - Bilirubin
  - Urobilinogen
  - Bile salts

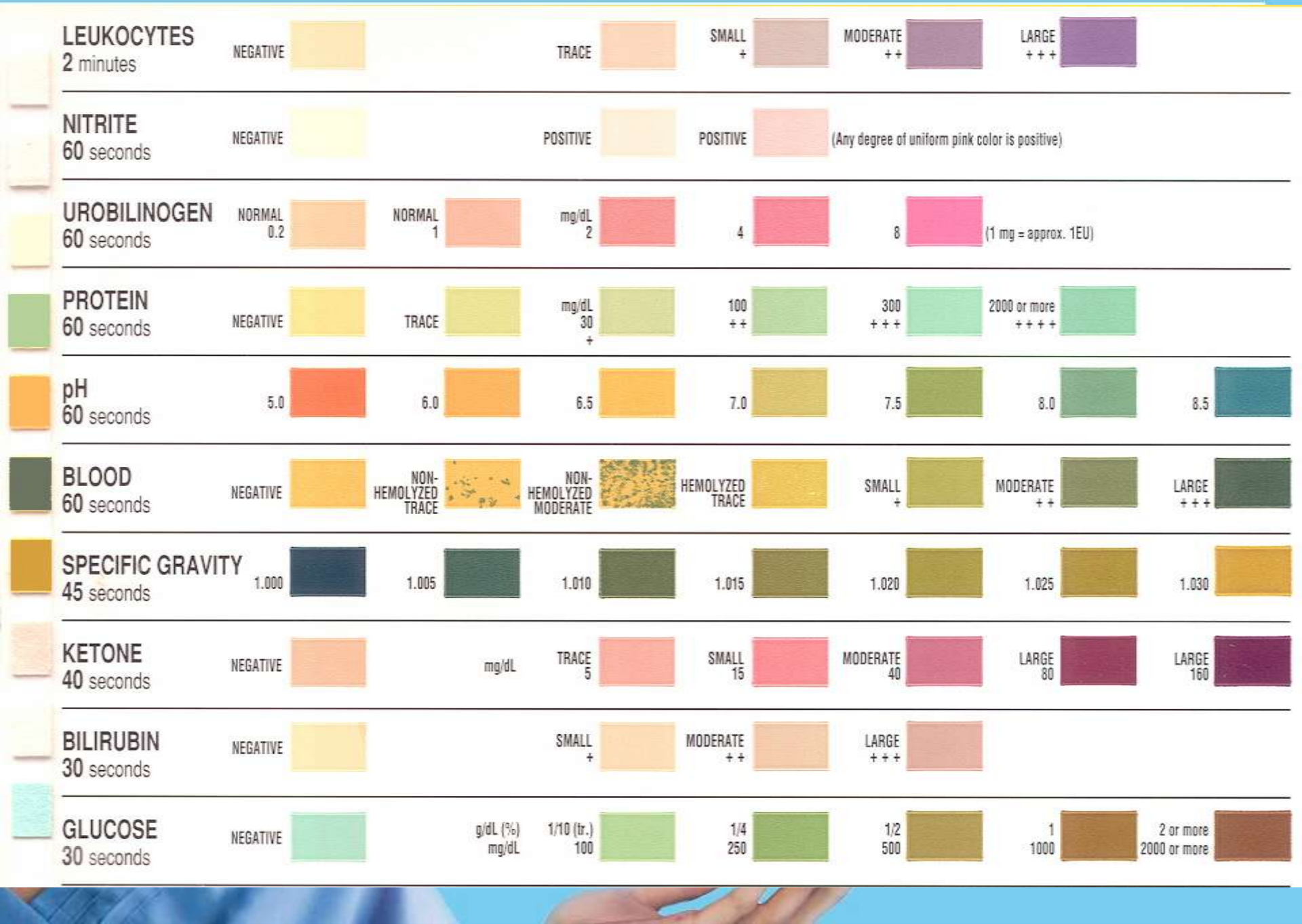
Chemical analysis of urine

- 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 by the

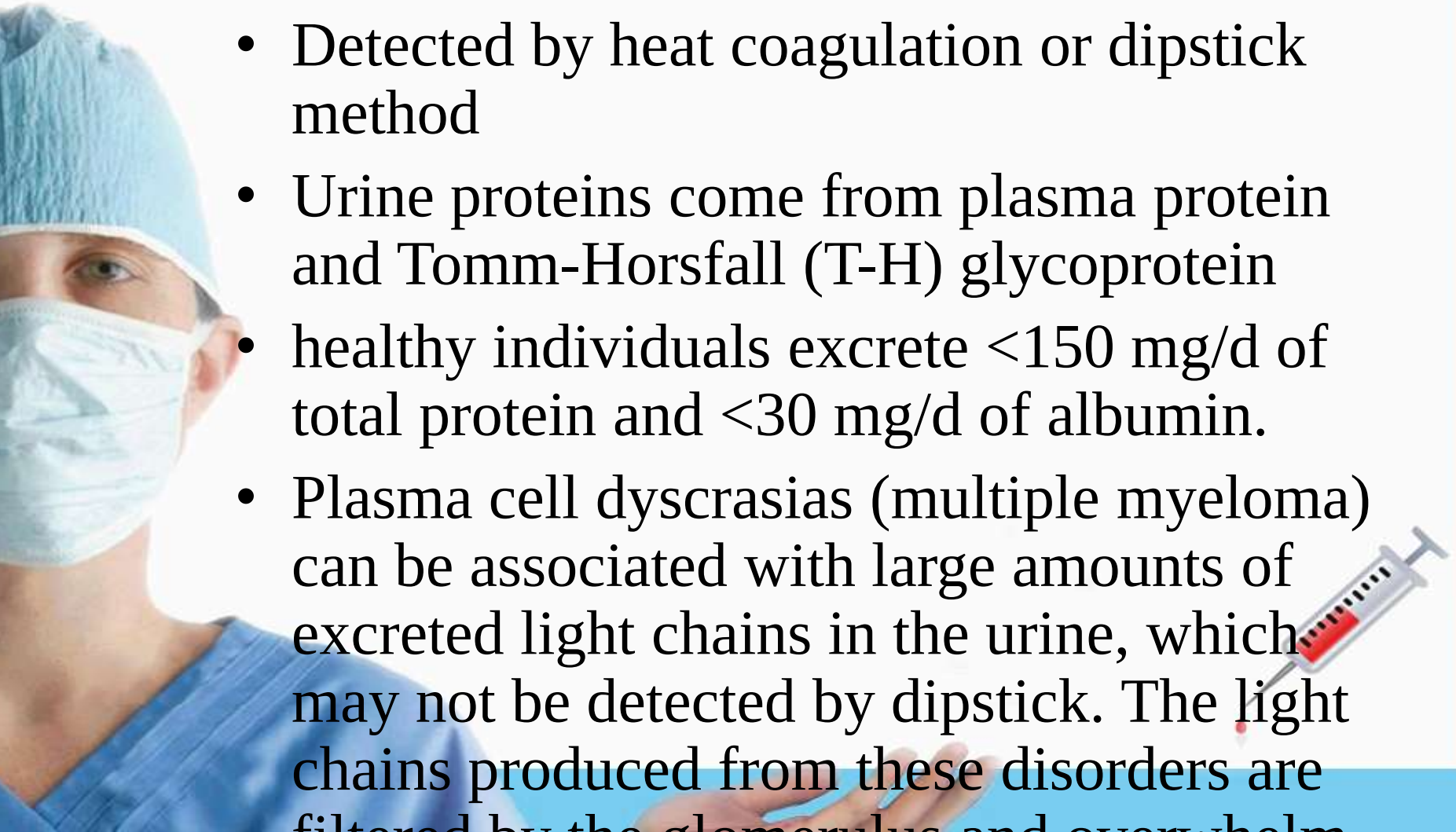


Chemical analysis of urine

The dipstick method of chemical analysis of urine


LEUKOCYTES
2 minutes
NEGATIVE
TRACE
SMALL +
MODERATE ++
LARGE +++
NITRITE
60 seconds
NEGATIVE
POSITIVE
POSITIVE
(Any degree of uniform pink color is positive)
UROBILINOGEN
60 seconds
NORMAL 0.2
NORMAL 1
mg/dL 2
4
8
(1 mg = approx. 1EU)
PROTEIN
60 seconds
NEGATIVE
TRACE
mg/dL 30 +
100 ++
300 +++
2000 or more ++++
pH
60 seconds
5.0
6.0
6.5
7.0
7.5
8.0
8.5
BLOOD
60 seconds
NEGATIVE
NON-HEMOLYZED TRACE
NON-HEMOLYZED MODERATE
HEMOLYZED TRACE
SMALL +
MODERATE ++
LARGE +++
SPECIFIC GRAVITY
45 seconds
1.000
1.005
1.010
1.015
1.020
1.025
1.030
KETONE
40 seconds
NEGATIVE
mg/dL
TRACE 5
SMALL 15
MODERATE 40
LARGE 80
LARGE 160
BILIRUBIN
30 seconds
NEGATIVE
SMALL +
MODERATE ++
LARGE +++
GLUCOSE
30 seconds
NEGATIVE
g/dL (%) mg/dL
1/10 (tr.) 100
1/4 250
1/2 500
1 1000
2 or more 2000 or more

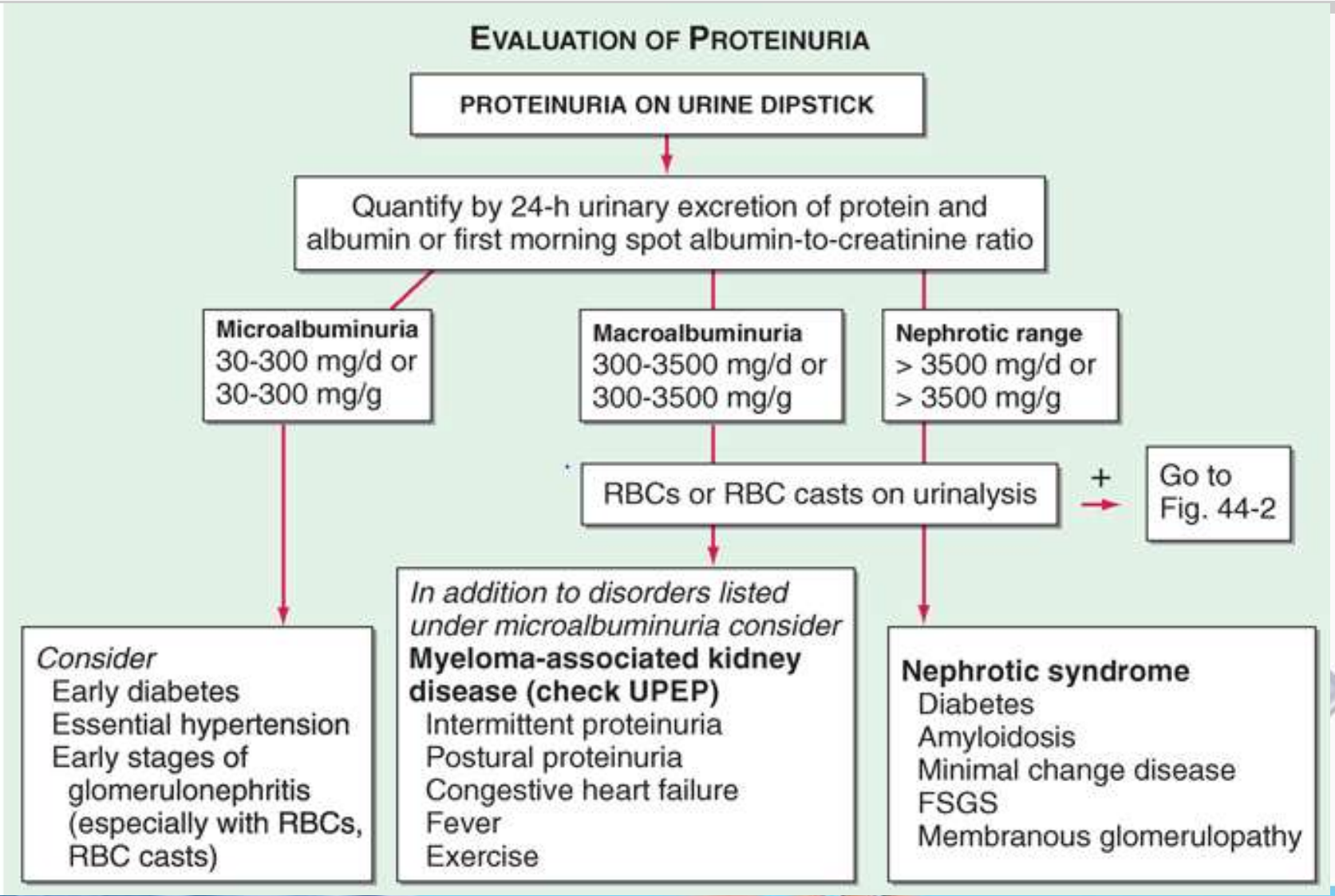
Chemical analysis of urine



Proteins in urine:

- Detected by heat coagulation or dipstick method
- Urine proteins come from plasma protein and Tomm-Horsfall (T-H) glycoprotein
- healthy individuals excrete <150 mg/d of total protein and <30 mg/d of albumin.
- Plasma cell dyscrasias (multiple myeloma) can be associated with large amounts of excreted light chains in the urine, which may not be detected by dipstick. The light chains produced from these disorders are

Chemical analysis of urine



That's all .....

Thank you!!!!