

Chapter 36

Urinary System Function, Assessment, and Therapeutic Measures

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Learning Outcomes

- Identify the normal anatomy of the urinary system.
- Describe the normal function of the urinary system.
- Discuss the effects of aging on the urinary system.
- Explain data to collect when caring for a patient with a disorder of the urinary system.

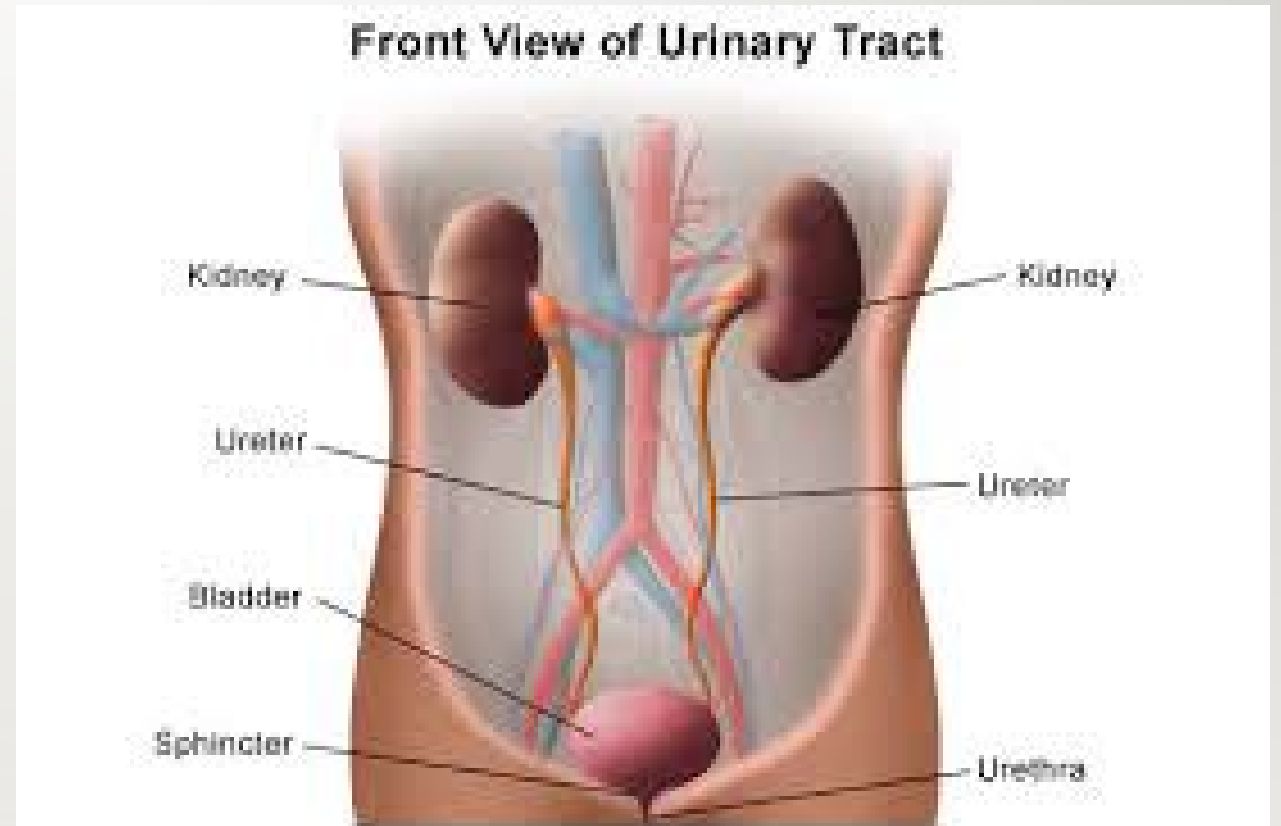


Learning Outcomes (continued)

- Plan preparation and postprocedure care for patients undergoing diagnostic tests of the urinary system.
- Plan nursing care for patients with incontinence.
- Discuss nursing actions to decrease the risk of infection in urinary catheterized patients.

Urinary Anatomy and Physiology

- Two kidneys
- Two ureters
- Urinary bladder
- Urethra



Interior of the Kidney

<https://www.youtube.com/watch?v=1DuBWFd5r2c>

The **renal cortex** forms the outer region of the kidney.

The **renal medulla** forms the inner region.

Extensions from the renal cortex, called **renal columns**, divide the interior region into cone-shaped sections.

The cone-shaped sections are called **renal pyramids**. Consisting of tubules for transporting urine away from the cortex, the base of each pyramid faces outward toward the cortex. The point of the pyramid, called the **renal papilla**, faces the hilum.

The renal papilla extends into a cup called a **minor calyx**. The calyx collects urine leaving the papilla.

Two or three minor calyces join together to form a **major calyx**.

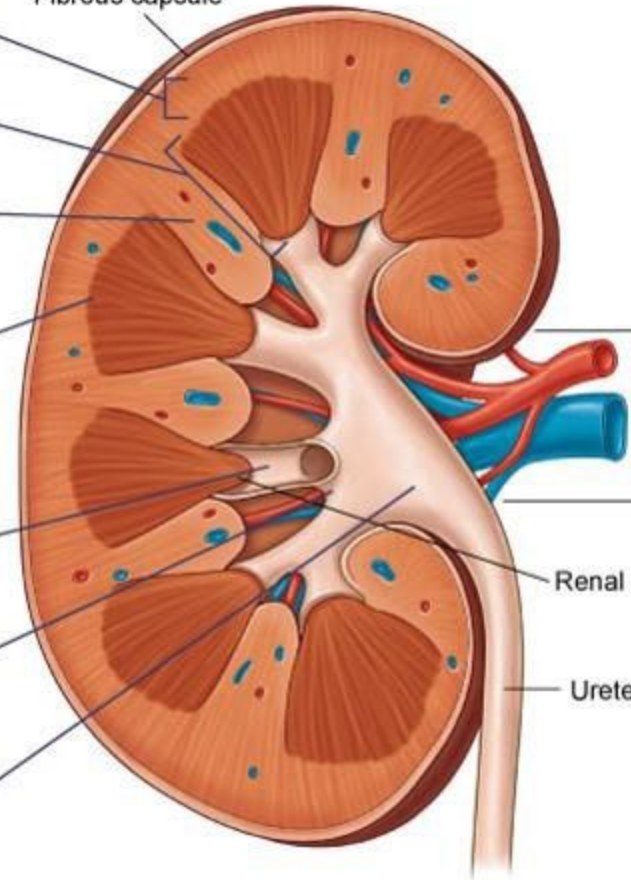
The major calyces converge to form the **renal pelvis**, which receives urine from the major calyces. The renal pelvis continues as the **ureter**, a tube-like structure that channels urine to the urinary bladder.

Fibrous capsule

Hilum

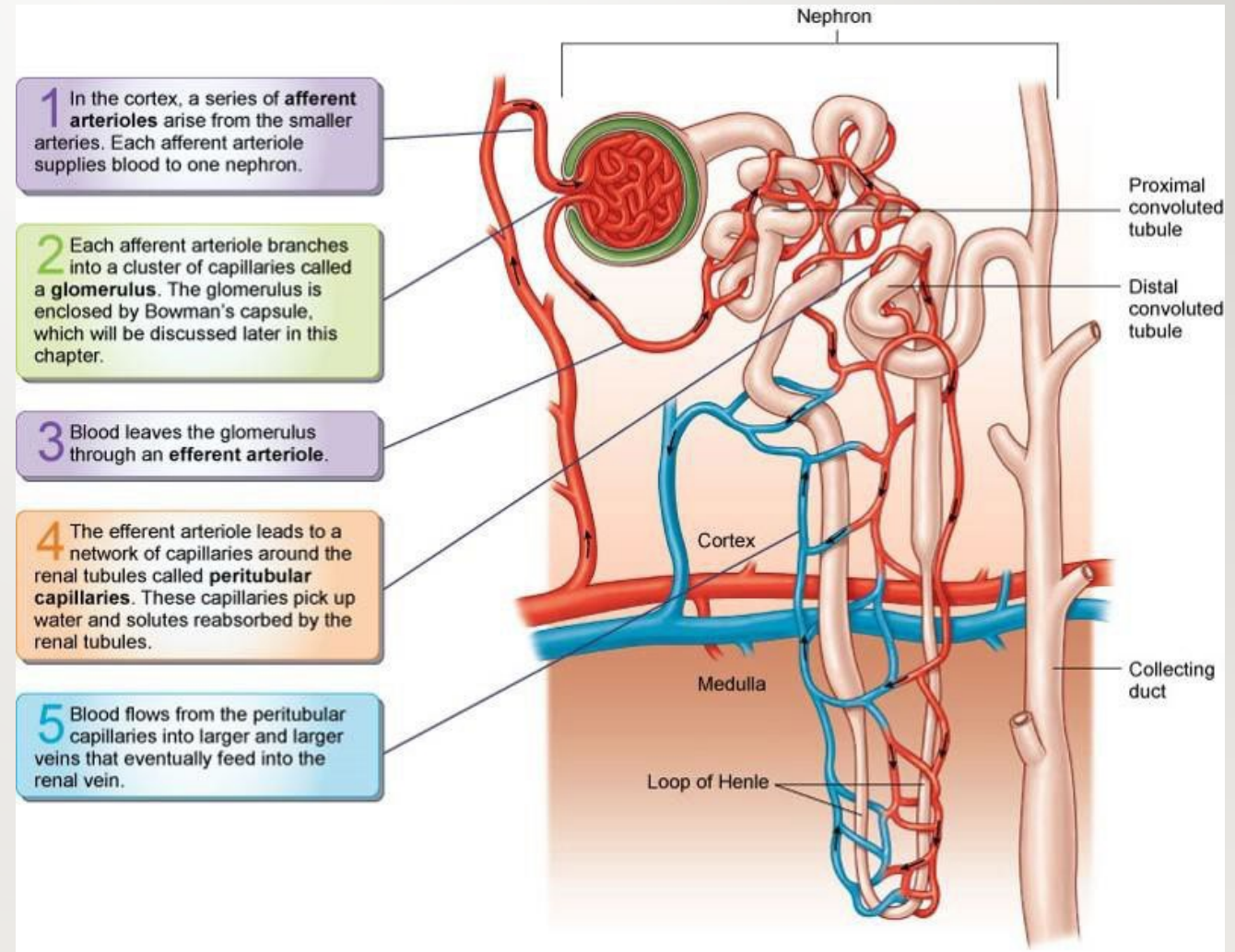
Renal papilla

Ureter



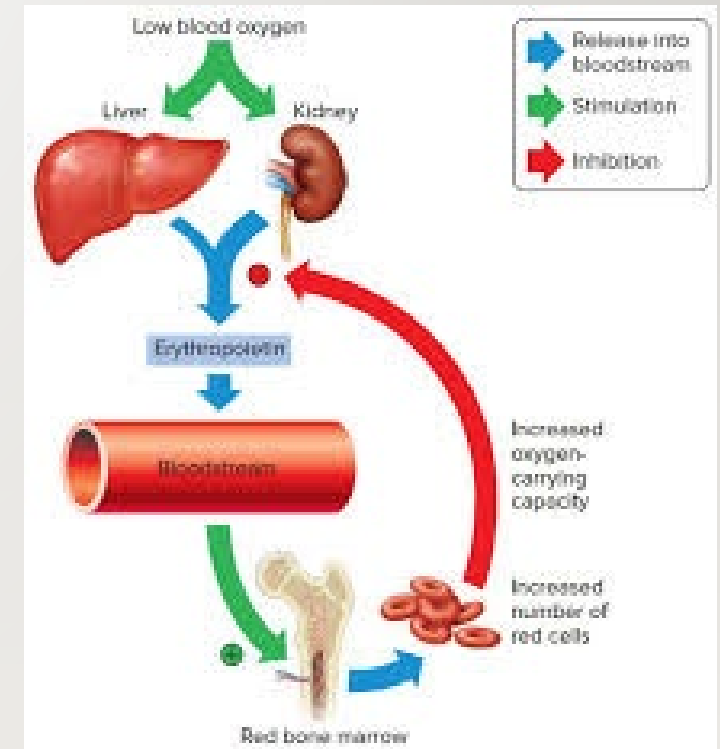
Nephron

<https://www.youtube.com/watch?v=CShAIAD-ask>



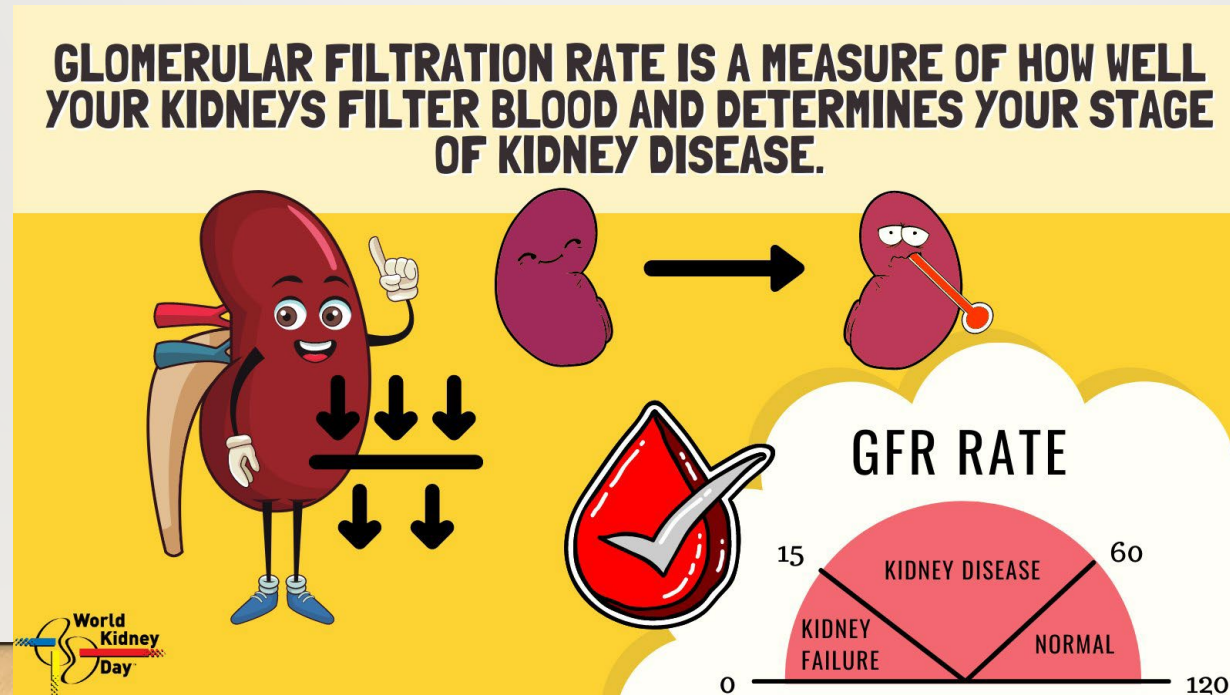
Kidney Function

- Formation of urine
- Excretion or conservation of water
- Electrolyte balance
- Acid–base balance
- Activation of vitamin D
- Production of erythropoietin
 - <https://www.youtube.com/watch?v=ZCjSGr-ywFU>
- Production of renin



Glomerular Filtration Rate

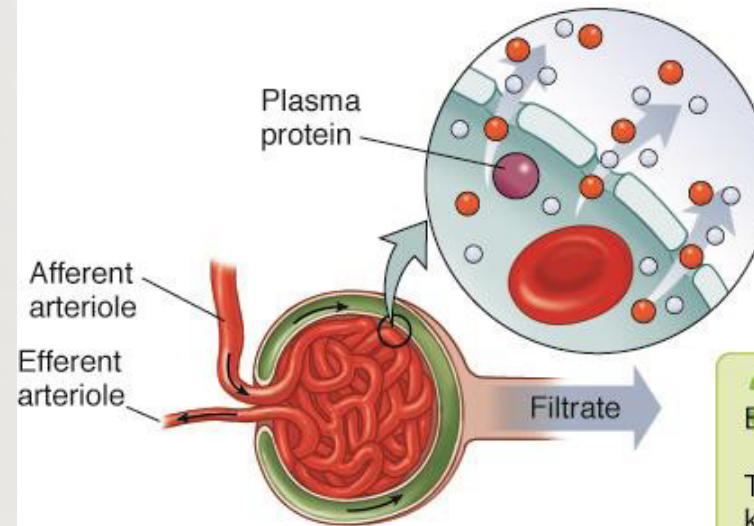
- Renal filtrate the kidneys form in 1 minute
- Averages 100 to 125 milliliter per minute



Glomerular Filtration

1 Blood flows into the glomerulus through the afferent arteriole, which is much larger than the efferent arteriole. Consequently, blood flows in faster than it can leave, which contributes to higher pressure within the glomerular capillaries.

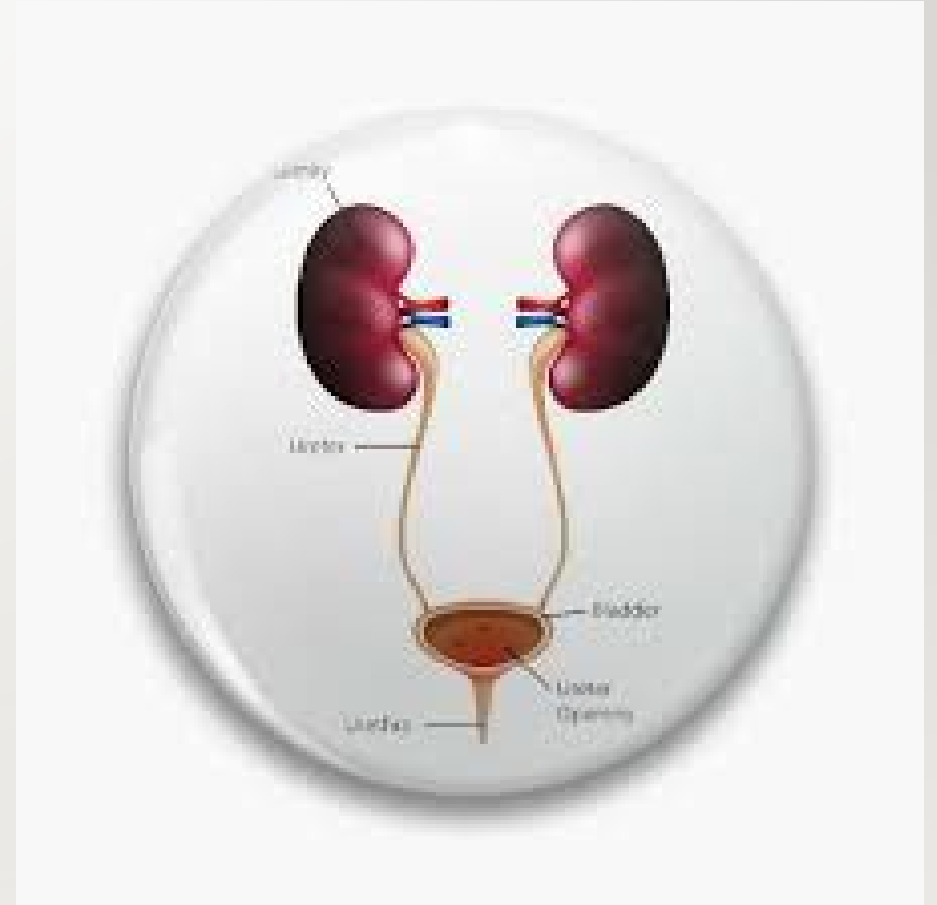
2 The walls of glomerular capillaries are dotted with pores, allowing water and small solutes (such as electrolytes, glucose, amino acids, vitamins, and nitrogenous wastes) to filter out of the blood and into Bowman's capsule. Blood cells and most plasma proteins, however, are too large to pass through the pores.



3 The fluid that has filtered into Bowman's capsule flows into the renal tubules. The amount of fluid filtered by both kidneys—called the **glomerular filtration rate (GFR)**—equals about 180 liters each day, which is 60 times more than the body's total blood volume. The body reabsorbs about 99% of this filtrate, leaving 1 to 2

Ureters, Urinary Bladder, and Urethra

- Ureters
 - Carry urine from kidneys to bladder
- Bladder
 - Temporary storage of urine and its elimination
- Urethra
 - Carries urine from bladder to exterior



Normal Urine Characteristics

■ Amount

- 1,000 to 2,000 milliliter per 24 hours

■ Color

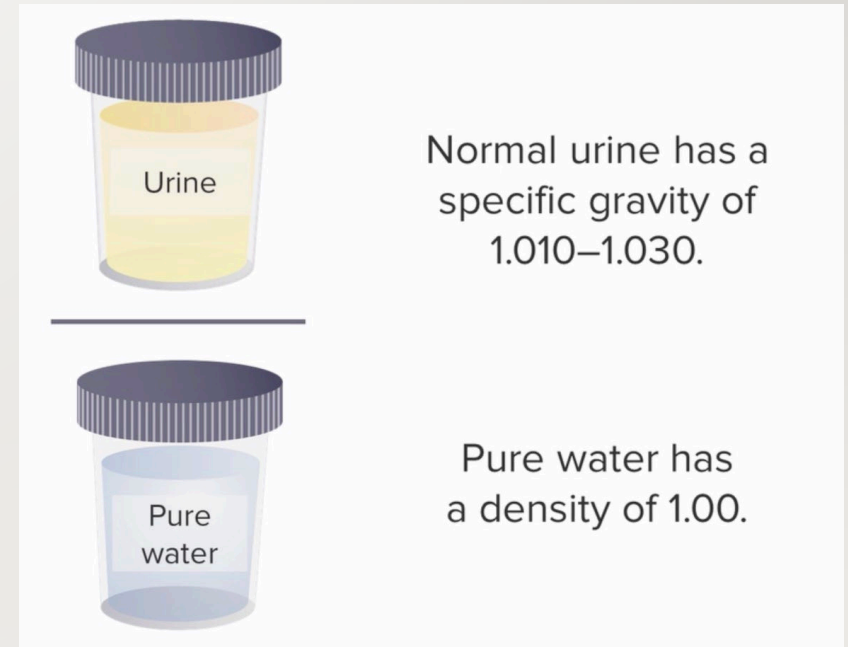
- Pale yellow to amber

■ Appearance

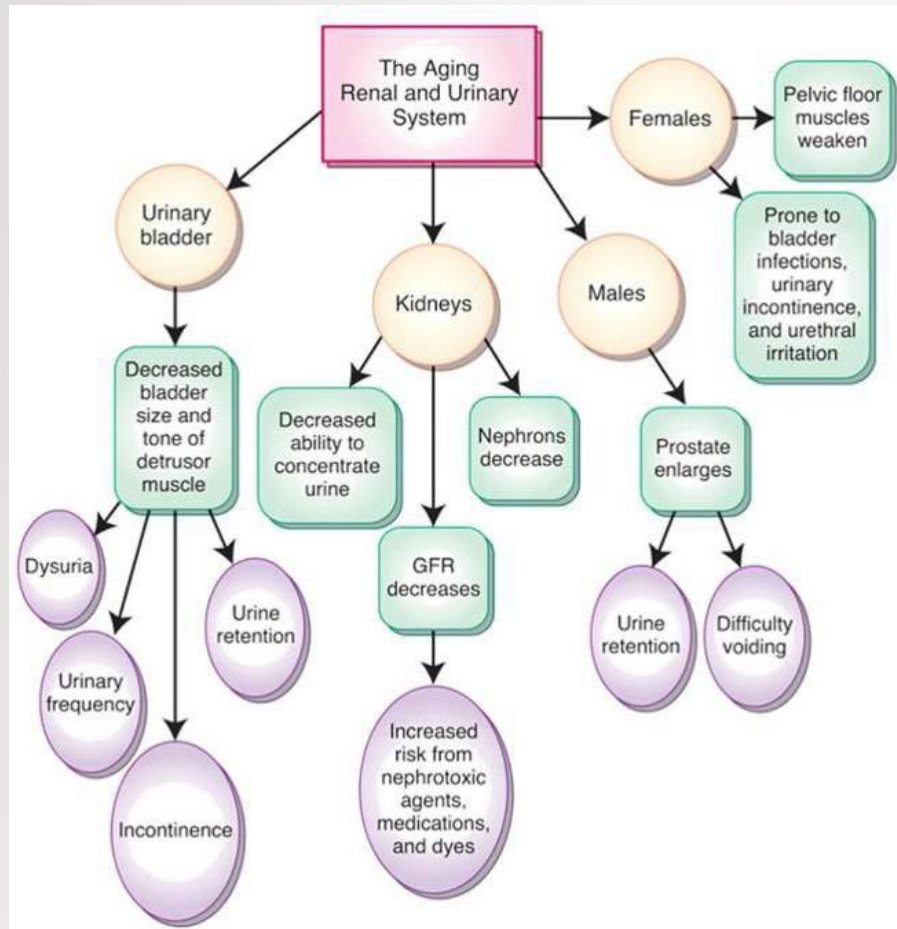
- Clear

■ Specific gravity: 1.005 to 1.030

- Lower = dilute
- Higher = concentrated



Aging and the Urinary System



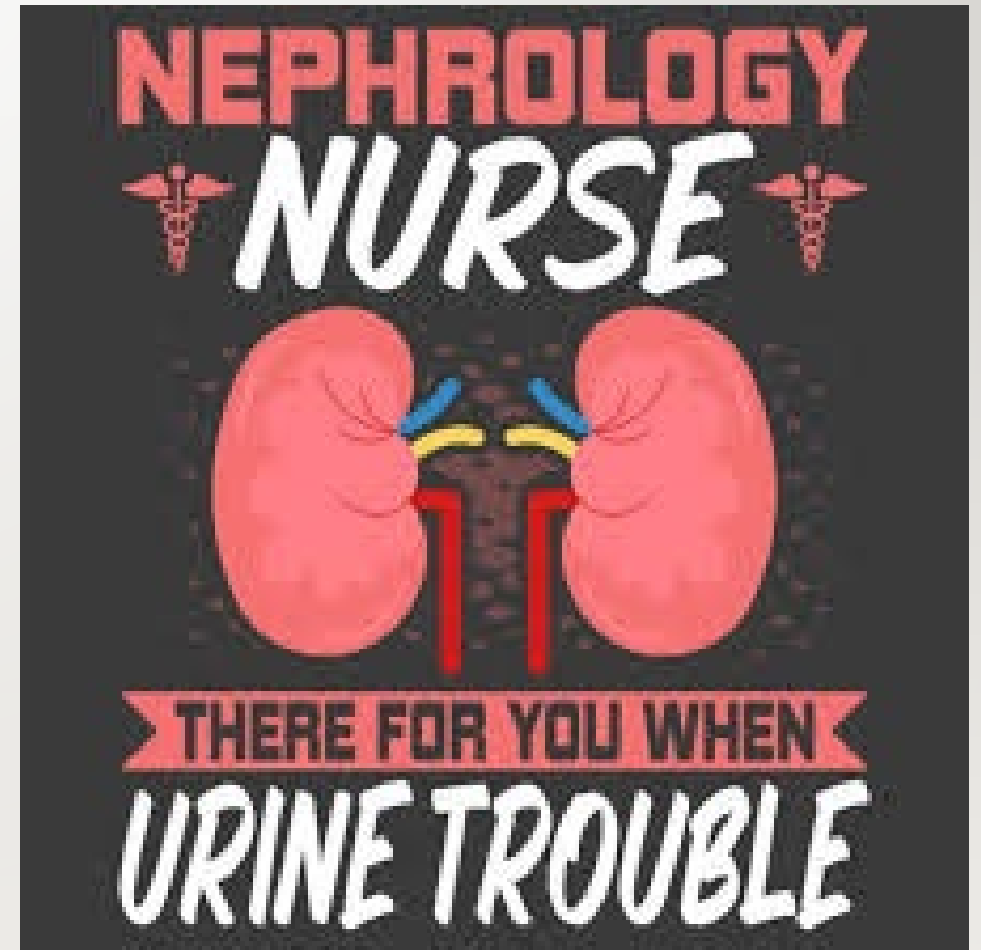
Aging and the Urinary System (continued)

- Renal mass smaller
- Renal flow decreased 50%
- Decreased tubular function
- Bladder muscles weaken
- Bladder capacity decreases
- Voiding reflex delayed



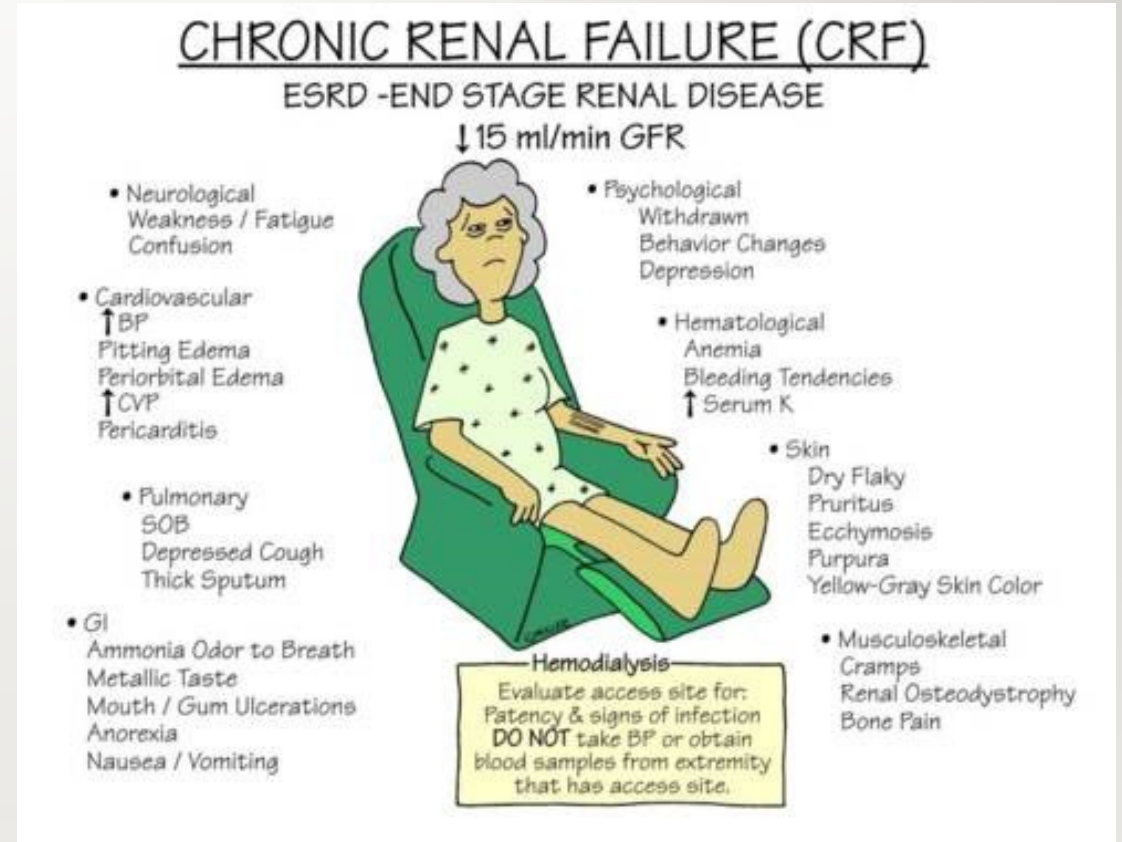
Nursing Assessment

- Kidney disease can affect every body system.
- Health history
- Pain in the flank area
- Burning with voiding
- New onset edema, shortness of breath, weight gain
- Fluid intake
- Functional ability



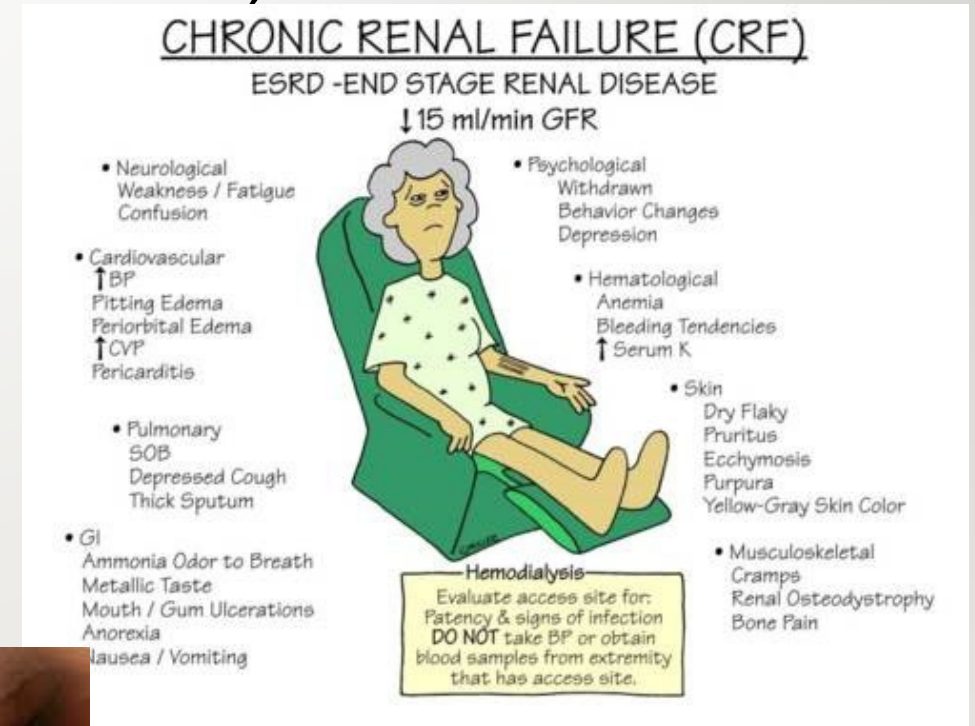
Physical Assessment

- Vital signs
 - High blood pressure occurs with kidney disease
- Lung sounds
 - Crackles indicate fluid overload
- Edema
 - Indicates fluid overload



Physical Assessment (continued)

- Daily weights
 - Best indicator of fluid balance
- Intake and output
 - Medication and fluid orders depend upon the accuracy of measurement
- Skin
 - Yellow or gray cast
 - **Uremic frost**



Laboratory Tests

■ Urinalysis

- First morning specimen best (unless for cytology)
 - Overnight cell changes can affect the accuracy of the cytology analysis
- Voided or sterile catheter specimen
- 10 milliliter of urine collected
- Examine within 1 hour or refrigerate
- Random specimens collected for cytology



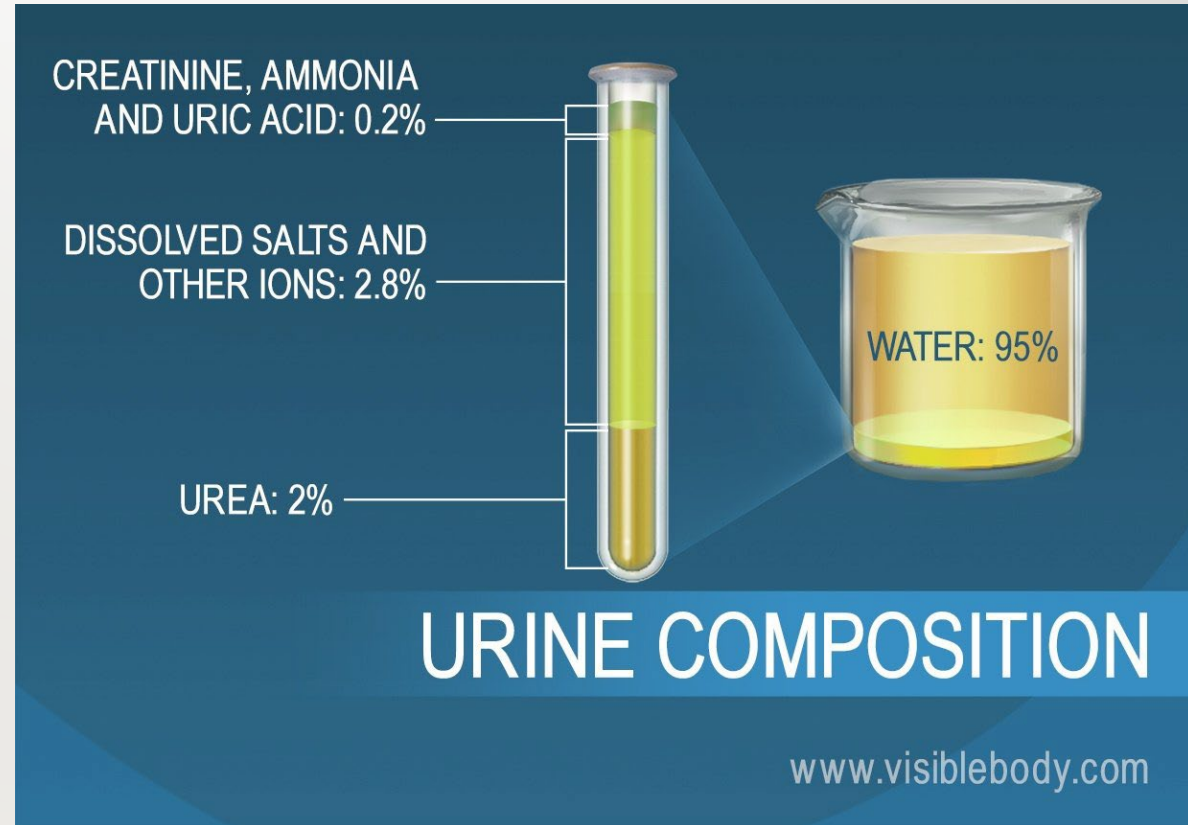
Normal Urine Characteristics (continued)

■ pH

- 4.5 to 8.0

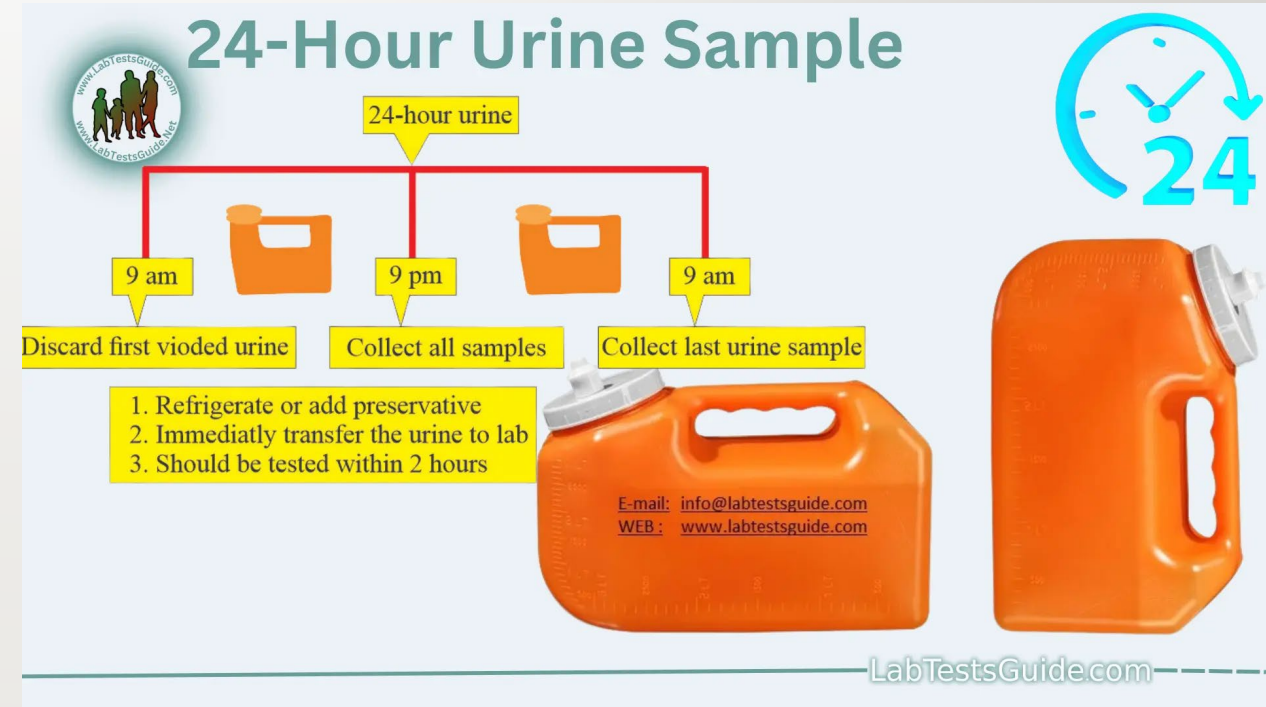
■ Constituents

- 95% water
- Waste products: Urea, creatinine, uric acid



Laboratory Tests (continued_1)

- Composite urine specimen: 24-hour urine
 - Patient instructed to void and discard urine
 - Time recorded as the start time of test
 - Exactly at 24 hours, patient instructed to void
 - Urine added to collection device and test ends
 - Incomplete urine collection cause inaccurate results



Laboratory Tests (continued_2)

■ Urine culture

- Identifies organisms present
 - Often bacteria
- Urine specimen collected before antibiotic given
- Sensitivity test identifies antibiotic that will destroy bacteria

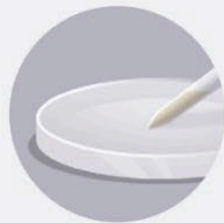
Process



Client provides a clean catch urine sample.



Sample is sent to the lab.



Lab technician applies urine to a plate w/ an inoculating loop.



Microorganisms grow for 24–48 hours.



Urine culture results are read as positive or negative.



If culture is positive, sensitivity testing may be completed.

Laboratory Tests (continued_3)

- Renal function tests

- Serum creatinine
- Blood urea nitrogen
- Serum uric acid
- Creatinine clearance test
- Glomerular filtration rate

<https://www.youtube.com/watch?v=zVXY7xLwNJQ>

