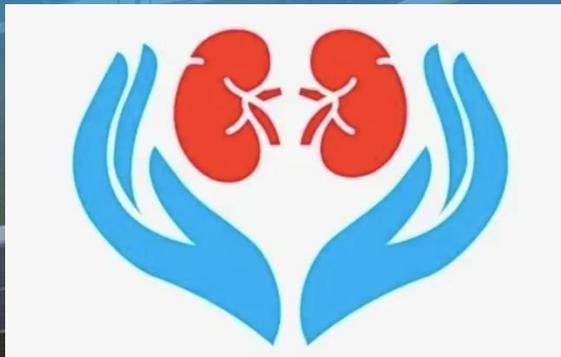




IT'S ALL ABOUT THE BEANS!

Sangeetha Satyan, MD

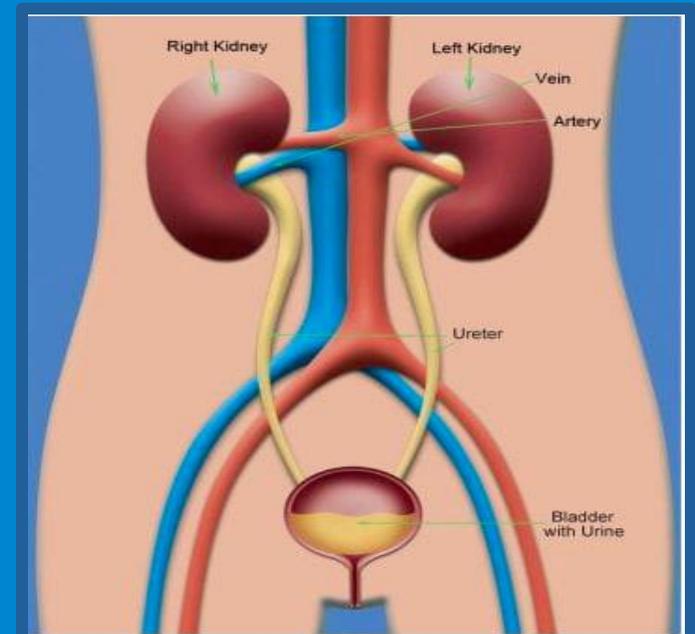
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OUTLINE

- KIDNEY STRUCTURE
- KIDNEY FUNCTION
- KIDNEY DISEASES

Terms: Kidney, Renal, Nephro

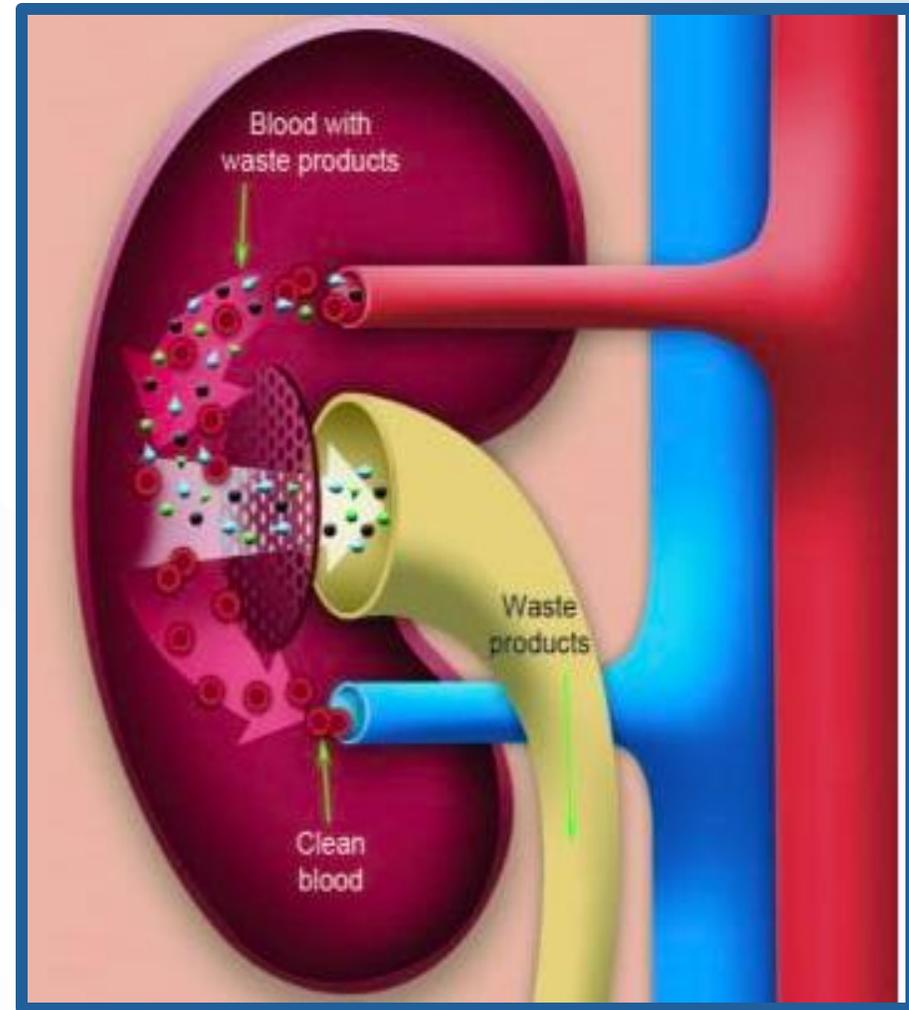
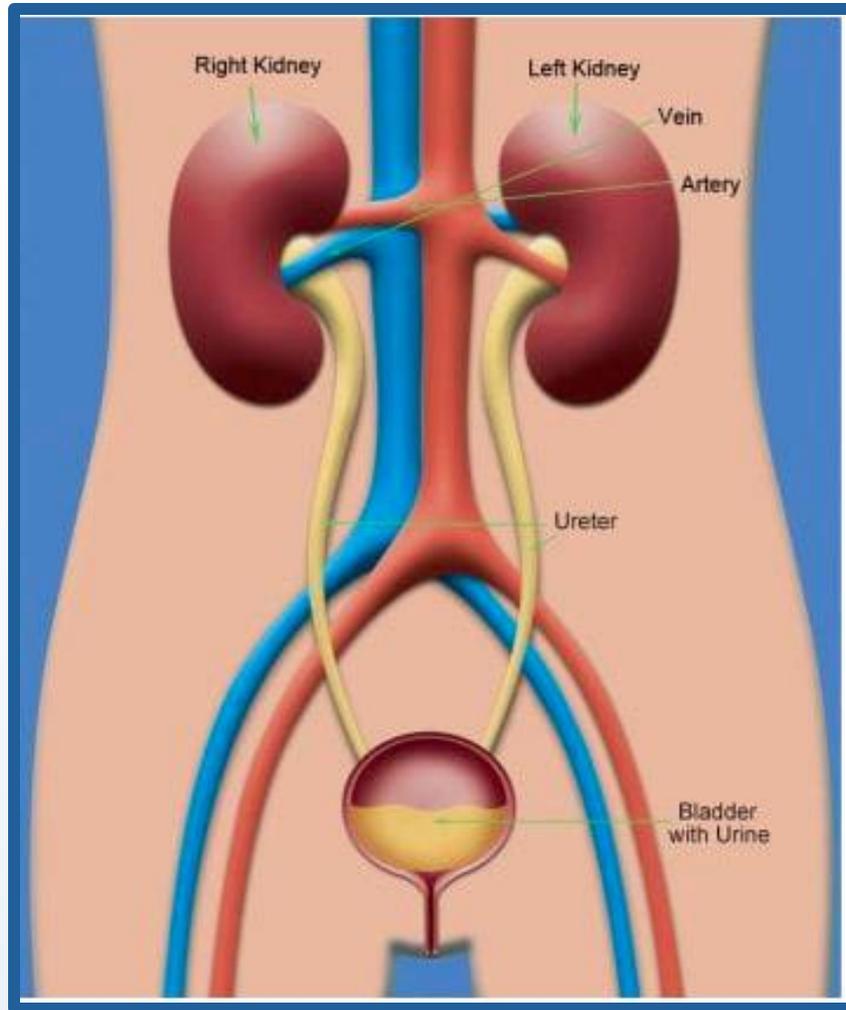


KIDNEYS

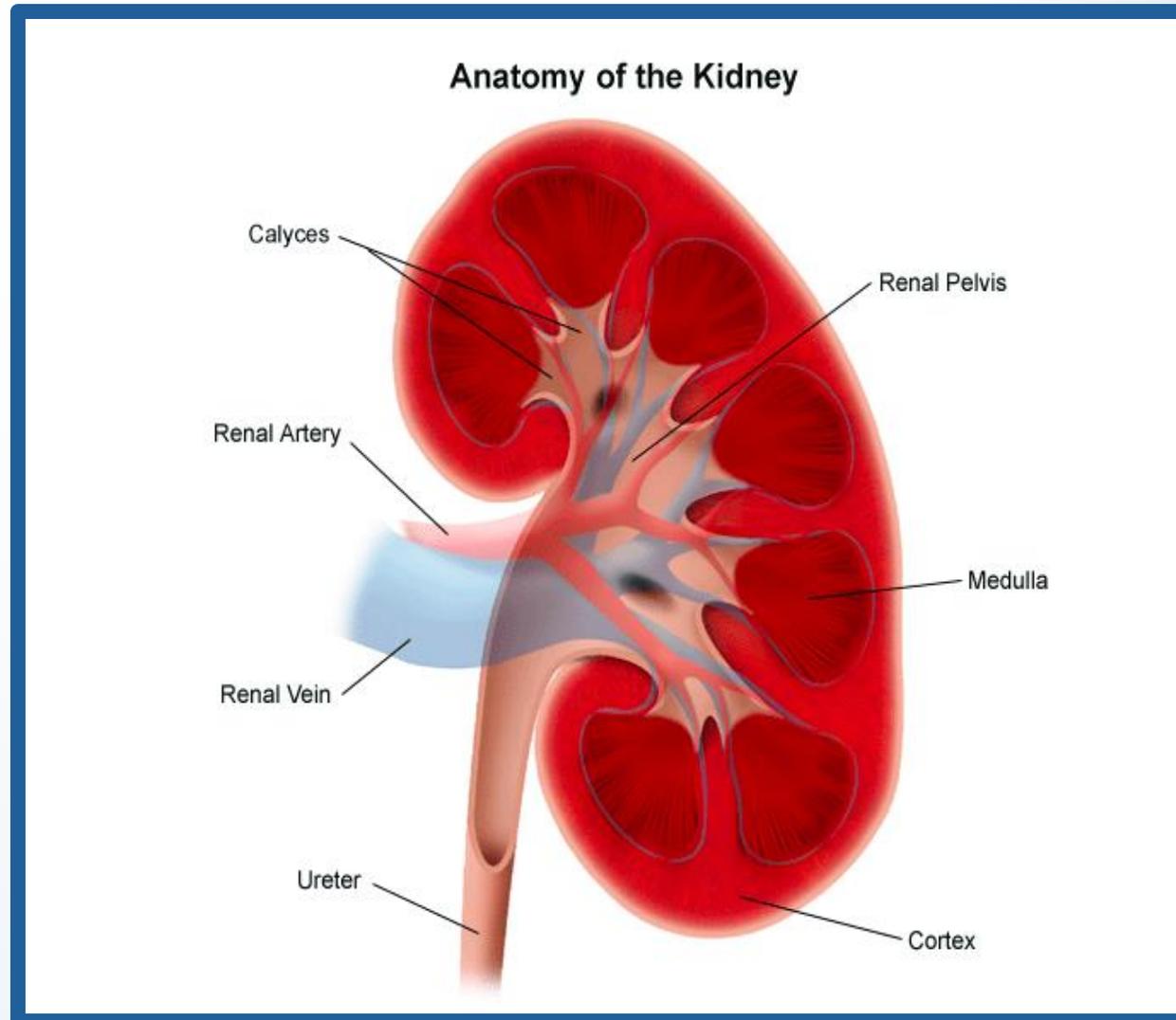
- Fun Fact – Bean shaped, about the size of a fist
- Located in the back, on either side of spine, below the rib cage
- Remove wastes and toxins
- Regulate fluid, electrolyte, acid-base balance
- Regulate blood pressure
- Produce hormones
 - Assist with red blood cell production
 - Keep bones strong



KIDNEYS

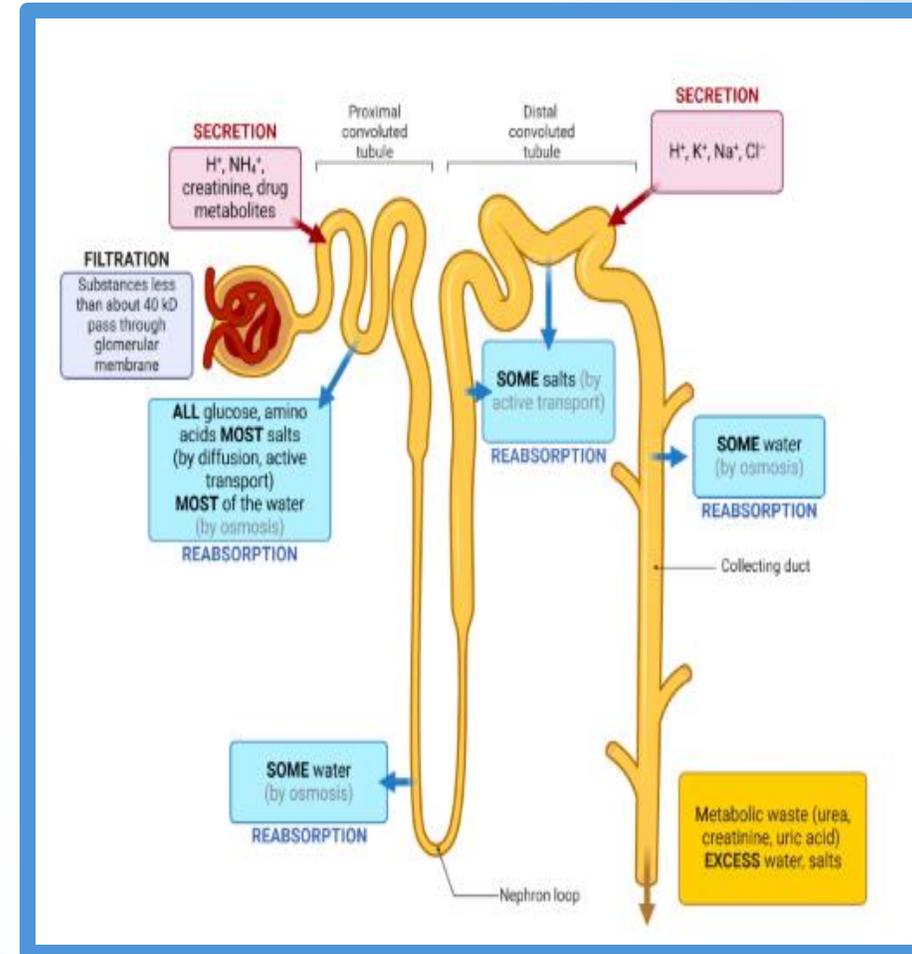
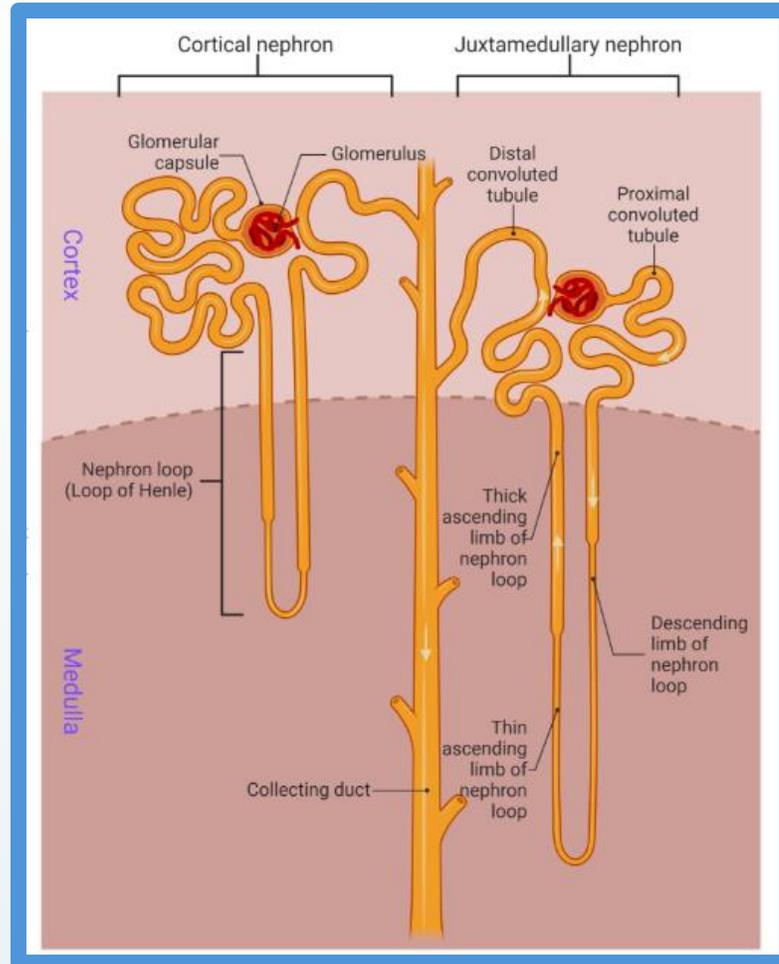


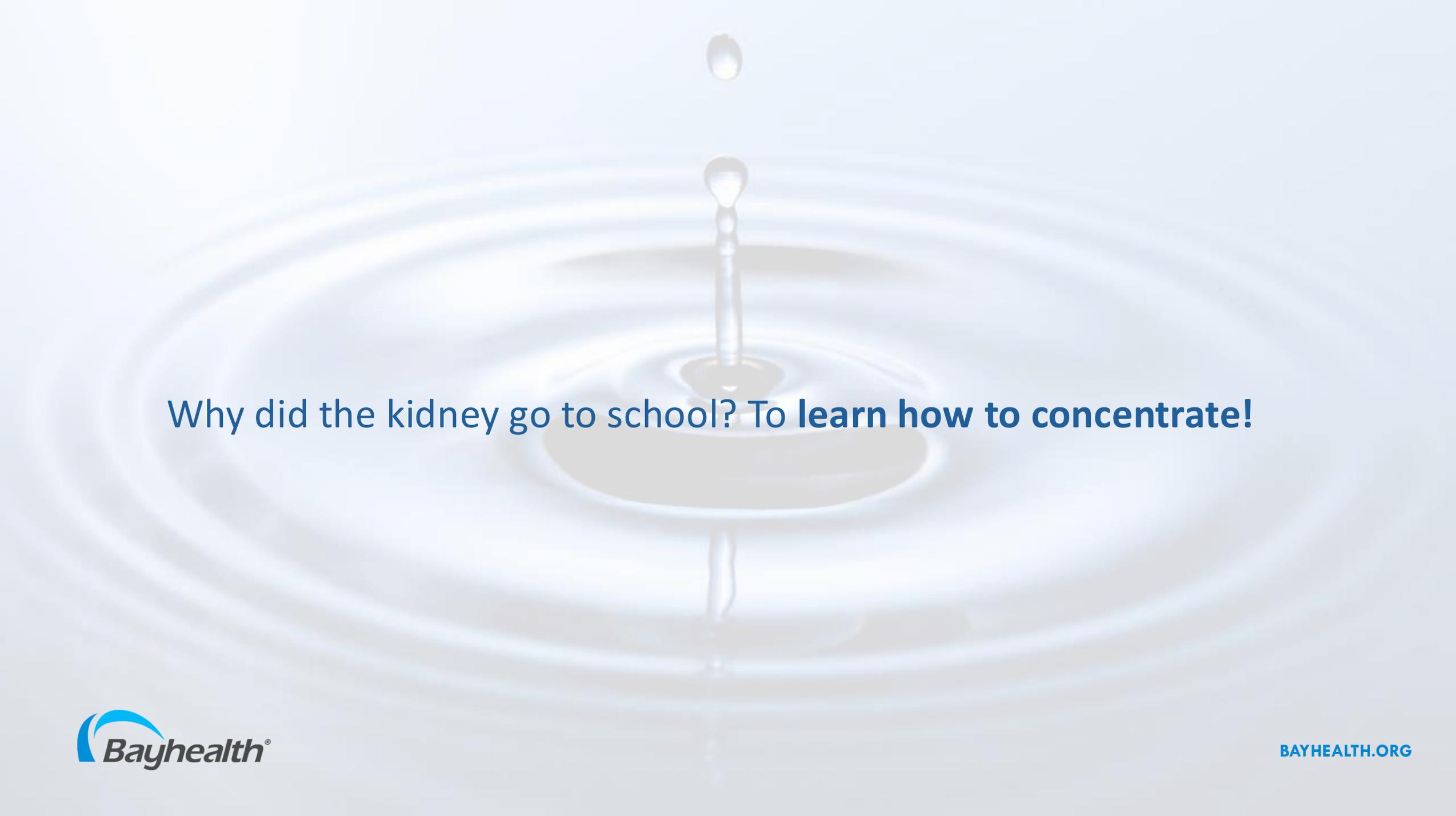
KIDNEY STRUCTURE



NEPHRON

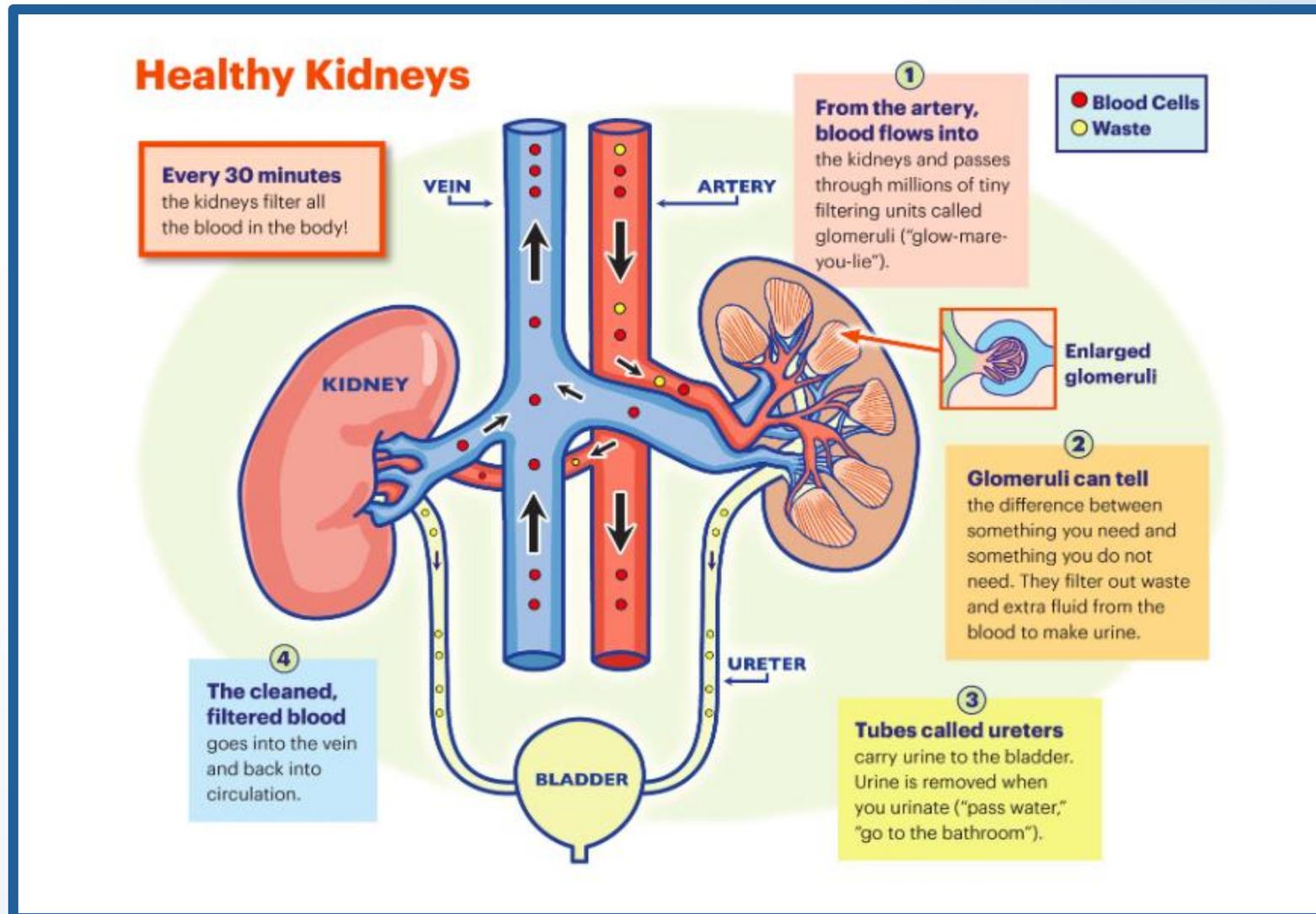
- Functional microscopic unit of kidney
- About 1 million nephrons on average in each kidney
- Glomerulus and complex tubular system



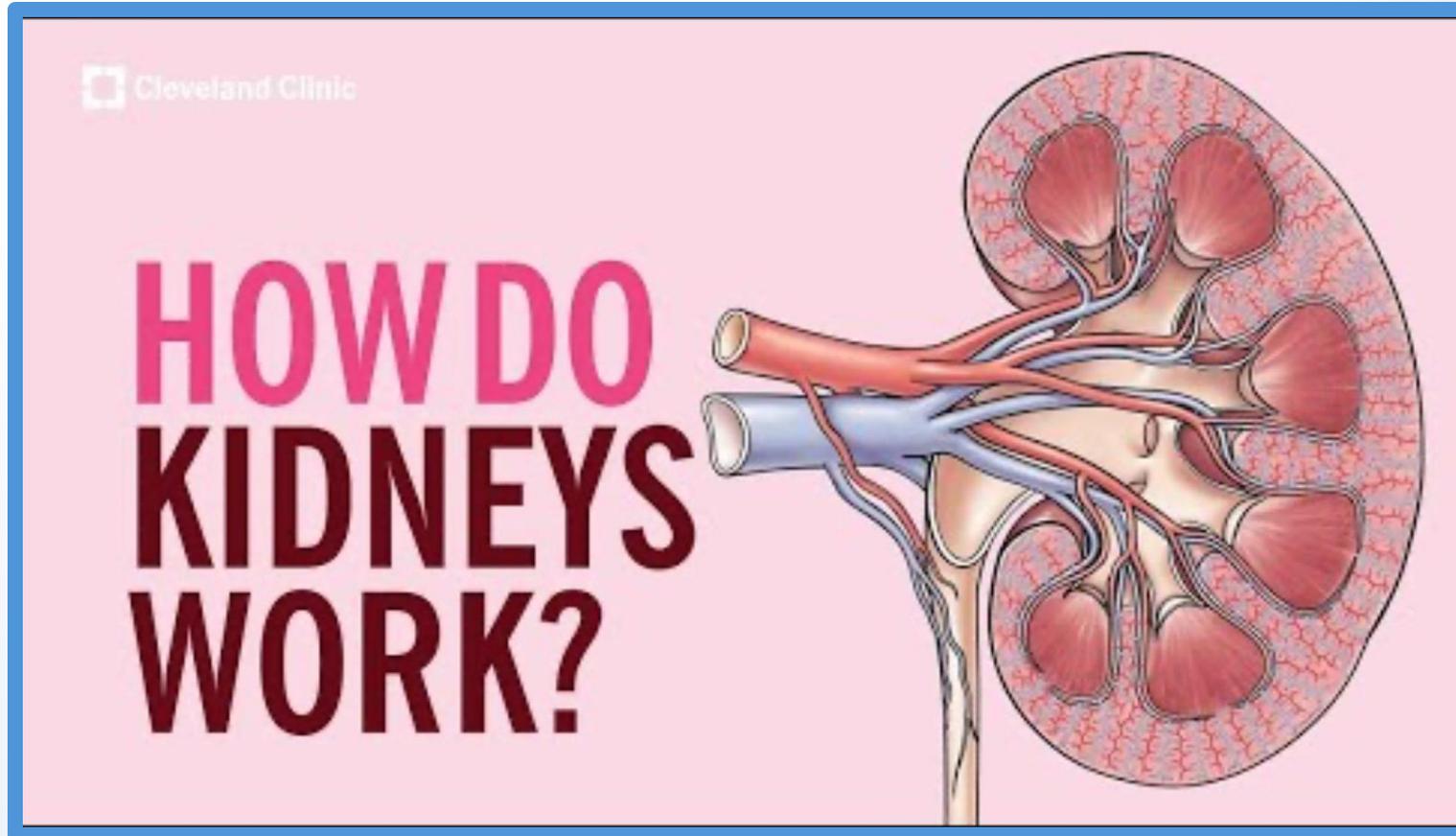
A high-speed photograph of a single water droplet falling into a pool of water. The droplet is captured mid-fall, just above the surface, with a small splash of water below it. The impact has created several concentric ripples that spread outwards from the center. The background is a soft, light blue gradient.

Why did the kidney go to school? To **learn how to concentrate!**

HOW KIDNEYS WORK



HOW DO KIDNEYS WORK



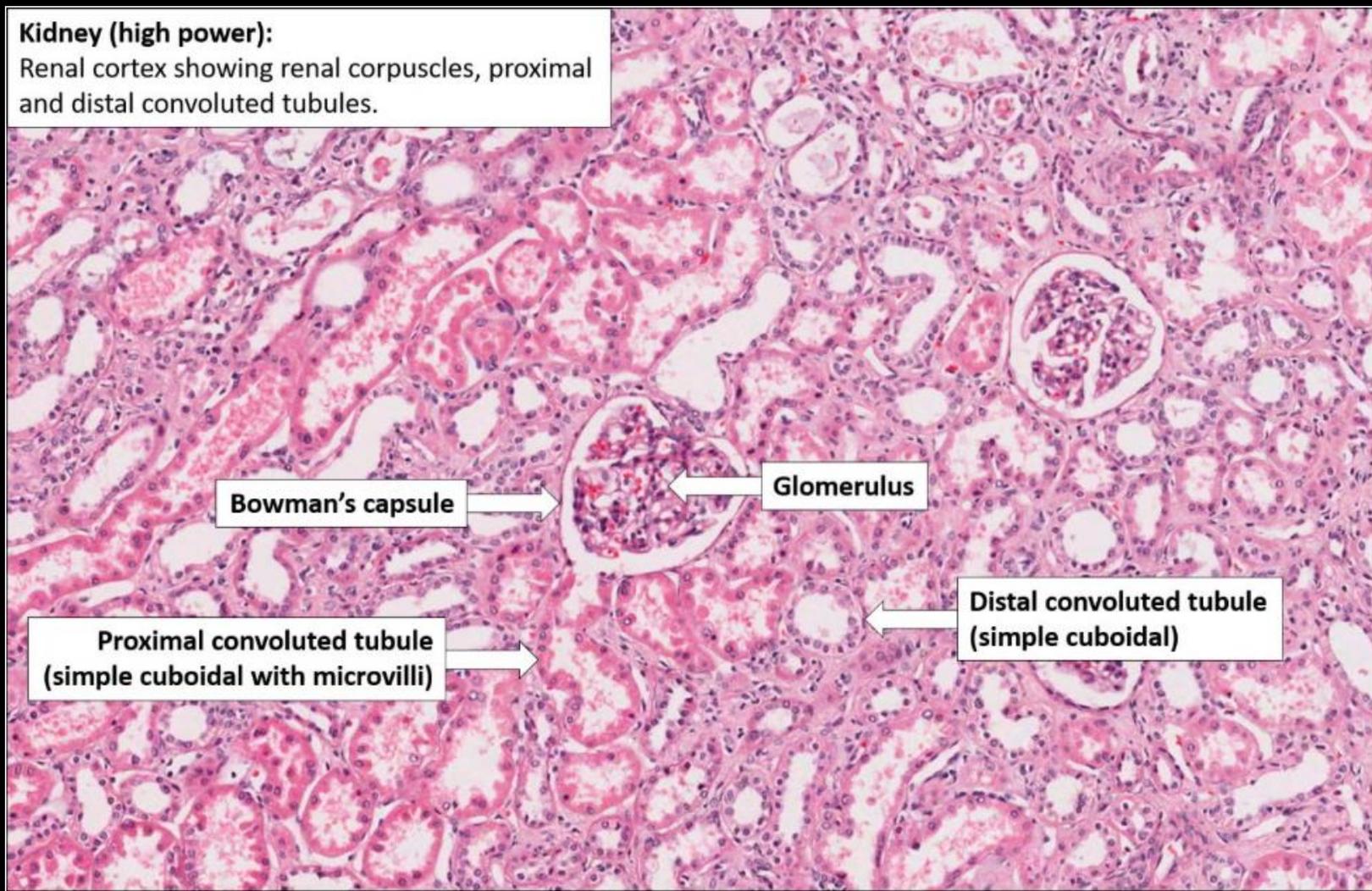
KIDNEY DISEASES

TYPES

- ACUTE KIDNEY INJURY (AKI)
- ELECTROLYTE AND ACID BASE DISORDERS
- CHRONIC KIDNEY DISEASE (CKD)
- GLOMERULAR DISORDERS
- TUBULO INTERSTITIAL DISORDERS
- VASCULAR DISEASES
- HEREDITARY KIDNEY DISEASES
- KIDNEY STONES AND INFECTIONS

NORMAL KIDNEY

Kidney (high power):
Renal cortex showing renal corpuscles, proximal and distal convoluted tubules.



Bowman's capsule

Glomerulus

Proximal convoluted tubule
(simple cuboidal with microvilli)

Distal convoluted tubule
(simple cuboidal)

ACUTE KIDNEY INJURY

- Sudden loss of kidney function – 48 hours to 7 days
- Causes
 - Low blood pressure
 - Infections
 - Dehydration
 - Medications
 - Muscle injury
 - Blockage of urine flow
 - Liver disease
 - Heart failure
 - Autoimmune disorders
 - After major surgeries
 - Other

ACUTE KIDNEY INJURY

- DIAGNOSIS
 - Symptoms and Signs
 - Blood and Urine tests, Imaging – Ultrasound, CT scan, Kidney Biopsy

- TREATMENT
 - Treat the underlying cause
 - Fluid and electrolyte management
 - Medications
 - Dialysis (if all else fails)

- PREVENTION

ELECTROLYTE DISORDERS

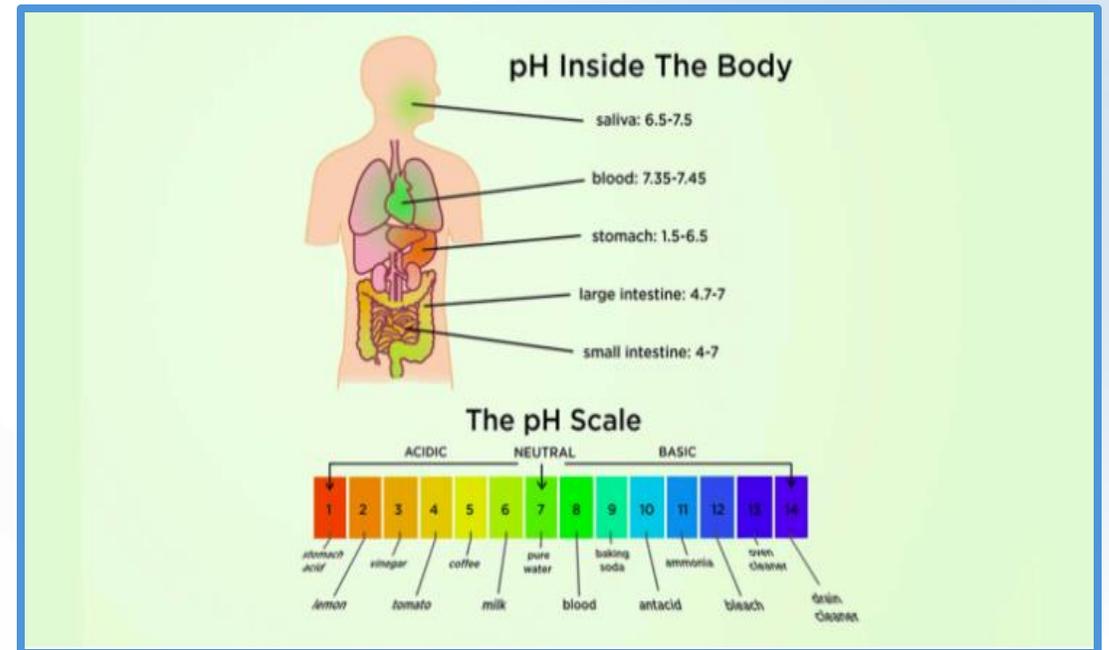
- Electrolytes (minerals)
 - Balance body fluids
 - Regulate heart rhythm
 - Support nerve, muscle, and bone function
- Reduced kidney function can impair body's ability to regulate electrolyte levels
- Electrolyte levels in the body can become too high or too low
 - Sodium
 - Potassium
 - Magnesium
 - Calcium
 - Phosphorus

ACID BASE DISORDERS

- Normal blood pH is 7.35 - 7.45
 - Too low = acidic (acidosis)
 - Too high = basic (alkalosis)

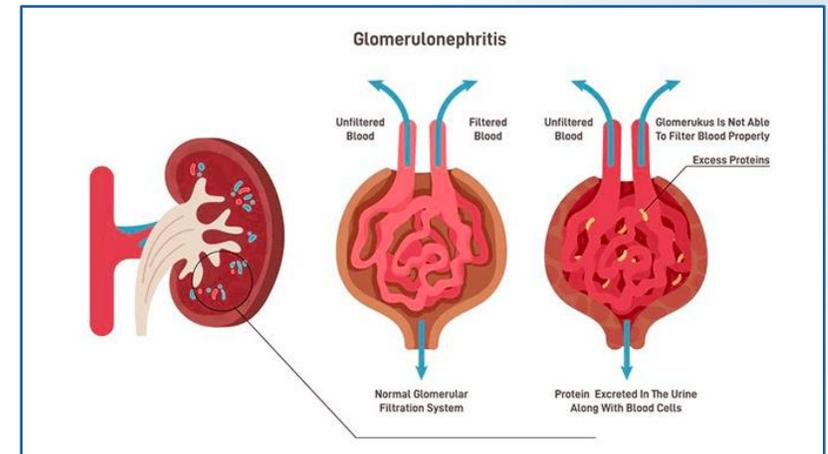
- Kidneys and pH balance

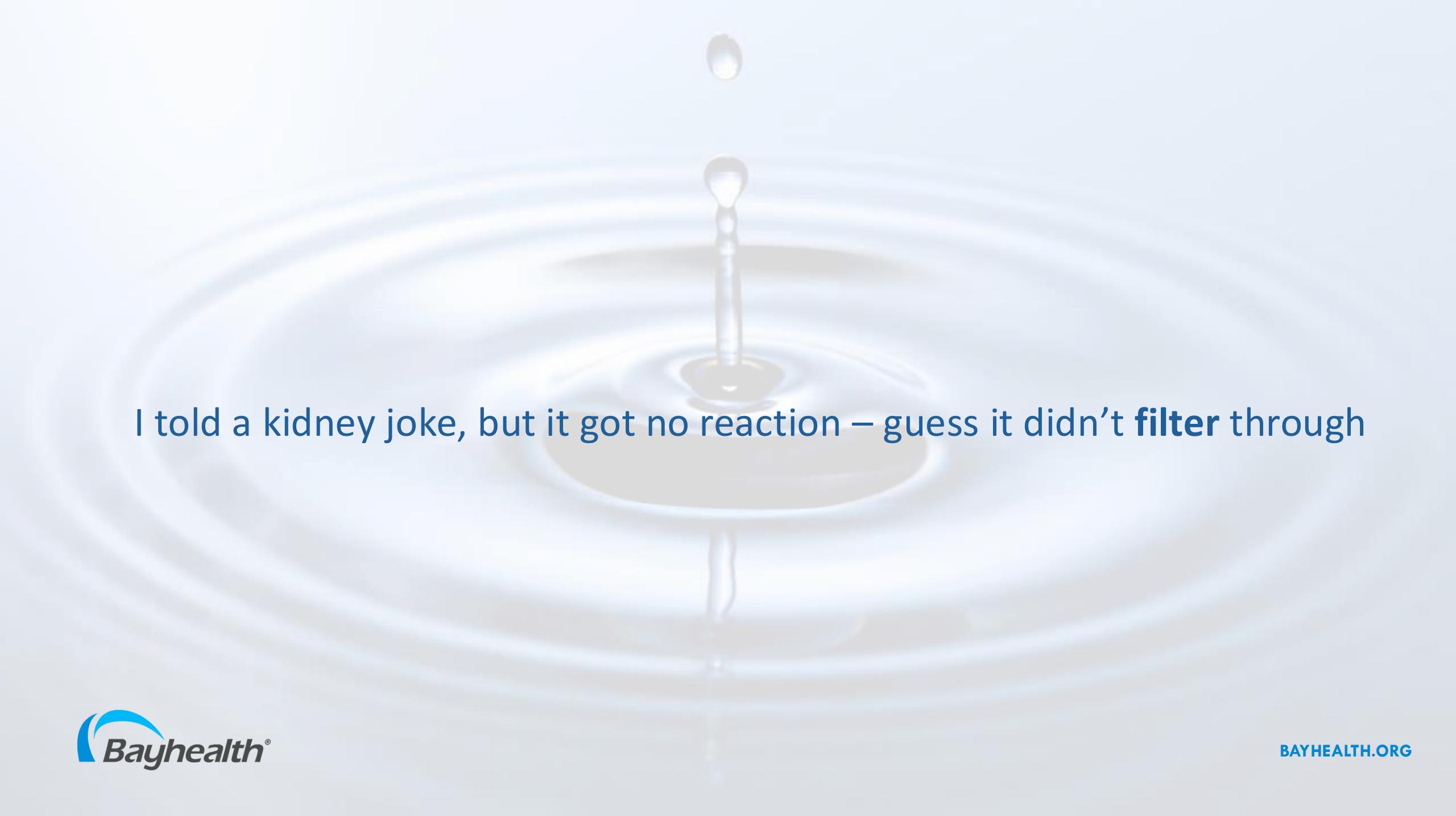
- Normal healthy kidneys maintain the acid base balance
- Metabolic Acidosis and Metabolic Alkalosis occur when kidneys are unable to maintain the balance



GLOMERULAR DISORDERS

- Glomerulus – tiny looping blood vessels that act as filtering units
- Glomerular disease (glomerulonephritis/nephrotic syndrome) – Blood and protein leak into the urine
- Symptoms
 - Foamy urine (protein)
 - Blood in urine (pink or cola-colored)
 - Swelling
 - High blood pressure
- Tests – Blood tests, Urine tests, Kidney Biopsy
- Treatment – depends on the type and cause

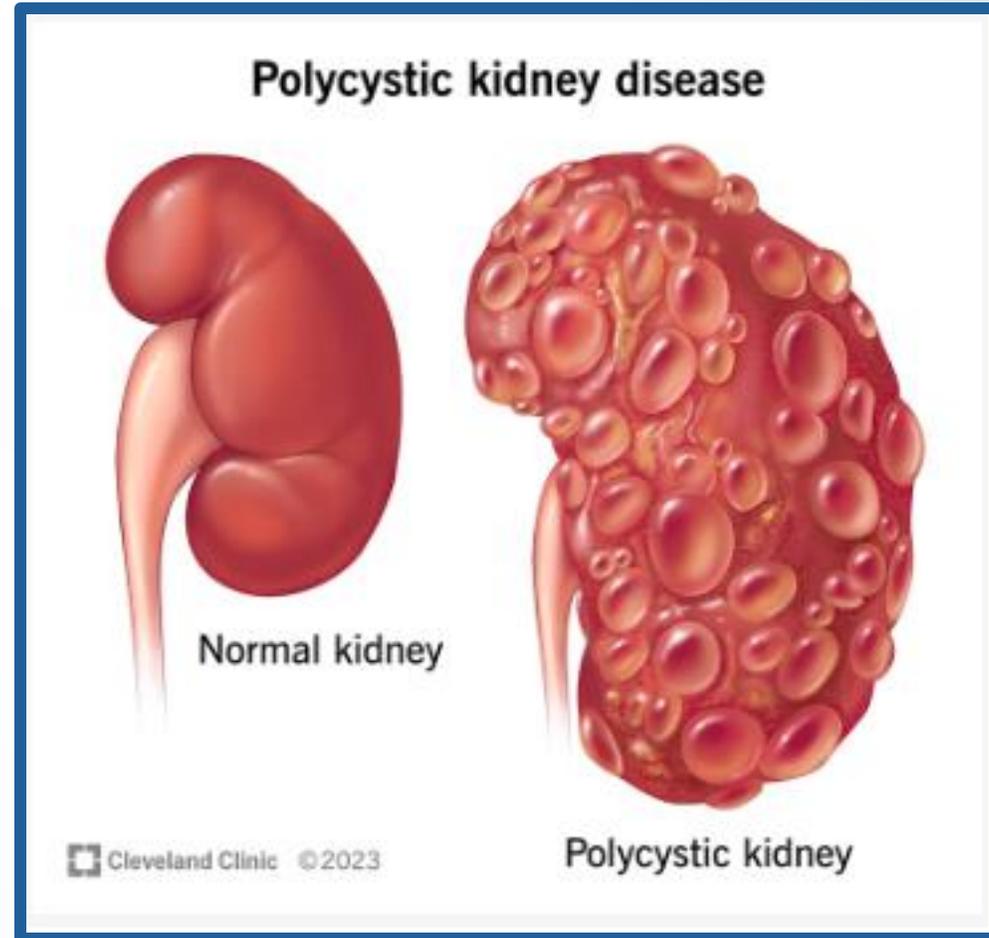


A high-speed photograph of a water droplet falling into a pool of water, creating a series of concentric ripples. The droplet is captured mid-fall, just above the surface, with a small splash of water below it. The background is a soft, light blue gradient.

I told a kidney joke, but it got no reaction – guess it didn't **filter** through

HEREDITARY KIDNEY DISEASES

- Polycystic Kidney Disease
- Alport Syndrome
- Fabry Disease



KIDNEY STONES

- Hard deposits of minerals and salts that form inside the kidney
- **TYPES** – calcium oxalate, calcium phosphate, uric acid, struvite, cystine
- **RISK FACTORS** – less water, high salt or animal protein diet, certain medical conditions and medications, family history
- **SYMPTOMS** – flank/back pain, blood in urine, nausea and vomiting, frequent urination
- **TREATMENT**
 - Small Stones – Plenty of water, pain medication
 - Larger stones – Shockwave Lithotripsy, Ureteroscopy, Surgery
- **PREVENTION**

CHRONIC KIDNEY DISEASE (CKD) FACTS

GRADUAL LOSS OF KIDNEY FUNCTION – THREE MONTHS OR LONGER

More than 1 in 7 US adults may have CKD

As many as 9 in 10 don't know they have it

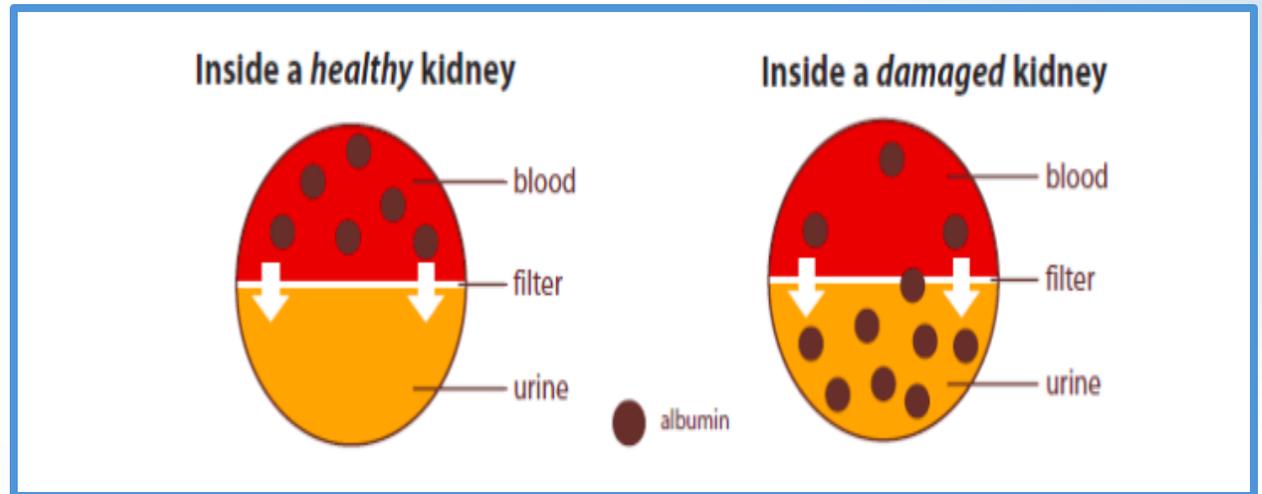
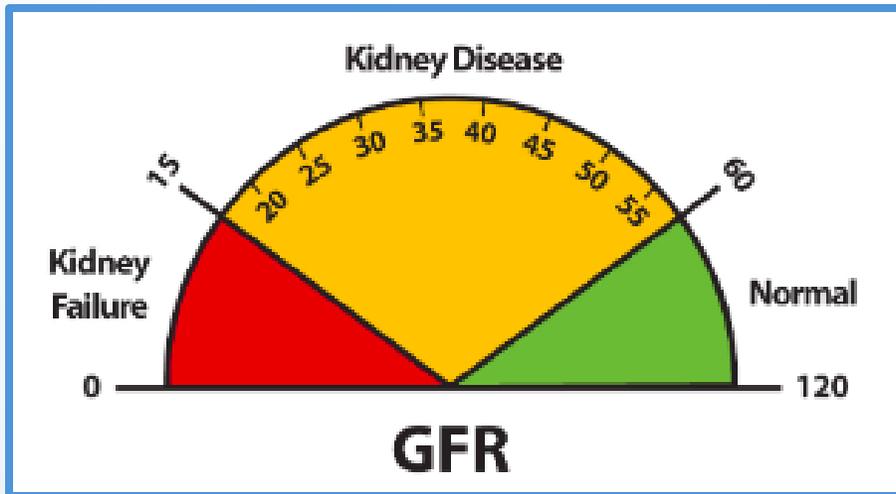
Kidney diseases are a leading cause of death in the United States

About 360 people begin treatment for kidney failure (dialysis or kidney transplant) every day

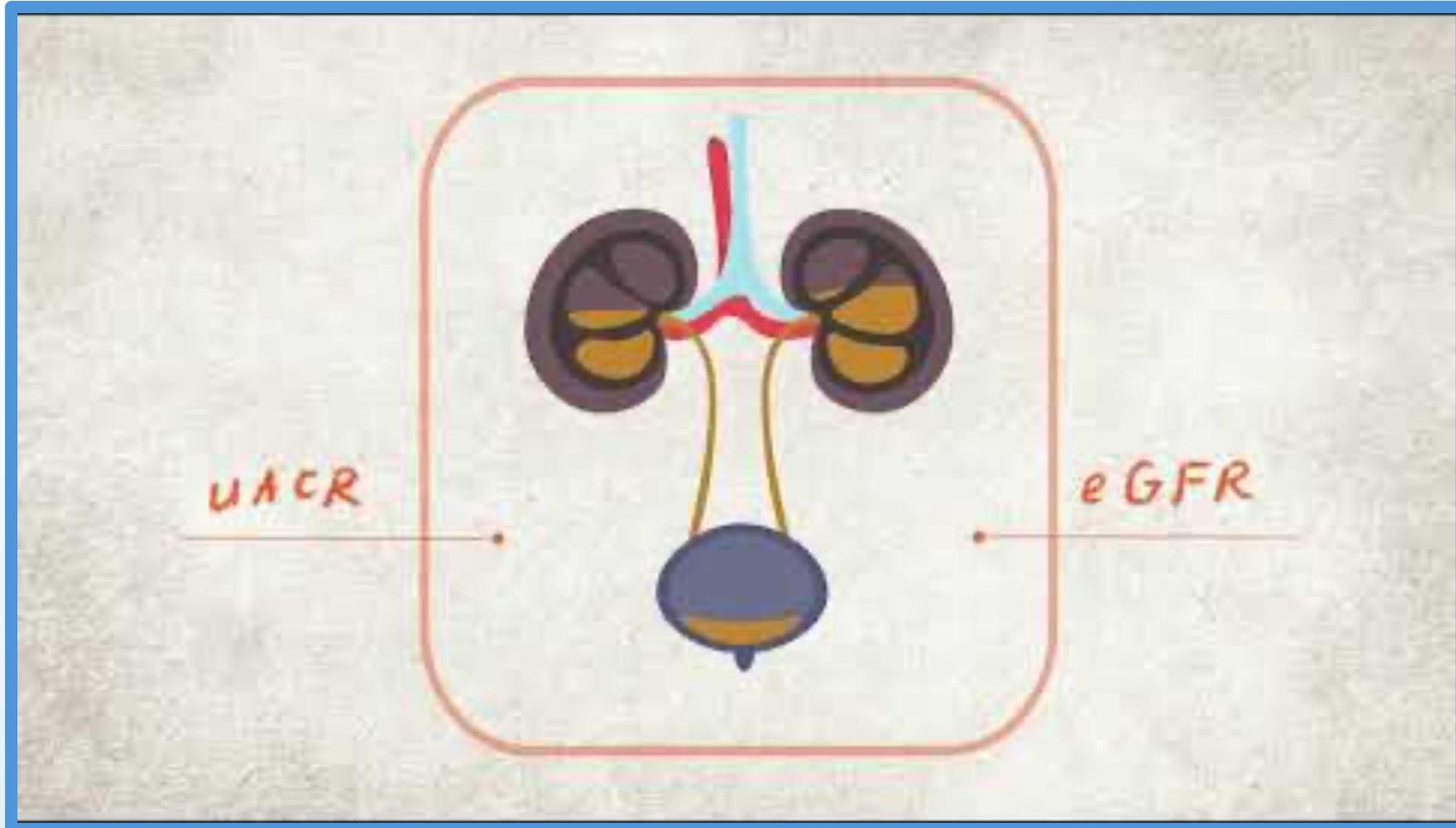
Tests for CKD

- Blood - Serum Creatinine, eGFR
- Urine – Urinalysis, Urine ACR (albumin excretion)
- Imaging – Kidney Ultrasound, CT scan, MRI
- Kidney Biopsy

CHRONIC KIDNEY DISEASE (CKD)



CHRONIC KIDNEY DISEASE (CKD)



CHRONIC KIDNEY DISEASE (CKD)

Risk factors for CKD

- Diabetes
- High blood pressure
- Heart disease
- Obesity
- Family history of CKD
- Older age

Treating CKD lowers the risk for End Stage Kidney Disease (ESKD)

CKD increases risk for:

- Heart disease and heart failure
- Stroke
- Early death

CHRONIC KIDNEY DISEASE (CKD)

Prognosis of CKD by GFR and albuminuria categories: KDIGO 2012				Persistent albuminuria categories		
				Description and range		
				A1	A2	A3
				Normal to mildly increased	Moderately increased	Severely increased
				< 30 mg/g < 3 mg/mmol	30–300 mg/g 3–30 mg/mmol	> 300 mg/g > 30 mg/mmol
GFR categories (ml/min/1.73 m ²) Description and range	G1	Normal or high	≥ 90			
	G2	Mildly decreased	60–89			
	G3a	Mildly to moderately decreased	45–59			
	G3b	Moderately to severely decreased	30–44			
	G4	Severely decreased	15–29			
	G5	Kidney failure	< 15			

Chronic kidney disease nomenclature used by Kidney Disease: Improving Global Outcomes. Chronic kidney disease is defined as abnormalities of kidney structure or function, present for >3 months, with implications for health. Chronic kidney disease is classified based on cause, glomerular filtration rate category (G1–G5), and albuminuria category (A1–A3), abbreviated as CGA. Prognosis of chronic kidney disease by glomerular filtration rate and albuminuria category is colour-coded as follows: green, low risk (if no other markers of kidney disease, no chronic kidney disease); yellow, moderately increased risk; orange, high risk; red, very high risk. CKD, chronic kidney disease; GFR, glomerular filtration rate; KDIGO, Kidney Disease: Improving Global Outcomes.

TREATMENT OF CKD

- Treatment of underlying cause
- Blood pressure control – ACE inhibitors or ARBs
- Blood glucose control
- Cholesterol control – Statins
- SGLT2i, GLP1 – RA, non-steroidal MRAs
- Lifestyle modifications – smoking cessation, diet, exercise, coping with stress
- Avoidance of certain types of medications
- Treatment of CKD complications
- Additional treatments in the pipeline

SYMPTOMS OF CKD

Symptoms of Chronic Kidney Disease

 <p>Dry and itchy skin.</p>	 <p>Tiredness or weakness.</p>	 <p>Bubbly or foamy pee.</p>
 <p>Swelling of hands, feet, ankles.</p>	 <p>Puffy eyes.</p>	 <p>Trouble sleeping.</p>
 <p>Loss of appetite.</p>	 <p>Muscle cramps.</p>	 <p>Need to pee more often.</p>

 Cleveland Clinic

KIDNEY FAILURE/END STAGE KIDNEY DISEASE

- Irreversible loss of kidney function
- Treatment options
 - Dialysis – Hemodialysis (center or home), Peritoneal dialysis
 - Kidney Transplant (living or deceased donor)
(You can live with one kidney!)
- Conservative management / Palliative care
- Future/Experimental treatments
 - Xenotransplantation – genetically-modified pig kidneys
 - Artificial/wearable kidneys

Kidney Replacement Therapy - Hemodialysis

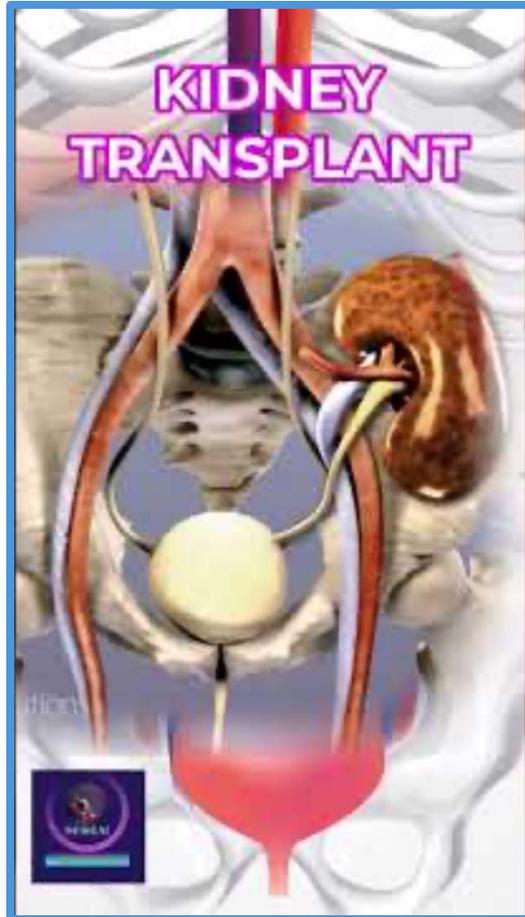


Kidney.org – National Kidney Foundation

Kidney Replacement Therapy – Peritoneal Dialysis

Peritoneal
Dialysis

KIDNEY TRANSPLANT



SUMMARY

KIDNEYS PERFORM
NUMEROUS
ESSENTIAL
FUNCTIONS IN THE
HUMAN BODY

THERE ARE SEVERAL
TYPES OF KIDNEY
DISEASES THAT CAN BE
ACUTE OR CHRONIC

EARLY DETECTION
AND TREATMENT IS
NECESSARY TO
DELAY
PROGRESSION

KIDNEY REPLACEMENT
TREATMENTS FOR
APPROPRIATE PATIENTS
CAN BE LIFE SAVING

CONSERVATIVE/PALLIATIVE
CARE OPTIONS FOR SOME
PATIENTS

PREVENTION IS
BETTER

COMMUNITY AWARENESS
AND EDUCATION ARE
ESSENTIAL FOR
PREVENTION AND EARLY
DETECTION

THANK YOU!

BE KIDNEY TO EACH OTHER!

