

# CLASSIFICATION OF KIDNEY DISORDERS

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# LEARNING OBJECTIVES

- Introduction
- Classification of kidney disorders according to etiology, site of dysfunction and type of dysfunction.
- Acute / Chronic renal disorders.
- Infectious disorders
- Immunological disorders.
- Neoplastic disorders
- Vascular / interstitial / parenchymal disorders
- Primary / Systemic disorders

**The kidneys:  
An Excretory organ or a Regulatory  
organ?!!!**



# INTRODUCTION

- The kidneys are a **pair of bean-shaped organs present in all vertebrates.**
- They remove waste products from the body, maintain balanced electrolyte levels, and regulate blood pressure.
- The kidneys are some of the most important organs in the body.
- Each kidney is attached to a ureter, a tube that carries excreted urine to the bladder.

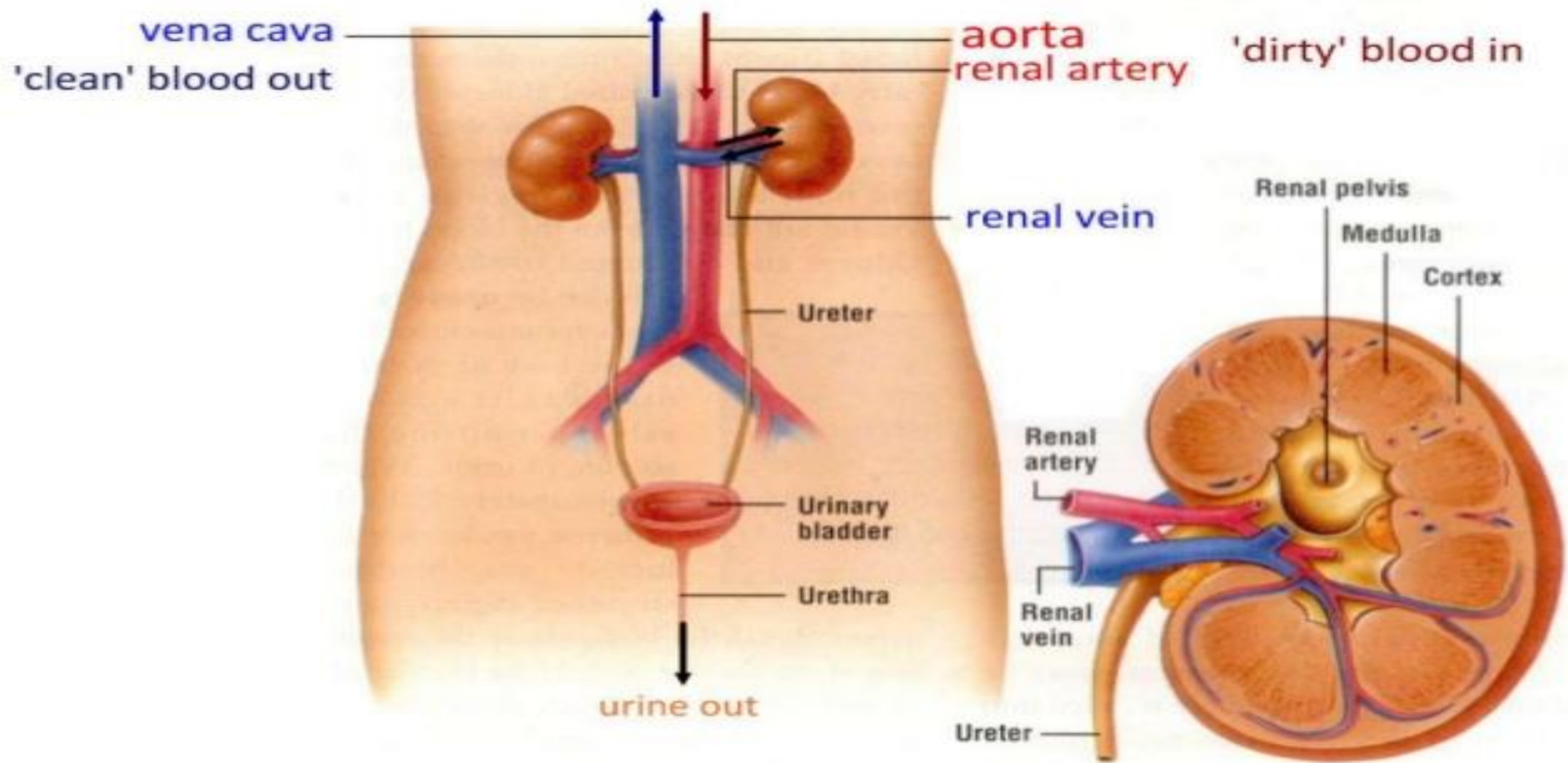
# INTRODUCTION

- Each kidney has about **1 million nephrons**, the functional units of the kidney.
- **Each nephron** is composed of a tubule that begins in the outer layer of the kidney and eventually joins other tubules to empty into the **ureter**.
- The tubule has a number of functional segments: **Bowman's capsule, the proximal tubule, loop of Henle, the distal tubule, the collecting duct**

# INTRODUCTION

- Surrounding each tubule is a **complex system of blood vessels** that exchange water and solutes with the tubule.
- This system is special in that **blood must pass through two capillary beds**.
  - **1. An afferent arteriole.....** takes blood to the renal corpuscle, where the blood passes through the first capillary bed, **a ball-shape tuft known as the glomerulus**.
  - **2. An efferent arteriole.....** takes blood away from the glomerulus.
  - **3. From there the blood passes into a set of peri-tubular capillaries**, which follow the remainder of the tubule and are the site of further exchange of water and solutes between plasma and tubular fluid.

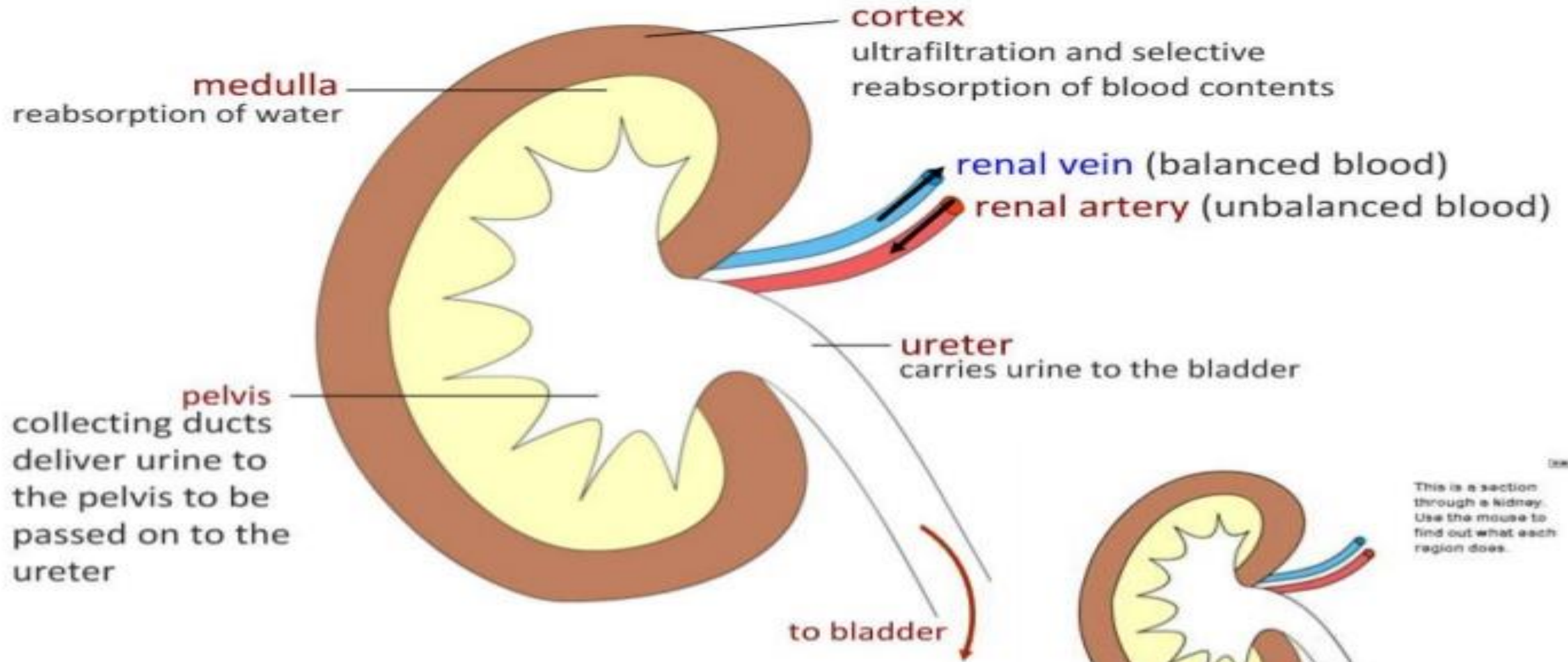
# The Urinary (Excretory) System filters blood and produces urine



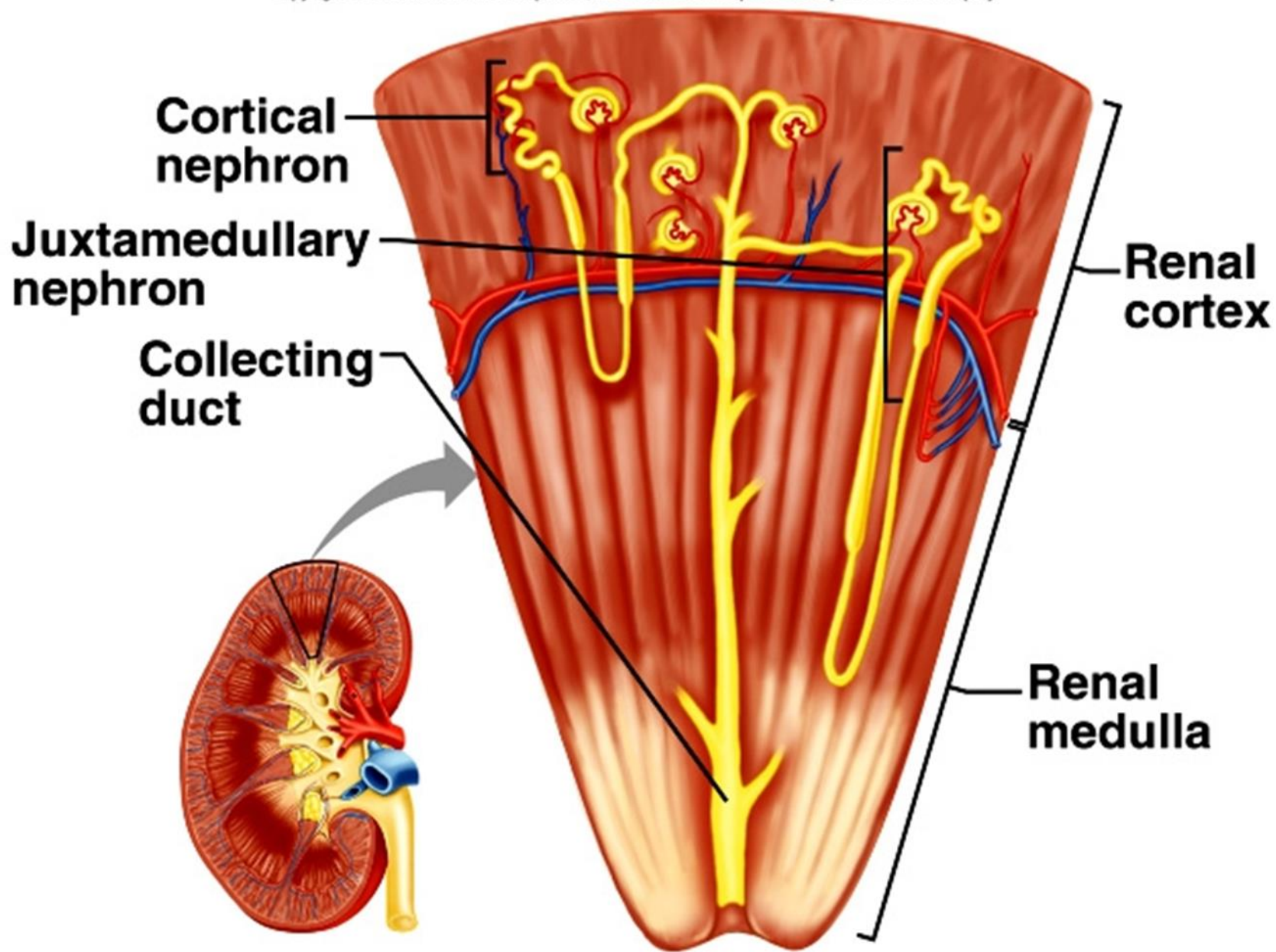
[http://kvhs.nbed.nb.ca/gallant/biology/excretory\\_system\\_anatomy.html](http://kvhs.nbed.nb.ca/gallant/biology/excretory_system_anatomy.html)



# The Kidney is the blood's filtration and balancing system

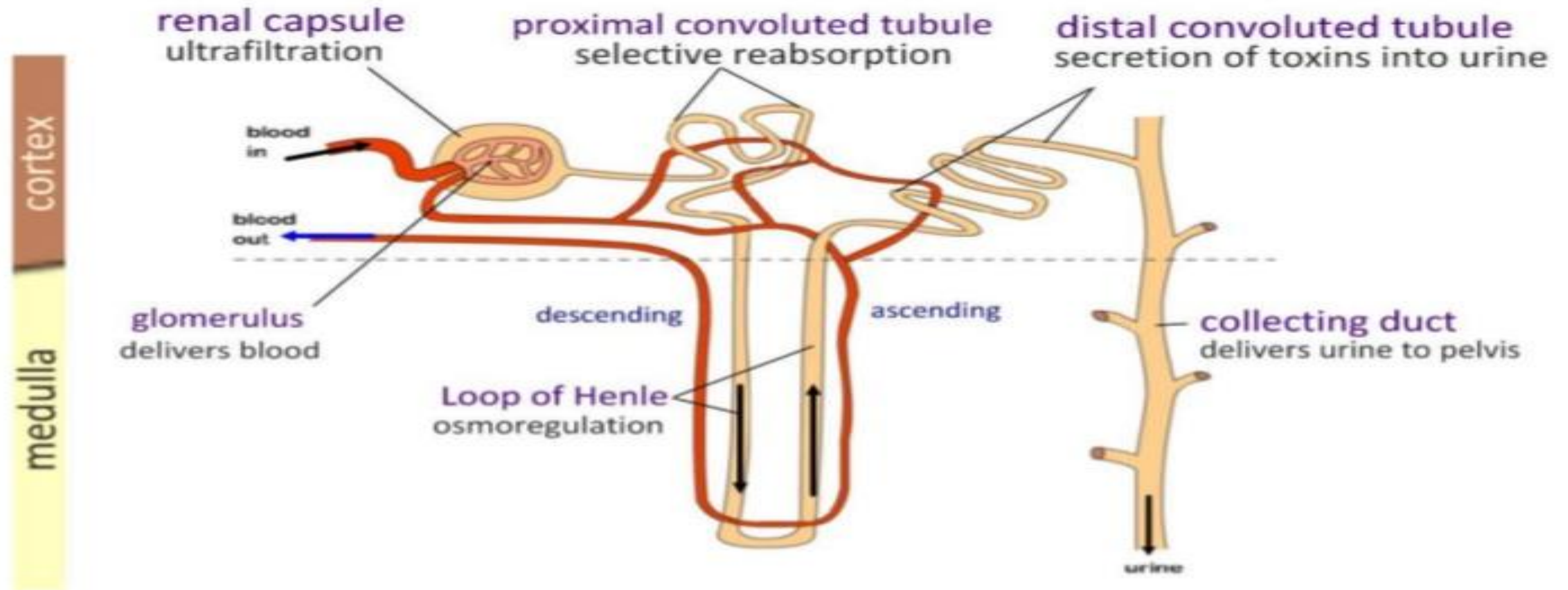






# The **Nephron** is the functional unit of the kidney

There are around one million in each kidney



<http://www.biologymad.com/resources/kidney.swf>

# INTRODUCTION..... KIDNEY DISEASES

- **KIDNEY DISEASES**.....can affect your body's ability to clean your [blood](#), filter extra water out of your blood, and help control your [blood pressure](#).
- It can also affect red blood cell production and [vitamin D](#) metabolism needed for [bone](#) health.

# INTRODUCTION..... KIDNEY DISEASES

- **Kidney disease** is defined as a heterogeneous group of disorders affecting kidney structure and function.
- Even mild abnormalities in measures of kidney structure and function are associated with increased risk for developing complications in other organ systems as well as mortality.
- Diseases can be defined and classified according to many domains: **structure, function, cause, duration, and outcomes .**

# RENAL DISEASES

- Renal disease can be divided into **four categories** based on the **morphologic components** involved
- **Diseases of Glomeruli**
- **Diseases of Tubules**
- **Diseases of Interstitium**
- **Diseases of Blood vessels**
- ❖ Most **glomerular** diseases **are immunologically mediated**, whereas **tubular and interstitial** disorders are frequently caused by **toxic or infectious agents**.

# RENAL DISEASES..... others

- **CYSTIC DISEASES**
- **CONGENITAL AND DEVELOPMENTAL ANOMALIES**
- **URINARY TRACT OBSTRUCTION (OBSTRUCTIVE UROPATHY)**
- **NEOPLASMS OF THE KIDNEY**

# **GLOMERULAR DISEASES**

- **PRIMARY GLOMERULOPATHIES**
- **SYSTEMIC DISEASES WITH GLOMERULAR INVOLVEMENT**
- **HEREDITARY DISORDERS**



# PRIMARY GLOMERULAR DISEASES

- ❑ Acute proliferative GN
  - post infectious
  - others
- ❑ Rapidly progressive ( crescentic ) GN
- ❑ Membranous nephropathy
- ❑ Minimal-change disease
- ❑ Focal segmental glomerulosclerosis
- ❑ Membranoproliferative GN
- ❑ Dense deposit disease
- ❑ IgA nephropathy
- ❑ Chronic GN

# SYSTEMIC DISEASES WITH GLOMERULAR INVOLVEMENT

- Systemic lupus erythematosus (lupus nephritis)
- Diabetes mellitus
- Amyloidosis
- Good pasture syndrome
- Microscopic polyarthritits/ polyangitis
- Wegener granulomatosis
- Henoch-Schönlein purpura
- Bacterial endocarditis
- GN secondary to MM

# HEREDITARY DISORDERS

- Alport syndrome
- Thin basement membrane disease
- Fabry disease

# COMMON DISEASES

- **ACUTE RENAL FAILURE**.....sudden loss of renal function....< 3 months
- **CHRONIC KIDNEY DISEASE**.....declining renal function progressively, over a period of > 3 months, with high rise in creatinine.
- **HEMATURIA**.....blood loss in urine.
- **PROTEINURIA**.....loss of protein especially albumin in urine.
- **MICROALBUMINURIA**.....slight increase in urinary albumin excretion.

# COMMON DISEASES....TYPES

- **AKI/ AKF / ARF....** is defined as a subgroup of acute kidney diseases and disorders (**AKD**) in which changes in kidney function evolve within **one week**.
- **AKI...** is the temporary loss of kidney function lasting less than three months.
- It has a **sudden fast onset**, in response to an **injury/trauma or illness** affecting the kidneys, **drugs, blockages of the kidney** or many other factors.
- There is a complex relationship between AKI and CKD; AKI can lead to CKD, and CKD increases the risk of AKI.

# COMMON DISEASES....TYPES

- Some people will need a short course of dialysis to help their kidneys recover.
- Many people fully recover from an [acute kidney injury](#) and go on to live a normal life.
- However, if significant damage has been caused, there is a higher risk of **developing chronic (or ongoing) kidney disease later on.**

# COMMON DISEASES....TYPES

- **Chronic kidney disease ( CKD)/ CRF** ..... occurs when your kidneys have been damaged in a way that cannot be reversed.
- **CKD.....** the condition will need to have been present for at least three months.
- You can live a normal life for many years with chronic kidney disease.
- However, many people will experience a continued decline in their kidney's ability to filter their blood and will eventually need **kidney replacement therapy**.
- This may be in the form of dialysis or a kidney transplant.



# COMMON DISEASES....TYPES

- **Criteria**..... Include measures of **kidney damage** (albuminuria, abnormalities in the urine sediment, imaging, or biopsy) and
- **Function** .....(decreased glomerular filtration rate [GFR], rising serum creatinine level, or decreased urine output;
- Both **CKD and AKI** are classified into stages based in part on the severity in abnormalities in these measures,

# CRITERIA FOR THE DEFINITIONS OF KIDNEY DISEASES AND DISORDERS

<b>AKI</b>	Increase in SCr by 50% within 7 d, <i>or</i> increase in SCr by 0.3 mg/dL within 2 d, <i>or</i> oliguria	No criteria
<b>CKD</b>	GFR <60 mL/min for >3 mo	Kidney damage for >3 months
<b>AKD</b>	AKI, <i>or</i> GFR <60 mL/min/1.73 m <sup>2</sup> for <3 mo, <i>or</i> decrease in GFR by ≥35% <i>or</i> increase in SCr by >50% for <3 mo	Kidney damage for <3 months
<b>NKD</b>	GFR ≥60 mL/min/1.73 m <sup>2</sup> , stable SCr	No damage

# Classification of Chronic Kidney Disease

Stage	Classification	GFR (mL/min/1.73 m <sup>2</sup> )
1		> 90
2	Mild	60-89
3a	Moderate	45-59
3b	Moderate	30-44
4	Severe	15-29
5	End-stage	< 15

# CAUSES AND RISK FACTORS

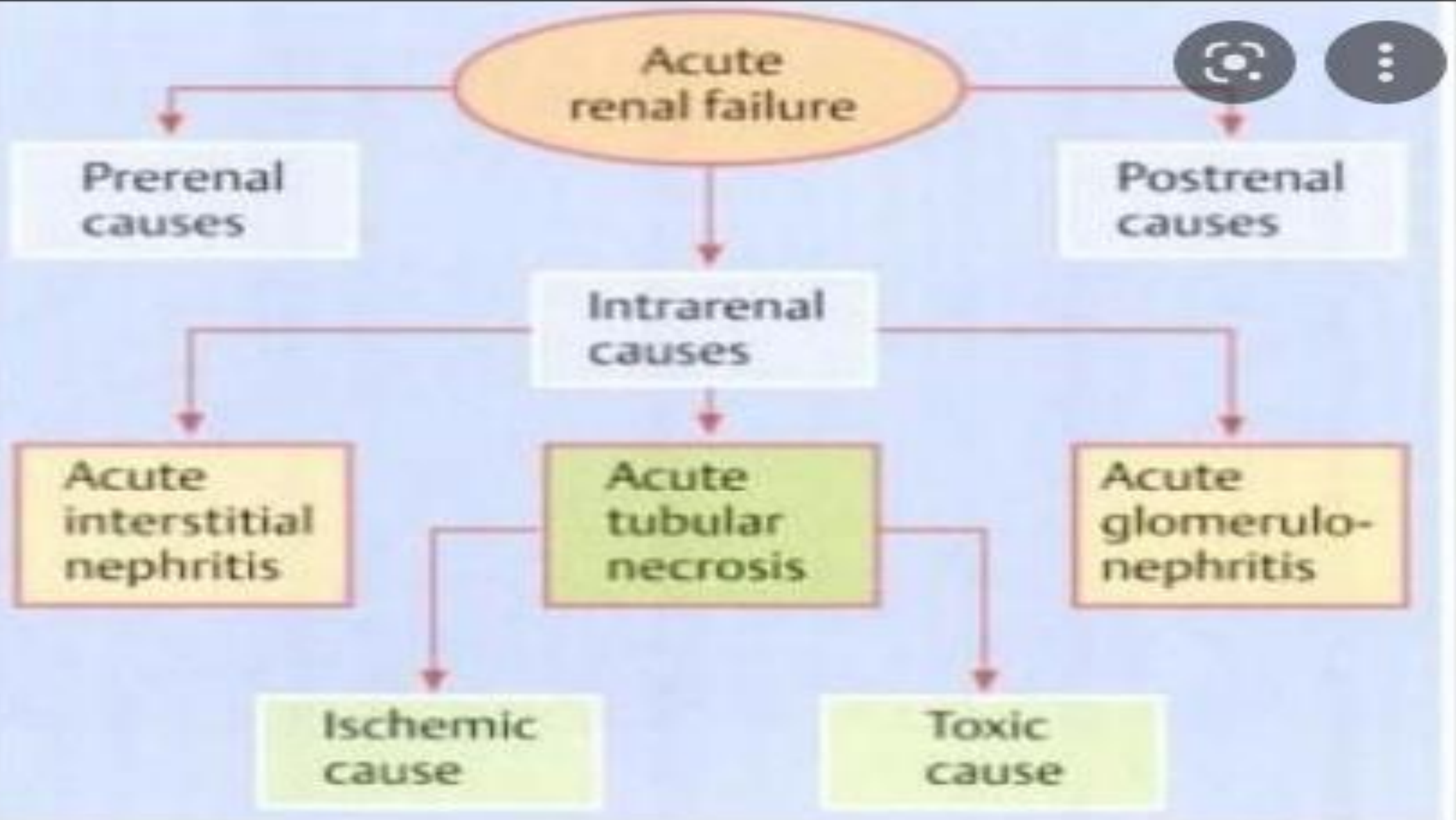
## Common causes of AKF include:

- low blood flow to the kidneys
- inflammation
- sudden high blood pressure
- blockages, sometimes due to kidney stones, mass , pregnancy etc

# CAUSES AND RISK FACTORS

## **Common causes of CKD include:**

- elevated blood sugar....diabetes
- high blood pressure
- kidney infections
- polycystic kidney disease



# INFECTIOUS DISEASE AFFECTING KIDNEYS

- **A kidney infection**..... called **pyelonephritis** .... when bacteria or viruses cause problems in one or both of your kidneys.
- It's a type of **urinary tract infection (UTI)**.
- Kidney infections usually start with a [bladder infection](#) that spreads to your kidney.
- **Bacteria called E. coli are most often the cause.**
- Other bacteria or viruses can also cause kidney infections.
- It's rare, make its way into your **blood**, and travel to your kidney....**Hematogenous route**



# INFECTIOUS DISEASE AFFECTING KIDNEYS

- **IN THE NEONATAL PERIOD.....** group B streptococci, coliforms, *Staphylococcus aureus*, and *Listeria monocytogenes* are the organisms usually responsible.
- **IN OLDER CHILDREN.....** *Neisseria meningitidis*, *Streptococcus pneumoniae*, and *S. aureus* account for most of the infections.
- **IN IMMUNOCOMPROMISED.....** *Haemophilus influenzae*, *Salmonella* species, and *Pseudomonas pseudomallei*, must be considered.

# IMMUNOLOGICAL DISORDERS AFFECTING KIDNEYS

- The human **immune system**..... **limits invasion of foreign organisms and eliminates foreign cells.**
- Discrimination between **self and foreign structures** is essential in this process.
- Ability to recognize “self” and limit “auto”-immune responses against self-antigens is defined as **TOLERANCE.**
- In many situations, the mechanisms either inducing or maintaining tolerance are disrupted.

# KIDNEYS IN AUTOIMMUNE DISEASE

- **Renal involvement** in autoimmunity has many facets.
- **Glomerular, tubular and vascular structures** are targeted and damaged as a consequence of autoimmune processes.
- **Autoimmunity** resulting in renal injury occurs as a systemic disturbance of immunity with the central feature being loss of tolerance to normal cellular and/or extracellular proteins.
- Some of the **target auto antigens** are now identified in autoimmune diseases where tissue injury includes the kidney.

# IMMUNOLOGICAL DISORDERS AFFECTING KIDNEYS

- **Cystinosis.** Cystinosis is a rare disorder that allows a natural chemical called cystine to build up in your body and cause health problems. ...
- **Glomerulonephritis.** ...
- **IgA Nephropathy.** ...
- **Lupus Nephritis.** ...
- **Polycystic Kidney Disease**

# NEOPLASTIC DISORDERS AFFECTING KIDNEYS

- **Kidney neoplasms** are common diseases with varying prognoses depending on the subtype of the tumor.
- The most common solid lesion of the kidney is **renal cell carcinoma**, and the treatment is typically surgical removal.
- Kidney cancer is caused when **DNA in cells in one or both kidneys mutate, which may lead to uncontrolled cell division and growth.**
- While the exact cause of a person's kidney cancer may not be known, certain risk factors are strongly linked to the disease, including **smoking tobacco and obesity.**

# NEOPLASTIC DISORDERS AFFECTING KIDNEYS

- A **benign or malignant neoplasm** affecting the kidney.
- Examples of benign renal neoplasms include .....**fibroma, lipoma, oncocytoma, and juxtaglomerular cell tumor.**
- Examples of malignant renal neoplasms include .....**renal cell carcinoma, renal pelvis carcinoma, Wilms tumor, rhabdoid tumor, sarcoma, and lymphoma.**

# VASCULAR , INTERSTITIAL AND PARENCHYMAL DISORDERS.

- **Renal parenchymal disease**, also termed **medical renal disease**, includes various disorders of the glomeruli, interstitium, tubules, and small blood vessels of the kidneys.
- It encompasses diseases **confined to the kidneys** and systemic disorders that secondarily affect the kidneys.
- Renal parenchymal diseases can be **primary, secondary, congenital, hereditary, or acquired..**



# VASCULAR DISORDERS

- **Renal vascular disease** ..affects the blood flow into and out of the kidneys. It may cause kidney damage, kidney failure, and high blood pressure.
- **affect the arteries and veins of the kidneys.**

...

## **Vascular conditions include:**

- Renal artery stenosis (RAS). ...
- Renal artery thrombosis. ...
- Renal vein thrombosis. ...
- Renal artery aneurysm. ...
- Athero-embolic renal disease.
- Benign and malignant nephrosclerosis

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# INTERSTITIAL DISORDERDS

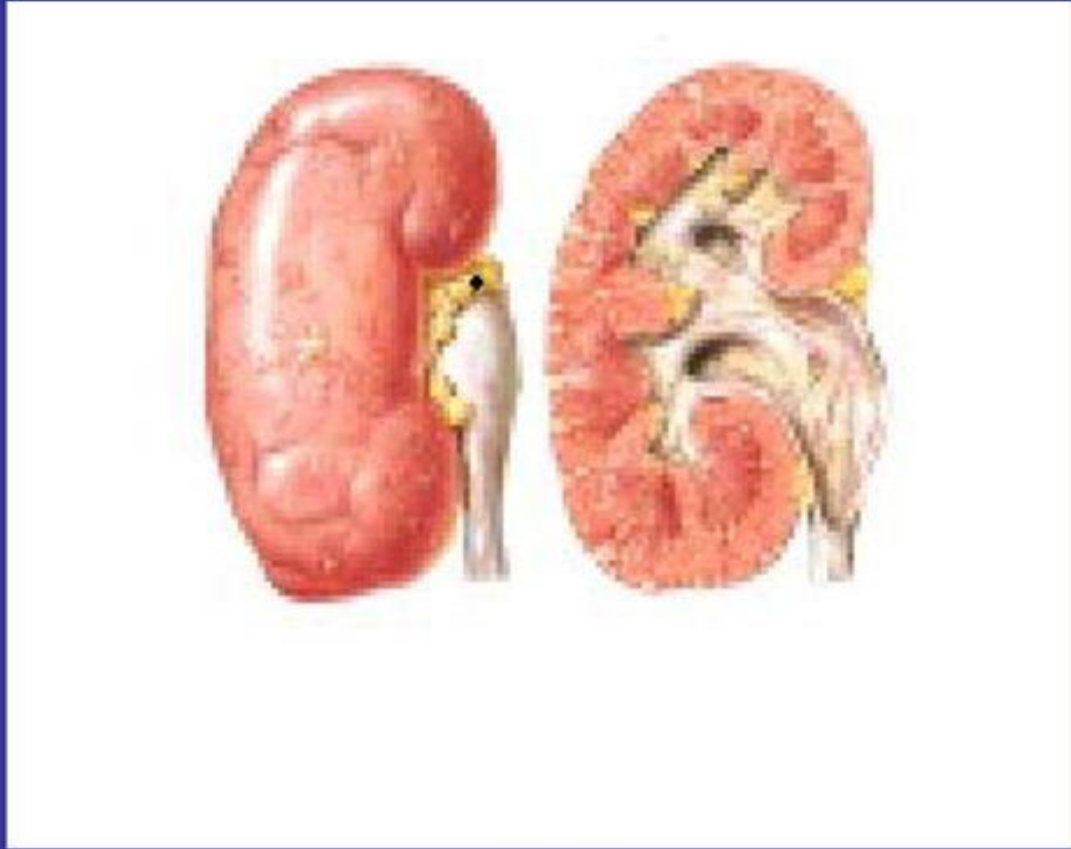
- **Interstitial nephritis / Tubulointerstitial nephritis** is a kidney disorder.
- **Tubulointerstitial nephritis is inflammation that affects the tubules of the kidneys and the tissues that surround them (interstitial tissue).**
- The kidneys filter waste and extra fluid from the body.
- When you have **interstitial nephritis**, the spaces between tubules (small tubes) inside the kidney become inflamed.
- This reduces the kidneys' ability to filter properly.
- The most common causes of interstitial nephritis are: **Drugs, diabetes, hypertension.**

# INTERSTITIAL DISORDERDS

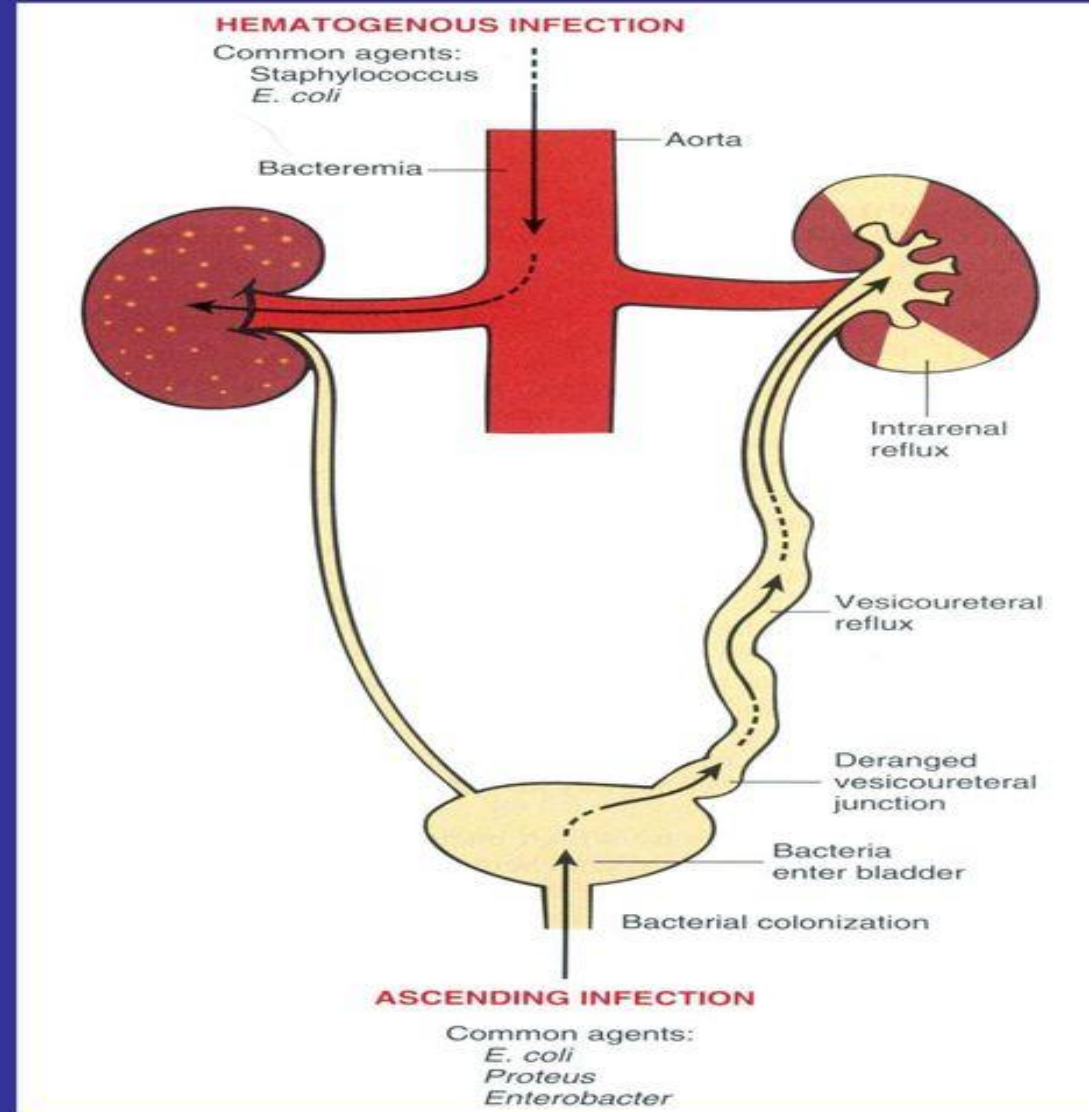
**1. PYELONEPHRITIS....pelvis of kidney is commonly involved due to**

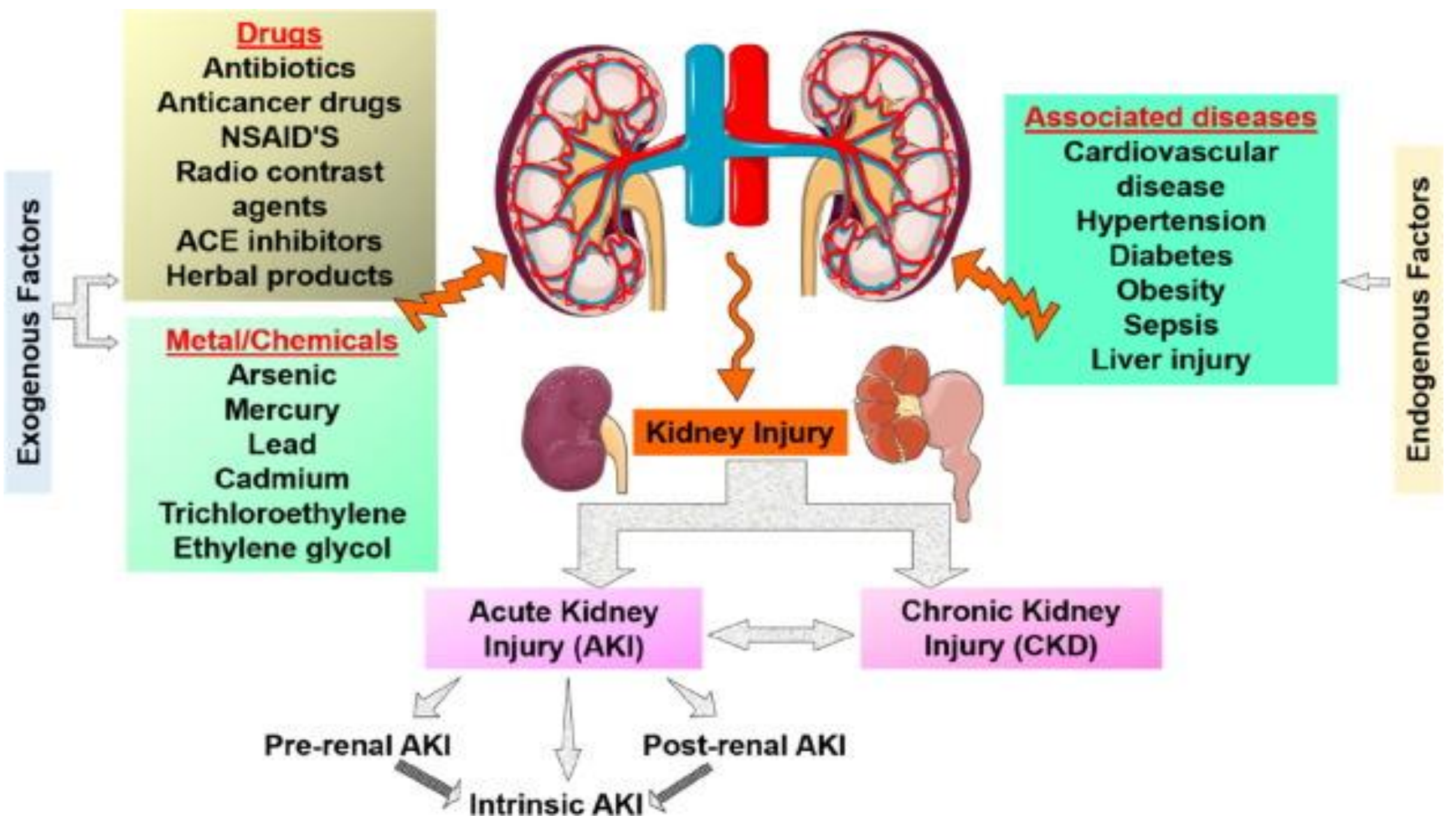
- **Bacterial infection.... E.coli, B. proteus, and others**
- **Obstruction....stones , pregnancy**
- **Vesico –ureteric reflux**
- **Diabetes**
- **Female sex**

# Acute PN



Yellow foci of pus





Any  
Questions?

*Thank you*