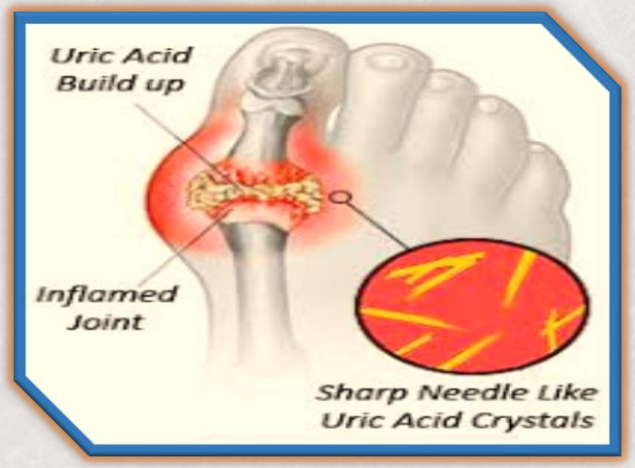
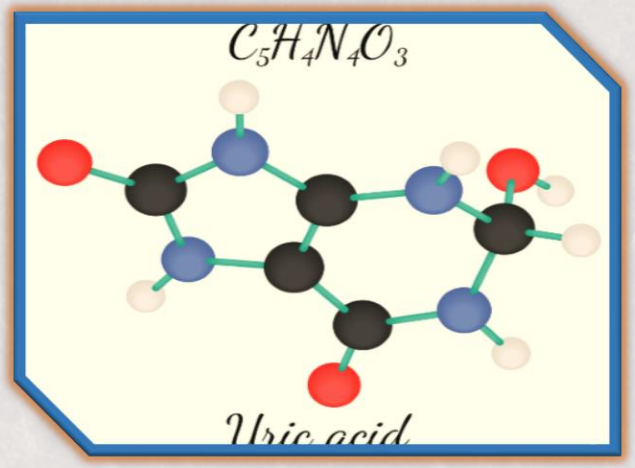
Al-Mustaqbal University College

Pharmacy Department – Fifth Class

Practical Clinical Chemistry

Estimation of Uric Acid



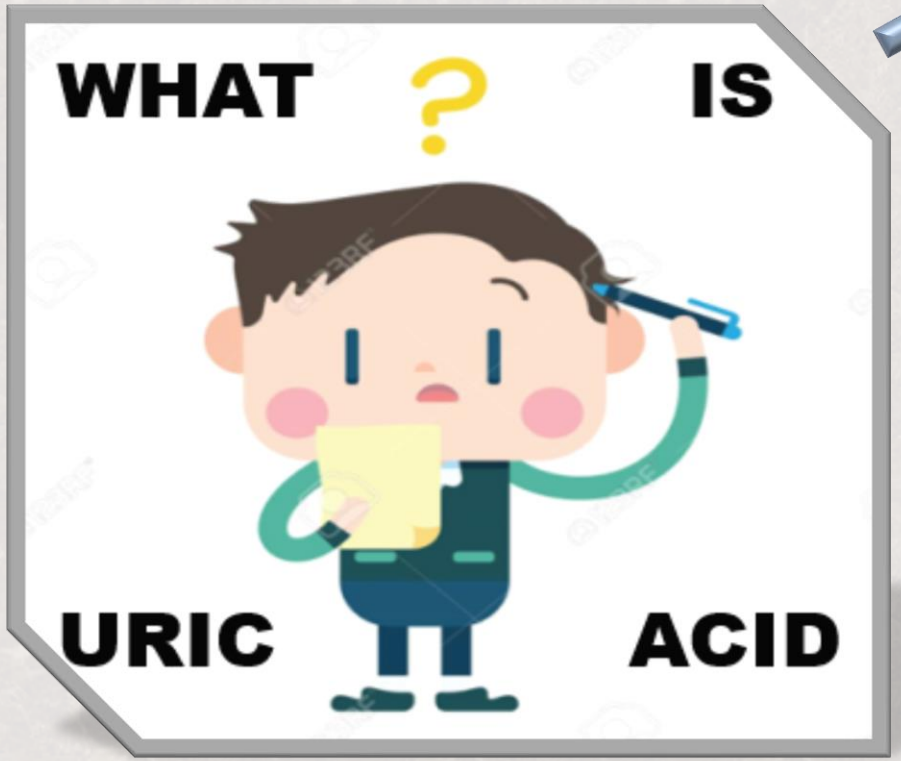


Fourth Lec.

Asst. Lec. ZAINAB GHALEB

Out Line

- ✓ Introduction.
- ✓ Purine Catabolism Pathway.
- ✓ Produce of Uric Acid.
- ✓ Clinical Application.
- ✓ Normal Value of Uric Acid.
- ✓ Clinical Significance.
- ✓ Determination of Uric Acid in Serum.


WHAT
?
IS
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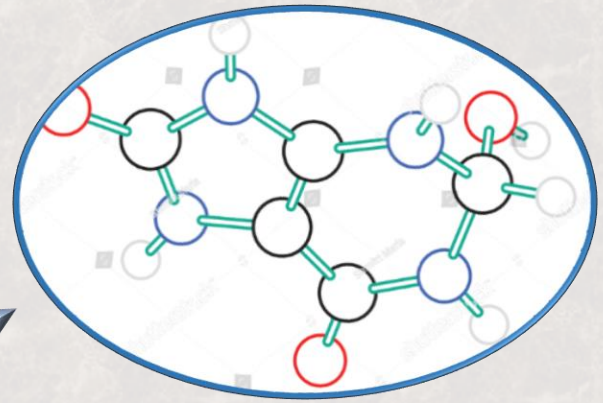
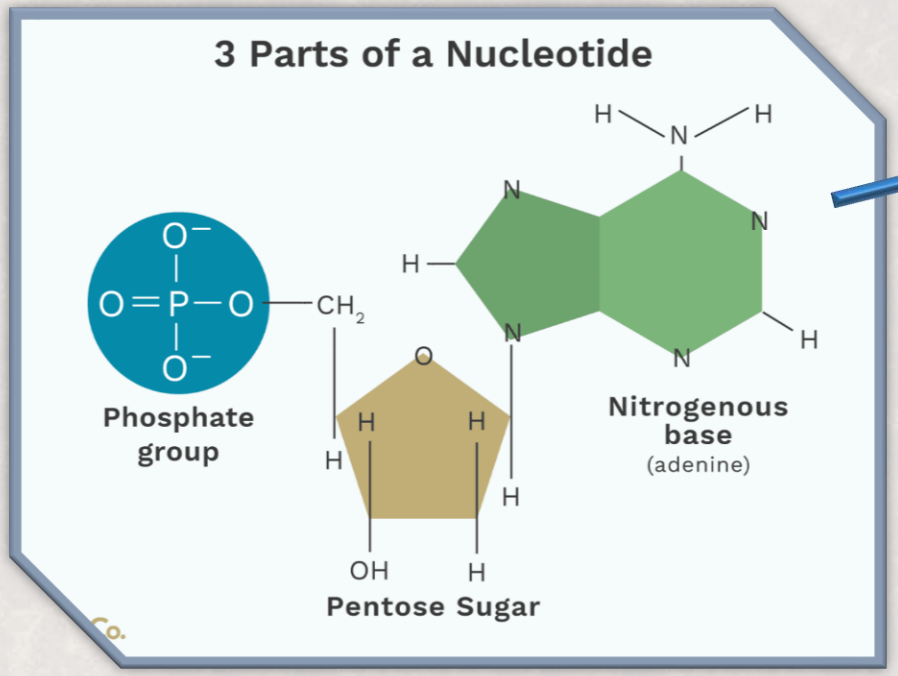


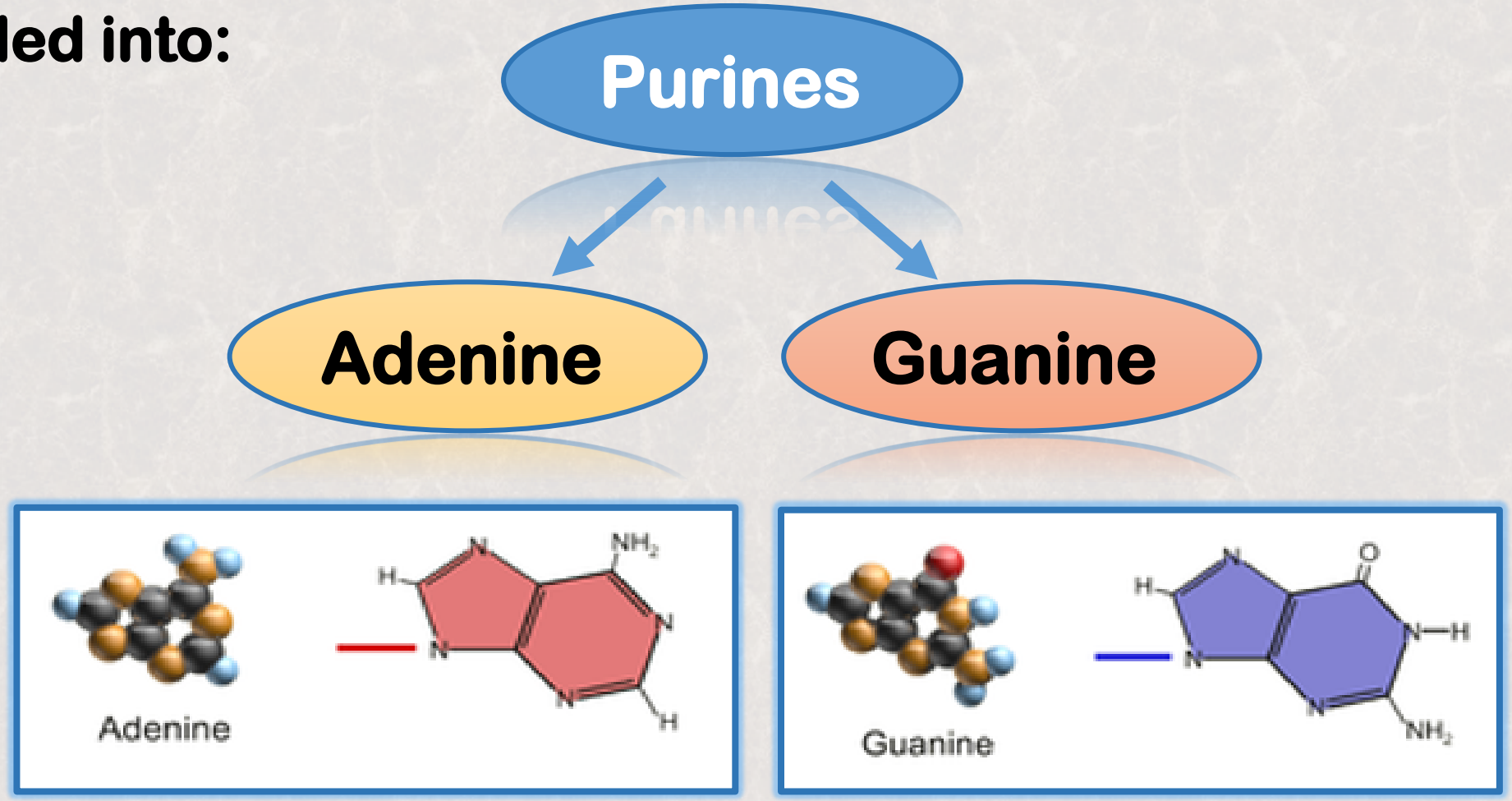
Introduction

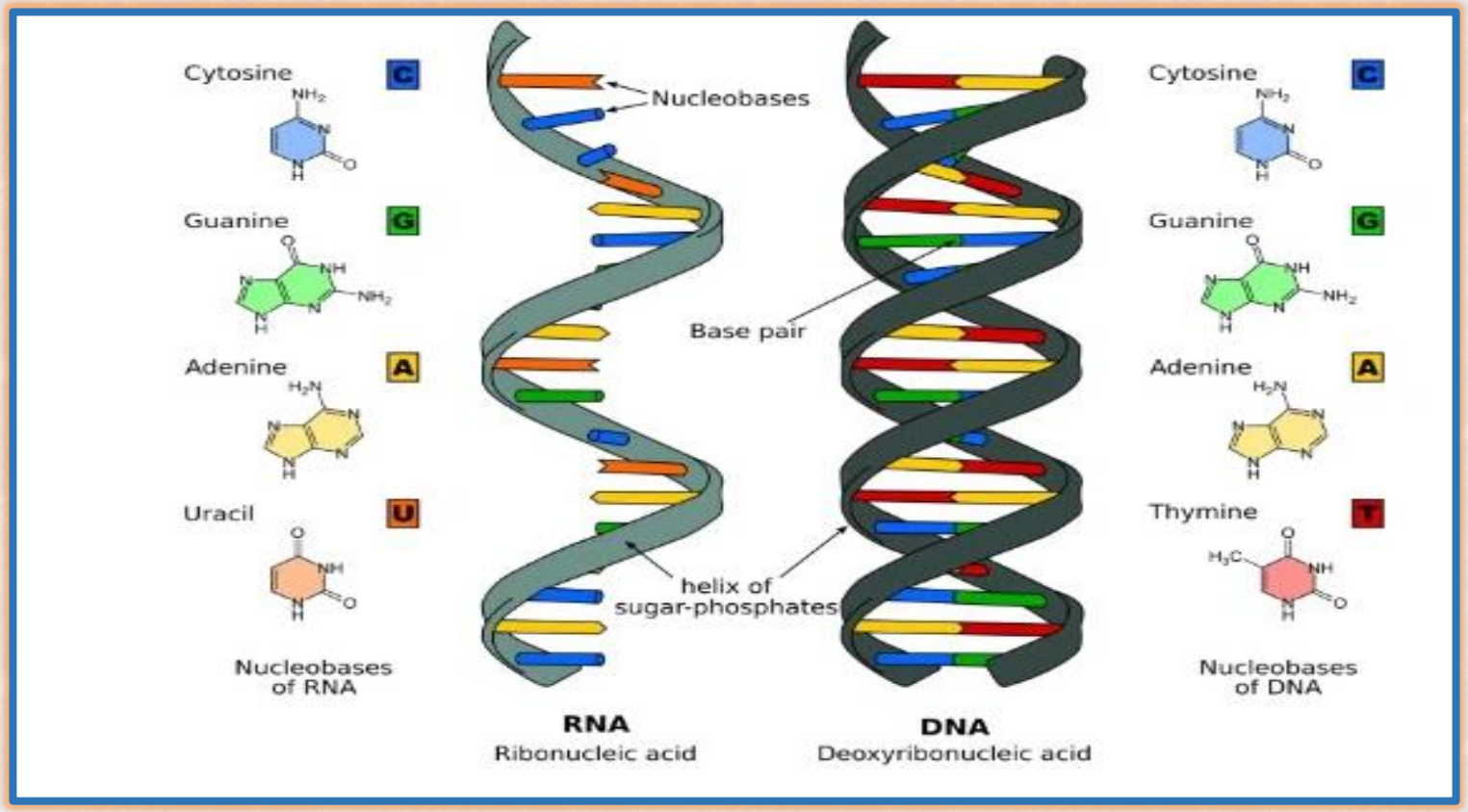
- Uric acid is the **End Product** of **Purine** Catabolism in human.



- Purines are the important constituents of Nucleic Acids (DNA, RNA)

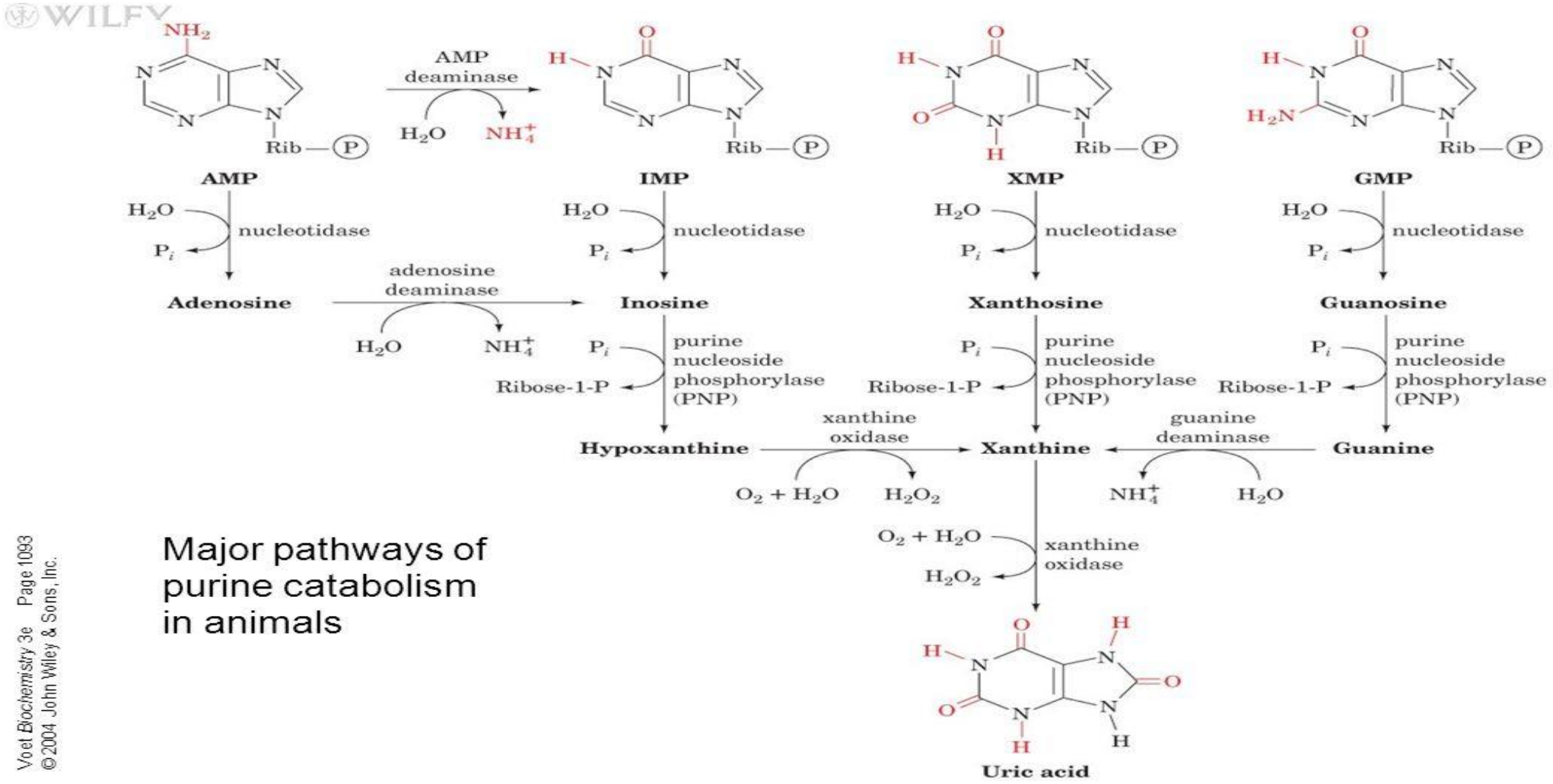
- **Purines:** are **Nitrogen Base** formed with **Sugar** and **Phosphate** a **Nucleotide** (the essential unit of **DNA**, **RNA**) and can be divided into:



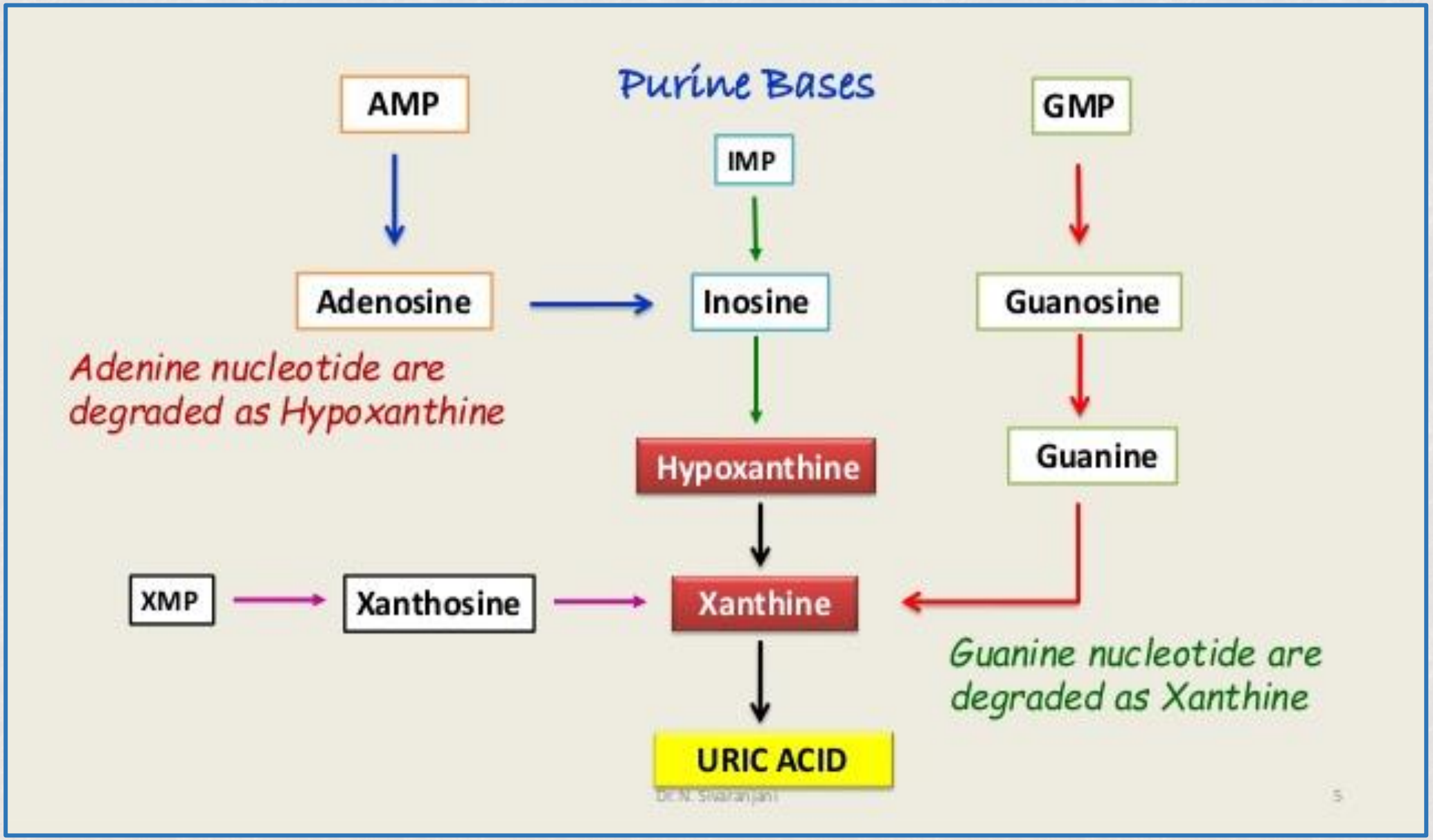


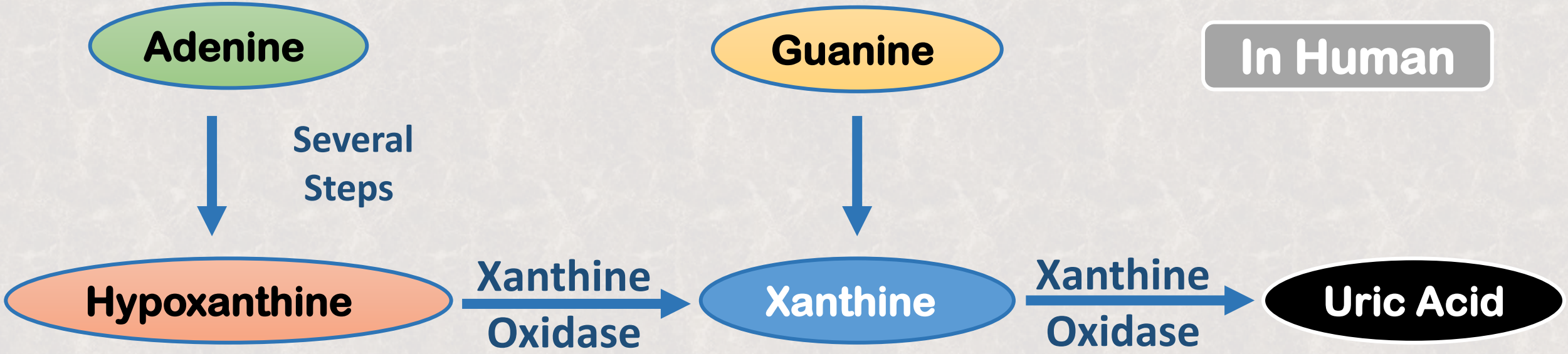
- ❑ **The sources of Purines are:**
- ✓ **Exogenous: The Breakdown of Ingested Nucleic acids (Diet).**
- ✓ **Endogenous: Tissue Destruction.**

Purines Catabolism Pathway



Major pathways of purine catabolism in animals


Purine Bases
AMP
IMP
GMP
Adenosine
Inosine
Guanosine
Adenine nucleotide are degraded as Hypoxanthine
Hypoxanthine
Guanine
XMP
Xanthosine
Xanthine
Guanine nucleotide are degraded as Xanthine
URIC ACID



- Purines are converted into Uric Acid, primarily in the Liver.

- Allantoin is more water-soluble End product.

- Uric acid is transported in the Plasma from the Liver to the Kidney, where it is filtered by the Glomerulus.
- Although it is filtered by the Glomerulus and secreted by the Distal tubules into the Urine, most of Uric acid is Reabsorbed in the Proximal tubules and reused.
- Renal excretion is about 70% of Uric acid elimination; the remainder passes into the Gastrointestinal tract and is degraded by Bacterial enzymes.

- Uric acid is relatively **Insoluble** in **Plasma** and nearly all of it presents in Plasma as **Monosodium Urate**.
- At high concentrations (greater than **6.8** mg/dL) the **Plasma** is **Saturated**, Uric Acid will be **Precipitate** in the **Joints** and **Tissue**, causing Painful Inflammation.

Clinical Application

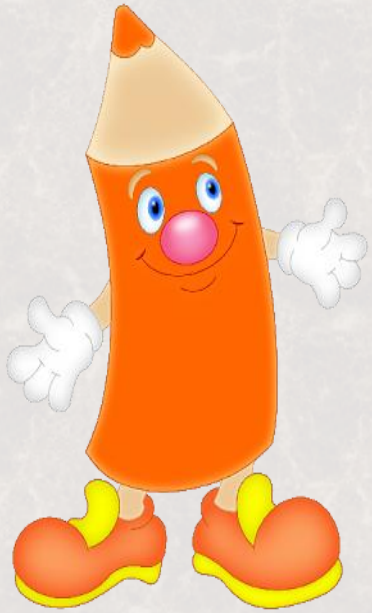
- **Uric acid is measured to:**

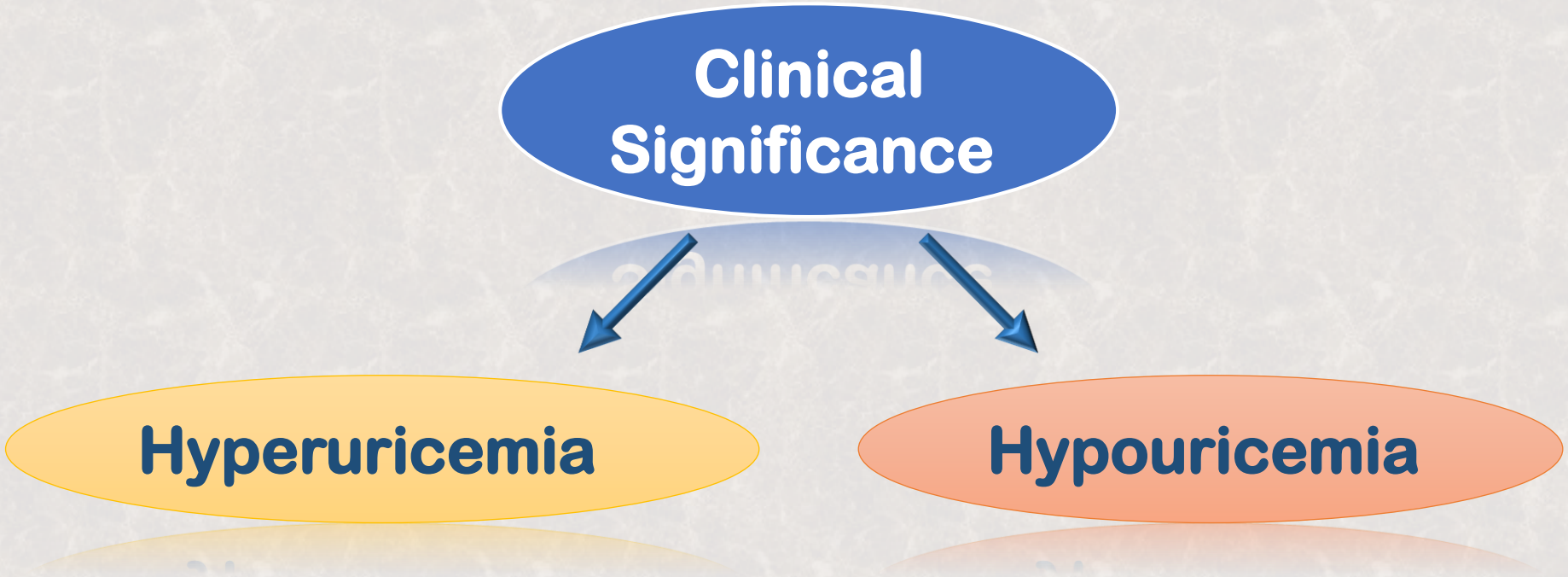
- ✓ **Assess Inherited Disorders of Purine Metabolism.**
- ✓ **Confirm Diagnosis and Monitor treatment of Gout.**
- ✓ **Assist in the Diagnosis of Renal Calculi.**
- ✓ **Prevent Uric acid Nephropathy during Chemotherapeutic treatment.**
- ✓ **Detect Kidney Dysfunction.**

Normal Value

- The Normal Value of Uric Acid is must be between:

Male	3.4 – 7 mg/dl
Female	2.5 – 6 mg/dl





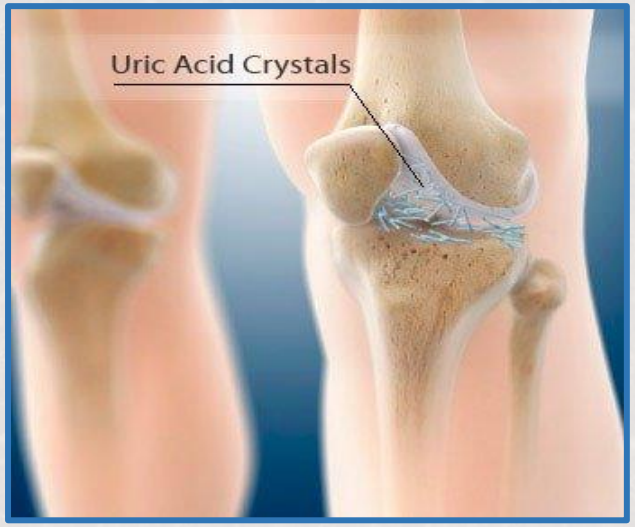
- Elevated Plasma Uric acid Concentration is found in:

Gout – Increased Catabolism of Nucleic acids – Renal Disease

Hyperuricemia

1. **Gout** is a disease found Primarily in **Men** and usually is first diagnosed between 30 and 50 years of age. Affected individuals have **Pain** and **Inflammation** of the **Joints** caused by **Precipitation** of **Sodium Urates**.

Patients with **Gout** are very susceptible to the **development** of **Renal Calculi**, although not all persons with high serum Urate concentrations develop this complication.


Uric Acid Crystals


Uric Acid
Build up
Inflamed
Joint
Sharp Needle Like
Uric Acid Crystals

2. Increased Metabolism of Cell Nuclei, as occurs in patients on Chemotherapy (Leukemia, Lymphoma, Multiple Myeloma).

3. Chronic Renal Disease.

4. Ingestion of a purines rich Diet.

5. Increased tissue catabolism due to inadequate Dietary intake (Starvation).

6. Inherited disorders of purine metabolism (Lesch-Nyhan syndrome).

7. Hyperuricemia is a common feature of Toxemia of Pregnancy and Lactic Acidosis.

8. Drugs such as Salicylates and Thiazides.

Hypouricemia

- **Hypouricemia** is less common than **Hyperuricemia**.

1. Liver disease.
2. Defective tubular reabsorption (**Fanconi Syndrome**).
3. Chemotherapy with **Azathioprine** or **6-mercaptopurine**.
4. Overtreatment with **allopurinol** (**Drug using to decrease the Uric Acid level**).

Principle

- **Uric acid is Oxidized by Uricase to Allantoin and Hydrogen Peroxide, according to the following equations:**

$$\text{Uric acid} + O_2 + 2H_2O \xrightarrow{\textit{Uricase}} \text{Allantoin} + CO_2 + H_2O_2$$

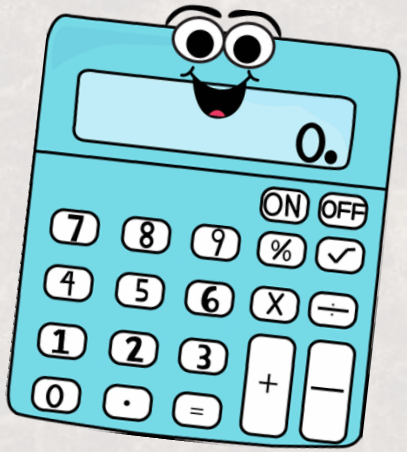
$$2H_2O_2 + \text{4-Aminophenazone} + \text{2,4-dichlorophenol-sulfonate} \xrightarrow{\textit{Peroxidase}} \text{Quinonimine} + 4H_2O$$

Procedure

- In this test (Uric Acid test) Wavelength used is 520 nm. Sample used is Serum.

Solutions	Blank	Standard	Sample
Working Reagent	1 ml	1 ml	1 ml
Standard	-	20 µl	-
Sample	-	-	20 µl
Mix, incubate 5 min at 37 ℃ or 10 min at 25 ℃. The color is stable for 30 minutes.			

Calculations



- The Uric Acid Concentration in the Sample is calculated by using the following general formula:

$$C\ sample = \frac{Absorbance\ of\ Sample}{Absorbance\ of\ Standard} \times Standard\ conc.$$

- The Concentration of the Standard is:

8 mg/dl

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