

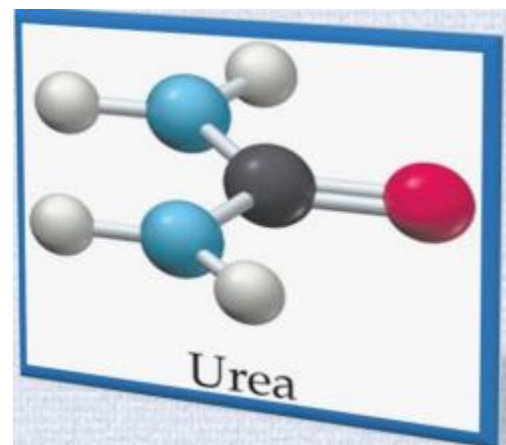


Class: Third Stage
Subject: Practical Biochemistry
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Al-Mustaqbal University
College Pharmacy
Department –Three Class
Practical Clinical Chemistry
Estimation of Urea

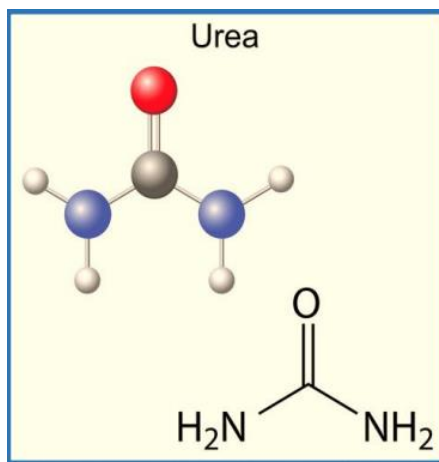
Asst. Lec. Alyaa kareem





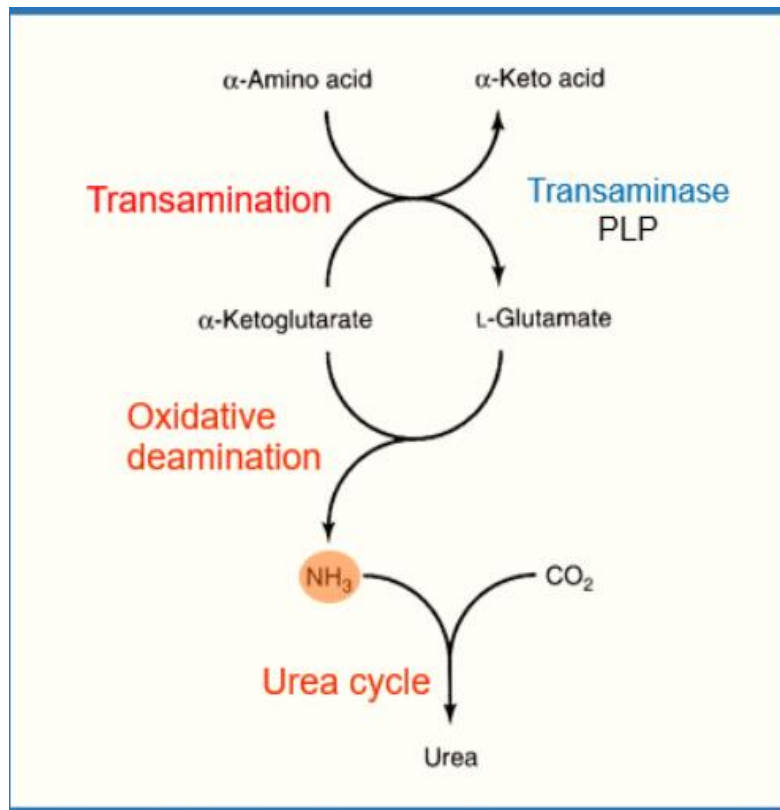
Urea is the Major Excretory Product of Protein Metabolism (**Amino acid metabolism**) in Human and Mammals.

- Urea is a Nitrogenous Compound containing a One Carbonyl Group attached to Two Amine Groups
- Protein metabolism produces Amino acids that can be Oxidized to produce Energy or stored, these processes release Nitrogen as NH_3 .



NH_3 produced from Oxidative Deamination reaction, is Toxic compound even in small amount and must be removed from the body.

- The amount of Nitrogen ingested is balanced by the Excretion of an equivalent amount of Nitrogen.
- Urea Cycle is the Conversion reactions of NH_3 into Urea.



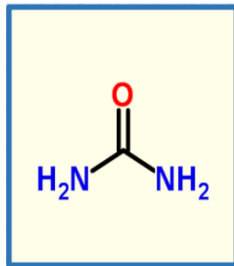
Concentration of Urea in the Blood mainly balanced between Urea Formation from Protein Catabolism and Urea Excretion from the Body.

Why NH_3 convert to Urea?

To Detoxification of NH_3 as Urea is less Toxic compound than Ammonia.

Urea is Soluble in Water.

Urea combine Two waste molecules (CO_2 , NH_3) into One molecule to excreted from the body.

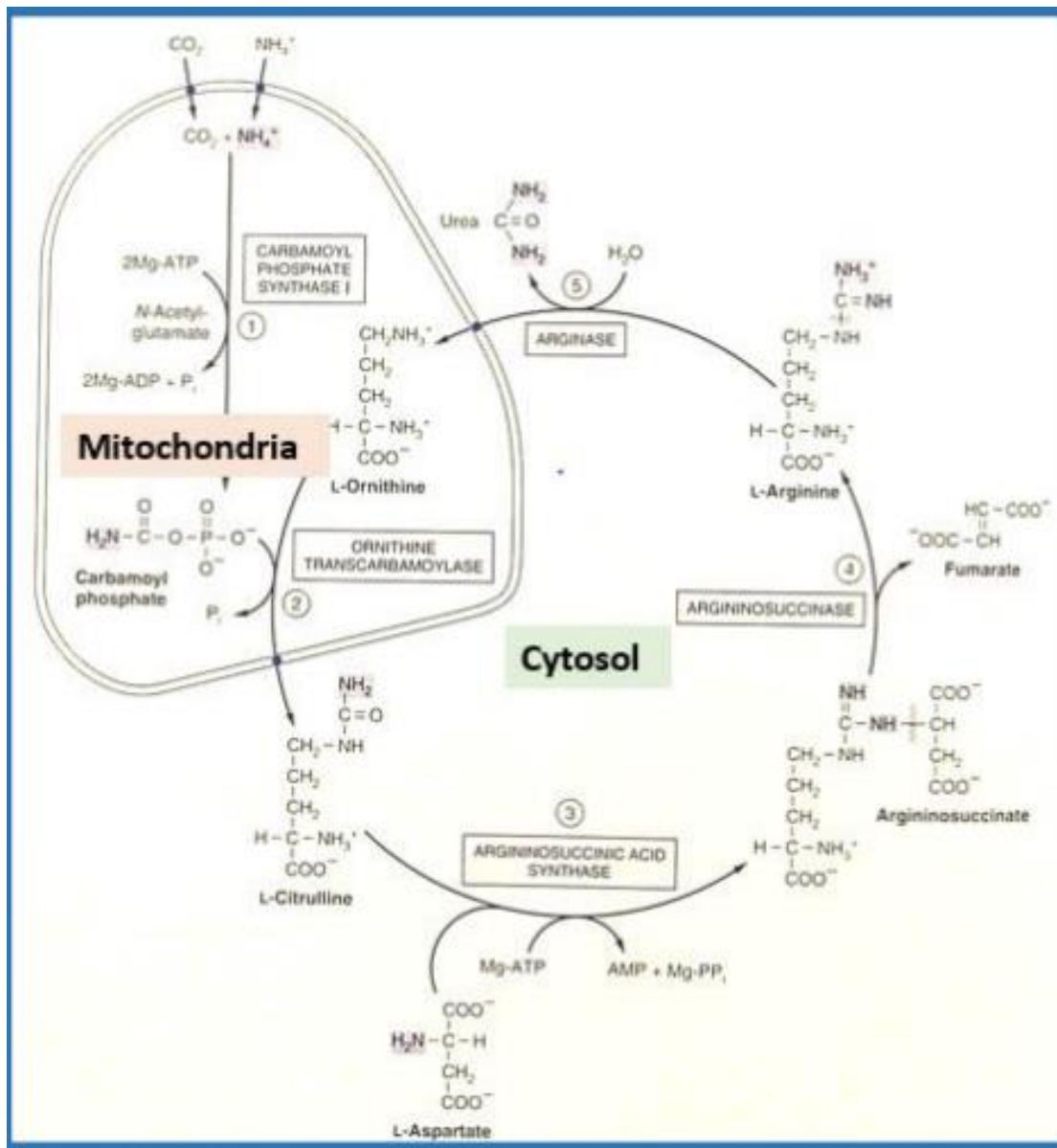


Urea is formed in the Liver by Urea Cycle (certain occurs in Cytosol & Mitochondria).

Following synthesis in the Liver,

Urea is carried in the Blood to the Kidney, where it is readily filtered by the Glomerulus.





- Most of the Urea is Excreted in the Urine, although some Urea is Reabsorbed by the Renal tubules.
- Small quantities of Urea (10% of the total) are Excreted through the Gastrointestinal tract and Skin.



The Concentration of Urea in the Plasma is determined by:

- ✓ Renal Function.
- ✓ The Protein content of the Diet.
- ✓ The Rate of Protein Catabolism.

Blood Urea Nitrogen (BUN) test:

- ❑ Blood Urea Nitrogen BUN test is a measure of the amount of Nitrogen in the Blood in form of Urea.
- ❑ To determine Nitrogen from Urea we use the following formula:

$$\text{Urea} = \text{BUN} * 2.14$$

Normal Value

The Normal Value of Urea & BUN is must be between:

Urea 15 – 45 mg/dl

BUN 7 – 21 mg/dl

This Value become higher with age.

Clinical Significance

Increased Urea

Decreased Urea



Increased Urea

Pathophysiology an Elevated Concentration of Urea in the Blood is called Azotemia.

❑ Very high plasma Urea Concentration accompanied by Renal Failure is called Uremia, or the Uremic Syndrome.

❑ This condition is eventually fatal if not treated by Dialysis or Transplantation.

❑ Conditions causing Increased plasma Urea are classified according to cause into three main categories:

✓ Prerenal.

✓ Renal.

✓ Postrenal.

➤ Prerenal Azotemia: is caused by reduced Renal Blood Flow.

Less Blood is delivered to the Kidney; consequently, less Urea is filtered. Causative factors include:

✓ Congestive heart failure.

✓ Shock.

✓ Hemorrhage.

✓ A high-protein diet or increased protein catabolism.

✓ Dehydration and other factors resulting in a significant decrease in blood volume.



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➤ **Renal Azotemia:** Decreased Renal Function causes an Increase in Plasma Urea concentration as a result of compromised Urea Excretion.

Renal causes of elevated Urea include:

- ✓ Acute and Chronic Renal Failure.
- ✓ Glomerular Nephritis.
- ✓ Tubular Necrosis.

➤ **Postrenal Azotemia:** can be due to Obstruction of Urine flow anywhere in the Urinary Tract by:

- ✓ Renal Calculi.
- ✓ Tumors of the Bladder or Prostate.
- ✓ Severe Infection.

Decreased Urea

➤ The major causes of Decreased Plasma Urea Concentration include:

- ✓ Low Protein Intake.
- ✓ Severe liver disease.
- ✓ Pregnancy.
- ✓ Severe Vomiting and Diarrhea.



Principle

➤ Urea is Hydrolyzed by water and Urease into Ammonia and Carbon Dioxide.



➤ The Ammonia produced is further acted with Hypochlorite and Salicylate to form Green Complex.

➤ The intensity of Color is proportional to the Urea Concentration in the Sample

❑ In this test (Urea test) Wavelength used is 578 nm. Sample used is Serum.

Solutions	Blank	Standard	Sample
Working Reagent	1 ml	1 ml	1 ml
Standard	-	10 μ l	-
Sample	-	-	10 μ l

Mix, incubate for 5 min at RT or for 3 min at 37C. After that add 1000 μ l for each tube, Mix and incubate for 10 min at RT or 5 min at 37C, read the absorbance at 578nm.



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Calculations

➤ The Urea Concentration in the Sample is calculated by using the following general formula:

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

➤ The Concentration of the Standard is:

80 mg/dl or 13.3 mmol/l