



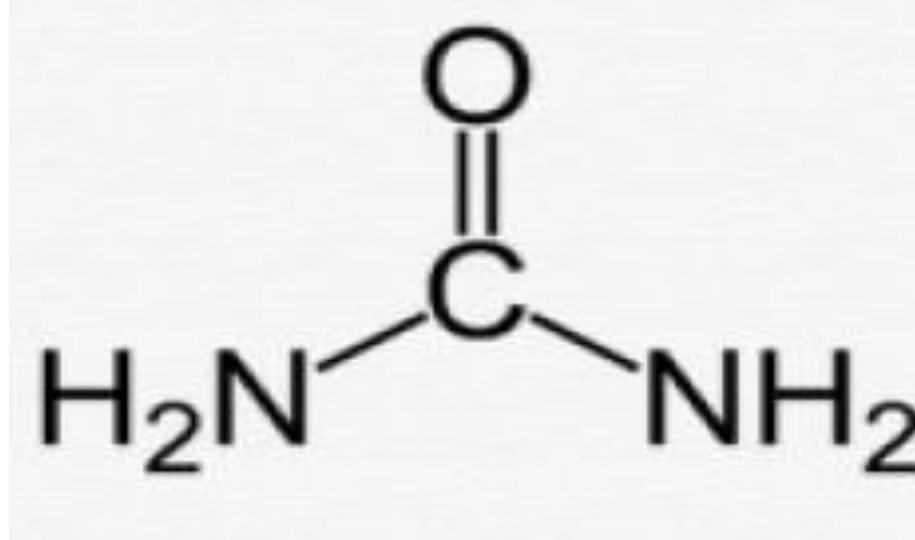
BioChemistry

Estimation of urea level in the blood

Third Stage

Second Semester

Determination of blood or serum urea



Background:

Urea metabolism is an important way to excrete ammonia, which is a waste product of proteins metabolism. After breakdown of protein into amino acids which catabolized in the liver to form ammonia. Urea is formed from combination of ammonia with CO_2 to be transported by the blood to kidney for excretion . Urea diffuse freely in and out of the red blood cell and its concentration in red blood cells and plasma is nearly the same, for most purpose it is not essential wheathere whole blood, plasma or serum used in analysis.

The circulating levels of urea depend upon protein intake, protein catabolism and kidney function. Elevated urea levels can occur due to renal impairment or in some diseases such as diabetes, infections, congestive heart failure and during different liver diseases .

Why estimation of blood urea is required?

Assessing Kidney Function:

High levels of urea in the blood (uremia) may indicate that the kidneys are not functioning properly, which could be due to conditions like chronic kidney disease (CKD), acute kidney injury, or kidney failure.

Evaluating Hydration Status:

Blood urea levels can help detect dehydration, as dehydration can lead to increased urea concentration due to reduced kidney perfusion.

Why estimation of blood urea is required?

Monitoring Liver Function:

Since urea is produced in the liver, low urea levels may indicate liver dysfunction or damage.

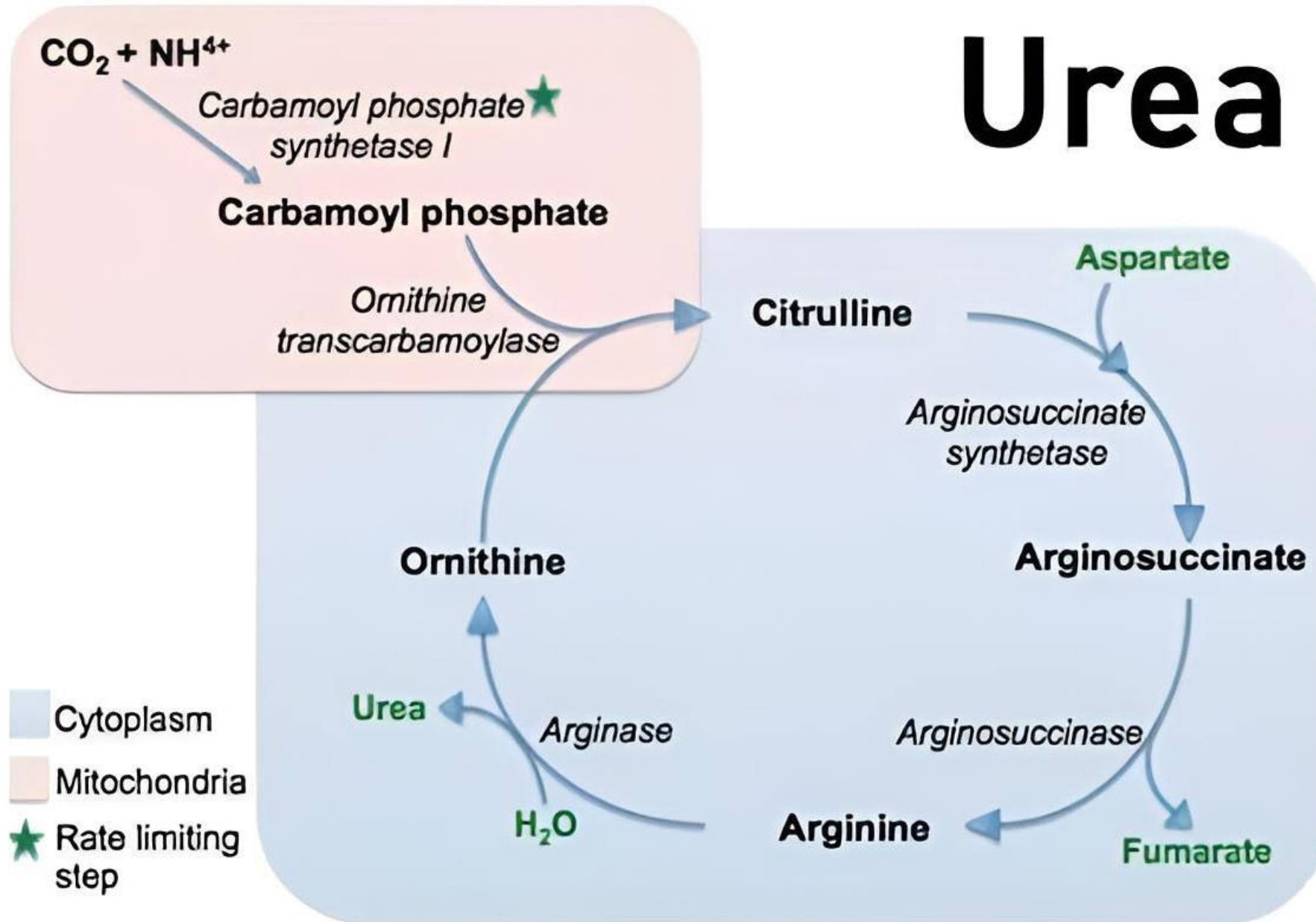
Assessing Protein Metabolism:

Blood urea levels reflect the breakdown of proteins in the body.

Elevated levels might occur due to a high-protein diet, tissue breakdown, or catabolic states, while low levels might suggest malnutrition.

Urea Cycle

Enzymes & Steps



Clinical significance :

Normal renal function depends on a normal filtration rate , normal tubular function and normal blood supply. A low GFR (glomerular filtration rate) lead to uremia.

➤ Causes lead to increased serum urea concentration :

1- Increase production (High protein diet , increase catabolism of cellular protein of the body as in fever and infection) .

2- Decrease GFR may be due to :

- Reduction of blood volume , which could be associated with gastrointestinal loss, reduced intake and dehydration
- Reduced pressure due to shock as a result for example MI or intravascular hemolysis.

3- Post-renal uremia as a result for example renal calculi or kidney diseases

➤ **Causes lead to decreased serum urea concentration:**

- 1 Malnutrition
- 2 Very severe liver disease
- 3 Inborn error of urea cycle
- 4 Inappropriate ADH secretion

Principle :

Urea is hydrolyzed by urease forming ammonia and carbamic acid. Carbamic acid spontaneously decomposes into ammonia and carbon dioxide.

The released ammonium, in the presence of salicylate and nitroferricyanide reacts in alkaline solution of sodium hypochlorite, to form a green dye compound.

The intensity of the green color produced is directly proportional to the urea concentration.

Procedure:

Pipetting in tubes:

	BLANK	STANDARD	SAMPLE
Reagent (R3)	1000 µL	1000 µL	1000 µL
R2	50 µL	50 µL	50 µL
Standard		10 µL	
Sample			10 µL

Mix and incubate for 3 min at 37 C or 5 min at 20-25C

Reagent (R4)	200 µL	200 µL	200 µL
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Incubate for 5 min at 37C or 10 min at 25C and read sample and standard extinction against blank.

Notes:

Wave length: 578nm (578-630)

Optical Path: 1 cm light path

Temperature: 20-25 / 37 C

Reading: Against reagent blank

Calculation:

$$\text{UREA mg/dl} = \frac{\text{A Sample}}{\text{A Standard}} \times 50$$

Unit conversion

$$\text{mg/dl} \times 0.166 = \text{mmol/l}$$

Expected value:

Serum/Plasma: 45-15mg/dl - 7.5-2.5mmol/l

Urine: 35-20g/24h - 580-330mmol/24h

