


**CREATININE ESTIMATION  
&  
CREATININE CLEARANCE  
TEST**

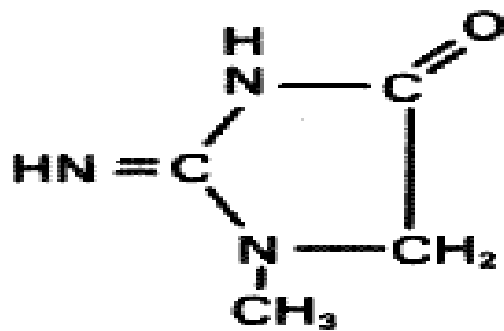
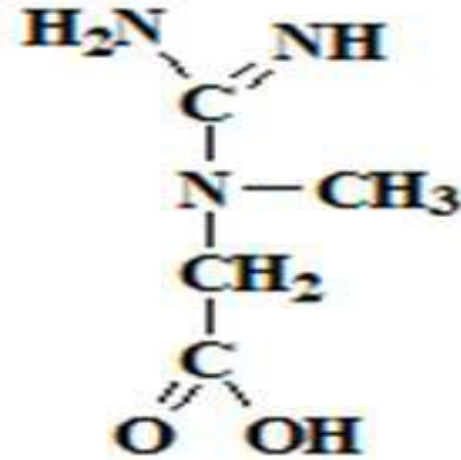


# *What's Creatine and Creatinine...?*

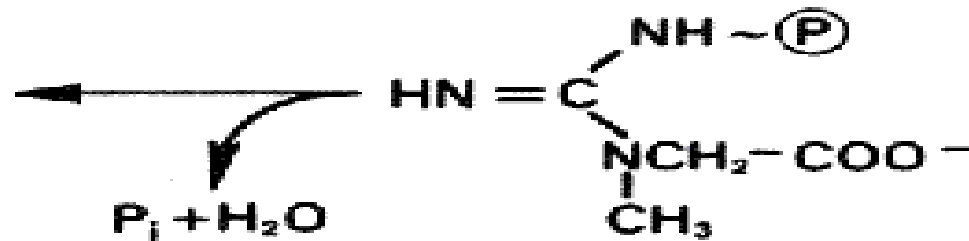
- *Creatine and creatinine are not the same substance!*
  - **Creatine** is synthesized in Liver from arginine, glycine & methionine
  - **Creatinine** is a break-down product (a waste product) of *creatine phosphate* and *creatine* in muscles, and is usually produced at a fairly constant rate by the body (depending on muscle mass).
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# *Creatine*

- is an amino acid that does not found in proteins.
- is a nitrogenous organic acid.
- Converted to Creatine Phosphate = high energy source for muscle tissue



**Creatinine**



**Creatine phosphate**

*Formation of Creatinine from Creatine Phosphate*

# *Source of Creatine*

## □ Endogenous Source

- Creatine is synthesized primarily by the liver, kidneys, and pancreas at a rate of 1 to 2 g/day.

## □ Exogenous Source :

- An additional 1 to 2 g/day is obtained in the diet, mainly from fish and meats.



## *What's the Relationship between Creatine and Creatine phosphate?*

- Creatine and creatine phosphate exist in a reversible equilibrium in skeletal muscle.
- In skeletal muscle, approximately 1/4 of creatine exists as free creatine and 3/4 exists as creatine phosphate.



## *Creatinine Excretion:*

- The creatinine is a waste product of creatine phosphate and it will be excreted by the kidney in the urine at a rate of **1 to 2 g/day**.



# Creatinine Metabolism

Approximately 2% of the body's creatine is converted to creatinine every day

Creatinine is transported through the bloodstream to the kidneys

The kidneys filter out most of the creatinine and excrete it in the urine.

# The Diagnostic Function of Creatinine

If the kidneys are damaged or impaired and cannot work normally



The amount of creatinine in urine goes down while its level in blood goes up.



Creatinine has been found to be a fairly reliable indicator of kidney function.

Serum creatinine level is an important diagnostic tool to assess renal function





## ***Serum Creatinine :*** *(creatinine level in the blood)*

- In renal failure the kidney will not be able to excrete creatinine in urine leading to an elevation in serum creatinine level.



*Levels of Creatinine in the Blood  
Depends Mainly on Renal Function...*

*but...*

*• Are there other factors that may  
affect creatinine level in the blood...*

*?*



## *Serum Creatinine may be Affected Partly by...*

- *The amount of muscle tissue you have..*

Men tend to have higher levels of blood creatinine because they have more skeletal muscle tissues than women.

- *Protein in diet :*

Vegetarians have been shown to have lower creatinine levels in blood.



# *How is Creatinine Used to Monitor Renal Function....?*

## *1. Creatinine Clearance Test:*

Measures how well creatinine is removed from blood by kidneys [which reflects glomerular filtration rate (GFR )].

*A Creatinine Clearance Test gives better information than a blood creatinine test on how well your kidneys are working (as serum creatinine may be affected by muscle bulk).*

## *The Glomerular Filtration Rate*

GFR is the rate at which blood is filtered through all of the glomeruli

*or*

- GFR is the measure of fluid filtered from the renal glomerular capillaries into the Bowman's capsule per unit time.



- In renal failure, the filtering (GFR ) of the kidney is deficient
- **Creatinine Clearance.** Therefore, creatinine levels in blood and urine may be used to calculate the creatinine clearance (CrCl), which reflects the GFR.



# *How to do Creatinine Clearance Test ?*

## The Principle Protocol of Creatinine Clearance Test :

- A creatinine clearance test is done on both a blood sample and on a sample of urine collected over 24 hours (24-hour urine samples).



*Creatinine clearance is the preferred, most common procedure used to assess renal function.*

*Creatinine clearance is preferred because:*

- It is a normal constituent of blood and no infusion is needed unlike *inulin*.
- It is not reabsorbed by the tubules as in the case of urea.





## *There are 3 major clearance tests:*

1. Creatinine clearance test.
2. Urea clearance test.
3. Inulin clearance.

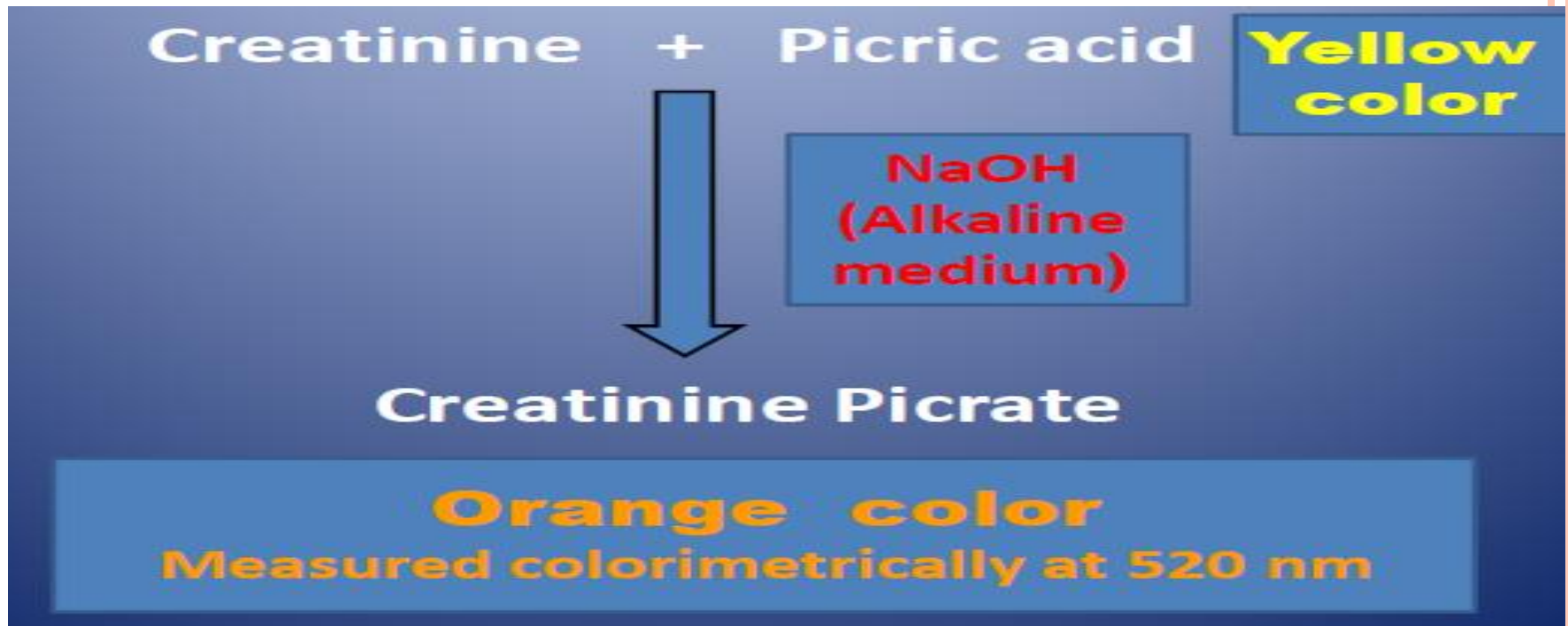
*Urea clearance test is a clinical test for renal function determined by the clearance of urea from the plasma by the kidney each minute.*

- *Inulin is a small, inert polysaccharide molecule that readily passes through the glomeruli into the urine.*
- *It is not reabsorbed by the renal tubules.*

## *Determination of Creatinine*

- The methods most widely used today are based on the **Jaffe reaction**.

This reaction occurs between *creatinine* and the *picrate ion* formed in alkaline medium (sodium picrate); a red-orange solution develops.



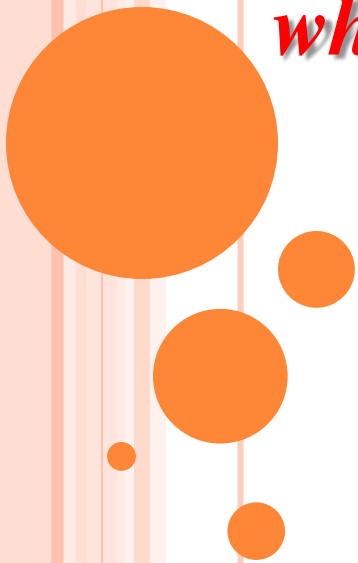
# Calculations

- **Serum creatinine** =  $\frac{\text{Abs of test}}{\text{Abs of std}} \times \text{concentration of standard}$
  - **Urinary creatinine** =  $\frac{\text{Abs of test}}{\text{Abs of std}} \times \text{concentration of standard}$
  - **Creatinine clearance** =  $\frac{\text{Urinary creatinine} \times \text{Volume of urine ml/min}}{1.73 \text{ m}^2 \times \text{Serum creatinine}}$
- ☐ **Normal creatinine clearance:**  
100-130 ml/min/1.73m<sup>2</sup>.

*If in a patient, serum creatinine has been found to be higher than normal but blood urea is within the normal range, what is the likely possibility?*



*In a patient with normal serum creatinine level, blood urea has been found to be much higher than normal, what could be the possibility?*



Excretion of creatine in urine is called **Creatinuria**, which is observed under the following conditions:

- In children-
  - Probably due to impaired conversion of creatine to creatinine
- Pregnancy
- Febrile conditions
- Thyrotoxicosis
- Muscular dystrophies, myositis and Myasthenia gravis
- Uncontrolled diabetes mellitus
- Starvation
- Wasting diseases- such as Malignancies.



Calculate the creatinine clearance of a patient with serum creatinine of 3 mg/dL, volume of urine excreted 1500 ml/ day and urinary creatinine of 0.75 G/L

$$\text{Creatinine clearance}(C) = UV/P$$

Where U= Urinary creatinine (mg/dl)

V= Volume of urine excreted (ml/day)

P= Serum Creatinine (mg/dl)

So,

Creatinine clearance (C) = **X** ml/minute

