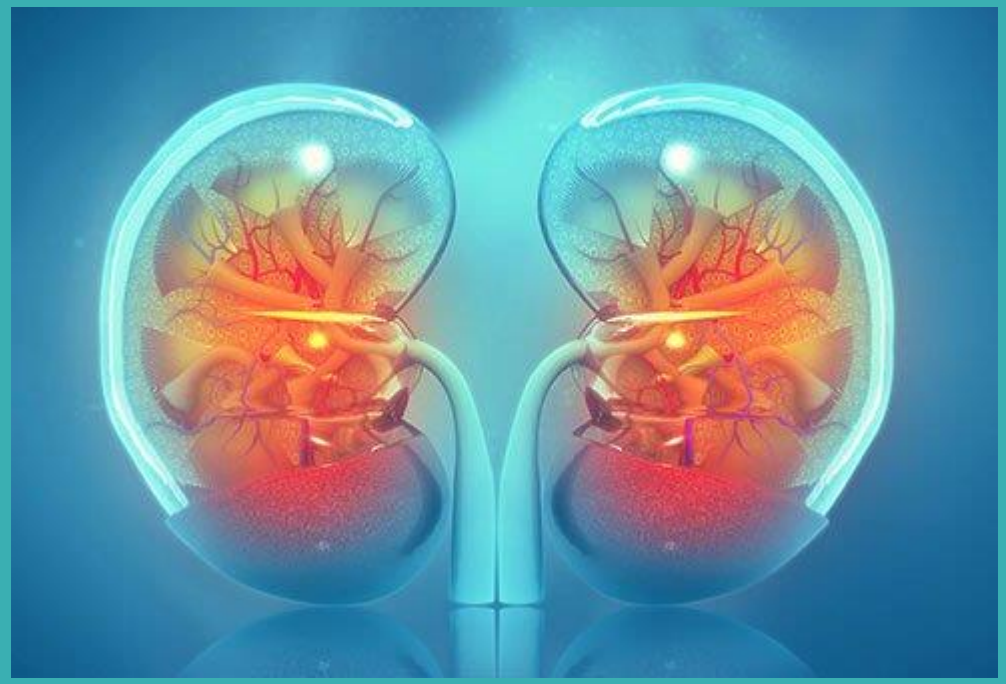
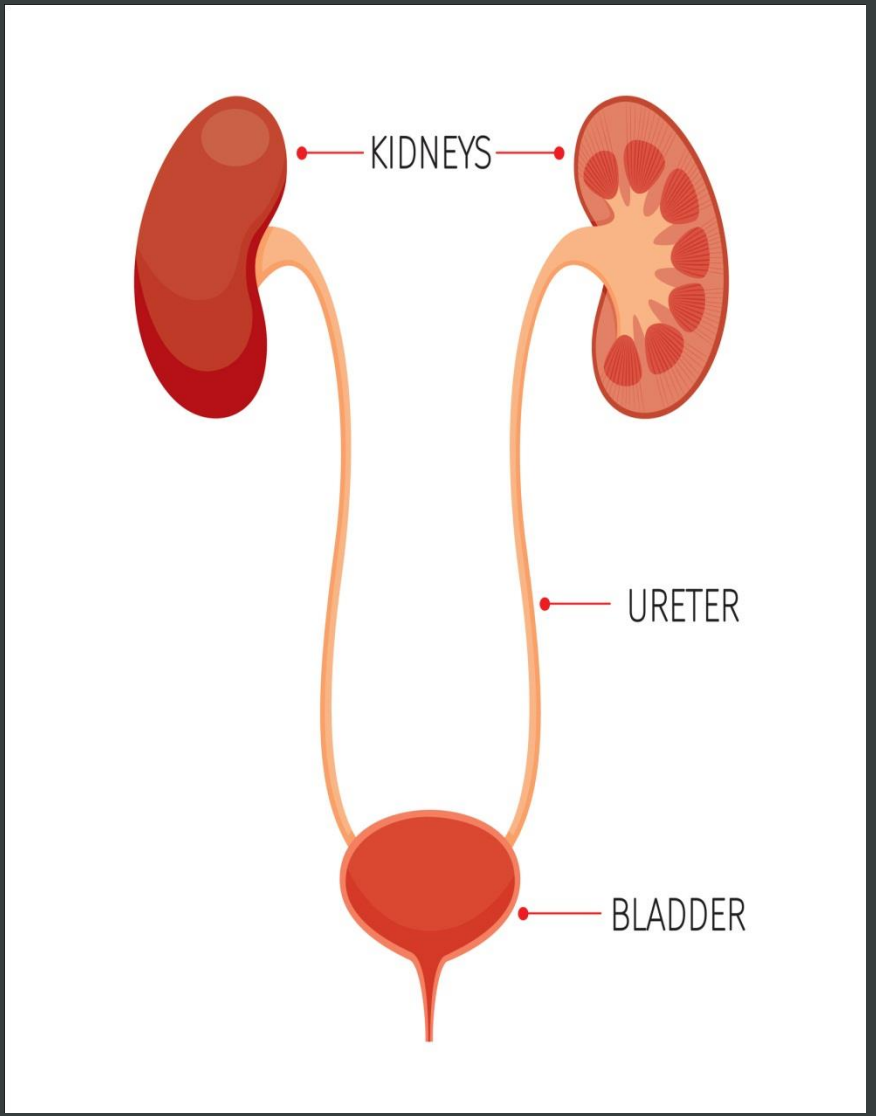
Medical Investigation

Kidney function tests
Renal function tests
(KFT)



kidney structure

- The kidneys are bean-shaped organs.
- the kidneys are located in the posterior part of the abdominal cavity.
- the right kidney sits just below the diaphragm and posterior to the liver
- Above each kidney there is an adrenal gland (also called the suprarenal gland)
- The asymmetry within the abdominal cavity caused by the liver results in the right kidney being slightly lower than the left one



kidney functions

1- Excretory function

The kidneys produce and excrete urine, which rids the body of the end products of metabolism Elimination of certain foreign toxic substances and drugs before or after they are metabolized in the liver.

2- Regulatory function

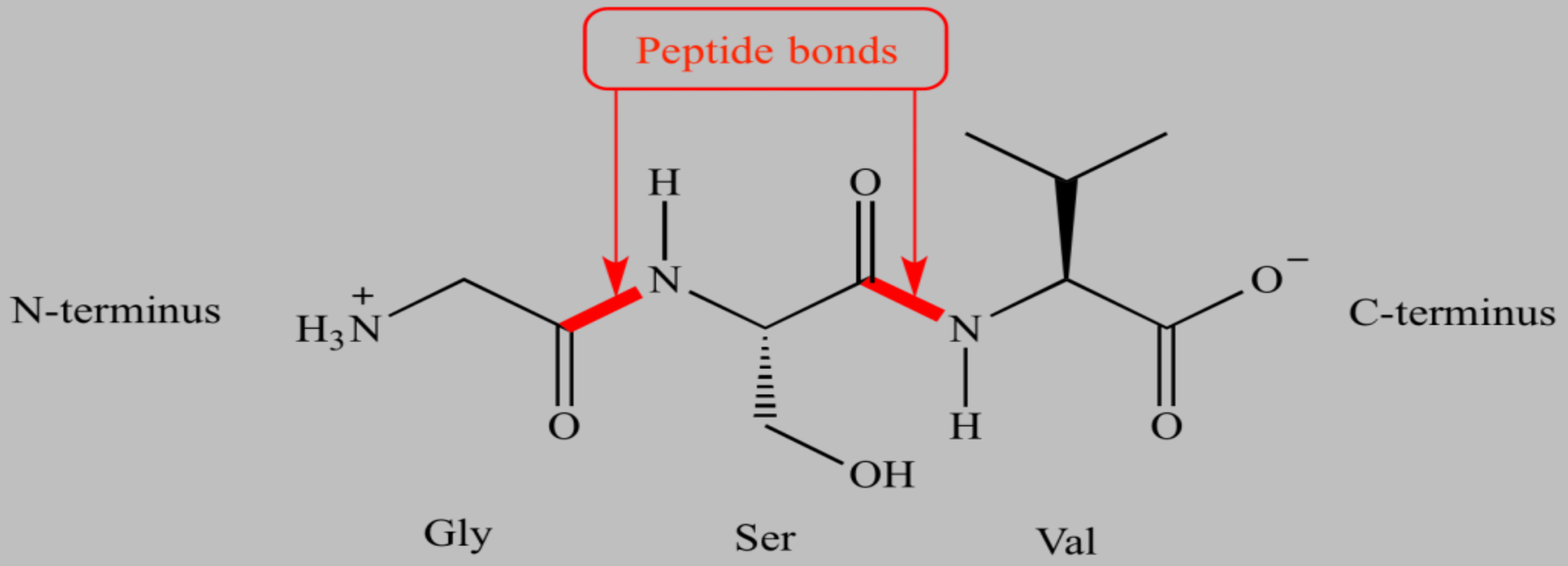
The primary role of the kidneys is to maintain the homeostatic balance of bodily fluids by filtering and secreting metabolites and minerals from the blood.

3- Endocrine function

Hormones such as Erythrobiotin and activation of Vitamin D

First Test
serum urea
(s.urea)

Protein Metabolism



Overview

Ammonia is produced in the liver when protein is broken into its component parts (amino acids) and metabolized. The nitrogen combines with other molecules in the liver to form the waste product urea. The urea is then released into the bloodstream and carried to the kidneys, where it is filtered out of the blood and excreted in the urine.

Function

The blood urea nitrogen or BUN test is primarily used, along with the creatinine test, to evaluate kidney function in a wide range of circumstances, to help diagnose kidney disease, and to monitor people with acute or chronic kidney dysfunction or failure.

UREA CYCLE

Mitochondria of liver cells

AMMONIA (waste nitrogen)

CO_2

Carbamoyl phosphate synthase 1

Carbamoyl phosphate

Citrulline

Aspartate

Ornithine Carbamoyltransferase 2

Argininosuccinate Synthase 3

UREA CYCLE

Ornithine

Argininosuccinate

Arginase 5

Argininosuccinate Lyase 4

Fumarate

Bloodstream

UREA

Agrinine

H_2O

Kidneys

Urine

Interpretation

- Azotemia (high urea level)
- Low urea level

Causes of Azotemia

1- dehydration

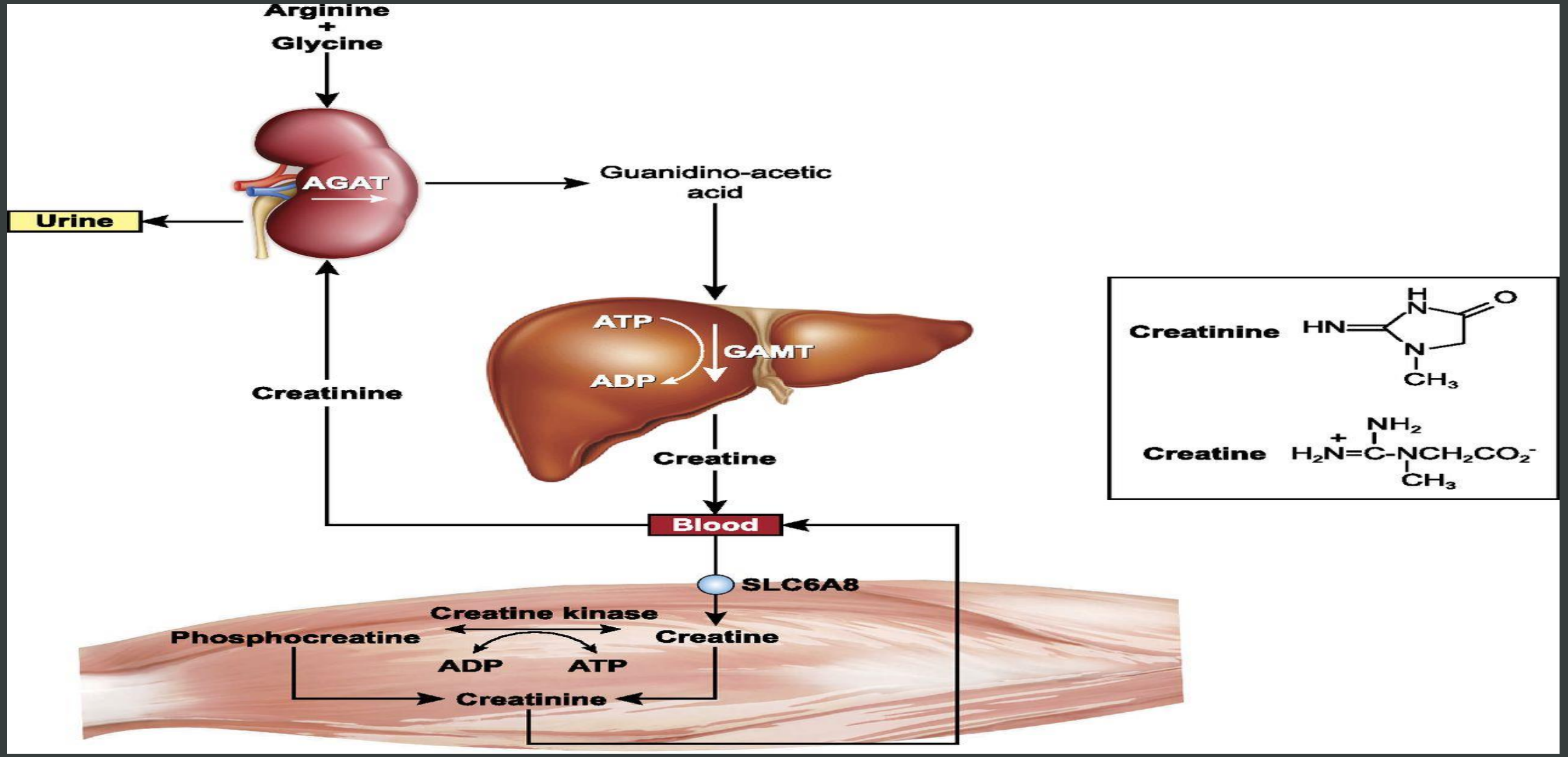
2- Renal failure

Uremia is a term used to describe the illness accompanying kidney failure (also called renal failure)

Causes of low urea level

- a diet very low in protein, or malnutrition.
- Drinking excessive amounts of liquid may cause over hydration and lead to a low BUN value.
- BUN levels may normally be low in the third trimester of pregnancy. Due to increase amount of fluid in blood

Second Test
Serum Creatinine
(S.Creat)


Arginine
+
Glycine
AGAT
Urine
Guanidino-acetic
acid
ATP
GAMT
ADP
Creatinine
Creatine
Blood
SLC6A8
Creatine kinase
Phosphocreatine
Creatine
ADP
ATP
Creatinine
Creatinine
Creatine

Overview

Creatine is synthesized in the liver, pancreas, and kidneys from the amino acids arginine, glycine, and methionine.

Creatine is transported through the circulatory system to muscle where it is converted to phosphocreatine and acts as an energy reservoir much like ATP.

Function

Creatinine is a waste product produced in your muscles from the breakdown of creatine (Creatinine is formed by the hydrolysis of creatine). Almost all creatinine is excreted by the kidneys, so blood levels are a good measure of how well your kidneys are working.

Serum creatinine is a more specific and sensitive indicator of renal disease than BUN why?!

Production of creatinine depends on an individual's muscle mass, which usually fluctuates very little. With normal kidney function, then, the amount of creatinine in the blood remains relatively constant and normal. For this reason, and because creatinine is affected very little by liver function, an elevated blood creatinine is a more sensitive indication of impaired kidney function than the BUN

Interpretation

- low creatinine level
- high creatinine level

Causes of low creatinine

- A diet very low in protein.
- A decrease in muscle mass caused by a disease, such as muscular dystrophy.
- Pregnancy can also cause low blood creatinine levels.

Creatinine clearance test

$$(4.1)\quad \text{Clearance} = \frac{U \times \dot{V}}{P}\ \text{mL/min}$$

U = urinary creatinine concentration (µmol/L)
$\dot{V}$ = urine flow rate [mL/min or (L/24 h)/1.44]
P = plasma creatinine concentration (µmol/L)

Creatinine clearance in adults is normally about **of 120 ml/min**,

Timed urine collection for creatinine measurement (usually 24h)
Blood sample taken within the period of collection.
Normal range = 120-145ml/min
Problems: -
Practical problems of accurate urine collection and volume measurement.

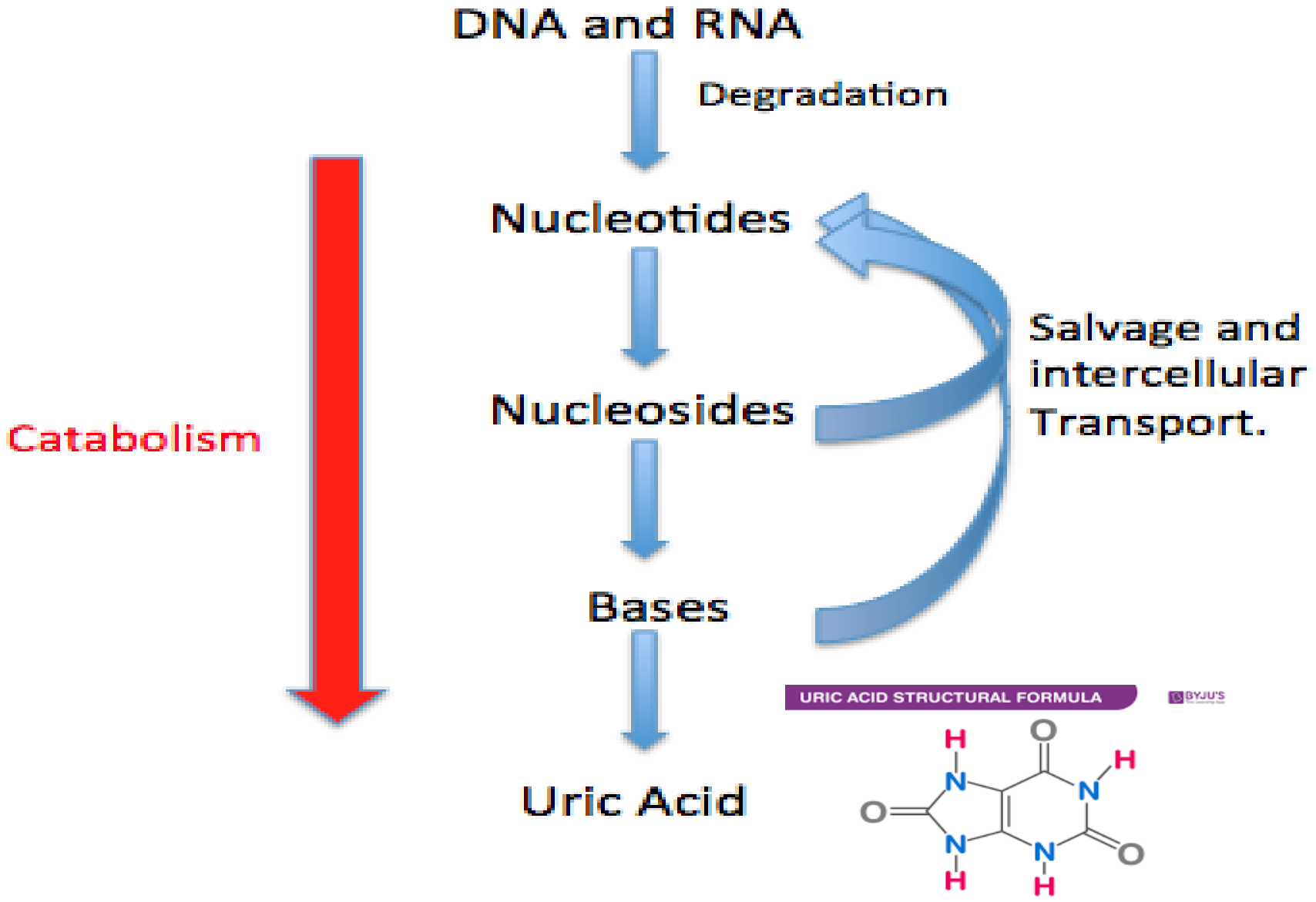
Third Test
serum Uric acid
(U.A)

Overview

- In humans and higher primates, uric acid is the final product of oxidation of purine nucleosides, adenosine and guanosine. metabolism and is excreted in urine.
- Purines are found in high amounts in animal internal organ food products, such as liver. A moderate amount of purine is also contained in beef, pork, fish and seafood, spinach, mushrooms, green peas, beans, and wheat germ.

Why uric acid test?!

- Help diagnose and monitor treatment gout
- Check to see if kidney stones may be caused by high uric acid levels in the body.
- Check to see if medicine that increases or decreases uric acid levels is working.


DNA and RNA
Degradation
Nucleotides
Nucleosides
Bases
Uric Acid
Catabolism
Salvage and intercellular Transport.
URIC ACID STRUCTURAL FORMULA
BYJU'S
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Interpretation of high uric acid (Hyperuricemia)

- In this case the increased purine synthesis. (genetically)
- The increased breakdown of body cells that occurs with some types of cancer (including leukaemia, lymphoma, and multiple myeloma)
- Cancer chemotherapy (e.g., nitrogen mustards vincristine)
- autosomal-dominant renal disease characterized by reduced concentrations of uric acid in the urine (hypouricuria) and increased concentrations of uric acid in the blood (hyperuricenmia) with early onset (teenage years), gout in both males and females

Interpretation of low uric acid (Hypouricemia)

- Low purine diet (Hypouricemia is common in vegetarians due to the low purine content of most vegetarian diets)
- Severe liver disease with reduced purine synthesis.
- Overtreatment of hyperuricemia with allopurinol or uricosuria drugs (drugs that increase the excretion of uric acid from the blood into the urine).

Gout Disease

The crystallization of uric acid, often related to relatively high levels in the blood, is the underlying cause of gout. This can occur for a number of reasons, including diet, genetic predisposition, or underexcretion of urate, the salts of uric acid.

Fourth Test
Total Protein
(TP)

Overview

Total protein and albumin are routinely included in the panels of tests performed as part of a physical, such as a Comprehensive Metabolic Panel (CMP), so they are frequently assessed as a part of an evaluation of a person's overall health status.

Function

Total protein measurements can reflect nutritional status and may be used to screen for and help diagnose kidney disease or liver disease, for example. Sometimes conditions are detected with routine testing before symptoms appear. If total protein is abnormal, further testing must be performed to identify which specific protein is abnormally low or high so that a specific diagnosis can be made. Some examples of follow-up tests include protein electrophoresis and quantitative immunoglobulins.

Interpretation of high Total Protein

- chronic inflammation.
- infections such as viral hepatitis or HIV.
- It also may be associated with bone marrow disorders such as multiple myeloma.

Interpretation of Low Total Protein

- liver disorder.
- Kidney disorder.

That’s all for today ☺

Thanks for attention