Biochemistry
Team 434

CREATINE METABOLISM

Musculoskeletal Block

Color index

Red= Important
Purple= Addition
Orange= Explanation

Biochemistry434@gmail.com

Objectives:

1. To study the importance of creatine in muscle as a storage form of energy
2. To understand the biosynthesis of creatine
3. To study the process of creatine degradation and formation of creatinine as an end product
4. To understand the clinical importance of creatinine as a sensitive indicator of kidney function
5. To study different types of creatine kinase (CK) and their clinical importance

creatine synthesis

- **the synthesis of creatine requires 3 amino acids :** shown in green
  - Glycine
  - Arginine
  - Methionine (as S-adenosylmethionine → is the activation form of methionine)

Kidneys

*this process happens in the liver and kidney [NOTE:the liver is the creatine synthesis site]

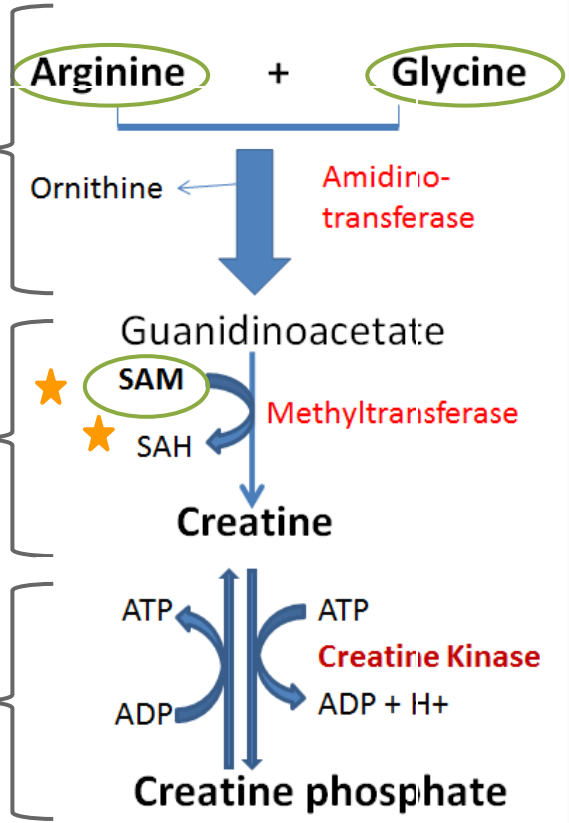
*From liver, transported to other tissues

Liver

*98% are present in skeletal and heart muscles

*In Muscle, gets converted to the high energy source creatine phosphate (NOTE: in presence of ATP and Creatine Kinase)

Muscle



*s.adenosylmethionine *s.adenosylhomocystine

Creatine Phosphate

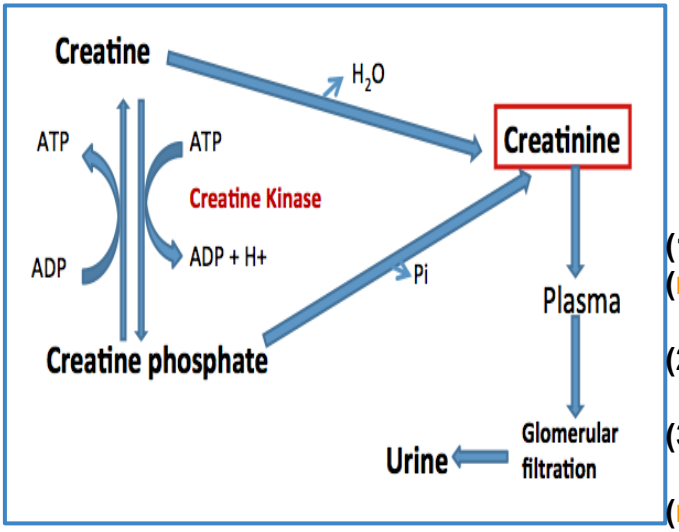
- High energy phosphate compound
- Acts as storage form of energy in muscle
- Provides small but ready form of energy *(during first minutes of intense muscular contraction)*
- Amount of Creatine Phosphate in body *~proportional to~* Muscle mass

Urinary Creatinine

(1) Typical male excretes about 15 mmol of Creatinine per day

(2) Decrease in muscle mass >> Decrease in level of Creatinine in urine *(due to muscular dystrophy or paralysis)*

(3) Amount of Creatinine in urine is used as an indicator for the proper collection of 24 hours urine sample



Creatine Degradation

(1) Creatine + Creatine Phosphate *>spontaneously form>* **Creatinine (end product)**
(NOTE:*spontaneously means in absence of any enzyme*)

(2) Creatinine excreted in urine

(3) Serum Creatinine: -Sensitive indicator of kidney disease *(Kidney Function Test)*
-Increases with impairment of kidney function
(NOTE: creatinine is called anhydrous creatine because it does not have a water)

Creatine Kinase (CK)

CK levels are changed in disorders of *cardiac* and *skeletal muscles*

Responsible for generation of energy *(in contractile muscular tissue)*

Has 3 Isoenzymes:
CK-MM (mainly in *Skeletal Muscles*)
CK-MB (mainly in *Heart Muscles*)
CK-BB (mainly in *Brain*)

Required for conversion of
Creatine >*into*> Creatine Phosphate

Serum Total CK increased in:
Crush Injuries (damage of skeletal muscles)
Myocardial Infarction (damage of heart muscle)

Summary

Creatine Phosphate

Creatine kinase

creatine

is responsible for the generation of energy in contractile musculartissues

CK has 3 isoenzymes:
CK-BB in Brain
In skeletal muscle CK-MM
CK-MB
In heart muscle.
Serum total CK is increased in Crush injuries, Myocardial infarction

- biosynthesis
  - Three amino acids are required:
    - Glycine
    - Arginine
    - Methionine (as S-adenosylmethionine)
  - Site of biosynthesis:
    - Step 1: Kidneys
    - Step 2: Liver
- Distribution
  - 98% are present in skeletal and heart muscles
- Storage form of energy
  - Creatine Phosphate Acts as a storage form of energy in the muscle
- Degradation
  - Creatinine is end product of both creatine and creatine phosphate. Creatinine is excreted in the urine

Creatinine level in serum indicate kidney function it will increase in case of impairment kidney function.
The amount of creatine phosphate in the body is proportional to the muscle mass

❖ Quiz your self

https://www.examtime.com/en-US/p/1809224

❖ Done By :

- Nouf AlOraini
- Hanan Mohammad
- Noha AlGwaiz
- Sheikhah AlDosari
- Njoud AlRasheed
- Aryaf AlSlmah

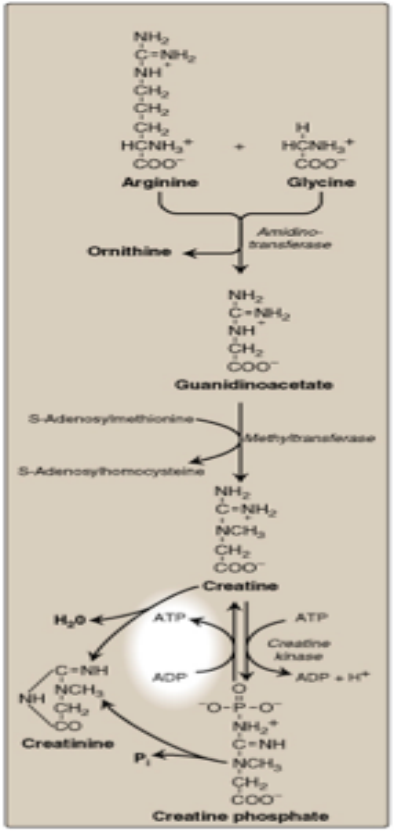


Figure 21.16
Synthesis of creatine.