بسم الله الرحمن الرحيم

Creatine Metabolism

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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 Metabolism

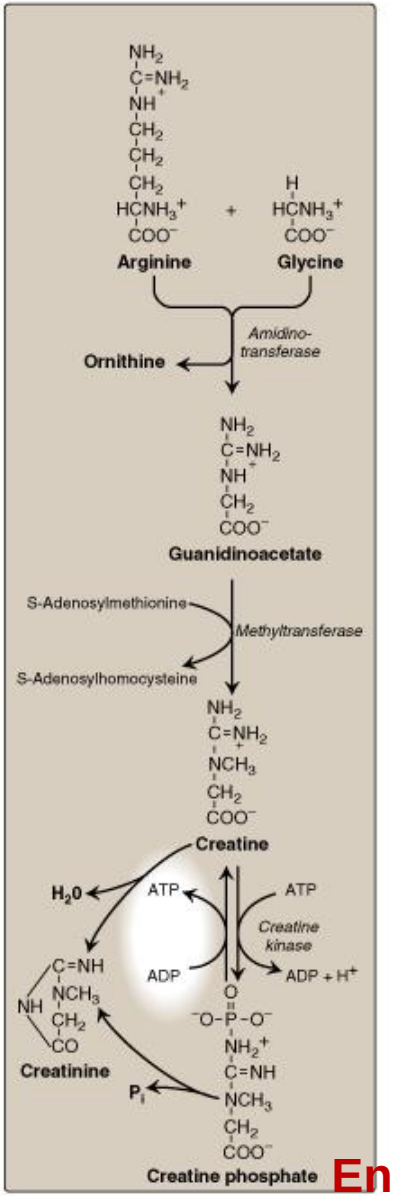


Figure 21.16
Synthesis of creatine.

End product

Energy Source

Creatine Biosynthesis

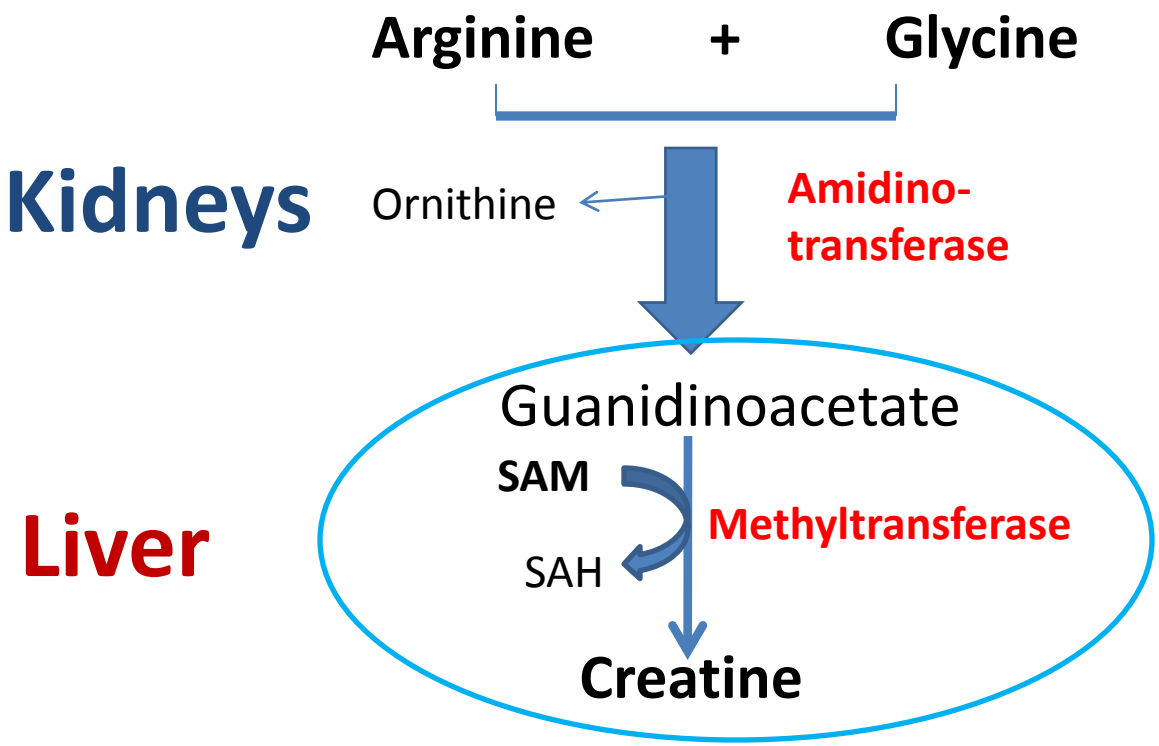
Three amino acids are required:

- **Glycine**
- **Arginine**
- **Methionine (as S-adenosylmethionine)**

Site of biosynthesis:

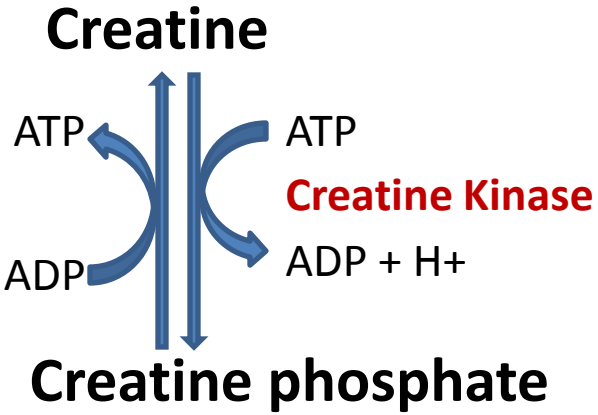
- **Step 1: Kidneys**
- **Step 2: Liver**

Creatine Biosynthesis



Distribution of body creatine

- From liver, transported to other tissues
- 98% are present in skeletal and heart muscles
- In Muscle, gets converted to the high energy source creatine phosphate (phosphocreatine)



Creatine Phosphate

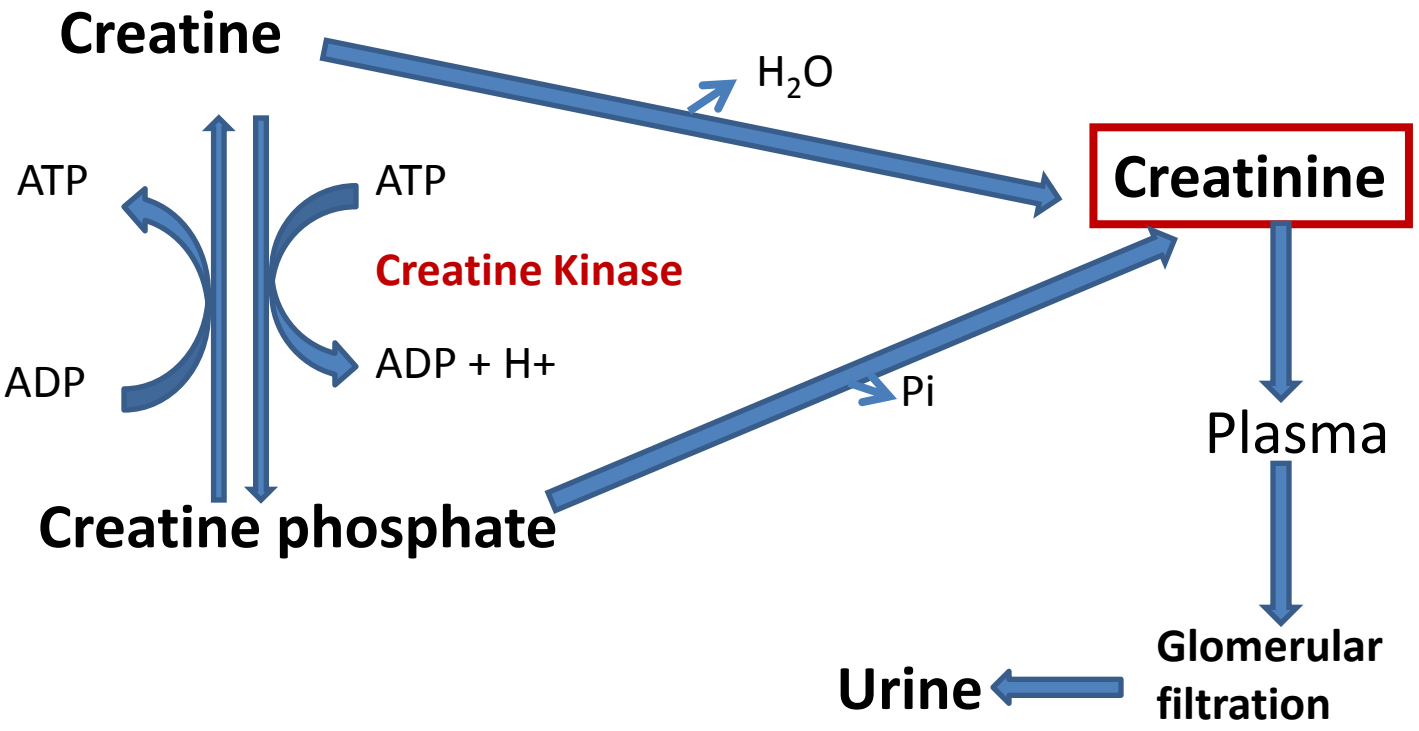
- Is a high-energy phosphate compound
- Acts as a storage form of energy in the muscle
- Provides a small but, ready source of energy during first few minutes of intense muscular contraction

The amount of creatine phosphate in the body is proportional to the muscle mass

Creatine Degradation

1. Creatine and creatine phosphate spontaneously form creatinine as an end product
2. Creatinine is excreted in the urine
3. Serum creatinine is a sensitive indicator of kidney disease (Kidney function test)
4. Serum creatinine increases with the impairment of kidney function

Creatine Degradation

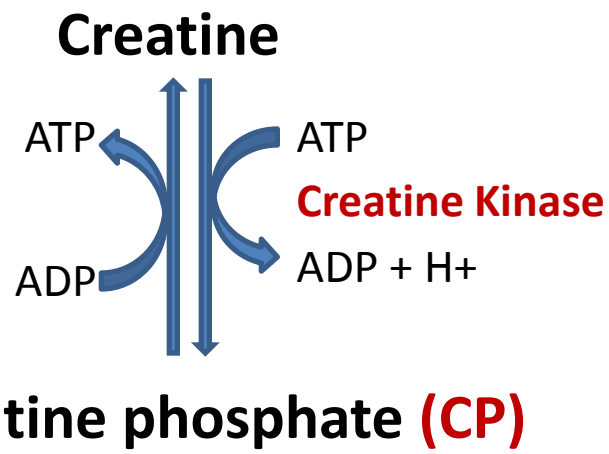


Urinary Creatinine

- A typical male excretes about 15mmol of creatinine per day
- A decrease in muscle mass due to muscular dystrophy or paralysis leads to decreased level of creatinine in urine
- The amount of creatinine in urine is used as an indicator for the proper collection of 24 hours urine sample

Creatine Kinase (CK)

- CK is responsible for the generation of energy compound (CP) in contractile muscular tissues
- CK levels are changed in disorders of cardiac and skeletal muscle



Creatine Kinase (CK)

1. CK is required for conversion of creatine into creatine phosphate

2. CK has 3 isoenzymes:

   CK-MM mainly in skeletal muscle

   CK-MB mainly in heart muscle

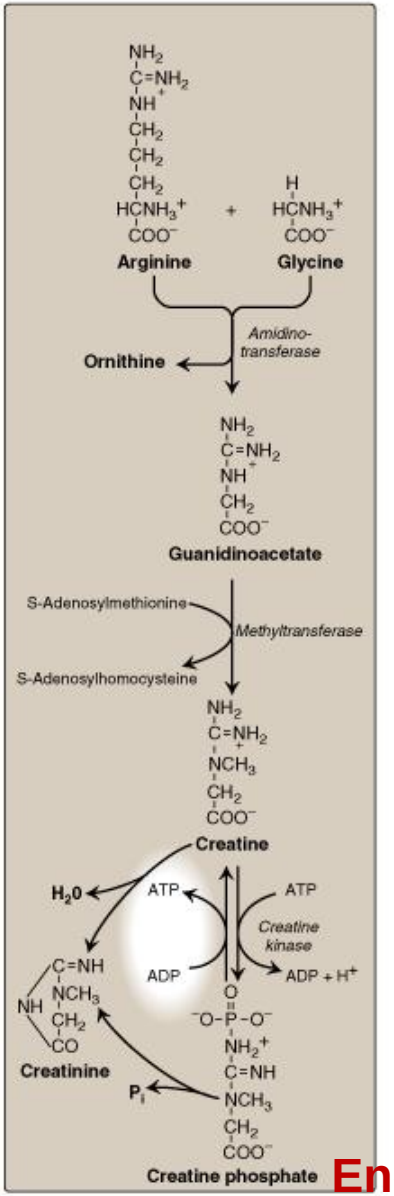
   CK-BB mainly in brain

3. Serum total CK is increased in:

   Crush injuries (Damage of skeletal muscles)

   Myocardial infarction (Damage of heart muscle)

Creatine Metabolism



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