BIO TEAM 429

بسم الله الرحمن الرحيم

MUSCULOSKELETAL BLOCK

CREATINE METABOLISM

إعداد الطالبات

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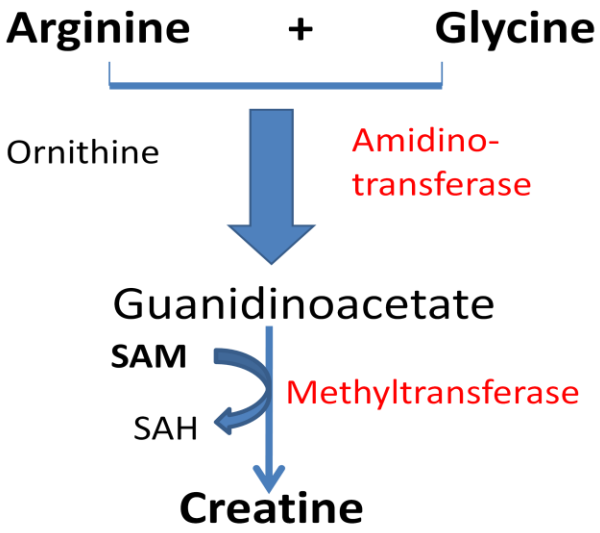
❖Creatine Biosynthesis:

- **Three amino acids are required :**

1) **Glycine**
2) **Arginine**
3) **Methionine**
   (as S-adenosylmethionine)

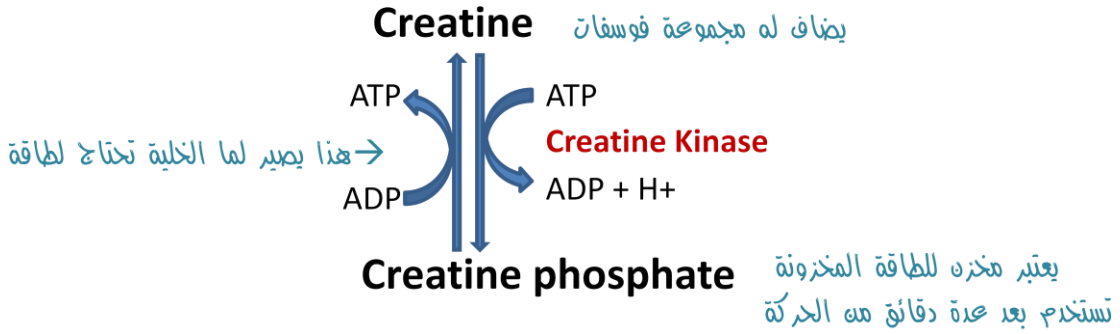
- **Organs involed :**

Step 1: Kidneys
Step 2: Liver



❖Distribution of body creatine:

- ✓ **98% are present in skeletal and heart muscles**
- ✓ **In Muscle, gets converted to the high energy source creatine phosphate (phosphocreatine)**



↑ muscle → ↑ creatine

❖ 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

❖ATP, the Currency of Free Energy:

- **Muscle contraction**
  - **ATP stored in muscle can sustain activity for < 1 sec**
  - **Creatine phosphate also stored in muscle**
  - **Creatine phosphate then transfers a phosphoryl group to ADP, catalyzed by creatine kinase**
  - **Creatine phosphate + ADP ↔ ATP + creatine**
  - **Creatine phosphate major source of ATP regeneration for next several seconds**

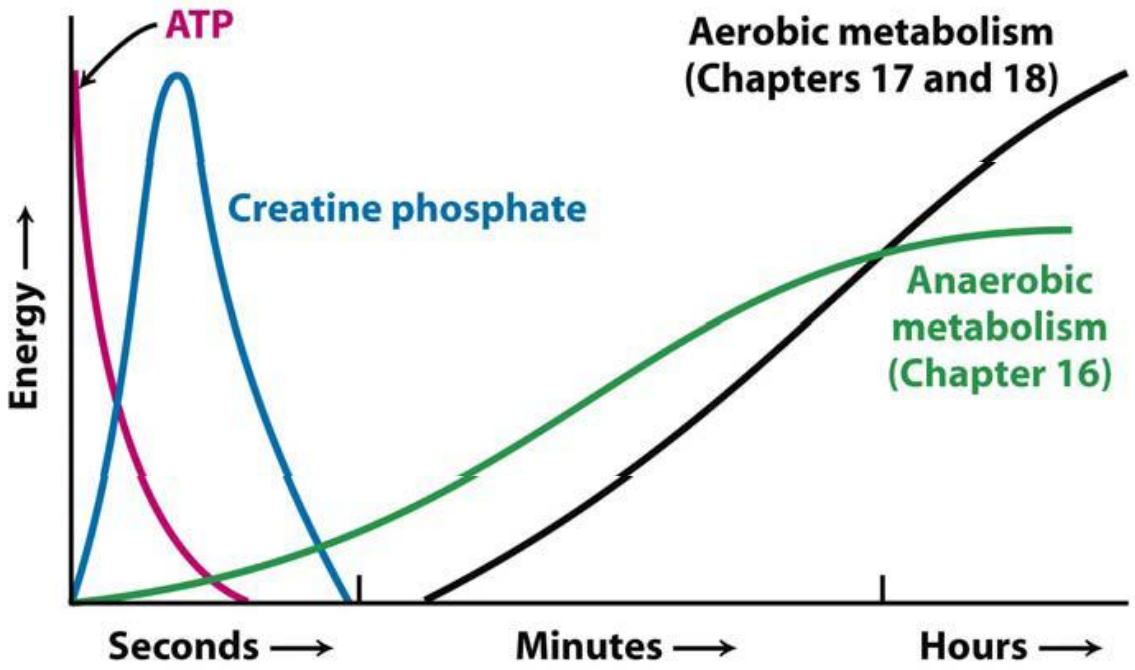
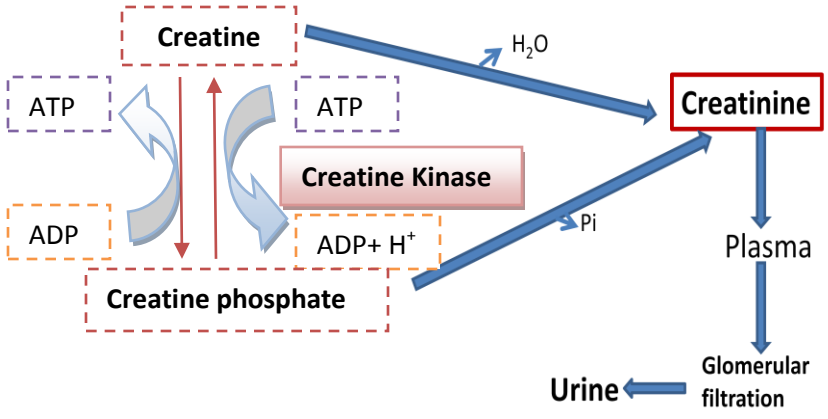


Figure 15-7
Biochemistry, Sixth Edition

❖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**



- That's why we use creatinin to diagnose kidney disease
- When the muscle mass ↓ → creatinin clearance ↓ " in case of muscle disease like muscular dystrophy

❖Creatinine in urine and plasma:

- ✓ **The amount of creatinine excreted is proportional to the total creatine phosphate content of the body**
  - **therefore can be used to estimate muscle mass**

- ✓ **Serum creatinine is a sensitive indicator of kidney disease (Kidney function test)**
  - **Because normally creatinine is rapidly removed from the blood and excreted**

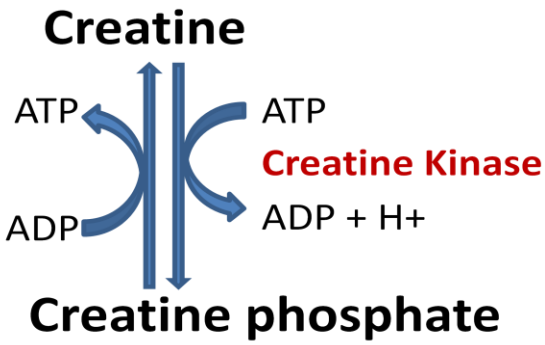
- ✓ **The amount of creatinine in urine is used as an indicator for the proper collection of 24 hours urine sample**

❖Creatinine levels:

- ✓ **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**
- ✓ **Any rise in blood creatinine level is a sensitive indicator of kidney malfunction**

❖Creatine Kinase:

- ✓ **Is responsible for the generation of energy in contractile or transport system mainly in muscles**
- ✓ **CK levels are changed in disorders of cardiac and skeletal muscle**



❖Creatine Kinase (CK) contd.

✓ CK has 3 isoenzymes :

✓Serum total CK is increased in :

- Crush injuries (Damage of skeletal muscles)
- Myocardial infarction (Damage of heart muscle)

But it is not Accurate b\c troponin is more accurately
if it's not available we can use CK-total and take the ratio between them.