

## Ways to Generate ATP

---

1. List the 3 main ways ATP is generated, in order from fastest to slowest.
2. Now rank the 3 ways in order from longest supply to shortest supply.
3. What are the fuels in each of the 3 ways?
4. Which of the 3 ways require mitochondria?
5. Why would an animal's most powerful muscles have fewer mitochondria than an animal's muscles with the most endurance?
6. What are the waste products from each of the 3 methods?
7. What organ rids the body of creatinine?
8. What do nurses monitor when evaluating kidney function and why?
9. Why do muscles sting (burn) during vigorous exercise?
10. What is the best way to rid the body of the burning sensation during intense exercise?
11. Give the chemical reaction (in general terms) for:
  - direct phosphorylation
  - glycolysis
  - oxidative phosphorylation

## Answers:

### Ways to Generate ATP

---

- List the 3 main ways ATP is generated, in order from fastest to slowest.
  - **Creatine phosphate (Direct Phosphorylation)**
  - **Glycolysis (Anaerobic ATP generation)**
  - **Krebs Cycle and Electron Transport Chain (Oxidative phosphorylation)**
- Now rank the 3 ways in order from longest supply to shortest supply.
  - **Krebs Cycle and Electron Transport Chain (Oxidative phosphorylation)**
  - **Glycolysis (Anaerobic ATP generation)**
  - **Creatine phosphate (Direct Phosphorylation)**
- What are the fuels in each of the 3 ways?
  - **Creatine phosphate (Direct Phosphorylation): creatine phosphate**
  - **Glycolysis (Anaerobic ATP generation): glucose (carbs)**
  - **Krebs Cycle and Electron Transport Chain (Oxidative phosphorylation): glucose, fatty acids, or amino acids (carbs, fats or protein)**
- Which of the 3 ways require mitochondria?  
**Krebs Cycle and Electron Transport Chain (Oxidative phosphorylation): glucose, fatty acids, or amino acids (carbs, fats or protein)**
- Why would an animal's most powerful muscles have fewer mitochondria than an animal's muscles with the most endurance?  
**Power muscles rely heavily on quick energy from sugar, so glycolytic enzymes are heavily concentrated in these muscles. Glycolysis does not require mitochondria.**
- What are the waste products from each of the 3 methods?
  - **Creatine phosphate (Direct Phosphorylation): creatinine**
  - **Glycolysis (Anaerobic ATP generation): pyruvate.... fermentation converts this to lactic acid in humans and Lactobacillus bacteria (which is why we use Lactobacillus to make yogurt). Yeast can ferment pyruvate into ethanol (which is why we use yeast to make beer, wine and other alcoholic products! I think this is one reason why a deer's meat tastes less "sour" if it didn't have to sprint before it was killed.**
  - **Krebs Cycle and Electron Transport Chain (Oxidative phosphorylation): carbon dioxide**
- What organ rids the body of creatinine?  
**kidneys**
- What do nurses monitor when evaluating kidney function and why?  
**serum creatinine. Healthy kidneys excrete all the creatinine that passes through them. Rising creatinine indicates kidney problems.**
- Why do muscles sting (burn) during vigorous exercise?  
**Lactic acid production.**
- What is the best way to rid the body of the burning sensation during intense exercise?  
**Keep doing the same exercise but at a gentler pace.**
- Give the chemical reaction (in general terms) for:
  - direct phosphorylation: **creatine phosphate + ADP → creatinine + ATP**
  - glycolysis: **glucose → pyruvate + ATP**
  - oxidative phosphorylation: **fats/carbs/proteins + oxygen → CO<sub>2</sub> + ATP + H<sub>2</sub>O**