

## 3.10

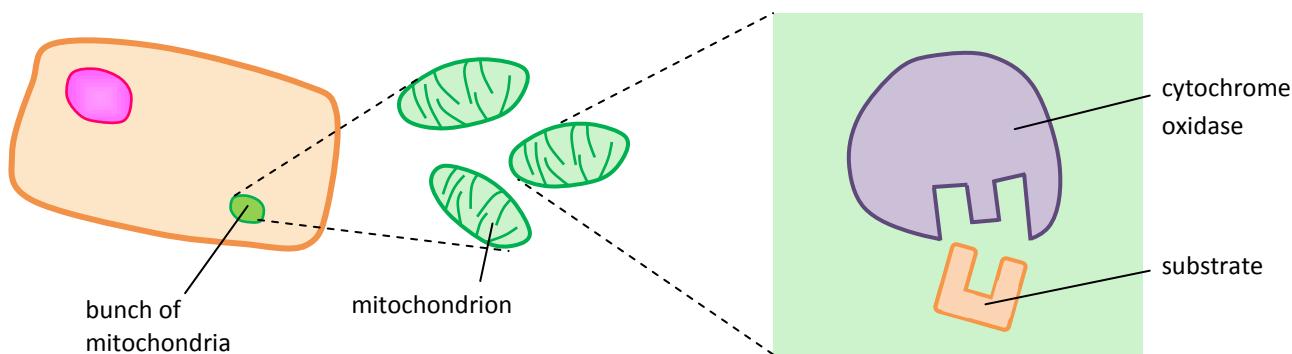
## POISONS INTERFERING WITH ENZYMES

The effect of a poison or drug inhibiting the function of enzymes

You learned in previous chapter how enzyme **inhibition** worked. Many poisons are in fact, enzyme inhibitors. For your course, you are required to know and understand one type of poison and how it works. You must also know about how medicinal drugs work by inhibiting the actions of certain enzymes.

The vast majority of deadly poisons inhibit the enzymes they encounter, but some of them can also overactivate enzymes. Your course suggests the poison **ethylene glycol**, found in antifreeze. However, the poison studied in detail here is **cyanide**.

Cyanide is a poison which inhibits **respiration**. It is a type of *non-competitive inhibitor*, which means that it binds to an enzyme in a place away from the active site, which causes the active site to alter its shape, ensuring that a substrate can no longer form the enzyme-substrate complex. The enzyme in question is **cytochrome oxidase**. This enzyme is found within the mitochondria of a cell, and when inhibited, oxygen usage decreases, which inhibits the production of **ATP** (*adenosine triphosphate*, the energy medium released in respiration).



Whilst a non-competitive inhibitor, cyanide is not a permanent inhibitor of enzymes. It is reversible. However, time is an important factor. For the average adult human, if even only 100mg of cyanide is absorbed, consciousness can be lost within ten-to-twenty seconds. If untreated, the body will slip into a coma in approximately 45 minutes, and death is inevitable within two-to-three hours. So whilst the action is reversible, and there are treatments available, it is very difficult to treat the problem before the effects are too serious.

The main biological effect of this inhibitor is of course the reduction in the usage of oxygen. This means that the infected cell or cells can no longer respire **aerobically**, but only can respire **anaerobically**. This leads to a build up of **lactic acid** in the blood stream.

#### MEDICINAL DRUGS AND MICROORGANISMS

An **antibiotic** is a type of medicinal drug used to combat bacteria. Antibiotics can kill or inhibit the growth of microorganisms. They're used to treat diseases caused by bacterial infections. One example is **penicillin**. This inhibits a bacterial enzyme which forms cross-links in the bacterial cell wall of some bacteria. This means that the cell walls are not formed, and therefore bacterial production comes to an end.

One common problem in the treatment of bacterial infections is **resistance**. Bacteria can become *resistant* to antibiotics often due to one-off mutations and alterations within their enzymes. Due to natural selection and adaptation laws (see **5.7 Evolution**), these will survive and pass on their mutations, making them a more resistant species.