Understandings:

1. Explain what a metabolic pathway is.

- When there is a chemical change, it is not often a one-step reaction. It usually involves many intermediate steps. The steps can form a chain reaction or even a cycle.

In living organisms, these reactions are catalyzed by enzymes.

2. Explain enzymes and its activation energy.

- Enzymes lower the activation energy.

The activation energy is required for pushing the reaction from reactants, to transition state and then to the product. Due to the reduced requirement of energy, the rate of reaction becomes much faster.

3. Explain the two different types of enzyme inhibitors.

- Competitive inhibitor competes for the binding site on the enzyme and therefore reduces the rate of reaction.

Non-competitive inhibitor does not bind on the active site, but on another site called allosteric site.

4. Explain end-product inhibition.

- This is basically when the end product of a metabolic pathway serves both as an enzyme inhibitor for the initial step of the pathway and a product. The product is the "original purpose" of that molecule, whatever that was. Thus if there is an excess of those, the molecule will start to inhibit the reaction, usually by non-competitive inhibition because it is the most safe and effective way.

This can be seen as a form of homeostasis, since it uses negative feedback and tries to stay around a certain line of balance.

Extra notes

- Be aware that in order for a molecule to be non-competitive, it does not only need to bind to an allosteric site, but also needs to be unique and not resemble the substrate. This is logical because we want no competition! If it resembled a substrate, then the substrate would be able to bind to the allosteric site and suddenly it would be competitive!

Applications and skills:

1. Describe an example of end-product inhibition.

- An example is the conversion process from threonine to isoleucine. When isoleucine is produced, it binds to the allosteric site on the enzyme that is responsible for the 1st step of the chain reaction.

Thus this is an example of a non-competitive enzyme inhibition.

2. Explain how chemo-genomics are applied to malaria drugs.

- First of all, what is chemo-genomics? By definition, it is the systematic screening of a chemical library on a particular reaction pathway.

Screening simply means the comparison or to overlap, just like in basketball where you screen people. So a machine systematically takes each compound from the "chemical library" and then sees how that compound affects a particular pathway.

This comes useful when new drugs are being researched. The example in this case is malaria drugs. Malaria is a disease caused by a pathogen called *Plasmodium falciparum.* We see which molecules have inhibiting effects on the enzymes in that pathogen, and therefore inhibit them from spreading. So far, 10-20 chemicals have been found that affects the pathogen. 2015 Nobel Prize winner Youyou Tu found a cure against malaria. But did she use chemo-genomics? Probably.

3. Distinguish different types of inhibition from graphs.

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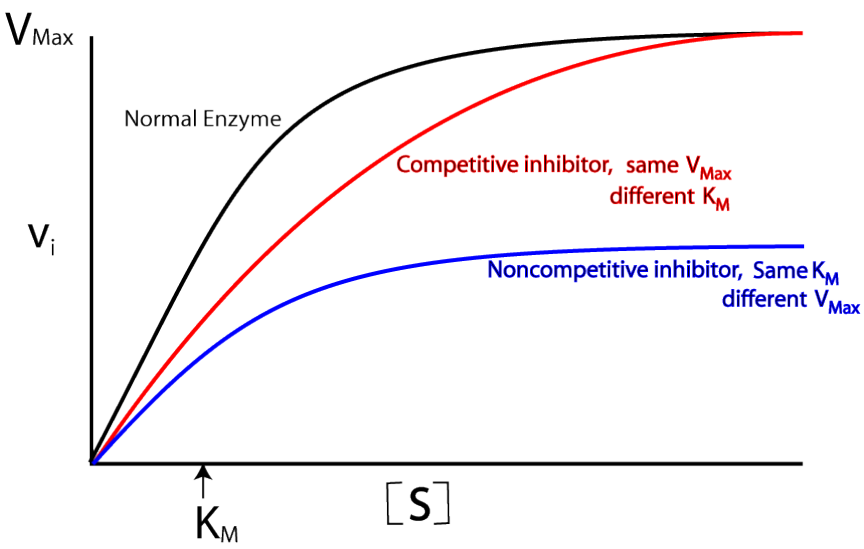

Normal enzyme reaches the max rate of reaction fastest.

Competitive inhibitor reaches the same max but need more substrate concentration to do it since it increases their chance of binding with enzyme.

Non-competitive inhibitor is a definite winner, thus it significantly lowers the max rate of reaction.

4. Be able to calculate and plot rate of reaction from experimental results.

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