

Research #1- Temperature Effects on Enzyme Activity

Scott Stagg

Every enzyme has a temperature range of ideal activity. Outside that temperature range the enzyme becomes inactive and is said to be totally ineffective. This occurs because as the temperature changes, there is energy to break the protein structure. When this structure is disturbed and changed, this causes a change in the active site. The active site is changed beyond its ability to attach to the substrate and cannot complete the chemical reaction it was intended to speed up.

Most enzymes (and there are hundreds within the human organism) within the human cells will shut down at a body temperature below or above a certain value. This can happen if body temperature gets too low (hypothermia) or too high (hyperthermia).

Research #2- Enzymes: A Quantitative Approach

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Many chemical reactions such as some metabolic processes are essential for an organism to survive but, unfortunately, are not quick enough to maintain life. Biological catalysts, or enzymes, are chemical agents that influence the rate of a reaction without changing the reaction. An enzyme is a protein that allows reactions to occur at much faster rates. With the help of enzymes, those slow reactions can occur quickly enough to sustain life.

Enzymes are substrate-specific. This means they are very “picky” and only react with specific substrates to form products. In a normal enzyme reaction, the enzyme and substrate collide randomly in a solution and join at the enzyme’s active site. This collision works much like a lock and key. The active site has a specific shape that only a particular substrate fits into. When the two are joined they react and the substrate is converted into a product. Once the reaction is complete the enzyme and newly formed product separate with the enzyme left unchanged.

Enzymes are proteins that function based on their 3-D shape. The easiest way to change the 3-D shape of a protein is to heat it. At high temperatures the protein will denature, or lose its 3-D shape, and no longer function. Temperature can also affect a reaction by increasing or decreasing the rate of collision between enzyme and substrate. If heat is increased, molecules (in this case enzyme and substrate) will move more quickly in solution, collide at higher rates, and react more quickly. Conversely, if the temperature is decreased than those same molecules will move more slowly, collide less frequently and therefore, react more slowly. Using the above information, one would expect that with increasing heat the enzyme reaction rate will also increase, BUT, only to a certain point. If the temperature is too high, then the enzyme will denature and the reaction will not run.