



# **Microbial Metabolism**

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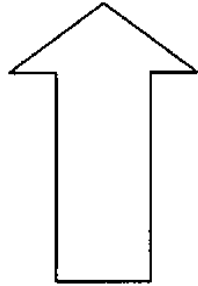
# Definitions

- *Metabolism* is the term used to describe all the biochemical reactions that take place inside a cell; it includes those reactions that release energy into the cell, and those that make use of that energy.
- *Catabolism* is the term used to describe reactions that break down large molecules, usually coupled to a release of energy.
- *Anabolism* is the term used to describe reactions involved in the synthesis of macromolecules, usually requiring an input of energy.

# Why Microorganisms Need Energy?

- to maintain the structural integrity of the cell by repairing any damage to its constituents
- to synthesis new cellular components such as nucleic acids, polysaccharides and enzymes
- to transport certain substances into the cell from its surroundings
- for the cell to grow and multiply
- for cellular movement.

**ATP**



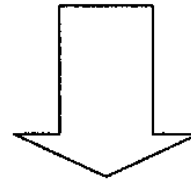
**ENERGY  
GENERATION**  
(Respiration, fermentation,  
photosynthesis)



**ADP  
+ Pi**



**ENERGY  
EXPENDITURE**  
(Biosynthesis,  
transport of  
nutrients, cellular  
movement)



# Enzymes

- An enzyme is a cellular catalyst; it makes biochemical reactions proceed many times more rapidly than they would if uncatalysed. The participation of an enzyme can increase the rate of a reaction by a factor of millions, or even billions.

# Environmental Factors Affect Enzyme Velocity

- *Temperature*

The rate of any chemical reaction increases with an increase in temperature due to the more rapid movement of molecules, and so it is with enzyme-catalysed reactions, until a peak is reached (the optimum temperature) after which the rate rapidly falls away.

- *pH*

Enzyme velocity is similarly affected by the prevailing pH. Once again, this is due to alterations in three-dimensional protein structure. Changes in the pH affect the ionization of charged 'R'-groups on amino acids at the active site and elsewhere, causing changes in the enzyme's precise shape, and a reduction in catalytic properties.

- *Substrate concentration*

Under conditions where the active sites of an enzyme population are not saturated, an increase in substrate concentration will be reflected in a proportional rise in the rate of reaction. A point is reached, however, when the addition of further substrate has no effect on the rate.