The importance of biotransformation in drug metabolism.

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Abstract

A chemical change in a substance (drug) that occurs because the substance is located in a biological system. Spontaneous decay of radium is not considered biotransformation, even if it occurs in the body; the chemical modification of a chemical by enzymatic attack is considered biotransformation even if it occurs in a model system *in vitro*. Pharmacodynamics includes the chemical effect of a drug on the body; biotransformation involves the body's chemical reaction to the drug. "Biotransformation" should be preferred to "metabolism of drugs" and the word "metabolism" should be reserved to describe the biotransformation of materials necessary for adequate nutritional status. "Biotransformation" and "detoxification" are not synonymous: the product of biotransformation can be more, not less, biologically active or stronger than the starting material.

Keywords: Biotransformation, Drug metabolism, Detoxification, Cytochrome P450.

Introduction

The major purpose of biotransformation is to chemically modify (metabolize) poorly excretable lipophilic compounds to more hydrophilic chemicals that are readily excreted in urine and/or bile. Without metabolism, lipophilic xenobiotics accumulate in biota, increasing the potential for toxicity. Biotransformation is a process in which living organisms, such as microorganisms, plants, and animals, transform various chemical compounds into different forms. This process can be either metabolic or enzymatic, and it is essential in the maintenance of biochemical equilibrium and the elimination of harmful substances from the body [1].

Biotransformation can occur in several different ways, but it generally involves the alteration of a chemical compound's structure and properties through the introduction or removal of functional groups. This process can be either oxidative or reductive, and it is often catalyzed by enzymes such as cytochrome P450. In the case of xenobiotics, which are foreign substances that enter the body, biotransformation is essential for their elimination. The liver is the primary site of xenobiotic biotransformation in mammals, where various enzymatic reactions occur, including hydrolysis, oxidation, reduction, and conjugation. These reactions convert the xenobiotics into more hydrophilic compounds, which are then excreted in the urine or feces [2,3].

One of the most well-known examples of biotransformation is the conversion of ethanol into acetaldehyde and then into acetic acid. This process is catalyzed by the enzyme alcohol dehydrogenase, which is found in the liver. Acetaldehyde is a toxic compound that can cause damage to cells, but it is rapidly converted into acetic acid by the enzyme acetaldehyde dehydrogenase, which is also found in the liver. Another example of biotransformation is the metabolism of caffeine. This compound is metabolized by the liver into various products, including paraxanthine, theobromine, and theophylline. Each of these compounds has different effects on the body, and they are responsible for caffeine's stimulant properties [4].

Biotransformation is also important in the pharmaceutical industry, where it is used to modify the properties of drugs. By altering the structure of a drug through biotransformation, scientists can improve its efficacy, reduce its toxicity, and enhance its pharmacokinetic properties [5].

Conclusion

Biotransformation is a vital process that occurs in living organisms to maintain biochemical equilibrium and eliminate harmful substances. This process can occur in many different ways and is often catalyzed by enzymes. Understanding biotransformation is essential in various fields, including toxicology, pharmacology, and environmental science.

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