Research and Reviews: Drug Delivery

# Biotransformation of Hydrophilic and Lipophilic Molecules in the Liver

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Commentary

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## ABOUT THE STUDY

Biotransformation is a nutritional process that occurs primarily in the liver and aids in the elimination of both exogenous and endogenous compounds. These chemical structures undergo a number of reactions. The enzymes that help spur these reactions have the ability to render the substrate inactive, active, or even toxic. The process of turning lipophilic (fat-soluble), xenobiotic (foreign), or endobiotic (endogenous) chemicals into more hydrophilic by-products in the body is known as biotransformation (water-soluble). Biotransformation is synonymous with metabolism and metabolic transformation in this context. Xenobiotic is a chemical that is comparatively small (molecular weight 1000) and foreign to the living things in which nutrition occurs. The main goal of biotransformation is to convert less easily ejected lipophilic molecules to more quickly excretable hydrophilic compounds that can be discharged in urine and/or bile. Lipid soluble toxins build up in biota without metabolism, might lead top sever3 adverse effects. Highly halogenated Polychlorinated Biphenyls (PCBs) and polychlorinated dibenzofurans (dioxins and tetrachlorodibenzodioxins), which are found in human tissue residues, are examples of such toxins. On the other hand, due to their quick excretion in the urine, xenobiotics with high water solubility typically do not require biotransformation.

To transform lipophilic substances into molecules that are effectively eliminated, two or more consecutive enzyme processes are frequently necessary. These pathways were categorised as phase I (oxidation, reduction, and hydrolysis processes) and phase II (biotransformation studies pioneer). A phase I reaction typically comes before its phase II counterpart, but some molecules have functional groups that can be used as receptors for immediate conjugation (e.g., –OH, –COOH, and $–NH_2$). It is common for a chemical's biological activity to reduce throughout metabolism (a process known as detoxication), however it is not always the situation. This is a basic mechanism for the synthesis of numerous chemical toxicants because phase I and phase II reactions can both act in toxication or

cellular activation processes. The most prevalent toxication process, cytochrome P450-dependent activity, produces numerous kinds of toxic chemicals, including carcinogens and mutagens generated from toxic compounds. The liver typically has the biggest amount of xenobiotic metabolising enzymes, however epithelial cells in extra-hepatic tissues thus the lung, kidney, gut, placenta, and eye also exhibit activity. Extrahepatic tissues typically do not participate much physically to the metabolization of foreign substances, including medicines, relative to the liver. Similarly, because the proportion of formation to detoxication enzyme activity is usually larger in these cells than in hepatocytes, extrahepatic organs can be crucial in the metabolic activation of xenobiotics and subsequent target organ toxicity.

Age, sex, dietary status, disease state, drugs, and a patient's heredity all have an impact on biotransformation. The CYP450 system exhibits variability in function and expression from newborn to adulthood, as well as during prenatal period. In contrast to the activity of many other systems involved in drug metabolism, which may be higher in males than in females, a small number of studies have found that cytochrome P450, particularly the activity of CYP3A4, is greater in females than in males. A balanced diet will supply the required protein as well as the vital metals and minerals, such as copper, zinc, and calcium, needed for regular cellular enzymatic processes, as opposed to a diet that is low in protein.

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