

What is toxicology?



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Research involving laboratory animals is important to people and to our quality of life. In the past century, most inhabitants of this planet have experienced an unprecedented rise in living standards, life expectancy and personal opportunity, in large part due to the many ways chemicals have been put to work for us. For example, drugs whose effects range from curing previously fatal bacterial infections, reducing the impact of AIDS, minimizing heart disease, decreasing age-related wrinkles, to reducing hair loss are widely available today.

The many benefits of the diverse uses of our natural resources are an outcome of careful scientific research and of using chemicals in an appropriate and safe manner. Toxicologists, the scientists who help determine the limits for safe use of materials, use modern technological research methods, including tests on animals, to protect human and animal health and the environment. What is toxicology? Toxicology is the study of how chemical substances interact with living systems and affect normal processes, and the use of this information to predict safe exposure levels.

Toxicological research and testing helps us to live safely and to derive benefit from natural and synthetic substances while avoiding harm. Toxicologists are involved in the evaluation of household products, medicines and the effects of incidental and occupational exposure to natural and manufactured substances. Toxicology also helps us develop the best treatments in the event that accidental overexposure does occur. What is safe? Toxicologists know that no substance is risk-free.

One fundamental tenet of the science of toxicology is that all chemicals can cause harm at some level of exposure, summed up in the phrase "the dose makes the poison." This means that exposure to a specific small amount of any substance will have no detectable impact on normal biological processes and is considered safe. Some doses actually have beneficial effects, as we all know from use of medicines. But increasing exposure to most substances will, at some point, cause harmful effects. Substances are considered toxic at that level.

For example, digitalis is a plant product that has been used with great benefit to treat heart irregularities, but too large a dose will cause death. Oxygen provides another example of how increasing the dose can turn a safe compound into a toxic one. Oxygen is essential to life and part of the air we breathe, but when given at high concentrations it can cause lung and eye damage in infants. Sometimes the possible negative effects of a substance are outweighed by the positive benefits at that dose. Dogs are treated with heartworm medication because the risk of death from heartworms is much greater than the risk of toxicity of the medication.

Similarly, chemotherapeutic agents are used to destroy cancerous cells even though they may damage healthy cells in the process. Prior to the use of new substances, toxicologists and policy makers are responsible for determining the range of exposure that is safe and the level of exposure that may be harmful to human health or to the environment. The effect of the level of exposure is also important when toxicologists assess the risk caused by a substance already present in the environment. The benefits of using a

new substance, or the costs of removing an environmental contaminant, are viewed relative to the perception of what is safe.