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## Animals in Research: The Importance of Animal Science of Toxicology

### Necessity of Animal Research

Research involving laboratory animals is important to people and to our quality past century, most inhabitants of this planet have experienced an unprecedented standards, life expectancy and personal opportunity, in large part due to the ma chemicals have been put to work for us. For example, drugs whose effects rang previously fatal bacterial infections, reducing the impact of AIDS, minimizing he decreasing age-related wrinkles, to reducing hair loss are widely available today benefits of the diverse uses of our natural resources are an outcome of careful : research and of using chemicals in an appropriate and safe manner. Toxicologis scientists who help determine the limits for safe use of materials, use modern t research methods, including tests on animals, to protect human and animal hea environment.

### What is toxicology?

Toxicology is the study of how chemical substances interact with living systems normal processes, and the use of this information to predict safe exposure level research and testing helps us to live safely and to derive benefit from natural a substances while avoiding harm. Toxicologists are involved in the evaluation of products, medicines and the effects of incidental and occupational exposure to r manufactured substances. Toxicology also helps us develop the best treatments that accidental overexposure does occur.

### What is safe?

Toxicologists know that no substance is risk-free. One fundamental tenet of the toxicology is that all chemicals can cause harm at some level of exposure, sumr phrase "the dose makes the poison." This means that exposure to a specific sm

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any substance will have no detectable impact on normal biological processes and is safe. Some doses actually have beneficial effects, as we all know from use of many drugs. Increasing exposure to most substances will, at some point, cause harmful effects. Doses that 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. Digoxin 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 benefits at that dose. Dogs are treated with heartworm medication because the benefits from heartworms is much greater than the risk of toxicity of the medication. Some chemotherapeutic agents are used to destroy cancerous cells even though they kill some 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 acceptable to human health or to the environment. The effect of the level of exposure is also a consideration. 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.

### **How do toxicologists determine which exposures may harm?**

Toxicologists conduct basic research, using both whole animals and *in vitro* methods to determine how various chemicals and dosages interact with living systems. Basic research is conducted to understand mechanisms that maintain living organisms and to determine basic physiological processes.

For many chemicals that enhance the quality of our lives, the mechanism that produces a beneficial effect is the same mechanism that makes the chemical toxic. For example, aspirin reduces pain and fever by reducing the activity of enzymes in the body that produce prostaglandins, which are involved in the production of compounds associated with pain and distress. However, acute toxicity occurs when the aspirin dose is so high that inhibition of similar enzymes in the heart impairs normal function. Animal studies help determine the ratio between the beneficial and toxic dose of medications.

Toxicologists determine which levels of a substance cause harm by conducting studies which progress from the test tube to animal studies and, in some cases, to human studies.

Safety testing is needed to identify the crossover points between no impact, beneficial and harmful effects. For example, alcohol, when ingested, is taken directly into bloodstream and blood levels rise in direct proportion to consumption. Many people feel a pleasant feeling produced by one alcoholic beverage and may consider that a beneficial effect. However, one drink, such as 12 ounces of beer, will impact motor skills and judgment. Such drinks in a short interval result in a blood alcohol content of .08% in a 120 lb woman. Persons with levels above 0.08% ethanol in the bloodstream are considered impaired to drive an automobile in many states. Further increases (above 0.4%) result in loss of consciousness and death.

Vitamins also illustrate the variation in effect depending upon the dose. Vitamin elements that are not manufactured by the body and must be furnished from the diet are typically in the diet. In general, either vitamin deficiency or vitamins in excess cause health problems and even cause birth defects. Birth defects such as spinal bifida are less common if the mother has a daily vitamin A intake of 5000 IU in advance of the pregnancy. Women using one prescription treatment for acne that involves high doses (50,000 IU) of this vitamin (isotretinoin) must take precautions to avoid pregnancy due to the risk of birth defects.

Safety evaluations establish a margin of safety to compensate for differences in sensitivity among individuals. For example, women in general are affected more by the same amount of alcohol than men are, not only because of smaller body size but also because alcohol is metabolized at different rates by men and women. Persons of differing ethnic heritages also metabolize ethanol at different rates.

Toxicologists use *in vitro* methods and animal models that have been accepted by the scientific community and recognized by regulatory bodies so that people who use products exposed to a variety of chemicals can enjoy the benefits with a minimum of risk. The use of accepted tests protects other organisms, including pets and farm animals, and the environment.



[\[Necessity of Animal Research\]](#) [\[Reliability of Animal Data\]](#)

[\[Commitment to Responsible Treatment\]](#) [\[Advancing Valid Alternatives\]](#) [\[Position Statement\]](#)

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*Research involving laboratory animals is necessary to ensure and enhance human health and protection of the environment.*

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