COMMENTARY

# A brief note on toxicity

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## DESCRIPTION

Toxicity is the extent to which a chemical substance or a specific mixture of chemicals can harm an organism. Toxicity can refer to an effect on an entire organism, such as an animal, bacterium, or plant, as well as an effect on a substructure of the organism, such as a cell (cytotoxicity) or an organ, such as the liver (hepatotoxicity). By extension, the term can be used metaphorically to describe the toxic effects on larger and more complex groups, such as the family unit or society as a whole. In everyday usage, the word is more or less synonymous with poisoning.

Disease-causing microorganisms and parasites are toxic in general, but they are referred to as pathogens rather than toxicants. Pathogens' biological toxicity can be difficult to assess because the "threshold dose" may be a single organism. In theory, a single virus, bacterium, or worm can multiply and cause a serious infection. However, in a host with a functioning immune system, the organism's inherent toxicity is balanced by the host's ability to fight back, and the effective toxicity is a combination of both parts of the relationship. In some cases, such as cholera, a nonliving substance secreted by the organism causes the disease rather than the organism itself. Toxins are nonliving biological toxicants produced by microorganisms, plants, or fungi, and venoms are produced by animals.

The effects of a substance on a target can be used to determine its toxicity (organism, organ, tissue or cell). Because individuals typically respond differently to the same dose of a toxic substance, a population-level measure of toxicity is frequently used to relate the probabilities of an outcome for a given individual in a population. The $LD_{50}$ is one such metric. When such data is unavailable, estimates are made by comparing known similar toxic substances or similar exposures in similar organisms. Then, to account for uncertainties in data and evaluation processes, "safety factors" are added. For example, if a toxic substance is safe for a laboratory rat, one might assume that one-tenth of that dose is safe for a human, allowing a safety factor of 10 to account for interspecies differences between two mammals; if the data is from fish, one might use a factor of 100 to account for the greater difference between two chordate classes (fish and mammals). Similarly, an additional protection factor may be used for people who are thought to be more vulnerable to toxic effects, such as during pregnancy or with certain diseases.

Because each component has its own toxicity, and components may interact to produce enhanced or diminished effects, determining the toxicity of chemical mixtures is more difficult than determining the toxicity of a pure chemical. Gasoline, cigarette smoke, and industrial waste are examples of common mixtures. Even more complicated are situations involving more than one type of toxic entity, such as the discharge of both chemical and biological agents from a malfunctioning sewage treatment plant.

A skin patch test analysis, similar to an allergic inflammation patch test, is used to determine skin corrosion and irritation. This investigates the extent of the damage, when it occurs and how long it lasts, whether it is reversible, and how many test subjects were affected.

A substance's skin corrosion must penetrate through the epidermis into the dermis within four hours of application and must not be reversed within 14 days. Skin irritation causes less severe damage than corrosion if it occurs within 72 hours of application, or for three consecutive days after application within a 14-day period.

For centuries, artists have been concerned about the toxicity of their tools, methods, and materials, despite the fact that the toxicity of their tools, methods, and materials was not always adequately recognized. Lead and cadmium, among other toxic elements, were frequently used in the names of artist's oil paints and pigments, such as "lead white" and "cadmium red."

Printmakers and other artists in the twentieth century became aware of the toxic substances, toxic techniques, and toxic fumes in glues, painting mediums, pigments, and solvents, many of which were labelled with no indication of their toxicity. A good example is the use of xylol to clean silk screens. Painters became aware of the dangers of breathing in painting mediums and thinners like turpentine.

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