

Introduction

This assignment addresses the following:

- The importance and role of definitions in technical writing
- Developing an understanding of how audience and purpose may indicate the need for a definition
- Acknowledgement of differentiation difference in detail level when making a definition
- Choosing the appropriate level of detail depending on the situation

This assignment introduces a relatively complex term from my area of study, pharmacology. A specific reading situation is given, clarifying the purpose of giving the definition. This term is then defined for a non-technical audience using three methods: parenthetical, sentence and expanded definitions, all with professional, yet friendly tone, posted on the team forum.

Term

Parathion

Reading Situation

A farmer is deciding whether or not to use parathion as a pesticide on his corn and wants to know a little more about it.

Parenthetical Definition

Parathion (a pesticide that is toxic to the nervous system) is dangerous to spray on the corn outside your house, as it has the potential to kill humans in addition to bugs.

Sentence Definition

Parathion is a drug of the organophosphate class used as a pesticide. Toxic to humans, the drug acts on the nervous system, blocking breakdown of neurotransmitters and ultimately resulting in death.

Expanded Definition

Parathion

History

Parathion is a drug of the organophosphate class (due to its structure; Figure 1 below), a brown or yellow liquid (when dissolved in water) with a faint garlic odor. It was synthesized by Bayer AG (a German pharmaceutical company) in 1947. It was registered by the US as a drug in 1948. Toxic to almost all life, the drug resulted in many human poisonings throughout its history. Half of the world's pesticide poisonings in the 1970's were due to parathion, with a reported 1,283 poisonings between 1966 and 1980 (47 deaths and 478 hospitalizations). Contaminations have also resulted in many deaths. For example, one Asian country had 828 cases of poisoning and 106 deaths when the food supply became contaminated with parathion. As a result, it has been banned if not heavily restricted in numerous countries, including Canada (Rubin et al., 2002).

Mechanism of Toxicity

In order to exert its toxic effects, parathion is readily absorbed on the skin, on the lungs (when inhaled) or in the gastrointestinal tract. Its chemical properties allow it to travel to the nerves, where it will act on acetylcholinesterases (AChE), inhibiting their normal function. AChE is an enzyme responsible for

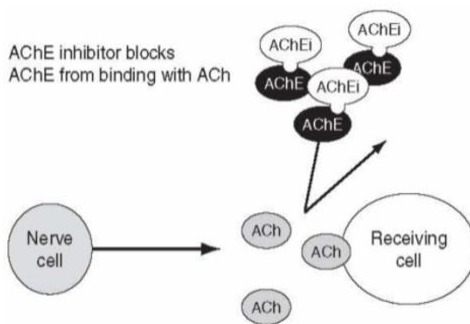


Figure 2: Mechanism of action of parathion (Note. Acetylcholinesterase (AChE) inhibitor or AChEi in this case is parathion) (Edwards, 2005)

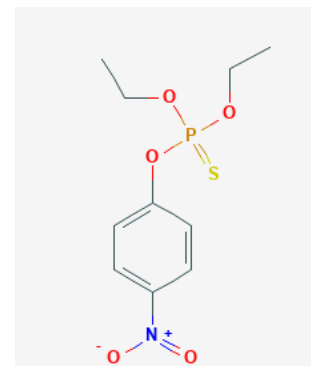


Figure 1: Parathion (chemical structure for reference; Note. the chemical group in colour with the P is the group that phosphorylates) (PubChem, n.d.)

degrading acetylcholine (ACh), a certain type of neurotransmitter, so that it does not overstimulate neurons. In order to act on AChE, parathion must be converted to paraoxon, undergoing a reaction that adds an oxygen to the molecule. Then, the active form, paraoxon, can phosphorylate (adds a chemical group; refer to Figure 1) AChE to inactivate it. This will cause ACh to build up, leading to overstimulation of the neuron (Refer to Figure 2) (Fukuto, 1990).

Toxicities

Once parathion inactivates AChE leading to buildup of ACh, it will result in an amplification of the usual effects of ACh. Thus, parathion indirectly results in overstimulation of nerve receptors, resulting in exhaustion, blurred vision, headache, weakness and confusion. Pupil constriction, vomiting, abdominal pain, excessive sweating and salivation may also occur. Difficulty in breathing may be present due to lung congestion and respiratory weakness. In severe poisoning one can expect involuntary voiding of the bowel and bladder, convulsions, unconsciousness and muscle spasms. Relaxation of the lungs is generally the cause of death (Baker & Robb, 2020).

Commercial Use

Parathion is commercially used as an insecticide and can also be used to kill ticks and mites. It may degrade due to microbes, soil, or sunlight, although sunlight can also convert it into paraoxon, its active form. It is used to control a broad spectrum of pests on alfalfa, canola, corn, cotton, sorghum, soybeans, sunflowers, barley and wheat (but not fruits or vegetables due to its toxicity). In liquid form, it may be applied using aerial equipment. Unfortunately, ecological effects are adverse and widespread, with parathion being very toxic to most animals and aquatic creatures and lasting a long time in soil (but much more rapidly degrading in aquatic environments) (Parathion, 1997).

Alternative Drugs of the Organophosphate Class

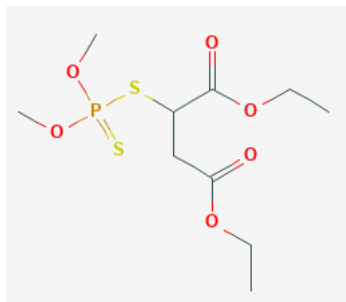


Figure 3: Malathion (chemical structure for reference; Note. The coloured group with the P is the phosphorus group; the ester groups are the two red Os on the right) (PubChem, n.d.)

Parathion is part of the organophosphate class, which consists of many different chemicals with similar chemical structure. One such chemical is malathion. Malathion acts like parathion (AChE inhibitor), but without the same level of toxicity. Malathion is much less toxic to mammals because the phosphate group (Figure 3) is less reactive, and thus not as quickly converted to its active form, malaaxon. Parathion, on the other hand is readily converted to paraoxon, its active form. In addition, the side chain of the molecule contains esters (groups with two oxygens, Figure 3), an access point for mammalian enzymes to degrade the molecule, allowing it to be degraded faster than its active

form can be generated. Parathion, which does not have these esters, is much more difficult to degrade. Because it does not degrade readily, its active form predominates, leading to toxicities as described above. Malathion is a terrific alternative pesticide to parathion, because although humans experience no toxicity, insects do (as they cannot degrade it) (Tchounwou et al., 2015).

Suggestions

Although parathion is a viable pesticide, it can also be toxic to the surrounding ecosystem and farmers tending to the crops. To eliminate some of these adverse effects, malathion is an excellent alternative.

Reference List

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