

Properties

- Organophosphate pesticide

Occupational Uses

- Agricultural pesticide
- Home and garden general insecticide
- Golf course maintenance
- Manufacturing of malathion

Occupational Exposure

- Workers exposed: field workers, manufacturers, and chemical sprayers
- Routes of Exposure: dermal, inhalation, ingestion of contaminated food or water

Toxicological Data

- Malathion affects the central nervous system.
- Malathion binds to acetylcholinesterase, making it unable to bind to acetylcholine in the synapse between neurons. This prevents the enzyme from stopping the neuron stimulation, allowing the stimulation to flow freely uncontrolled and hyper-stimulating the nervous system (figure 1).
- Malathion is also bioactivated into malaoxon in the liver, which is more toxic than malathion.

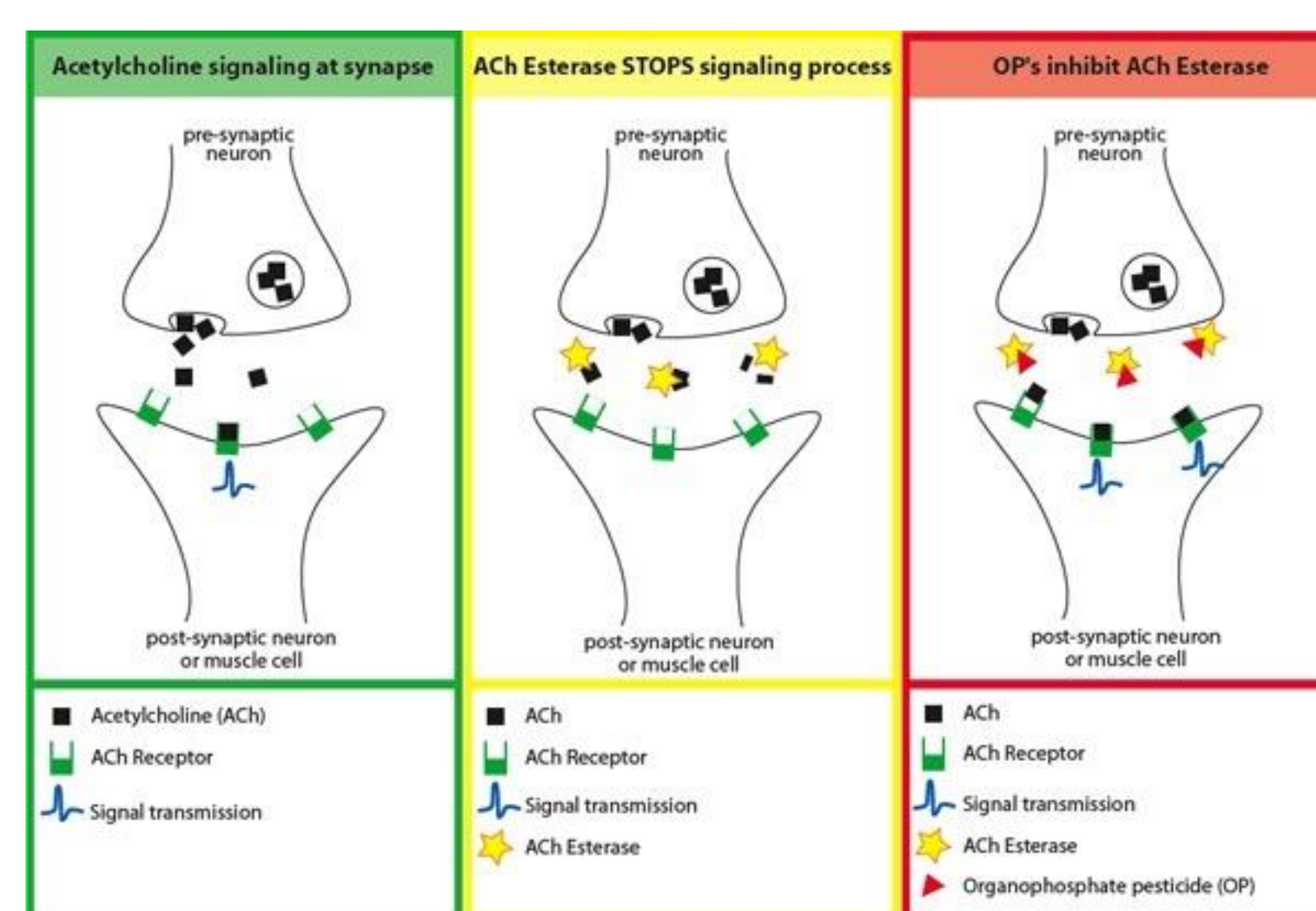


Figure 1. Acetylcholinesterase inhibition by organophosphate
Source: http://ruthanna.tumblr.com/post/108547457795/mechanism-of-action-of-organophosphate-pesticides?is_related_post=1

Animal testing

- The EPA states that malathion is not carcinogenic.
- There are studies that have been done on rats that show if the dose of malathion is high enough, cancer will become present.

Occupational Exposure Limits (OELs)

- OSHA Permissible Exposure Limit (PEL)
 - 8-hr TWA - 15 mg/m³
- ACGIH Threshold Limit Value (TLV)
 - 8-hr TWA - 1 mg/m³
- NIOSH Recommended Exposure Limit (REL)
 - 10-hr TWA - 10 mg/m³
- Immediately Dangerous to Life and Health (IDLH)
 - 250 mg/m³



Figure 2. Aerial Spraying Application
Source: <http://www.islandbreath.org/2013Year/02/130206duster.jpg>

Sampling Methods

- OSHA Method 62 and NIOSH Method 5600
 - Active sampling using a sampling pump
 - Glass sampling tubes containing XAD-2 absorbent and then desorbed by toluene
- Sampling flow rate:
 - OSHA Method: 60 L at 1 L/min (max volume: 60 L)
 - NIOSH Method: 0.2 to 1 L/min (max volume: 240 L, min volume: 12 L)



Figure 3. XAD-2 sorbent tubes for air sampling
Source: <http://www.skcltd.com/index.php/sorbent-tubes/9-uncategorised/184-xad-2-sorbent-tubes>

Analytical Methods

- Gas chromatography (GC) using a flame photometric detector (FID)

Case Study

- Malathion's effect on developing asthma
- Farm women in North Carolina exposed to malathion in the field have a 60% higher risk of developing asthma.
- Malathion inflames the bronchial tubes, eventually leading to permanent damage.
- The bronchial tubes are then more sensitive to allergens and stimuli.

Control Measures

- Engineering controls - proper ventilation, isolation of the area where malathion is being manufactured or used
- Administrative controls
 - Worker rotation in fields and while manufacturing
 - Proper maintenance of equipment used
 - Implementing restricted entry interval (REI) when workers are not allowed to re-enter into a treated area
- Personal protective equipment (PPE)
 - Protective clothing
 - Full-facepiece respirator (required if exposure is > 1 mg/m³)
 - Supplied air respirator (required if exposure is near the IDLH of 250 mg/m³)



Figure 4. Warning sign for REI use
Source: <http://www.mysafetysign.com>

References

- Agency for Toxic Substances and Disease Registry (ATSDR): Toxic Substance Portal: Malathion. <http://www.atsdr.cdc.gov/PHS/PHS.asp?id=520&tid=92>
- National Pesticide Information Center (NPIC): Malathion General Fact Sheet. <http://npic.orst.edu/factsheets/malagen.html#products>
- Agency for Toxic Substances and Disease Registry (ATSDR): ToxGuide for Malathion. <http://www.atsdr.cdc.gov/toxguides/toxguide-154.pdf>
- Pesticide Linked to Asthma Risk for Farm Women. OH&S. <https://ohsonline.com/Articles/2008/01/Pesticides-Linked-to-Asthma-Risk-for-Farm-Women.aspx?Page=1>
- Organophosphorus Pesticides. CDC. <http://www.cdc.gov/niosh/docs/2003-154/pdfs/5600-f.pdf>
- OSHA. Malathion sampling method. <https://www.osha.gov/dts/sltc/methods/organic/org062/org062.html>