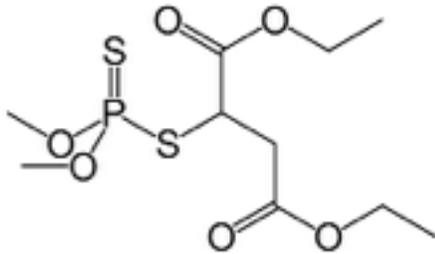


BioQuiz

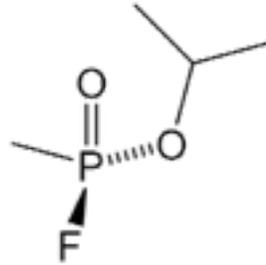
Name:

Period:

1. One dangerous class of chemicals is known as "organophosphates." These include several insecticides (malathion, diazinon) and the now outlawed "nerve gas," Sarin.



Malathion:



Sarin:

Both of these are inhibitors of the enzyme acetylcholine esterase, which breaks down the neurotransmitter acetylcholine. The chemicals mimic acetylcholine, binding to the active site, but then phosphorylate the enzyme, leaving it inactive. In humans, exposure to these chemicals can lead to "SLUDGE" syndrome: Salivation, Lacrimation (watery eyes), Urination, Defecation, Gastrointestinal upset and Emesis (vomiting). Sounds like fun. The most likely explanation of this is:

- A) They lead to failure of neurons to fire at the neuromuscular junctions because not enough neurotransmitter is available
 - B) They cause neurons to rupture, leading to immune inflammation at the smooth muscle in the stomach and around the mucosal membranes of the eye and mouth
 - C) They cause hyper-stimulation of neuromuscular junctions in the somatic (voluntary) neuromuscular junctions due to build up of acetylcholine
 - D) They result in higher levels of the neurotransmitter in the parasympathetic (Rest and Digest) synapsis resulting in unregulated stimulation of the acetylcholine receptors
 - E) They result in higher levels of the neurotransmitter in the sympathetic (Fight or Flight)
2. Explain your reasoning.

3. Atropine, a product of plants in the "nightshade" family, can be deadly on its own (please go to the Wikipedia entry on acetylcholine and read the section on "receptors." You may look at more if you like). Atropine is a competitive antagonist for the acetylcholine receptor. It has many medical uses, including as an antidote for poisoning by malathion and was even provided to soldiers who might be exposed to Sarin in the battlefield, as an antidote for that. Explain how it could work.
4. At neuromuscular synapses, the trigger for transmitter release and muscle contraction relies on voltage-gated calcium channels. These allow the flow of divalent calcium ions (Ca^{2+}) to flow into the cell. Ca^{2+} has a radius of about 114 picometers ($1\text{pm}=10^{-12}\text{m}$). Lead ions (Pb^{2+}) have an ionic radius of 133 pm, but are otherwise similar to calcium. One symptom of acute lead poisoning is muscle weakness or lack of coordination. What could account for this effect?
- A) Lead ions and calcium ions stick together, leading to a lack of calcium available for signaling
 - B) Lead ions interact with the calcium channels, but are too large to pass through, blocking flow of calcium
 - C) Lead ions lock the calcium channel in the "open" position, resulting in the inability to shut down neuromuscular signals
 - D) Lead ions lead to precipitation of calcium ions through the "common-ion effect," causing bones to be unusually dense and heavy.
5. Explain your reasoning.