



**Pesticides: What Children
Eat, Drink and Breathe**

Chemicals and Safety
Concerns

Kenya Pediatric
Association Annual
Conference 2018

Range of Chemicals

- Based on use
 - Pesticides and other agrochemicals
 - Industrial
 - Household
 - Therapeutics
 - Radioactive - energy
- How many chemicals are in use in the world?



EPA has more than 85,000 chemicals listed on its inventory of substances that fall under the Toxic Substances Control Act

Chemicals in Kenya

- We are part of the world of chemicals
- National Chemicals Profile available from the Ministry of Environment
- Includes what the world is using currently



Pesticides as a reference –imports kg/lt

	2014	2015	2016
Herbicides	2167472864	1827290097	1827.290097
Insecticides	3111757079	2889850352	2889.850352
Fungicides	3439147649	2715073763	2715.073763
Acaricides	733978239	466905600	466.9056
Fumigants	96606925	65061240	65.06124
Miticides	0	254320800	254.3208
Nematicides	0	124489106	124.489106
Rodenticides	21731525	0	0
Others	1463054628	359769734	359.769734
Total		8702760692	8702.760692

Current Concerns with chemicals

- Chemical residues in food, MRLs
- Environmental contamination- water, air, soil
- Biodiversity concerns, depletion and distortion of organisms plants, animals.
- Toxicity of chemicals to people as they handle them- storage, use, disposal, etc



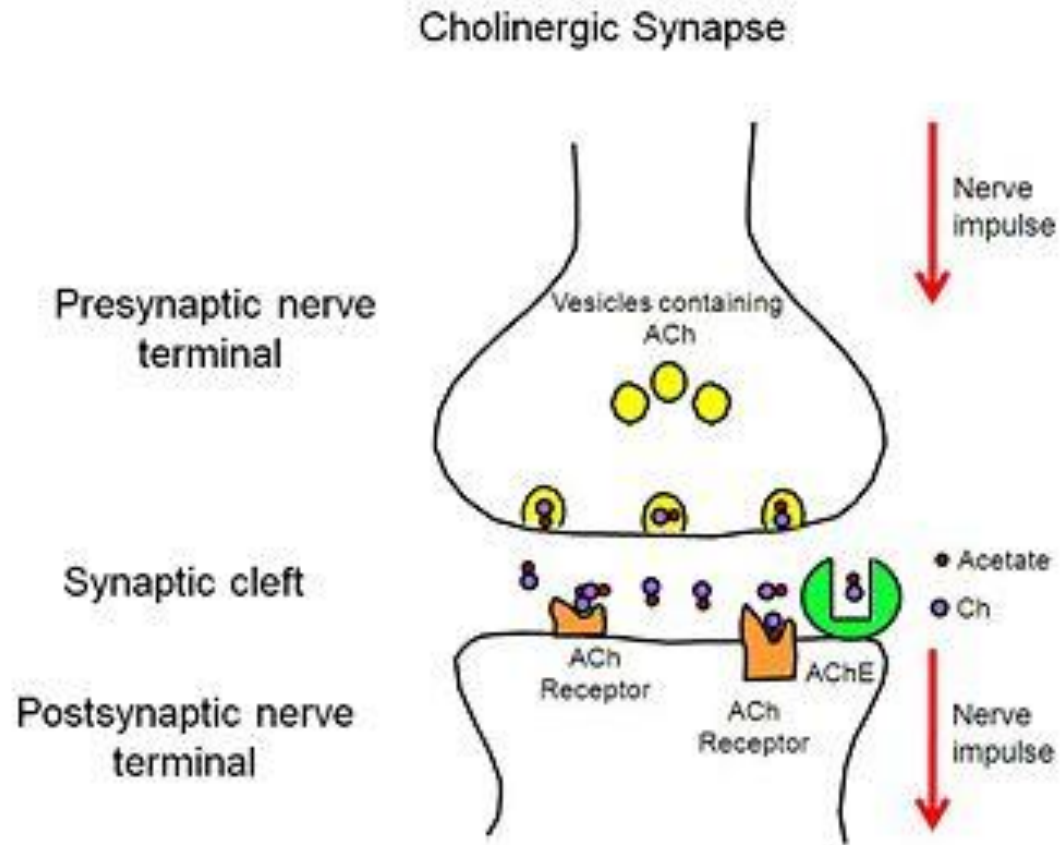
pesticides and agricultural resource centre

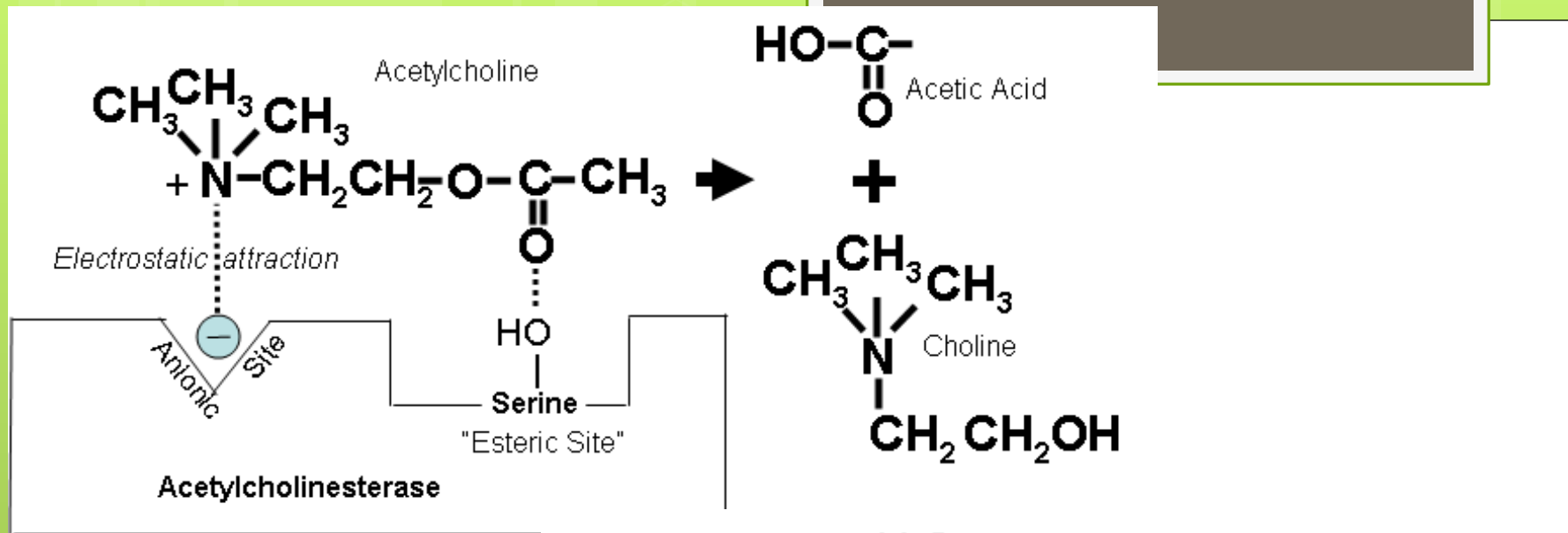
Concerns for people

- Related to Modes of action
- Question: do chemicals that affect insects, plants also affect people?
 - Insecticides can directly
 - Herbicides can due to overall toxicity and action
 - Fungicides, somehow depending on mode of action.



Insecticides: Mode of Action of OPs and Carbamates





Organophosphates

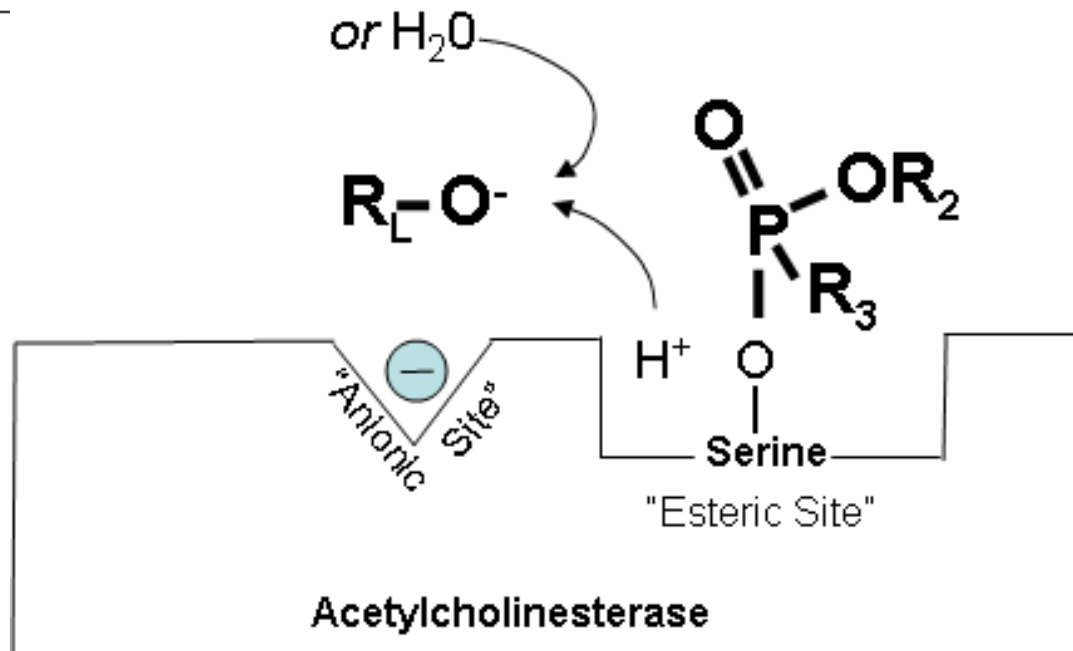
Examples in use

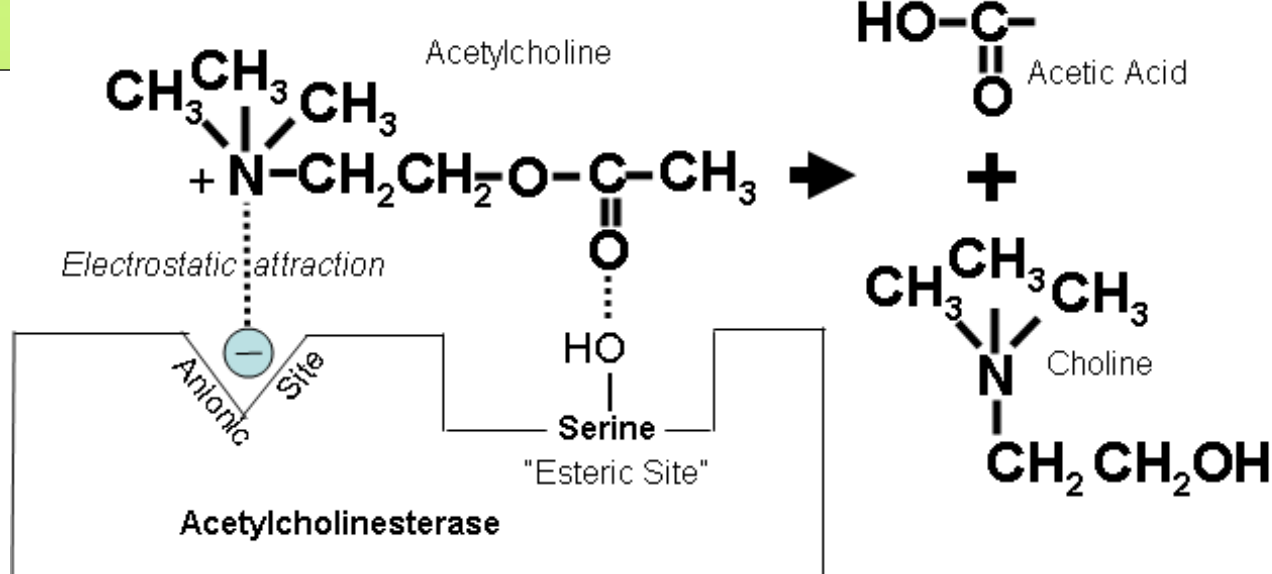
Malathion

Diazinon

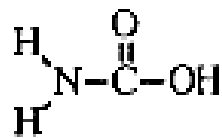
Dimethoate

Chlorpyrifos

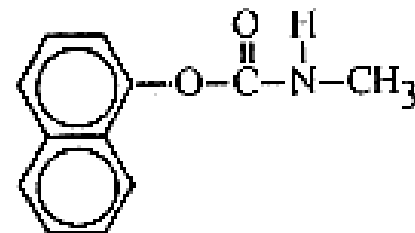




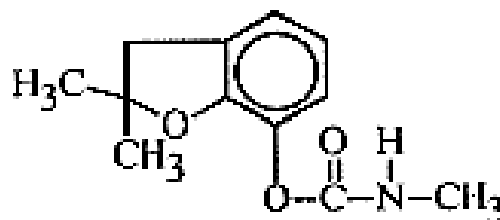
Carbamates



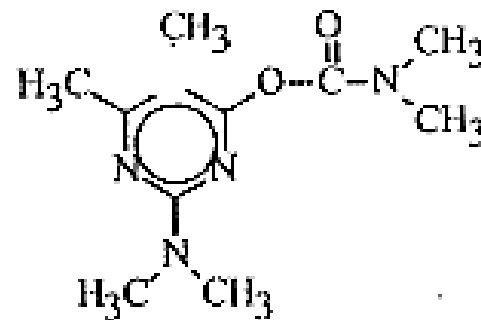
Carbamic acid



Carbaryl



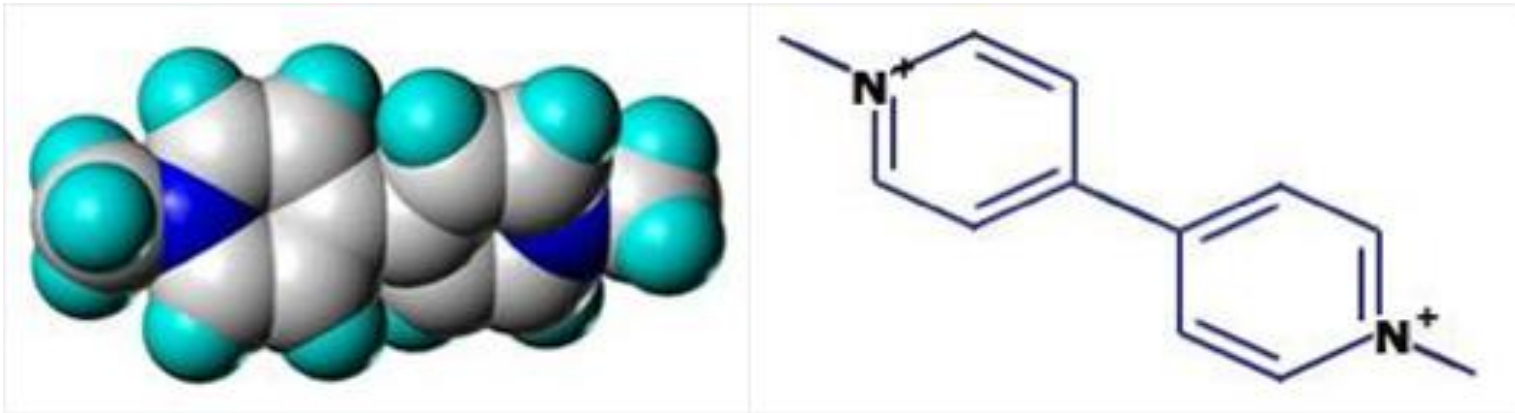
Carbofuran



Pirimicarb

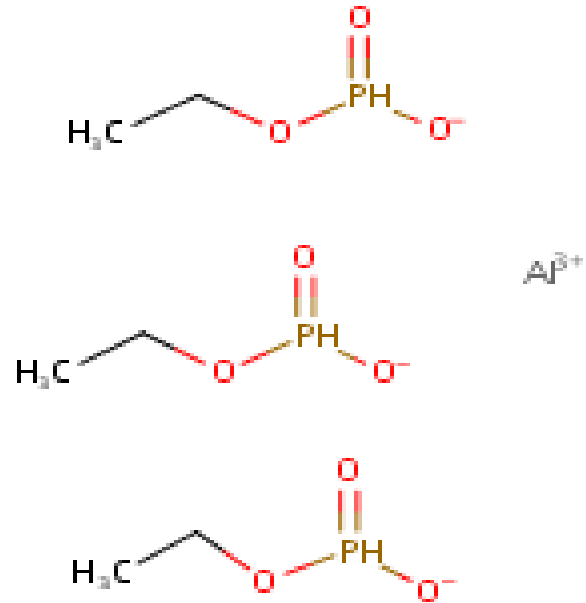
Herbicides

- E.g Paraquat is positively charged and highly reactive
- Acts by binding with electrons in the plant
- Can also bind with electrons in the human body hence very toxic to people



Fungicides

- Some are metallic e.g Fosetyl-Aluminium
- Interferes with membrane structure of the fungus
- Severe eye irritant in people



Residues of pesticides in food

- Arise from usage, even authorized ones
- Residues allowed are referred to as Maximum Residue Limits and are set by
 - Countries, National e.g Kenya
 - Regions, e.g the EU
 - International bodies , e.g Codex Alimentarius Commission



CODEX ALIMENTARIUS
INTERNATIONAL FOOD STANDARDS

MRLs

- What's left when a chemical is used with Good Agricultural Practice
- Suggested by the company registering the chemical
 - E.g Company A suggests 5 mg/kg as MRL for pesticide B on Crop C



What's allowed as intake

- Called Acceptable Daily Intake, ADI mg/kg bw per day
- ADI is the max amount or dose that can be consumed daily over the life of a human being(70 years) without causing an adverse effect
 - The ADI is calculated based on No Observed Adverse Effect Level (NOAEL) found in toxicology studies with rats, mice, i.e ,mammals divided by the margin of safety, MOS which is 10X 10.
 - Human beings are 10 times more sensitive than the most sensitive animal tested.
 - Some humans may be 10 times more sensitive than the least sensitive humans. Includes therefore the elderly, children

ARfD

ARfD (acute reference dose) is an estimate of the amount of a substance in food or drinking water that can be ingested over a short period of time, usually during one meal or one day, without appreciable health risk to the consumer (JMPR, 2002)

Validating the MRL

- Has to be validated usually using the intake
 - If chemical A is used on various food crops, then they are eaten, how much do people eat?
 - The total called Theoretical Daily Intake, derived from various foods is then compared with the ADI. It has to be less than the ADI. The assumed MRL can then be accepted

Kenya

- MRLs suggested by the companies based on EU or CODEX MRL since we do not have MRLs set
- Validation has not been done
- Most food MRLs are now adopted from CODEX except the EU ones for the export crops such as French beans, peas, etc.
- Observance of Pre-Harvest Interval and overall GAP is the way to ensure the residues are within the MRL



What children eat and drink

- Children vulnerable due to body weight and other factors but covered by the ADI as long as the MRL has been set and validated.
- What would concern us most?
 - What foods are children eating?
 - What may be used on the crop?
 - What is the handling after harvest
 - Cleaning, Cooking, trimming are all important in reducing in residues
- Meats, milk, fish, subject to contamination
- Water, what are the sources of the water?
- Is there contamination from farm lands?

Tips

- Leafy vegetables have more residues due to surface area compared with fruity vegetables
 - Compare sukuma wiki with tomatoes
- Wash all vegetables and fruits thoroughly, not casually
 - Soap, enough water
- Residues can be visible or not visible
 - Older pesticides had more visible residues but technology has improved to increase solubility and dispersion
 - What you see as residues may not be pesticides but mostly some form of powder e.g talc is commonly used in formulations
- Cooking does not substitute for washing, some chemicals break down to more toxic products.

What children breathe

- The concern here is pollution
- With pesticides, we are concerned with volatility based on vapour pressure
- Most have low vapour pressure
- But people and children can breathe in mist in sprayed plots, as what is called By-stander exposure, etc
- Rule is Children out of spray areas, sprayed areas (Re-Entry Intervals are for adults not children)

Restricted Entry Intervals



Conclusion

- How serious is the problem in Kenya?
 - No studies and no data
 - However, a lot of alarming statements not based on objective data
 - Talk of cancer and other diseases is not supported by data
 - Very high doses of many chemicals can cause cancer but not proven for doses consumed in real life
 - In the past in the US, Canada, many epidemiological studies done did not generally associate pesticides with illness
 - Farmers that used a lot of pesticides were healthier than urban populations



**The
End
and
Thank
you**

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