PESTICIDES

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- Compounds used to kill pests.
- Pesticides include:
  - Insecticides
  - Rodenticides
  - Fungicides
  - Nematicides
  - Acaricides
  - Molluscicides
  - Herbicides
  - Miscellaneous

Insecticides :

- These compounds which kill or repel insects and related species.

- E.g;
  - ORGANOPHOSPHOROUS COMPUNDS
  - ORGANOCHLOROUS COMPUNDS
  - CARBAMATES
  - PYRETHROIDS

ORGANOPHOSPHOROUS COMPOUNDS

- Available in dust, granules or liquid form.
- Some products need to be diluted in water before use and some are burnt to make smoke.

- Classified as:

ALKYL COMPOUNDS	ARYL COMPOUNDS
Tetra ethyl pyrophosphate (TEPP)	Parathion
Hexa ethyl tetraphosphate (HETP)	Chlorothion
Octa methyl pyrophosphate (OMPA)	Diazionon
Malathion etc.,	Paraoxon etc.,

❑Toxokinetics

- Absorption: By any route

  Skin, conjunctiva, inhalational, oral, ingestion.

- Metabolism: Liver
- Excretion: Urine.

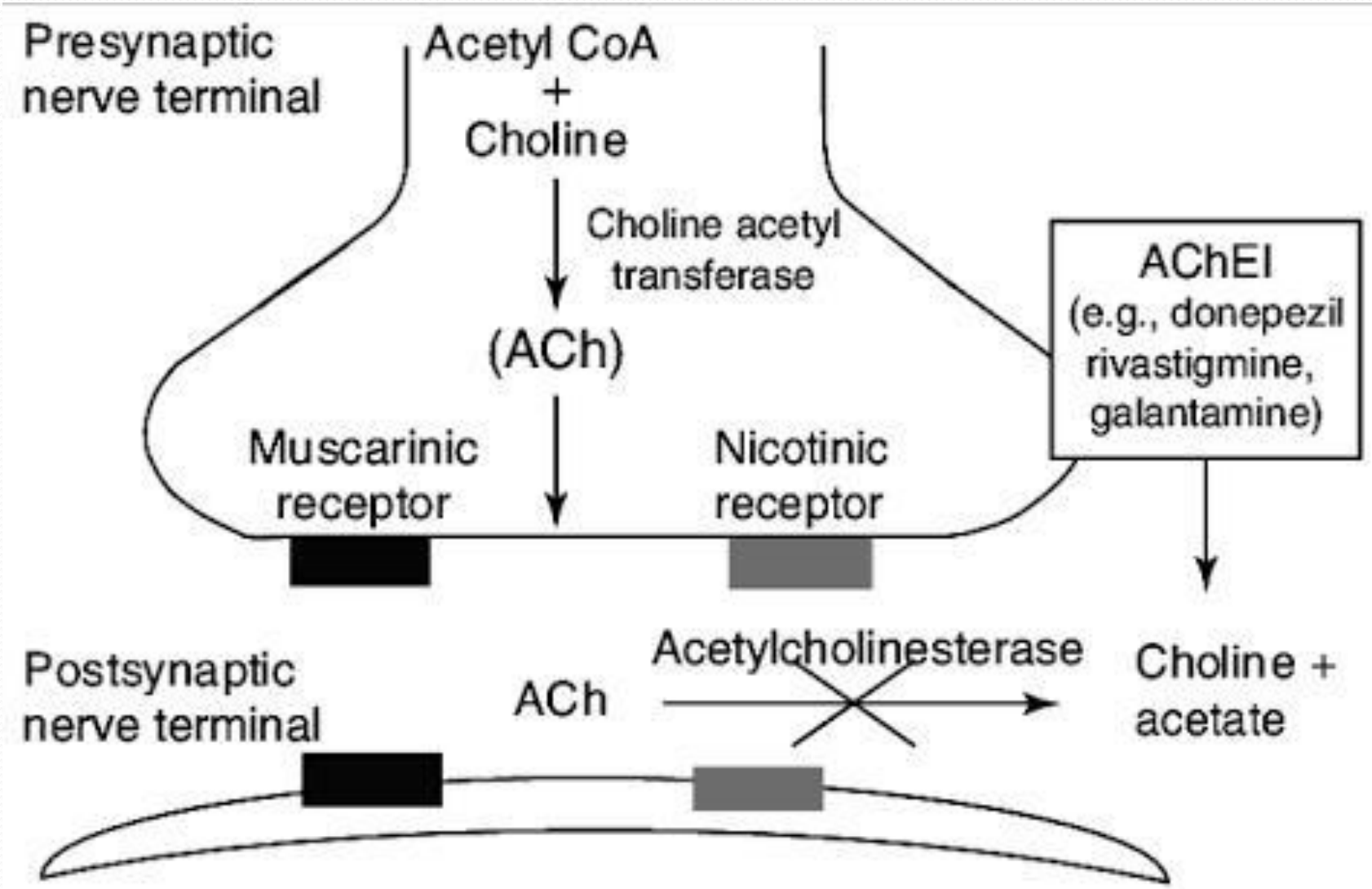
PARATHION:

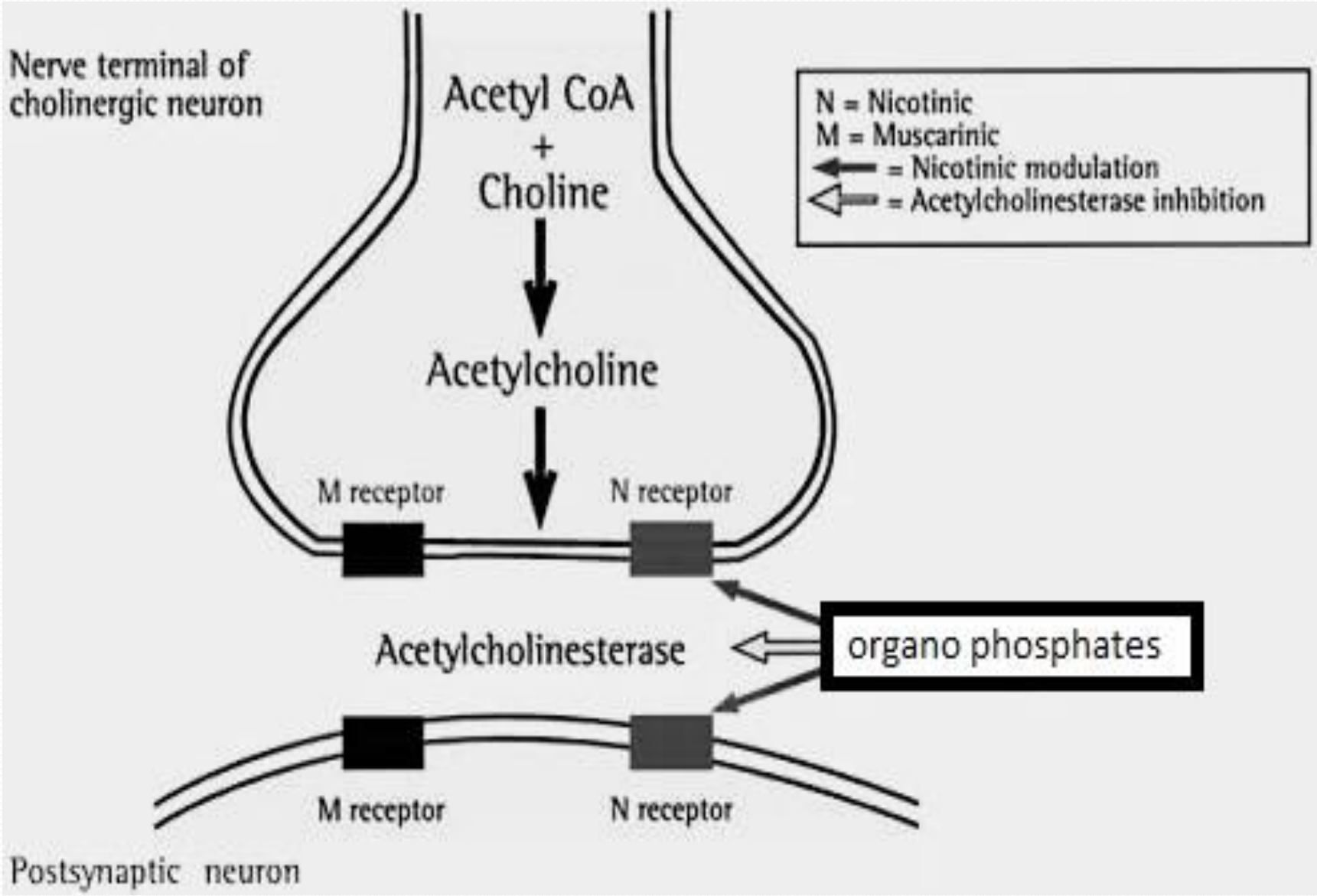
- Stored in body fat and are released slowly in the circulation thus prolonging the toxic action.
- It first metabolized to **PARAOXON** (active toxic agent) and then to paranitro phenol that is excreted into urine.

MALATHION:

- Metabolised in liver by **ESTERASES** and part of this metabolized product is excreted in urine as **PHOSPHATE.**

Mechanism of action:




Nerve terminal of cholinergic neuron
Acetyl CoA
+
Choline
Acetylcholine
N = Nicotinic
M = Muscarinic
= Nicotinic modulation
= Acetylcholinesterase inhibition
M receptor
N receptor
Acetylcholinesterase
organo phosphates
M receptor
N receptor
Postsynaptic neuron

Clinical (Toxic) features:

- **Acute Poisoning**:- due to Acute Peripheral and central cholinergic block.

1. Muscarinic effects: **SLUDGE/DUMBELS**
2. Nicotinic effects: **MATCH**
3. CNS effects: **CCC TRIAD**
4. Other features: toxic myocarditis, pancreatitis, metabolic acidosis by respiratory depression, lactacidosis, bronchoconstriction, pulmonary edema.

Muscarinic effects:

S➔ Salivation, Sweating
L➔ Lacrimation
U➔ Urination
D➔ Diarrhea
G➔ GI Upset
E➔ Emesis

CHROMODACRYORRHEA

Shedding of red tears due to accumulation of porphyrin in the lacrymal glands.

D➔ Diarrhea
U➔ Urination
M➔ Miosis
B➔ Bronchoconstriction, Bronchial secretions
E➔ Emesis
L➔ Lacrimation
S➔ Salivation, Sweating

Nicotinic effects:

M➔ Muscle weakness

A➔ Adrenal medulla activity increase

T➔ Tachycardia

C➔ Cramps in muscle

H➔ Hypertension

CNS effects:

C➔ Conculsions, Confusion, Coma

T➔ Tremors of face, tongue, eyelids and hands

R➔ Restlessness

I➔ Irritability

A➔ Anxiety

D➔ Depression of respiratory and circulatory centers

Cause of Death:

1. Respiratory failure
2. Cerebral hypoxia
3. Hyperthermia
4. Hepatic failure
5. Renal failure

Diagnosis:

1. Estimation of cholinesterase level (RBC & Serum)
2. Colorimetric method – purplish blue colour – spectrophotometer.
3. P-nitrophenol test
4. Paper chromatography
5. Thin layer chromatography
6. Gas chromatography
7. High performance liquid chromatography
8. ECG may show right axis deviation, ST depression and T wave inversion.

Management:

- Stabilization and assurance of patient

- Decontamination
  - Skin ➔ washing and bathing
  - Ocular ➔ eye irrigation with NS or water
  - Ingestion ➔ Gastric lavage and administration of activated charcoal

- Antidote administration
  - **Atropine** 2mg for every 10 min (max. 200mg/day)
  - **Oximes** – 1-2gm per dose every 6th hrly.

- Supportive measures.

Autopsy findings:

- Insecticide smell (garlicky or kerosene like smell)
- Froth at mouth and nostils (pulmonary edema)
- Cyanosis (Respiratory insufficiency)
- Stomach mucosa congested
- All organs congested
- Cerebral edema
- Features of toxic myocarditis may be present.

Microscopic examination of heart reveals dilatation of pericardial blood vessels with hemorrhages in the sorrounding tissues, interstitial edema of myocardium, inflammatory cells, hemosiderin laden macrophages and fatty infiltration of myocardium.

Medico legal importance

- Accidental poisoning – while spraying
- Suicidal poisoning – most common
- Homicidal poisoning –Rare due to smell

❖Intermediate syndrome:

- It is a neurotoxic effect that appears after acute cholinergic crisis but before the expected onset of delayed neuropathy.

- This syndrome carries a risk of death because of the associated respiratory depression.

❑Cardinal features of this syndrome:

- Muscular weakness, affecting predominantly the **proximal limb muscles and neck flexors.**

- Muscle weakness had an acute onset, noticed within 24 – 96 hours after poisoning.

- Cranial nerve palsies are common.

- Respiratory muscle paralysis is common.

- **<u>Delayed Polyneuropathy:</u>**

- It appears 2 to 3 weeks after poisoning.

- This is due to inhibition of enzyme neurotoxic esterase with nerve demyelination.

- In this condition paralysis is usually limited to **distal limb muscles.**

- Cranial nerves and respiratory muscles are spared.

❑Cardinal signs of this syndrome:

- Flaccid weakness and atrophy
- Spasticity
- Ataxia

} distal limb muscles.

Differences between Intermediate syndrome and Delayed Polyneuropathy.

variable	Intermediate syndrome	Delayed polyneuropathy
Time of onset of symptoms	1-4 days	2-3 weeks
Limb muscle weakness	proximal	Distal
Neck muscle weakness	Present	Absent
Respiratory muscle weakness	Present	Absent
Cranial nerve palsies	Present	Absent
Electromyogram	Tetanic fade	Denervation
Recovery from time of onset	4-18 days	6-12 months

❖Chronic Organo Phosphorous Compound Poisoning

- Usually occurs as a Occupational Hazard
  - Agriculturists
  - Those engaged in pesticide spraying
  - Pesticide industrial labours
  - Pesticide vendors at outlets.
- Route of exposure:
  - Inhalation
  - Contamination of skin

❑Clinical features:

- ➢Polyneuropathy
  - Paraesthesias
  - Muscle cramps
  - Muscle weakness
  - Gait disorders
- ➢CNS effects:
  - Drowsiness
  - Confusion
  - Irritability
  - anxiety

- Chronic OP Poisoning has been associated with a variety of subacute or delayed onset chronic neurological, neurobehavioural or psychiatric syndromes.

Dipper's flu:

one or more episodes of severe flu like symptoms lasting for more than 3 days following exposure to extremely low concentration of organophosphates.

Sheep farmer's disease:

Neuropsychiatric manifestations encountered in sheep farmers involved in long term sheep dip operations.