



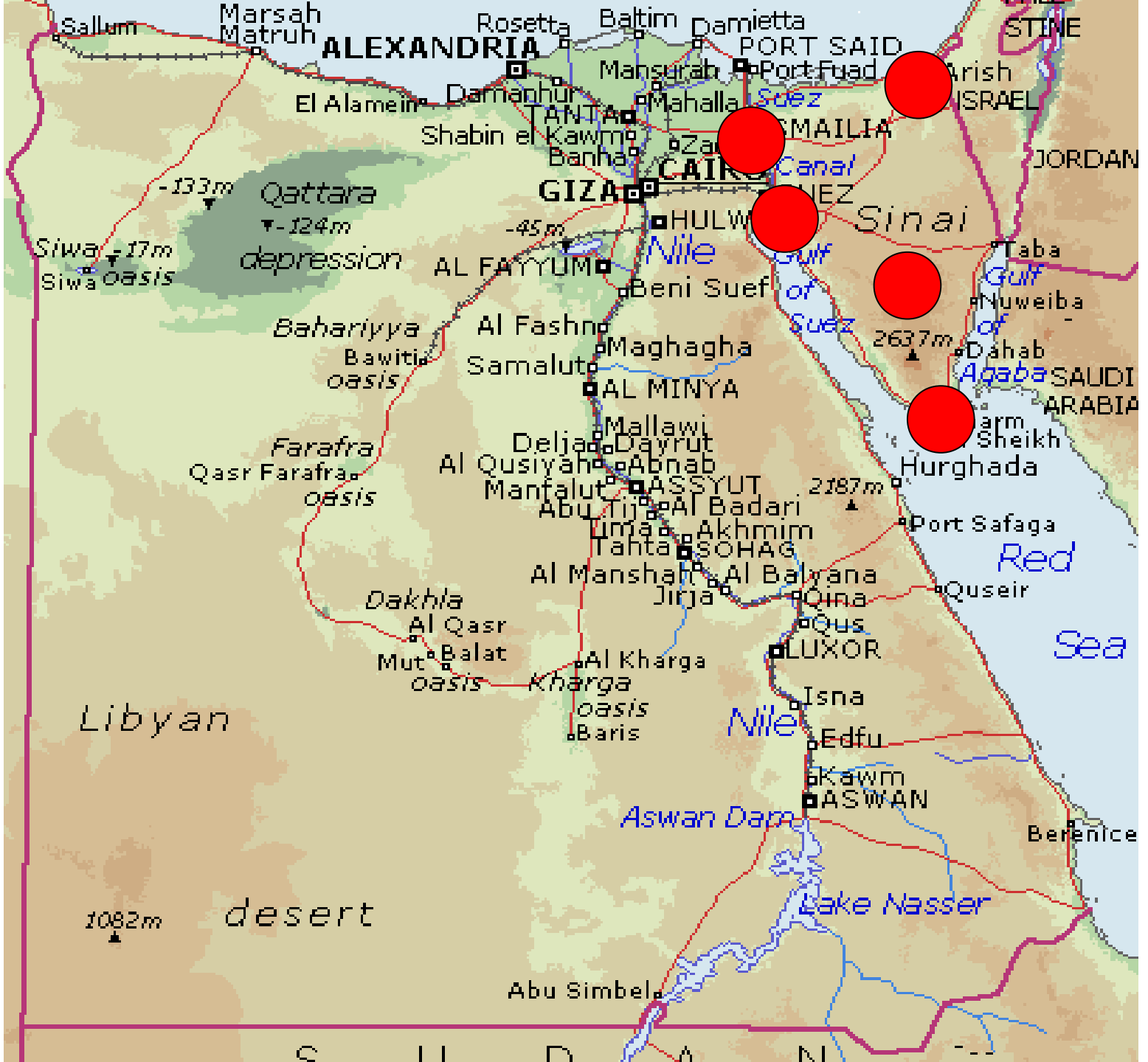
New trends in veterinary insecticides



By

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Faculty of Vet. Medicine – Suez Canal University





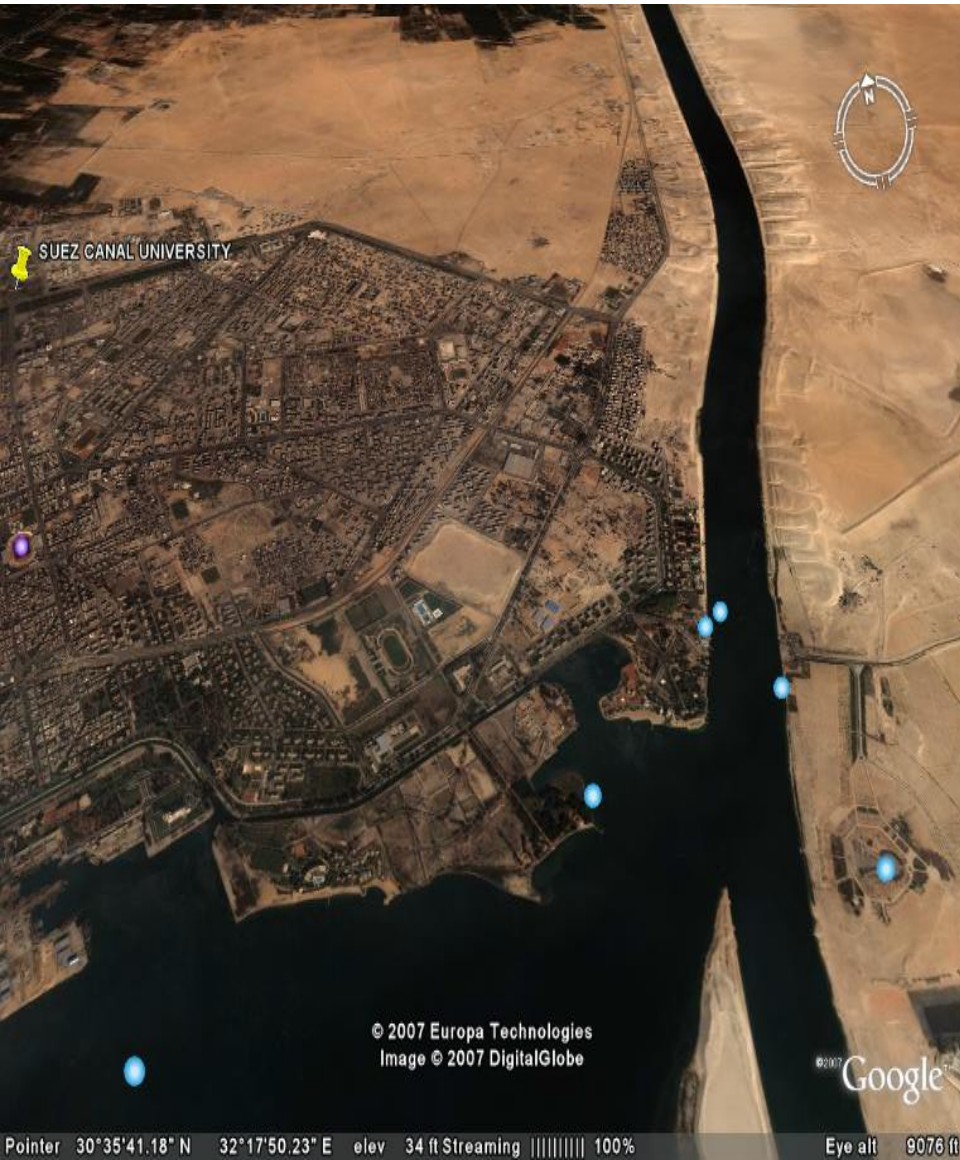
Suez Canal University

A Community-Based Education Institute





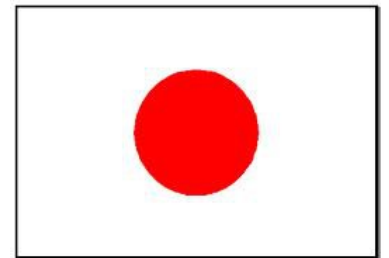
SUEZ CANAL UNIVERSITY



Students	40.000,0
Staff Members	4.000,0
Employees	7.700,0
Faculties	22
Provinces	4

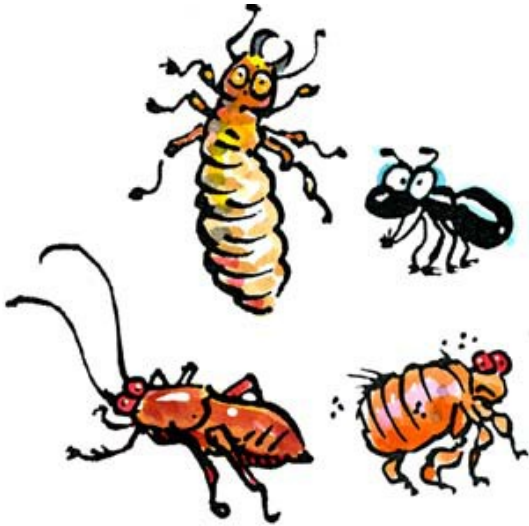
The Japan International Cooperation Agency (JICA)

- **Workshops for sub-Saharan African physicians at SCU and funded by JICA.**
- **Combating Infectious Diseases in Sub-Saharan Africa.**
- **Medical crisis management**

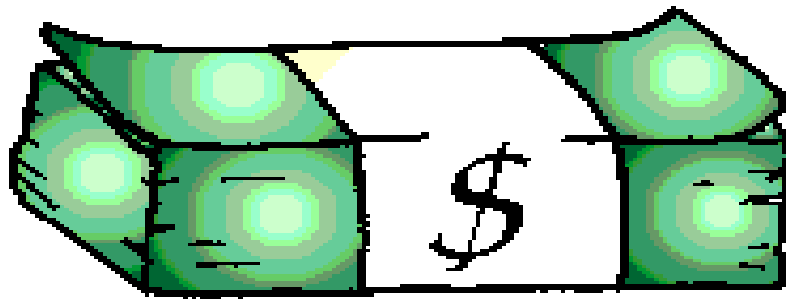


Insecticide

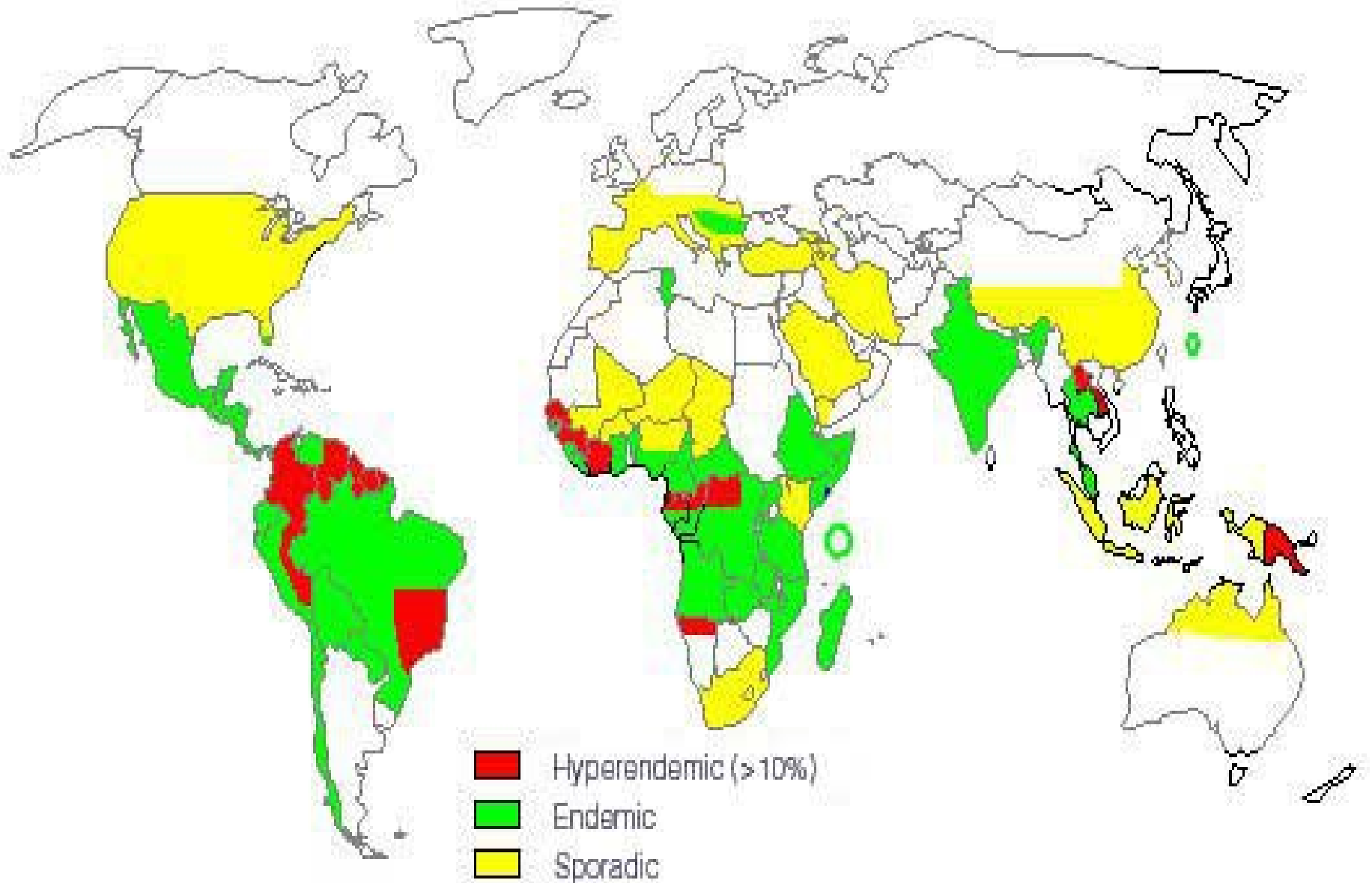
Any substance or mixture of substances intended for preventing, destroying, repelling, or mitigating insects.



Insecticides represent an \$ 8 billion industry



Epidemiology





Classes of Insecticides



Botanical Insecticides

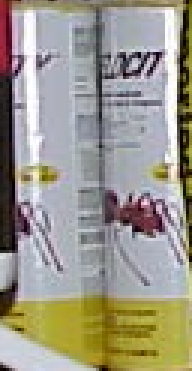
- **Sabadilla**
- **Nicotine**
- **Quassia**
- **Unsaturated isobutylamides**
- **Ryanodine**
- **Naphtoquinones**
- **Rotenone**
- **Sweet flag**
- **Marigolds**
- **Pyrethrum**
- **Azadirachtin**
- **Essential oils**

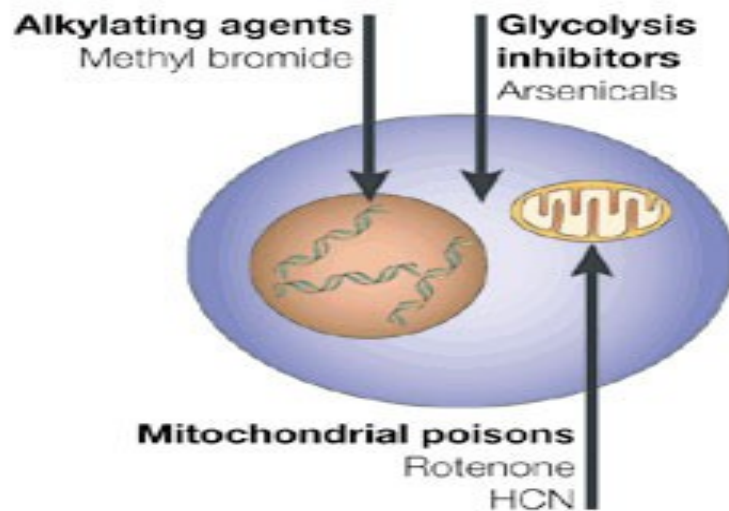
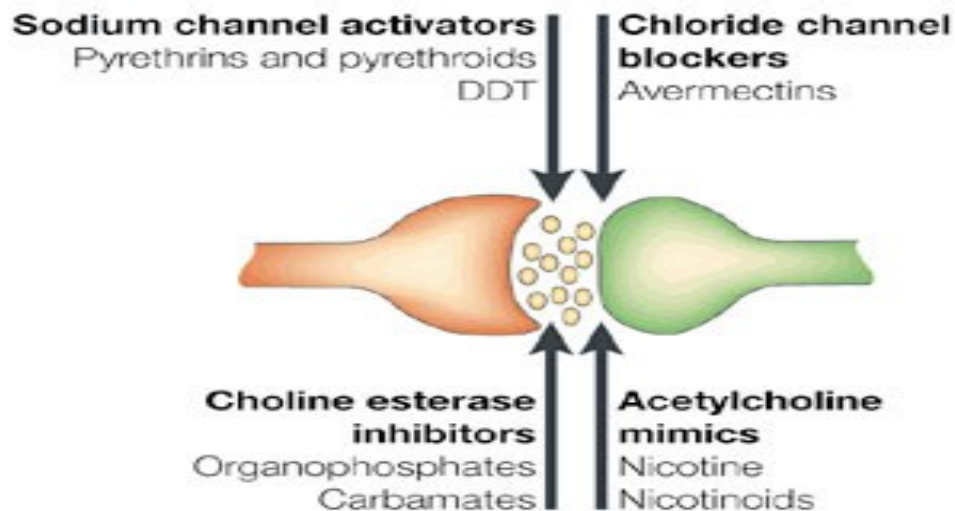
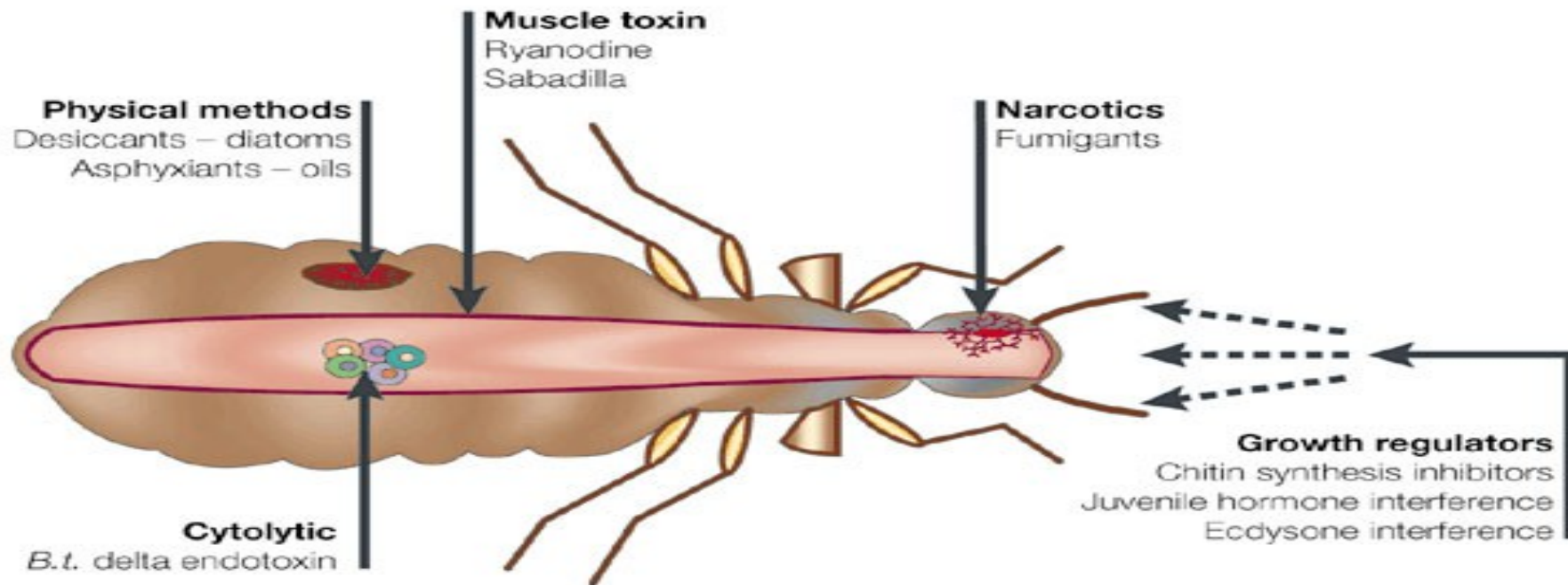
Synthetic Insecticides

Organochlorines
Organophosphates
Carbamates
Pyrethroids
Neonicotinoids

Biorational Formulations

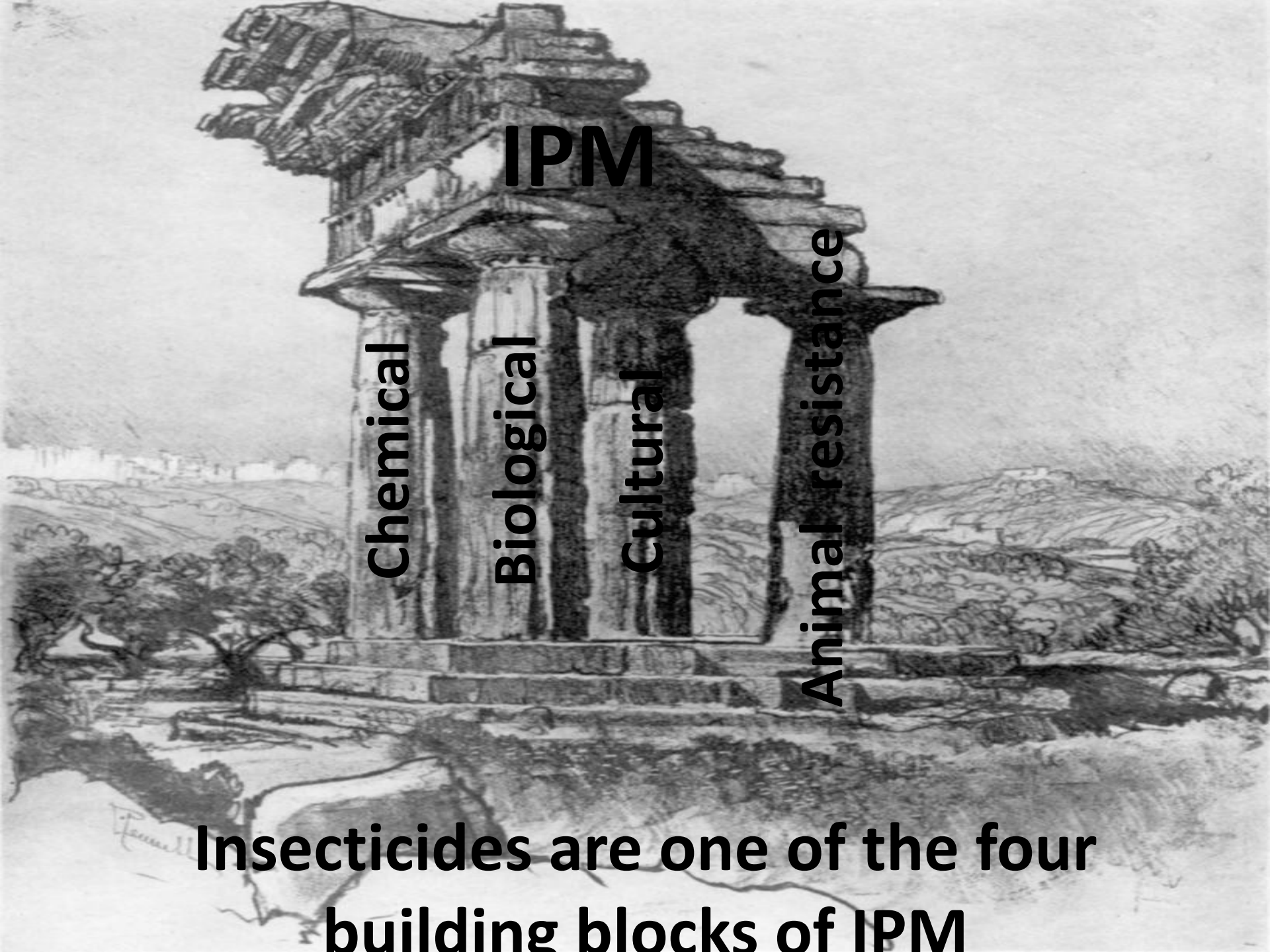
Growth regulators
Pheromones
Microbial formulations





Which product should I use





IPM

Chemical

Biological

Cultural

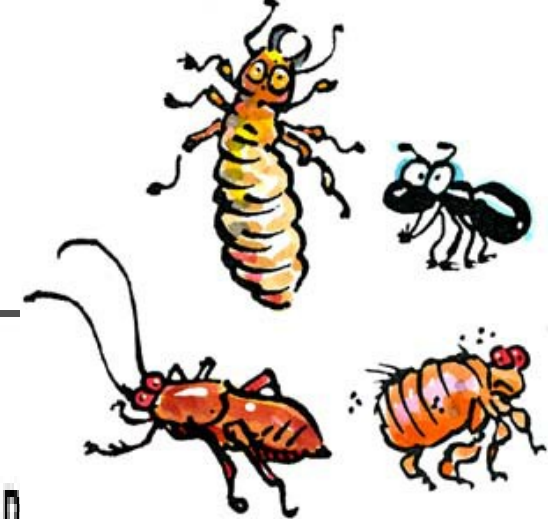
Animal resistance

Insecticides are one of the four
building blocks of IPM

Chemical Control: Insecticides



Insecticides



Anticholinesterases

Avermectins

Botanicals

Organochlorines

Pyrethroids

Neonics

-Organophosphates

-Ivermectin

-Nicotine

-Cyclodienes

-Type I

-Nitromethylene

-Parathion,

-Rotenoids

-Dieldrin*, Heptachlor

-Permethrin*

-Chloronicotinyl

Chlorpyrifos*

-Rotenone*,

-Dichlorodiphenylethanes

-Type II

-Phenylpyrazole

-Carbamates

Deguelin

-DDT*, methoxychlor

-Cypermethrin,

-Aldicarb, Methomyl*

-Cyclohexanes

Deltamethrin*

-Lindane, β -HCH

Synthetic Insecticides

Synthetic Insecticides

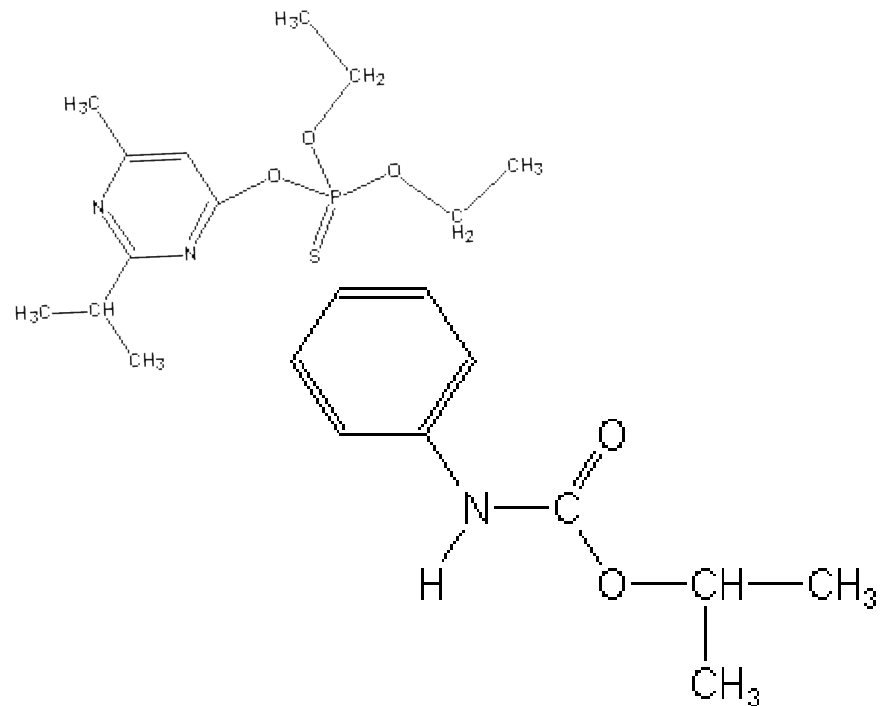
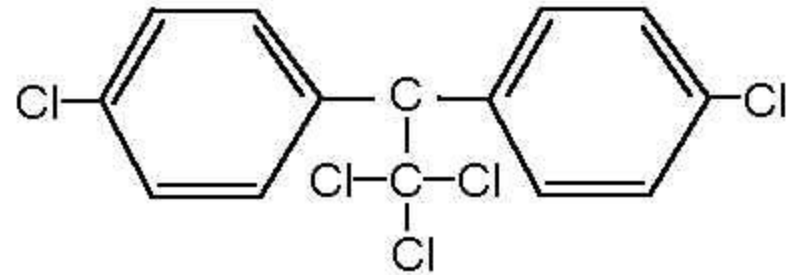
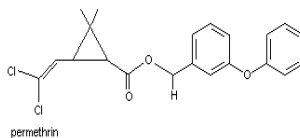
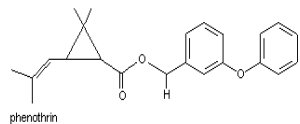
Organochlorines

Organophosphates

Carbamates

Pyrethroids

Neonicotinoids

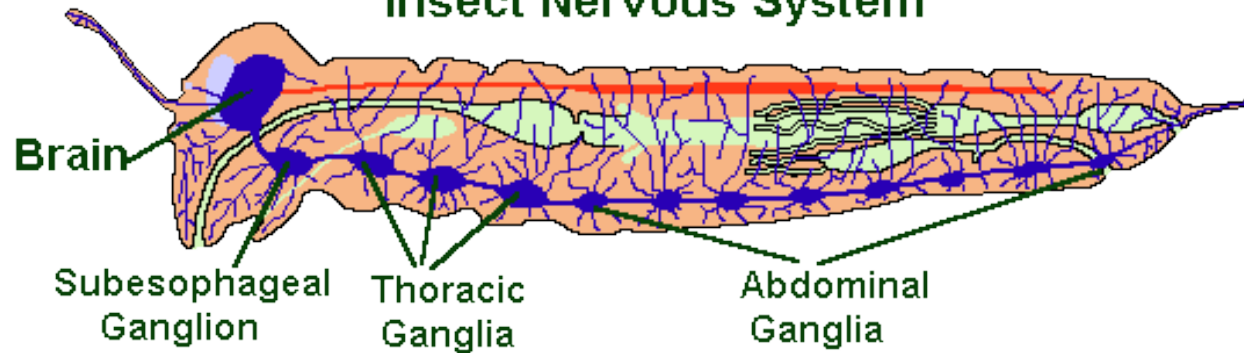


Nervous System

- Why does this happen?
- Let's look at a "normal" nerve impulse.

Nervous system

A Diagrammatic Representation of the
Insect Nervous System



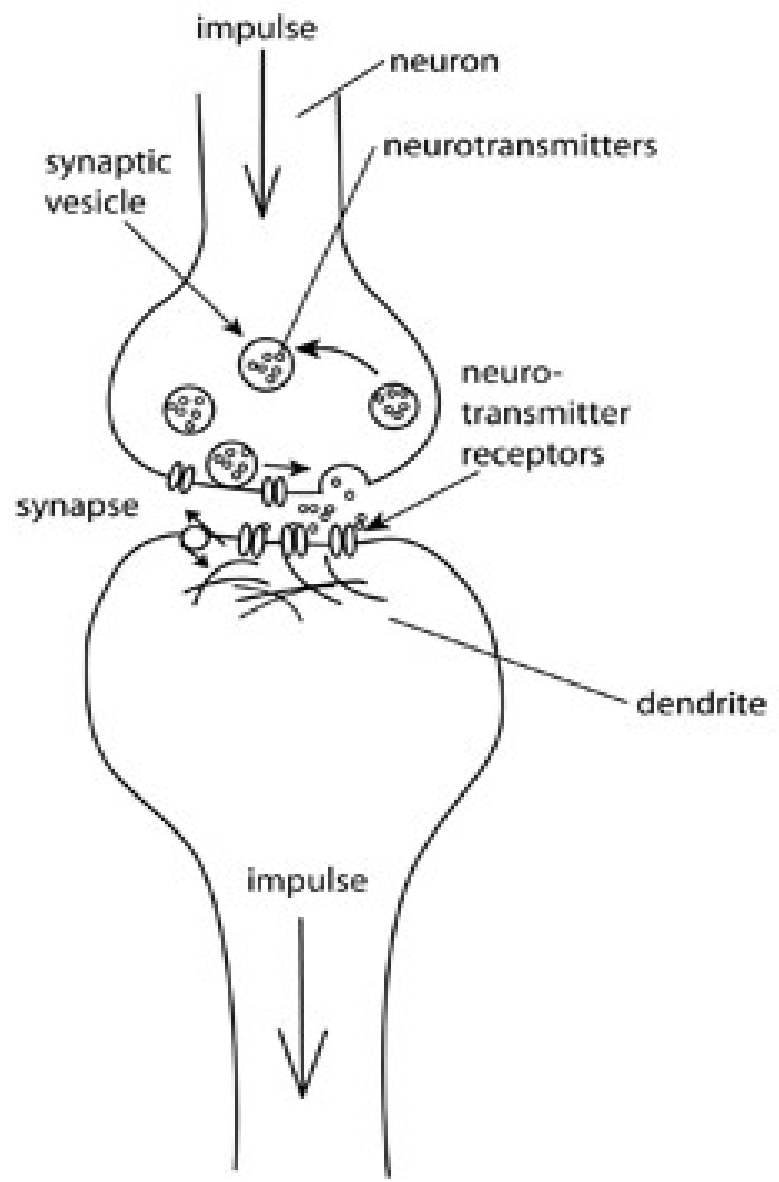


Affect synaptic transmission



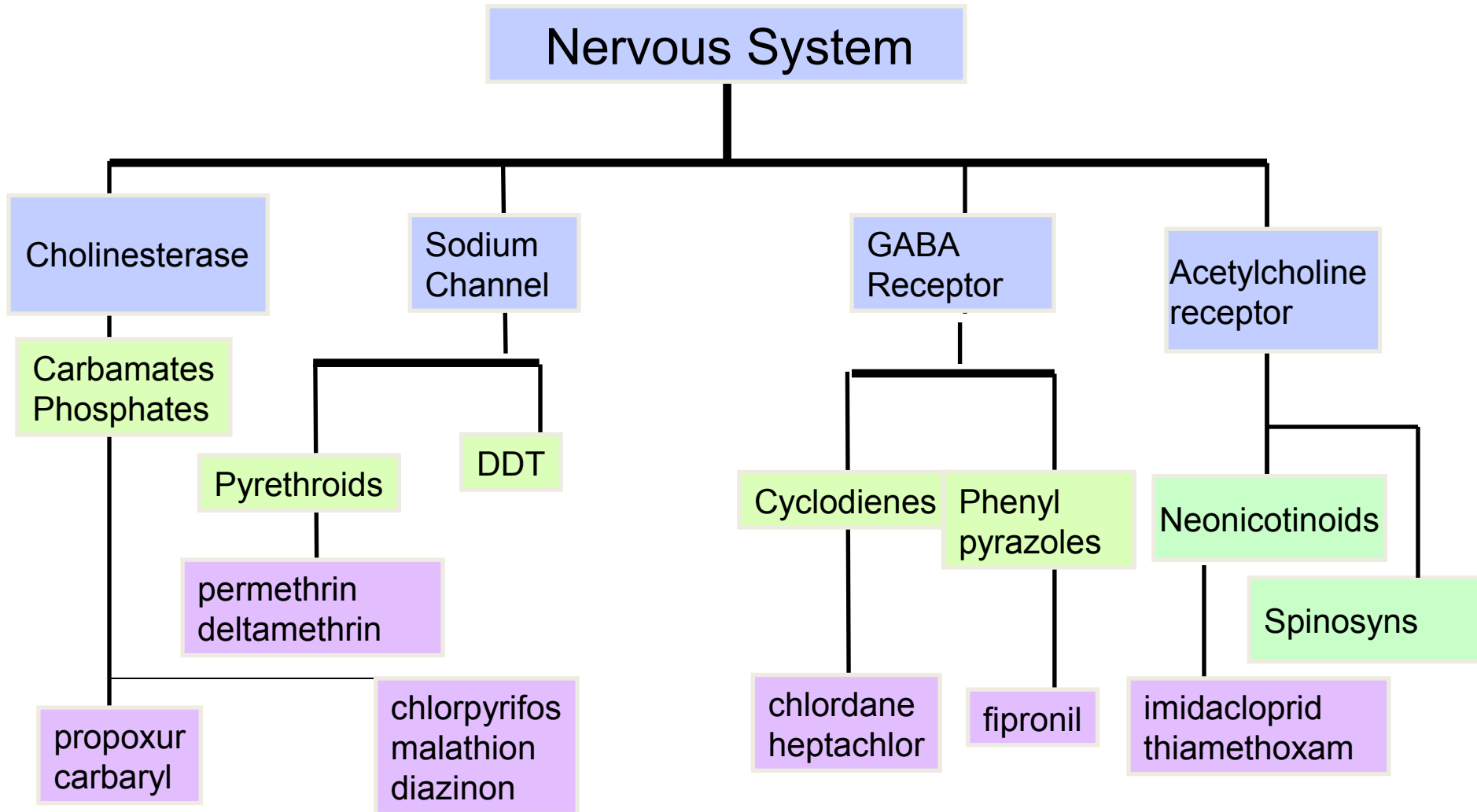
1 Vesicles of acetylcholine
2 Imidacloprid

3 Nicotinic receptors blocked open
4 Constant neuromuscular stimulation

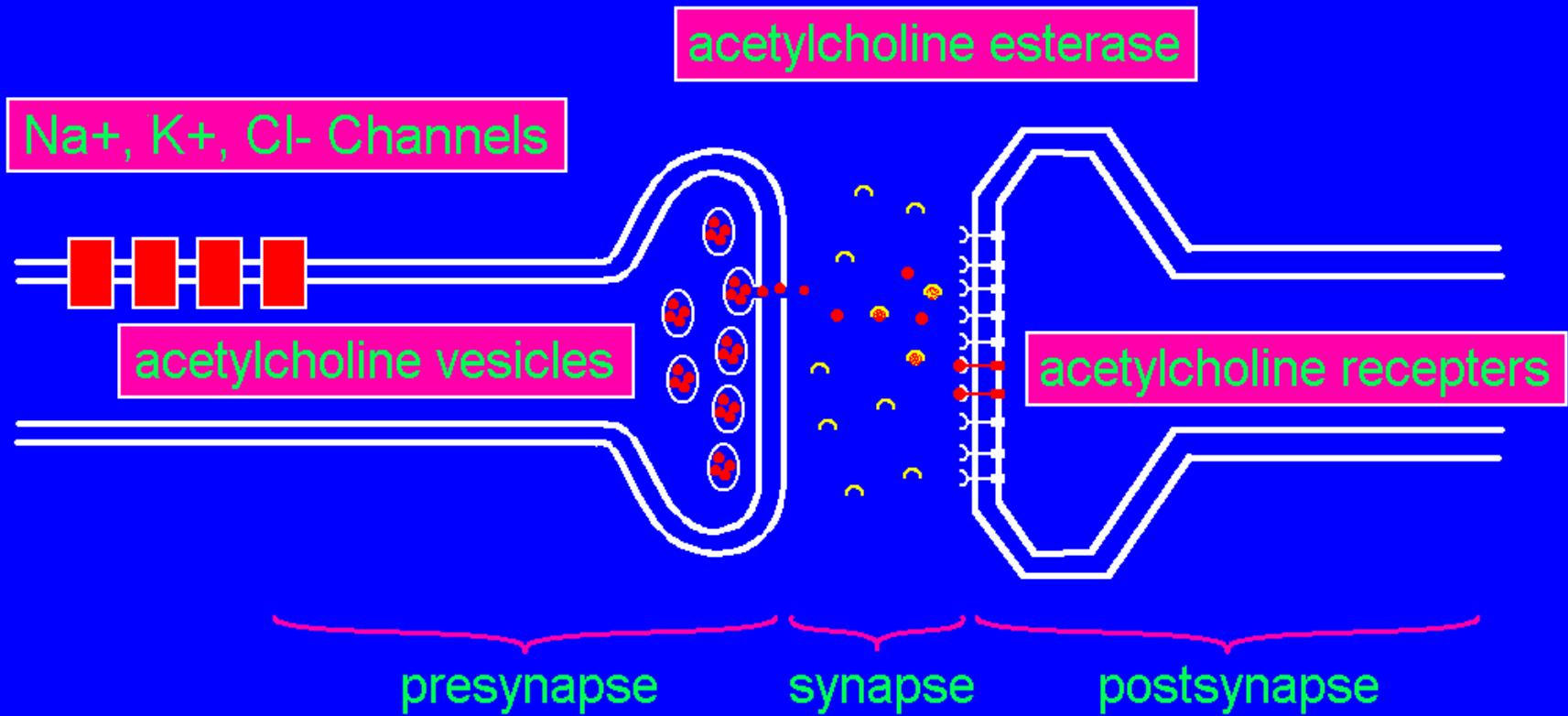


impulse
neuron
synaptic vesicle
neurotransmitters
neuro-transmitter receptors
synapse
dendrite
impulse

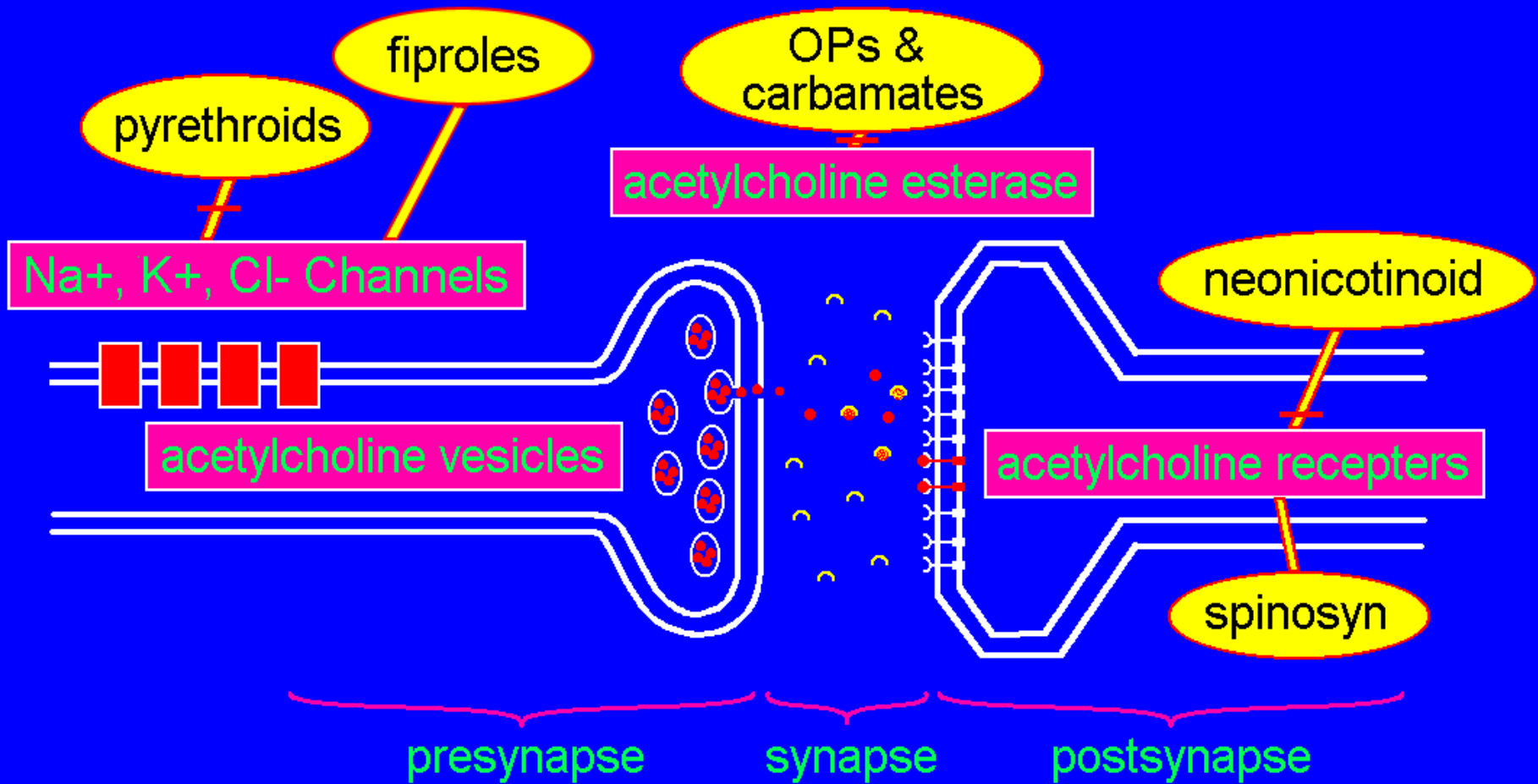
Insecticides that Affect the Nervous System



Affects on Nerves




Affects on Nerves



Modes of Action Nervous Systems

Neural membrane disruption
(ion transport disruption)

sodium/potassium ions  chloride ions
(ion pumps)

(organochlorines & pyrethroids)

(fiproles = phenylpyrazoles)

Modes of Action

Nervous System

Neural synapse disruption

acetylcholine (ACh)

(neural transmitter)



cholinesterase (ChE)

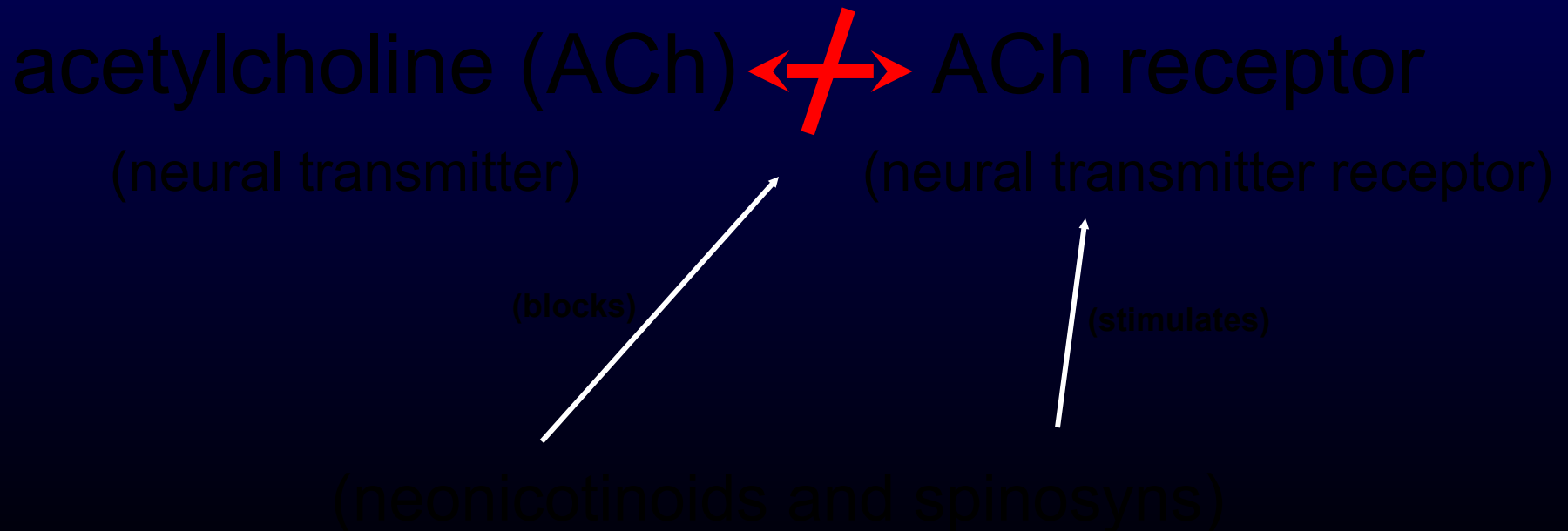
(neural transmitter eraser)

(organophosphates & carbamates - inhibit ChE)
(alkaloids, like nicotine, mimic ACh)

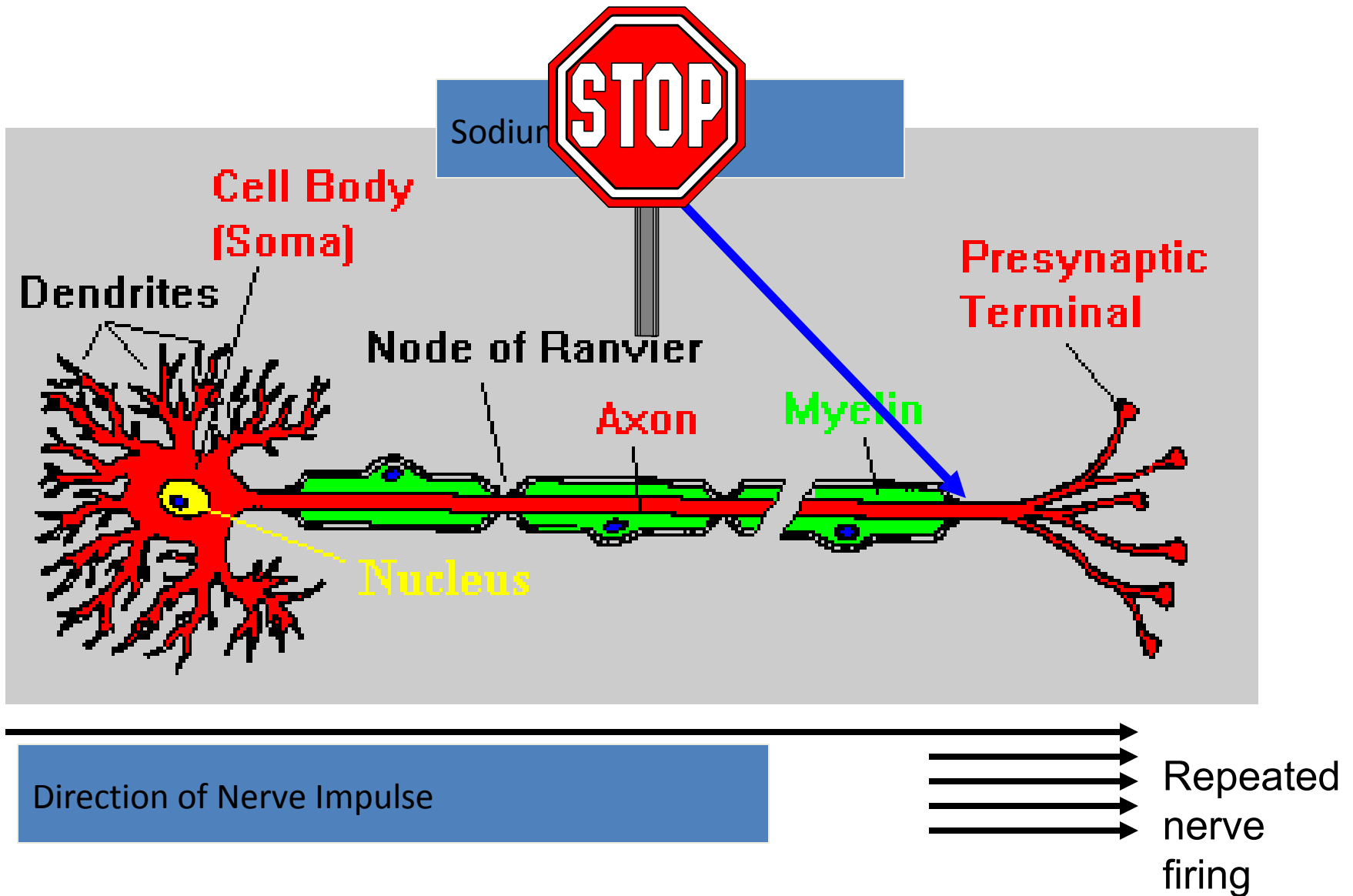
Modes of Action

Nervous Systems

Neural post-synapse disruption



Nerves and Pyrethroids



MOA: Pyrethroids

- Axonic poisons
- Bind to a protein called the voltage-gated sodium channel
- Normally, the sodium channel opens, causing stimulation of the nerve and closes to end the nerve signal
- Pyrethroids bind to the sodium channel and prevent it from closing normally
- Result: continuous nerve stimulation
- Symptoms: Tremors, uncoordinated movement

From Valles and Koehler. 1998. Insecticides Used in the Urban Environment: Mode of Action. ENY-282

Pyrethrins and Pyrethroids

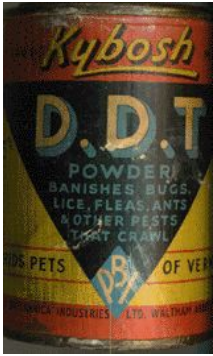
Pyrethroids -- synthetically produced chemicals with similar chemistry and mode of action as pyrethrins, axonic poisons

- Type I
 - Short residual,
 - Fast flushing, and
 - Quick knockdown,
 - Negative temperature correlation: more effective at low temps
 - Ex.: Allethrin, d-phenothrin, resmethrin
- Synergists -- used to deactivate mixed function oxidases (MFOs) within insects
- Type II
 - Long residual,
 - Slower flushing, and
 - Slower knockdown,
 - Better killing power than type 1
 - Positive temperature correlation
 - Ex.: Permethrin, cypermethrin, cyfluthrin, lambdacyhalothrin

MOA: Carbamates and OPs

- Synaptic poisons
 - Carbamates and organophosphorus insecticides bind to an enzyme called acetylcholinesterase (AChE)
 - AChE is found at the nerve synapse
 - AChE is designed to stop a nerve impulse after
- From Vallejos and Koehn, 1998. Insecticides Used in the Urban Environment: Mode of Action. ENY-282

Examples



Organochlorines

- DDT
- Endosulfan
- Aldrin
- Gamma HCH
- Dieldrin
- Gamma BHC



Carbamates

- Aldicarb
- Carbofuran

Pyrethroids

- Tefluthrin
- Deltamethrin
- Lambda
- cyhalothrin
- Permethrin
- Cypermethrin



Organophosphates

- Diazinon
- Fenitrothion
- Dichlorvos
- Dimethoate
- Malathion



Neonicotinoids

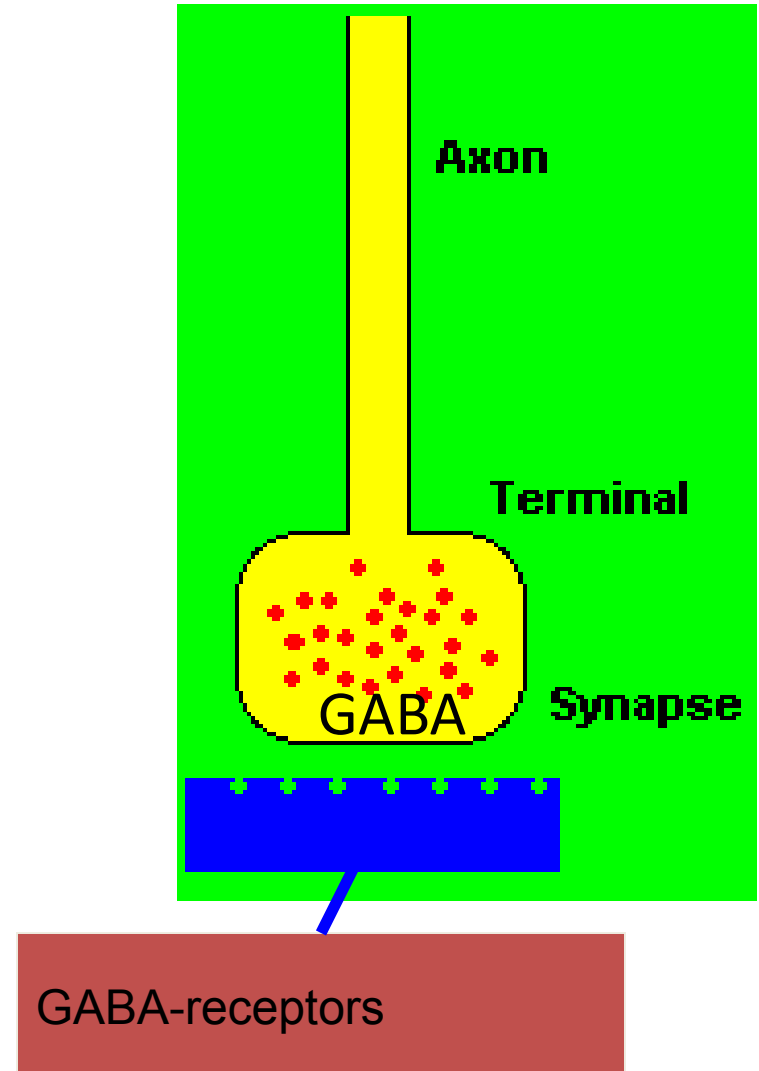
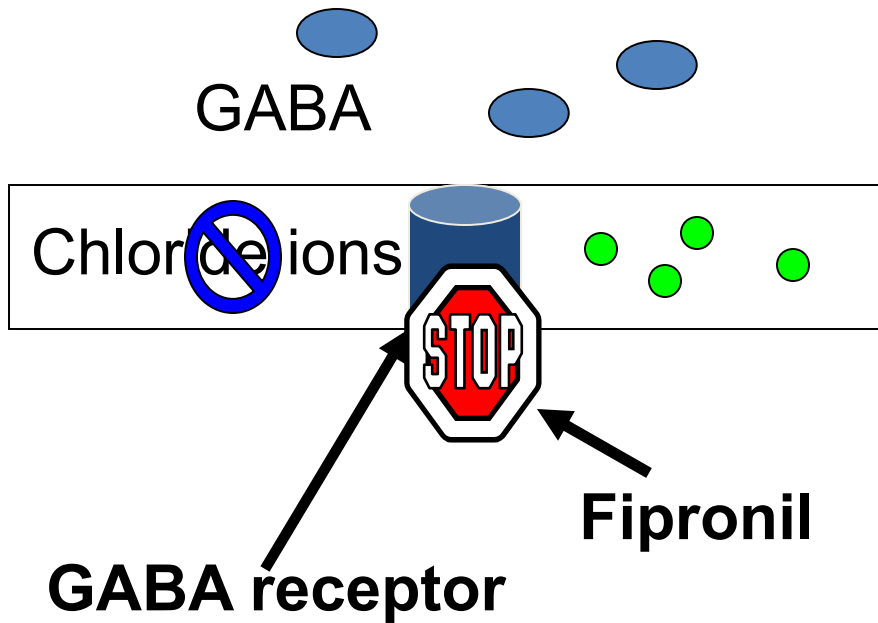
- imidacloprid
- nitenpyram
- acetamiprid
- thiamethoxam

Neonicotinoids

- Imidacloprid (subgroup: pyridylmethylanine)
 - Advantage – pet treatment
 - Merit -- turf ornamentals
 - Water soluble
 - Systemic in plants
 - Premise – termites
 - Affects insects first by paralyzing mouthparts
 - Bayer Advantage OTC
- Thiamethoxam (subgroup: nitroguanidine)
 - Used in crops

GABA Receptor in Central Nervous System

- Phenylpyrazoles or
- Fiproles



MOA: GABA Antagonist

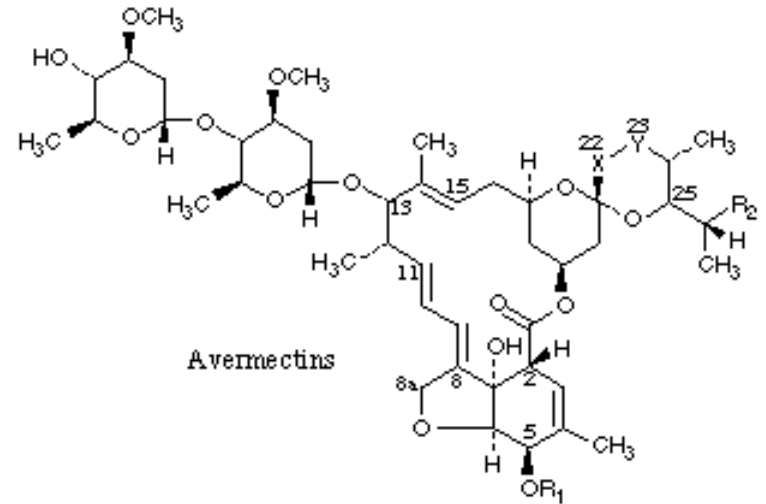
- Phenylpyrazole (fipronil), cyclodienes
- Antagonists of GABA activated chloride channels
- GABA Antagonists: chemicals that bind to but do not activate GAMMA-AMINOBUTYRIC ACID receptors, thereby blocking the actions of endogenous GAMMA-AMINOBUTYRIC ACID or GAMMA-AMINOBUTYRIC ACID agonists.
- GABA can't bind to receptor
- Doesn't activate channel (doesn't open)
- Interferes with (prevents) the passage of chlorine ions through the channel.
- Concerns with cross resistance with other GABAergic insecticides

MOA: GABA Agonist

- Avermectins
- Bind to GABA (Gamma-Amino-Butyric Acid gated chloride channel
- Opens channel
- Chloride influx
- Cannot reach threshold for action potential
- Causes membrane to hyperpolarize, making it less excitatory, decreasing nerve transmission
- Result: flaccid paralysis and death

Avermectins

- Abamectin
 - Avert -- cockroaches
 - Advance -- ants



Produced from soil microbials. Stomach poison for ants
and cockroaches
slow acting
low toxicity to mammals

Avert Kill

- 22 hours to nerve effects
- 40 hours to kill



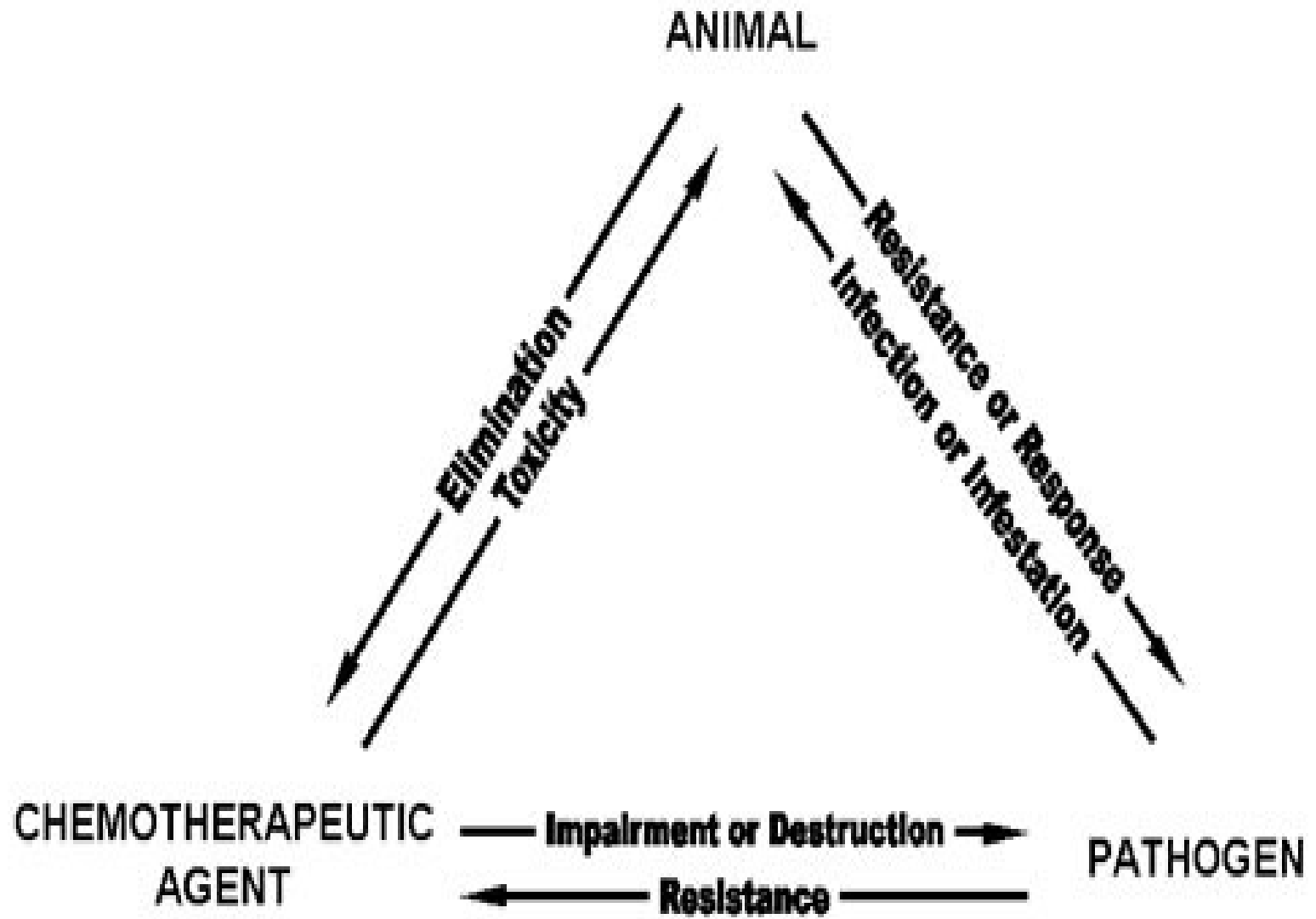
Which product should I use

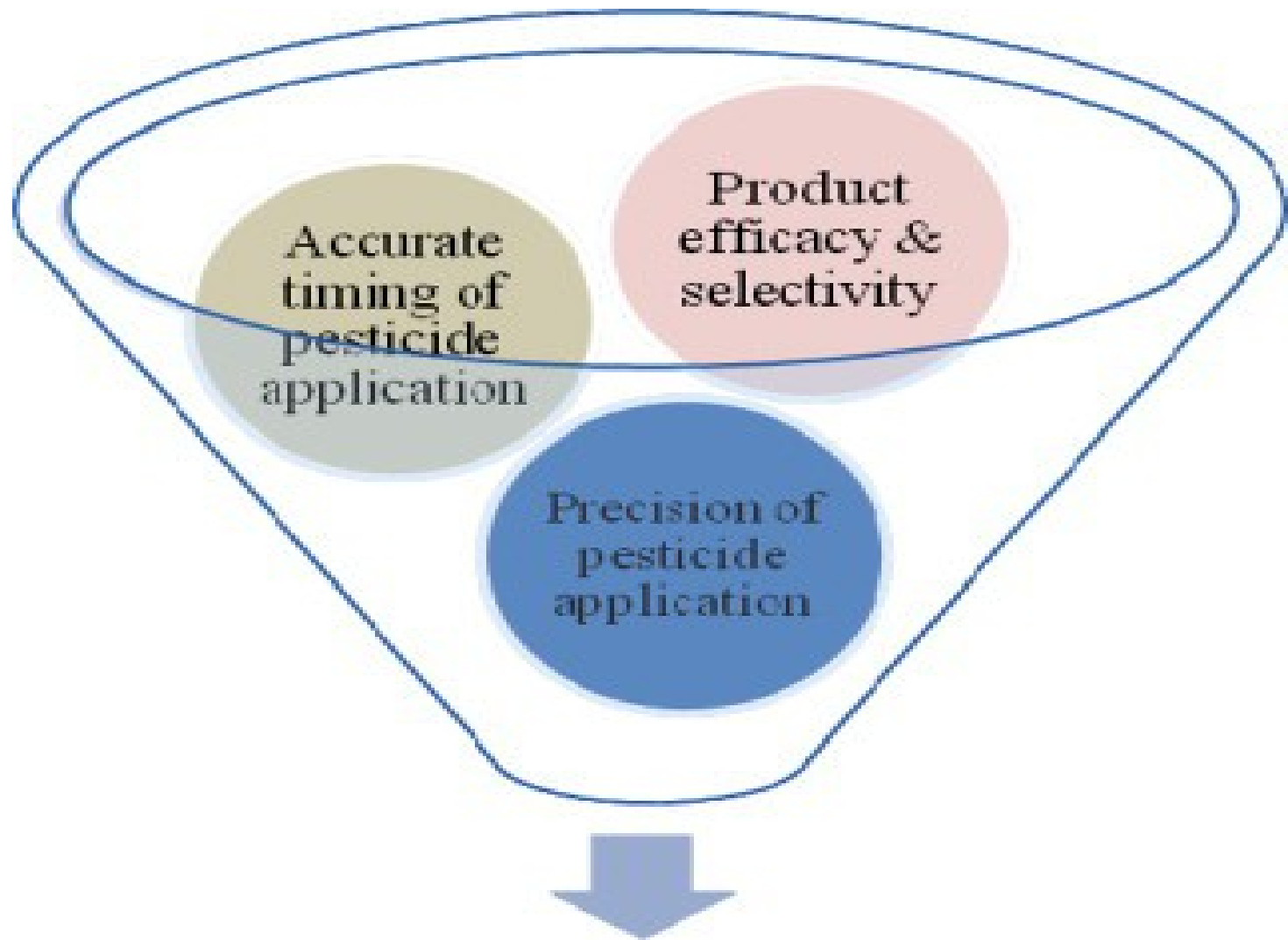


insecticide...??

“choice of insecticide”



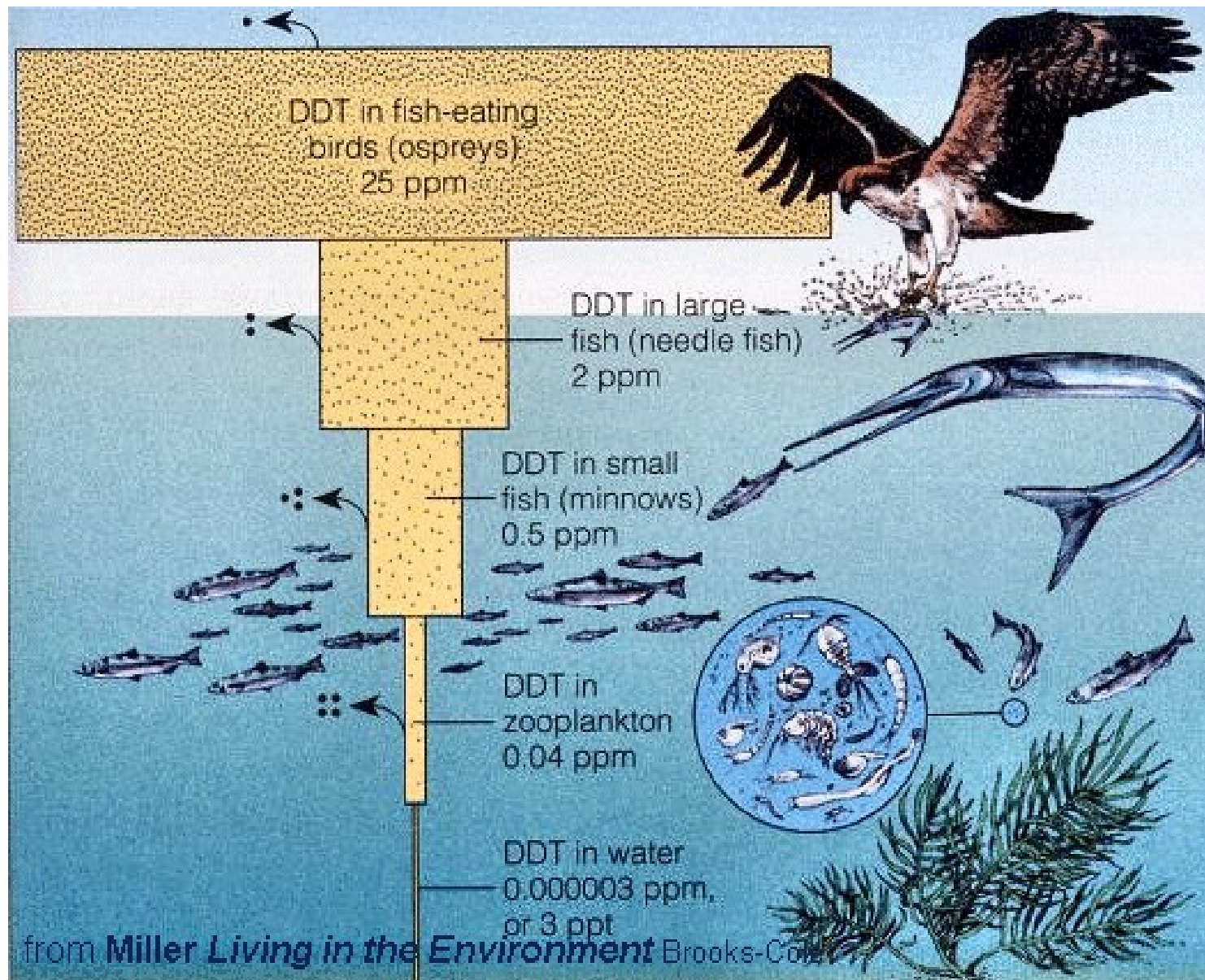




Rational Pesticide Use (RPU)

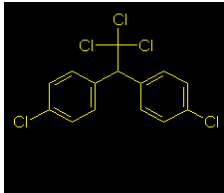
Environmental hazard

- Environmental hazard of insecticides is generally evaluated as a function of persistence often compared to effectiveness



Public concern about Insecticide use

~100% of us have some insecticide residue in our bodies



World Health Organization (WHO) Classification of Pesticides

		LD ₅₀ for the rat (mg/kg body weight)			
Class		Oral		Dermal	
		Solids	Liquids	Solids	Liquids
Ia	Extremely hazardous	5 or less	20 or less	10 or less	40 or less
Ib	Highly hazardous	5 - 50	20 - 200	10 - 100	40 - 400
II	Moderately hazardous	50 - 500	200 - 2000	100 - 1000	400 - 4000
III	Slightly hazardous	Over 500	Over 2000	Over 1000	Over 4000

For the Correct use of insecticides, we need to consider:

Ease of use

Insecticide resistance

Safety

Economics

Insect behavior

Ecotoxicological impact

Way of delivery

Toxicology

Thank you for your attention