

## *PESTICIDES*

- History
  - Pests compete with humans for food, serve as vectors of disease, destroy crops or depress their market quality, cause structural damage to buildings and homes, and attack people directly causing annoyance, injury, or even death.

## *PESTICIDES*

- History
  - 1800s
    - Copper arsenate compounds (Paris Green) and lead arsenate (Bordeaux mixture) were introduced as fungicides and pesticides.
  - WWII
    - DDT

## *PESTICIDES*

- History
  - 1970s
    - Realization of detrimental effects on ecology and human health.

## *PESTICIDES*

- Present Day Problems
  - (1) the resistance of vectors to pesticides;
  - (2) the adverse health and ecological effects of pesticides; and
  - (3) the proliferation of pesticides globally.

## *Insect Resistance*

- From 1970 to 1980, the number of arthropods resistant to insecticides nearly doubled from 224 to 428 while the numbers of resistant species of rodents, bacteria, fungi, and weeds are increasing as well.

## *Insect Resistance*

- Physiological Resistance
  - (1) enzymatic detoxification of pesticides into a less harmful form;
  - (2) reduced permeability of exoskeleton to pesticides; and
  - (3) storage or excretion of pesticides without harm.

## *Insect Resistance*

- Behavioral Resistance
  - (1) landing less frequently or changing landing areas: or
  - (2) avoidance of baits such as fly-paper.

## *The Health and Ecological Effect of Pesticides*

- Humans are exposed to pesticides through:
  - (1) contaminated drinking water;
  - (2) eating foods contaminated with pesticides;
  - (3) pesticide use in the home, garden or lawn;
  - (4) exposure on transcontinental flights;

## *The Health and Ecological Effect of Pesticides*

- Humans are exposed to pesticides through:
  - (5) use in agriculture;
  - (6) in the production of pesticides; and
  - (7) in other occupations.

## *Effects of Pesticide Poisonings*

- Most Acute or one-time exposures
  - Headaches, dizziness, muscular weakness, and fatigue
- Chronic or low-level pesticide exposure
  - Uncertain, but cancer and/or reproductive are possible problems associated with organochlorine pesticides.

## *Children at Risk*

- Children are exposed to pesticides through:
  - (1) prenatal maternal exposure;
  - (2) food and water sources;
  - (3) presence in agricultural, fields with parents, or working the fields themselves;

## *Children at Risk*

- Children are exposed to pesticides through:
  - (4) contact with residues on parents' clothing; or
  - (5) exposure to common household pesticides while in the home (Table 6-1).

Adapted from USEPA.<sup>24</sup>

*Table 6-1*

**PREVENTING ACCIDENTAL POISONINGS IN CHILDREN**

1. Store out of reach in a locked cabinet or shed. Use child-proof safety latches.
2. Read label and follow instructions for use including precautions and restrictions.
3. Before applying pesticides, remove children, toys, and pets until pesticide dries, or according to recommendations on label.
4. If use is interrupted (as by phone call), reclose the package and place out of reach of children.
5. Never transfer pesticides to other containers.
6. Teach children that pesticides are poisonous - something not to touch.
7. Keep the number of the Poison Control Center nearby telephone.
8. Alert caregivers of children to potential hazards of pesticides.

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## *Exposures in LDCs*

- Reasons for higher incidence of pesticide poisonings in LDCs
  - (1) failure to use protective clothing when applying pesticides;
  - (2) workers may be in the field during pesticide spraying;
  - (3) pesticides are being used in LDCs that are banned or severely restricted in the developed countries;

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## *Exposures in LDCs*

- Reasons for higher incidence of pesticide poisonings in LDCs
  - (4) pesticide containers are often recycled to store food, milk, or cooking oil; and
  - (5) pesticide products are labeled in languages not readable to the native populations

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## *Ecological Concerns*

- Much more than 1.1 billion pounds of pesticides are used in the United States each year with more than five times that amount used globally.

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## *Ecological Concerns*

- Pesticide residues, especially of the persistent organochlorines, are now detected in the tissues of animals in virtually every location on earth from the Antarctic to the everglades, small new England streams, to the deepest ocean trenches.

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## *Ecological Effects*

- Disrupted the endocrine system of bird, fish, mammals
- Decreased fertility
- Increased abnormal behaviors
- Feminization and Masculinization

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## Types of Pesticides

- Insecticides
  - (1) act as contact poisons by penetrating the foot pads or body wall;
  - (2) enter the insect breathing pores as a fumigant;
  - (3) act as a stomach poison after ingestion; or
  - (4) desiccate (dryout) the body wall causing it to crack or break.

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## Insecticides

- Organochlorines
- Organophosphates
- Carbamates

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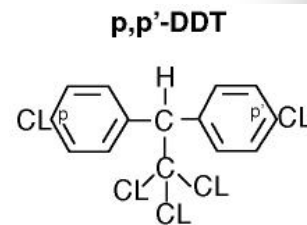
## Organochlorines

- Dichlorophenylethanes
  - DDT (Fig. 6-19)
  - Bioaccumulation
  - Caused thinning egg shells in fish eating birds

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Fig. 6-19



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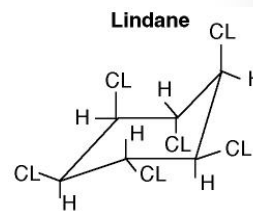
## Organochlorines

- Hexachlorocyclohexanes
  - Lindane (Fig. 6-20)
  - Treatment for ectoparasites.

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Fig. 6-20



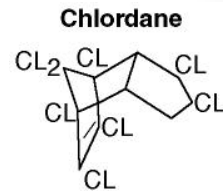
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## Organochlorines

- Chlorinated Cyclodienes
  - Chlordane (Fig. 6-21)
  - Stomach poisons, fumigants, contact poisons
  - Used against roaches, silverfish ants, and termites.
  - Most were suspended by the EPA in the 1970s

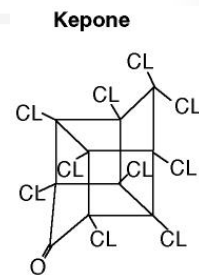
Fig. 6-21



## Organochlorines

- Chlorinated Cyclodiene
  - Kepone (Fig. 6-22)
    - Neurological damage among workers in Virginia
    - Chesapeake Bay

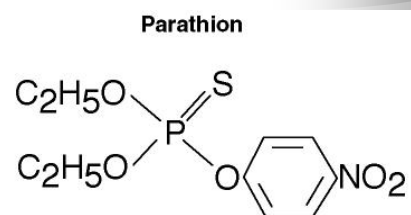
Fig. 6-22

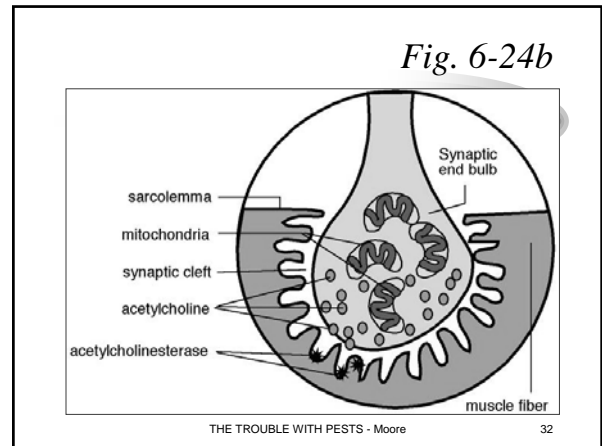
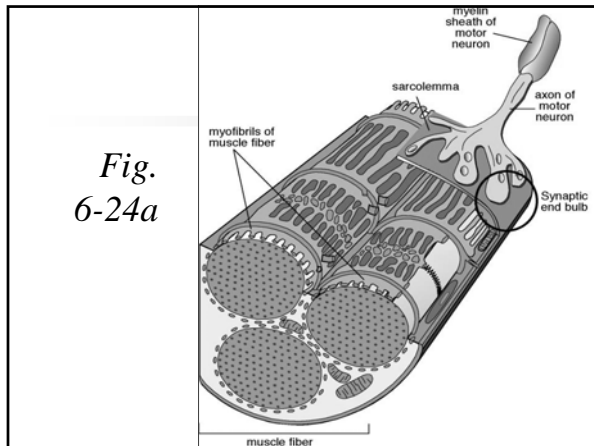


## Organophosphates

- Parathion (Fig. 6-23)
  - Most likely to be involved with human fatalities.
- Cholinesterase inhibitors (Fig. 6-24)

Fig. 6-23





### *Carbamates*

- Derivatives of carbonic acid are contact poisons that inhibit cholinesterase in a manner similar to organophosphates.

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### *Botanical and Biological Insecticides and other Alternatives*

- Naturally derived alkaloids
- Bacteria
- Fungal Spores
- Integrated Pest Management (IPM)

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### *Herbicides*

- Atrazine, alachlor (Fig. 6-25)
  - Destroy the plants by stimulating abnormal growth and interfering with the transport of nutrients.

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*Fig. 6-25*

2,4,5-T herbicide

O=C(O)COc1cc(Cl)c(Cl)c(Cl)c1

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## Rodenticides

- Warfarin (Fig. 6-26)
  - Inhibits prothrombin synthesis.
  - Animal bleeds to death

## Fig. 6-26

