

Health Effects of Pesticides?



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THINK

Thought-pro·vok·ing

adjective

stimulating careful consideration or
attention

Chemicals play an important role in everyday life, but some come with inherent risks to human health and the environment

Groups of chemicals are regulated by a number of different agencies

Hazards are assessed and indicated on packaging



E.g. drugs

- Food and Drug Administration – safe and effective
- Intended to improve the human condition
- Known side effects when used correctly
- Are misused...intentionally and unintentionally
- Knowledge develops over time
- Big business \$289 bill annually US
- Many need them to live!



E.g. pesticides

- Environmental Protection Agency - safe
- Intended to improve the human condition
- Known side effects when used correctly
- Are misused...intentionally and unintentionally
- Knowledge of effects develops over time
- Big business \$10 billion annually
US
- I use them, many need them to live!



Pesticides

- Insecticides

- Miticides

- Fungicides

- Rodenticides

- Nematicides

- Herbicides

- Fumigants

- Wood Preservatives

- Growth Disrupters

- Endocrine Disrupters

- Some disinfectants, sanitizers, and sterilizers

Pesticides

- Natural chemicals
- Biological
- Desiccants
- Synthetic chemicals
- Baits
- Sprays
- Foggers
- Granules
- Powders
- Space treatments
- Fumigants

Pesticides play a role in:
Managing crop pests



Crop protection products increase crop productivity by 20 – 50%

Make it possible for consumers to consume fresh, high-quality foods that are affordable and accessible year-round

Agricultural output has to double in the next 20-30 years in order to feed the world population. By 2030, the United Nations predicts there will be 1.7 billion more people to feed worldwide

Crop Life America

Pesticides play a role in:

Managing human and livestock disease vectors

Vector-Borne Diseases – West Nile virus, Lyme disease, and rabies can be carried and vectored

Asthma and Allergies – Cockroaches can contribute to asthma and allergies

Microbial Contamination – Microorganisms

Avian Flu - sanitizers or disinfectants

Prions – are considered to be a pest under FIFRA

Anthrax – *Bacillus anthracis* spores



The most compelling reason for establishing a rigorous pest management process – **is the control of disease causing organisms**



Pesticides play a role in:
Managing critters that impact human
“stuff” - Termites, bed bugs, etc.



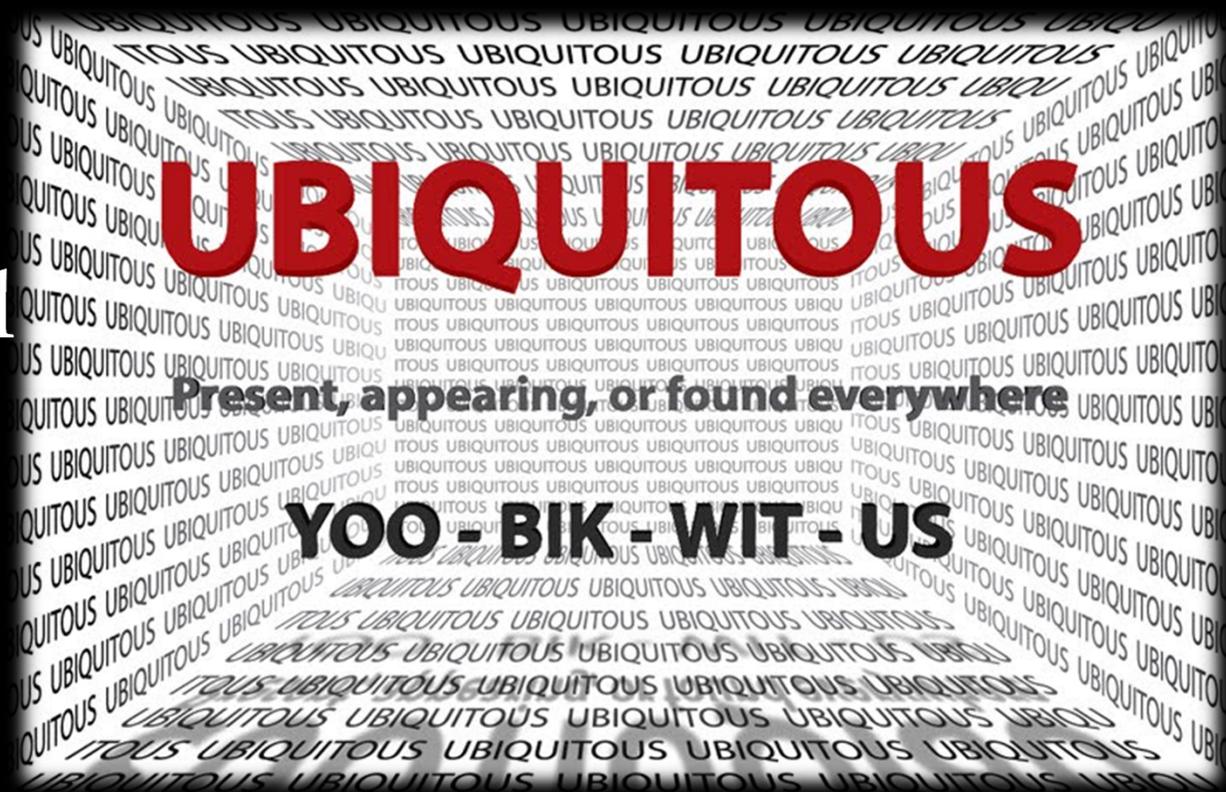
Problems with Pesticides – #1 Risk

- Inherent risk
- Toxic to ecosystems – biomagnification, etc.
- Toxic to living organisms (humans, other animals and plants)
- **Used in accordance with Western cultural demand – some people are nuts!**



Toxic to ecosystems –biomagnification

- Pesticides are ubiquitous - Simonich & Hites, Science, 1995
- 97% of US surface waters are contaminated with pesticides (100% of drinking water)



Problems with Pesticides – #2 Advancing Research Reveals New Findings

- Knowledge of health effects develops over time



U.S. Product Registration History for Dursban pro

U.S. EPA Product Reg No: 62719-166

Product Registration Status: Cancelled

Approval Date: Jun 12, 1991

Cancellation Date: Sep 15, 2009

Cancel/Transfer Reason: Company request

? Dose makes the poison ?

Essential vitamins can be toxic in high quantities e.g. Vitamin A

Pesticides can be present in ppm or ppb in our bodies

Hormones are active in our bodies in the parts-per-trillion (ppt) range

We live in a complex environment

Our living environments include:

- Industrial chemicals
- Agricultural chemicals
- Physical agents (heat, radiation, etc.)
- By-products of combustion and industrial processes (dioxin)
- Foods
- Drugs
- Lifestyle choices (sunbathing, substance abuse, too much fast food, stress, etc.)
- Social and economic factors

Adapted from National Institute of Environmental Health Sciences Education Materials

Genes, environment, and disease:

- Certain diseases have increased in incidence over the past 40 years, e.g. diabetes, asthma, ADHA, obesity, etc.
- Genes do not change that fast
- We may never understand the entire etiology of diseases without a clear understanding of environmental influences



Adapted from National Institute of Environmental Health Sciences Education Materials

Diseases with a known or suspected environmental component include:

- Cancer
- Birth defects (cleft palate, cardiac malformations)
- Reproductive dysfunction (infertility)
- Lung dysfunction (asthma)
- Neurodegenerative diseases (Parkinson's)
- Neurodevelopment disorders (autism)

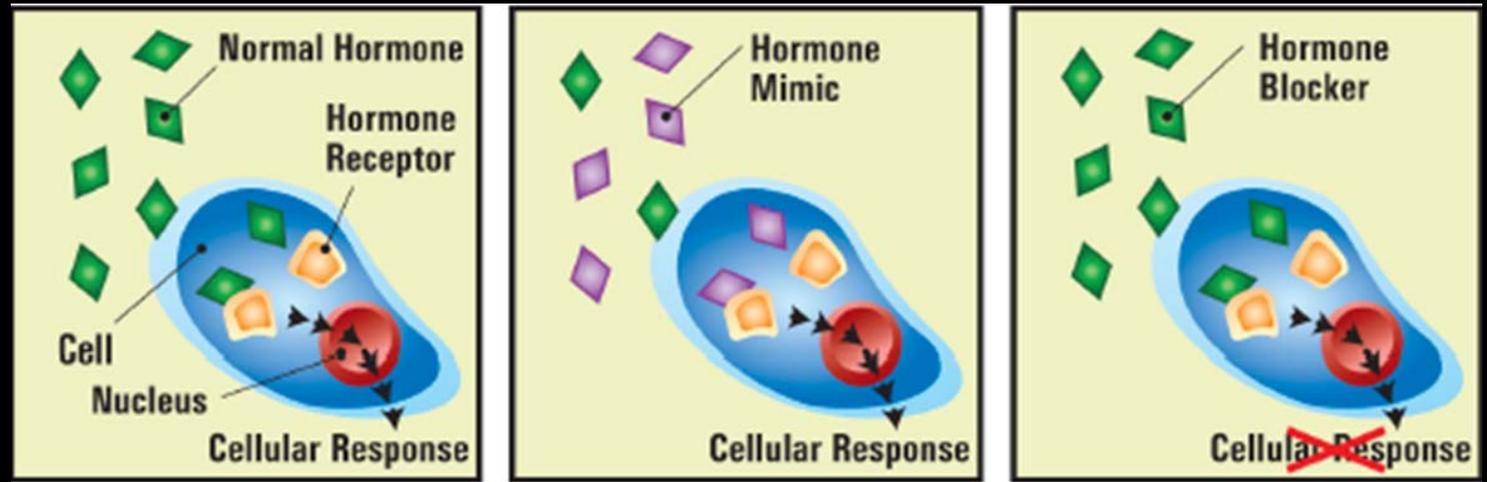
Adapted from National Institute of Environmental Health Sciences Education Materials

Endocrine disrupting chemicals - EDCs:

- Agents that interfere with the production, release, transport, metabolism, binding, action, or elimination of natural hormones
- >150 pesticide EDCs, 3 common examples below:
 - Permethrin (I) inhibition of estrogen
 - Glyphosphate (H) prevent the production of estrogens
 - Fipronil (I) thyroid hormone inhibition

Why endocrine disruptors are a “very big deal”

- Low doses can have BIG effects
- Wide range of effects
- Early life exposures can have persistent effects
- Endocrine disrupting chemicals are ubiquitous



Adapted from National Institute of Environmental Health Sciences Education Materials

Low dose

- For some endocrine disruptors, biological changes can be seen at low doses, but not at higher doses (some nonmonotonic dose response)
 - E.g. Glyphosate (H) cytotox

Wide range of effects

- Endocrine signals govern every organ and process in the body

Persistent effects

- Health effects may occur long after exposure and may have epigenetic effects (heritable changes in gene expression)

Windows of susceptibility

Altshuler et al. 2003



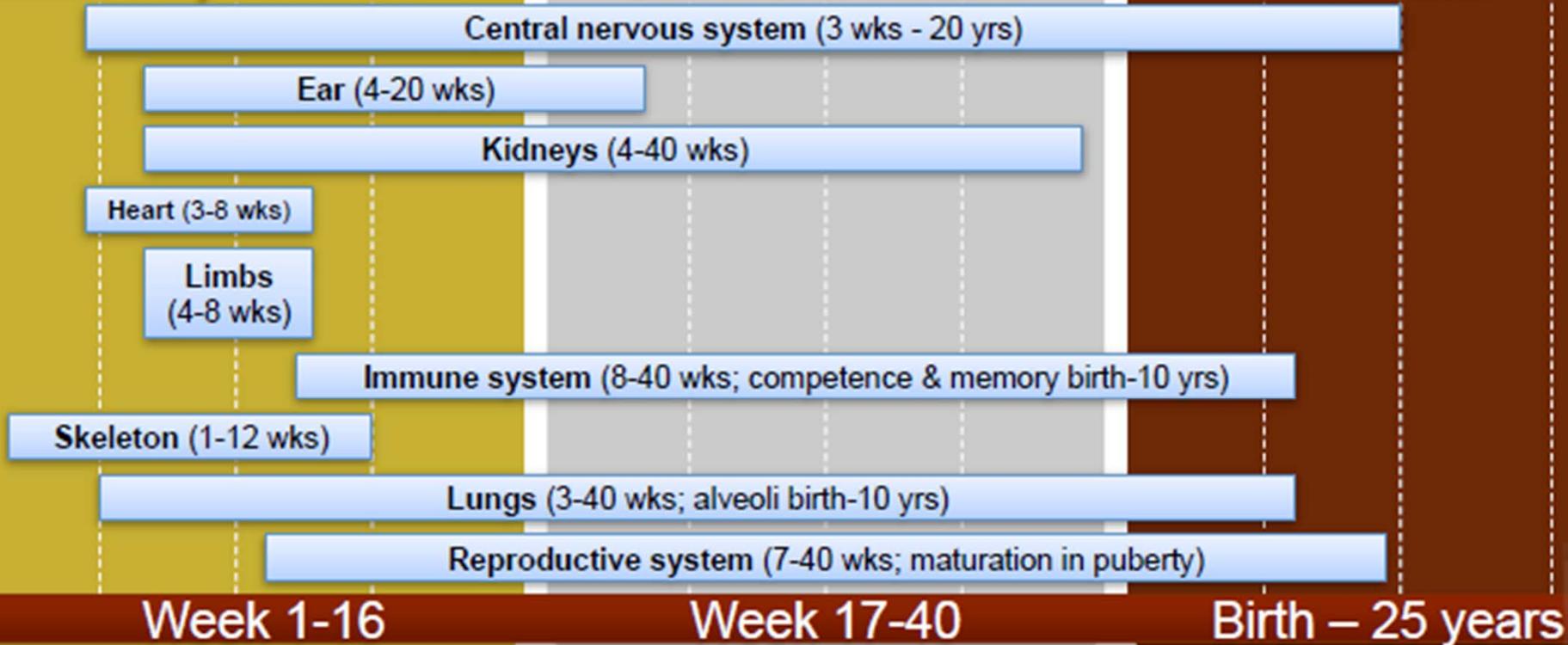
Early Prenatal



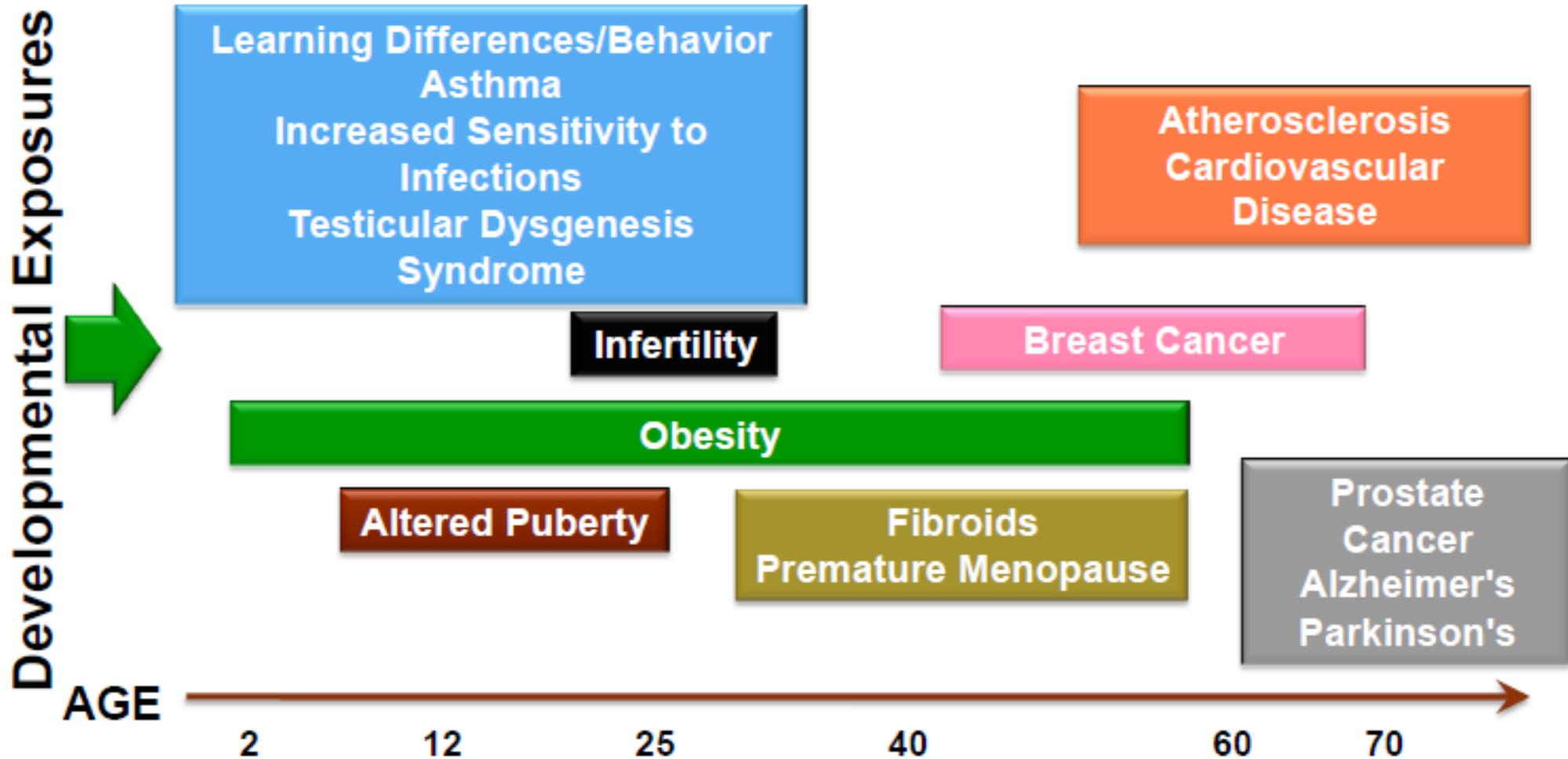
Mid-Late Prenatal



Postnatal



Developmental origins of disease



Exposure

- Endocrine disruptors are widely dispersed in the environment
- Present at biologically effective levels
- Human exposure is common



Mixtures

- Multiple exposures occur simultaneously
- Exposure can alter the body's response to later exposures
- Your "exposome" is your total exposure (usually unknown)
- Synergistic effects may occur



Adapted from National Institute of Environmental Health Sciences Education Materials

Outcomes

- Cancer and birth defects are not the only endpoints
- Complex diseases have complex causes
- Environment is a contributor to: obesity, diabetes, cardiopulmonary disease, cancer, birth defects, autoimmune disease, reproductive dysfunction, neurodevelopmental disorders, schizophrenia, addiction, Alzheimer's disease, and depression

Science changes



Problems with Pesticides – #3 Limited Disclosure

CAUTION, WARNING, DANGER - Signal words found on pesticide product labels, and describe the acute (short-term) toxicity of the formulated pesticide product

They do not indicate long-term exposure risks



Strychnine
Alkaloid



Pyrethrins



Abamectin

Problems with Pesticides – #4 Illegal



Miraculous or
Chinese Chalk
and safe to use.
Deltamethrin

Tres Pasitos
Aldicarb



Malathion

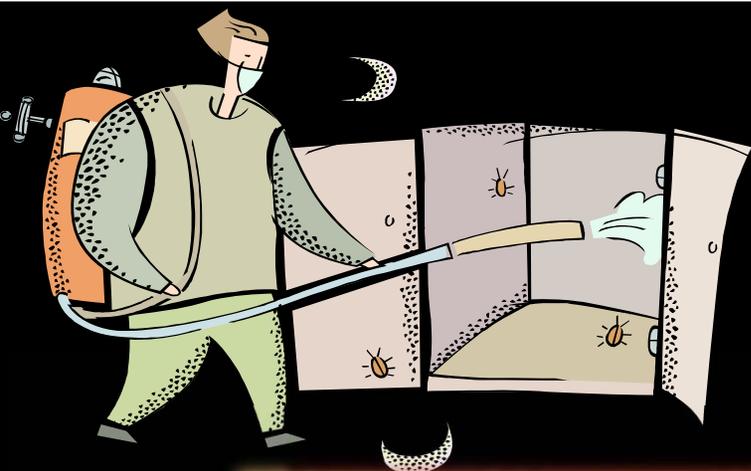
Naphthalene



Problems with Pesticides – #5 *Homo sapiens!*



Pesticide spraying around US model Kay Heffernon to show that it won't contaminate her food, Jones Beach, NY, 1948



**For Use Around Foundations, Outside Buildings,
Lawns, Woodpiles, Stored Lumber
and Fence Posts**





The Goals of the Teen Parent Program

1. To provide information about child care options.

2. To provide information about the state child support system and how to apply for it.

3. To provide information about the state's child care subsidy program and how to apply for it.

4. To provide information about the state's child care licensing program and how to apply for it.

5. To provide information about the state's child care assistance program and how to apply for it.

6. To provide information about the state's child care voucher program and how to apply for it.

7. To provide information about the state's child care tax credit and how to apply for it.

8. To provide information about the state's child care expense deduction and how to apply for it.

9. To provide information about the state's child care credit and how to apply for it.

10. To provide information about the state's child care deduction and how to apply for it.

SHOPPING IS FUN AGAIN

BUG STOP Home Insect Killer

Problems with Pesticides – #6 Children



BodyBurden

The Pollution in People



BodyBurden

The Pollution in Newborns

A benchmark investigation of industrial chemicals, pollutants, and pesticides in human umbilical cord blood



10 new babies



Born in US hospitals

Analysis of cord blood samples for 413 chemicals: pesticides, heavy metals, plastics, flame retardants, stain- and grease-proof coatings

**Found
287**

Average number/baby = **200** chemicals

Lowest = **154**

Highest = **231**

Pesticides

Tetra-pcb
Perfluorochemicals
Perfluorochemicals (Pfc)
Tri-pcb
Pentachlorinated Furan
Chlorinated Dioxins & Furans
Nona-pcb
Heptachlorinated Naphthalene
Mono-pcb
Polychlorinated Biphenyls
Polyaromatic Hydrocarbon
Trichlorinated Naphthalene
Hexachlorinated Naphthalene
Pentachlorinated Dioxin
Tribrominated Diphenyl Ether
Perfluorinated Carboxylic Acid
Heptachlorinated Dioxin
Nonabrominated Diphenyl Ether
Polyaromatic Hydrocarbons
Dichlorinated Naphthalene
Tetrabrominated Furan
Perfluorinated Sulfonate
Tetrachlorinated Naphthalene
Heptabrominated Furan
Polybrominated Diphenyl Ethers
Octachlorinated Naphthalene
Deca-pcb
Tetrabrominated Diphenyl Ether
Pentachlorinated Naphthalene
Hexachlorinated Furan
Hexachlorinated Dioxin
Hexachlorinated Dioxin
Brominated Dioxins & Furans
Polybrominated Diphenyl Ether
Di-pcb
Brominated Furans
Hexabrominated Dioxin
Dibrominated Diphenyl Ether
Pentabrominated Furan
Hexa-pcb
Chlorinated Dioxins
Octachlorinated Dioxin
Hexabrominated Furan
Metals (Lead, Mercury, Arsenic, Etc.)
Decabrominated Diphenyl Ether
Pentabrominated Diphenyl Ether
Chlorinated Furans
Penta-pcb
Octachlorinated Naphthalene
Monochlorinated Naphthalene
Brominated Dioxins
Octabrominated Diphenyl Ether
Octa-pcb
Polychlorinated Naphthalenes
Pentabrominated Diphenyl Ether
Heptachlorinated Furan
Heptabrominated Diphenyl Ether
Hexabrominated Diphenyl Ether
Hepta-pcb



Effects of **multiple and/or**
cumulative exposures to
toxicants and their potential
synergistic effects are

UNKNOWN

Problems with Pesticides – #7 Intentional or Accidental Misuse

- Agricultural pesticides are the most common means of suicide worldwide, resulting in **more than 250,000 deaths each year**. – Dawson²⁰¹⁰ *PLoS Medicine*
- 2010, the US EPA announced expanded use restrictions for rodenticide uses of aluminum and magnesium phosphide products in response to two deaths in Utah

December 19, 2012

American Academy of Pediatrics issues policy statement on pesticide exposure in children

By Elizabeth Sharpe

Posted under: Education, News Releases, Politics and Government, Research, Science, UW and the Community

Increasing evidence shows urban and rural children are regularly exposed to low levels of pesticides that can have serious long-term health effects, according to a report issued by the American Academy of Pediatrics.

The technical report and an accompanying policy statement on pesticide exposure in children appear in the December 2012 issue of *Pediatrics*.



Pesticide Exposure in Children PEDIATRICS

Volume 130, No. 6, December 2012 (33 papers)

Findings:

- 1) Children encounter pesticides daily and have unique susceptibilities...
- 2) Acute poisoning risks are clear, and understanding of chronic health implications from both acute and chronic exposure are emerging



Findings:

- 3) Epidemiological evidence that demonstrates associations between early life exposure to pesticides and
- pediatric cancers
 - decreased cognitive function
 - behavioral problems



Findings:

- 4) Chronic toxicity end points identified in epidemiologic studies include:
- adverse birth outcomes including preterm birth
 - low birth weight
 - congenital anomalies
 - pediatric cancers
 - neurobehavioral and cognitive deficits
 - asthma



Findings:

5) Multiple case-control studies and evidence reviews support a role for insecticides in:

- risk of brain tumors
- acute lymphocytic leukemia



Findings:

- 6) Prospective contemporary birth cohort studies in the US link early-life exposure to organophosphate insecticides with:
- reductions in IQ
 - abnormal behaviors associated with attention-deficit/hyperactivity disorder
 - autism



POLICY STATEMENT – Recommendations based on the following three principles:

- 1) Pesticide exposures are common and cause both acute and chronic effects



2) Pediatricians need to be knowledgeable in pesticide identification, counseling, and management

Pediatric care providers have a (self reported) poor track record for recognition of **acute pesticide poisoning**



3) Governmental actions to improve pesticide safety are needed



Recommendations for Pediatricians:

Acute exposures: become familiar with the clinical signs and symptoms for the major types of pesticides

Chronic exposures: become familiar with the subclinical effects of chronic exposures and routes of exposures for the major types of pesticides

Counseling: Ask parents about pesticide use in or around the home

Recommend use of minimal-risk products, safe storage practices, and application of IPM



Advocacy: work with schools and governmental agencies to advocate for application of **least hazardous** pesticides and using **IPM** principles

Promote community right-to-know procedures when pesticide spraying occurs in public areas



Marketing: ensure that pesticide products as marketed are not attractive to children

- I. Kids eat pesticides
- II. Kids play with pesticides
- III. Kids wear pesticides

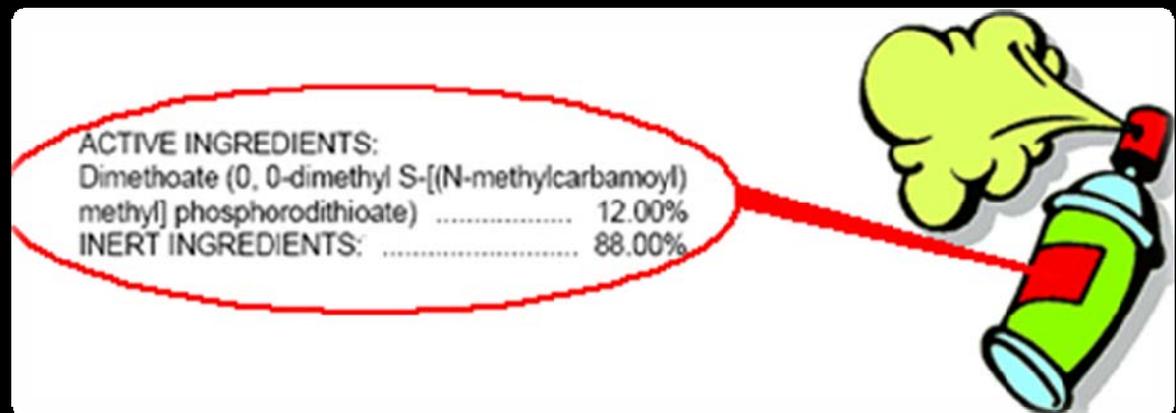


31.2% Metfluthrin



Labeling:

- Include chemical ingredient identity on label
- Include a label section specific to “Risks to children”
- Enforce labeling practices that have adequate information on product contents acute and chronic toxicity potential
- Consider labels in Spanish, Korean, etc.



Exposure reduction:

- Set goals to reduce exposure overall
- Promote application methods that minimize children's exposure (bait stations and gels, and advising against overuse of pediculicides)
- Promote education regarding proper storage of products



Reporting: Make pesticide-related suspected poisonings **universally reportable** and support a systematic central repository of such incidents to optimize national surveillance



Export: Ban the export of products restricted or banned in the US due to toxicity problems



Advance less toxic/least hazardous pesticide alternatives:

- Increase economic incentives for growers who adopt IPM, including less toxic pesticides
- Support research to expand and improve IPM in agriculture and nonagricultural pest control



Research:

- Support toxicological and epidemiologic research to better understand health risks



Health provider education and support:
Support educational efforts to increase the capacity of pediatric health care providers to diagnose and manage acute pesticide exposures



- Pediatricians can play a role in promotion and development of model programs and practices in the communities and schools of their patients



The Best Way to Protect our Community
from Pesticide Risks is by Implementing
IPM

Integrated
Pest
Management



Implementing Integrated Pest Management

“Pest Management is People
Management”



Pesticides are important tools, many can be used effectively and safely

<http://npic.orst.edu/>



National Pesticide Information Center

1.800.858.7378 npic@ace.orst.edu

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POISON
Help

1-800-222-1222

Questions?

