Pesticides & Plastics

A Benefit or Detriment?

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Pesticides

According to the US Environmental Protection Agency (EPA):

"…a pesticide is any substance or mixture of substances intended for preventing, destroying, repelling, or mitigating any pest."

Common types:

- Herbicides – plants/moss
- Insecticides – insects
- Fungicides – molds/fungi

How do pesticides work?

Pesticides are *poisons*, so they work in a variety of ways to *interfere* with chemical processes in organisms.

Benefits of Pesticides

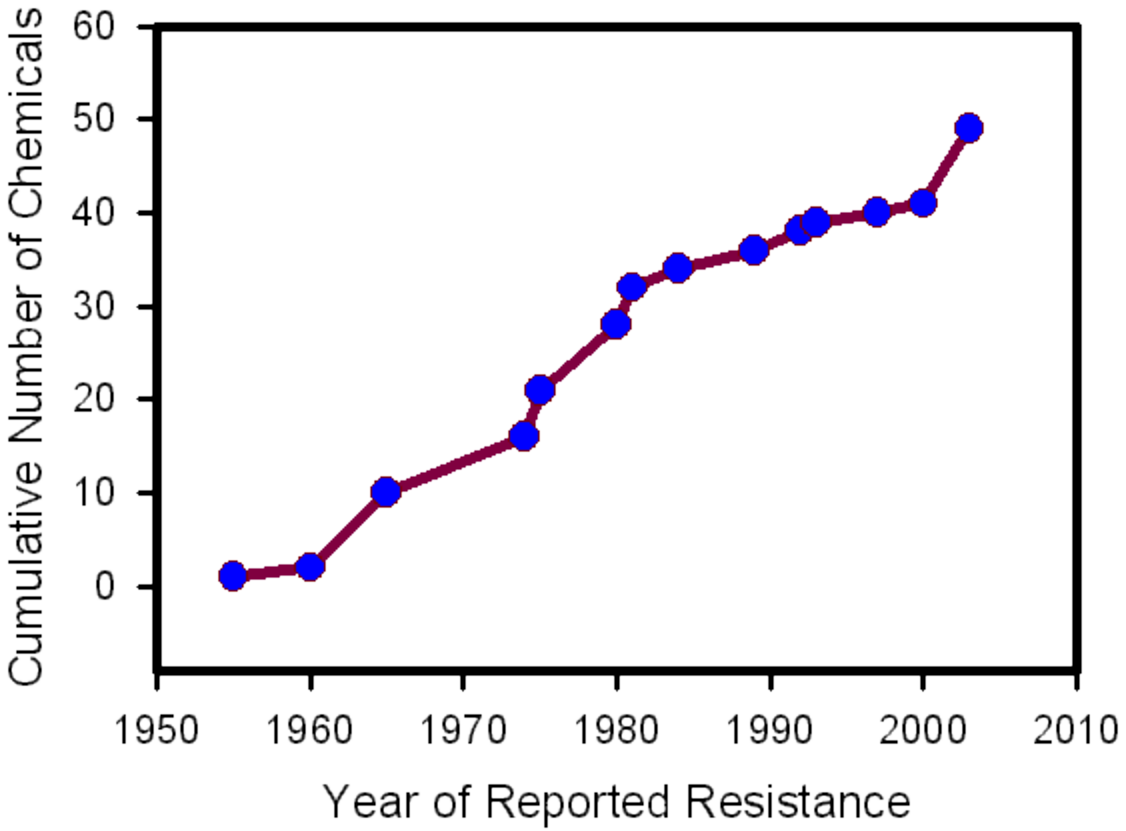
Used by plants for millions of years…

Used by humans for over 4500 years to:

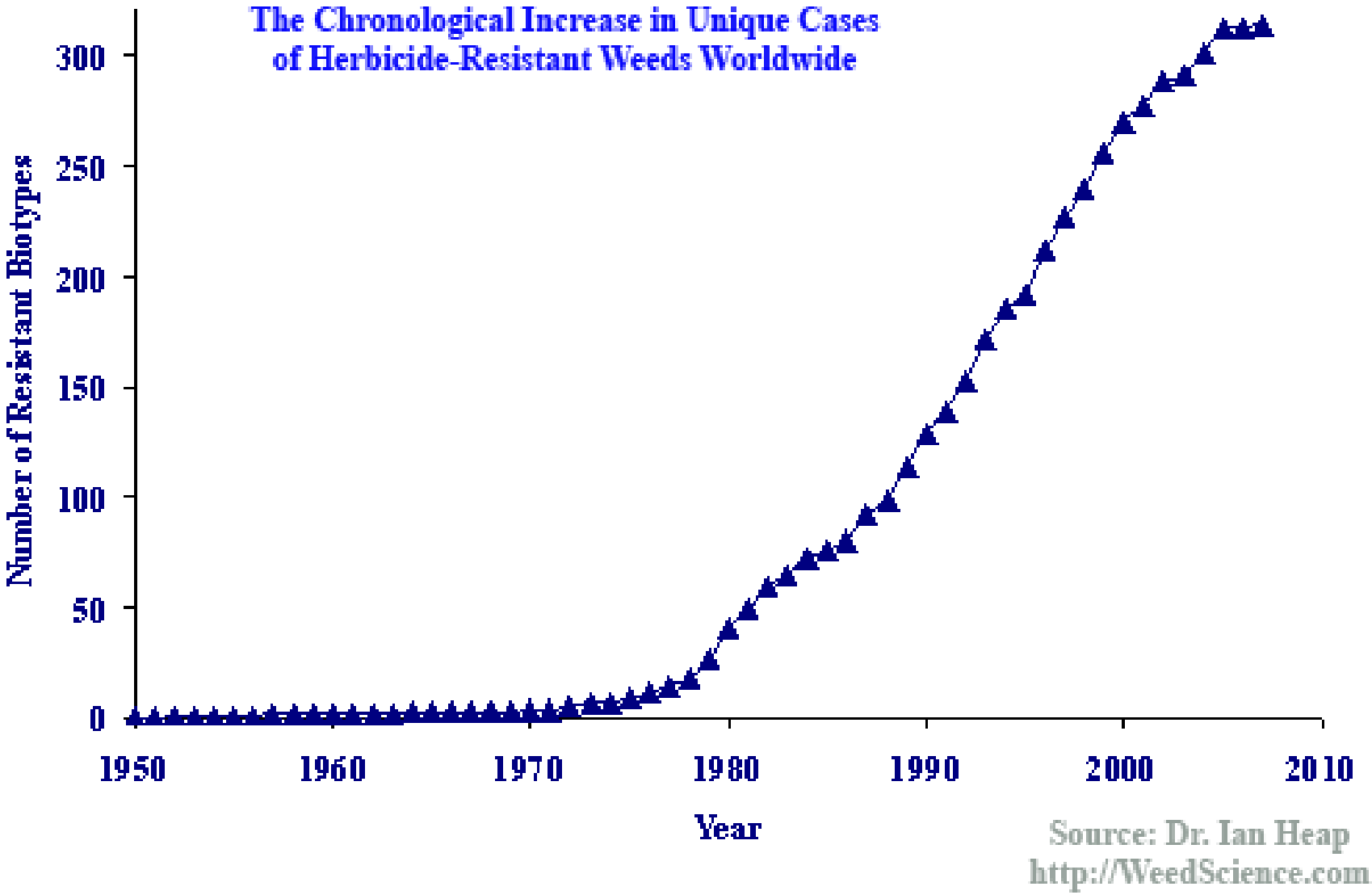
- Increase food production
- Control disease vectors (e.g., mosquitos, rats)
- Control other harmful animals (e.g., wasps, fleas)
- Control weedy, invasive plants and algae
- Protect food from contamination

Classic Raid commercial – “Kills bugs dead”

Limitations of pesticides:
Case study: Colorado potato beetle and evolution of insecticide resistance



- Many more examples for evolution of resistance among pests exposed to pesticides:
  - Aphids and neonicotinoids (e.g., imidacloprid)
  - Mosquitoes and DDT (an organochlorine)
  - Various insects against various insecticides
  - Various weeds against various herbicides


The Chronological Increase in Unique Cases of Herbicide-Resistant Weeds Worldwide
Number of Resistant Biotypes
300
250
200
150
100
50
0
1950
1960
1970
1980
1990
2000
2010
Year
Source: Dr. Ian Heap
http://WeedScience.com

Benefits of Plastics

Plastics are
- durable
- flexible or rigid
- corrosion-free
- light
- inexpensive

Plastics are used in
- toys
- packaging
- building and construction
- transportation
- electronics
- medical industry

(*plasticsindustry.com*)

What are the risks?

For humans and other non-target organisms, chemicals in many plastics and pesticides can act as:

Neurotoxins

Endocrine disruptors

(e.g., phthalates, bisphenol-A are found in a variety of plastic products)

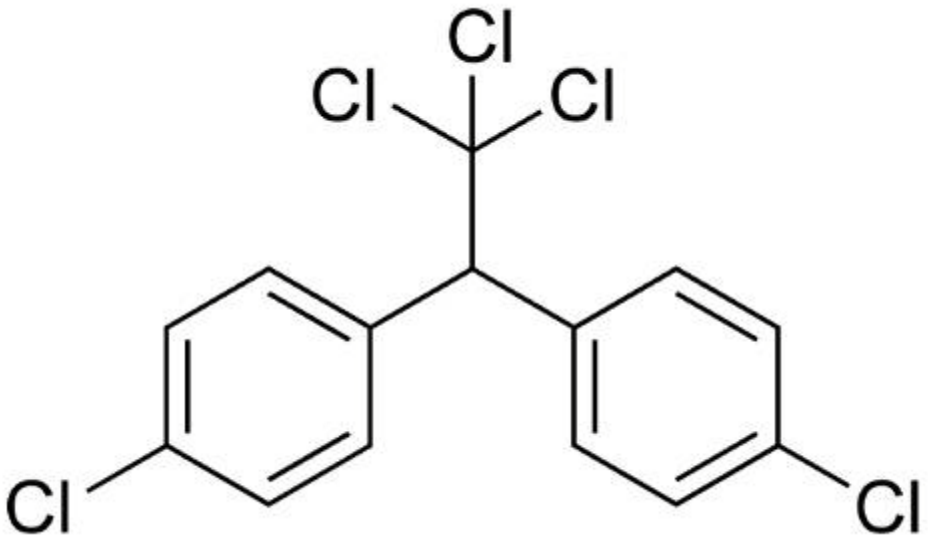
Non-target organisms

Colony Collapse Disorder?

30 day-old Human embryo

- **Environmental toxicologists** study the effects of chemical poisons released into the environment.

- One of the first of these poisons to be identified as having a wide-spread impact on non-target organisms was the insecticide DDT.



Posters from late 1940s

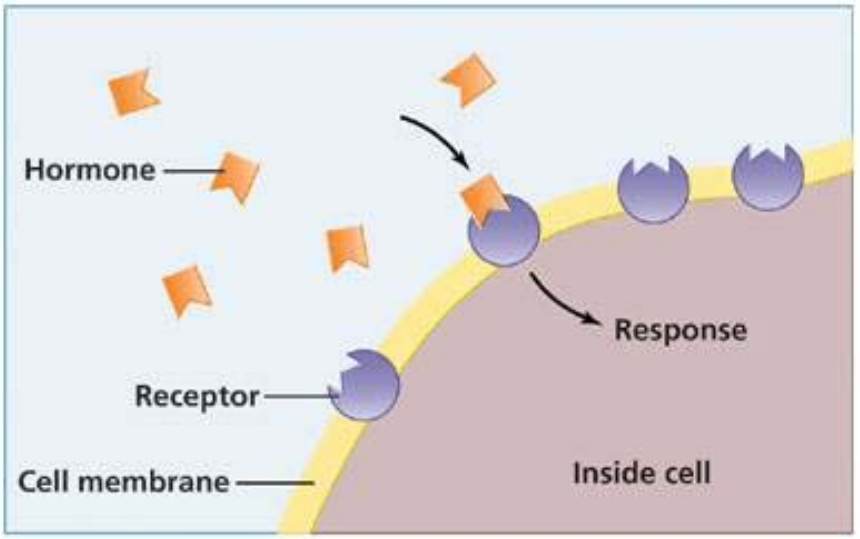
One of the many pieces of evidence in support of EVOLUTION is that we share many genes, and physiological and metabolic functions with other organisms – even bacteria!

What does this mean? (good -- bad -- ugly)

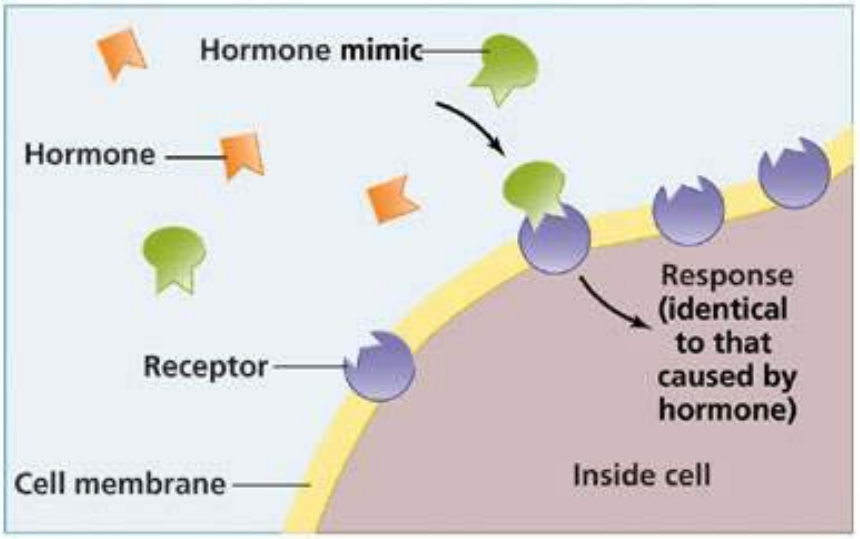
Many chemicals mimic hormones in our bodies (so what?)…

This is a good thing, right?

Endocrine disruptors



(a) Normal hormone binding



(b) Hormone mimicry

Endocrine disruptors have been linked to:

-Increased predisposition to cancer

-Reversal in normal sex differences in brain and behavior

-Decreased testosterone

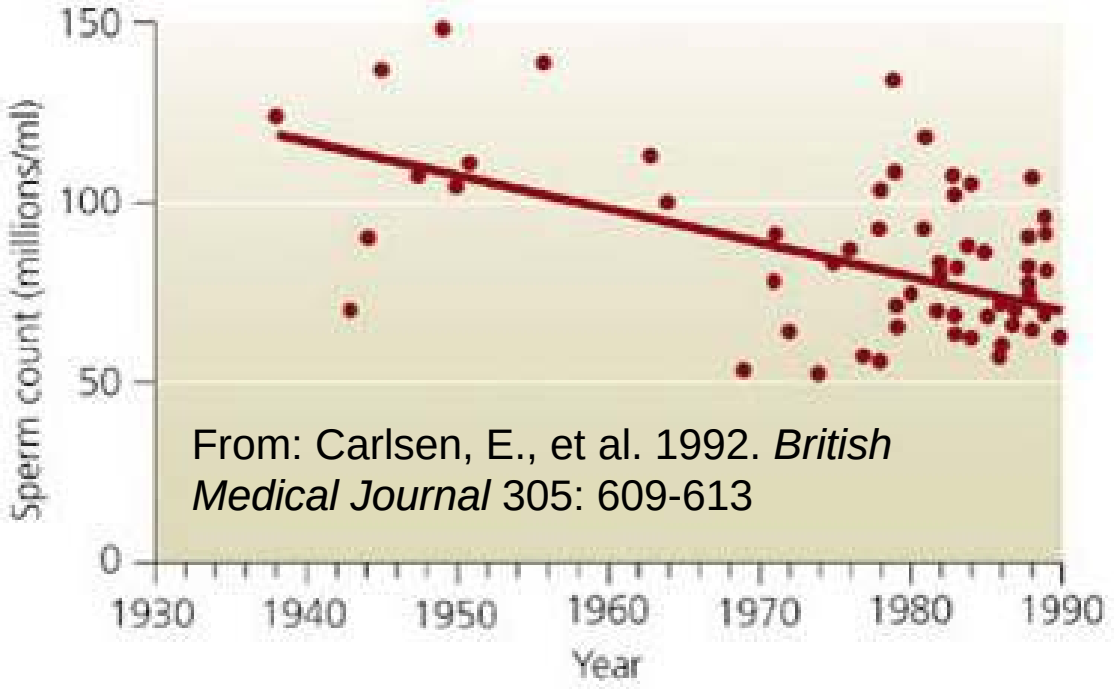
-Adverse impact on sperm development

-Developmental abnormalities

"Every man in this room is half the man his grandfather was."

- Reproductive biologist, Louis Guillette, at a 1995 congressional committee hearing on reduced sperm counts in men

Are reduced sperm counts in humans the result of exposure to chemicals in pesticides and plastics?



More recent evidence - 1

"Results: We observed… Several combinations of organophosphates were lethal at concentrations that were sublethal in single-chemical trials."

From:

Laetz, CA, et al. 2009. The Synergistic Toxicity of Pesticide Mixtures: Implications for Risk Assessment and the Conservation of Endangered Pacific Salmon. *Environmental Health Perspectives* 117:348–353.

- http://www.eenews.net/public/25/9960/features/documents/2009/03/03/document_gw_01.pdf

More recent evidence - 2

"The associations between male genital development and phthalate exposure seen here are consistent with the phthalate-related syndrome of incomplete virilization that has been reported in prenatally exposed rodents. The median concentrations of phthalate metabolites that are associated with short [anogenital distance] and incomplete testicular descent are below those found in one-quarter of the female population of the United States, based on a nationwide sample. These data support the hypothesis that prenatal phthalate exposure at environmental levels can adversely affect male reproductive development in humans."

Swan, HS, et al. 2005. Decrease in Anogenital Distance among Male Infants with Prenatal Phthalate Exposure. *Environmental Health Perspectives* 113:1056–1061.

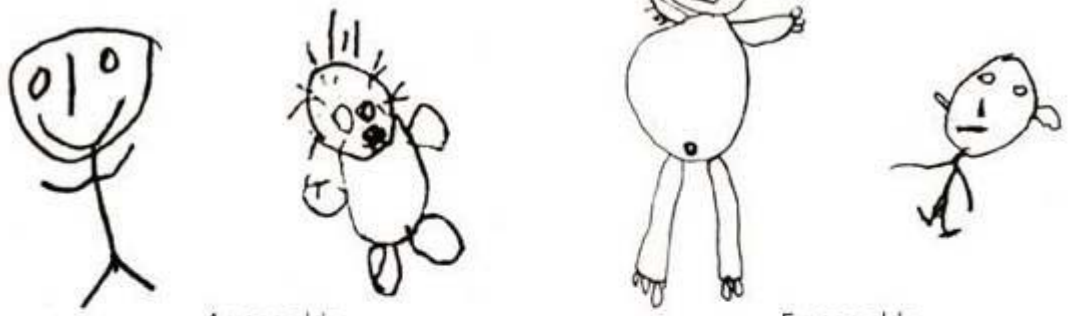
- http://www.ehponline.org/docs/2005/8100/abstract.html

More recent evidence - 3

Pesticide exposure and children

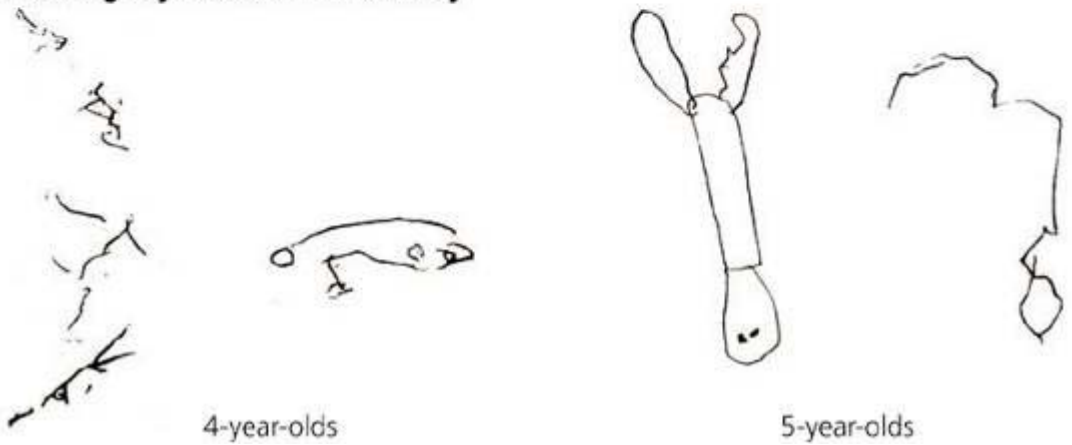
From: Guillette, EA, et al. 1998. *Environ. Health Perspect.* 106: 347-353

Drawings by children in the foothills



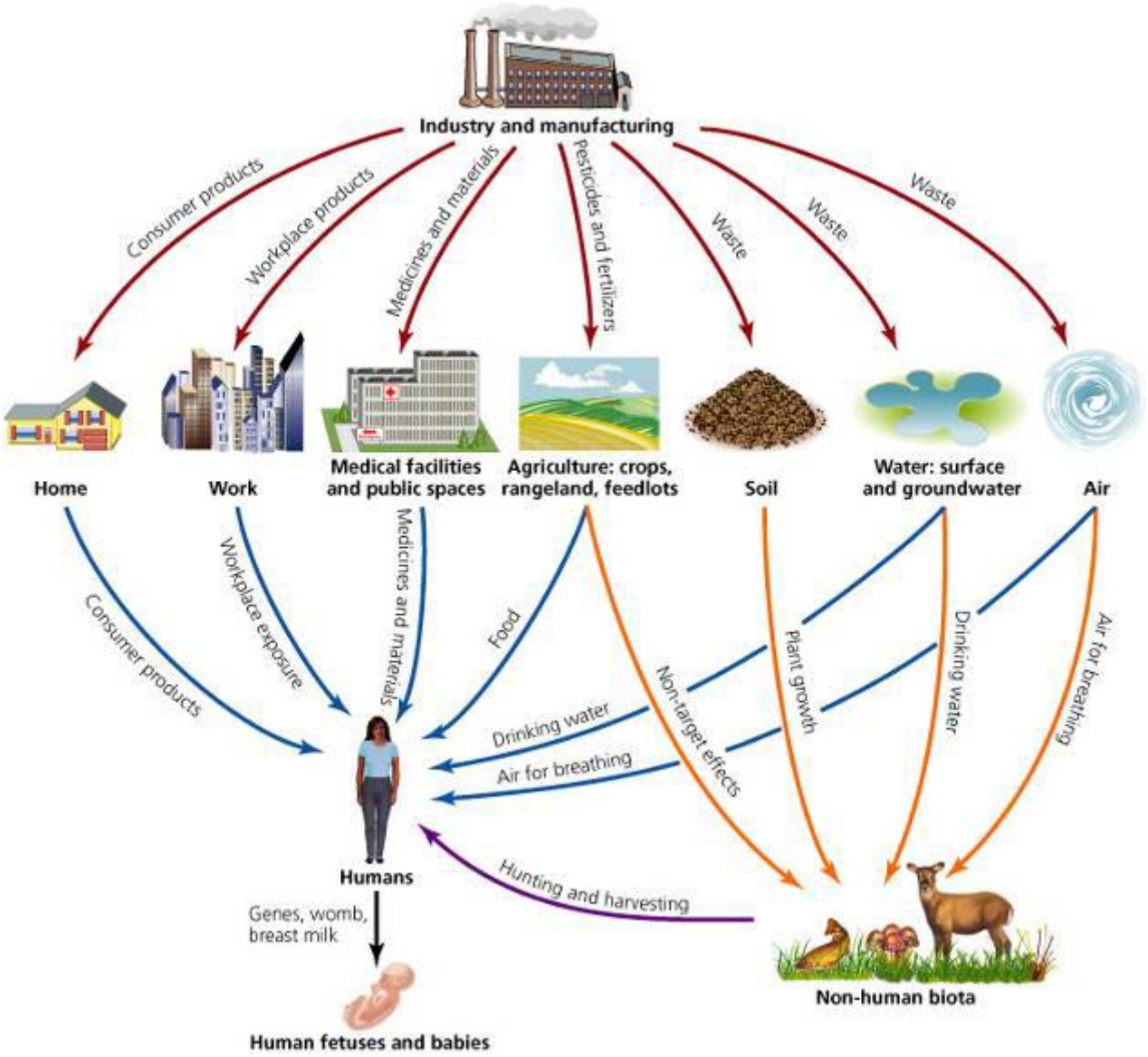
Drawings by nonexposed children

Drawings by children in the valley



Drawings by exposed children

How do they get into the environment and our bodies?



Chemicals our bodies

- Chemical Body Burden http://www.chemicalbodyburden.org/

- “Pollution In People: A Study of Toxic Chemicals in Washingtonians”

  http://www.pollutioninpeople.org/

Toxic Pollution Found In Washingtonians

Toxic Chemicals	Pam Tazioli	Bill Finkbeiner	Karen Bowman	Ann Holmes Redding	Lisa Brown	Laurie Valeriano	Patricia Dawson	Denis Hayes	Allyson Schrier	Deb Abrahamson
PFCs ("Teflon chemicals")	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
PBDEs (toxic flame retardants)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Phthalates (plasticizers and fragrance carriers)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Pesticides		✓		✓	✓		✓		✓	✓
DDT (banned pesticide)	✓		✓	✓	✓		✓	✓	✓	✓
PCBs (banned industrial coolant)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Mercury	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Lead			✓							
Arsenic	✓		✓		✓		✓	✓		

Source: http://www.pollutioninpeople.org/

In addition to developmental abnormalities, many of these chemicals can compromise immune system function.

This makes organisms more susceptible to other infections that might normally not be of concern.

Alternatives to Pesticides

Back to basics…

Keep your area clean to discourage ants and other pests and use vinegar and soap as a spray to kill them if that's the goal.

In the garden:

Promote beneficial insects and use "elbow grease."

Use safe alternatives: sulfur, insecticidal soaps, water.

Choose plants that are naturally resistant to pests.

Accept a few blemishes.

The bottom line:
The “good life” has risks

Use alternatives to pesticides and plastics whenever possible and use CAUTION and follow directions when applying pesticides. Do not heat foods in plastics.

You have more control over LIMITING your exposure to these chemicals than you might think:

educate yourself
support programs and legislation
vote with your pen and your penny!