



**Responding to the chemical part of
pesticide risks in modern agriculture**

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Commercial Chemicals

- *Natural products*

- *Synthetics*



Drugs

Ceremonial

Medicinal

Recreational

Pesticides

Storage

Crop protection

Residences

Food

Industrial

Process

Product

Pollutant

Pesticide Product

- Active Ingredient
- Inert or ***Other*** Ingredients
 - Water
 - Formulating agents
 - Surfactants
- Mixture

Perceptions

Origins of Concern

- Food Taboos and Medicines
- German Beer Purity Law of 1516
- England-food adulteration (1800s)
- USA-food purity (1900s)
 - Production conditions
 - Adulteration
 - Contamination
 - Pesticide residues
- Conventional and Organic Produce

Food Taboos

Food is often the subject of taboo or disgust because it is internalized. *Any revulsion we have for the food is magnified by the thought it will become part of us.*

Carole M. Counihan, 1999
Ethnographer
Millersville University, PA

Taboo Food and Drinks

- Religion
 - Forbidden consumption of meats
 - Observe vegetarianism
- Culture
 - Species standing (pets, “non-foods”)
- Health
 - Undercooked pork
 - Seafood (seasonal poisoning)
 - Scavengers and carnivores

Food Remains the First Concern

(today the Food Quality Protection
Act of 1996)

German Beer Purity Law, 1516

Specified ingredients

Water

Malt

Hops

Yeast



Pesticides are EU citizens' top food-related health concern

63%

September, 2005

Food Purity

A BASIC HUMAN CONCERN

Food as Food

Properties

Ingredients

Chemicals



1. Food

2. Properties

3. Ingredients

What makes strawberries *strawberries* and grapes *grapes*?

- Water
- Glucose, sucrose, pectin
- Hydrocarbons, esters, aldehydes, ketones, alcohols, acids (tartaric, malic, citric)
- Minerals
- Nutrients (vitamins, antioxidants)

key flavor chemicals

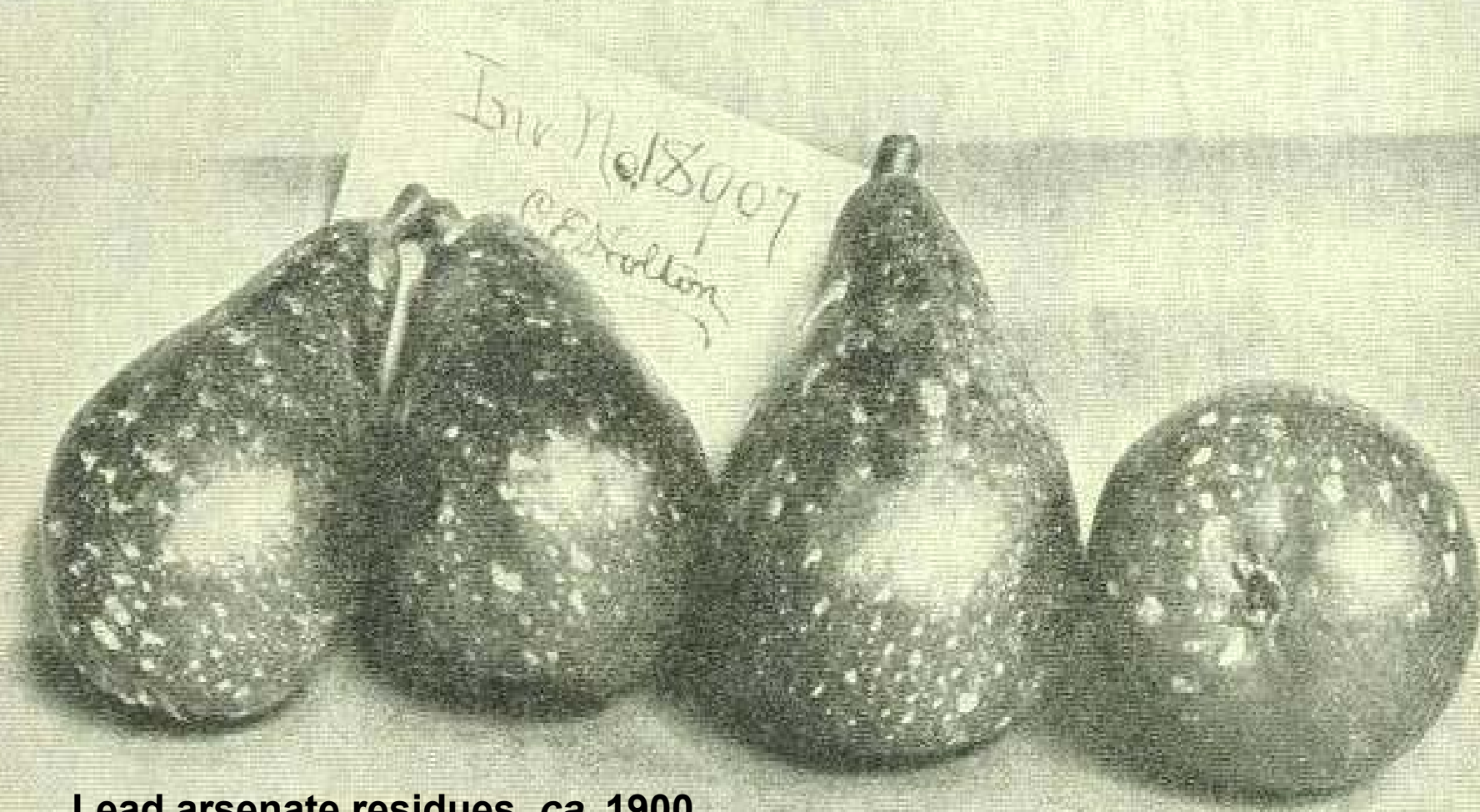
- (Z)-3-hexenal (green),
- 4-hydroxy-2,5-dimethyl-3(2H)-furanone (caramel-like, sweet),
- methyl butanoate (fruity),
- ethyl butanoate (fruity),
- methyl 2-methylpropanoate (fruity),
- 2,3-butanedione (buttery)

- Water
- Glucose, sucrose, pectin
- Hydrocarbons, esters, aldehydes, ketones, alcohols, acids (tartaric, malic, citric)
- Minerals
- Nutrients (vitamins, antioxidants)

other key chemicals

- Methyl anthranilate
- Anthocyanins (phenolics; both)

“Pesticide residues are a condition of production...



Lead arsenate residues, ca. 1900

A white mouse with red eyes is looking at a large red strawberry. The background is filled with many other strawberries.

***“...to be on the safe side,
she doesn’t buy.”***

1959

New perspective on food residues...

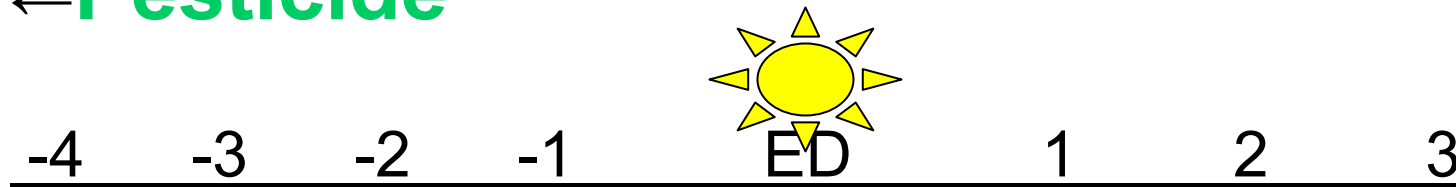
**The public revulsion for pesticides
is magnified by the thought they
will become part of us.**

B. Krieger, 2007

Testing for Safety: Scientific Studies

Pest Responses: Adverse Effects (ED50)

← **Pesticide**



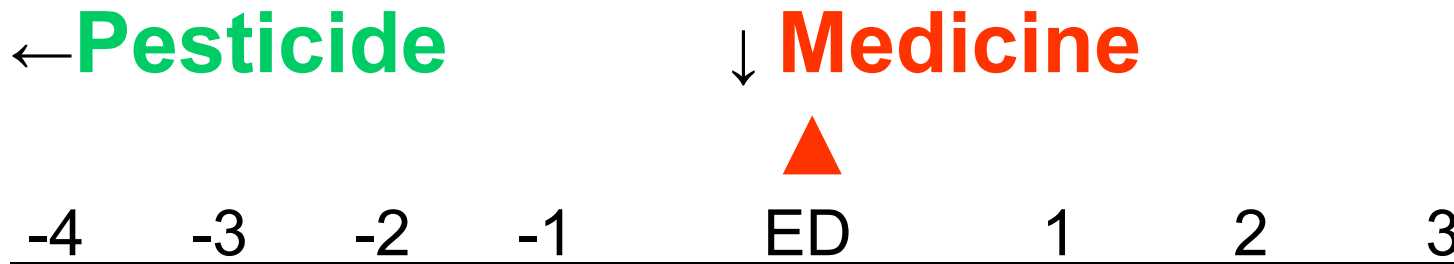
▲
a. Chemical Exposure Levels

b. Time

$$(ED = a \times b)$$

Testing for Safety: Scientific Studies

Responses: Adverse Effects (ED50)



- ◀
- a. Chemical Exposure Levels
 - b. Time
- (ED = a x b)

Prescription Drugs and Over-the-Counter Medicines

- allergic reaction
- chest pain or irregular heartbeat
- chest, jaw, or neck pain
- severe stomach pain
- weakness or numbness
- nausea



Signal Word: Acute Toxicities

	Highly toxic	Moderately toxic	Slightly toxic	Very low toxicity
Oral LD50 (mg/kg)	0-50	50-500	500-5000	>5000
Inhalation LC50 (mg/L)	<0.2	0.2-2	2-20	>20
Dermal LD50 (mg/kg)	<200	200-2000	2000-5000	>5000
Eye effects	corrosive	irritation persists 7d	irritation reversible 7d	no irritation
Skin effects	corrosive	severe irritation @72 h	moderate irritation @ 72 h	mild irritation @ 72 h

Product Signal Words

Signal word	Acute Oral LD50 (mg/kg bw)
CAUTION <i>slightly toxic</i>	500-5000
WARNING <i>moderately toxic</i>	50-500
DANGER <i>highly toxic</i>	0-50

Environmental Chemicals- Contact, Then What

- Absorption
- Distribution
- Metabolism
- Excretion

Urine

 */after work*

Feces

Risk

Chemicals are not associated with *risk* unless a vulnerable group of people are *exposed* and *produce a harmful* effect.

- 1. Chemical**
- 2. Risk**
- 3. Toxicity**

A red starburst shape with a black outline, centered on a white background. The text "Look at the Record" is written in white, bold, sans-serif font inside the starburst.

**Look at the
Record**

Unintentional Injuries On-the-Job

Injury Division	Workers x 10 ³	Deaths 2003	Deaths per 10 ⁵ Workers
Agriculture	3,340	710	20.9
Mining	539	120	22.3
Construction	9,268	1,060	11.4
Manufacturing	17,708	490	2.8
All industries	138,988	4,500	3.2

US National Safety Council, 2004

Causes of Death, 2004

Cause	Number	Deaths per 10 ⁵ Deaths
All unintentional injuries	101,537	35.6
Motor-vehicle	43,788	15.4
Falls	15,019	5.3
Poisoning	14,078	4.9
Pesticide	7	0.0025
Choking	4,185	1.5
Drowning	3,281	1.2
All other	21,186	7.4

National Safety Council, 2004

California Illness and Injury Data Classified by Definite, Probable, and Possible Exposures¹

Year	Total cases	Relationship of Illness or Injury to Pesticide Exposure					
		Definitely or Probably			Possible		
		Cases	Hospitalized	Lost work time	Cases	Hospitalized	Lost work time
1999	1,629	830	32	126	371	2	51
2000	1,144	637	33	144	256	3	51
2001	979	430	27	78	186	2	25
2002	1,859	924	19	106	291	6	42
2003	1,232	614	8	70	188	1	42

¹Definite: Signs and symptoms would be expected from exposure described. Probable: Close correspondence. Possible: Some correspondence.

Substances Most Frequently Involved Children Under 6

Substance	Number x 10 ⁵	Per Cent
Cosmetics & personal products	1.7	13.4
Cleaning substances	1.2	9.7
Analgesics	1.0	7.8
Foreign bodies	0.92	7.4
Topicals	0.92	7.4
Cough and cold preparations	0.68	5.5
Plants	0.58	4.6
Pesticides	0.51	4.1
Vitamins	0.45	3.6
Antimicrobials	0.35	2.8
All other	1.5	11.2
Total	12.5	--

Shaping Pesticide Perception

Environmental Justice
Or
Advocate Blackmail?

**Everyone *knows* how
bad *they* are!**

Rachel Carson (1962) and media like EDF,
NRDC, PAN, Landrigan, Seymour, Sheen,
Press Enterprise, CBS, NBC, ABC, CNN,
etc.

**Institute Analysts have just
announced—mg, ug, ng, pg, fg, at**

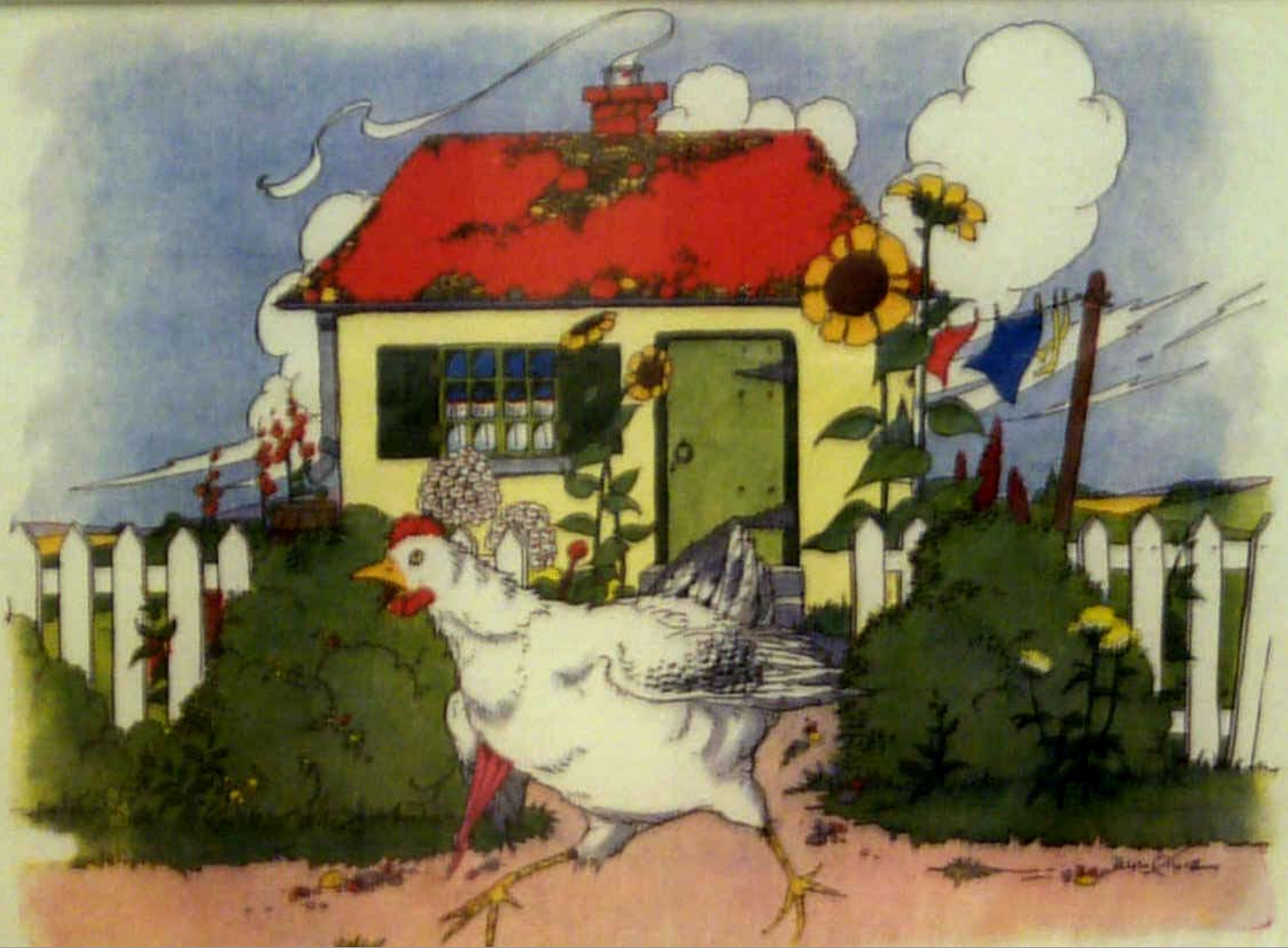
**“We can now find *a flea* in a line of
100 full-grown, circus elephants!”**

1 Flea ≈ millimeter

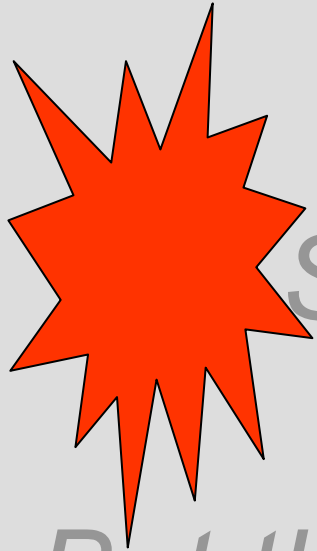
Elephant ≈ 10 meters

Regulate!

- An alarmed, chemically naïve public
- Extremely low contact
- NOAELs become illness thresholds!



Chicken Little



Safe pesticide use?

Yes, I think so!

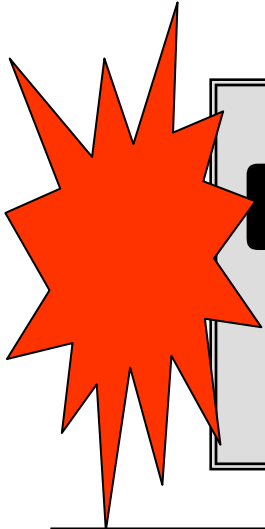
But there is a long way to go!

Getting there...

- Exposure is inevitable at some level.
- Everything goes somewhere.
- Even zero isn't none!
- Exposure is not an effect.
- *How little is OK?* Usual amounts.
- What is *usual*? Heed the label.

Including the fine print...

- Dose is the chemical part of risk.
- Risk reduction must be an ongoing educational process—a lot more can be done.



**Demonstrate by doing:
Strive For Safe Use!**

Know and Heed Labels

Recognize Reality of Exposure

Use Good Judgment!

Reduce your daily absorbed dose 50 to 95% by wearing clean gloves!

Gloves

for
all
work
tasks



Rice

GLOVE PROTECTION: A SPECIAL POINT OF EMPHASIS



RESPIRATOR PROTECTION

<u>SPHERES IN YOUR AIR</u>	<u>DIAMETER</u>	<u>RADIUS</u>
• BIG ONES (HAIR)	100 MICRONS	50 mu
• SPRAY mu	10, 30, 50	5, 15, 25
• RESPIRABLE	LESS THAN 10	5 mu
• REGULATORY FOCUS	2.5 mu	1.25 mu

$$\text{Volume} = \frac{4}{3} \text{ radius}^3$$

Spray protection= 125, 3375, 15625

Flash!



Lawn Runoff, Roseville, CA

Piperonyl butoxide and pyrethroids in sediments: increase toxicity (Weston et al. esp. media) or increase rate of breakdown in insects?? Krieger and Thongsinthusak (1974, terrestrial)