



Pesticides in Health Surveys and Biological Monitoring

Bob Krieger, Ph. D.
Personal Chemical Exposure Program
Department of Entomology
University of California, Riverside

Bob.krieger@ucr.edu

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

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 7 d	irritation reversible 7d	no irritation
Skin effects	corrosive	severe irritation @72 h	moderate irritation @ 72 h	mild irritation @ 72 h

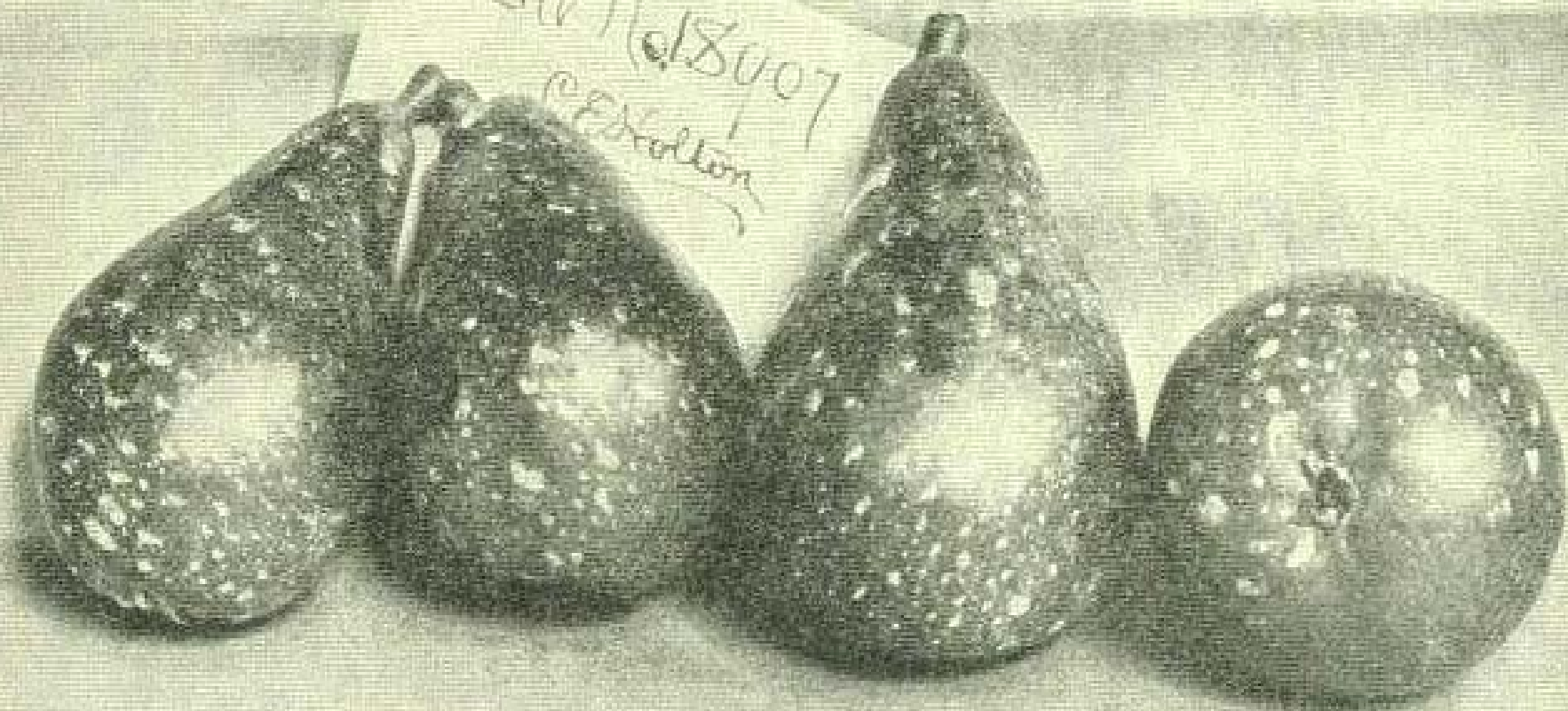
Product Signal Words

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

Food First Public Concern

Food Quality Protection Act of 1996

Low No 18007
C. E. Holton



Cranberry Scare, 1959

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

Arthur Fleming, Secy. HEW



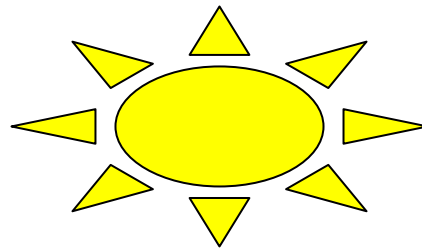


Pesticides are EU citizens' top food-related health concern

63%

September, 2005

Testing for Product Safety: Drugs Effective Dose & Side Effects



-4 -3 -2 -1 ED 1 2 3

a. Chemical Exposure Levels

b. Time

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

Side Effects: *May Occur....*

Thyroxine

headache
nervousness
trembling
sweating
↑appetite
diarrhea
weight loss
insomnia

Lithium

drowsiness
tiredness
↑thirst
↑urination
↑weight
trembling of hands

Coumadin

nausea
vomiting
↓appetite
bloating
cramps
↑bleeding

Gilpizide

nausea
vomiting
diarrhea
constipation_±
upset stomach
headache
↑weight

Topamax 25 mg

drowsiness
loss of coordination
numbness and tingling
tremor
change in speech
decreased sweating
loss of concentration

Keflex 500 mg

stomach upset
fatigue
dizziness
diarrhea

Doxycycline 100mg

stomach upset
mild diarrhea
nausea
vomiting

Seroquel

constipation
drowsiness
dizziness
headache
stomach pain/upset
tiredness
weight gain
dry mouth

Side Effects: *May Occur....*

“Remember that your doctor has prescribed this medication because the benefit to you is greater than the risk of side effects. Many people using this medication do not have serious side effects”.

Allergy

rash

itching

swelling

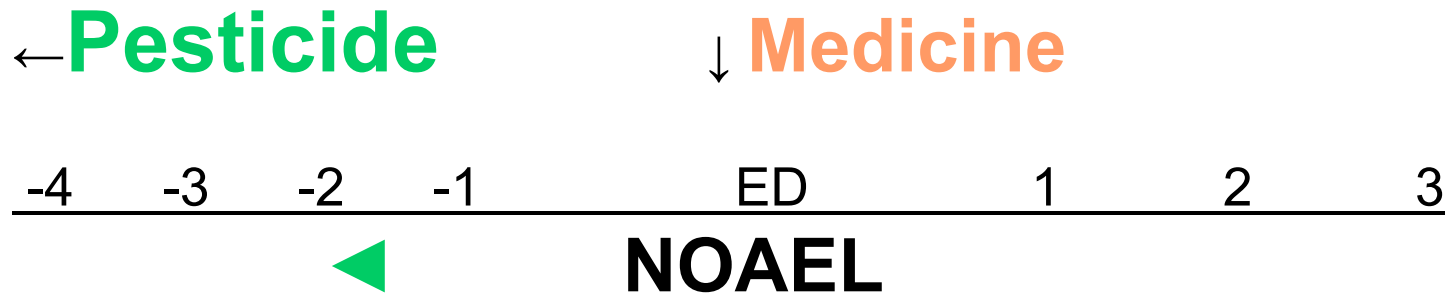
severe dizziness

trouble breathing

“Other effects not listed above.”

Testing for Product Safety: Pesticide

No Observed Adverse Effect Level



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



Look at the
Record

SAFE?

Unintentional Injuries On-the-Job

Injury Division	100,000 Workers	Deaths 2003	Deaths per 100,000 Workers
Agriculture	33	710	21
Mining	5.4	120	22
Construction	92.0	1,060	11
Manufacturing	175	490	3
All industries	1,406	4,500	3

Rounded for purposes of discussion,
US National Safety Council, 2004

Causes of Death, 2004

Cause	Number	Deaths per 100,000 Deaths
All unintentional injuries	101,537	35.6
Motor-vehicle	43,788	15.4
Falls	15,019	5.3
Poisoning	14,078	4.9
Choking	4,185	1.5
Drowning	3,281	1.2
All other	21,186	7.4

National Safety Council, 2004

Causes of Death, 2004

Cause	Number	Deaths per 100,000 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

Causes of Death, 2004

Cause	Number	Deaths per 100,000 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	100,000 Children	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	--

American Association of Poison Control Centers, 2003

The Parlier Study, 2006

(& McFarland 1984-91, 1997-2000 & Lompoc 1997-2003)

Pesticide Perceptions

Environmental Justice

or

Advocate Blackmail?

Everyone knows how
bad *they* are!

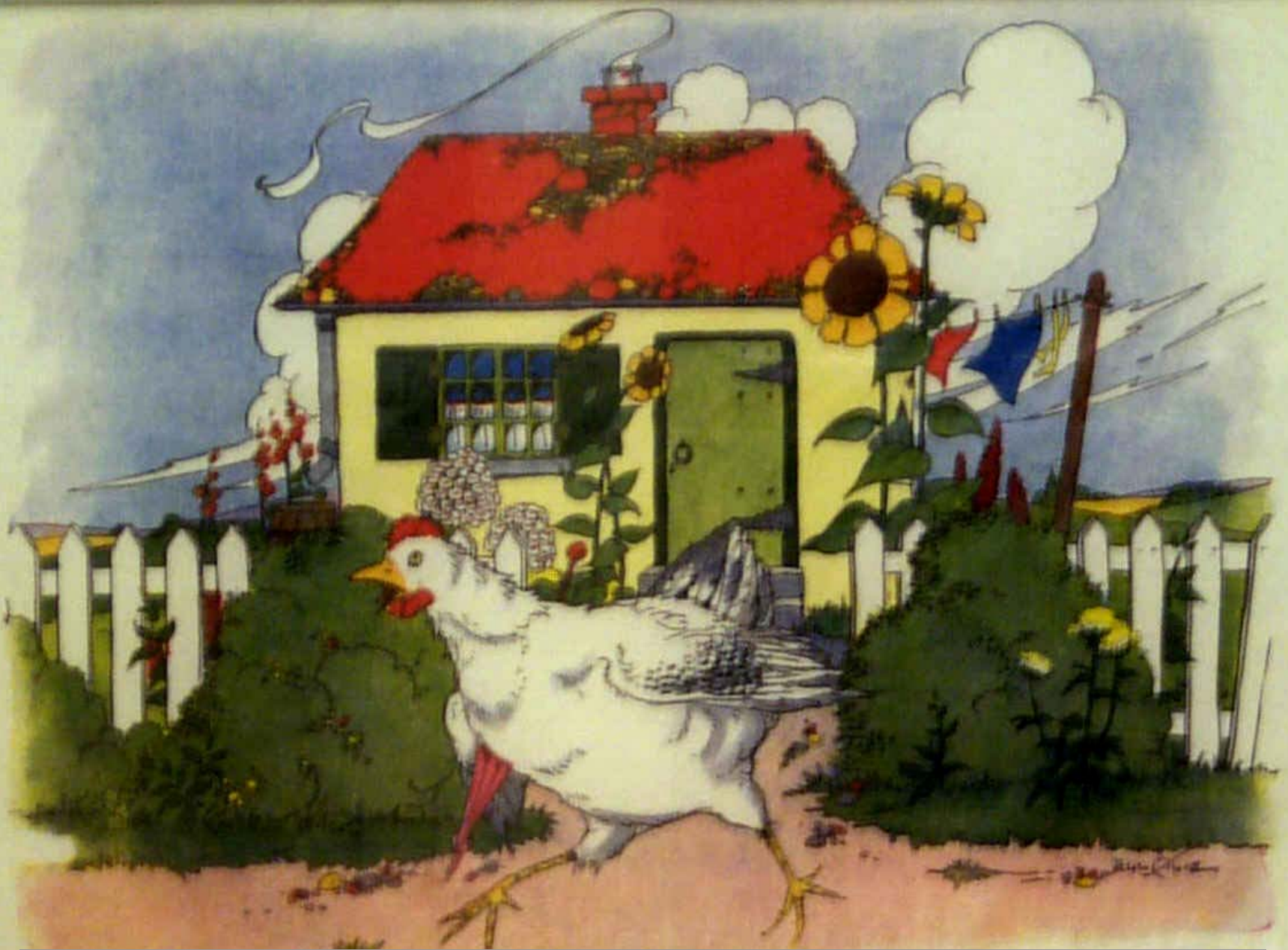
Rachel Carson and media like EDF, NRDC,
PAN, Landrigan, Seymour, Sheen, *Press
Enterprise, CBS, NBC, ABC, CNN, etc.*

**Analysts at the Institute have
just announced—**

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

1 Flea \approx *millimeter*

Elephant \approx *10 meters*




Chicken Little Model

Regulate!

- An alarmed, chemically naïve public
- Extremely low personal chemical exposures
- NOAELs become illness thresholds!

Measuring up: **Bio**monitoring

- *Outside: environmental residues*
 - Air, water, food (dietary), indoors
- **Inside: absorbed dosage**
 - Legal: racehorses and impaired drivers
 - Blood (availability: receptor)
 - **Urine** (eliminated  absorbed)

Biomonitoring: *Blood Sugar.....*

- **Too Much**

↑thirst

↑urine

drowsiness

flushing

↑breathing

“fruity breath”

- **Too little**

chills

cold sweat

blurred vision

dizziness

drowsiness

shaking

↑heart rate

weakness

headache

fainting

tingling hands or feet

hunger

Pesticide Biomonitoring

Regulatory

- NOAEL
- Specific endpoint
- Biomarkers

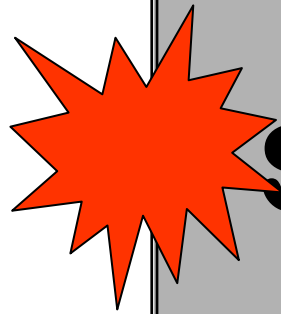
Personal

- Not toxicity
- Response
- Breakdown products
- Rarely the pesticide

Margin-of-Exposure (Safety)

$$\text{NOAEL} / 100 = \text{RfD}$$

Personal Exposure



Strive For Safe Use!

Know Your Labels

Recognize Reality of Exposure

Use Good Judgment!

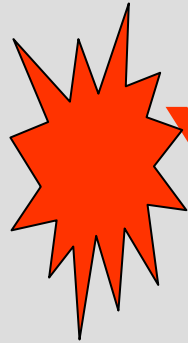
Chemical exposures— can't live without 'em

- Exposure is essential
- Exposure can be measured
- Exposure is not a disease

Dose is the chemical part of risk

*Risk reduction is about education, values and
perceptions*

Safe use?



Yes, I think so!

Bob Krieger, Ph. D.

UC Extension Toxicologist, 2006

UCR PCEP Exposure Monitoring Research

Statement of Interest to PCEP

General Study Plan from PCEP

Respond if interested

Send Study Plan for Comments/Questions

Specific Directions

Voluntary Consent

Statement of Interest in UCR PCEP exposure monitoring research?

- Type of work _____
 - Products used _____
-
- How to contact me with general study plan
(please print 4-digit ID ___ __ __ __)
 - Name and address _____

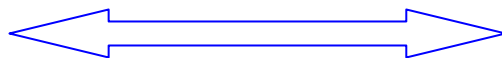
 - *OR* e-mail _____
 - *OR* telephone _____
 - *OR* fax _____
- Year 200**__ Will retain this Statement of Interest for 5 years



Chemicals Of Our World

23,000,000 and growing

Natural



Synthetic

Food

A

Drugs

B

Pesticides

C

Specialty

D

Process

E

1. Greatest Number

2. Most toxic in use

3. Best studied: Environmental and Toxicity



Biomonitoring: *Blood Sugar.....*

- Too Much

↑thirst

↑urine

drowsiness

flushing

↑breathing

“fruity breath”

- Too little

chills

cold sweat

blurred vision

dizziness

drowsiness

shaking

↑heart rate

weakness

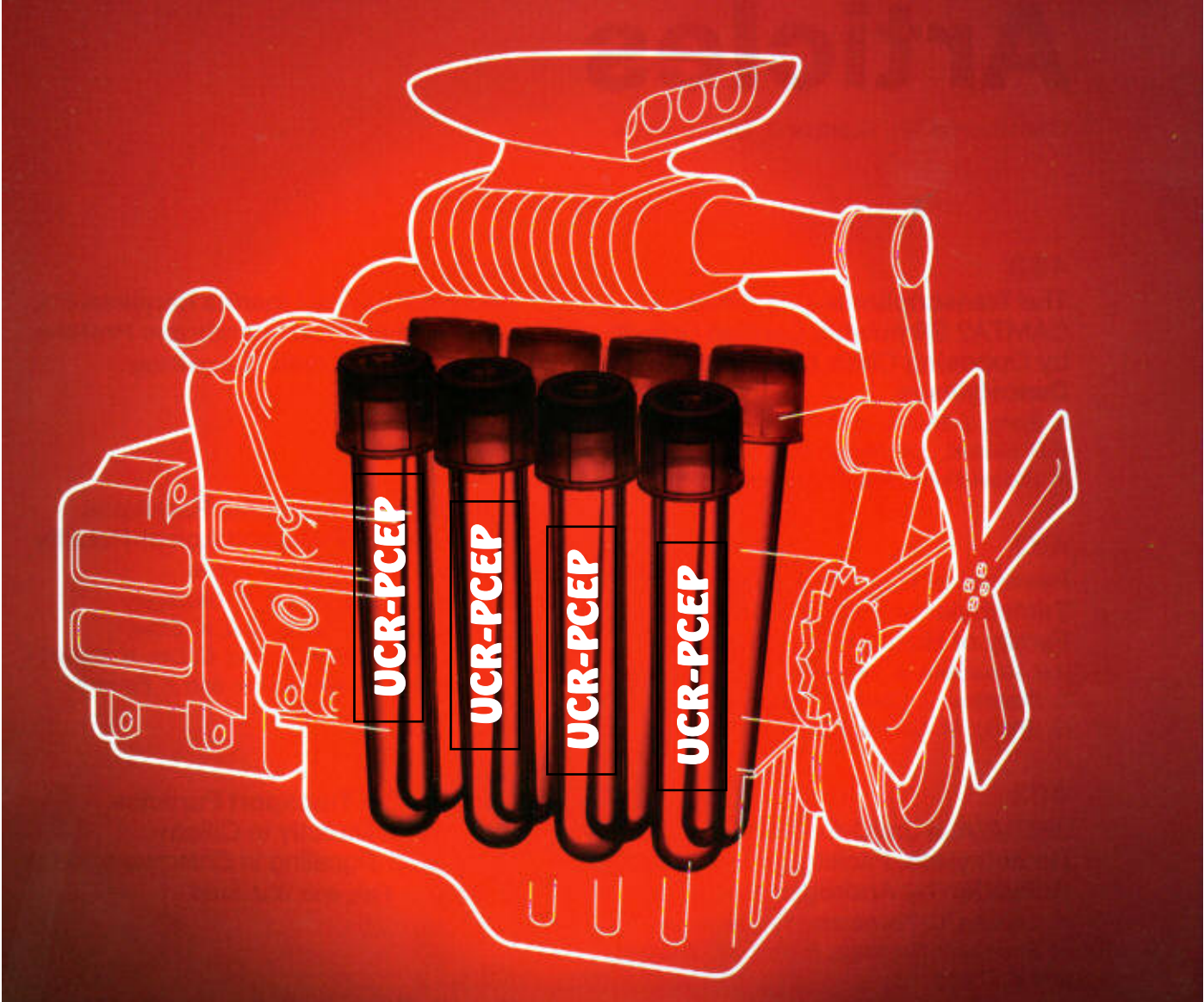
headache

fainting

tingling hands or feet

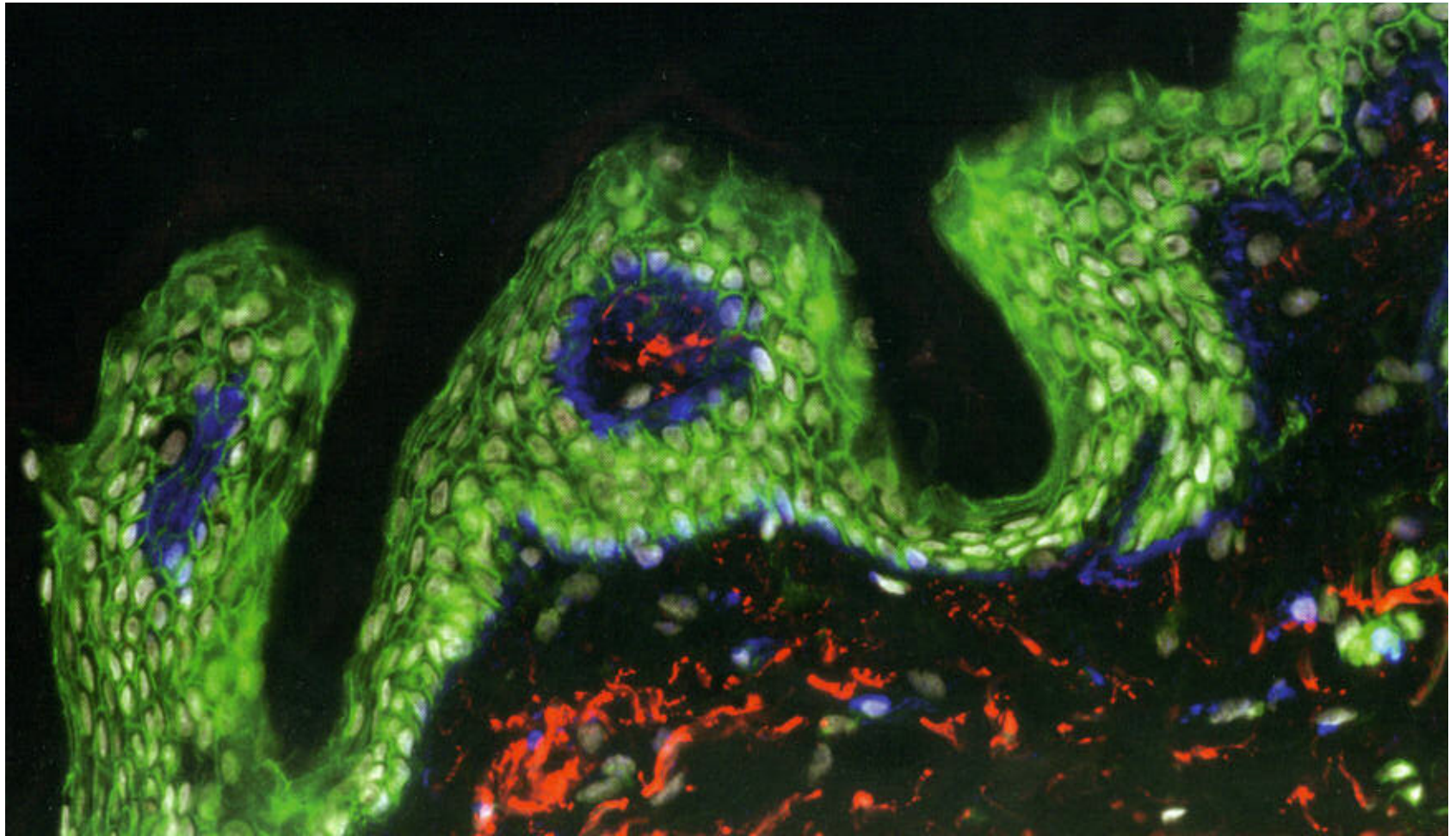
hunger





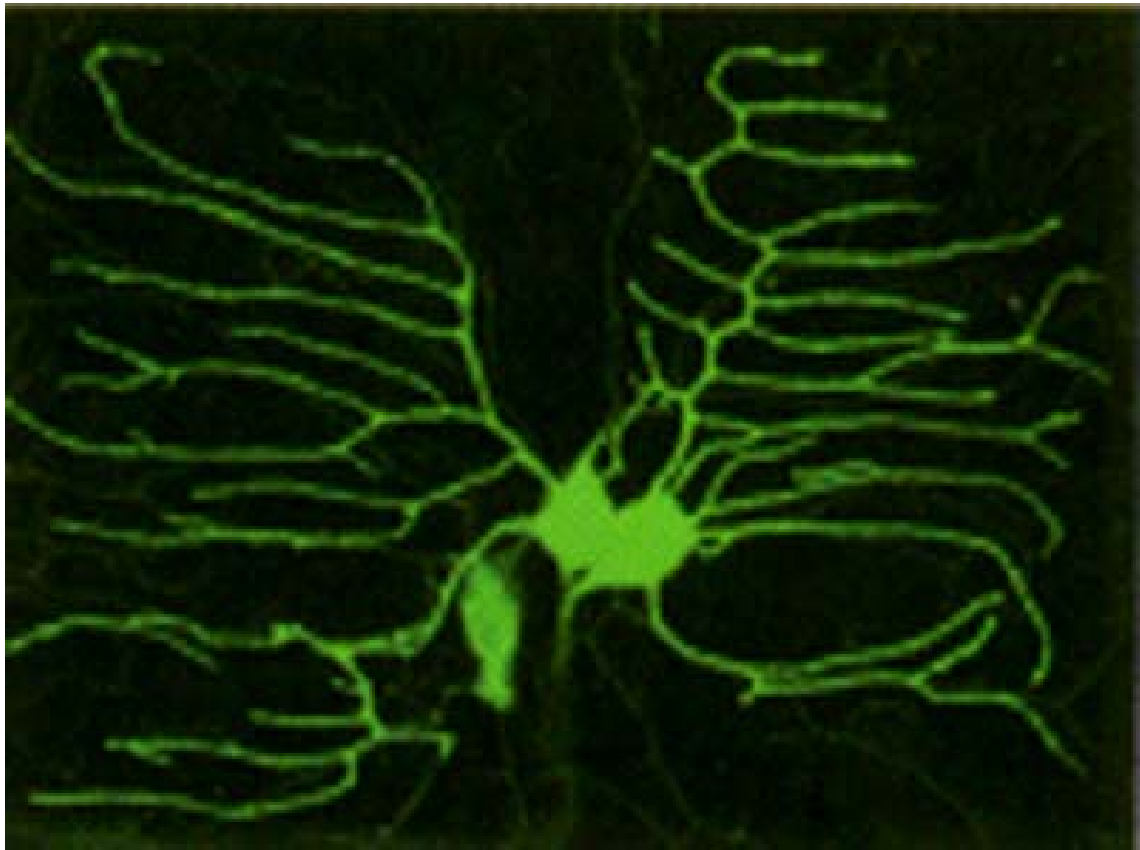














<http://faculty.ucr.edu/~krieger/>