

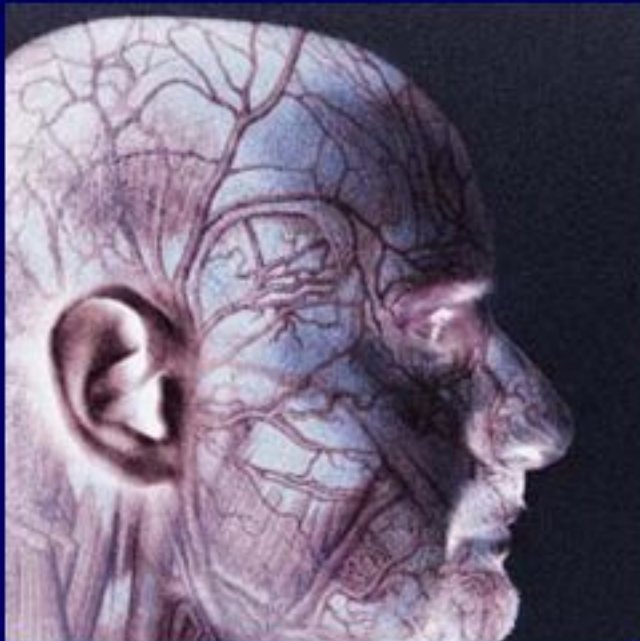


## Biomonitoring: a tool for creating good public health policies

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**Biomonitoring has given us a new framing of the internal landscape of the human body, in the same way as the astronaut photo of the Earth gave us a fresh perspective of our external environment**

**We are of the world and  
the world is in us.**

**Biomonitoring  
helps us measure  
the chemicals from  
the external  
environment  
that have become  
part of in our  
Internal environment**





# Biomonitoring tells a story ... a history of human contamination



Neandertal

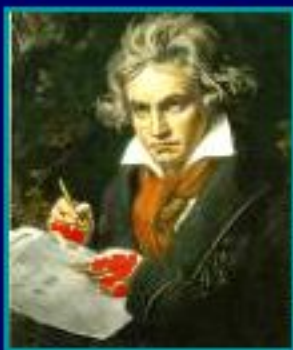


Early art  
Early industries



Mona Lisa

Beethoven



And now, after the explosion  
of chemical use post- WWII....





**Biomonitoring tells the  
story of our daily lives...**

**ultimate proof of our  
exposure to a tide of  
toxic chemicals in our  
food, air, water, in the  
products we use.**

**My friend, Evelyn, 5 years old**

# Biomonitoring

1. Measurement of presence of chemicals or their metabolites, in human fluids or tissues;
2. Identification of chemically-induced damage to human cells, DNA, proteins;
3. Identification of polymorphisms that indicate heightened vulnerability to toxic chemical exposure.



# Uses of biomonitoring

Biomonitoring data can help identify:

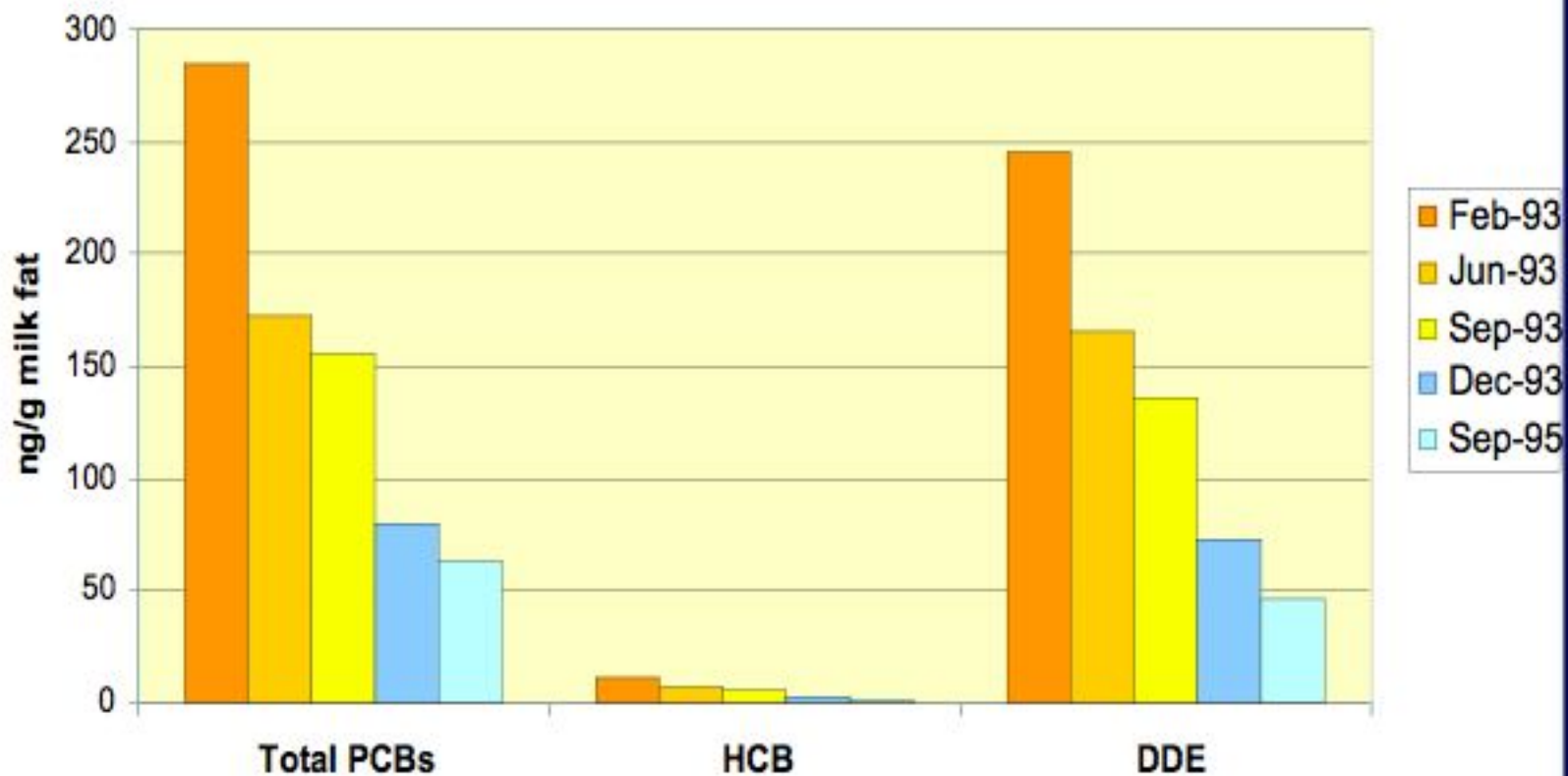
1. Changes, trends in toxic chemical exposures;
2. Vulnerable populations;
3. Effectiveness of regulations;
4. New information about action of toxic chemicals in body
5. Possible linkages between exposures and health outcomes.

Biomonitoring data can:

1. Support changes in public health policy;
2. Can help frame scientific research;
3. Can support need for change in industry and corporate policy;
4. Provide communities, families, individuals with information to guide personal and political choices.

# Trends in chemical exposures

## Reductions in Breast Milk Pollutant Concentrations Over a 38-Month Period of Breast Feeding Twins



Slide: Dr. Gina Solomon, University of California Pediatric Environmental Health Division



## Identification of vulnerable populations

Environmental  
Working Group and  
Commonweal



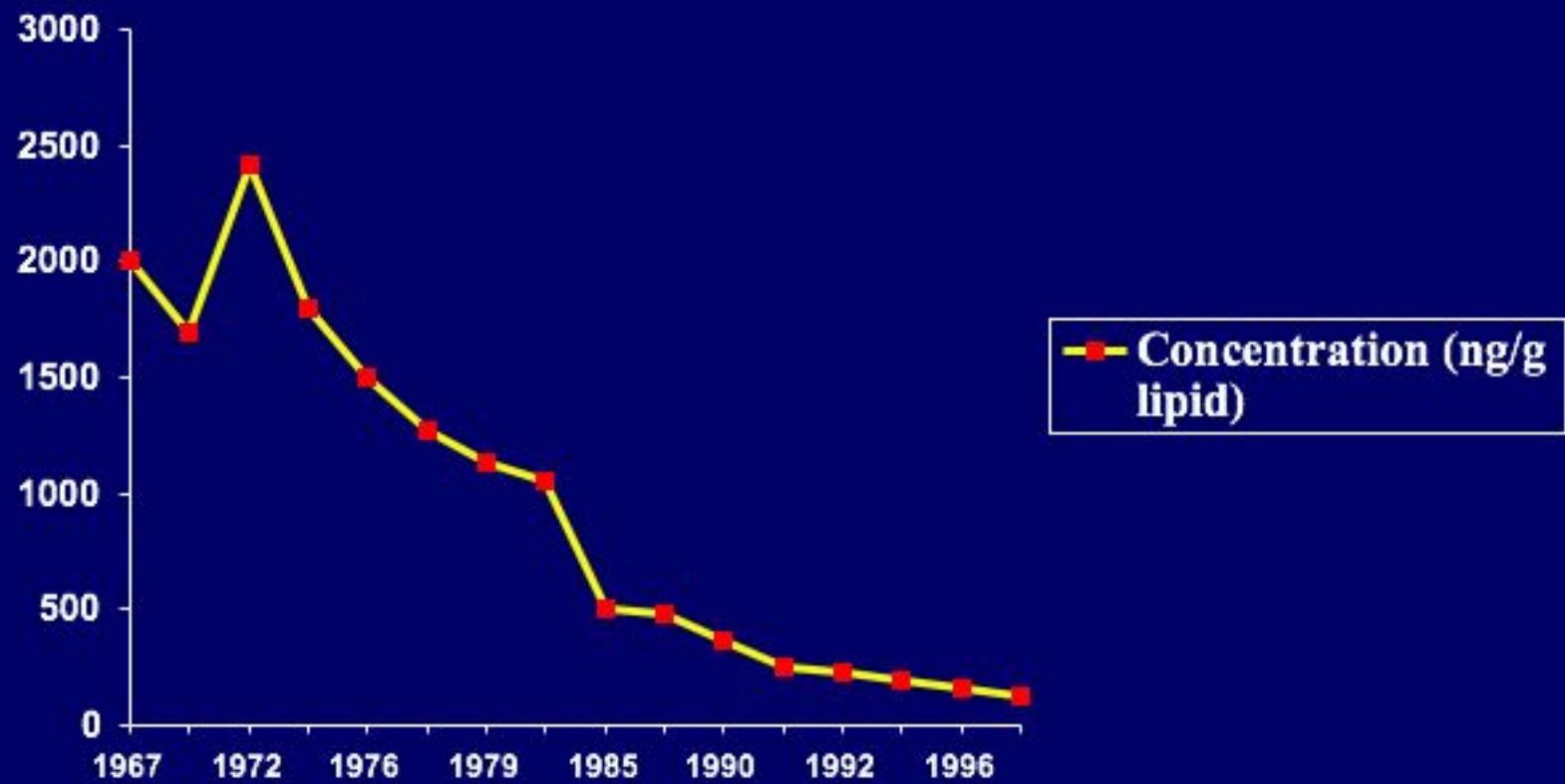
Umbilical cord tested from 10 babies born in August and September, 2004, in the United States .

Out of 410 chemicals tested for, 287 chemicals were found in this cohort.

Implication: The developing child is particularly vulnerable

## Effectiveness of regulations

### DDE in Breastmilk - Sweden



## **New info about chemical capacities**

### **Changes in Androgen-Mediated Reproductive Development In Male Rat Offspring Following Exposure To A Single Oral Dose Of Flutamide At Different Gestational Ages**

**Paul M.D. Foster and Martha W. Harris**

**Published online 23 March, 2005**

**Toxicological Sciences, doi: 10.1093/toxsci/kfi159**

**<http://toxsci.oupjournals.org/cgi/content/abstract/kfi159v1>**



## Timing of exposure

- Exposure to an anti-androgen caused hypospadias in over 50 percent of fetuses exposed on gestational day 17, but none on day 16 and less than 10 percent on day 18.
- Windows of vulnerability during fetal development for specific impacts can be extremely narrow.
- Current epidemiology would have difficulty detecting these effects.

## Toxic chemical exposures and health



**Good health is based on many factors:**

**Genetic inheritance**

**Nutrition/exercise/lifestyle**

**Socioeconomic status/ adequate health care**

**Lack of stress**

**Little or no exposure to harmful bacterial/viral infections**

**Freedom from toxic chemical exposures**

**Other**



**An adverse change in or poor quality of one factor can cause or be linked to a corresponding change in health status.**

**Bad or damaged genetic inheritance**

**Poor quality of nutrition/exercise/lifestyle**

**Low socioeconomic status**

**Stress**

**Harmful bacterial infections/viruses**

**Toxic chemical exposures**



But by augmenting one factor, negative effects of other factors contributing to poor health may be ameliorated.

The elimination of exposures to toxic chemicals increases likelihood of good health.



Damaged genetic inheritance  
Poor nutrition/exercise/lifestyle  
Low socioeconomic status  
Stress  
Bacterial infections/viruses

Freedom from toxic chemical exposures = better health

## Basic human right: reproductive health

How are chemicals impairing our ability to have healthy children?



# How the new problem emerged:

Industrial chemicals falsely impersonate:

Estrogens

Estrogen-blockers

Androgens

Androgen-blockers

Progesterone blockers

Thyroid hormones



# Endocrine disrupting chemicals but not just endocrine system

**Metals can impact the brain and nervous system of a developing child...**



**...at much lower exposures than have been shown to harm workers.**



# Chemicals and Infertility

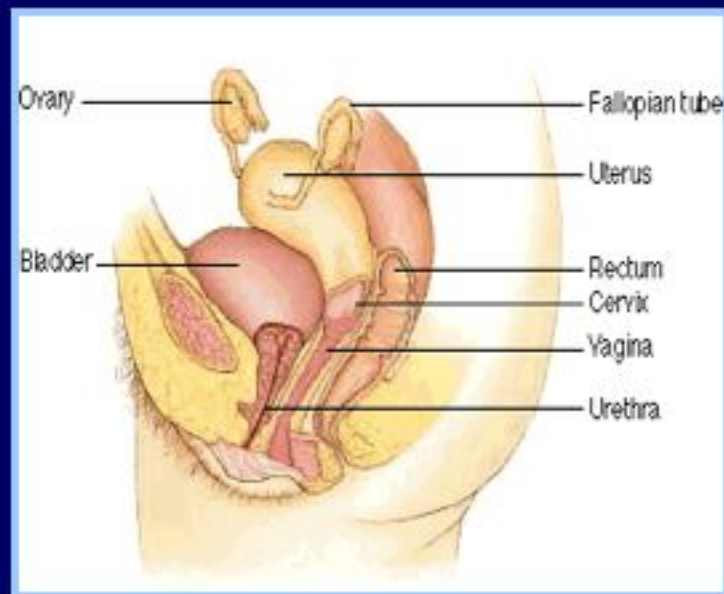
## Endometriosis

Every year in the United States, 100,000 hysterectomies take place because of endometriosis.

Animal and human studies indicate that dioxin causes endometriosis via its ability to disrupt immune and endocrine system function.

Rier, S and WG Foster. 2002.  
Environmental dioxins and endometriosis.

[Toxicological Sciences 70:161-170.](#)



# Chemicals and Infertility

**Women who were infertile were 27 times more likely to have mixed or applied herbicides in the two years prior to attempting conception than women who were fertile.**

Greenlee, AR, TE Arbuckle and P-H Chyou. 2003.  
**Risk factors for female infertility in an agricultural region.**  
*Epidemiology* 14:429-436.





# Chemicals and Infertility

The risk of low sperm quality in Missouri men is strongly associated with pesticide exposures, especially alachlor, diazinon and atrazine.

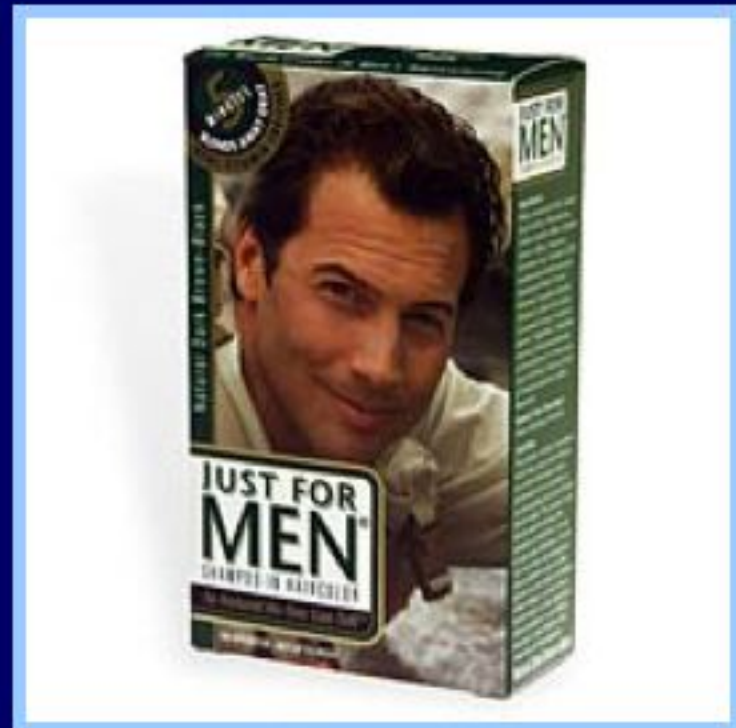
The scientists conclude that exposures to these agricultural chemicals is most likely to be through contaminated drinking water.

Swan, SH, RL Kruse, L Fan, DB Barr, EZ Drobnis, JB Redmon, C Wang, C Brazil and JW Overstreet and the Study for the Future of Families Research Group. 2003. **Semen quality in relation to biomarkers of pesticide exposure.** *Environmental Health Perspectives*. online 18 June 2003



# Chemicals and Infertility

**Men with higher levels of certain phthalates have reduced sperm counts, lower sperm motility and more deformed sperm.**



Duty, SM, MJ Silva, DB Barr, JW Brock, L Ryan, Z Chen, RF Herrick, DC Christiani and R Hauser 2003. Phthalate Exposure and Human Semen Parameters. *Epidemiology* 14:269 –277.

# Chemicals and Birth Defects

In animal studies, Bisphenol A (BPA) increases an error in cell division linked to spontaneous abortion and birth defects, including Down's Syndrome



- Hunt, PA, KE Koehler, M Susiarjo, CA Hodges, A Ilagan, RC Voigt, S Thomas, BF Thomas and TJ Hassold. 2003. [Bisphenol A exposure causes meiotic aneuploidy in the female mouse](#). Current Biology 13: 546-553.



# Chemicals and Birth Defects

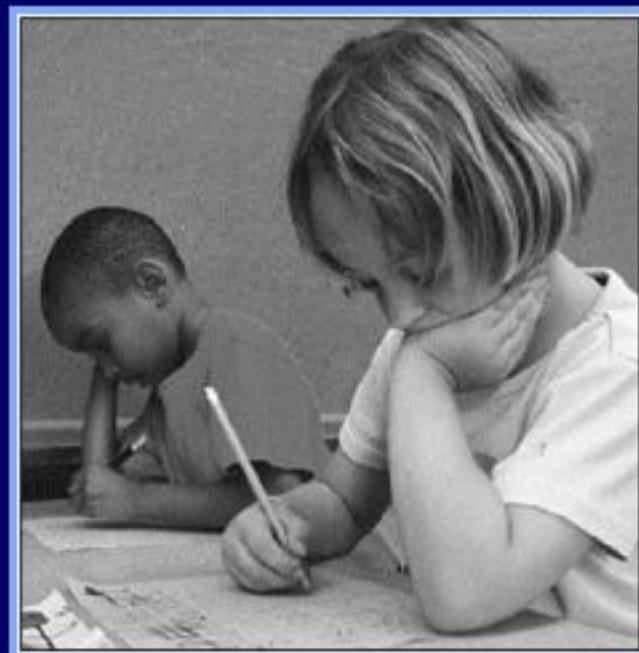


- Bisphenol A is in the blood of pregnant women, in umbilical blood at birth and in placental tissue.
- All samples examined contained BPA, at levels within the range shown to alter development.

Schönfelder, G, W Wittfoht, H Hopp, CE Talsness, M Paul and I Chahoud. 2002.  
[Parent Bisphenol A Accumulation in the Human Maternal-Fetal-Placental Unit.](#)  
Environmental Health Perspectives 110:A703-A707.

# Chemicals and Gender

Fewer boys than expected  
are born to fathers with  
high dioxin levels.



# Chemicals and Birth Outcomes

Polycyclic aromatic hydrocarbons (PAHs) and chlorpyrifos (Dursban) are linked to lower birth weight and head circumference



Perera, F, V Rauh, WY Tsal, P Kinney, D Camann, D Barr, T Bernert, R Garfinkel, Y-H Tu, D Diaz, J Dietrich and RM Whyatt. 2003. **Effects of Transplacental Exposure to Environmental Pollutants on Birth Outcomes In a Multi-Ethnic Population.** *Environmental Health Perspectives* 111:201-205. [Online 31 October 2002].



# Chemicals and Behavior

More feminized behaviors were found in both boys and girls exposed prenatally to higher levels of dioxin.

Lower IQs were found in children exposed to “safe” levels of lead.



Vreugdenhil, HJI, FME Slijper, PGH Mulder, and N Weisglas-Kuperus 2002. **Effects of Perinatal Exposure to PCBs and Dioxins on Play Behavior In Dutch Children at School Age.** [Environmental Health Perspectives 110:A593](#)

[A598](#).

Canfield, RL, CR Henderson, DA Cory-Slechta, C Cox, TA Jusko and BP Lanphear. 2003. **Intellectual Impairment In Children with Blood Lead Concentrations below 10 µg per Deciliter.** [New England Journal of Medicine 348:1517-](#)

[1526](#).

# Reproductive right?

Does the right to decide when and if to bear a child, include:

The right, to conceive and bear a child unimpaired by industrial chemicals

## Organizing around Biomonitoring data

1. Communities carry out their studies; US Military contamination
2. Communities use existing data; Sue company
3. NGOs use existing data; cosmetics campaign
4. NGOs carry out study to support international agreements



# Community-based Biomonitoring Projects

## 1. St. Lawrence Island, Alaska

- Issue: Military waste / health concerns
- Biomonitoring: Yu'pik tested 60 individuals for PCBs
- Findings: population has up to 7 times higher levels of PCBs in their bodies than others in the US.
- Result: Data used to prevent further contamination and to ask for clean-up of US military sites



Annie Alowa, Yu'pik elder



Military waste on St. Lawrence Island

# Community-based Biomonitoring Projects:

## 2. Anniston, Alabama, US

- Issue: PCB contamination by chemical company, Monsanto/Solutia / health concerns

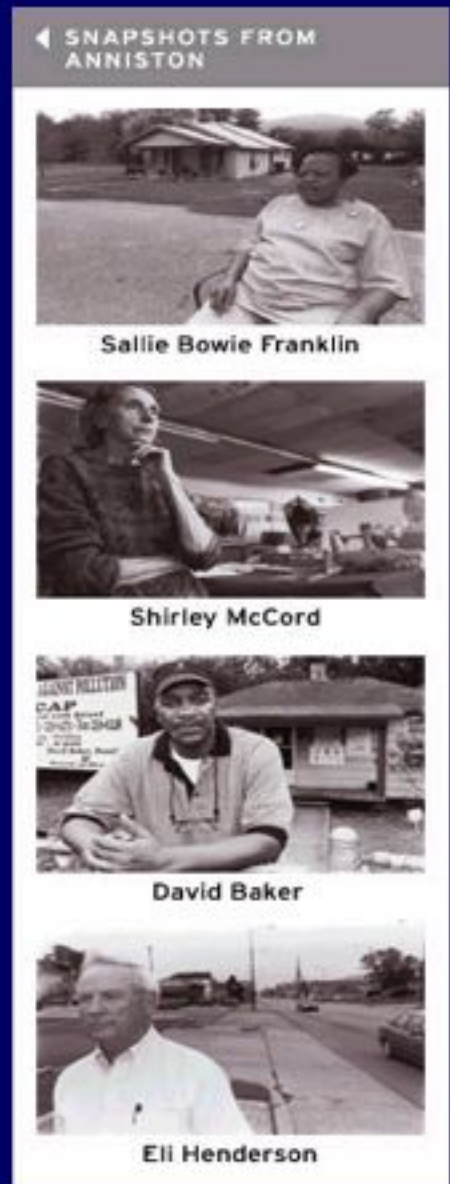
- Biomonitoring: Community worked with US agencies to test inhabitants of Anniston

- Findings: High levels of PCBs in soil, fish and humans

- Result: Data used to sue Monsanto. Inhabitants were awarded funds and twenty years of free medical care.



Dead fish near chemical plant



Sallie Bowie Franklin

Shirley McCord

David Baker

Eli Henderson

Anniston activists



# Community-based Biomonitoring Projects:

## 3. Lindsay, California, US

- Issue: Pesticide, chlorpyrifos, in agricultural community; health concerns
- Biomonitoring: Community tested 12 members for levels of metabolite of pesticide linked to neurological problems in humans;
- Findings: Levels of pesticides were up to 8 times higher than what is considered safe for pregnant or lactating women.
- Result: Data is being used to establish pesticide-free zones around schools, homes, health clinics.



Press conference



biomonitoring participant



I decided to participate in this project because we live near agricultural areas and I am concerned about my daughter and my family's health. We live in front of a school, and both the school and our home are near orange orchards.

When I went to the biomonitoring project doctor, he told me my levels were high.

I would like more children, and there is evidence that babies can be born with health problems when mothers are exposed. I want to ensure my family is safe.

Sometimes I think we should move to another place far away from farming areas, but I know that this would not solve the problem and that we need to participate to make necessary changes.

I understand that we need agricultural products, but we also need authorities to ban bad pesticides from where we work and live.

Ana Espinoza, biomonitoring participant



Levels of chlorpyrifos metabolite, indicating exposure to chlorpyrifos

3.8 micrograms/liter

Safe level for pregnant or nursing mothers, as determined by U.S. EPA:  
1.5 micrograms/liter



Department of Health and Human Services

Centers for Disease Control and Prevention



## National Report on Human Exposure to Chemicals:

Ongoing assessment of human exposure. Third Report (2005) included information for a total of 148 chemicals.

[www.cdc.gov/exposurereport](http://www.cdc.gov/exposurereport)





Department of Health and Human Services  
Centers for Disease Control and Prevention

# CDC biomonitoring determines chemical body burdens for average Americans

Results by Chemical Group

**Metals**

**Tobacco Smoke**

**Polycyclic Aromatic Hydrocarbons**

**Polychlorinated Dibenzo-p-dioxins,  
Polychlorinated Dibenzofurans, and Coplanar and  
Mono-ortho-substituted Polychlorinated Biphenyls**

**Non-dioxin-like Polychlorinated Biphenyls**

**Phthalates**

**Phytoestrogens**

**Organochlorine Pesticides**

**Organophosphate Pesticides:**

**Dialkyl Phosphate Metabolites**

**Organophosphate Pesticides: Specific Metabolites**

**Herbicides**

**Pyrethroid Pesticides**

**Other Pesticides**

**Carbamate Insecticides**



[www/cdc.gov/exposurereport](http://www/cdc.gov/exposurereport)



<http://www.safecosmetics.org>

In the US, everyday products such as shampoo, deodorant and make-up contain chemicals linked to cancer, birth defects and other serious health consequences. And many lipsticks contain high amounts of lead.

In the US, cosmetics manufacturers are allowed to use almost any chemical as an ingredient without government approval.

So far, more than 200 companies have signed the Compact for Safe Cosmetics, a pledge to make safe products.



# Skin Deep

News about the safety of popular  
health & beauty brands

a project of Environmental Working Group



**Biomonitoring information about toxics, including phthalates, encouraged NGOs to create a database for consumer use.**

**NGOs tested many personal care products such as lipstick, lotion, deodorant, and sun screen.**

**This database called “Skin Deep” provides safety ratings and brand-by-brand comparisons of over 14,000 personal care items that can help consumers choose safer products.**

**The site was created by staff scientists at the Environmental Working Group - US.**

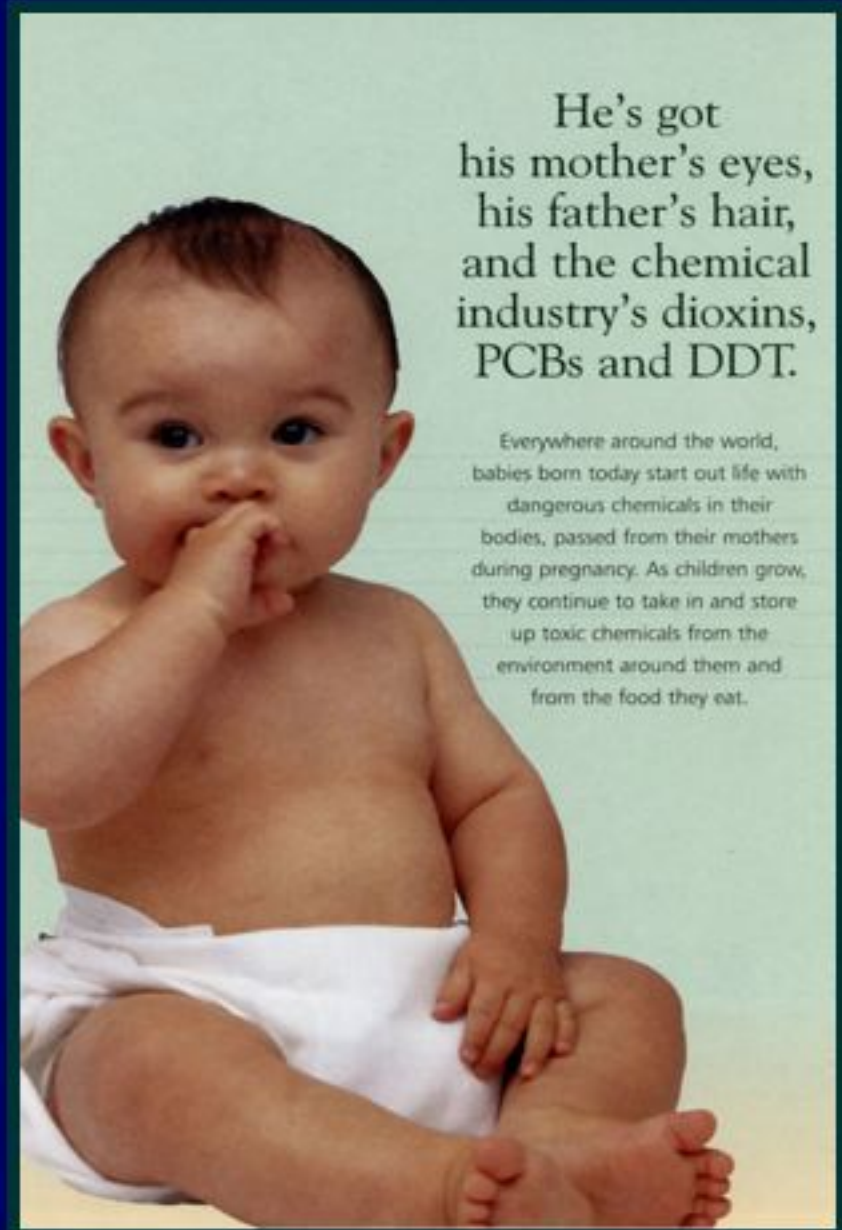
**[www.cosmeticdatabase.com](http://www.cosmeticdatabase.com)**



# Stockholm Convention

A legally binding global treaty that:

- Bans or severely restricts 12 POPs chemicals;
- Provides mechanism for placing additional chemicals on list for action under mandate of Convention



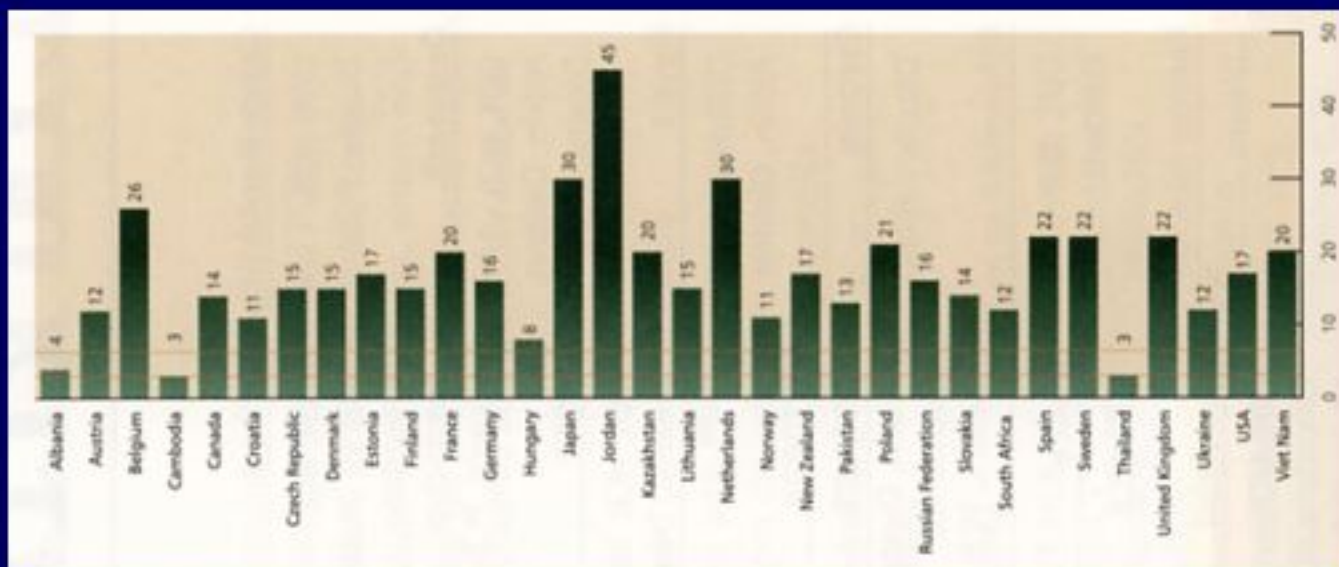
He's got his mother's eyes, his father's hair, and the chemical industry's dioxins, PCBs and DDT.

Everywhere around the world, babies born today start out life with dangerous chemicals in their bodies, passed from their mothers during pregnancy. As children grow, they continue to take in and store up toxic chemicals from the environment around them and from the food they eat.



# Dioxins in Breastmilk in Selected Countries

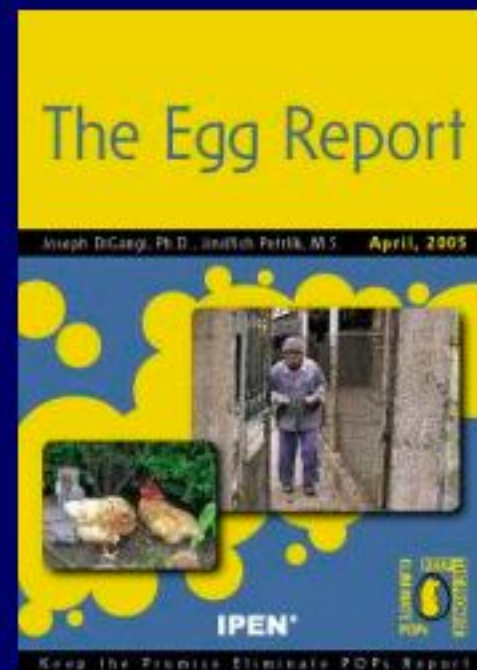
Biomonitoring data informed decision-making process and supported creation of a strong Convention.



SOURCE: IARC, 1997 most recent studies selected for each country

# IPEN Egg Monitoring Project

Eggs monitored near POPs  
Hotspots around globe



Sample countries:

Philippines - medical waste incinerator 9.7 X background levels of dioxin  
3X EU limit for dioxin

Slovakia - incinerator 11X background levels of dioxin  
3.8X limit for dioxins

Egypt - metallurgical facility 125 X background levels of dioxin  
42 X EU limit for dioxins

Kenya - Dandora dump 23 X background level for dioxins  
7.6X EU limit for dioxins

## **Effectiveness Evaluation Program for Stockholm Convention**

- 1. Breastmilk monitoring around the globe to establish base line levels of exposure and to determine trends in POPs chemicals.**
- 2. This will provide an enormous opportunity for organizing women around the world to get get toxic chemicals out of breastmilk.**
- 3. Monitoring needs to be done respectfully, in ways that promote breastfeeding.**
- 4. Women should be communicated individual levels of their chemical body burden.**



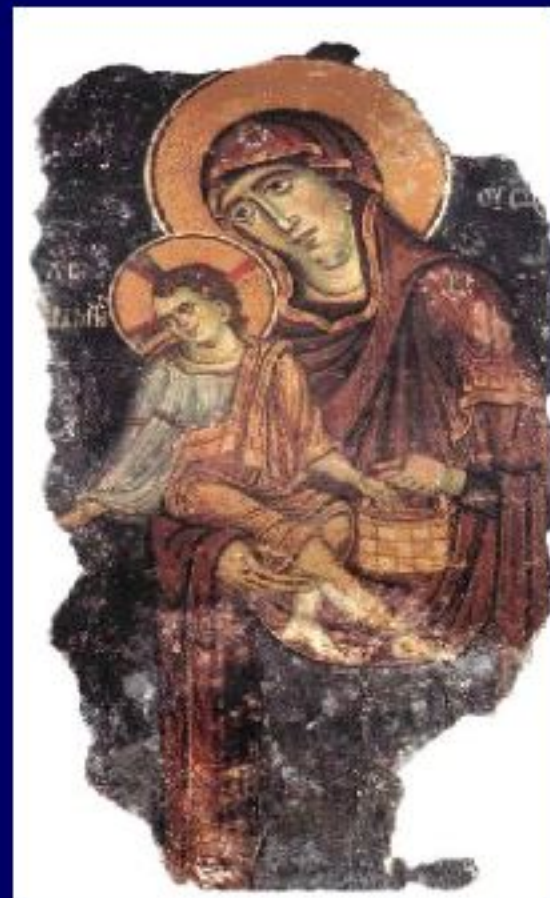


**See my works, how fine and excellent they are! All that I created, I created for you. Reflect on this, and do not corrupt or desolate my world; For if you do, there will be no one to repair it after you.”**

**Midrash Ecclesiastes Rabbah 7:13**

For I was hungry and you  
gave me something to eat,  
I was thirsty and you gave me  
something to drink,  
I was a stranger  
and you invited me in,  
I needed clothes  
and you clothed me,  
I was sick and  
you looked after me,  
I was in prison  
and you came to visit me.

Matthew 25:34-45





Even as a mother protects with her life her child, her only child,  
So with a boundless heart, should one cherish all living beings,  
Radiating kindness over the entire world, spreading upward  
to the skies, and downward to the depths. This is said to be  
the sublime abiding.

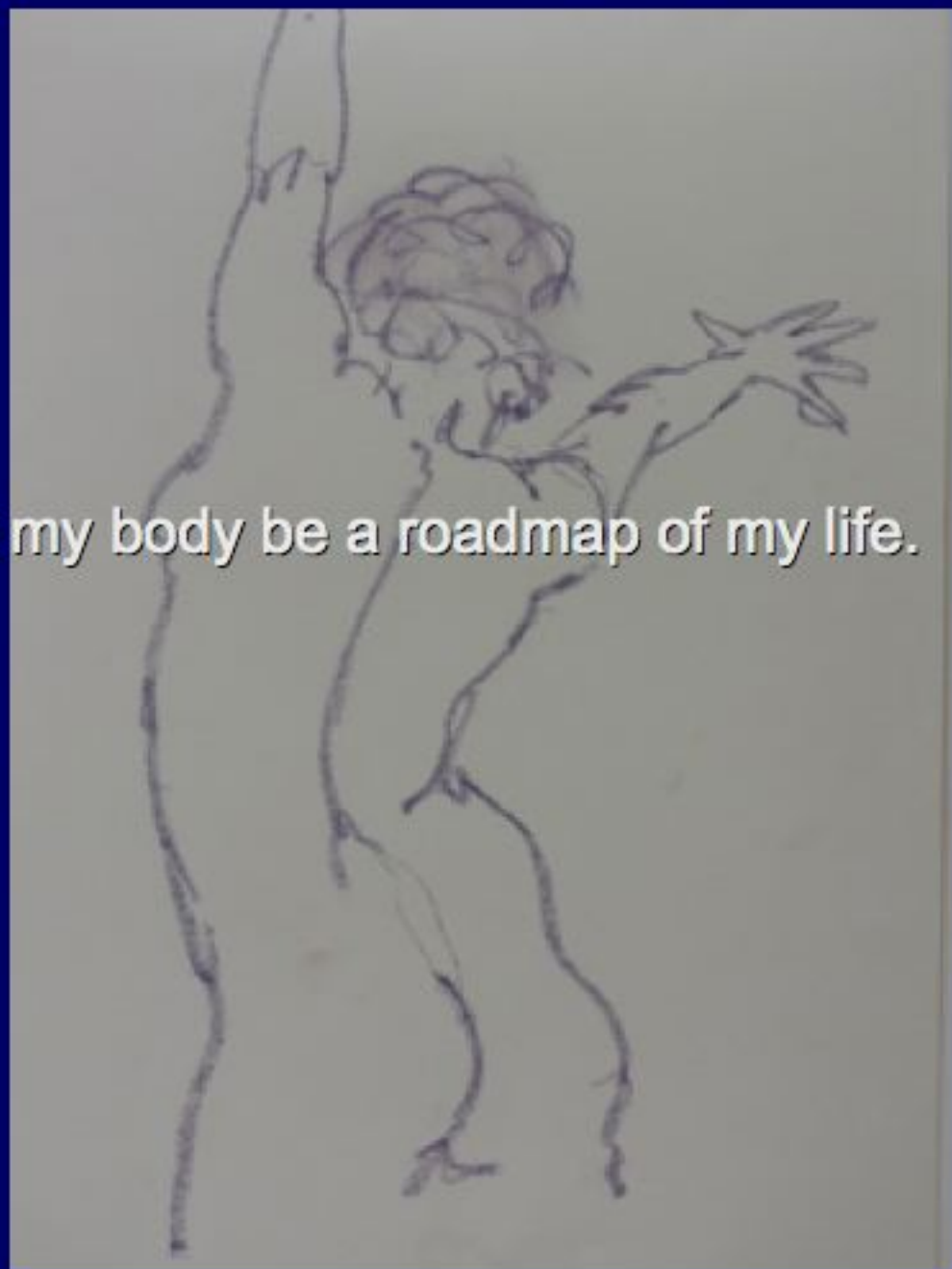
Metta Sutta, "Loving-kindness"





One more story.....

**Early on I decided to let my body be a roadmap of my life.**



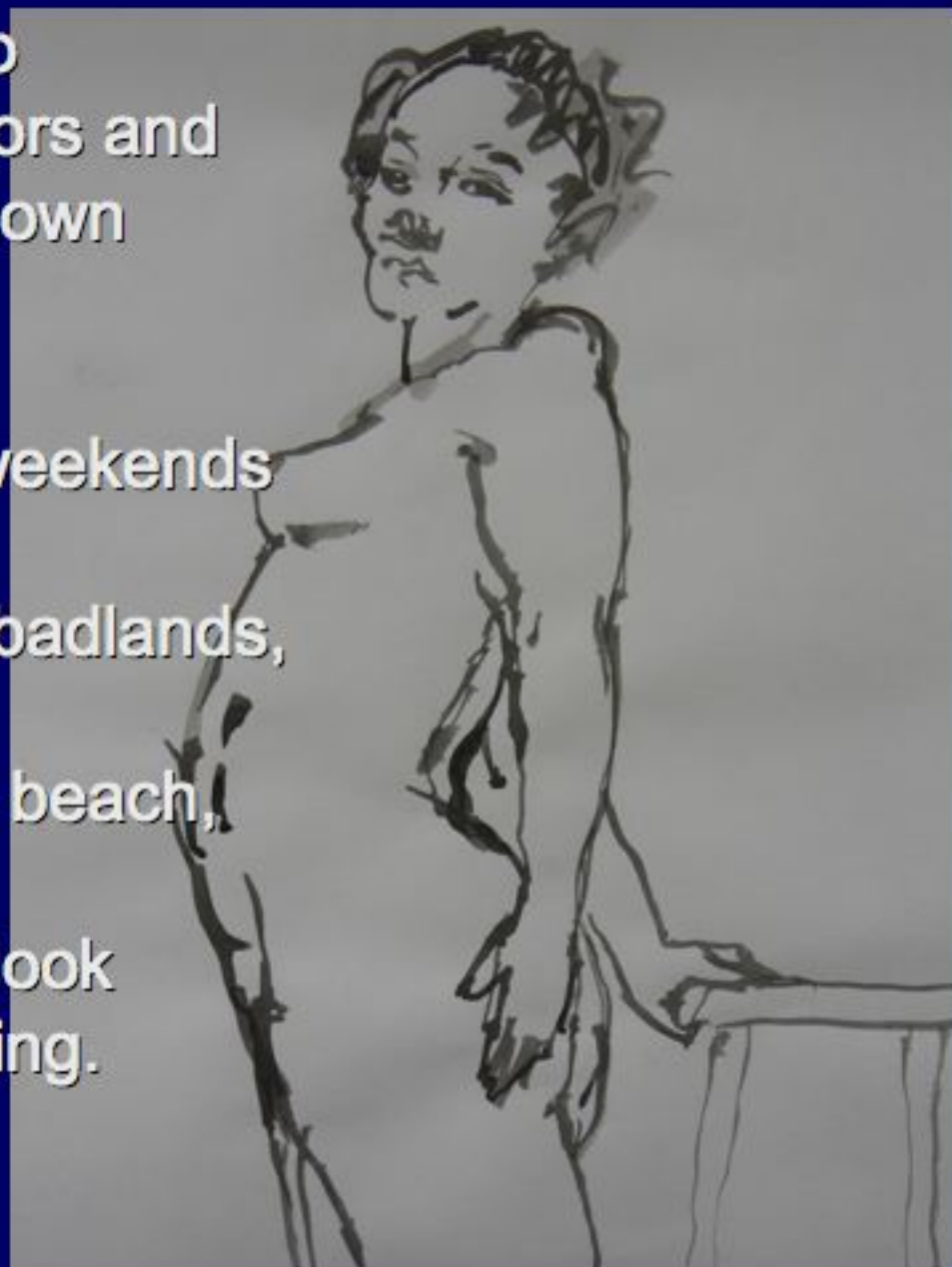
With sunspots to testify to  
all the hours spent outdoors and  
all the pleasure I have known  
there,

Gardening for hours on weekends

Excavating fossils in the badlands,

Playing with Hank on the beach,

Hiking up the ridge for a look  
at the first wild iris in spring.



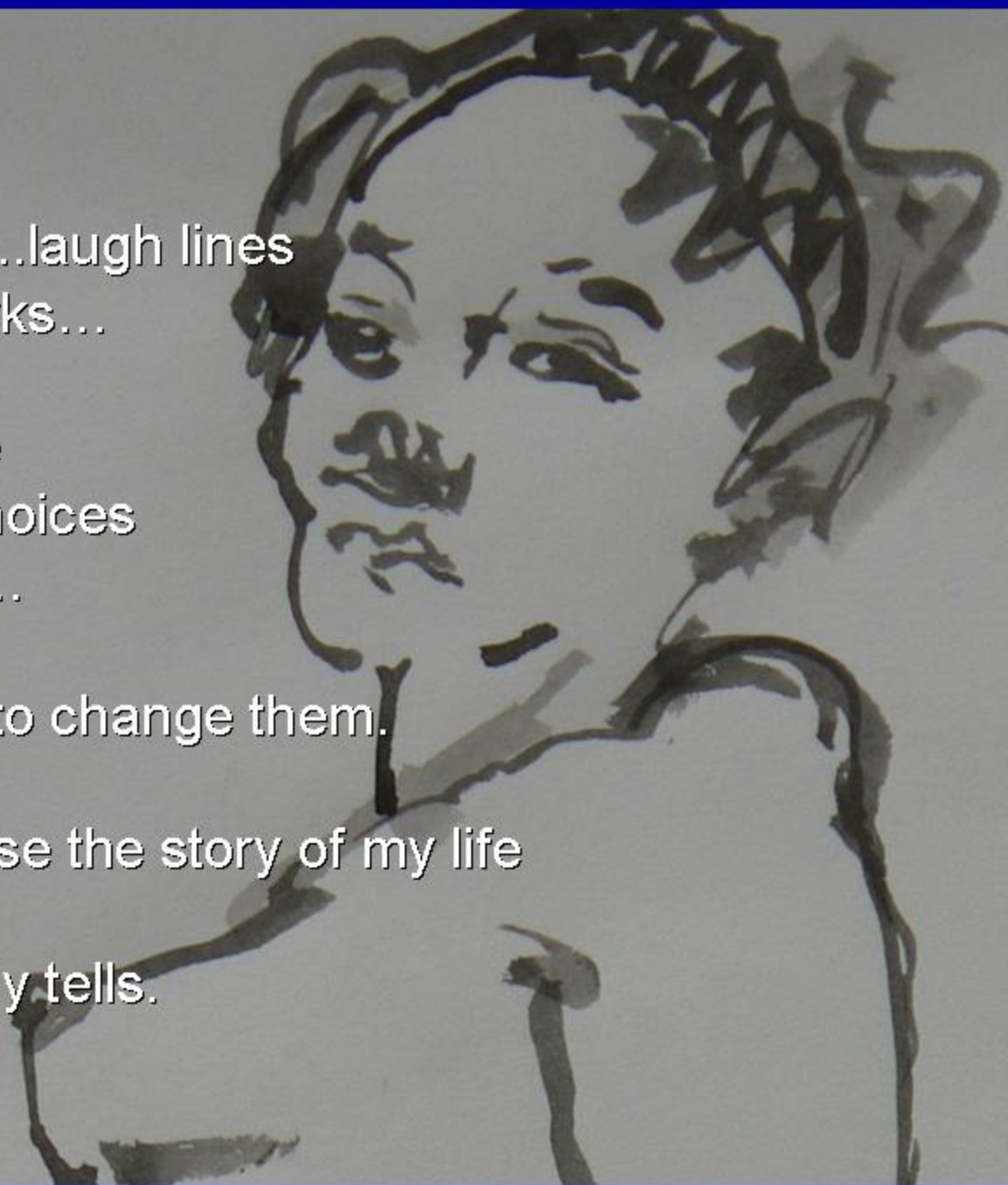


Frown lines..laugh lines  
Stretch marks...

These have  
Been my choices  
For my life...

I do not try to change them.

I do not erase the story of my life  
that my body tells.



But my body carries another story...not of my choice.

It carries the evidence of everyday acts...by carrying thousands of chemicals from the food I eat, air I breathe, water I drink and the products I use.



For example, when I was a kid  
My mother used DDT on the  
roses.

My body carries residues to this  
day  
Of that DDT.

And every time I use perfume, I  
may douse myself with  
A chemical known to cause birth  
defects.

If I were pregnant, choosing to  
smell like roses could  
Be harming my developing baby





And every time I have sat on a  
foam couch,



Absentmindedly  
burned the burgers  
in a non-stick pan,

Used a Nalgene water bottle,

Drove a new car,

Used a plastic shower curtain

Stripped paint...

Chances are good that chemicals  
In these products took up residence  
In my body..

Chances are, if I worked in the orange groves;  
Worked putting together circuit boards,  
Worked cleaning hotel rooms,  
Worked in a nail salon, or in front of a computer,

If I worked at home cooking and cleaning and...

Chances are chemicals from work took up  
residence in my body and I carried them  
to my family.



Chemicals from all of these  
Days, from this work have become  
Part of my body...my own  
Chemical body burden

I carry them as a record of my  
Days..

I know because I have been  
Tested.

My blood and urine were analyzed and I know what  
My body says about my life.







Of the 206 chemicals my  
body carries,  
62 are carcinogens,  
55 are linked to heart  
disease,  
58 are linked to  
neurological problems,  
and 72 are related to  
respiratory illness.

I didn't give permission to anyone to use my body  
as a toxic dump.

I want these chemicals  
Out of my body.  
I want them out of the  
Bodies of my children  
And of the bodies of the  
People in my community.

I want the chemical  
Industry to test all  
Chemicals to make sure  
They are safe before  
Putting them in products  
I will be using.



I want my body to be  
My own.

I want the story my body  
Tells to be the story I have chosen  
To tell....





# Useful website

<http://www.healthandenvironment.org>

Collaborative on Health and Environment website

- Robust and recent science linking environmental threats to health outcomes
  - Transcripts from interviews with leading scientists
  - Library and database
  - Information about joining CHE