

# Multi-Specialty Grand Rounds

## Maternal-infant Child Health and the Environment: Building a Clinical Program

May 29, 2009

Edmonton, AB

### **Lorie Grundy, RN MScN**

- Pediatric Environmental Health Nurse Specialist, Pediatric Environmental Health Specialty Unit, Misericordia Hospital

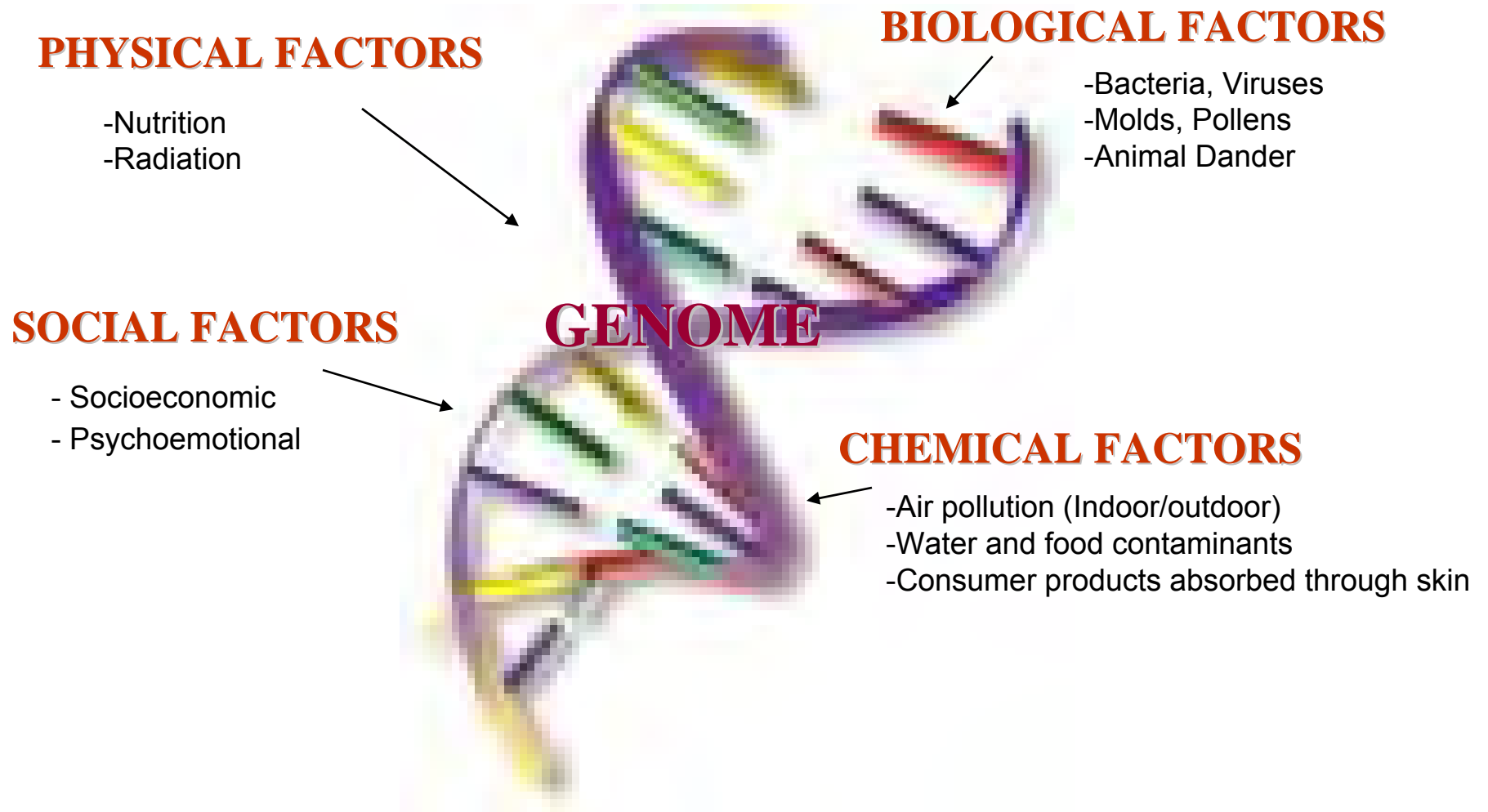
### **Dr. Irena Buka, FRCPC**

- Clinical Professor of Pediatrics, University of Alberta
- Director of the Pediatric Environmental Health Specialty Unit,

# To introduce Maternal-infant Child Health and the Environment (MiCHE) & its relevance to multi-specialty audience

1. What is MiCHE and the Pediatric Environmental Health Specialty Unit (PEHSU)?
2. What are the issues?
3. What does the program offer patients & the community?

# Maternal-infant Child Health and the Environment



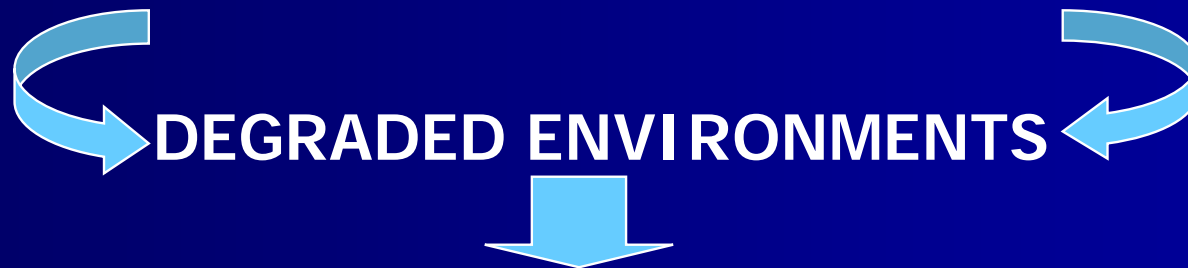
# GLOBAL CHALLENGES TO HUMAN HEALTH AND DEVELOPMENT

## *NEW DRIVING FORCES*

Rapid globalization  
New industrialization  
Upsurge of urbanization  
Poverty and inequity  
Non-sustainable consumption  
Excessive population growth  
Trans-boundary chemical transport

## *ENVIRONMENTAL CHANGE*

Climate change  
Ozone depletion  
Desertification/deforestation  
Forest fires  
Loss of biodiversity  
Increased use of biotechnology



Vulnerable groups affected disproportionately



# CHILDREN'S HEALTH AND THE ENVIRONMENT

- Air pollution
- Chemical hazards in food and water
- Radiation
- Ozone depletion
- Climate change
- Built environment
- Asthma and respiratory disorders
- Neurodevelopmental behavioural disorders, ADHD, autism
- Cancer
- Birth defects and reproductive problems
- Renal disorders e.g. urolithiasis
- Obesity

**.... EMERGING  
ISSUES!**



• The figures quoted have been checked and certified to by LYBRAND, ROSS BROS. AND MONTGOMERY, Accountants and Auditors.

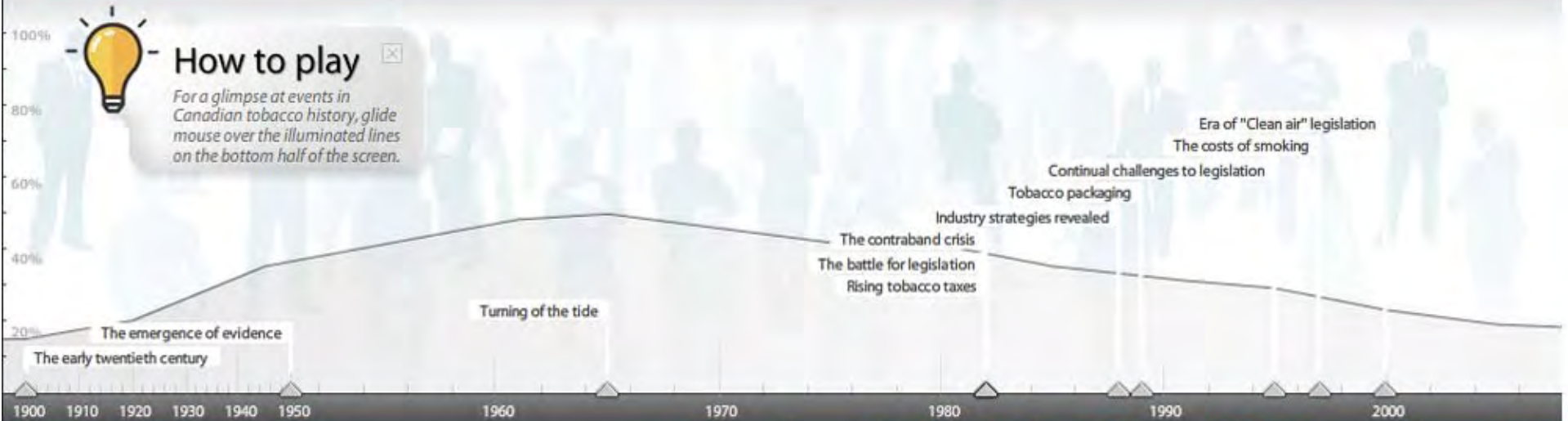
**20,679\*** Physicians  
*say* “**LUCKIES**  
are less irritating”

“**It's toasted**”

Your Throat Protection against irritation against cough

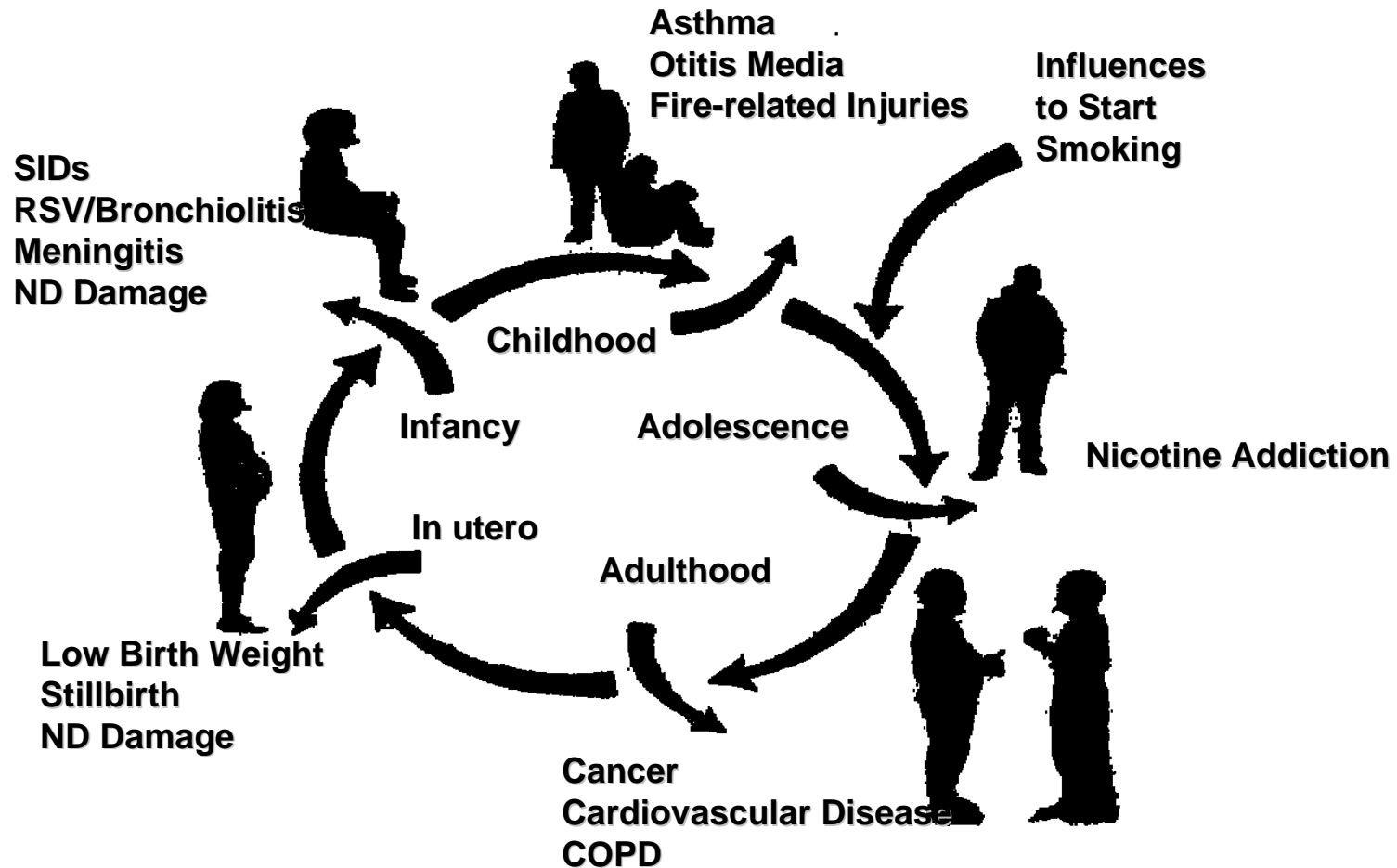
# The Tobacco Story in Canada: 1900 until today

## Prevalence of smokers in Canada (males and females, 15 years and older) (%)

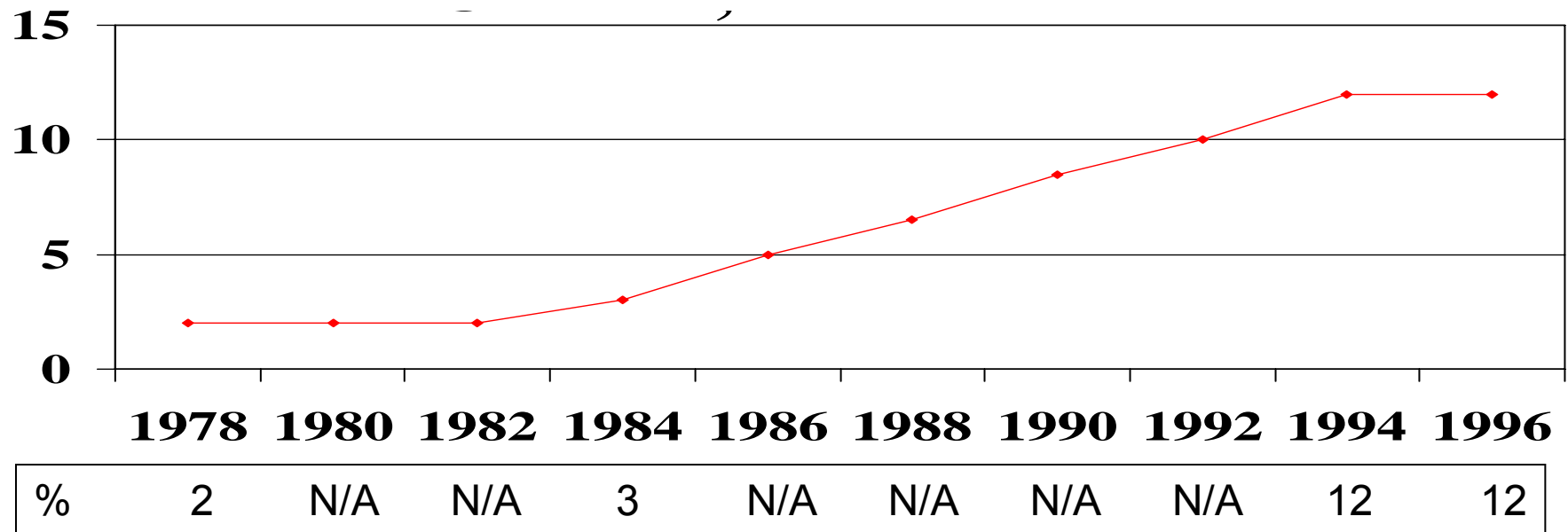


The precautionary approach/principle is a distinctive approach to managing threats of serious or irreversible harm where there is scientific uncertainty.

# THE LIFE CYCLE OF THE EFFECTS OF SMOKING ON HEALTH



# Reported Asthma Prevalence, Birth to 19 Years Canada, 1978-1996



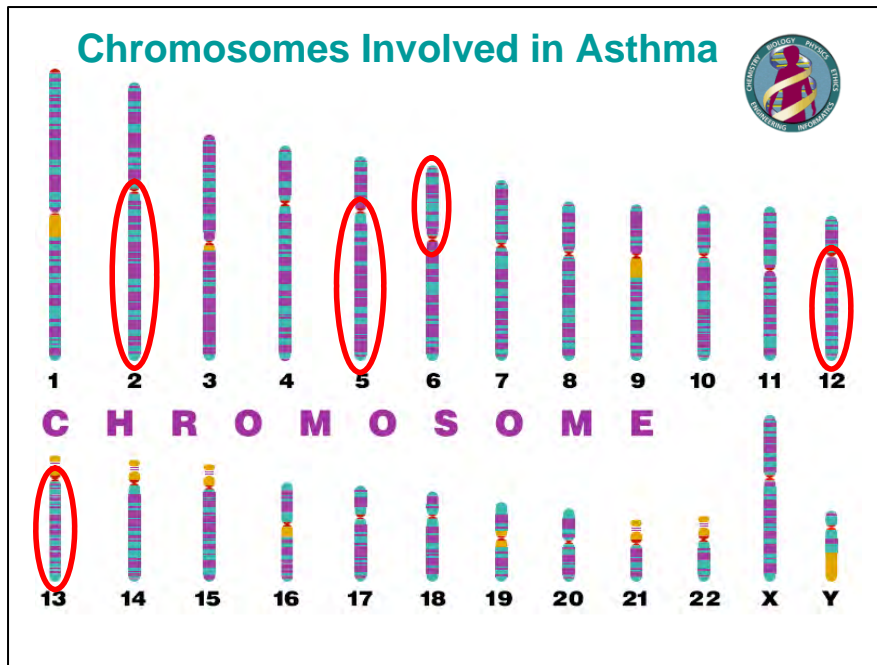
\* 1984 survey includes 0-14 years of age only.

\* Note: Percentages are weighted estimates.

\* Source: Health Canada. 1999. *Measuring Up: A Health Surveillance Update on Canadian Children and Youth.*



# Asthma



## Indoor air contaminants

1. ETS, mosquito coils, candles
2. Animal allergens, molds
3. Gas/propane/wood cooking, heating – NO<sub>2</sub>, CO
4. Household products e.g. cleaning, personal care, hobby materials, furniture
5. Outdoor contaminants infiltrating indoors

## Outdoor air contaminants

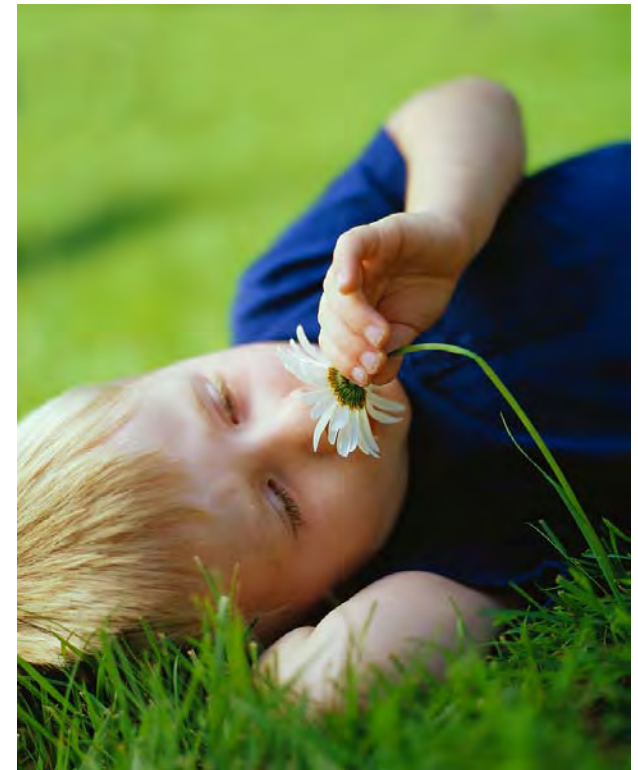
Particulate Matter	Industry, construction, traffic
Ozone	Vehicle emissions (NOs) + VOCs reaction under sunlight
NO <sub>2</sub>	Fuel combustion, atmospheric reactions
CO	Motor vehicles, industry
SO <sub>2</sub>	Power plants, paper mills, sour gas

## Social Factors

- socioeconomic

# Outdoor air pollution and emergency department visits for asthma among children and adults: a case-crossover study in northern Alberta, Canada.

- Findings from the metropolitan area of Edmonton, taken together, suggest that exposure to ambient levels of air pollution is an important determinant of ED visits for asthma, particularly among young children and the elderly.



Environ Health, 2007 Dec 24; 6:40. Villeneuve PJ, Chen L, Rowe BH, Coates, F. Biostatistics and Epidemiology Division, Health Canada, Ottawa Ontario, Canada.

# Recent evidence for adverse effects of residential proximity to traffic sources on asthma.

- There is consistent evidence that living near traffic sources is associated with asthma occurrence and exacerbations.
- Future studies have the opportunity to improve exposure estimates by measuring traffic-related pollutants near homes and schools and including time/activity patterns in prediction models.
- Further research is also warranted to investigate the differential impact of traffic by genetic and other susceptibility factors and to identify specific pollutants that underlie the adverse effect of traffic on asthma.

# Prevalence of abnormal neurobehavioral intellectual development

## 1 in 6 children:

- cerebral palsy
- ↓IQ
- learning disabilities
- ADHD
- autism
- developmental delay



**>70% cases – effects evident in adulthood**

Dietrich K, Eskenazi B, Schantz S, et.al. Principles and Practices of Neurodevelopmental Assessment in Children: Lessons Learned from the Centers for Children's Environmental Health and Disease Prevention Research. Environ Health Perspect. 2005;113(10):1437-1446.

## **Socioeconomic status**

- nutrition, prenatal care
- education
- access to healthcare

## **Sociohereditary factors**

- maternal IQ, ethnicity, gender, culture

# **Determinants of Neurobehavioral Intellectual Development**

**Obstetric factors**  
**Support networks**  
**Quality of childrearing**

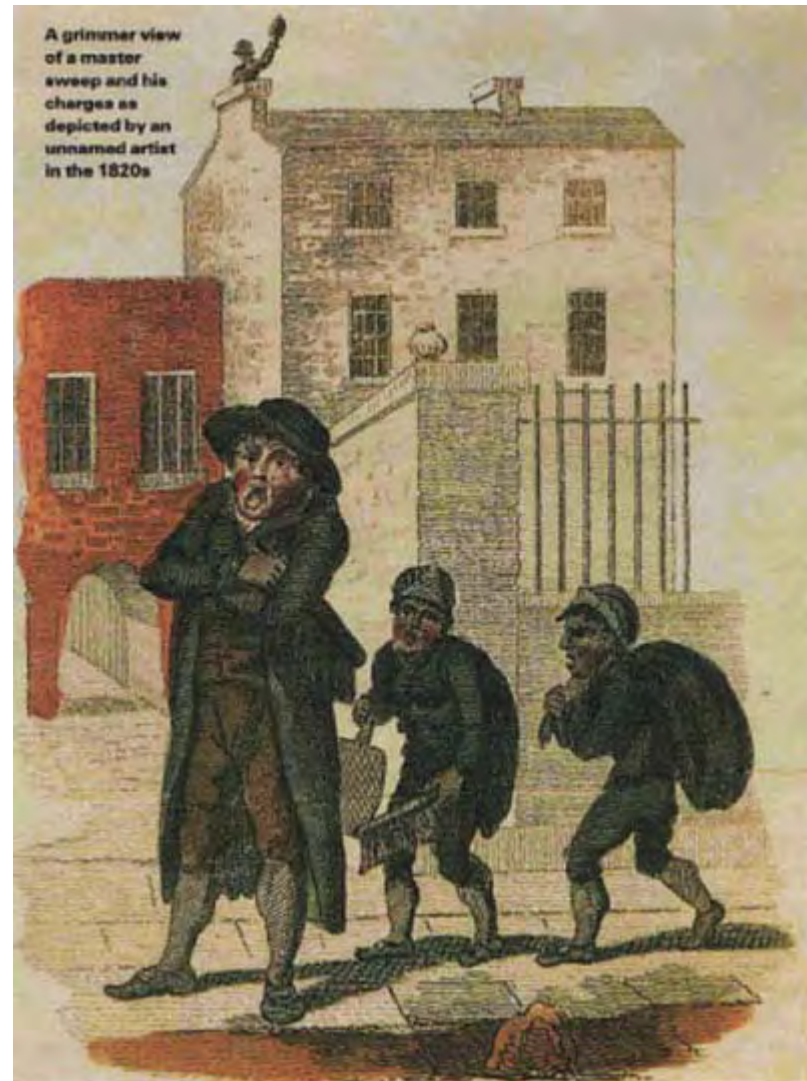
## **Chemical exposures**

- Pb, Hg, Mn, As
- PCBs, PAHs
- Pesticides, ETS



**PERCIVAL POTT (1775):**

**200 years later**  
3,4-benzpyrene

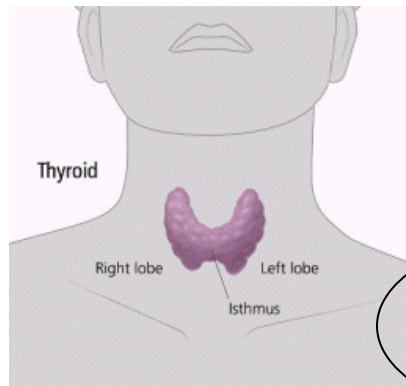


**LINKED SCROTAL CANCER TO CHIMNEY SWEEPS  
EXPOSED TO SOOT**

Percival Pott and the Chimney Sweeps' Cancer. Available from: <http://www.bookrags.com/research/percivall-pott-and-the-chimney-swee-scit-0412/>

# Compelling environmental links with childhood cancers

(cause & effect no dose-response trends)



**Thyroid neoplasm**

**Fetal exposure to diagnostic radiographs**



**Cancers**

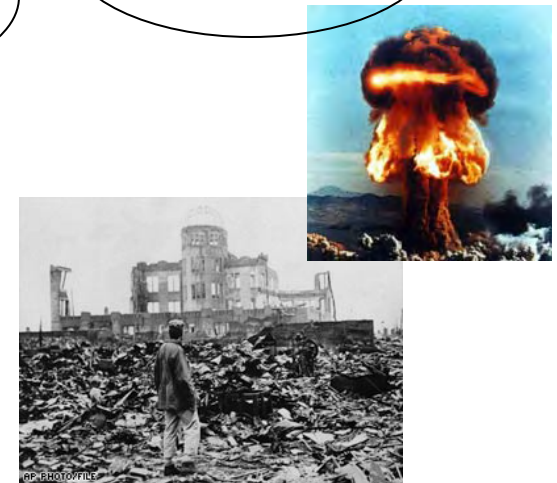
**Nuclear weapon's testing in USA & Russia**



**Industrial air pollution**



**Hiroshima atom bomb**



# Fetal Susceptibility

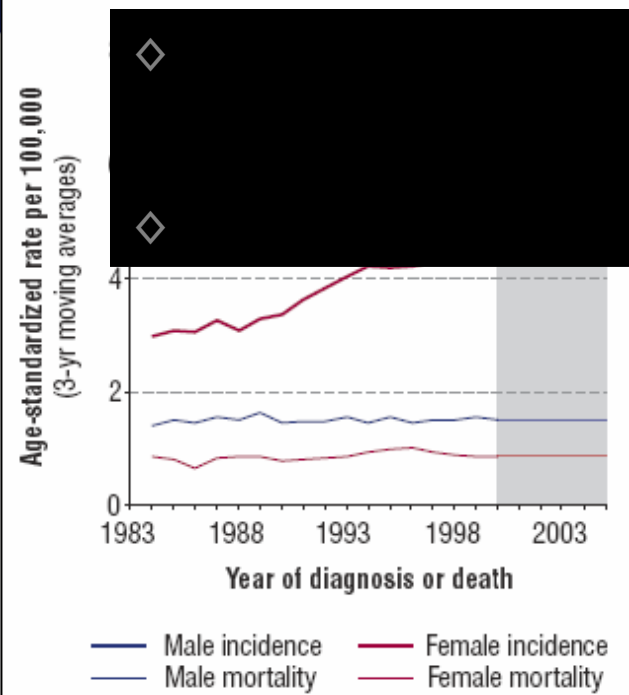
- Polycyclic aromatic hydrocarbons (PAH) are widespread air contaminants released by vehicles, combustion of tobacco products & power generation
- Studies indicate the developing fetus is more susceptible than the adult to carcinogenic effects of PAHs.



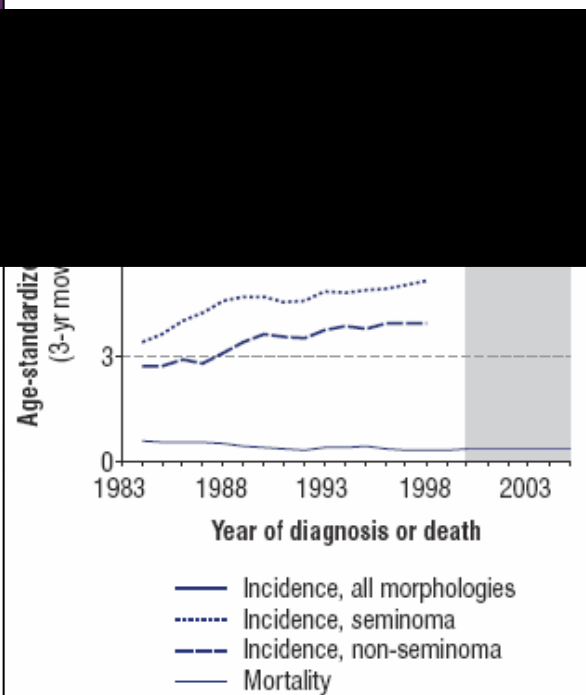
**Perera FP, Tang D, Tu Y, et al** , Biomarkers in Maternal and Newborn Blood Indicate Heightened Fetal Susceptibility to Procarcinogenic DNA Damage. *Environ Health Perspect.* 2004; 112(10): 1133–1136.

# Cancer in Young Adults in Canada

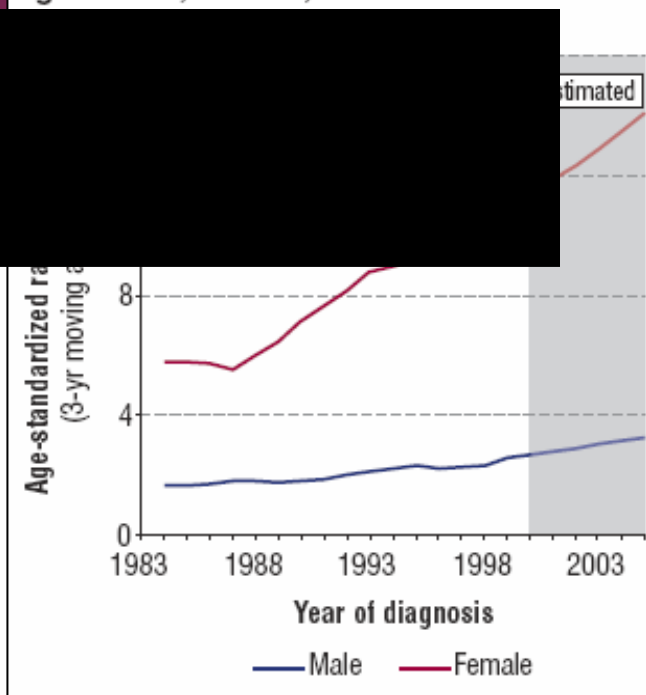
**Non-Hodgkin lymphoma**  
Age-standardized rates for adults aged 20–44, Canada, 1983–2005



**Testicular cancer**  
Age-standardized rates for males aged 20–44, Canada, 1983–2005



**Thyroid cancer**  
Age-standardized incidence rates for adults aged 20–44, Canada, 1983–2005



# Air Monitoring: What we look for Reports / Data



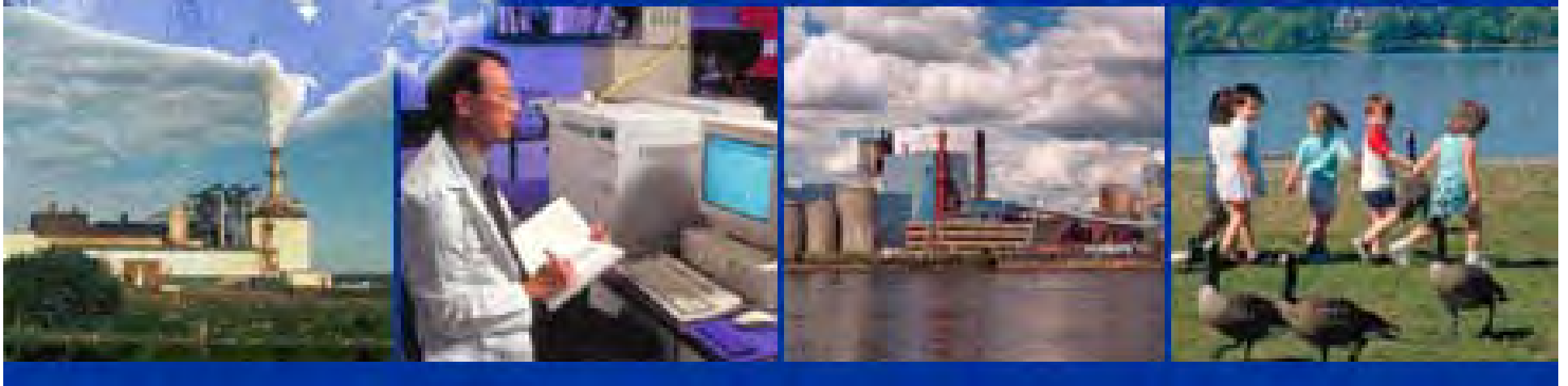
# **“Ambient Air Pollution and Children’s Health: A Systematic Review of Canadian Epidemiological Studies”**

1. Increased asthma ED visits
2. Increased respiratory hospital admissions and ED visits
3. Decrements in lung function and increased reporting of respiratory symptoms
4. Adverse pregnancy outcomes
5. Infant mortality: SIDS

***Koranteng S, Osornio Vargas AR, Buka I. Ambient Air Pollution and Children’s Health: A Systematic Review of Canadian Epidemiological Studies. Paediatr Child Health 2007; 12(3):225-233.***

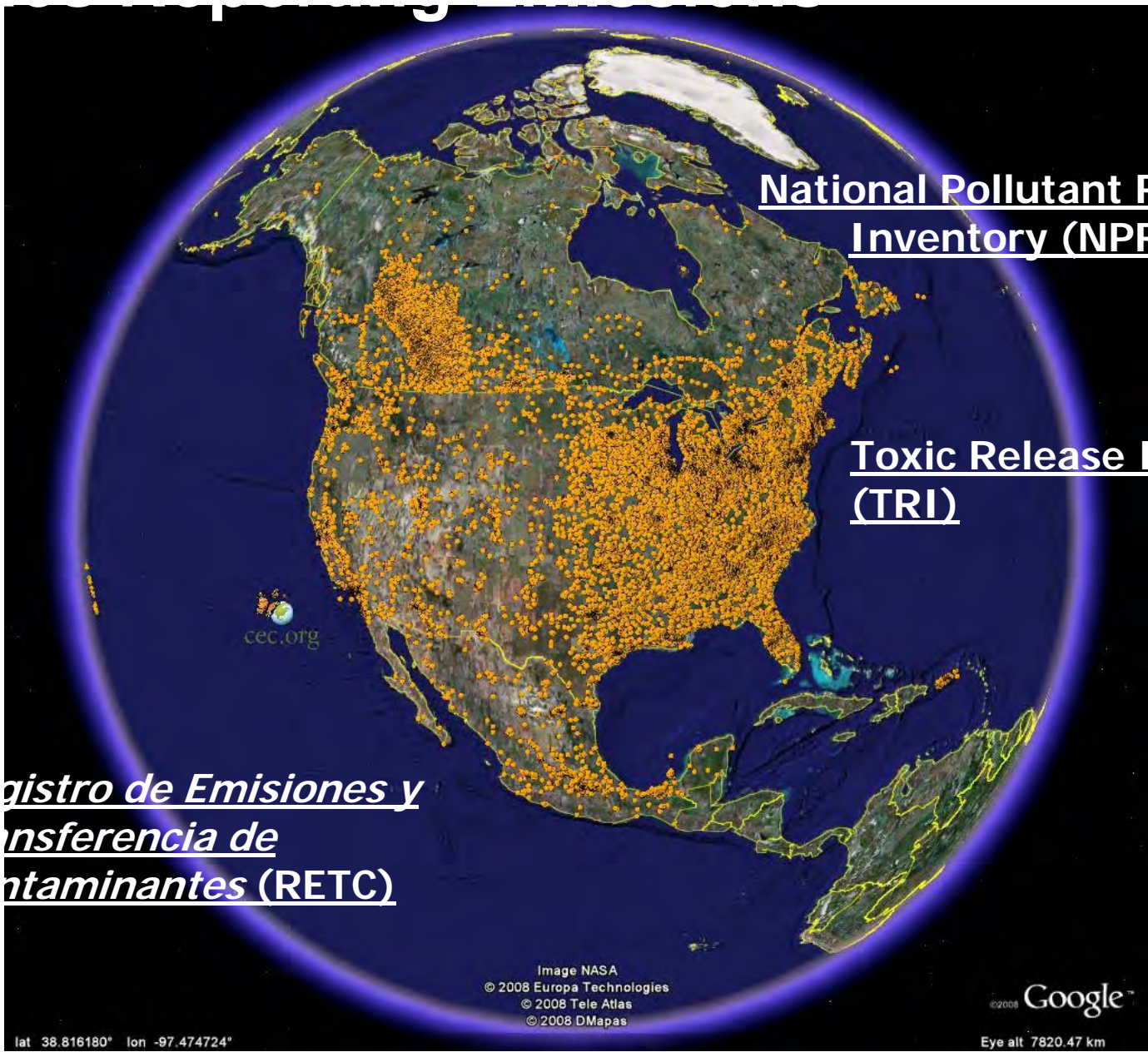
# NPRI

MERCURY ASBESTOS SO<sub>2</sub> LEAD  
BENZENE SO<sub>2</sub> NATIONAL POLLUTANT RELEASE INVENTORY  
LEAD ASBESTOS SO<sub>2</sub> MERCURY



- > 300 chemicals, carcinogens, teratogens, neurotoxins (provinces collect information separately)
- > 8,000 facilities

[http://www.ec.gc.ca/pdb/npri/npri\\_home\\_e.cfm](http://www.ec.gc.ca/pdb/npri/npri_home_e.cfm)



National Pollutant Inventory (NPI)

Toxic Release Inventory (TRI)

Registro de Emisiones y Transferencia de Contaminantes (RETC)

cec.org

Image NASA  
© 2008 Europa Technologies  
© 2008 Tele Atlas  
© 2008 DMapas

©2008 Google™

Eye alt 7820.47 km

lat 38.816180° lon -97.474724°

# CHILDREN ARE NOT LITTLE ADULTS



- 1. Different and unique exposures**
- 2. Dynamic developmental physiology**
- 3. Longer life expectancy**
- 4. Politically powerless**

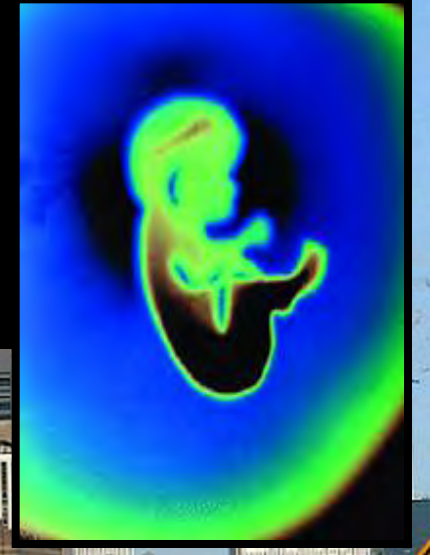
# Cognitive development & PAHs

The results require confirmation that

Many chemicals cross the placenta

- Lead, mercury, polychlorinated biphenyls (PCBs), polyaromatic hydrocarbons (PAHs)
- Cotinine, alcohol, methadone

development at 3 years of age, with implications for school performance.



Perera FP, Rauh V, Whyatt RM, et.al. Effect of Prenatal Exposure to Airborne Polycyclic Aromatic Hydrocarbons on Neurodevelopment in the First 3 Years of Life among Inner-City Children. *Environ Health Perspect.* 2006; 114(8):1287-1292.



WHO

<http://www.usatoday.com/story/news/health/2011/08/18/bpa-canada/971181>

## declared dangerous substance

Added to toxic substances list  
CTV.ca News Staff  
[ArticleNews/story/CTVNews/200810131017?hub=CTVNewsAt11](http://www.ctv.ca/ArticleNews/story/CTVNews/200810131017?hub=CTVNewsAt11)



### ❖ Breast milk is the safest and most complete nutrition for infants

- Mothers should avoid toxic exposures
- Milk (human, cow, sheep) can be a marker of environmental contamination

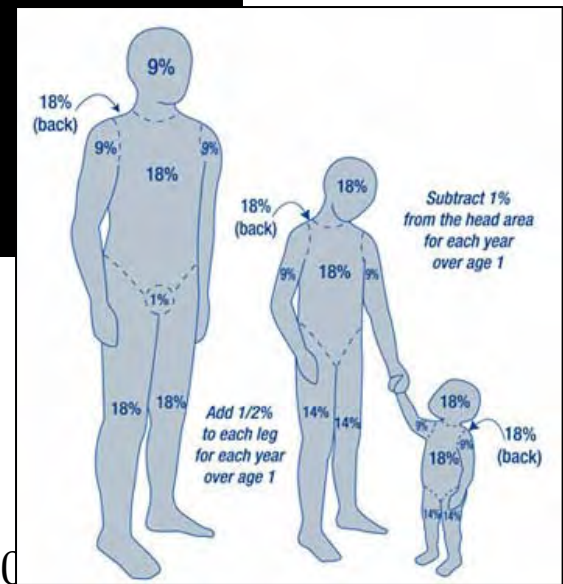
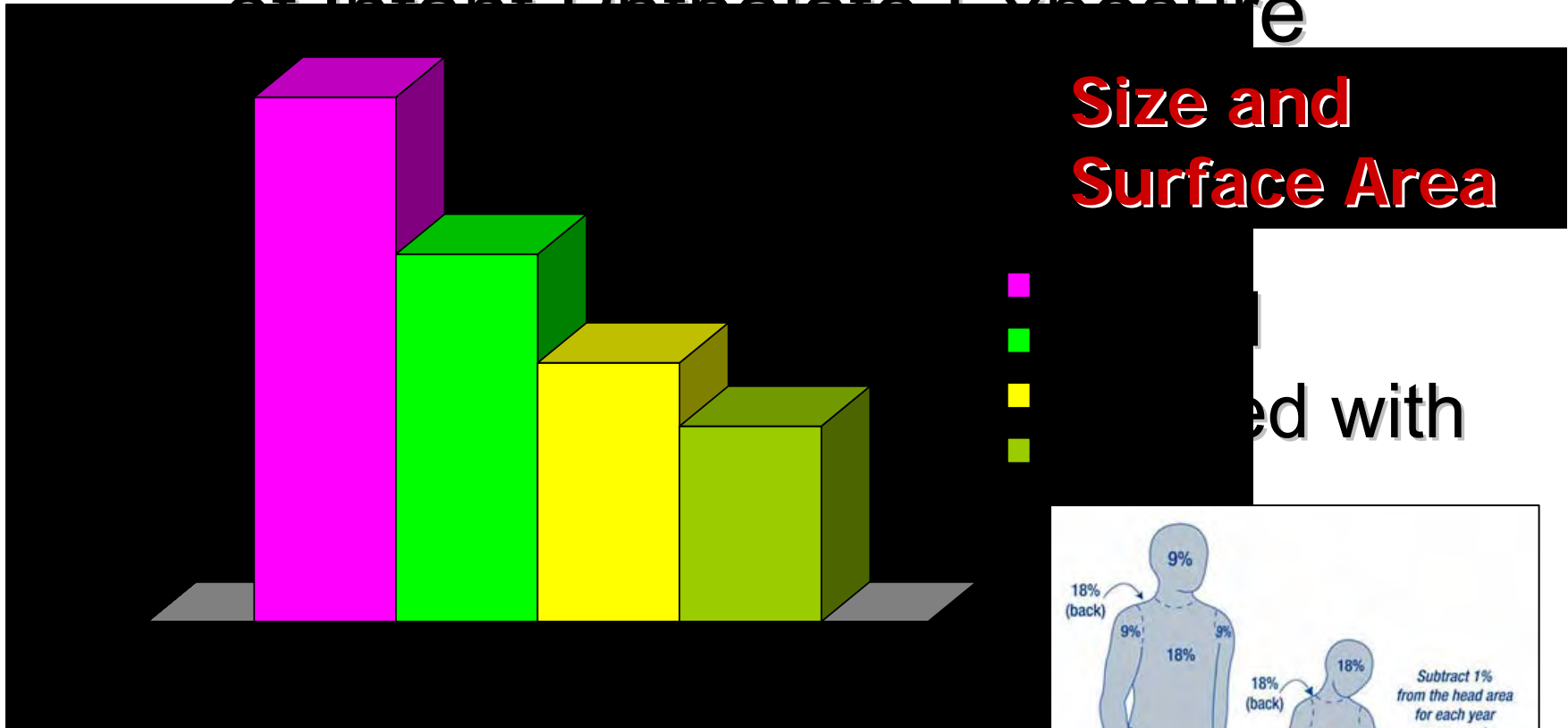
### • Melamine

### ❖ DDT, DDE, PCBs, TCDD (dioxins), nicotine, lead, methylmercury, alcohol

**Intentional melamine contamination in Chinese infant formula led to at least 150 cases of renal failure and 6 deaths.**

Buka I, Vargas ARO, Karr C. Melamine Food Contamination: Relevance to Canadian Children. *Pediatr Child Health*. 2009;14(4):222-224.

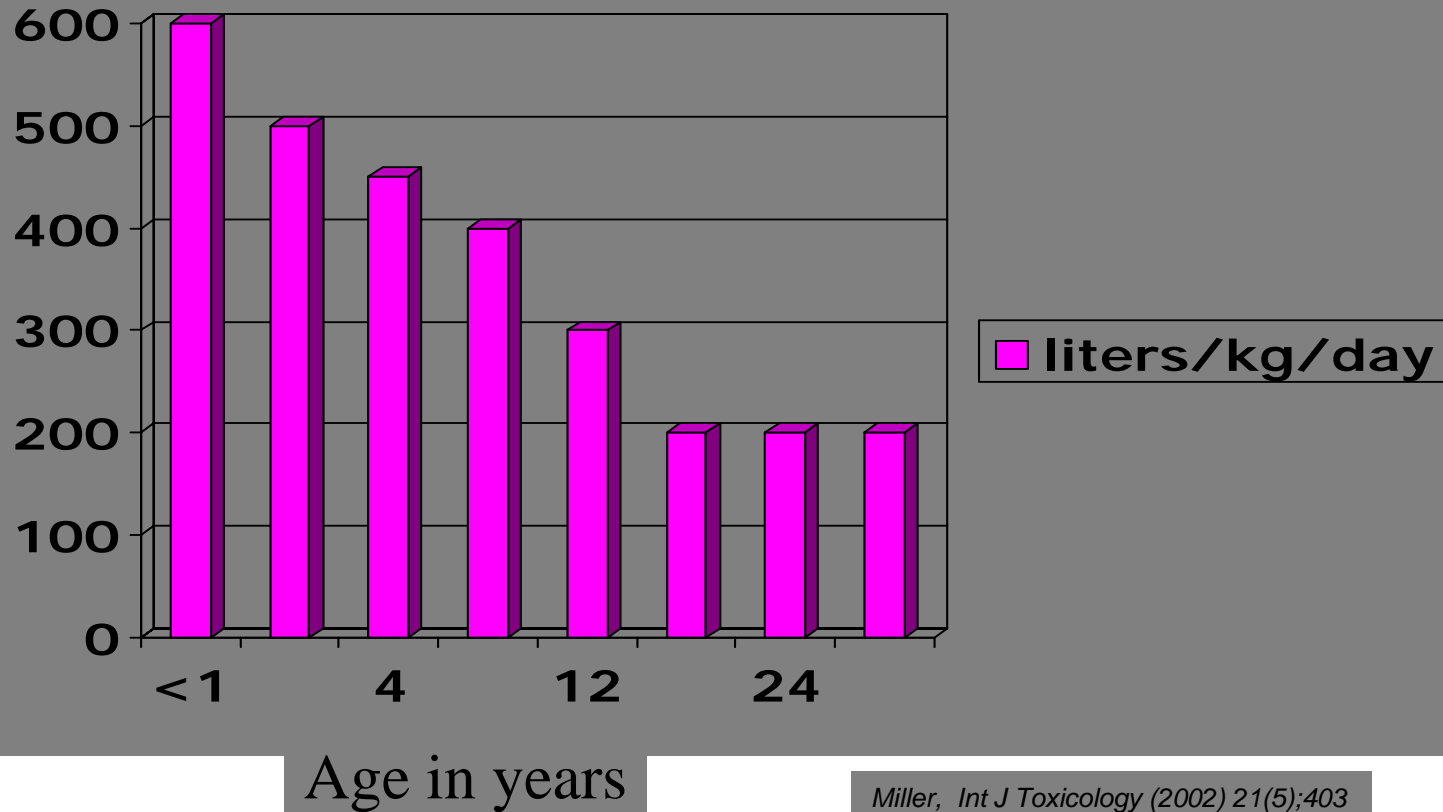
# Baby Care Products: Possible Sources of Infant DDT/Chlordane Exposure



# DYNAMIC DEVELOPMENTAL PHYSIOLOGY

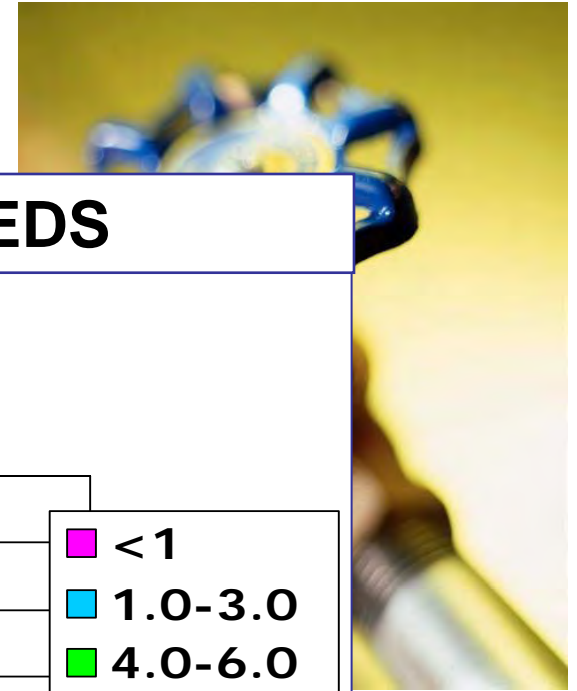
## OXYGEN DEMAND

Minute ventilation per kg body weight/day



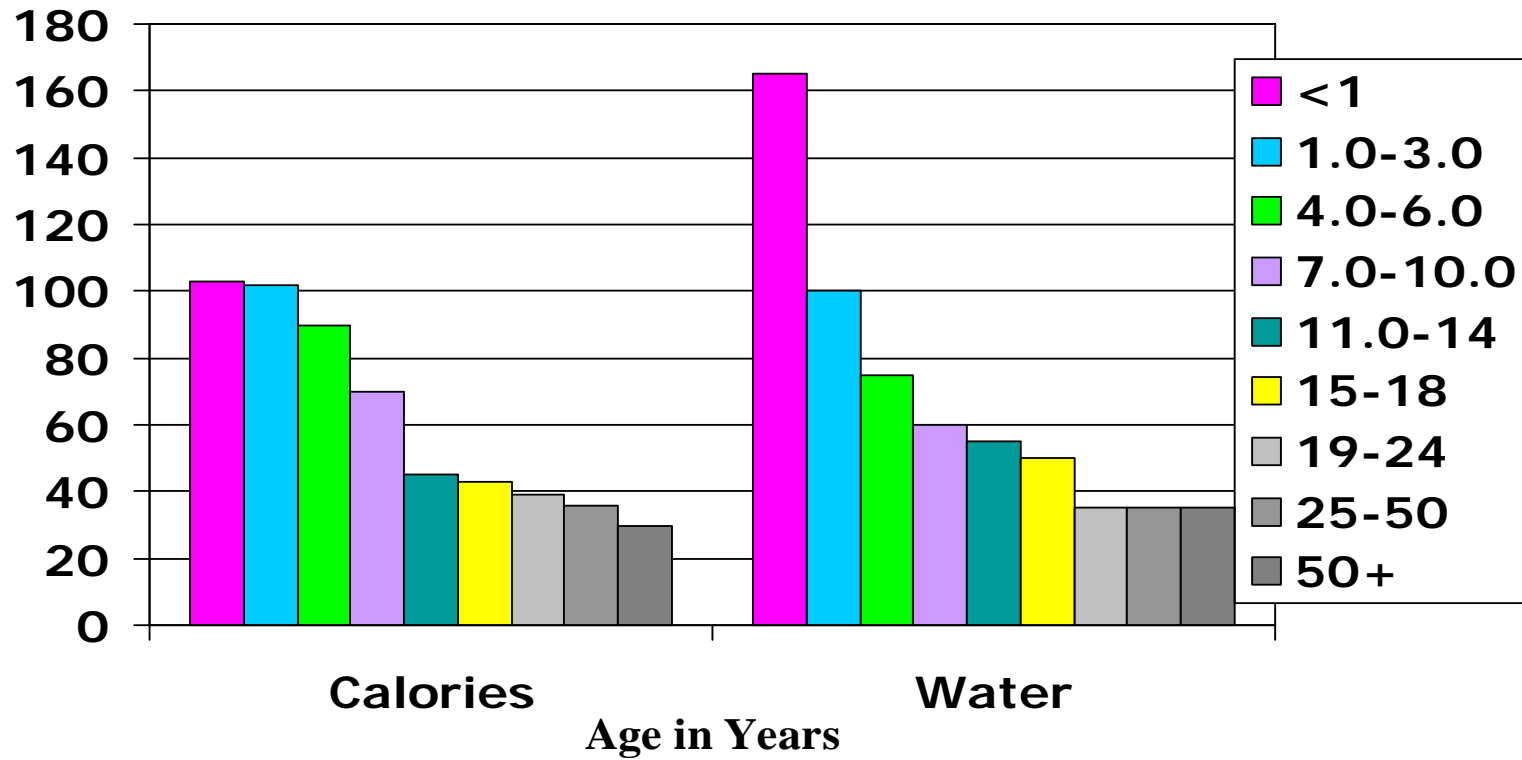
Miller, *Int J Toxicology* (2002) 21(5);403

# Lead water pipes in 5000 Edmonton homes

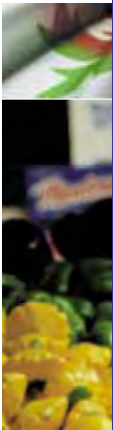


## CALORIE AND WATER NEEDS

Maintenance requirements  
cal/kg/day                      ml/kg/day



• "Tap w  
h  
n  
r  
n  
F  
2  
to 15



we eat  
AN INTERNATIONAL COMPARISON  
OF PESTICIDE REGULATIONS

[http://www.davidsuzuki.org/files/SWAG/D\\_SF-HEHC-Food-sum1.pdf](http://www.davidsuzuki.org/files/SWAG/D_SF-HEHC-Food-sum1.pdf)

# Longer Life Expectancy

- Will Lead Exposure In Youth Lead To Alzheimer's In Old Age?
  - Jinfang Wu, Md. Riyaz Basha, Brian Brock, et.al. Environmental Trigger for Alzheimer's Disease  
[http://www.scientificblogging.com/news\\_releases/will\\_lead\\_exposure\\_in\\_youth\\_lead\\_to\\_alzheimers\\_in\\_old\\_age](http://www.scientificblogging.com/news_releases/will_lead_exposure_in_youth_lead_to_alzheimers_in_old_age)
- A 50-year follow-up of childhood plumbism. Hypertension, renal function and hemoglobin levels among survivors.
  - Hu H. Am J Dis Child. 1991;145(6):681-687.
- Blood lead levels and mortality.
  - Lustberg M, Silbergeld E. Arch Intern Med. 2002;162(21):2443-2449.



Health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity.



[www.WHO.int](http://www.WHO.int)

**Children should reach their full potential as contributing members of society and are intrinsic for sustainability.**

**Represent 20% of the population but 100% of the future**

# WHY A PAEDIATRIC ENVIRONMENTAL HEALTH SPECIALTY UNIT?

- **To ensure that communities have access to special knowledge and resources for children and pregnant women faced with health risks due to a natural or human-made environmental hazard.**
- **Most healthcare professionals do not receive training to advise, prevent, recognize, and manage environmentally-related conditions in their patients.**





P  
a  
r  
t  
n  
e  
r  
s  
h  
i  
p  
s



**Commission for  
Environmental Cooperation  
of North America**



**World Health  
Organization**

**Comisión para la  
Cooperación Ambiental  
de América del Norte**

**Commission de  
Coopération environnementale  
de l'Amérique du Nord**



## Mission

- Offer evidence based clinical care supported by research to identify local health and environment linkages
- Interface science, practice and policy through education and advocacy to better protect children from adverse environmental influences

# WHAT WE DO

- **Assessment and clinical care**
- **Research**
- **Education**
- **Advocacy**



# Assessment and Clinical Care



- Assess the child's condition taking into account their physical, psychosocial and chemical environmental history
- Offer investigations, advice and treatment when necessary
- Report clinical findings, investigations , and decisions to the child's referring health care provider
- Consultation by telephone, email, or telehealth when families and/or health care professionals live at a distance

# Assessment and Clinical Care

- Use evidence collected for early identification and protection of other children potentially at risk
- Develop a data base that will be invaluable to bring about population health interventions



# Assessment and Clinical Care

The clinical team includes:

- Pediatrician
- Occupational health and environment physician
- Pediatric environmental health nurse And specialists in laboratory medicine, public health, & sub specialists at the Stollery Children's Hospital

# Assessment and Clinical Care

The clinic will see referrals from Family physicians, pediatricians and specialists:

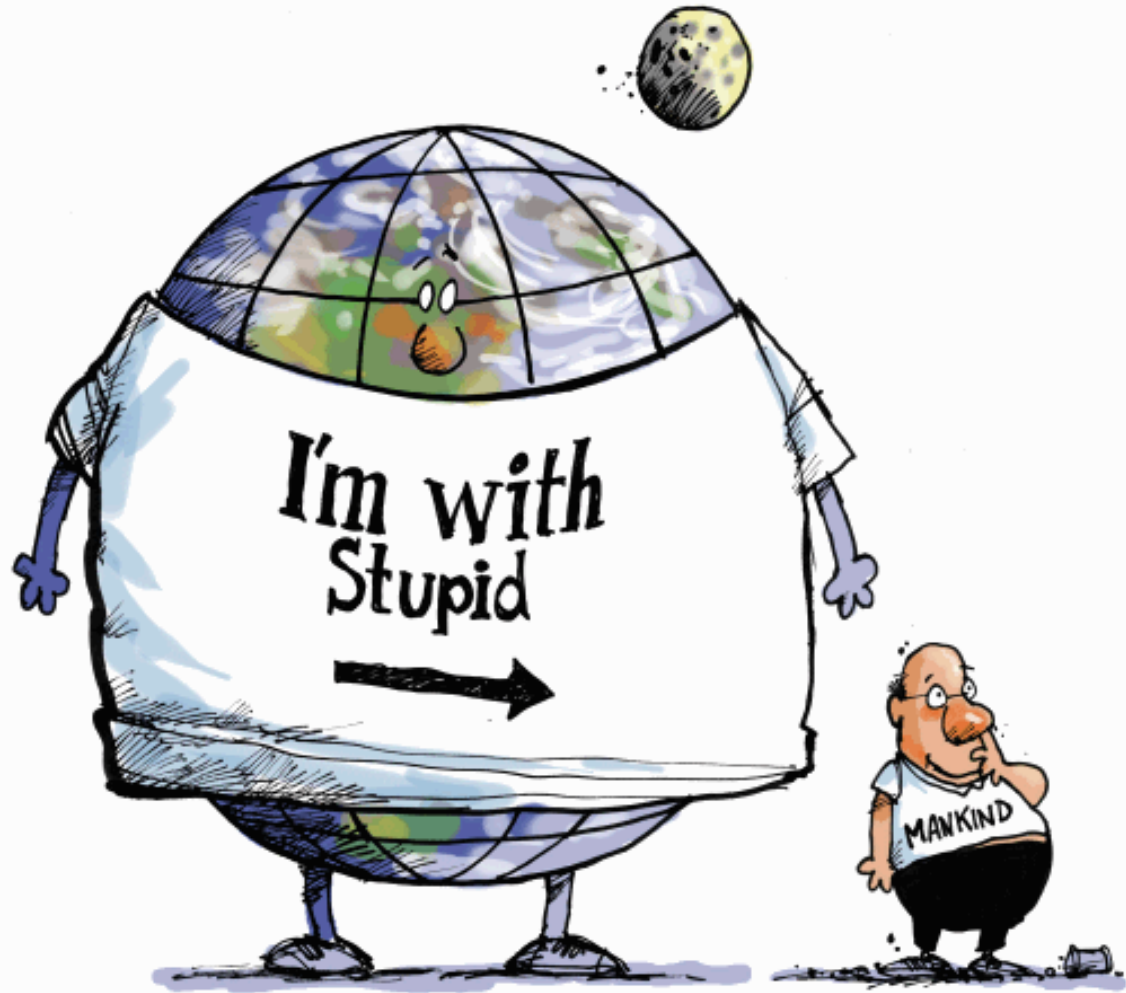
- children and pregnant women with or suspected environmental exposure
- environmental assessment of children who have diagnosed health issues



# Education



tabtoons@telus.net  
caglecartoons.com



# Advocacy



## Convention on the Rights of the Child Sept, 1990

### *Article 24*

*Parties recognize the right of the child to the enjoyment of the highest attainable standard of health ....*

*(and) shall pursue full implementation of this right and, in particular, shall take appropriate measures:*

*“...to combat disease ...taking into consideration the dangers and risks of environmental pollution”*

# Pediatric Environmental Health: *and the overburden health care system*

**In the 1800's:** Clinicians focus on social issues, such as housing and sanitation...



**In the 1900's:** Clinicians focus on prevention of infectious disease

*“More recently, the practice of public health is seeing a return to its roots.... to address skyrocketing rates of preventable chronic disease”*

- Dr. Sylvie Stachenko,  
Dean, School of Public Health  
University of Alberta

# Acknowledgements

- Alvaro Osornio-Vargas
- Melissa Wiens

-