

**Commission for Environmental
Cooperation
Lindane Task Force
Children's Environmental Health
& Lindane**



**February 11-13, 2004
Anchorage, Alaska, U.S.A.**

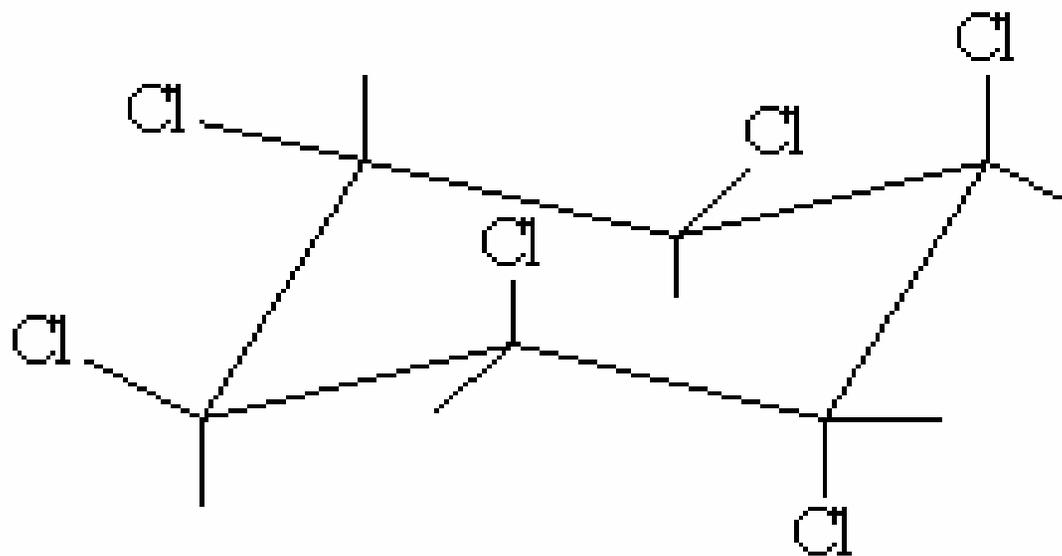
Health Effects and Childrens' Exposure to Lindane and Hexachlorocyclohexane



Dr. Irena Buka, MB. ChB. FRCP(C)

- Chair of the Expert Advisory Board on Children's Health & the Environment for the Commission for Environmental Cooperation
- Assoc Clinical Prof of Peds, U of A, Canada
- Director, Ped Enviro Health Specialty Unit

Lindane - γ -Hexachlorocyclohexane (γ -HCH)



gamma-1,2,3,4,5,6-hexachlorocyclohexane

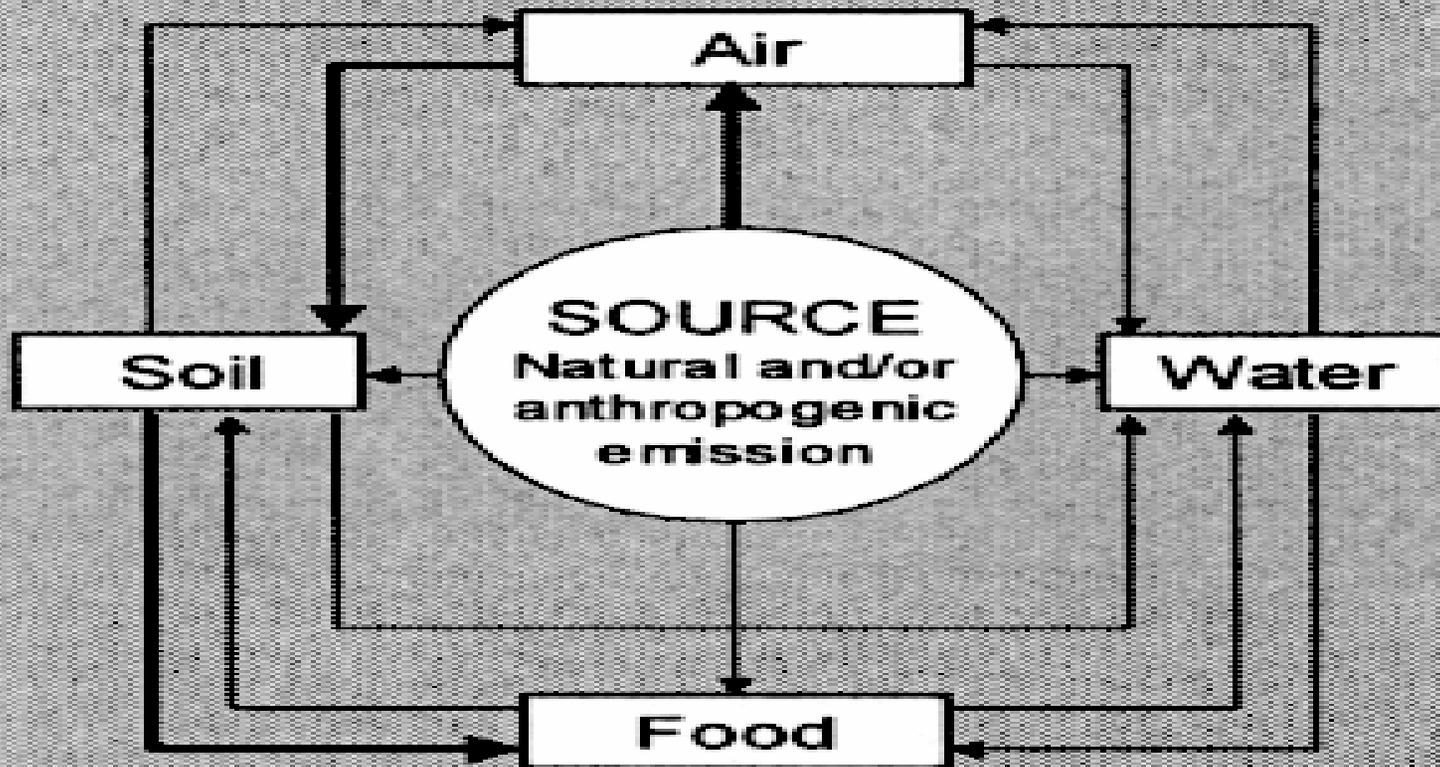
Organochlorine - used as pesticide

1. Children - scabies
- lice
2. Veterinary application
cattle, pigs - ticks, fleas, fly larvae
3. Domestic animals - fleas
4. Seed and crop disinfection
5. Ornamental plant pest control
6. Scorpion control



→ wide dissemination in environ

Environmental media



Lindane absorption

1. Dermal
2. Inhalation
3. Ingestion
4. Transplacental
5. Breast milk



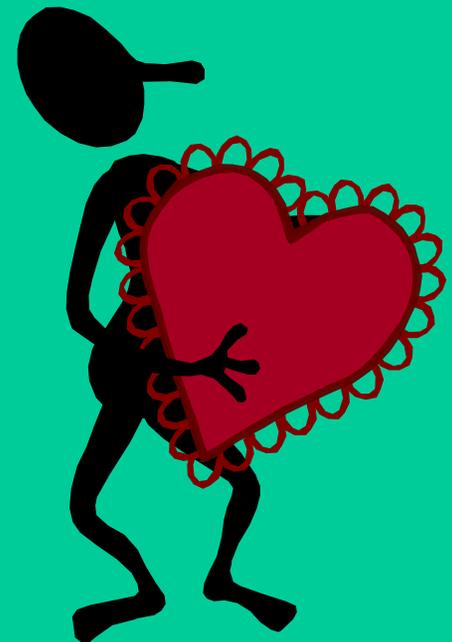
How are children exposed to chemical environmental hazards?

1. Air
2. Water
3. Food
4. Skin absorption
5. Trans placental



Lindane accumulation

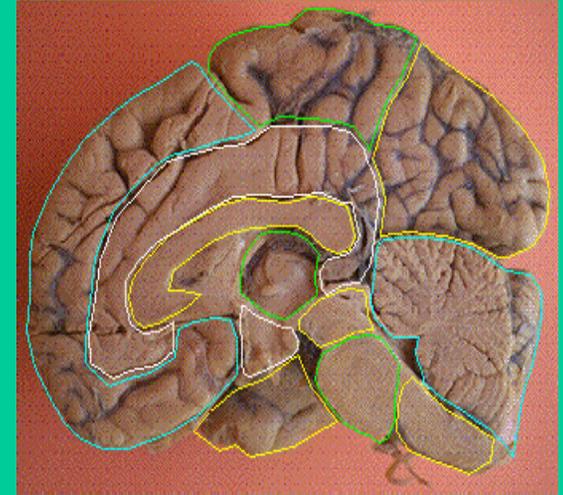
- > fat > brain
- > kidney > muscle
- > lungs > heart > liver
- > blood



Lindane health effects

Higher dose

1. Neurotoxic - seizures
2. Haematologic aplastic anemia



Lindane health effects



Lower dose

1. Teratogenic ↑ fetal loss
 ↓ fetal & placental wt
2. Cancerogenic - tumor promoters
3. Immunologic - suppression
4. Endocrine disrupter - reproductive abnormalities

Lindane neurotoxicity



mitochondria



sarcoplasmic reticulum



myelin



brain microsomes



Lindane neurotoxicity



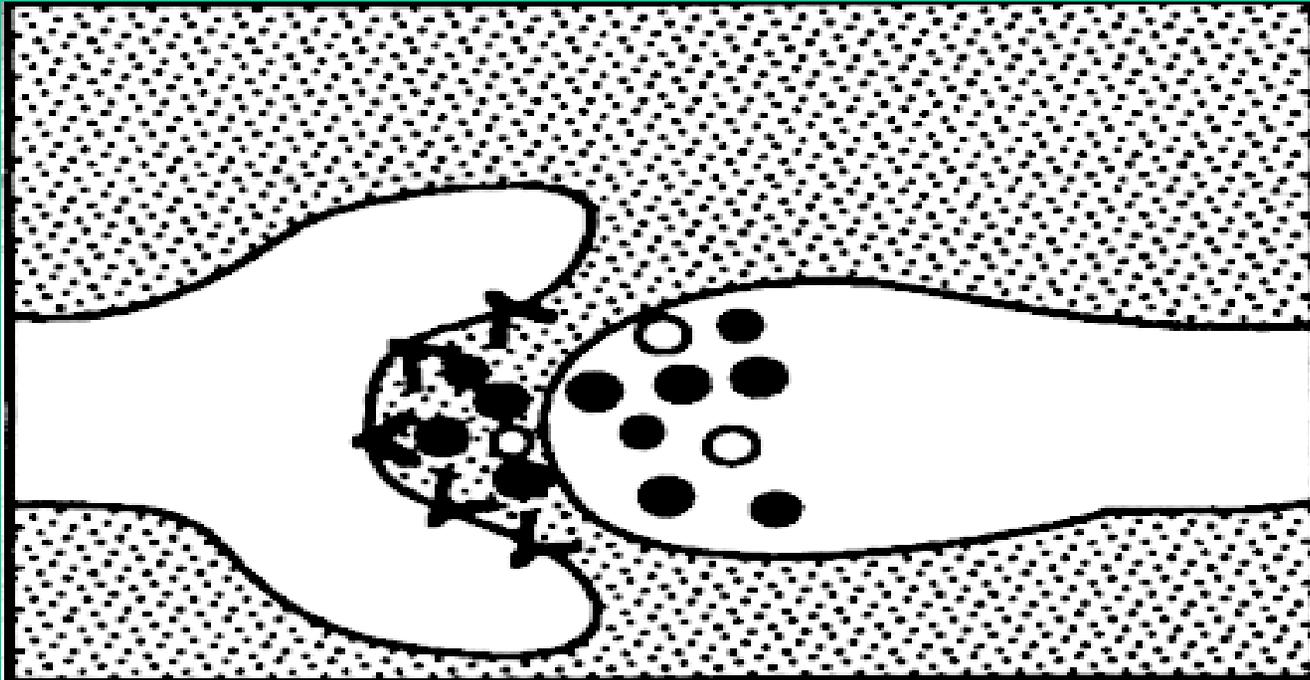
stimulating action
on
synaptic transmission
by
interacting with receptors



GABA - chloride channel complex

Neurodevelopmental Processes

Transmitters and Receptors



Lindane neurotoxicity

Alterations in dopamine,
serotonin, noradrenaline



affect attention and behaviour



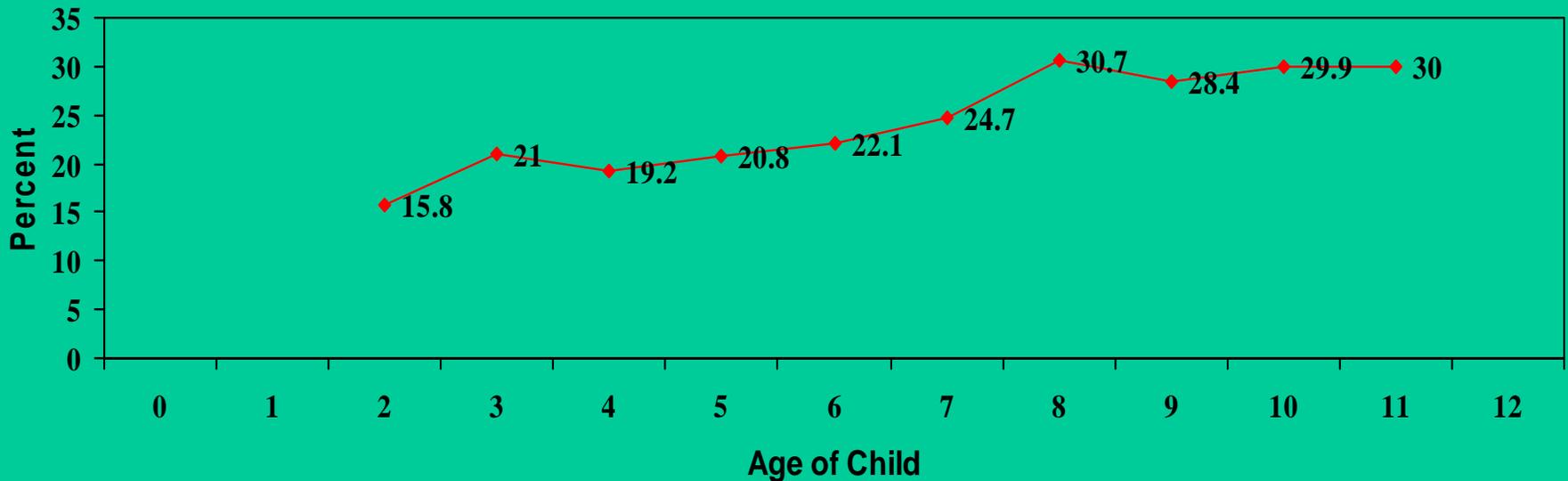
Neurodevelopmental Disorders (ND)

1. Learning disabilities
2. Attention deficit hyperactive disorder
3. Reduced IQ
4. Behavioral disorders
5. Autism spectrum disorders



Prevalence of ND

Prevalence of One or More Problems
Increases as the Age of Child Increases (%)*



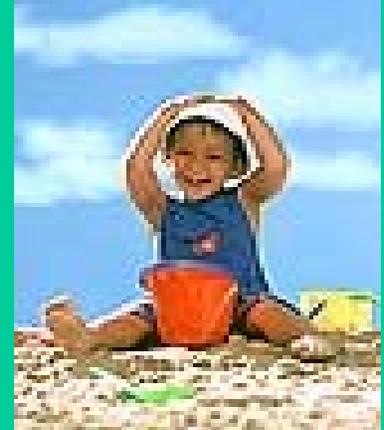
* Aggressive behaviour, emotional problems, and hyperactivity behaviour were assessed for children age
conduct disorder, emotional disorder, and relationship problem were assessed for children

Prevalence of ND



- 17% deaf, blind, speech deficit
cerebral palsy
emotional/behavioral disorders
learning disabilities
- 5-10 % learning disabilities alone
- 6-17% attention deficit hyperactive
disorders

ND Aetiology



G
E
N
E
T
I
C
S

Physical
Biological
Psychoemotional
Socioeconomic
Chemical

- environments

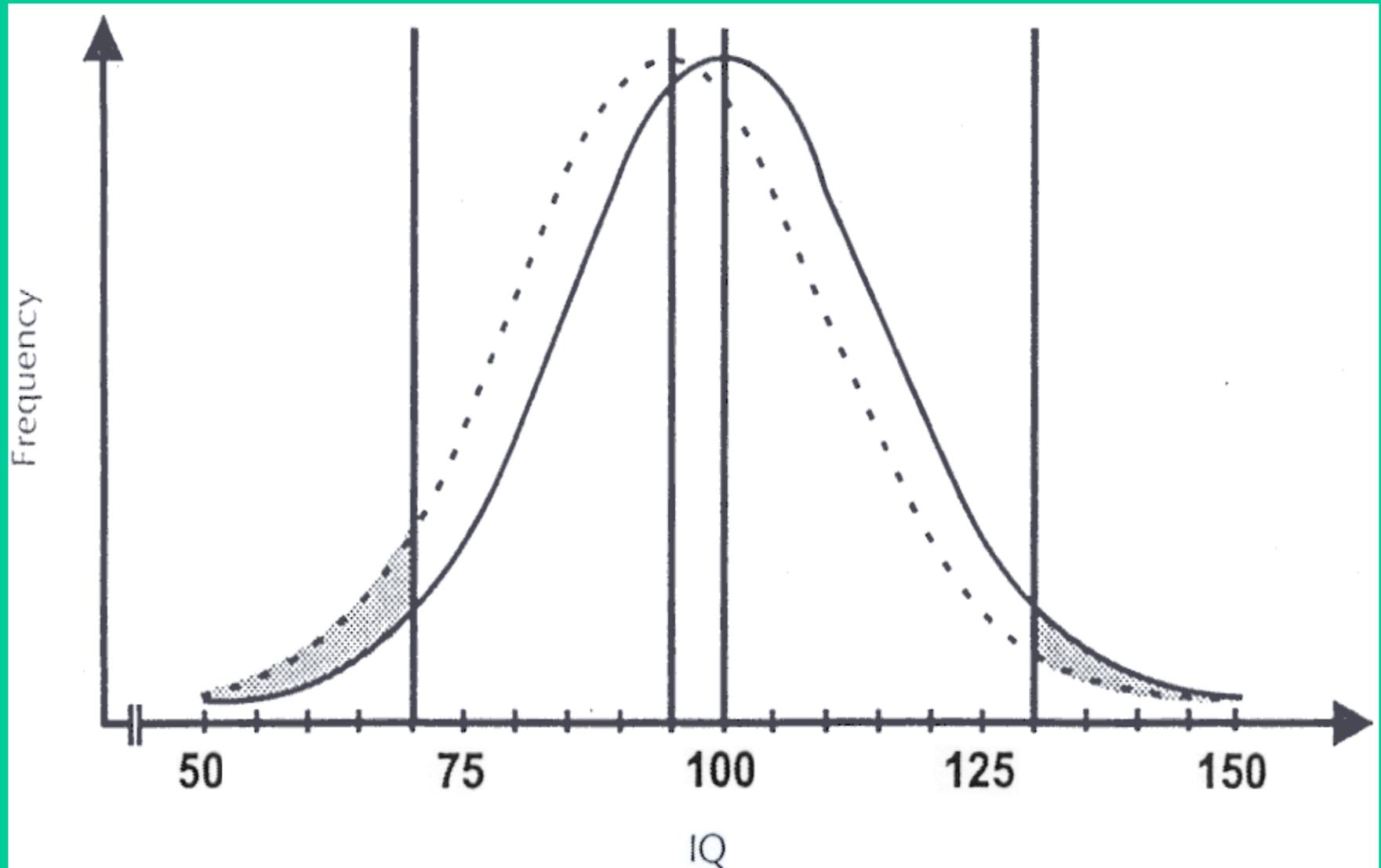
ND Aetiology

- chemical toxins

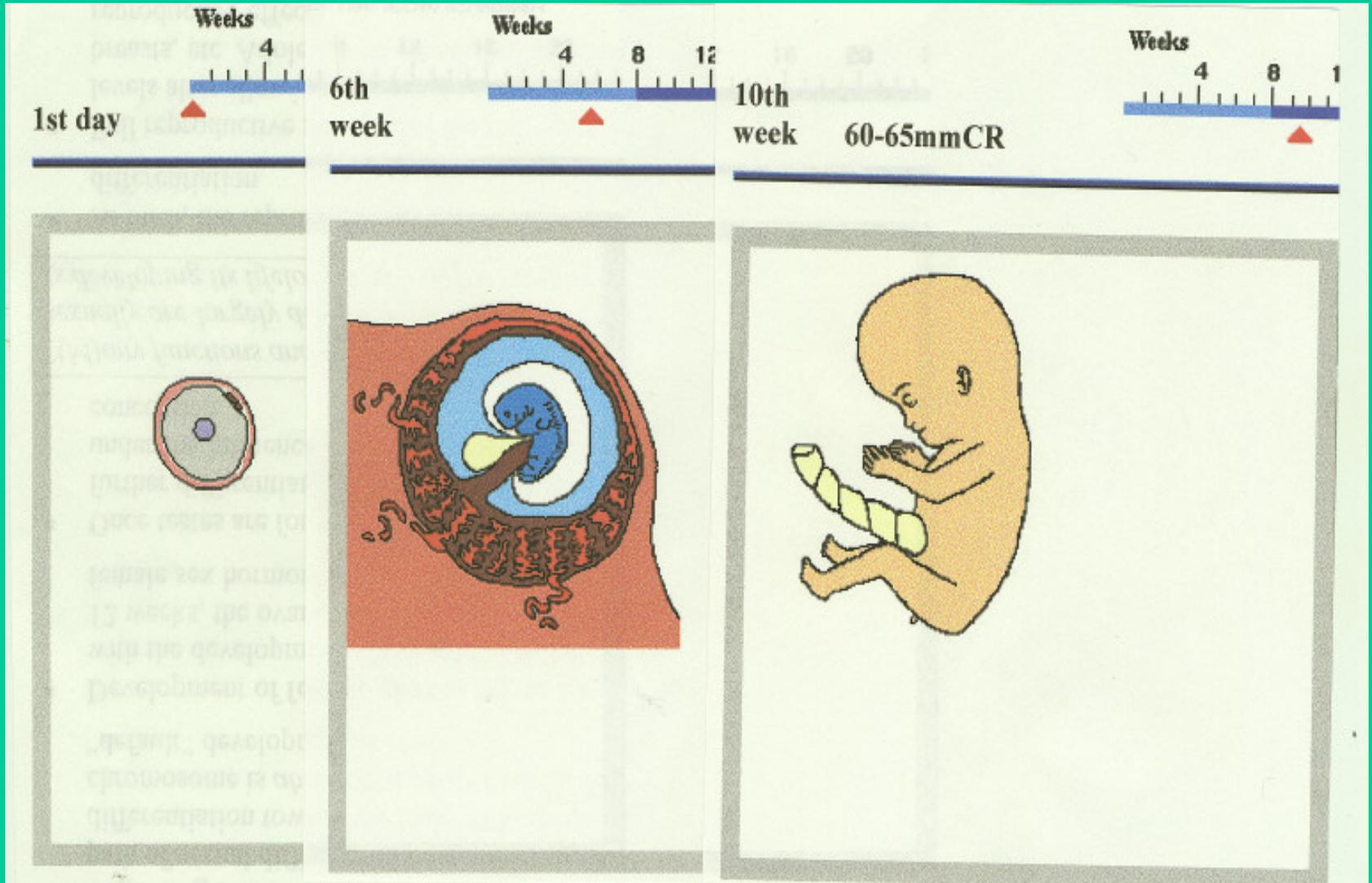


1. Lead (Pb)
2. Mercury (Hg)
3. Polychlorinated biphenyls (PCBs)
4. Foetal alcohol syndrome/effect (FAS/FAE)
5. Environmental tobacco smoke (ETS)
- other neurotoxins not studied

Normal Distribution of IQ with a Mean of 100 (solid curve) and Decreased by Five Points (dashed curve)



Foetus in utero



Child Development

Preconception

2 generations

++



Conception

continuous

critical

Adolescence

complex

delicate

...steps

Infant



Microenvironments

Developmental physiology

Neurobehavioral stages



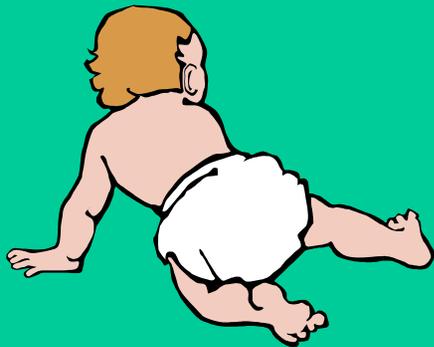






Infant Developmental Physiology

- ↑ surface to vol^e ratio - skin permeable
- ↑ metabolic rate
- ↑ O₂ consumption



- ↑ lung absorption
- ↑ GI absorption
- degradation pathways
- ↓ renal excretion
- ↓ blood brain barrier

Infant Developmental Physiology

↑ H₂O intake
(infant 150 mls/kg/day)
(adult 2-3 L/day)

↑ calories/kg/day
- limited dietary variety







Neurobehavioral Stages

- hand to mouth activity
- play, fun
- limited judgment









Neurodevelopmental Disorders

- vital next steps

1. Neurodevelopmental databases
2. Biomonitoring of body burden chemical contaminants
3. Biomonitoring with health outcome data



Neurodevelopmental Disorders

Our children are our future



PREVENTION





















