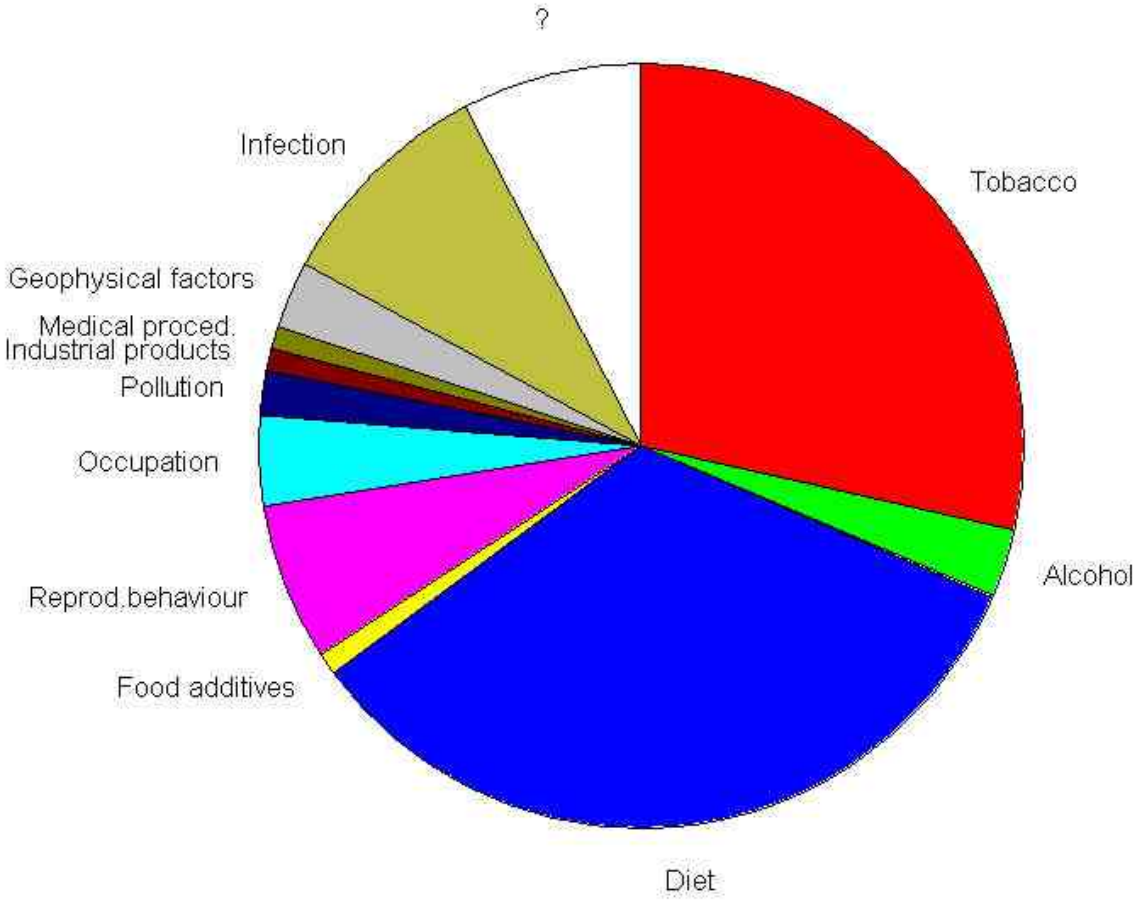
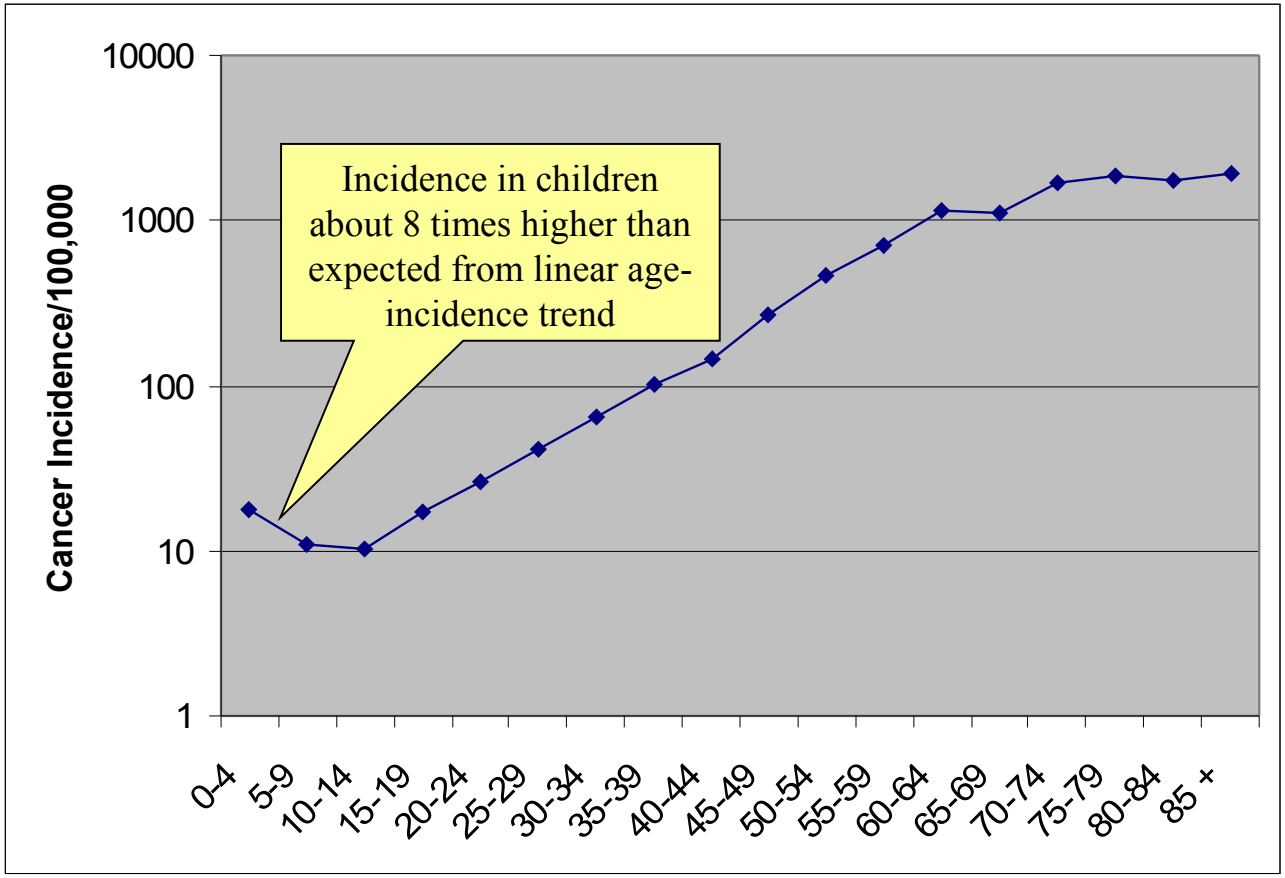
Childhood Cancer and the Environment

Cancer Deaths in Adults Attributed to Environmental Factors



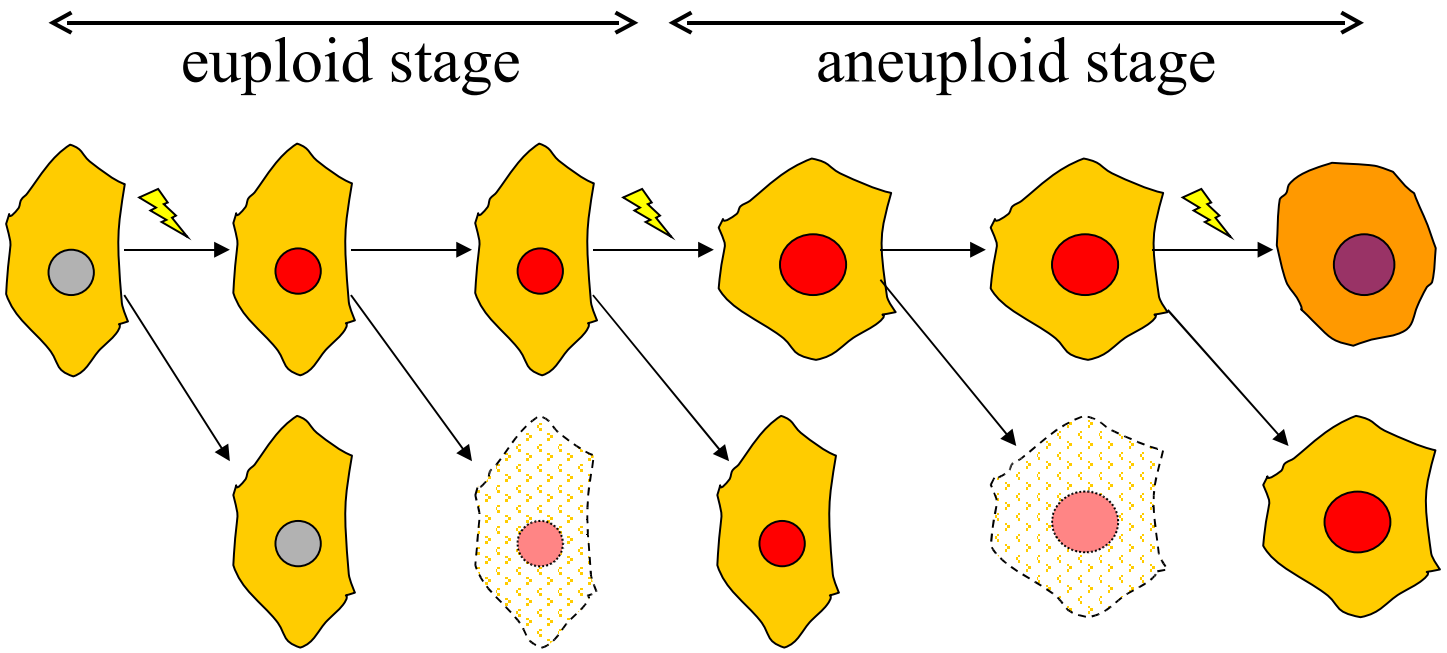
Doll & Peto 1981

Cancer Incidence by Age



Austria, 2003

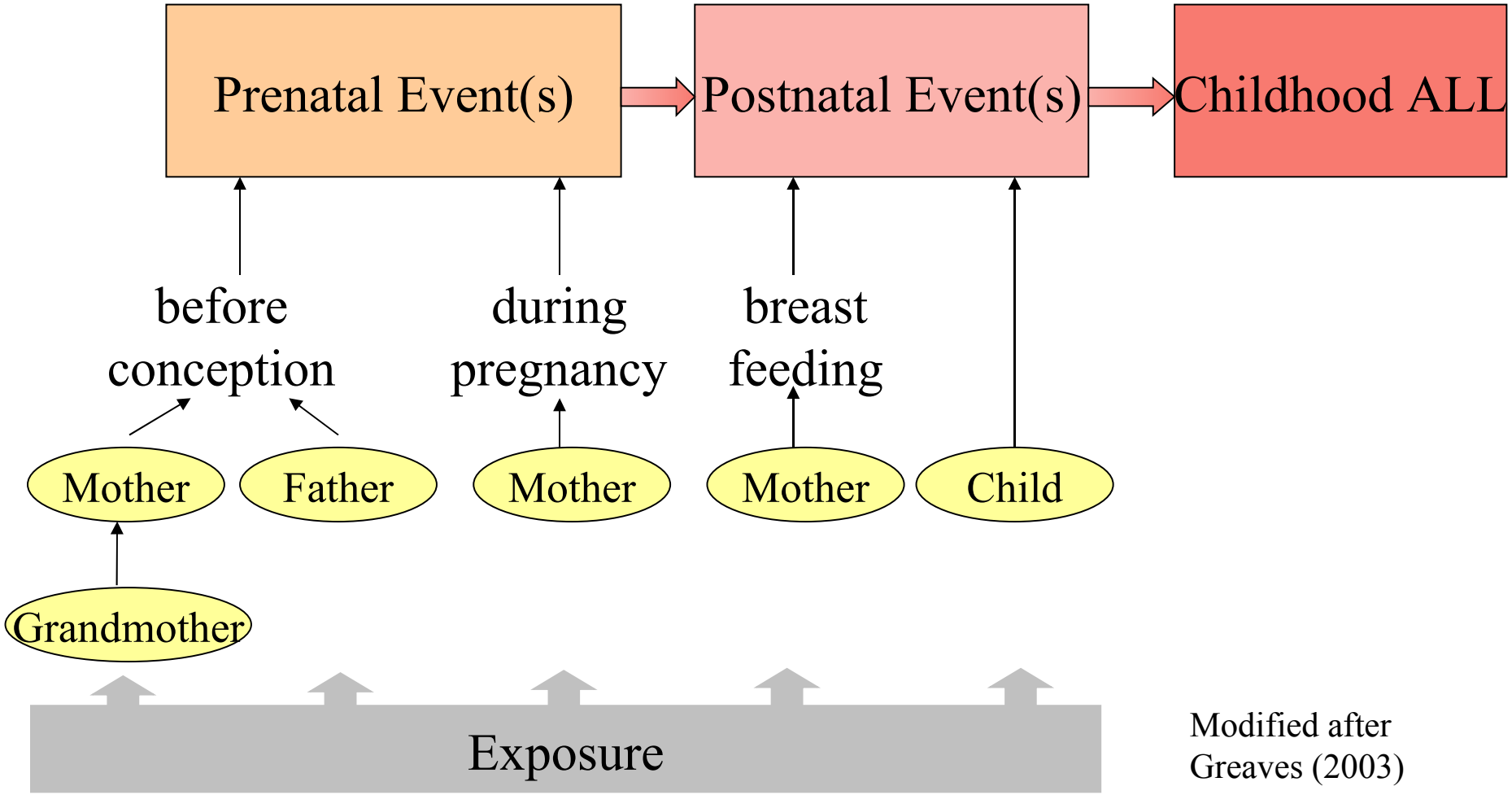
Multistage Carcinogenesis



Cancer in Childhood

- There is evidence that at least one stage of the malignant process is already present at time of birth
  - twin studies of acute lymphocytic leukaemia
  - umbilical cord samples
- Higher turn-over rate of stem cells increases the likelihood of further genetic events

Model of Childhood ALL



Modified after Greaves (2003)

Preconceptional Risk Factors for ALL

Target	Exposure	Risk
Mother	Solvents (e.g. TCE)	+
	Paints/thinners	+
	Pesticides	+
	Oral contraceptives	+
	Vegetables/fruits	-
	Protein rich nutrition	-
Father	Exhaust fumes	+
	Solvents	+
	Particulate matter (occupational)	+
	Radiation exposure	++
	Cigarette smoking	++
	Alcohol	+
	Amphetamines	+

Modified after Kim et al. (2006)

Prenatal Risk Factors for ALL

Target	Exposure	Risk
Mother	Solvents/hydrocarbons (occupational)	++
	Paints/thinners	++
	Pesticides	+
	Organic dusts	+
	Radiation	+
	Electric appliances	+
	Viral exposure (EBV)	+
	Antihistamins	+
	Sugars and sirups	+
	Alcohol	+/-
	Vitamins	-
	Cigarette smoking	-- ?
	Folate/iron supplements	--

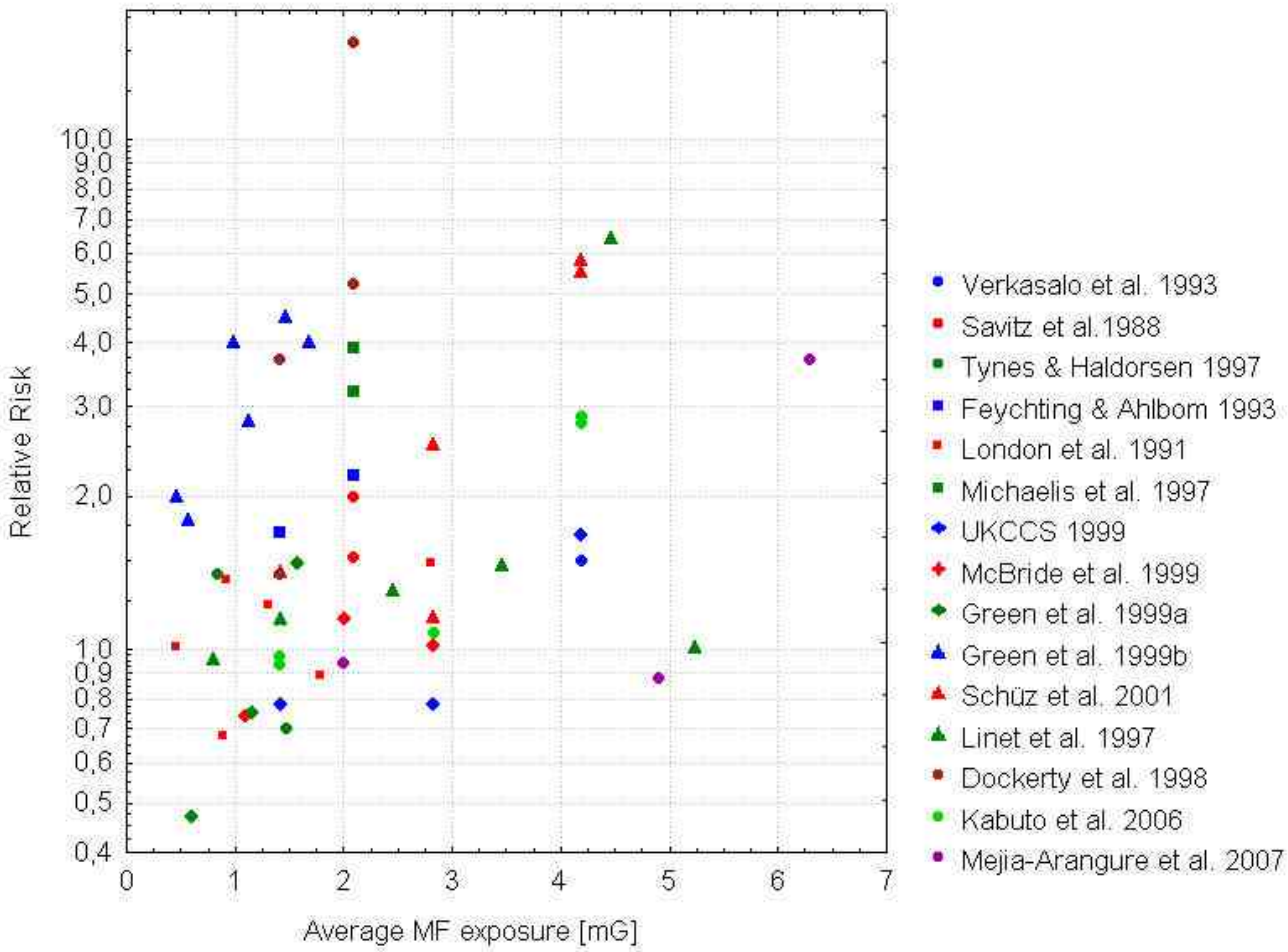
Postnatal Risk Factors for ALL

Target	Exposure	Risk
Mother	PVC (occupational)	+
	Alcohol	-
Child	Pesticides	++
	Radiation	++
	Power frequency EMF	++
	Benzene	+
	Radon	+
	Chernobyl	+
	Organic solvents	+
	Chloramphenicol	+
	Supplementary oxygen	+
	BCG, measles vaccination	-
	History of allergy	--
	Early infection	--
	Hib vaccination	--

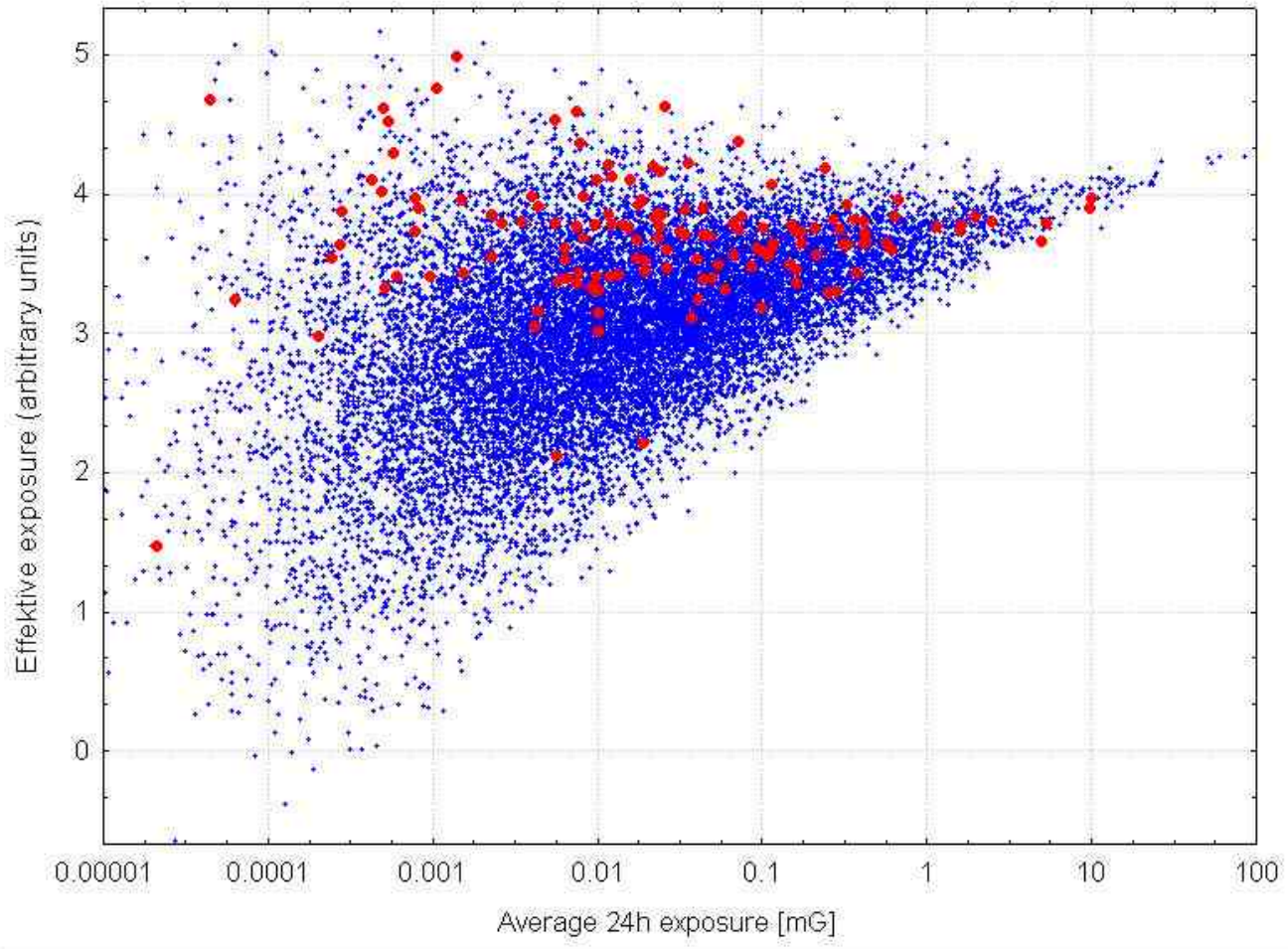
Childhood Leukaemia

- Overall only about 10-20% of childhood ALL can be attributed to environmental risk factors
- Considering potential combined effects as suggested by similar pathways of some identified risk factors the attributable fraction may be somewhat higher
- One key element seems to be error-prone NHEJ during double-strand break repair

Magnetic Field Exposure



The Problem of Exposure Assessment



Childhood Cancer

- Even for the best studied childhood malignancy (ALL) only a small proportion can presently be attributed to environmental factors
- This does not suggest that there are no such factors
- There are too few epidemiological, animal and mechanistic studies to unravel the complex aetiology of childhood cancers

Outlook

- In a comprehensive literature review of over 50 chemicals U.S. EPA identified only 6 with sufficient data to assess childhood cancer risk
- There is a critical need to better estimate the effects of early-life exposures on childhood cancer risk as well as on subsequent adult cancer risk
- It should be a standard of risk assessment in the future to specifically address exposures affecting childhood cancer risk