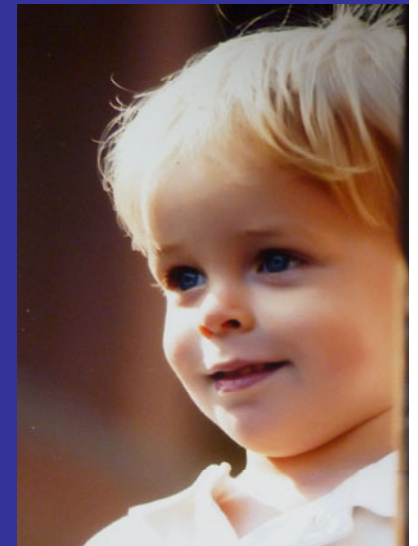


Effects of childhood exposure:

An Issue from CT scans to Fukushima

9th Annual
Warren K. Sinclair Address



Fred A. Mettler Jr. MD,MPH

Warren at UNSCEAR meetings



Even small details are interesting to Warren



Acknowledgements

Disclosures

Task group of UNSCEAR

- Radiation effects after childhood exposure
- Publication expected 2013-14

- F. Mettler
- Roy Shore (RERF)
- Sandy Constine (Univ of Rochester)
- Dietmar Nosske (Bfs, Munchen)

- Note: Prior work of Dave Brenner, John Boice et.al.

2nd disclosure

*There has been an
Alarming Increase
?
in the Number
of Things*



*I Know
Nothing About*

Meetings in villages heavily contaminated by Chernobyl



I don't care about myself. What about my children...?

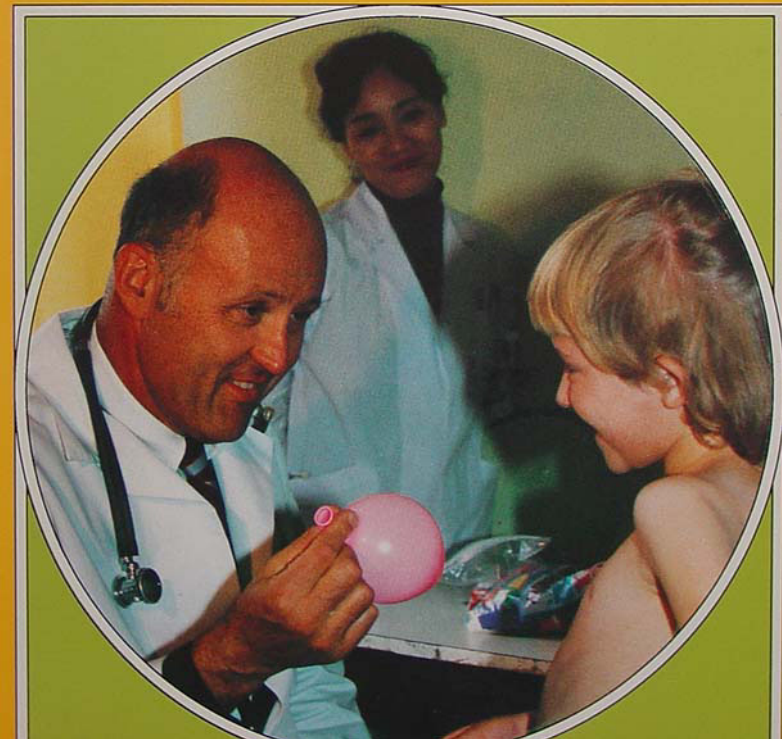
Has anybody written a report on children we can look at ??



THE INTERNATIONAL CHERNOBYL PROJECT

ASSESSMENT OF RADIOLOGICAL CONSEQUENCES
AND EVALUATION OF PROTECTIVE MEASURES

SUMMARY BROCHURE



Outline

What are the questions

Data sources

Developmental anatomy and physiology

Dosimetry variations

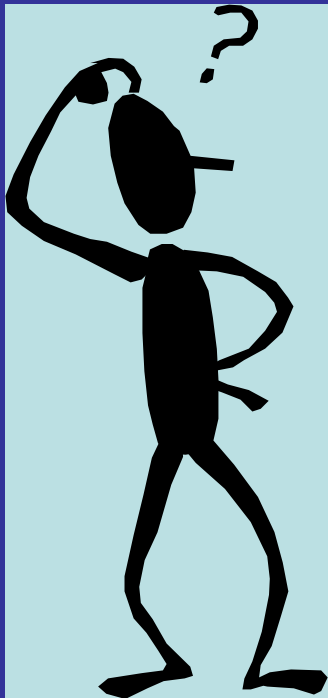
Induced malignancies

Deterministic effects

Scams, scares and good things

A few radiation protection points

“Children are 3-5 times more sensitive to radiation than adults”



- Is this actually true ?
- Is it true for all effects ?
- If they are, why is that ?
- Could they be less sensitive to some effects ?

Childhood irradiation data sources

Atomic bomb survivors (LSS)

35,382 or 41% were 0-20 years old at exposure

Radiotherapy for benign conditions (thousands)

Childhood cancer survivor study

14,359 5-year survivors treated 1970-1986

Childhood irradiation data sources

Accidents

27% of those evacuated at Chernobyl
were 0-17 years old

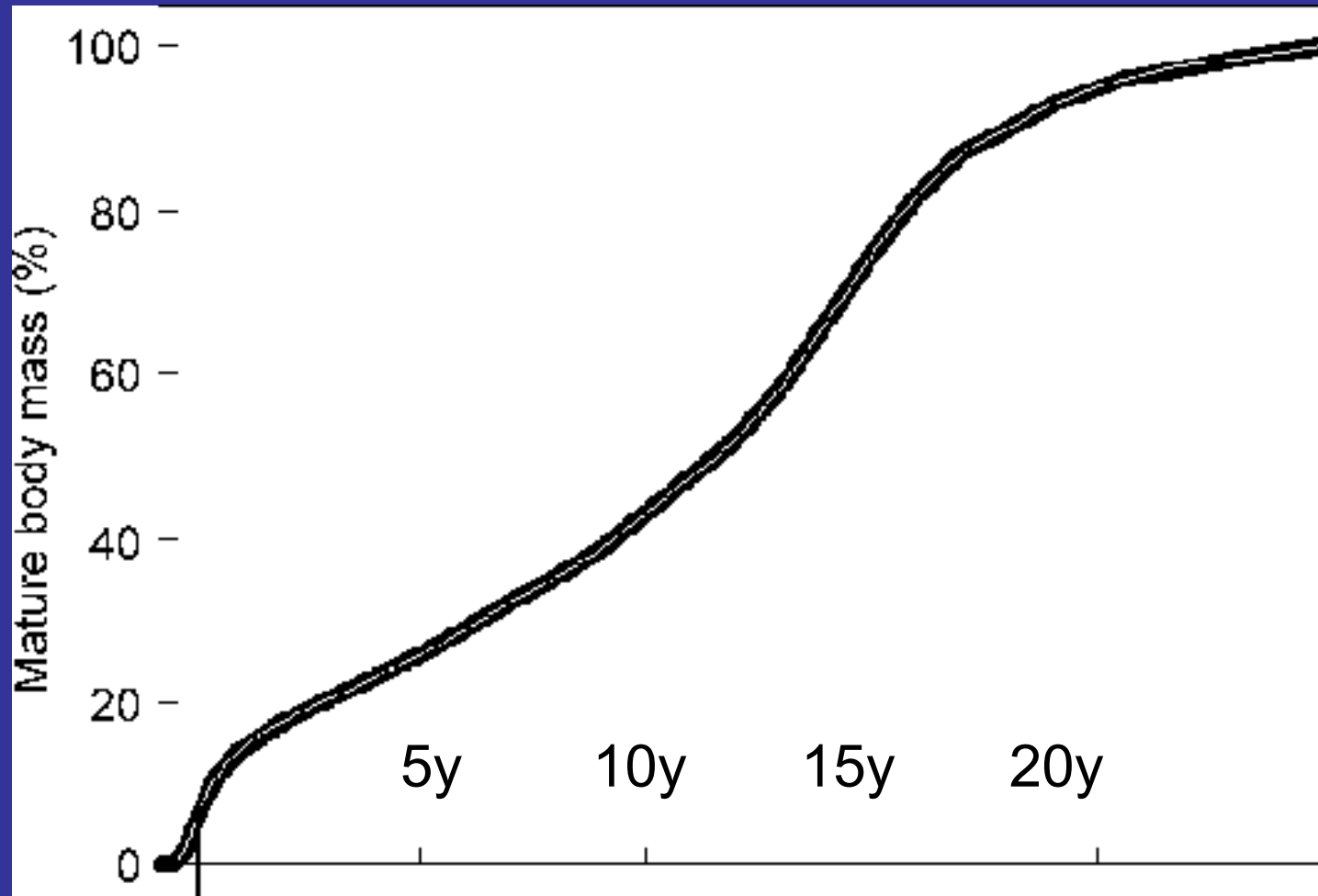
Future sources

13% at Fukushima were 0-14

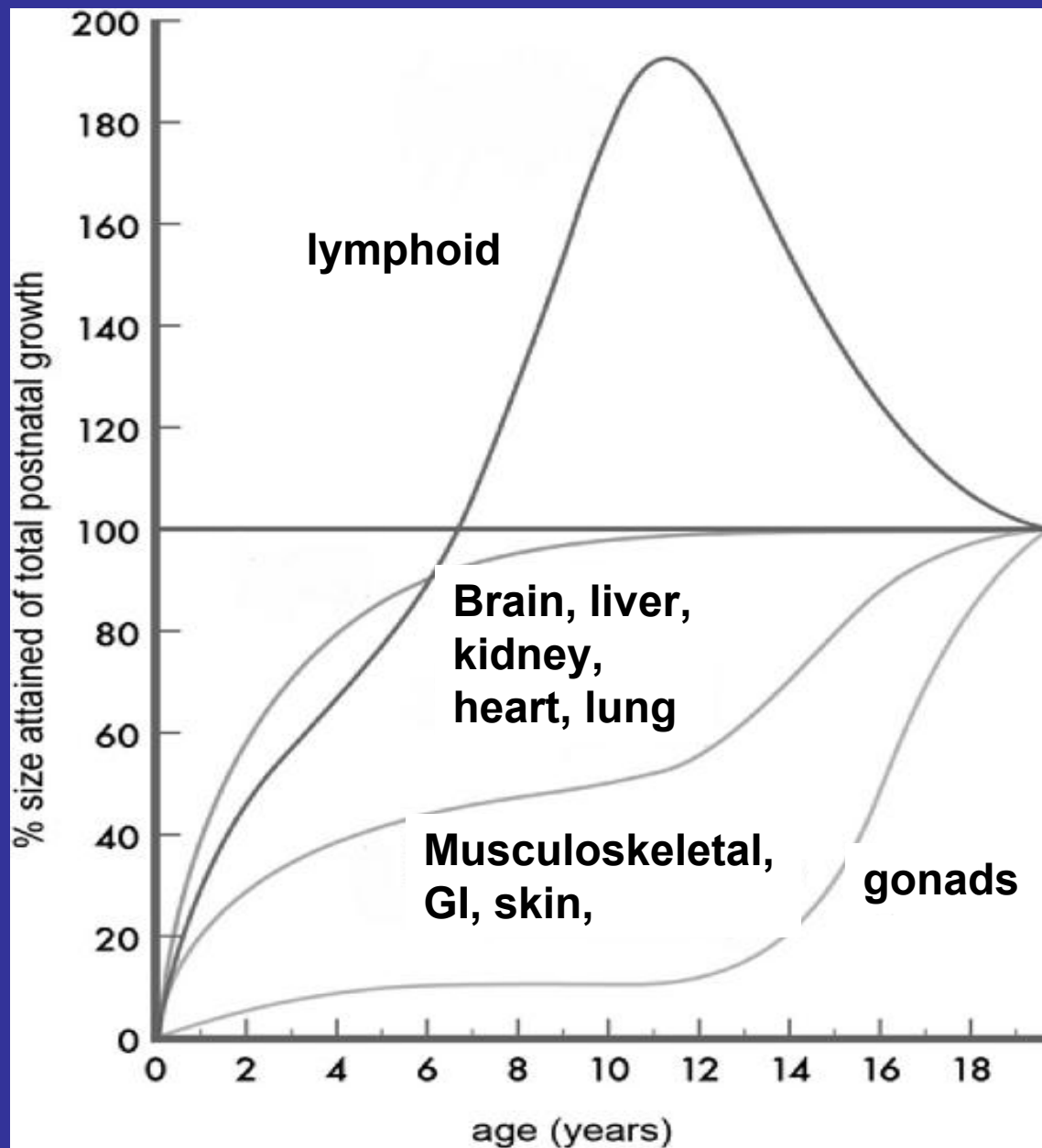
CT scanning of children. In US (5
million annually). Mostly European studies

Aspects of developmental anatomy and physiology that affect radiation response

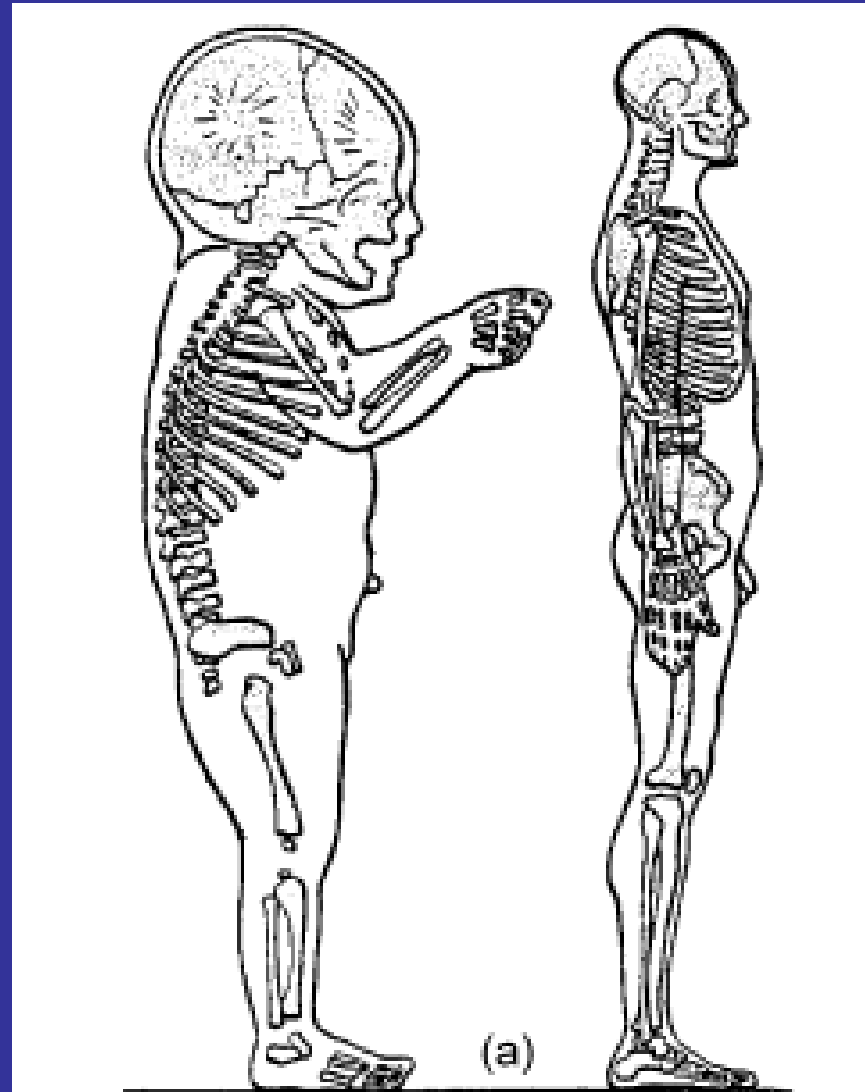
Patterns of human growth



Growth period unusually long for mammals > 25% lifespan



Proportional changes



The Brain

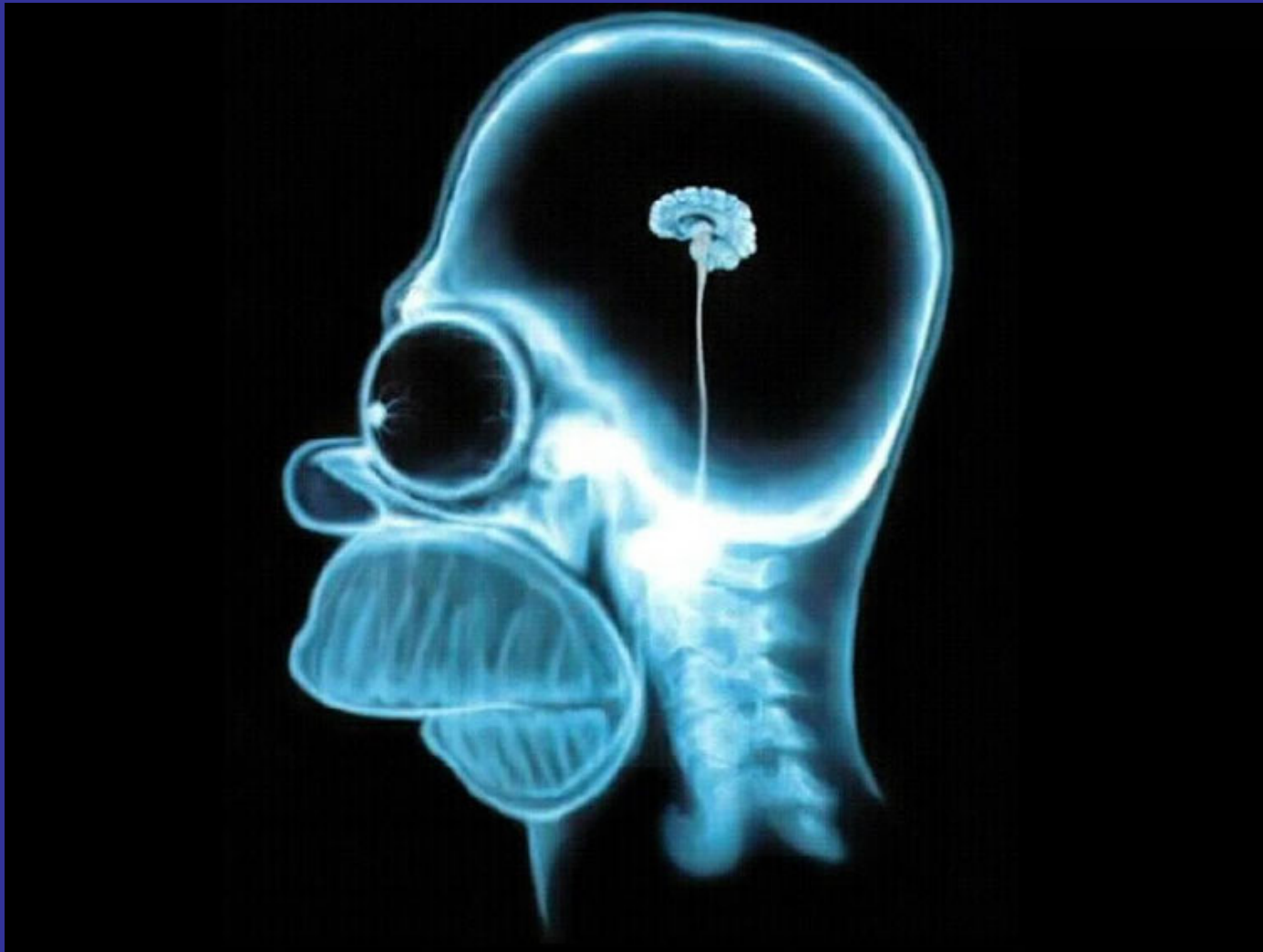
Long period of development and sequence makes children susceptible to high dose effects



10% body weight at birth

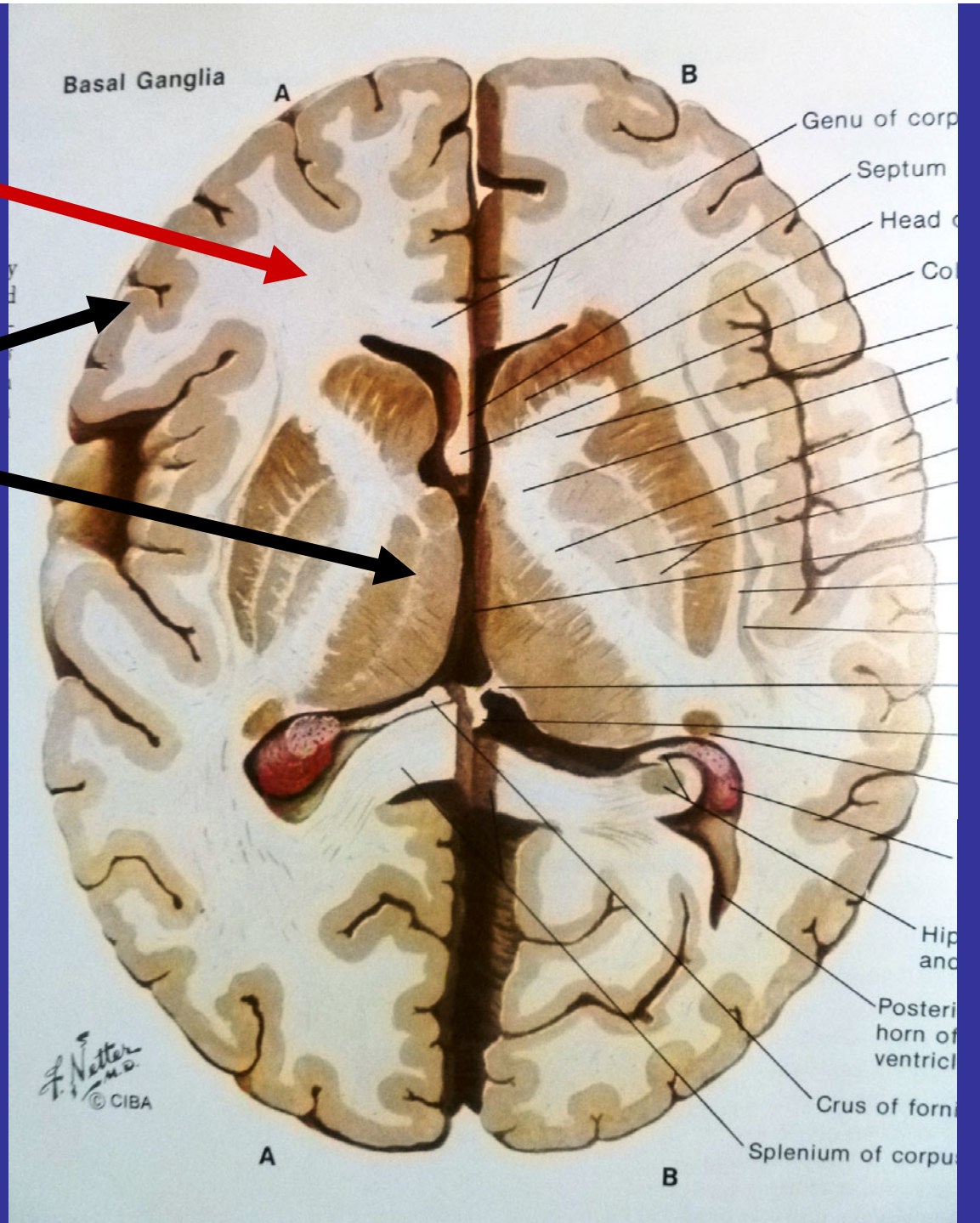
2% body weight in an adult

.....and even less than 2% in some persons



White matter
(wiring)

Gray matter
what you
think, feel and
move with



Development of the wiring and communication pathways

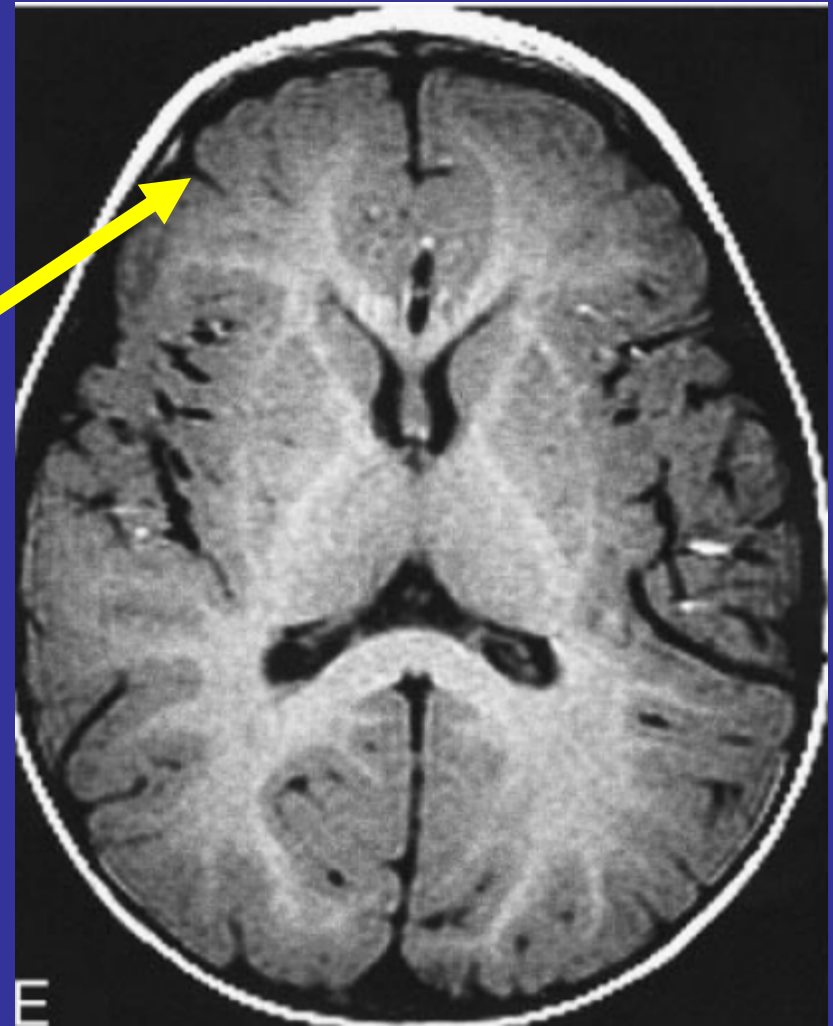


20-100 billion neurons (= number of stars in our galaxy)
Linked by 150 trillion synapses
or 1500-10,000 synapses per neuron

Increase in gray matter

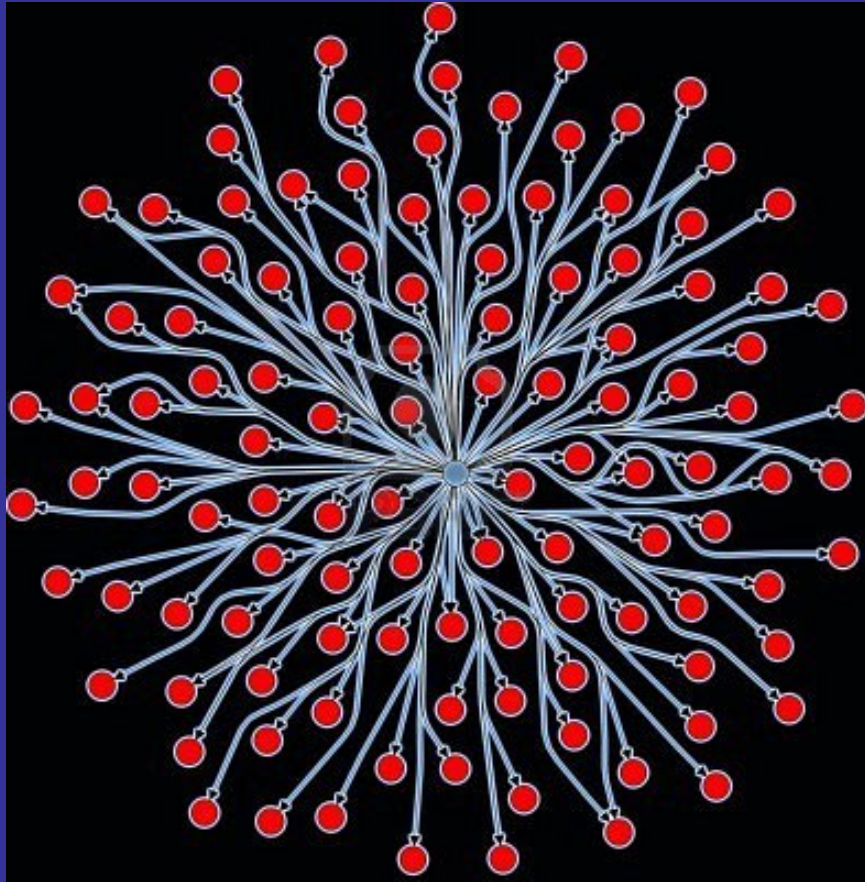


Neonate



8 months

“Use it or lose it”



More synapses produced than are ever needed.
“Pruning occurs” with experience. Half of synapses are removed by puberty and pruning occurs into the 20's

Cortical gray matter

Peaks at 1-2 years of age

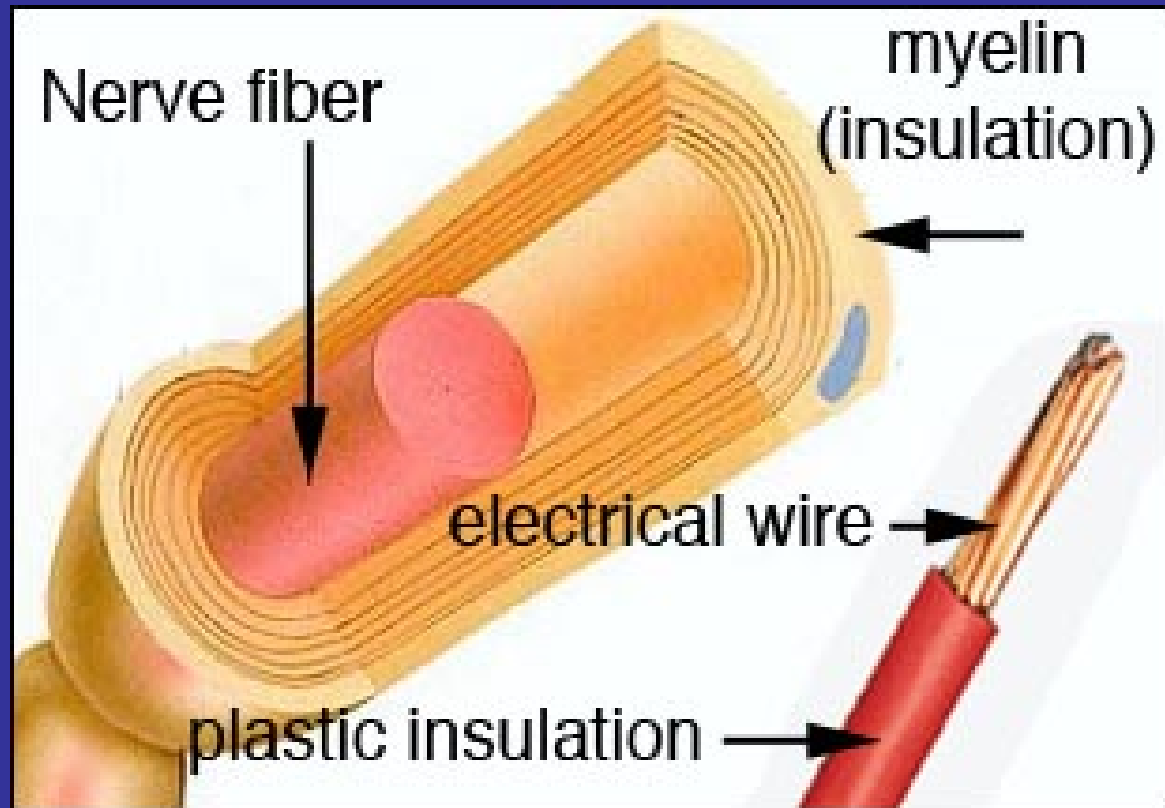
Remains high until about 12 then declines
40% a year until age 16

Loss of neocortical neurons in adults

85,000 per day ~31 million per year ~1/sec

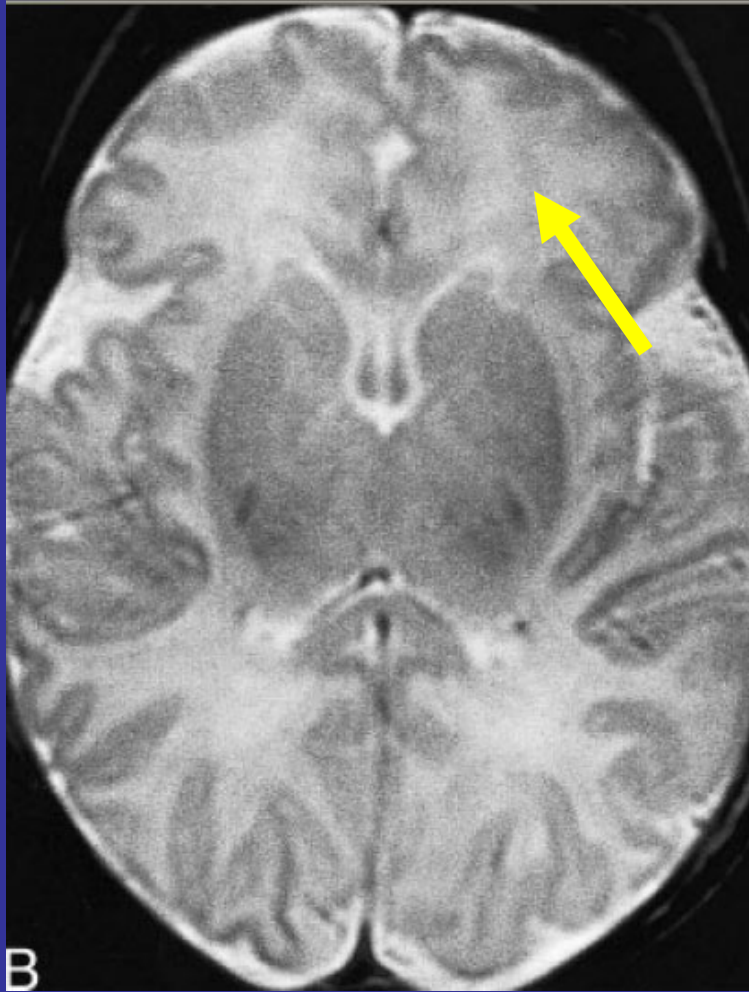
~ 3,000 lost during this lecture

Development of insulation for the wiring occurs over the first several years of life

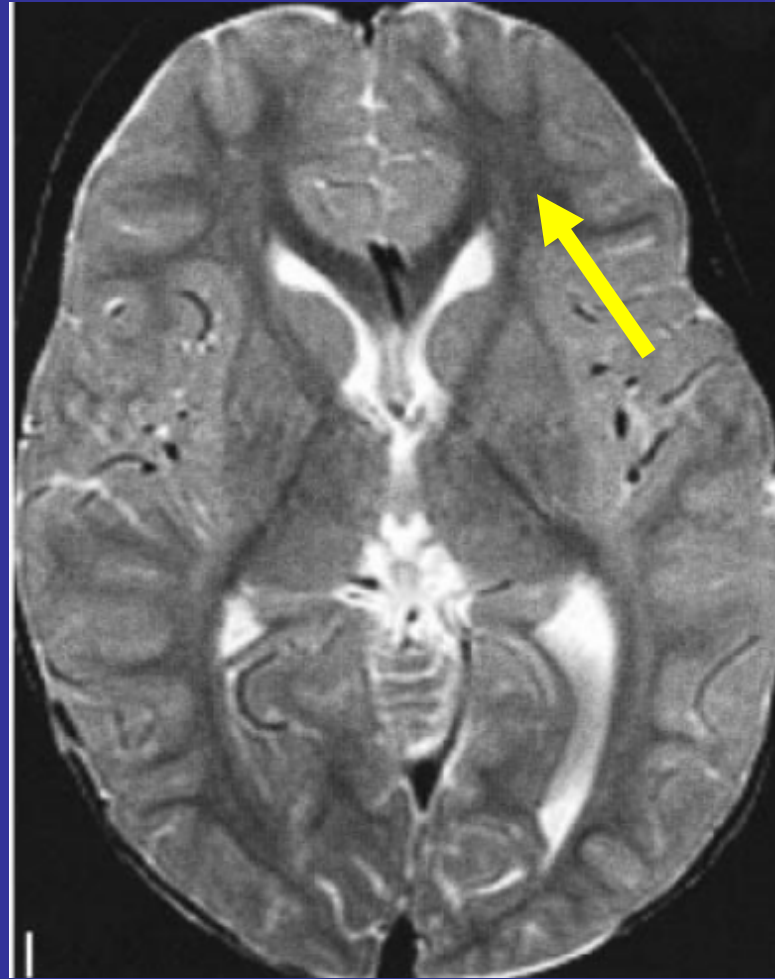


180,000 km of myelinated fibers

Myelin development



Neonate

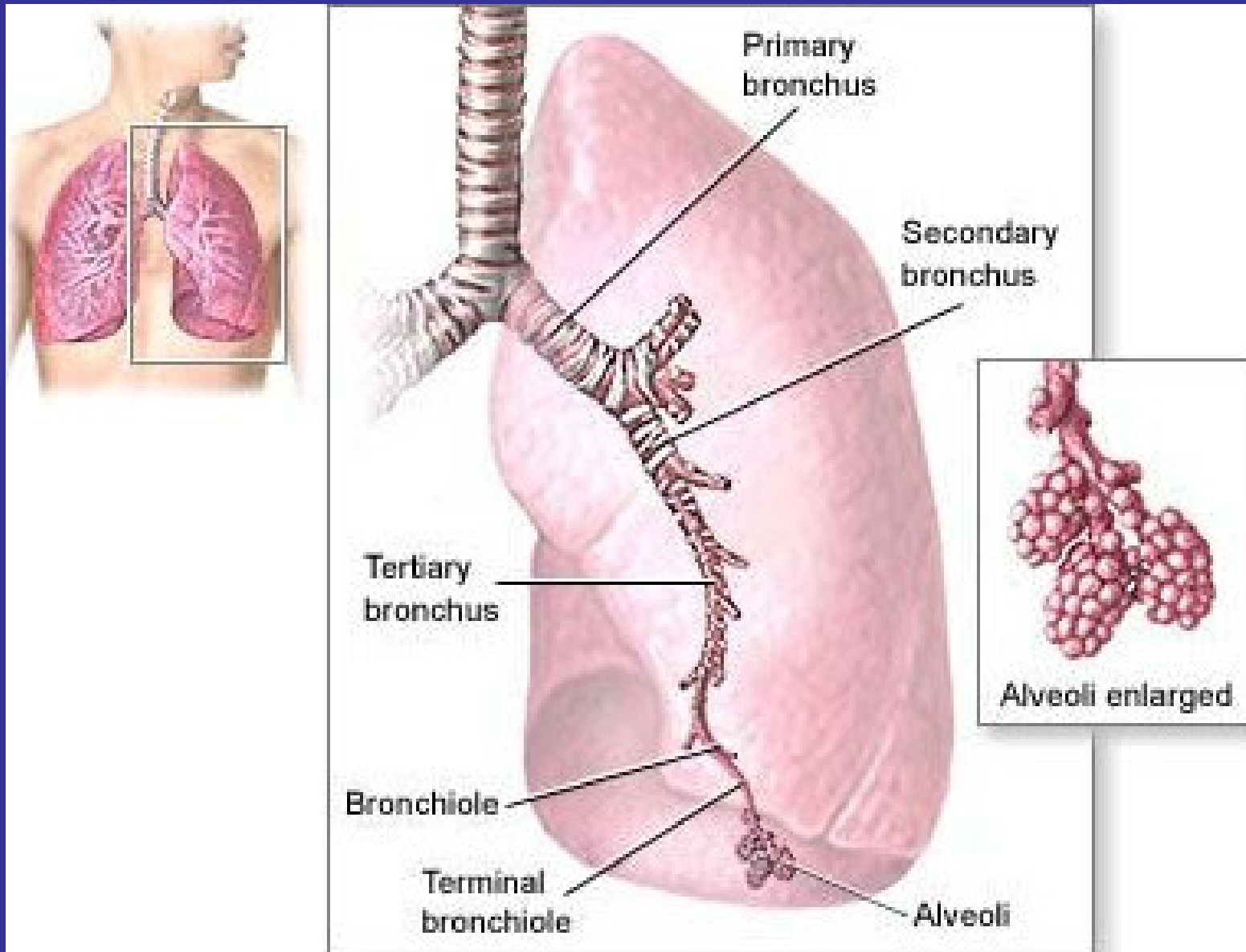


24 months

During development of the brain high doses of radiation can...

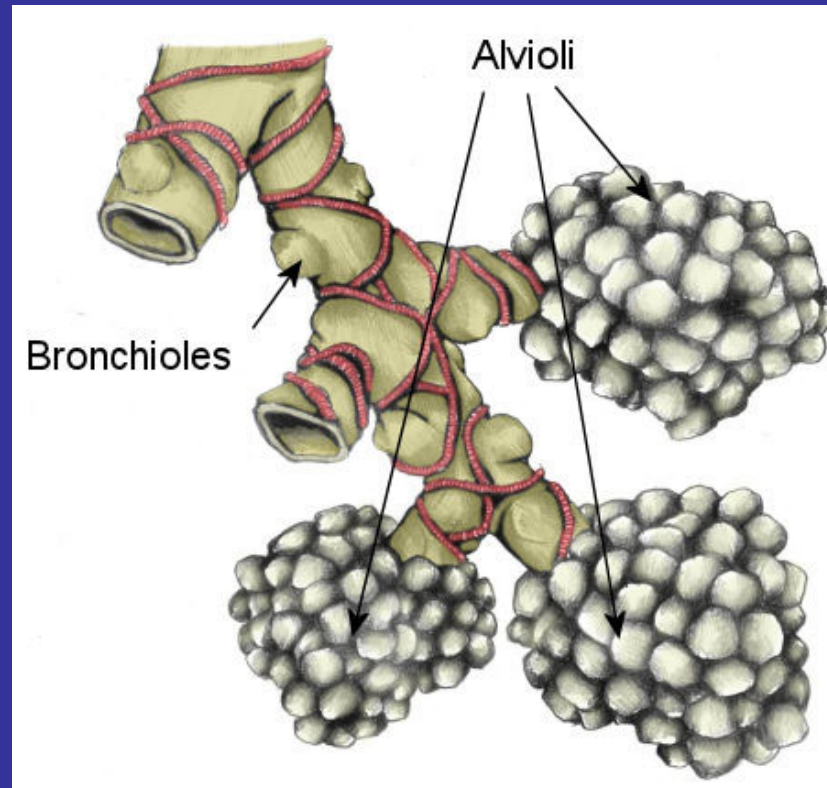
- Reduce the number of neurons and reduce IQ
- Interfere with myelin development or even remove the myelin insulation

Pulmonary



20 million alveoli at birth, 150 million by age 2

300- 400 million by age 7

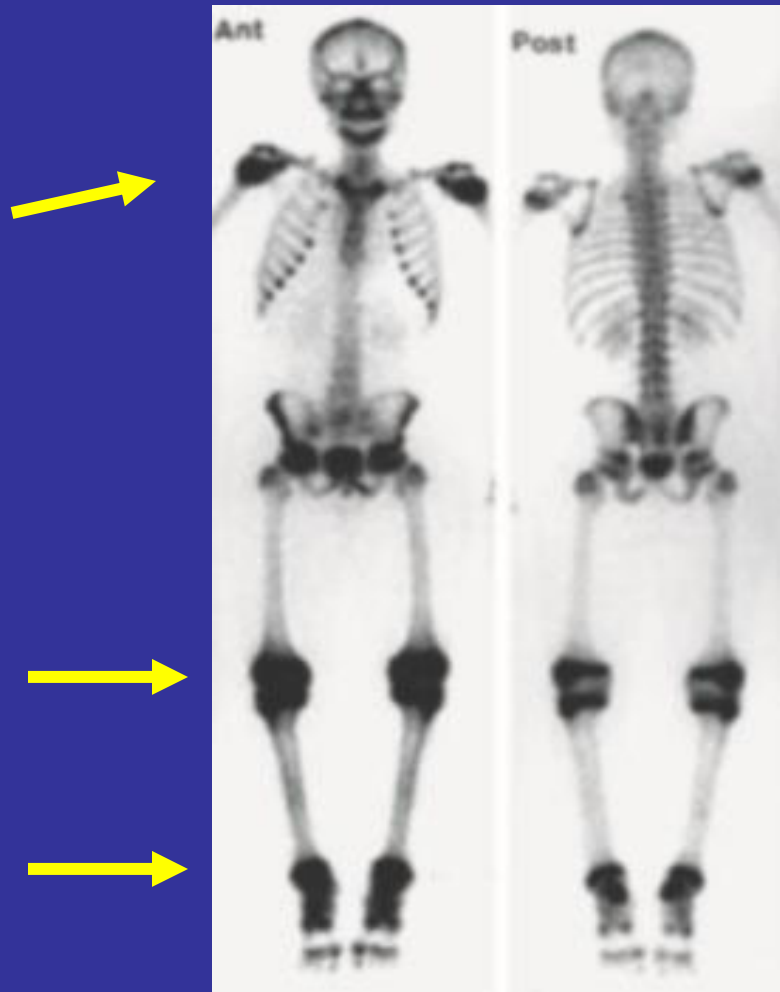


Before age 5 disproportion of narrow peripheral airways increases airway resistance affecting deposition and retention

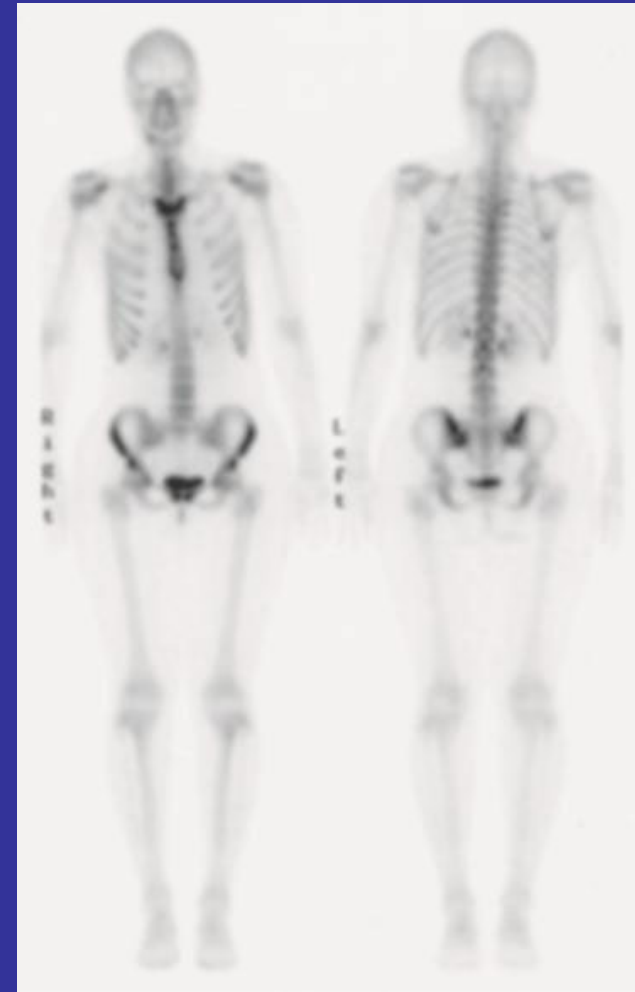
Children's pulmonary system is somewhat less sensitive than adults to high dose radiation

- Can grow new alveoli up to a certain point
- Children have less underlying disease and aging damage

Bone growth occurs at the ends of long bones affecting radionuclide distribution



14 years



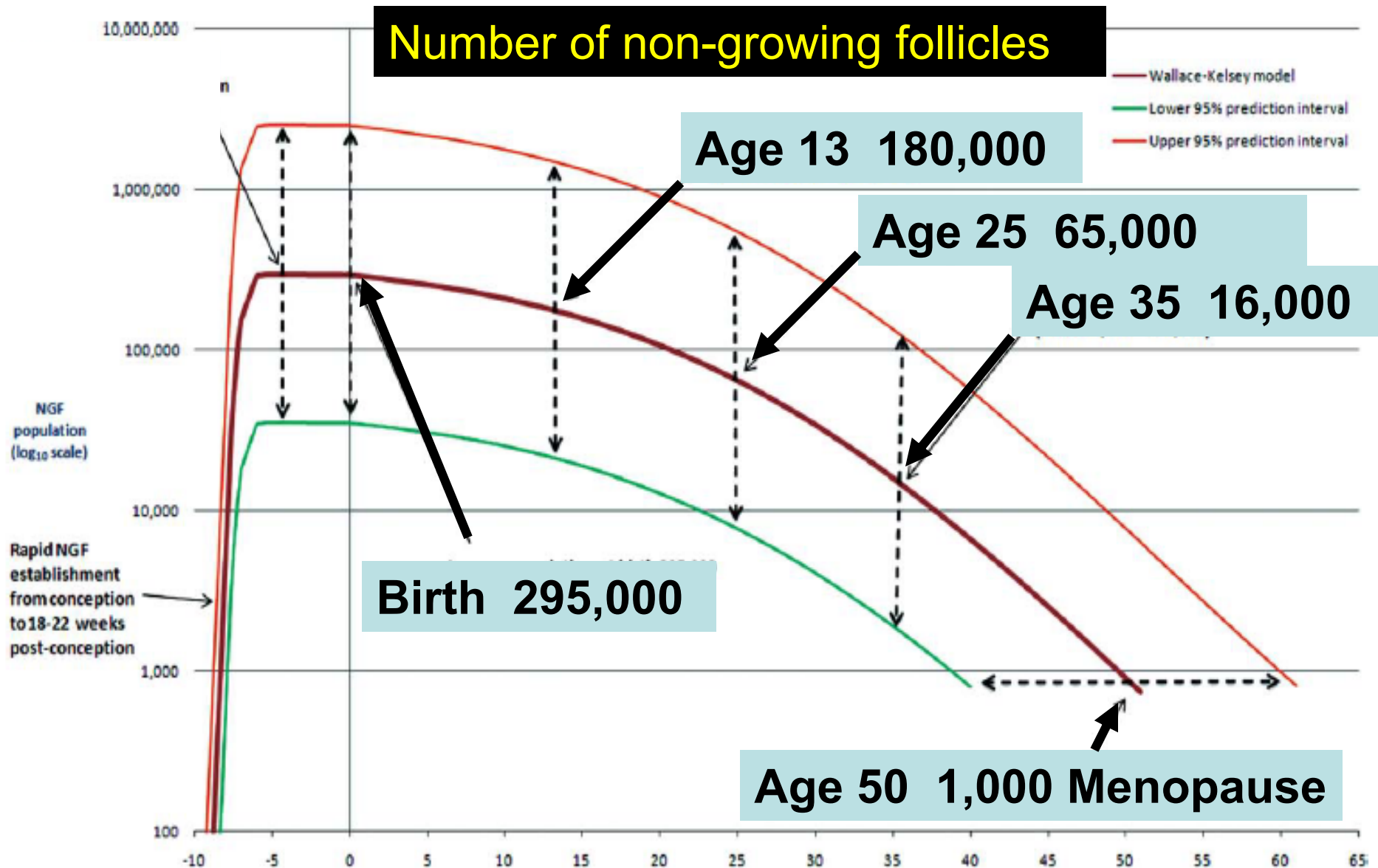
Adult

Alimentary Tract Age-dependent f_1 ingestion values

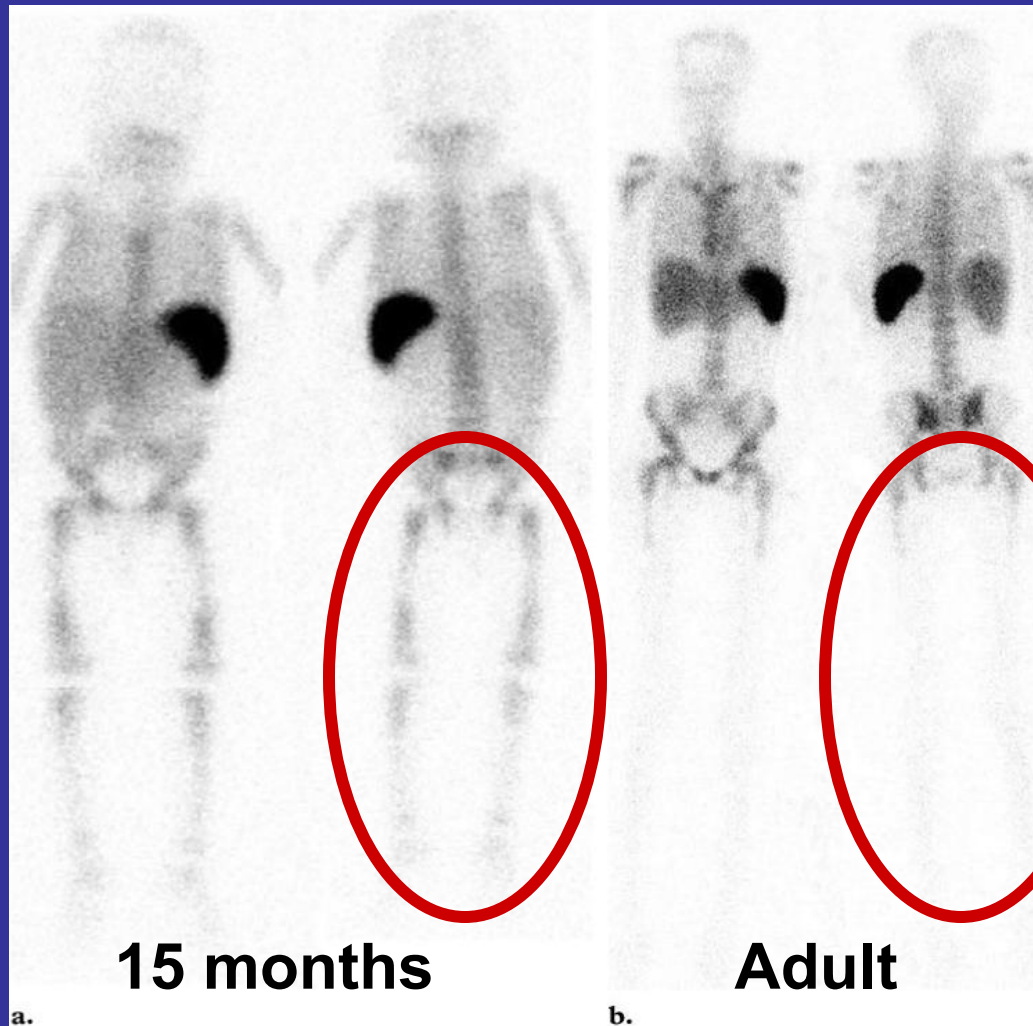
ICRP Publications 67 and 69

Element	f_1 value			
	3 months	5 y	15 y	adults
Iron	0.6	0.2	0.2	0.1
Cobalt	0.6	0.3	0.3	0.1
Strontium	0.6	0.4	0.4	0.3
Radium	0.6	0.3	0.3	0.2

Ovary



Marrow retraction with age



Children have more red bone marrow in extremities and are more resistant to localized marrow irradiation

Dosimetry Issues



Ukrainian and Belarussian children in contaminated villages

Who is getting the most absorbed dose ?

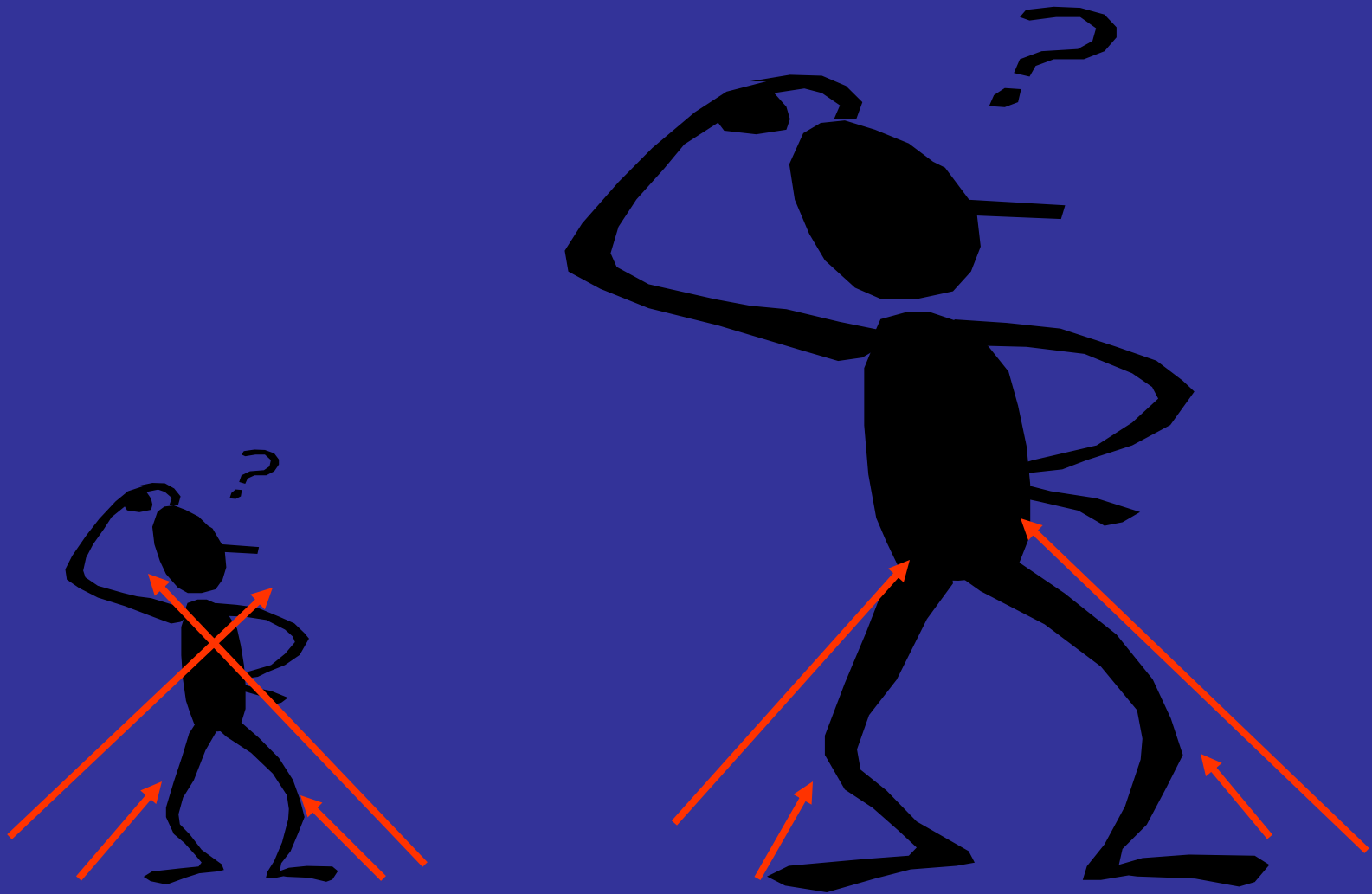
1 $\mu\text{Sv/hr}$

1000 kBq/m^2

Polesskoe 1989



External radiation exposure is rarely uniform



Who is getting the most absorbed dose ?



**Good answer
but wrong**

1 $\mu\text{Sv/hr}$

1000 kBq/m^2

Poleskoe 1989

Who is getting the most absorbed dose ?

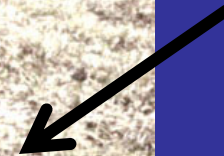


1 $\mu\text{Sv/hr}$

1000 kBq/m^2

Poleskoe 1989

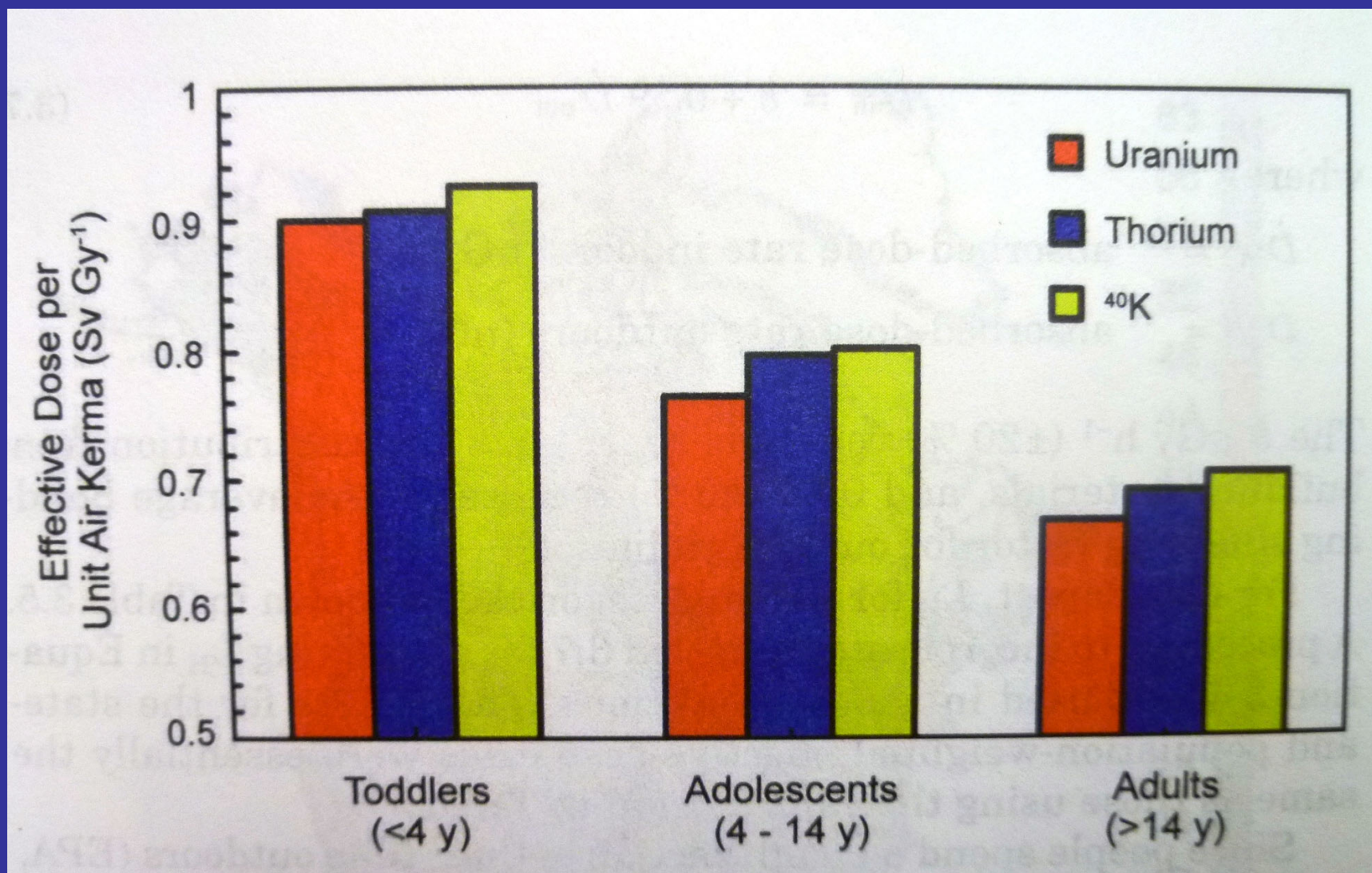
Correct
answer



Age-related correction factors for submersion and irradiation from the ground

	Age groups					
	≤1a	1-2a	2-7a	7-12a	12-17a	>17a
Submersion >200 keV	1.4	1.4	1.3	1.2	1.1	1.0
Submersion ≤ 200 keV	1.8	1.7	1.5	1.3	1.1	1.0
Irradiation from the ground; > 200 keV	1.6	1.5	1.3	1.2	1.1	1.0
Irradiation from the ground; ≤ 200 keV	1.7	1.6	1.4	1.3	1.1	1.0

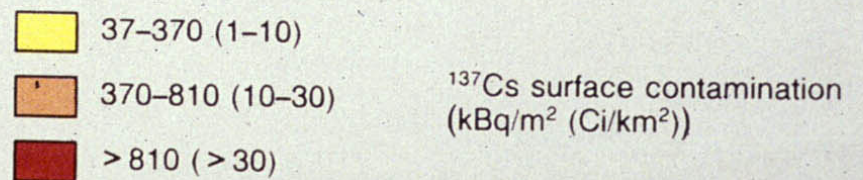
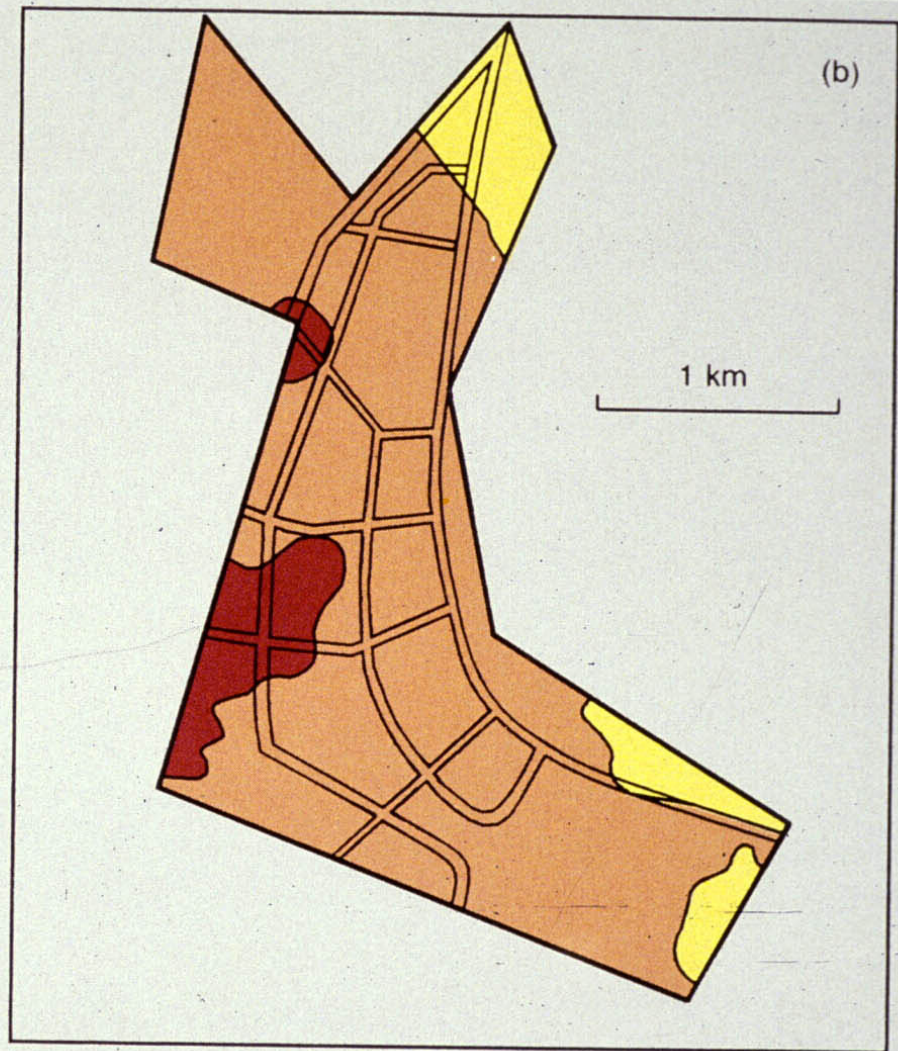
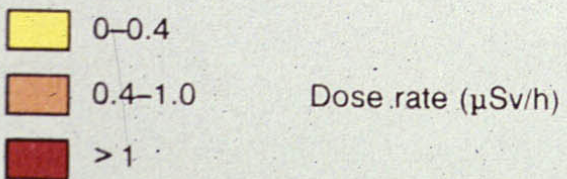
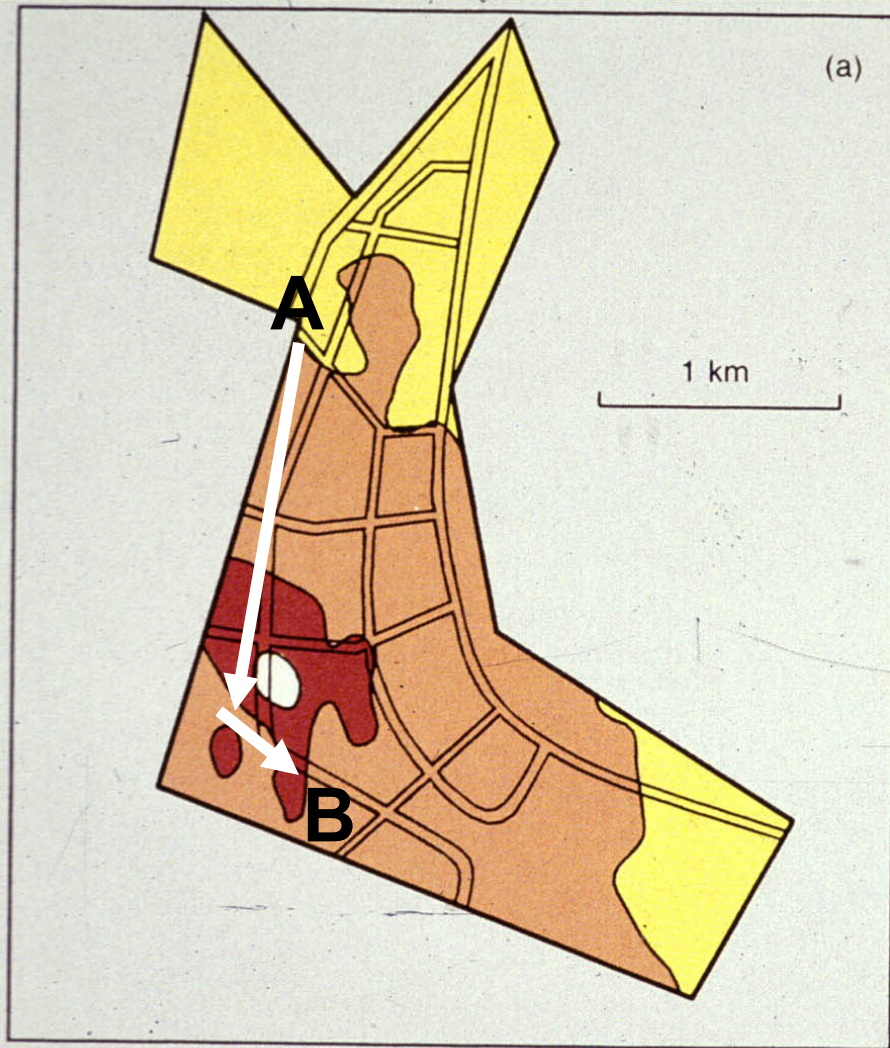
Age dependent conversion coefficients

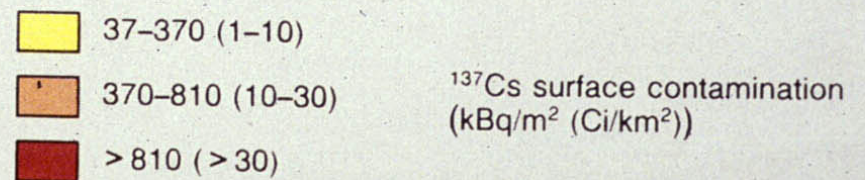
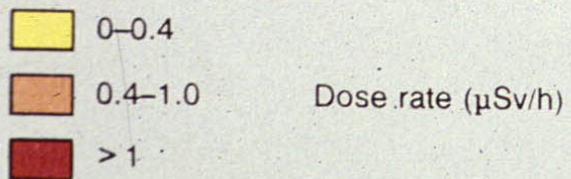
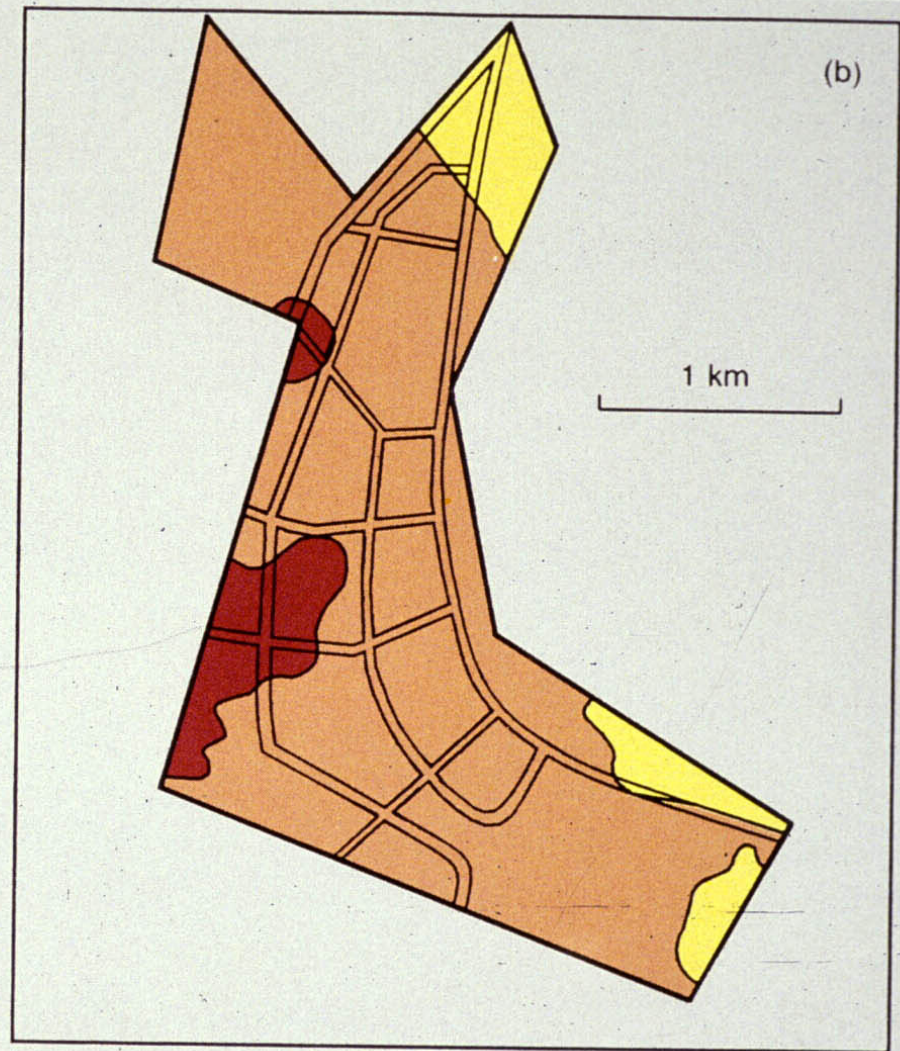
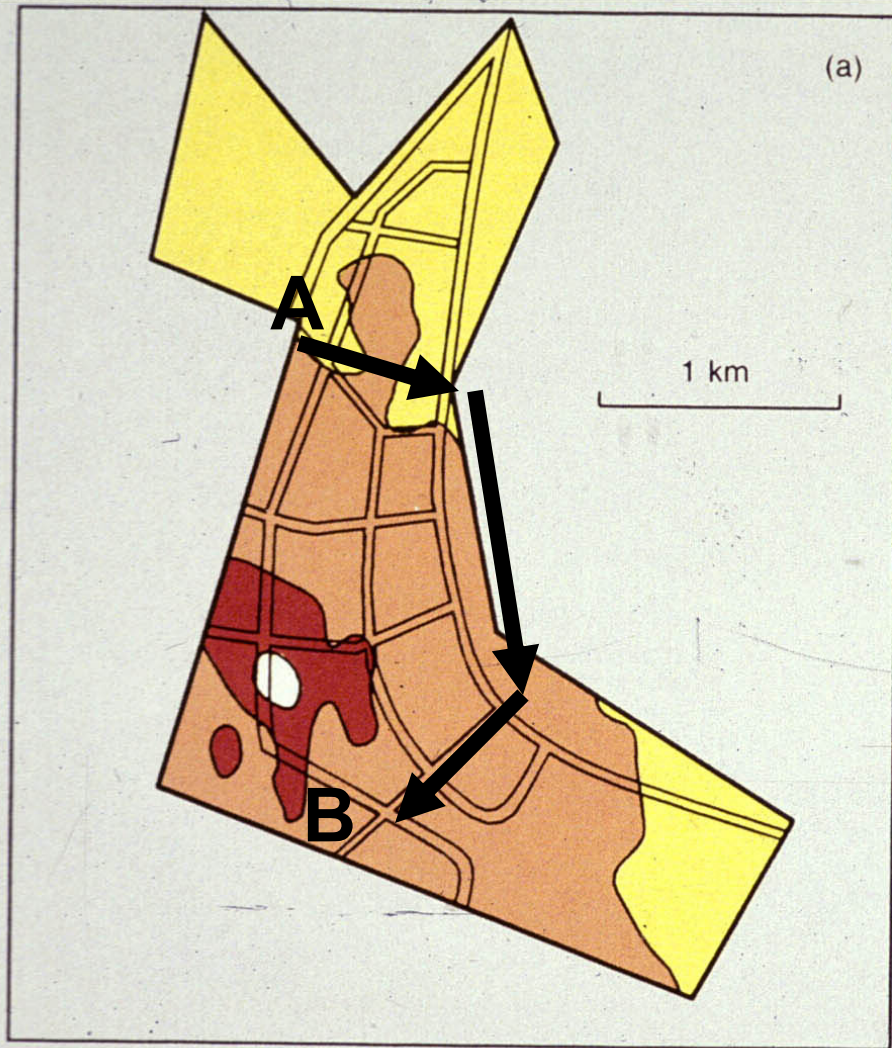


Do kids get the dose we estimate ?



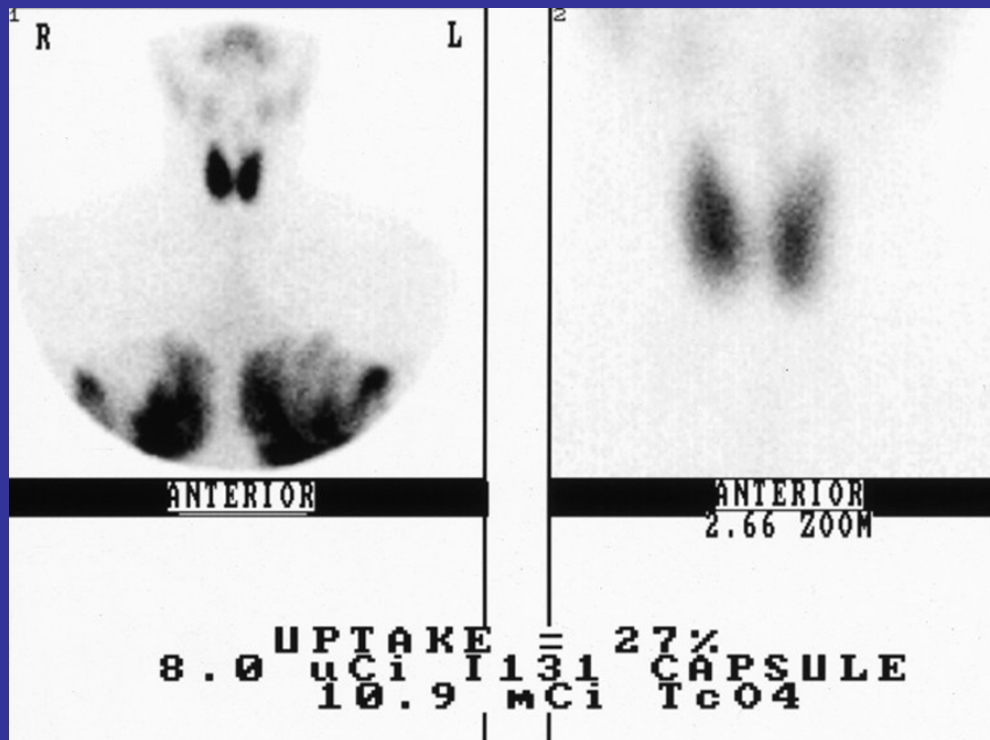
Novozybkov 1989 200 kBq/m² cesium 137



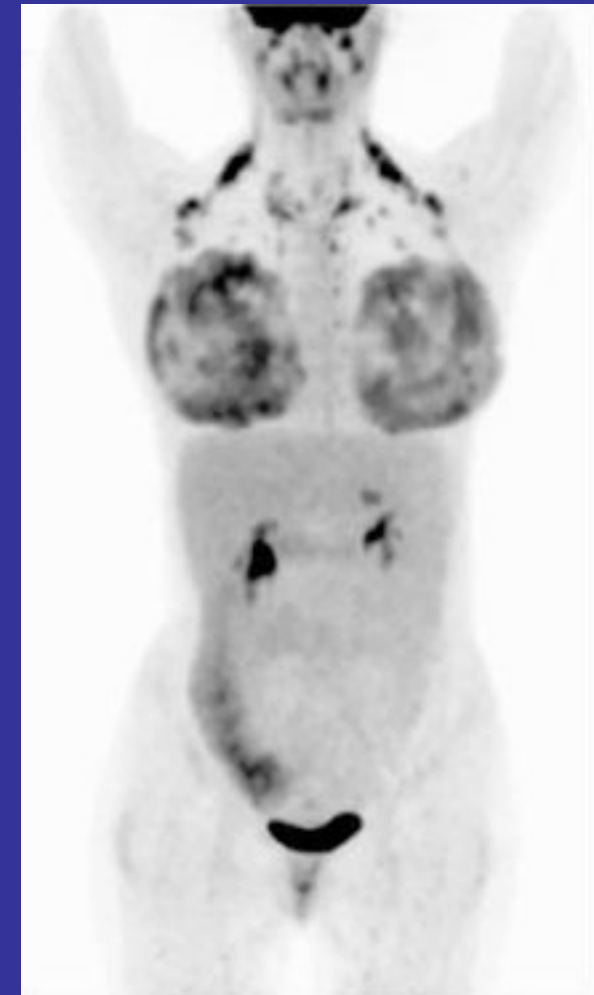


Children are at increased risk due to radionuclides in breast milk or in Mom.



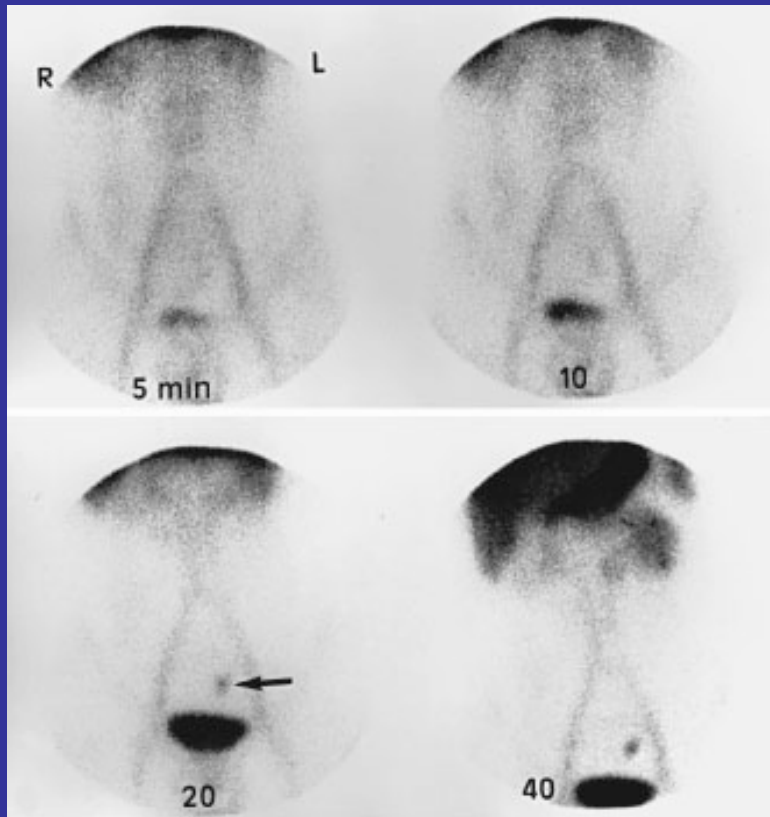


Technetium-99m and Iodine-131

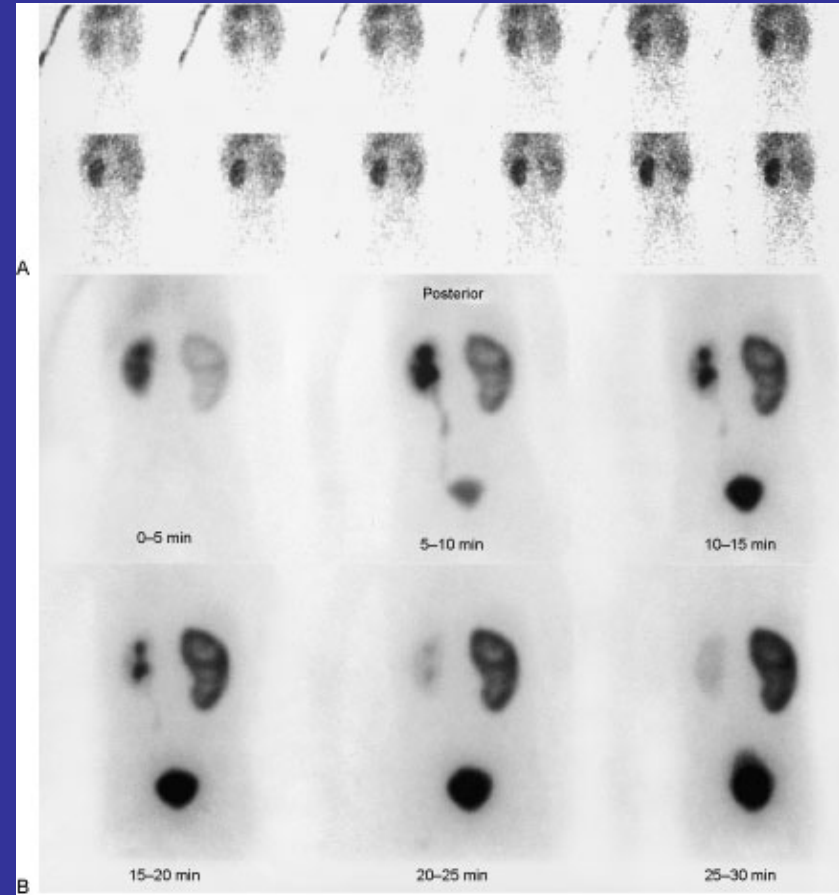


Flourine-18 FDG

Children often get nuclear medicine scans with renal and bladder excretion



Meckel's scan $^{99m}\text{TcO}_4^-$



Renal scan $^{99m}\text{Tc-MAG3}$

Worries about radiation-induced malignancies



Accidental exposure and cancer

Alosha



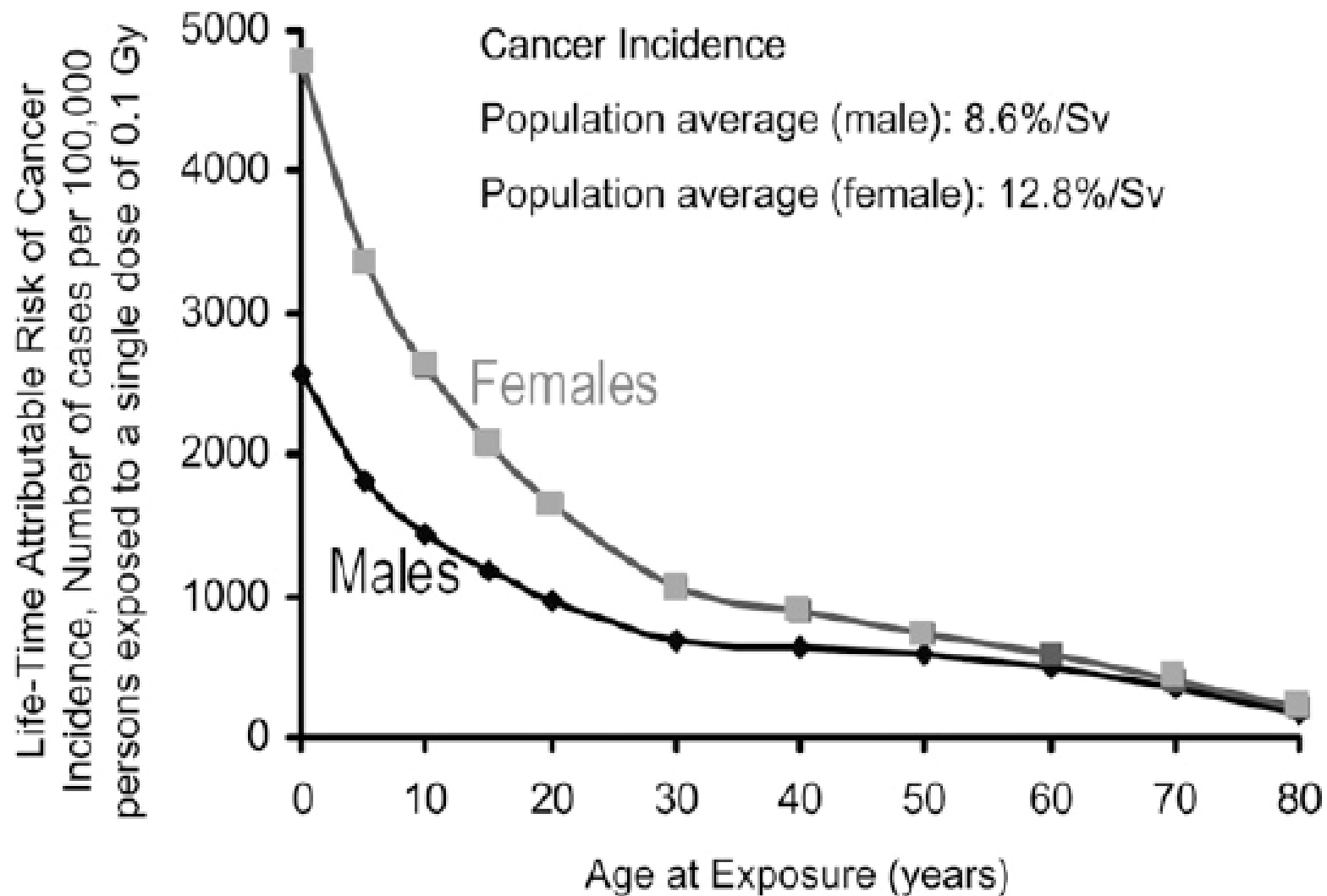


Cesium-137 2.6×10^{12} Bq source 1988-1991

Are children really 3-5 more sensitive to cancer induction ???

- The answer depends upon
 - what data you look at
 - how you look at the data
 - what model is used
 - what you do when there is no data

Lifetime attributable risk of radiation-induced cancer incidence (based on BEIR VII)



Relative sensitivity of LAR by age at exposure
in the BEIR VII model (male incidence)

	0	5	10	40
Colon	2.7	2.4	2.0	1
Lung	3.0	2.5	2.1	1
Bladder	2.6	2.2	1.9	1
Prostate	2.7	2.3	1.9	1
Other (40%)	6.5	3.9	2.9	1
Thyroid	38.3	25.3	16.7	1
Leukemia	2.8	1.8	1.4	1
All	5.4	3.8	2.9	1

Mortality A- bomb survivors 1950-2003

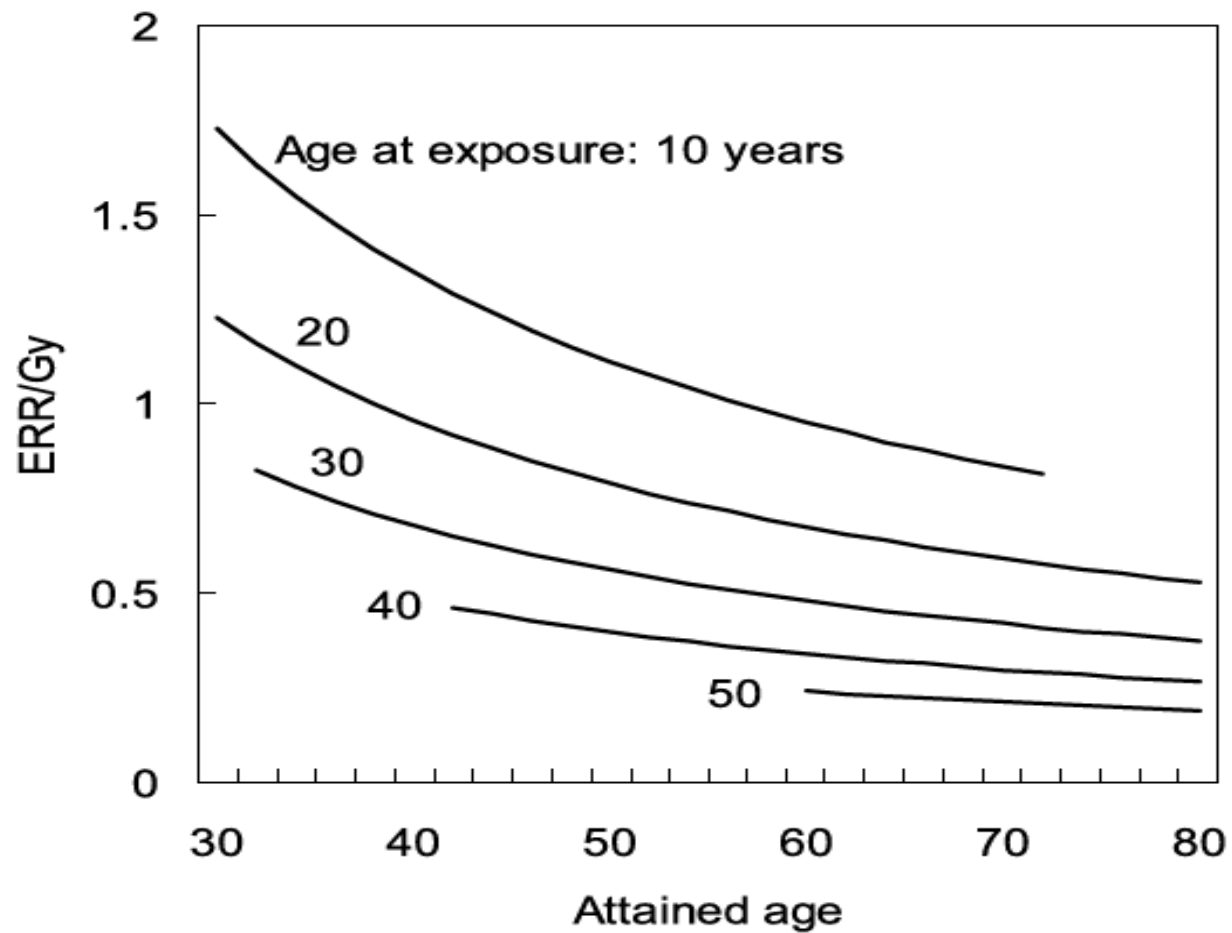


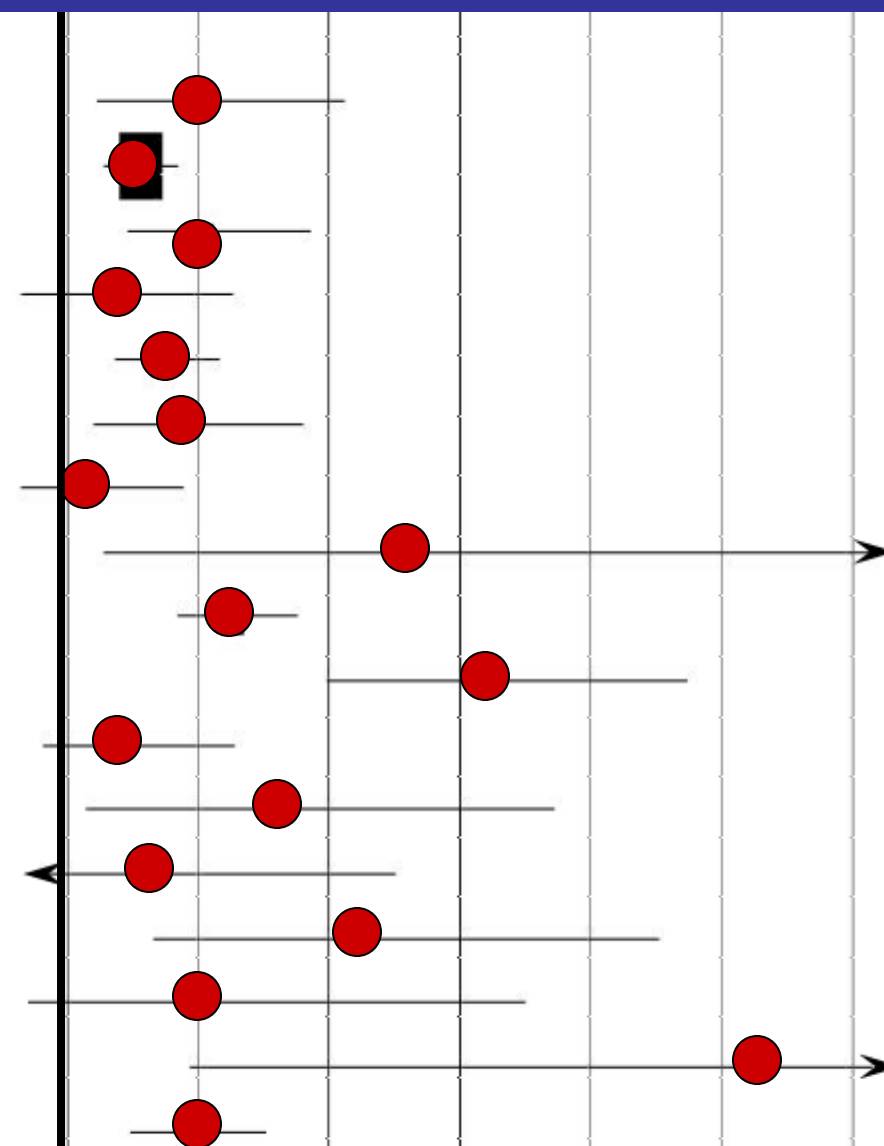
FIG. 2. Modification of the excess relative risk (ERR) for all solid cancer by age at exposure and attained age.

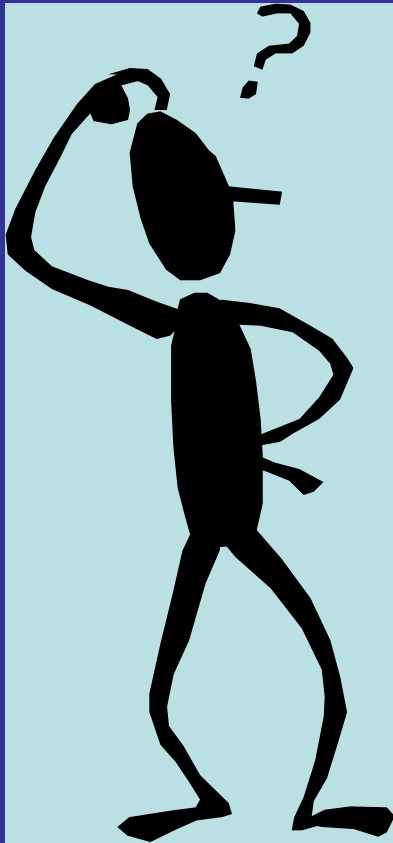
Excess relative risk/Gy

0.0 1.0 2.0 3.0

Cancers of Specific sites ^c

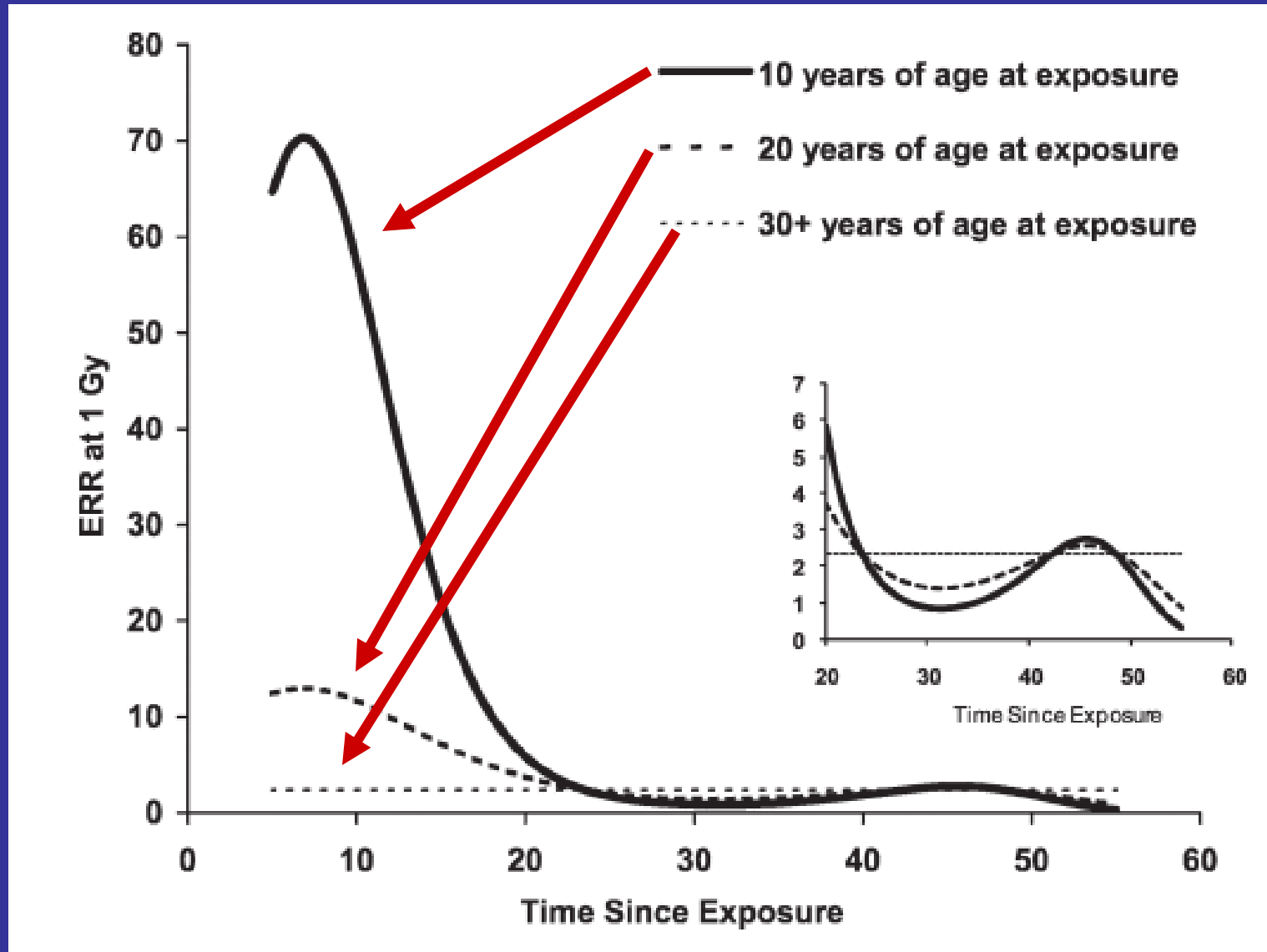
Esophagus	0.51 (0.11, 1.06)	339
Stomach	0.28 (0.14, 0.42)	3,125
Colon	0.54 (0.23, 0.93)	621
Rectum	0.17 (-0.17, 0.64)	427
Liver	0.36 (0.18, 0.58)	1,519
Gallbladder	0.45 (0.10, 0.90)	419
Pancreas	0.08 (-0.18, 0.44)	513
Other digestive system	1.29 (0.14, 3.25)	84
Lung	0.63 (0.42, 0.88)	1,558
Breast	1.60 (0.99, 2.37)	324
Uterus	0.22 (-0.09, 0.64)	547
Ovary	0.79 (0.07, 1.86)	157
Prostate	0.33 (NA ^e , 1.25)	130
Bladder	1.12 (0.33, 2.26)	183
Kidney parenchyma	0.52 (-0.15, 1.75)	80
Renal pelvis and ureter	2.62 (0.47, 7.25)	33
Other solid cancer	0.47 (0.24, 0.76)	864





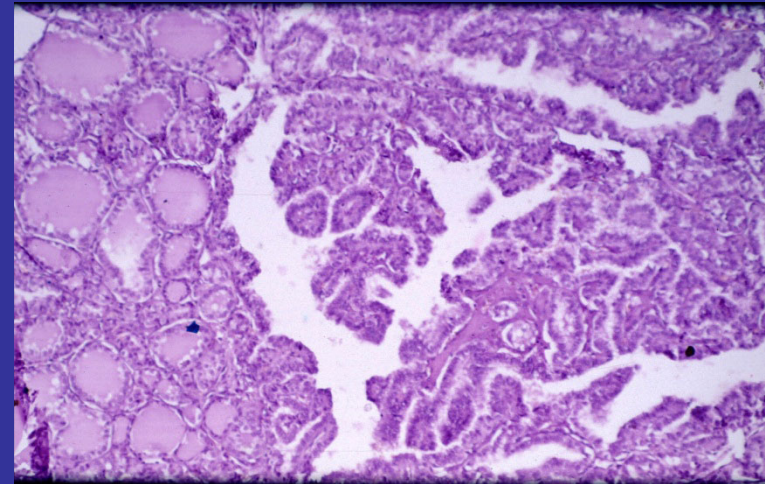
- If tissues are rather different in radiation sensitivity.....
- Why should most have similar age-at-exposure effects ?
- Or do they ?????

Leukemia (huge difference)

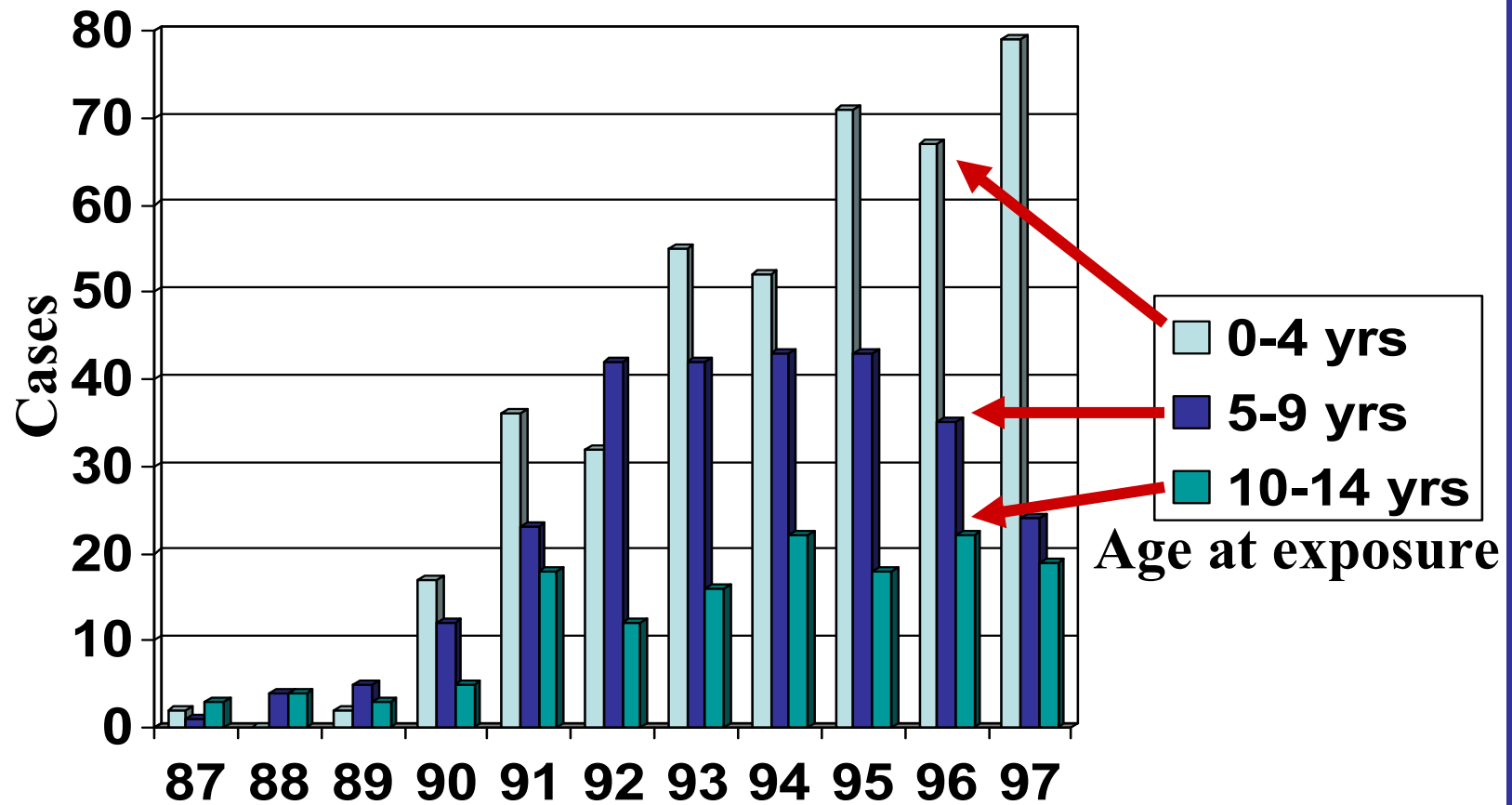


Thyroid cancer after radioiodine exposure

Marked age-at-exposure
effect



Childhood thyroid cancer as a result of Chernobyl radioiodine exposure



September 2011 Fukushima symposium

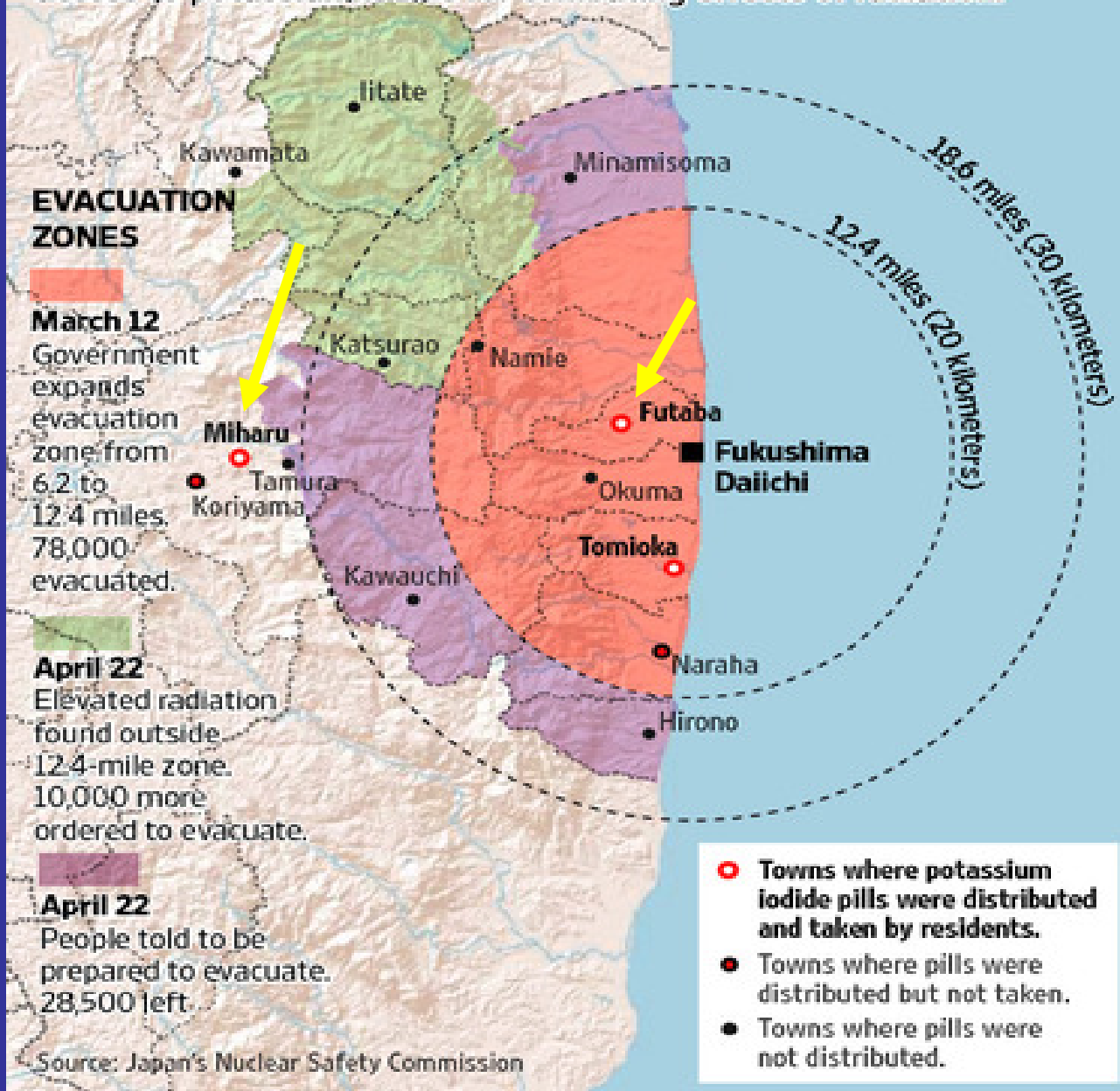
Subjects of Regional Radiation Medical Network

1. Many primary radiation hospitals were located within 30km radius. These hospitals were subject to evacuation, so didn't work.
2. Fukushima Medical Univ. was not suitable for WBC measurement on March 15, because the air dose rate was $20 \mu\text{Sv/h}$.
3. Majority of health care professionals in the Primary Secondary Radiation Hospitals had little knowledge about the radiation injuries and the radiation risk, so got an excess fear.
4. Appropriate instructions for the administration in stable iodine was not conducted.



Passing Pills

Japanese towns near the Fukushima Daiichi power plant and their access to potassium iodide for combating effects of radiation.



Most around Fukushima did not get KI



Breast cancer (3-4 fold difference)

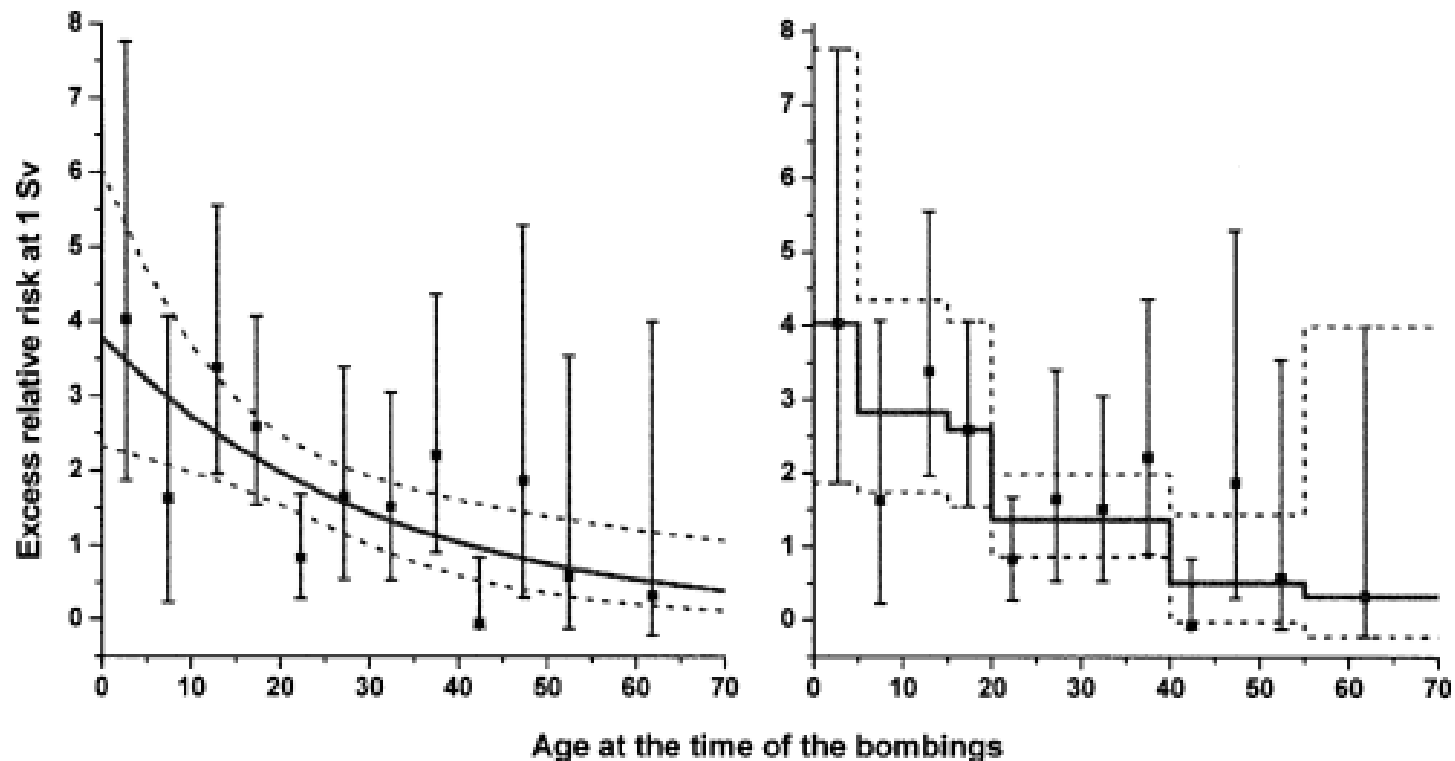
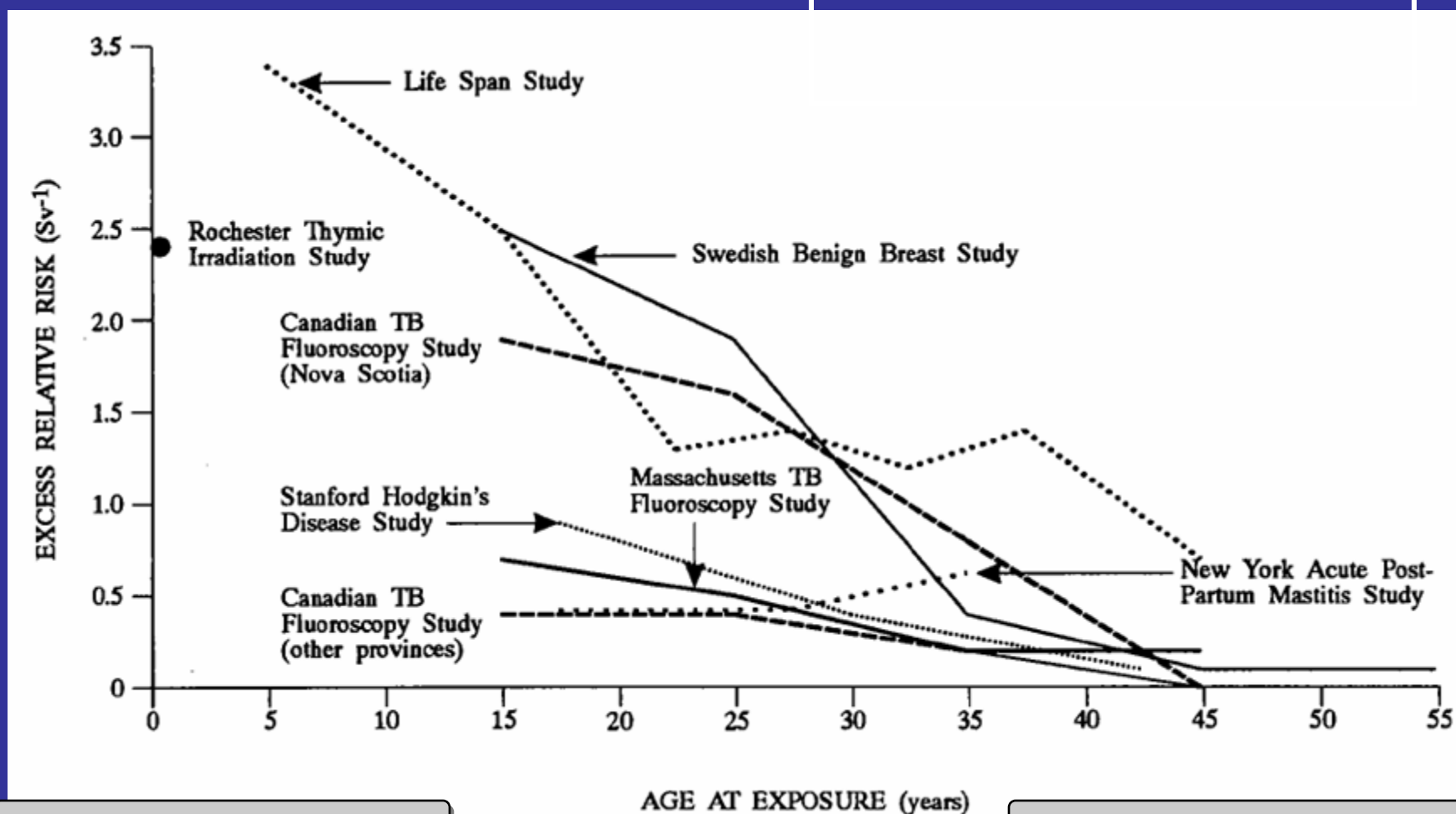


FIG. 3. Estimated excess relative risk per Sv with 90% confidence limits, by 5-year intervals of age ATB, e . The panels show a fitted exponential function on the left, $ERR_{1Sv} = a \times \beta^{e-25}$, and an isotonic regression on the right constrained only to be monotone non-decreasing in e .

Age at exposure response is similar in most radiation-induced breast cancer studies



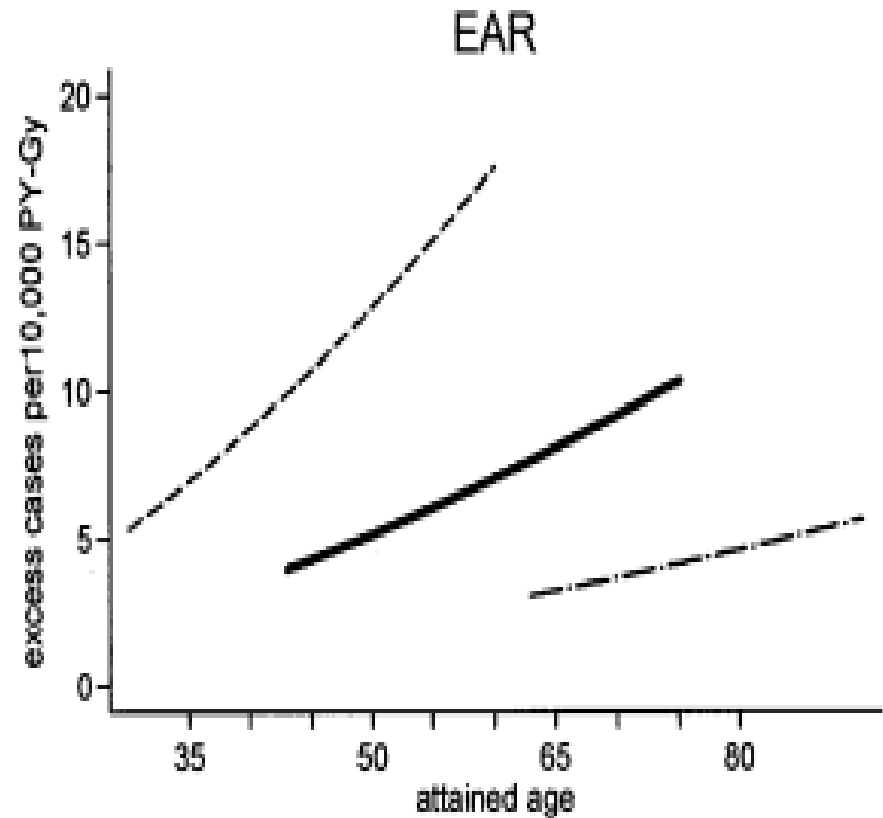
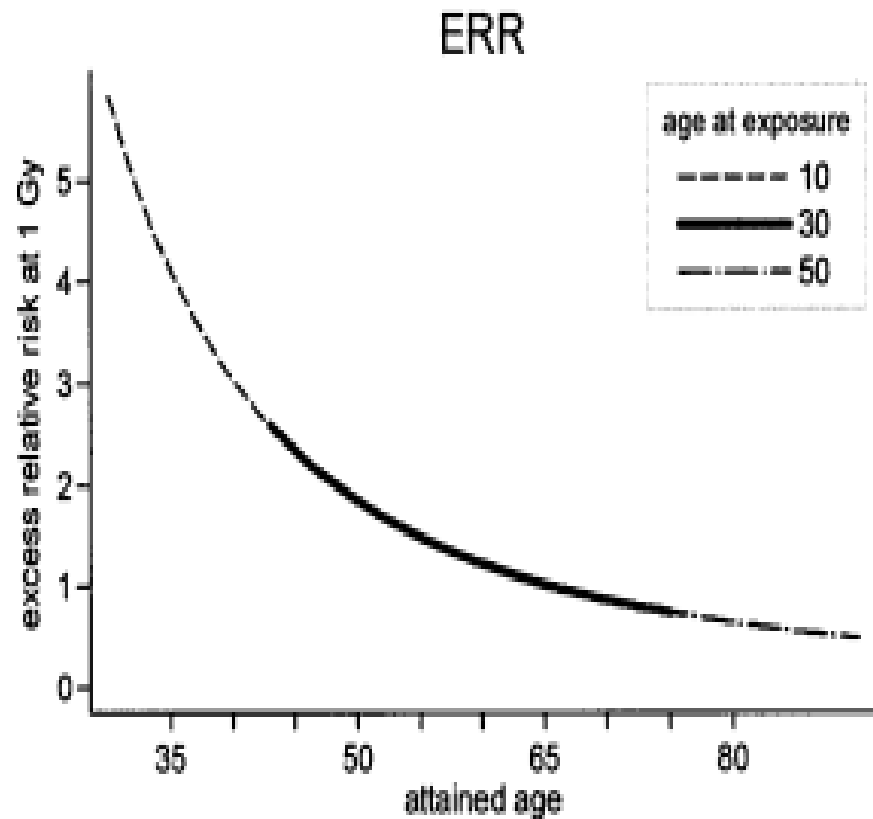
UNSCEAR, p. 155, 1994

Preston et al. *Rad Res* 2002

J. Boice "Consistency is so important in radiation epidemiology"

Breast cancer

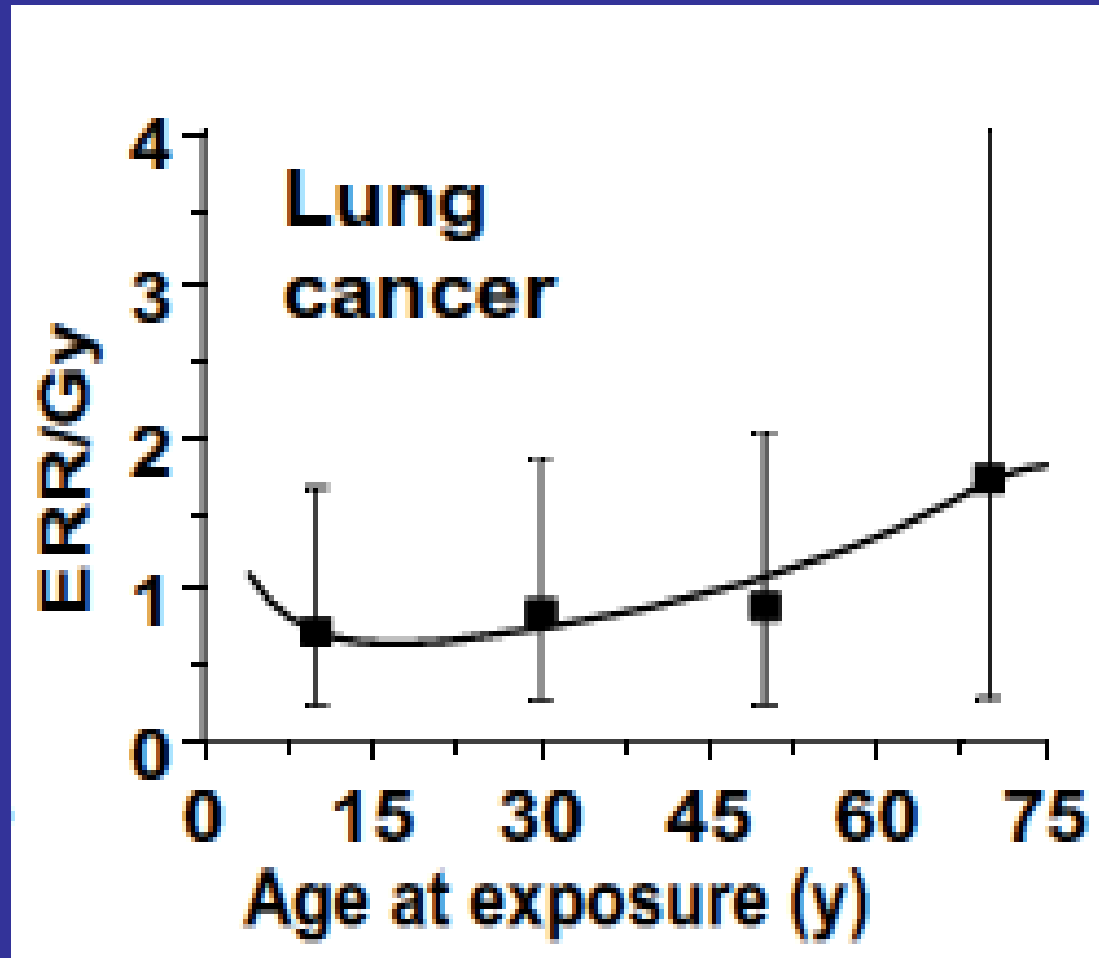
(different results of age-at-exposure effect by model)



Relative sensitivity of LAR by age at exposure in the BEIR VII model (male incidence)

	0	5	10	40
Colon	2.7	2.4	2.0	1
Lung	3.0	2.5	2.1	1
Bladder	2.6	2.2	1.9	1
Prostate	2.7	2.3	1.9	1
Other (40%)	6.5	3.9	2.9	1
Thyroid	38.3	25.3	16.7	1
Leukemia	2.8	1.8	1.4	1
All	5.4	3.8	2.9	1

ERR for cancer incidence in atomic bomb survivors estimated at attained age of 80 years



Relative sensitivity of LAR by age at exposure in the BEIR VII model (male incidence)

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Thyroid	38.3	25.3	16.7	1
Leukemia	2.8	1.8	1.4	1
All	5.4	3.8	2.9	1

Colon cancer (Incidence vs mortality)

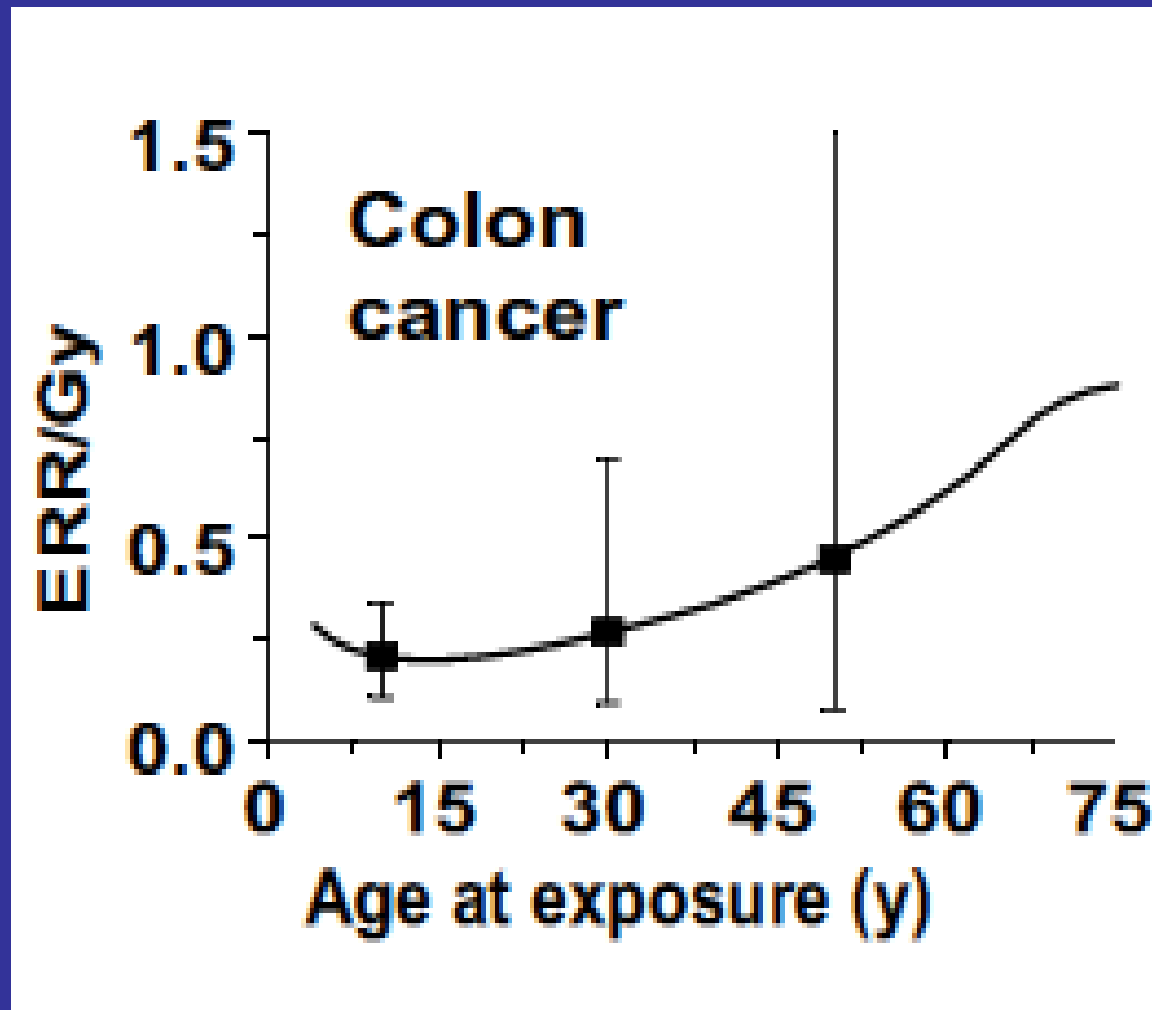
- A-bomb incidence

ERR no effect, EAR effect (attained age model)

- A-bomb mortality

ERR no effect , EAR +/-

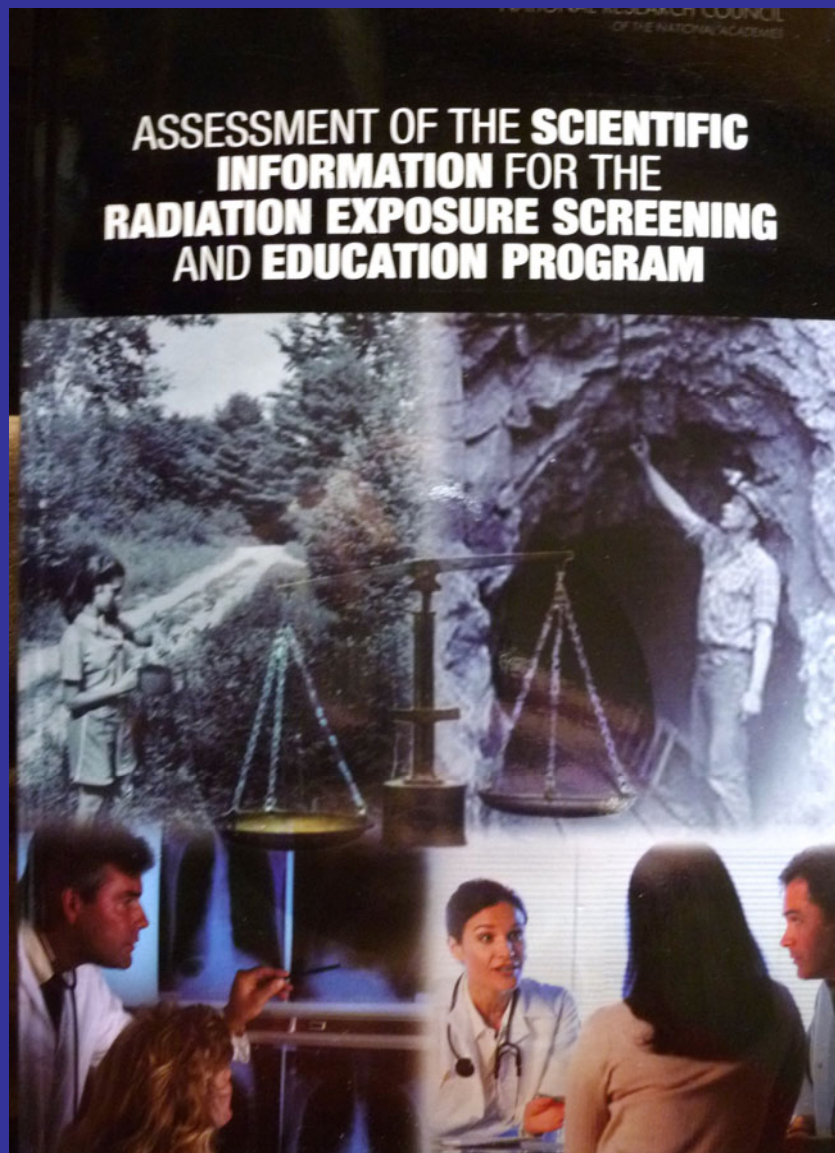
ERR for cancer incidence in atomic bomb survivors estimated at attained age of 80 years



Relative sensitivity of LAR by age at exposure in the BEIR VII model (male incidence)

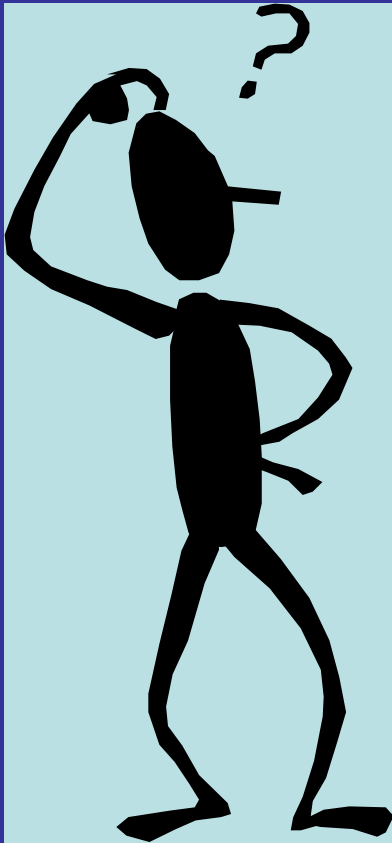
	0 yr	5 yr	10 yr	40 yr
Colon	2.7	2.4	2.0	1
Lung	3.0	2.5	2.1	1
Bladder	2.6	2.2	1.9	1
Prostate	2.7	2.3	1.9	1
Other (40%)	6.5	3.9	2.9	1
Thyroid	38.3	25.3	16.7	1
Leukemia	2.8	1.8	1.4	1
All	5.4	3.8	2.9	1

Other National Academy reports

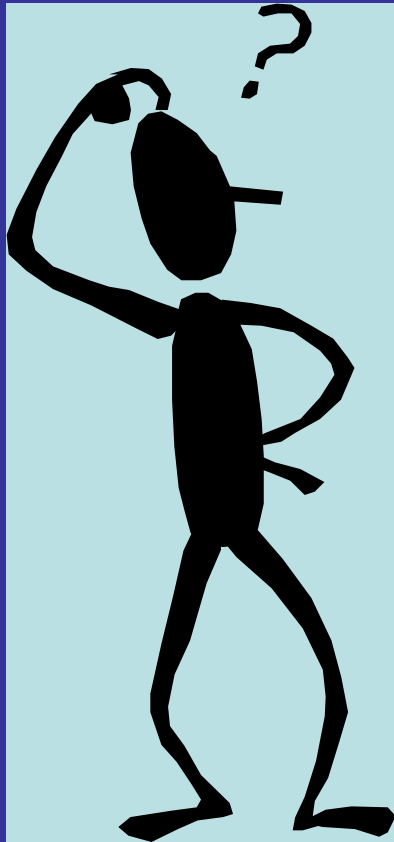


“There is no convincing evidence that prostate cancer is a radiogenic disease”

Do we have a “procrustean”
problem ?

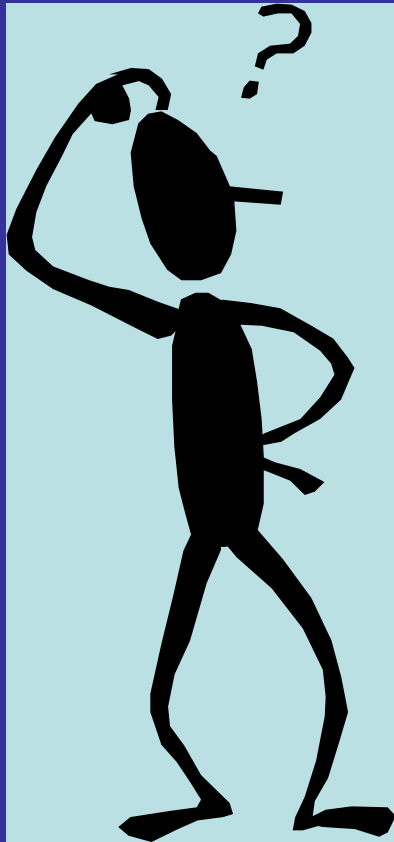


“procrustean”



- 1. A early form of a crustacean
- 2. The lower layer of the earth's mantle or crust
- 3. A mythical Greek robber
- 4. The outermost layer of a baguette

“procrustean”



- 1. A early form of a crustacean
- 2. The lower layer of the earth's mantle or crust
- **3. A Greek robber** ←
- 4. The outermost layer of a baguette

Procrustus and approaches to dealing with data



Not long enough.....



Too long....



**There is little or no data for some tumor types
....are we cutting off legs that were never there ?**



**This is OK if you realize it....but don't assume
the model is really the truth**



Sensitivity to cancer induction

Children vs adults

Site	More	Same	Less	No data on AAE	Evidence
Esophagus				X	weak
Stomach (mortality)	ERR	EAR			moderate
Small intestine*					
Colon (incidence)	EAR	ERR			
(mortality)	EAR, ERR?				
Liver			X		weak
Lung			X		weak
Skin (non-melanoma)	X				moderate
Breast	X				strong
Uterus				X	weak
Cervix				X	weak
Ovary				X	

* Little relation to radiation exposure

Sensitivity to cancer induction

Children vs adults

Site*	More	Same	Less	No data on AAE	Evidence
Prostate *					
Kidney		X			
Bladder		X			weak
Brain	X				strong
Thyroid	ERR	EAR			strong
Parathyroid					
Hodgkin's*					
Non-Hodgkin's lymphoma*					
Myeloma				X	moderate
Leukemia (non-CLL)	X				strong
Pancreas*					

* Little relation to radiation exposure

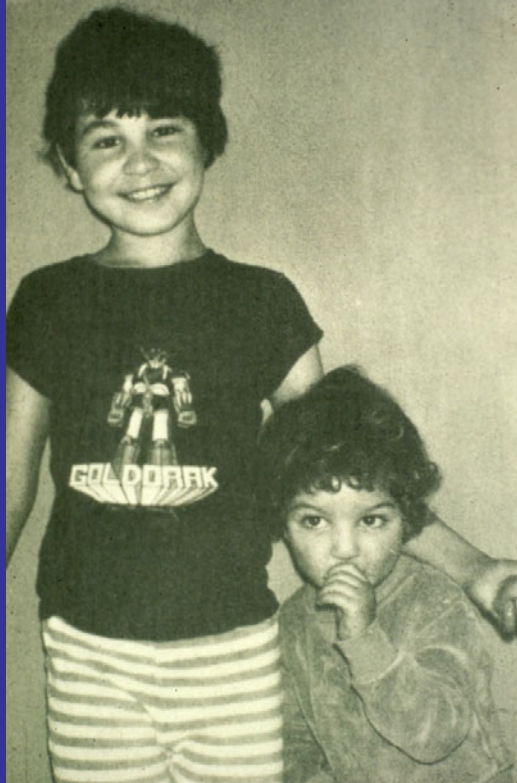
Tumor site and differential sensitivity based on the epidemiological data

- Children more sensitive 7 (30%)
 - Same as adults 5 +/- (22%)
 - Less than adults 2 (11%)
 - No good data on age at exposure 5 (22%)
 - Poorly or not related to radiation 4 (17%)
-
- Actually only a few tumor types have strong age-at-exposure data

Deterministic effects/ Tissue reactions

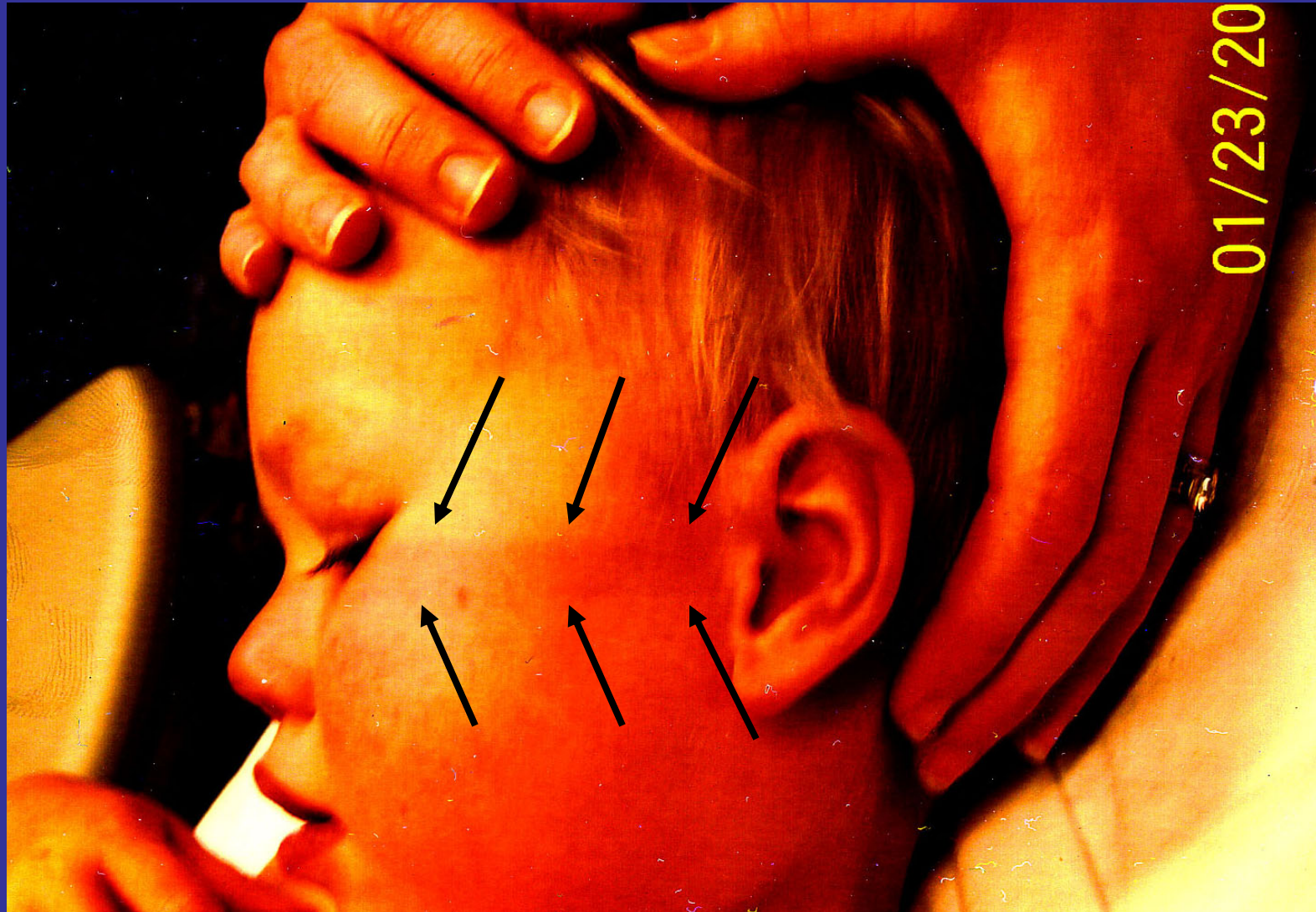
Data primarily from radiotherapy
and accidents

Accidental exposures



Orphan industrial radiography source 10^{12} Bq (26 Ci) ^{192}Ir

Erythema from accidental CT scan overexposure



Issues that drove Jacoby's parents crazy

- Initial radiologist said “there is no problem or risk”
- Parents saw erythema and were skeptical
- Hospital medical physicist reported a “fatal cancer risk of 39% due to the exposure”
- Dicentric analysis 5 Gy to several hundred Gy

**BETA BURNS
ON 13 YEAR OLD
MARSHALLESE BOY
45 DAYS AFTER
EXPOSURE**

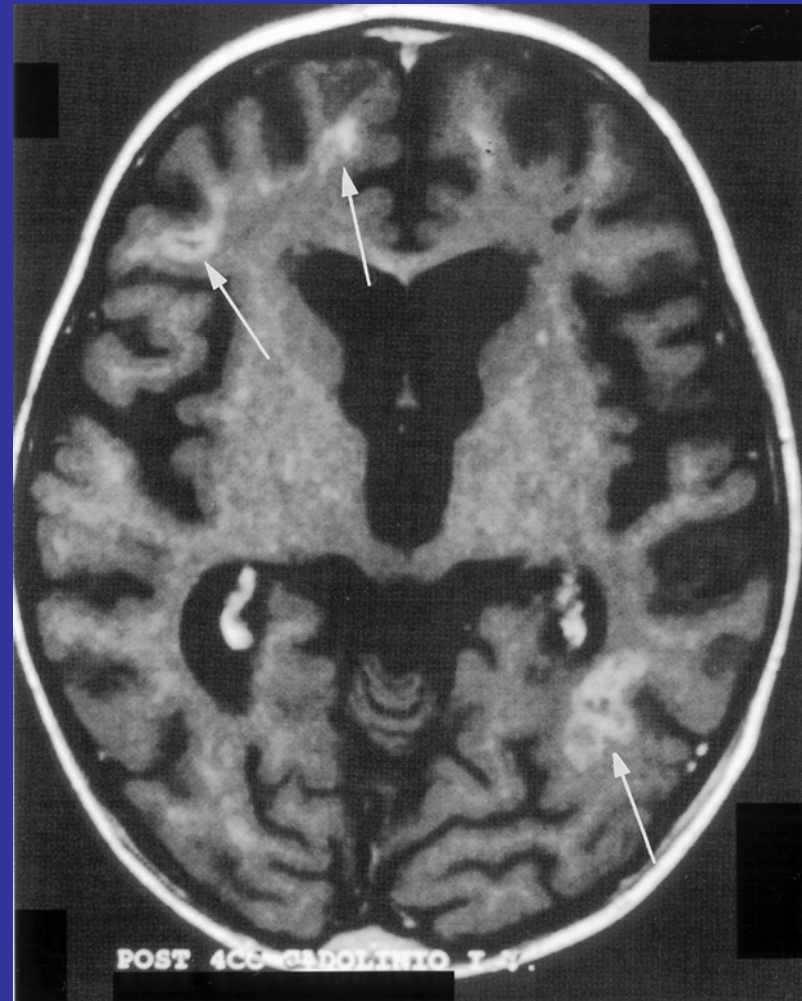


**13 YEAR OLD
MARSHALLESE BOY
6 MONTHS AFTER
EXPOSURE**



Brain

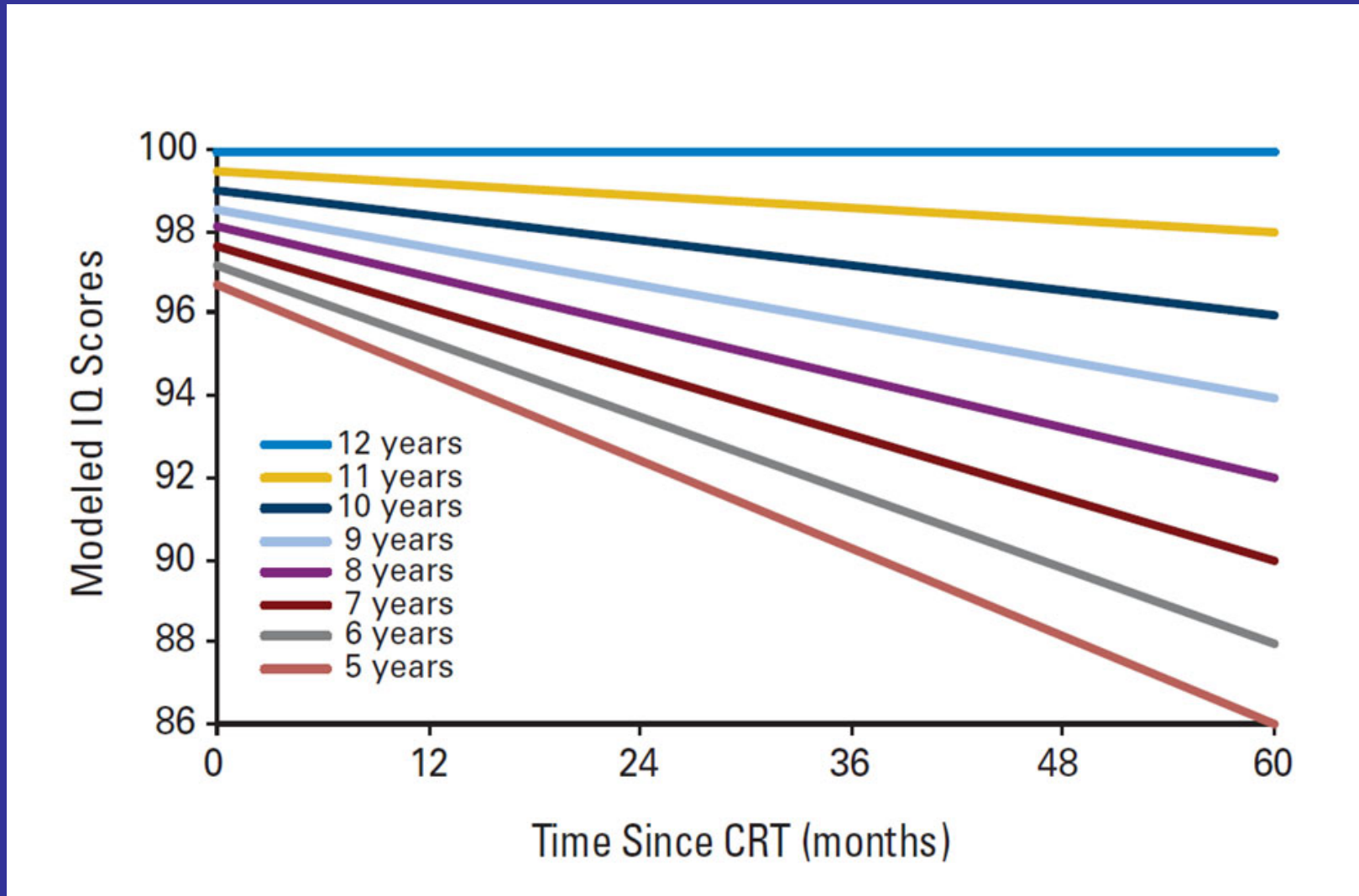
Costa Rica accident: 60% overexposure for leukemia treatment



Childhood cancer survivor study

- 5 year survival
 - Leukemia, lymphoma, CNS, bone, Wilm's, neuroblastoma, soft tissue sarcoma
 - Diagnosis 1970-1986
 - 20,696 eligible
 - 14,370 participants
- | | |
|--------------------|-----|
| • Surg, chemo, xrt | 43% |
| • Chemo + xrt | 12% |
| • Surg + xrt | 12% |
| • Xrt | 1% |

IQ reduction variation with age



Schizophrenia and Childhood Radiation ??

- Inconclusive studies

A bomb prenatal

Imamura et.al 1999

Childhood radiotherapy

Ross et. al.2003

Chernobyl

Loganovsky et.al.2000

- Tinea capitus 46 year followup 20,000+ subjects. Association not supported

Sadetzki et.al. Rad Res 176 670-677 2011

Cataracts and subcapsular opacities

- Radiotherapy of children

total body irradiation $<40\text{Gy}$ = $<10\%$ severe
cataracts

Tinea capitus pre-cataract changes not severe at
doses $> 0.2\text{ Gy}$

- Chernobyl

Increase 2-3 fold opacities in 12-17 males.

? dosimetry and observer bias

Subcapsular opacities ? 1.5-2 fold more sensitive

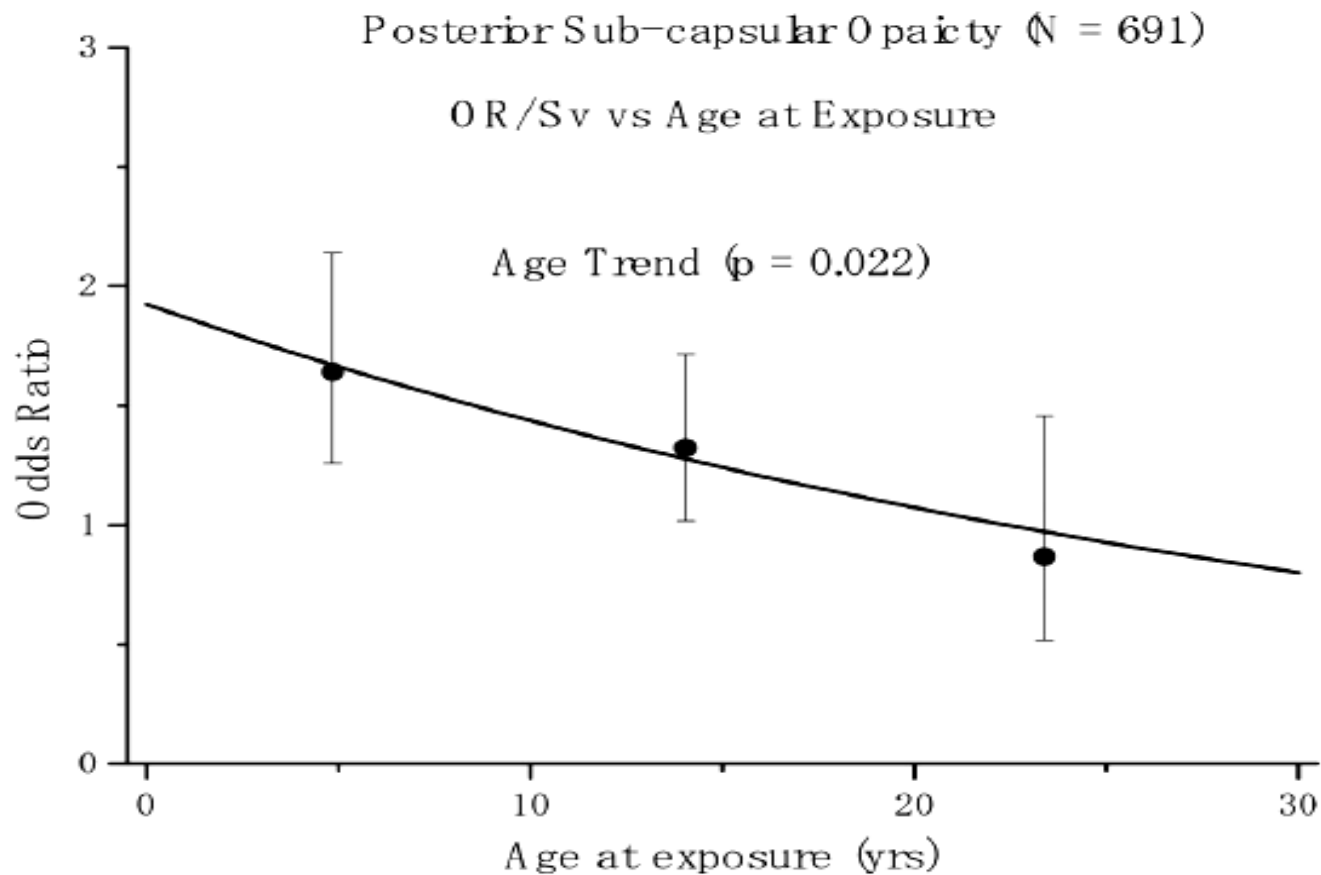


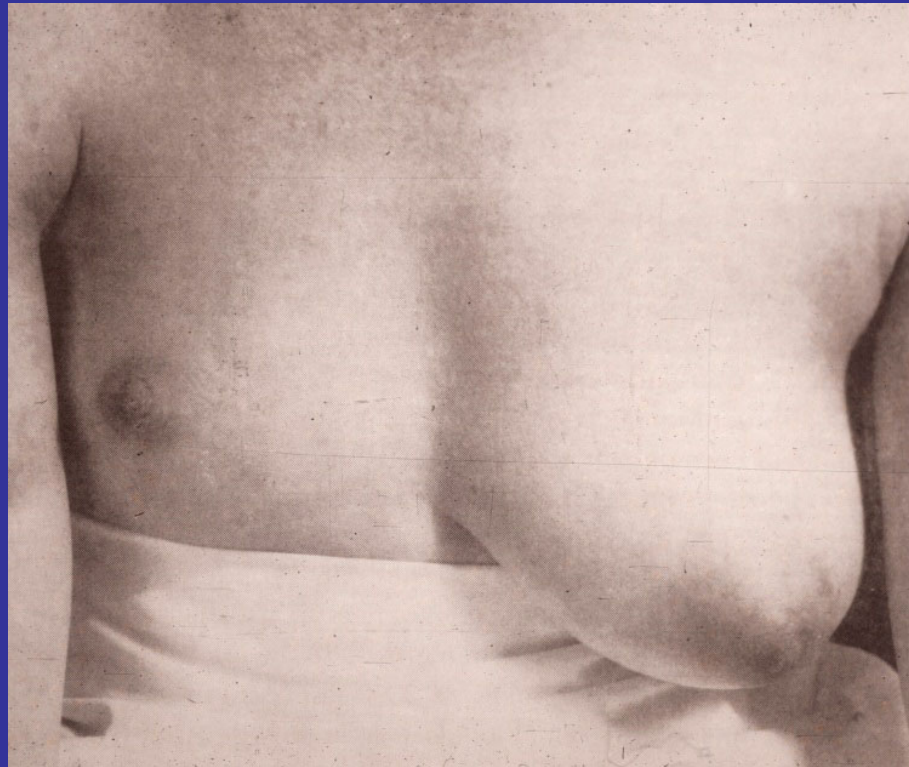
Fig. 5. Odds ratio per Sv for posterior sub-capsular opacity (PS) vs. age at exposure.

Cataracts



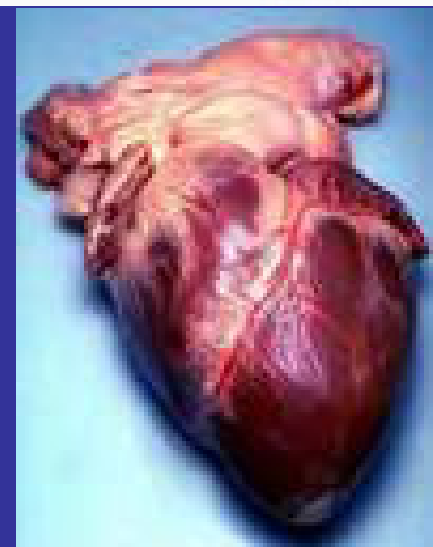
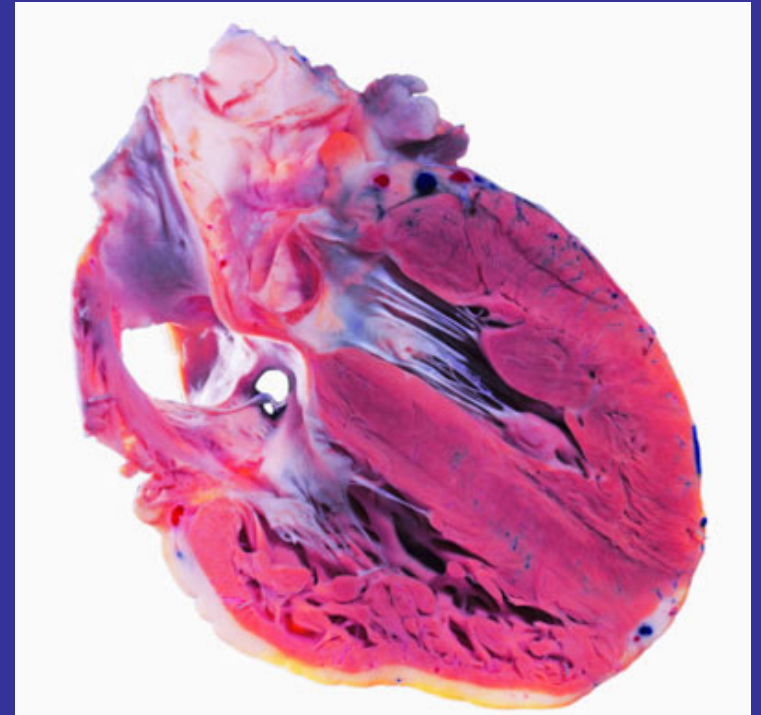
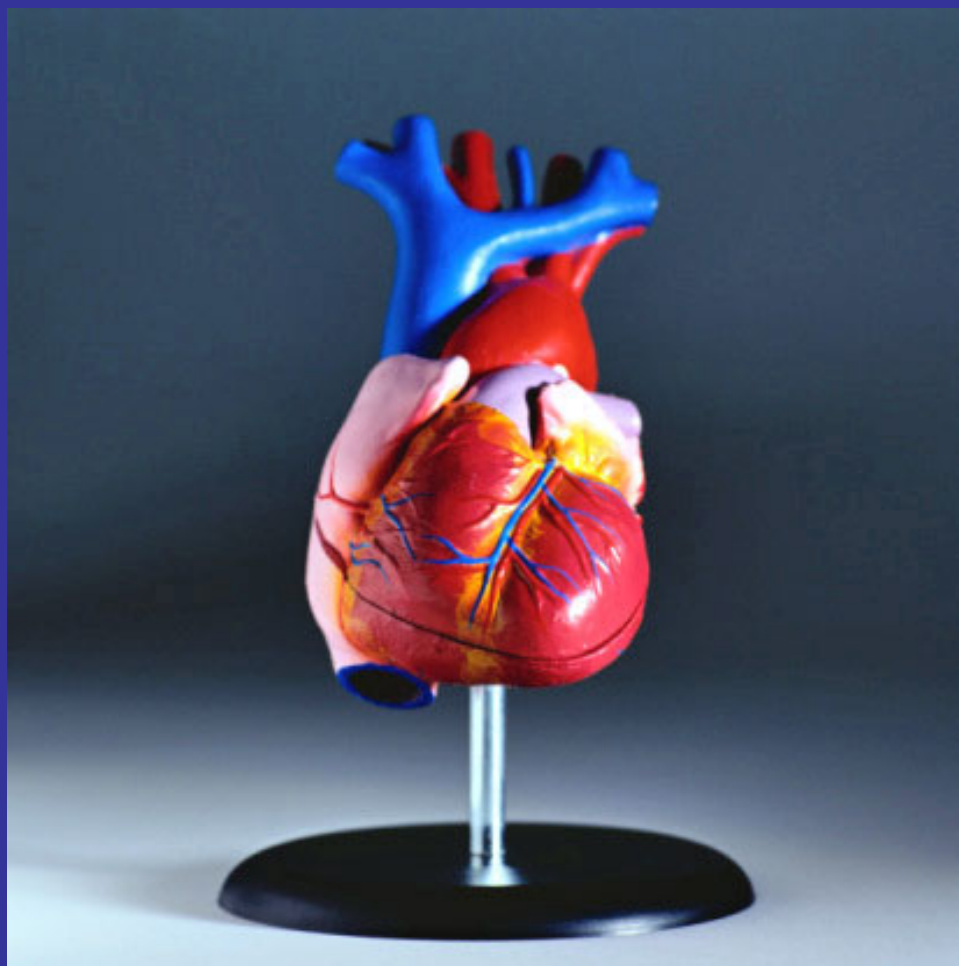
Jacoby at 4.5 years later has no evidence of lenticular opacities or cataract

Breast hypoplasia after benign hemangioma radiotherapy

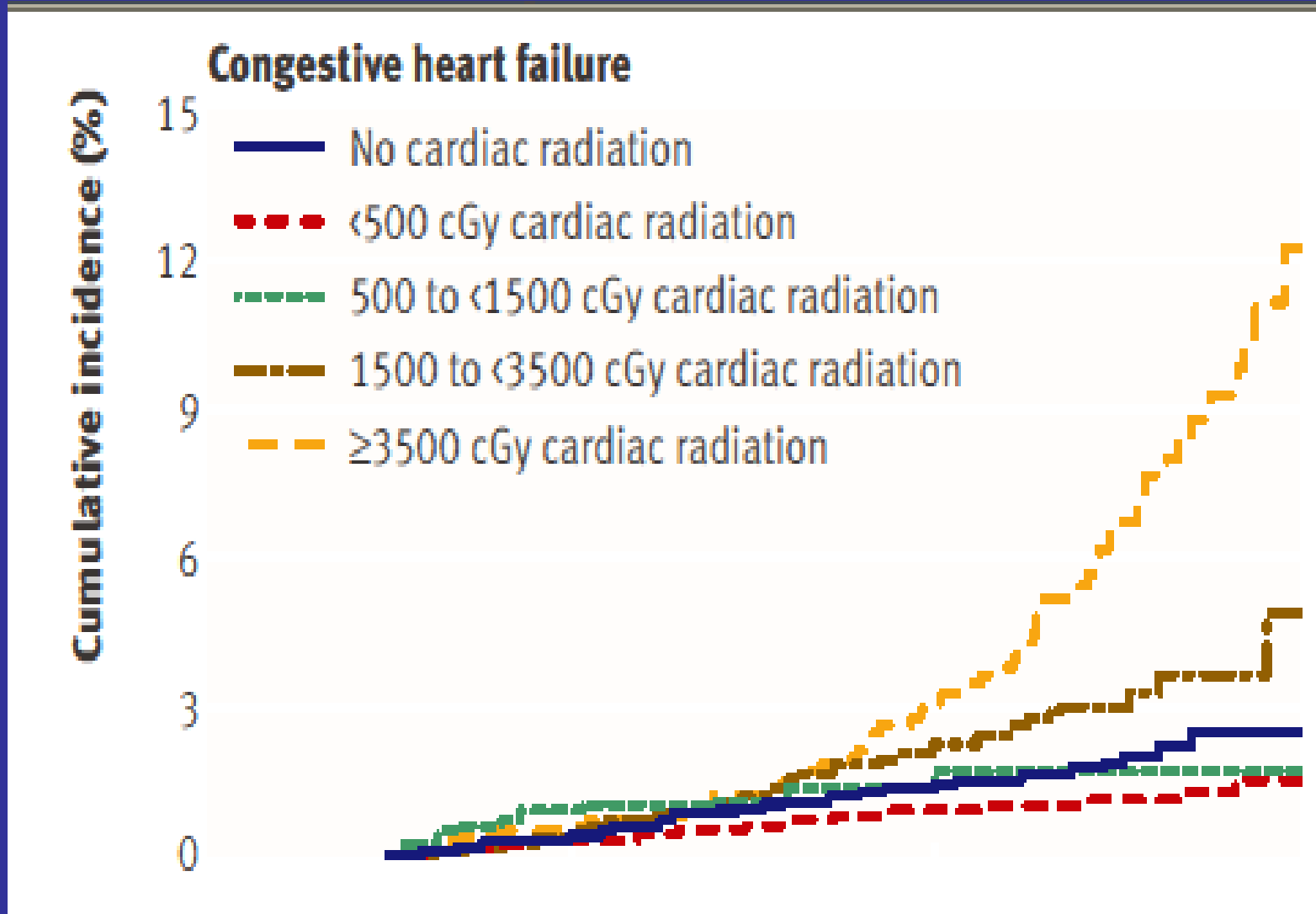


Fact: Humans are unique among mammals with breast ducts etc present at birth. Most mammals develop these with pregnancy

Heart



Heart disease in childhood cancer survivors



Is there an age-at-exposure effect ?

Atomic bomb survivors

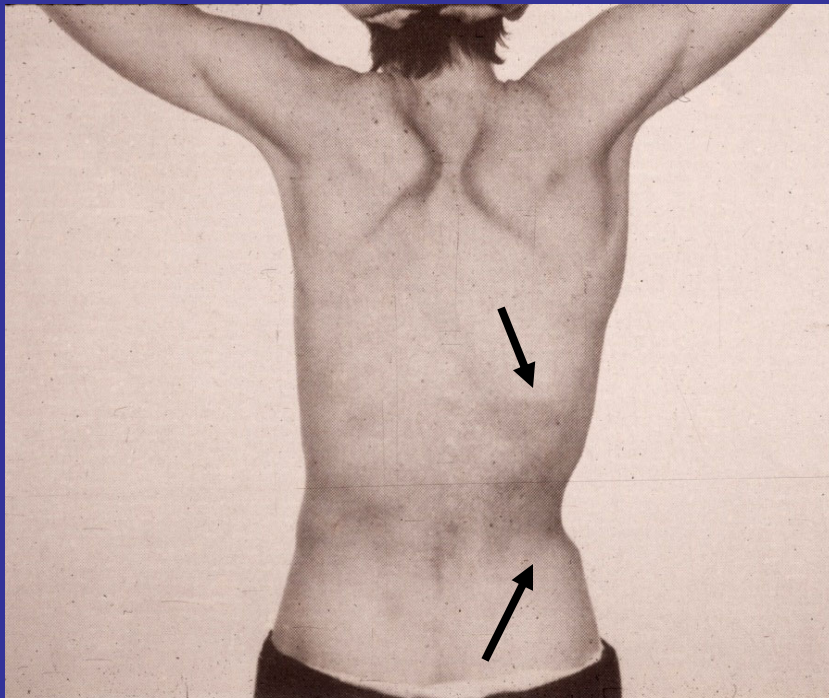
Shimizu et.al. For heart disease no significant modification by age-at-exposure

Childhood cancer survivors

Mulrooney et.al. 14,000 + survivors. Risk for cardiac outcomes slightly higher for “diagnosis” at young ages.

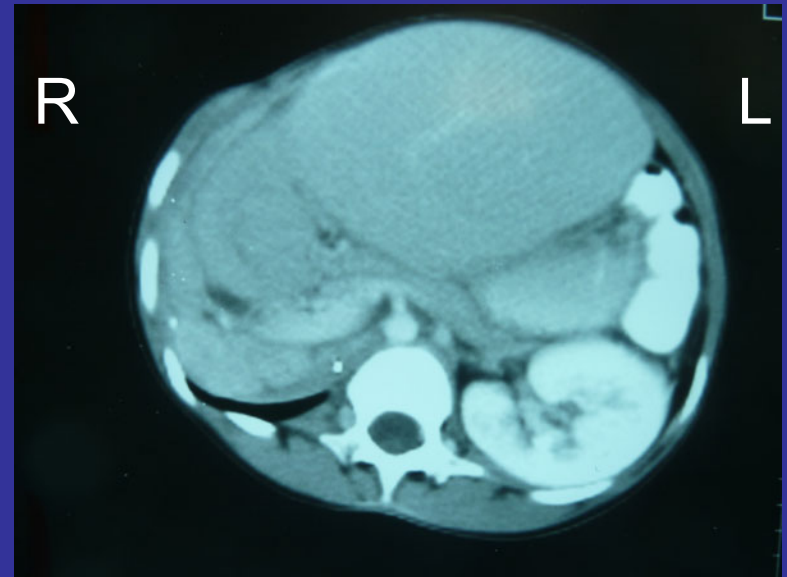
No risk at doses < 5 Gy. Risk significantly increased only at doses > 15 Gy

Musculoskeletal

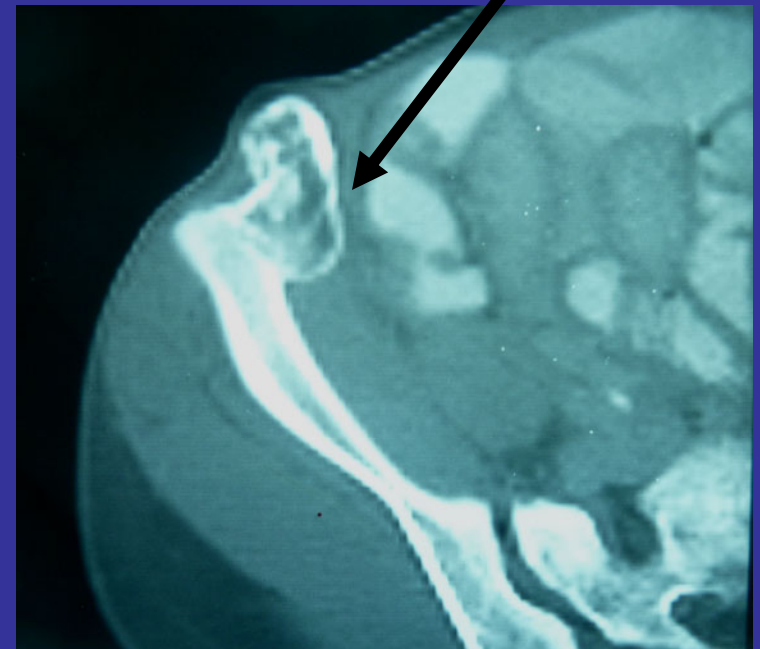


Pigmentation and muscle atrophy

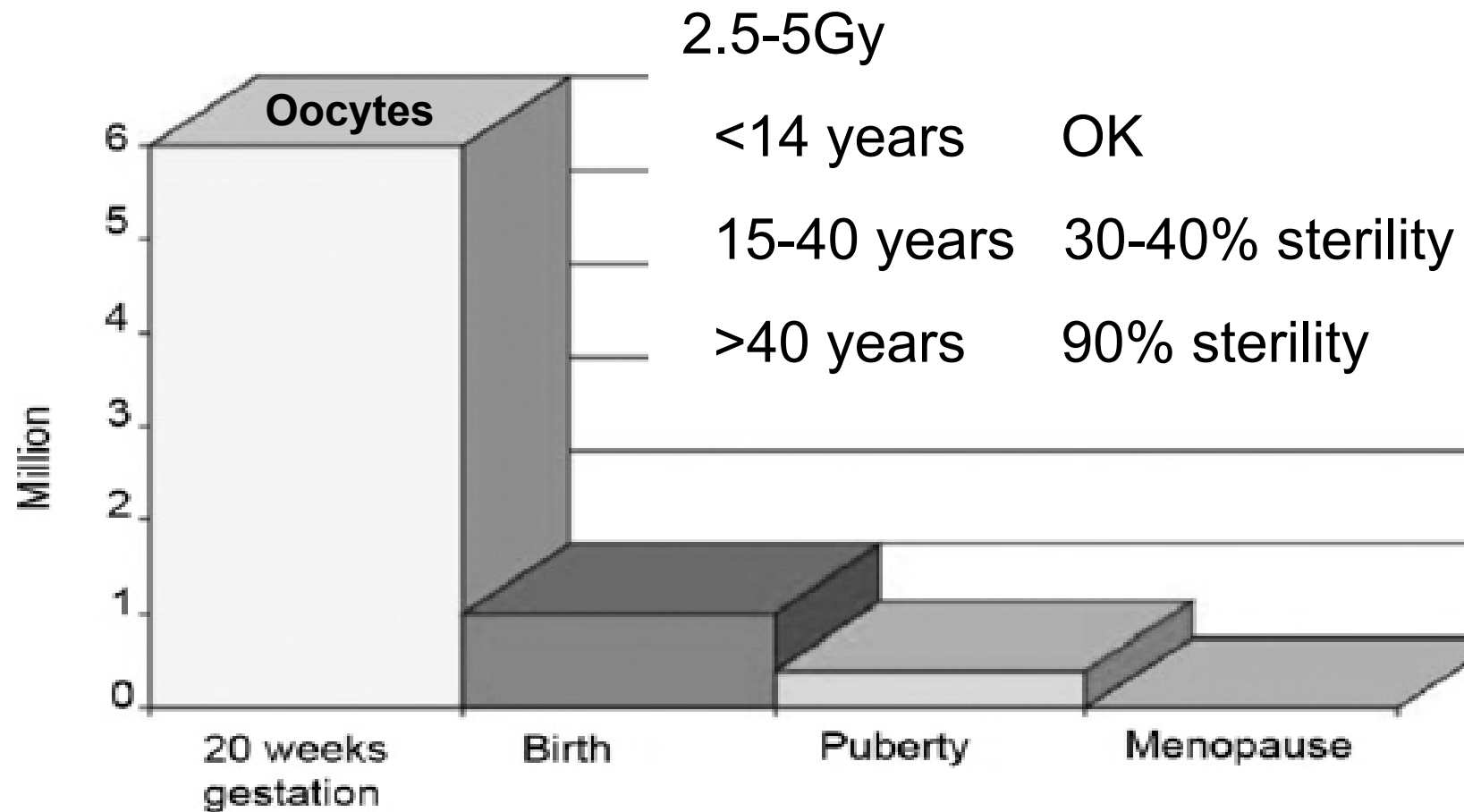
Atrophy on right



Osteochondroma



Ovary



Testes

- Sensitive especially during puberty
- Case of child abuse. Texas 1972-73
 - Petroleum engineer two 1Ci ^{137}Cs sources
 - Divorce issues. Partial custody 12 yr old son
 - Put in sock, pillow, headphones, underwear
 - Exposed over months
 - Injuries not diagnosed for a year or more
 - 16 surgeries. Effectively castrate

Uterine ovarian damage

CCSS Children of women who received more than 5 Gy uterine dose were small for age

(Green et.al 2009)

No effect from male exposure on stillbirth and neonatal death. At uterine doses > 10 Gy there was an increase in adverse effects from uterine (not hereditary) damage (Signorello, Boice et.al.2010)

1-2.5 Gy uterine dose before menarche increased adult risk of stillbirth or neonatal death (Signorello, Boice et.al 2010)

Deterministic effects Child vs adult sensitivity

Radiotherapy dose levels !!!!

Tissue	More	Same	Less	?	Data	Comment
Brain	X				strong	IQ decrease
Neuroendo		X			strong	more consequence
Cataracts/ opacities	X				weak	2-fold for opacities
CVA/stroke	X				moderate	
Heart	X				strong	myocyte issues
Breast	X				strong	Hypoplasia
Lung			X		weak	

Deterministic effects Child vs adult sensitivity

Radiotherapy dose levels !!!!

Tissue	More	Same	Less	?	Data	Comment
Ovaries			X		Moderate	
Uterus	X				Moderate	decrease perfusion
Marrow			X		Moderate	
Immune				X		
Musculoskel	X				Strong	Hypoplasia
Testes	X					During puberty
Bladder	X				Strong	< capacity
Kidney				X		

Deterministic effects

Dose levels below radiotherapy

Tissue	More	Same	Less	?	Data
Cataract	X				Weak
Hypothyroid				X	
Autoimmune				X	
Nodules	X				Strong

Hereditary effects

What about the children of the exposed children ?



NCI Five – Center Study

Offspring of Cancer Survivors

Survivors (2,198) Controls (4,544)

Birth defect	3.37%	3.13%
Cancer	0.30%	0.23%

Byrne, Teratology 59:210, 1999



Recent childhood cancer survivor studies

4,699 children. No relation between ovarian or testicular dose to congenital abnormalities (Signorello et.al. 2011)

No increase in cancer in offspring (Madanat-Harjuola et.al.2010)

Scams, scares and some good things

“Children of Chernobyl” Then vs now.....

Adli Roche's
Chernobyl children international 25 years
There is hope, it's you

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Chernobyl 25 years on
Facts and Figures
Chernobyl Stories
The liquidators
The bee keepers
The medical volunteer
The volunteer builder
The outreach volunteer
The children
Video Library
Photo Galleries
Children's Heart Surgeries
Hospital & Community Care Programs
2010 Christmas Program
Volunteers In Action
Volunteers

CHILDREN'S HEART SURGERIES

Home / Learn More / Photo Galleries / Children's Heart Surgeries

1
Pulse Ox
[Buttons]

Child in hospital bed with medical equipment

Children of Chernobyl USA Website

Now, over twenty years later traces of plutonium are still being detected in the placenta of mothers, and children are still being born with documented cases of life threatening diseases including "Chernobyl heart" disease.

<http://www.world-heart.org/doc/9078>

Japan Says Children Exposed to Radiation

Survey of Youths Near Stricken Plant Raises Concerns Over Long-Term Health

By YUKA HAYASHI

TOKYO—Nearly half of the children surveyed in three towns near the stricken Fukushima Dai-ichi nuclear plant received low-grade internal exposure to radiation during the early days of the accident there, the government said Thursday, fueling concerns about long-term health effects on local residents.

The government in late March tested 1,150 children in the three towns located primarily outside the government mandatory evacuation zones of 20 and 30 kilometers, and said that all of them cleared its health standard. After Fukushima parents and radiation experts demanded more details, the government revealed this week that 45% of the children were exposed to radiation, albeit at low levels.

While the government has released reports on radiation exposure for workers at the Fukushima complex, this is the first time officials have made public the results for tests to detect internal exposure on residents near the reactors.

Internal radiation—which enters the human body through breathing in contaminated air or consuming contaminated food or drinks—can have a greater health effect than what is known as external radiation, in which radiation is confined to the surrounding environment.

Since the accident, the government has tested 219,000 residents for external exposure. Some initially showed elevated levels, but once clothes were removed and showers were taken, none had showed results high enough to warrant health con-

cerns, according to a Nuclear and Industrial Safety Agency statement. The government has promised to do further tests in the coming weeks on potentially affected populations.

A spokesman for NISA, the main nuclear regulatory body, said Thursday that the doses the Fukushima children received were below the levels at which health effects become a concern. Children, particularly younger ones, are more susceptible to the effects of radiation, facing higher risks than adults of developing thyroid cancer later in life, experts say.

One independent expert, Yoshio Hosoi, a professor at the Research Institute for Radiation Biology and Medicine at Hiroshima University, said in an interview that, assuming the results reported are accurate, "I think the possibility of these children developing thyroid cancer is extremely low."

However, he raised some questions about the government's testing methodology, saying that officials didn't conduct the tests quickly enough after the initial exposure to measure radioactive elements known to disintegrate rapidly, such as iodine 132 and tellurium. NISA officials couldn't be reached late Thursday to comment.

The latest news follows a series of reports raising concerns about the protection against radiation exposure provided by the government to local residents during the days and weeks following the accident. For example, government officials had data a few days after the accident indicating that Iitate—one of the three towns where the



A girl received a radiation scan at a March screening in Fukushima prefecture. Japan says many children received low-grade internal exposure.

children were tested—had become what they later called a nuclear "hot spot" with elevated levels of contamination.

The tests were conducted between March 24 and 30 on the thyroid glands of children in Iitate, Kawamata and Iwaki—three municipalities located outside the government's 20-kilometer

evacuation zone set the day after the March 11 earthquake and tsunami struck the plant.

The move came after the government confirmed in late March its radiation projection system known as Speedi showed these towns had received relatively large doses of exposure. The tests were conducted on children

from infancy to 15 years old.

According to the breakdown of the test results—first revealed to some Fukushima parents on Wednesday—55% of the children showed "zero" exposure to radiation. An additional 26% were found to have received 0.01 microsievert per hour, well below 0.2 microsieverts per hour that

the government considers a health risk.

"They told me my son will be fine," Yuka Sato, a 25-year-old mother from Iitate said. The exposure level of her 17-month-old child was below the 0.2 microsieverts guideline, she said, adding, "I am still worried about his health in the future."

**Christopher Busby Foundation
for
Children of Fukushima**





contact@4u-detox.com

==
Calcium Lactate 800mg
===== 800mg
Magnesium Oxide 300mg
===== 300mg
Sodium selenate 50micrograms
===== 50micrograms
Sodium molybdate 25micrograms
===== 25micrograms
plus cellulose etc bulking agents etc
=====

Price: ₹ 5800

Add to Cart

Launching the products and tests, Busby warns in his video of a public health catastrophe in Japan caused by the Fukushima explosions, and claims that radioactive caesium will destroy the heart muscles of Japanese children.

He also alleges that the Japanese government is trucking radioactive material from the Fukushima site all over Japan, in order to "increase the cancer rate in the whole of Japan so that there will be no control group" of children unaffected by the disaster, in order to help the Japanese government prevent potential lawsuits from people whose health may have been affected by the radiation. The pills, he claims, will stop radioactive contaminants attaching themselves to the DNA of Japanese children.

But Gerry Thomas, professor of molecular pathology at the department of

Data

Environment > Nuclear power

Post-Fukushima 'anti-radiation' pills condemned by scientists

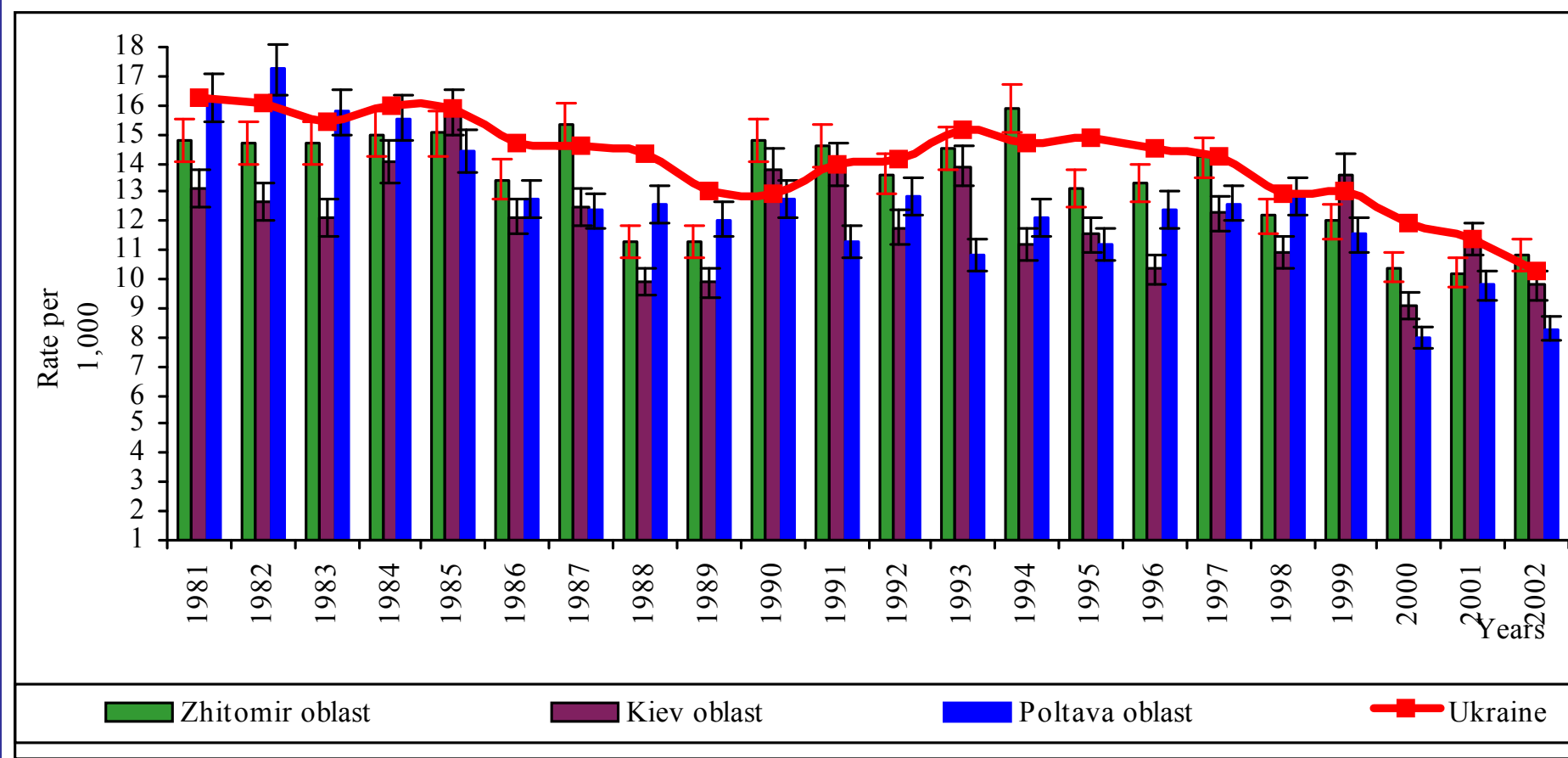
Green party distances itself from Dr Christopher Busby, a former spokesman promoting products following Japanese nuclear disaster

George Monbiot and Justin McCurry in Tokyo
guardian.co.uk, Monday 21 November 2011 11.59 EST
[Article history](#)



Dr Christopher Busby, director of environmental consultancy Green Audit, who published a YouTube video to launch his products. Photograph: Yann Forget

Infant mortality and Chernobyl



Contaminated oblasts vs Ukraine as a whole

Why then this current literature ?

Weekend Edition
June 10 - 12, 2011

*A 35% Spike in Infant Mortality in Northwest Cities Since
Meltdown*

Is the Dramatic Increase in Baby Deaths in the US a Result of Fukushima Fallout?

By JANETTE D. SHERMAN, MD
and JOSEPH MANGANO

U.S. babies are dying at an increased rate. While the United States spends billions on medical care, as of 2006, the US ranked 28th in the world in infant mortality, more than twice that of the lowest ranked countries. ([DHHS, CDC, National Center for Health Statistics](#). Health United States 2010, Table 20, p. 131, February 2011.)

Are Babies Dying in the Pacific Northwest Due to Fukushima? A Look at the Numbers

By Michael Moyer | Tuesday, June 21, 2011 | 34 comments



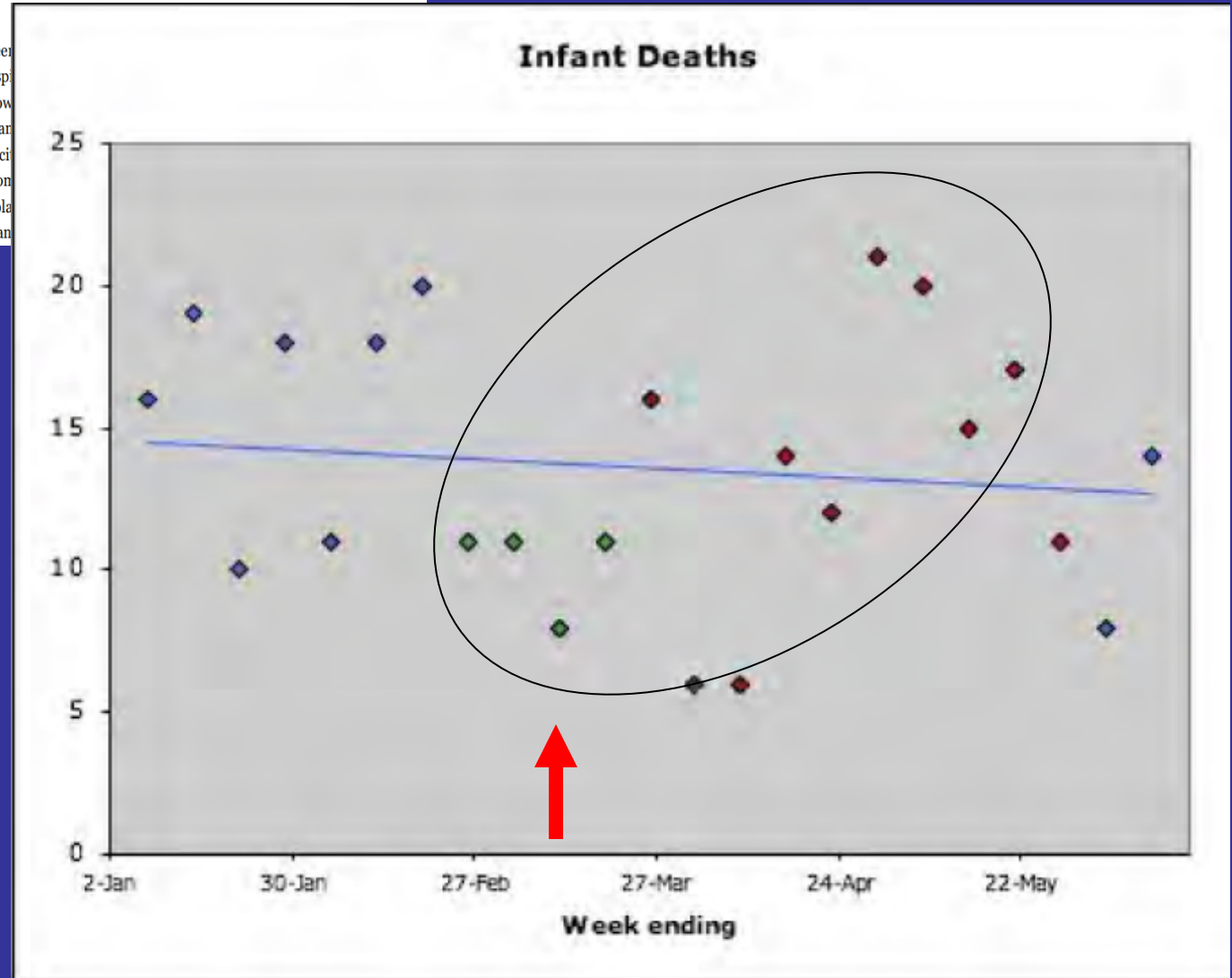
A recent article on the Al Jazeera English web site cites a disturbing statistic: infant mortality in certain U.S. Northwest cities spiked by 35 percent in the weeks following the disaster at the Fukushima Daiichi nuclear power plant. The author writes that "physician Janette Sherman MD and epidemiologist Joseph Mangano published an essay shedding light on a 35 per cent spike in infant mortality in northwest cities that occurred after the Fukushima meltdown, and [sic] may well be the result of fallout from the stricken nuclear plant." The implication is clear: Radioactive fallout from the plant is spreading across the Pacific in sufficient quantities to imperil the lives of children (and presumably the rest of us as well).

Are Babies Dying in the Pacific Northwest Due to Fukushima? A Look at the Numbers

By Michael Moyer | Tuesday, June 21, 2011 | 34 comments



A recent article on the Al Jazeera website claims that a spike in infant deaths in certain U.S. Northwest cities since the Fukushima Daiichi nuclear power plant disaster is the result of radioactive fallout from the plant. An epidemiologist and pediatrician, Joseph Martignetti, says that the spike in infant mortality in northwest cities is well above what would be expected. He says that the spike in infant mortality will be the result of fallout from the Fukushima Daiichi nuclear power plant. Radioactive fallout from the plant will imperil the lives of children (and



Good things

HEALTHCARE



CHILD SMART ◦

Shielding appropriate?

Marking of films, ID etc. appropriate?

Area collimation appropriate? Field size and location.

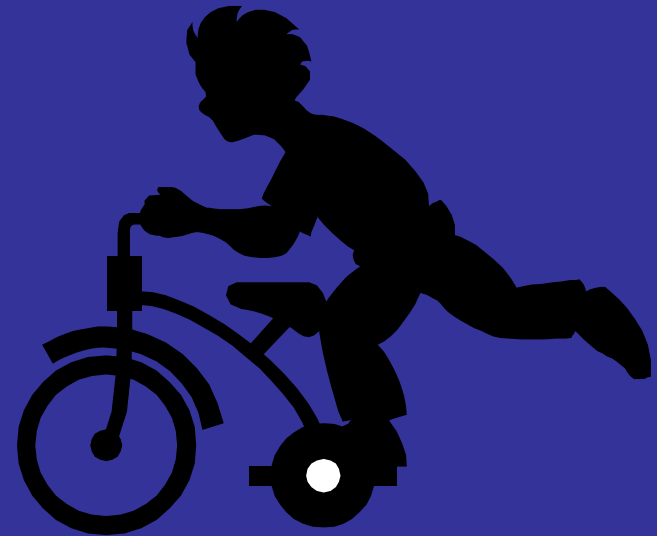
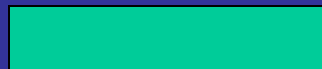
Restriction of child motion appropriate?

Technical settings appropriate? Shortest exposure time, kV up.



Great Idea !!

- Donald Frush et. al. AJR 2002
- Color by size
- Protocol/dose by size



It really took media attention to accelerate changes in CT scanner design, but it happened.....

CT scans for young kids raise concerns

from PAGE C1

1930 to 1959.

Because 95 percent of Swedish men ages 18 and 19 are tested before military service, researchers were able to track information about the education and cognitive test results of these former pediatric patients.

The researchers found that the proportion of boys who attended high school decreased in relation to increasing doses of ionizing radiation — the type that penetrates the body — to the front and back of the brain.

The more radiation they were exposed to, the more impaired their learning ability and logical reasoning. Spatial recognition was unaffected. Because the dosages overlap those of CT scans, the findings raise questions about the long-term developmental effects of CT scans, which increasingly are used to assess minor head injuries, Swedish researchers wrote. Although they had data only about

radiation exposure before the age of 18 months, they said the findings raised questions about exposure and young children in general.

But Nelson said the types of radiation used then are different from today's CT, and that there are differences in the way various types of radiation are absorbed by the brain.

"If the child has significant head trauma as determined by the examining physician would not hesitate to do a CT," Nelson said "The benefits far outweigh the risks."

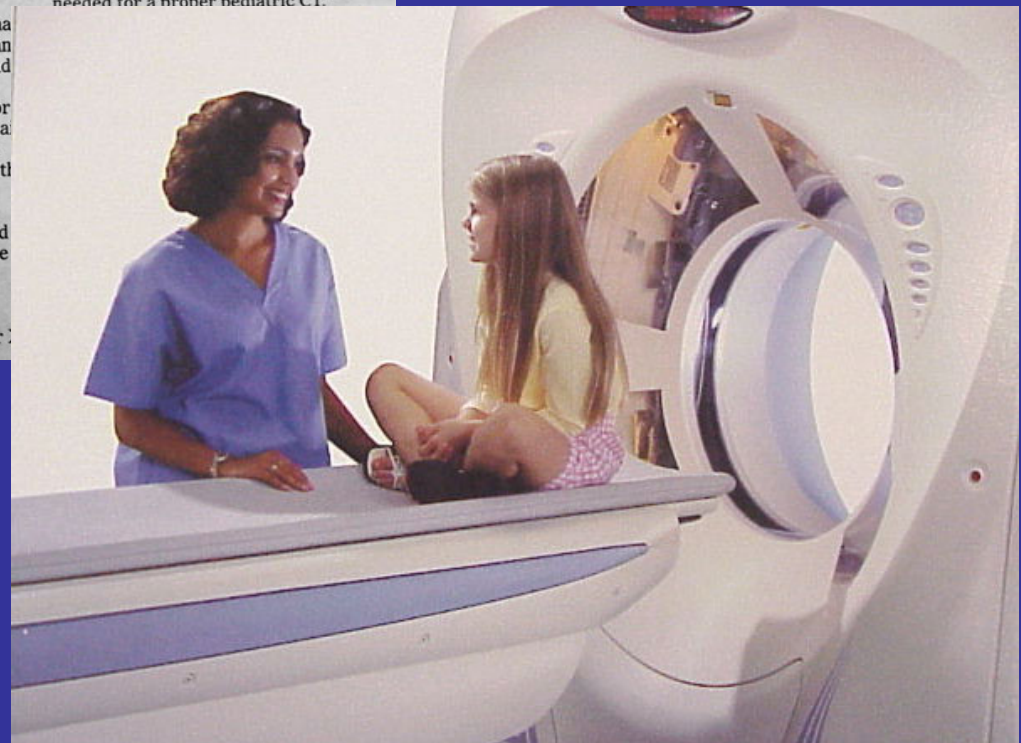
CT is the preferred test when a doctor suspects that a child has sustained a brain injury. The signs are unequal eye pupil size, weakness or lack of movement in the extremities and abnormal reflexes or unconsciousness for several minutes.

But it's not always required. If a child knocked out briefly, he or she should be observed and usually won't need a CT scan, Nelson said.

If a CT is recommended, Nelson suggests that parents ask the doctor or

ray technician "whether the CT facility is using the proper reduced-dose protocols for children based on the size of the child."

He noted that many hospitals and medical facilities use radiation dosing guidelines for adults, which "deliver two to three times more radiation than is needed for a proper pediatric CT."



Good

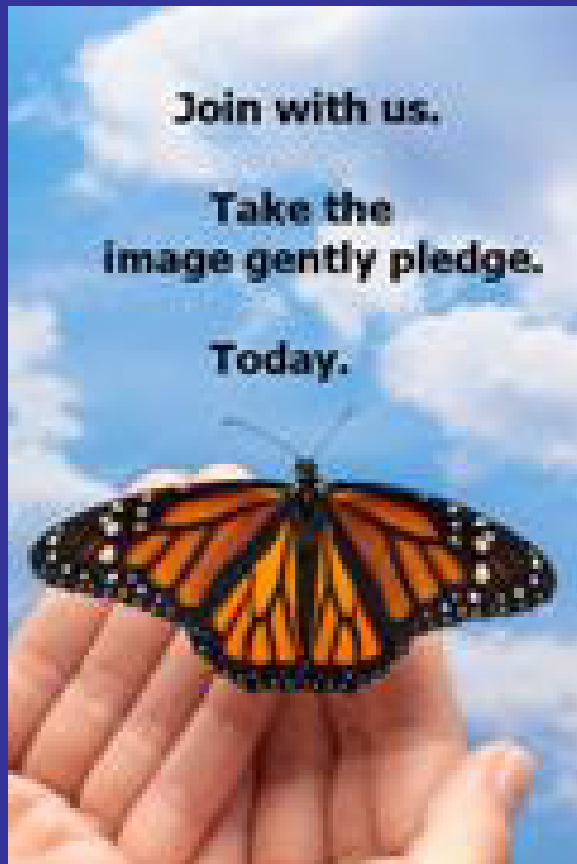


IMAGE WISELY™

Radiation Safety in
Adult Medical Imaging



Dosage Card (Version 1.5.2008)

Multiple of Baseline Activity

Weight kg	Class A	Class B	Class C	Weight kg	Class A	Class B	Class C
3	1	1	1	32	3.77	7.29	14.00

NORTH AMERICAN CONSENSUS GUIDELINES FOR ADMINISTERED
RADIOPHARMACEUTICAL ACTIVITIES IN CHILDREN AND ADOLESCENTS

Yohei Sasakawa



日本財団
The Nippon Foundation



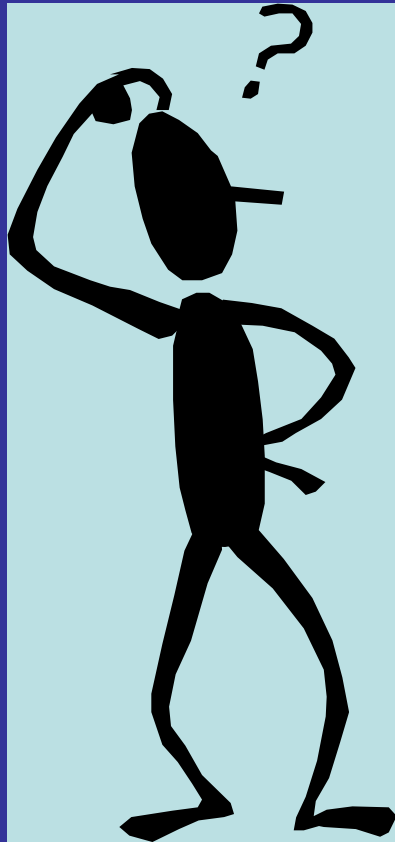
A few radiation protection points



The issue of effective dose for different ages

Effective doses (mSv) for CT scans

Age	Newborn	≤ 1 y	2 - 5 y	6 - 10 y	11 - 15 y	> 15 y
Cranium	3.3	2.7	2.0	2.1	0.89	1.0
Thorax	1.6	1.6	2.3	3.0	3.2	5.6
Abdomen	4.4	5.1	6.6	7.5	7.5	14



Is there really such a thing as an effective dose for a newborn or a 5 year old ?

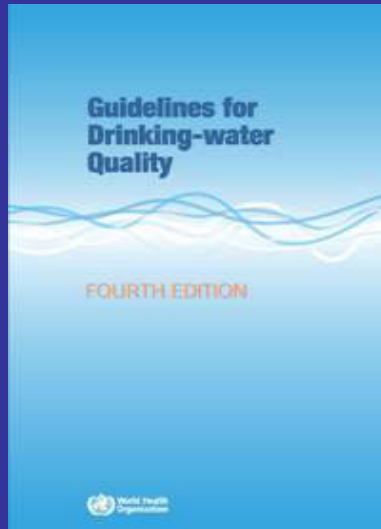
Disparate radiation criteria and “limits” cause intense anxiety among parents



Incoherence in drinking liquids



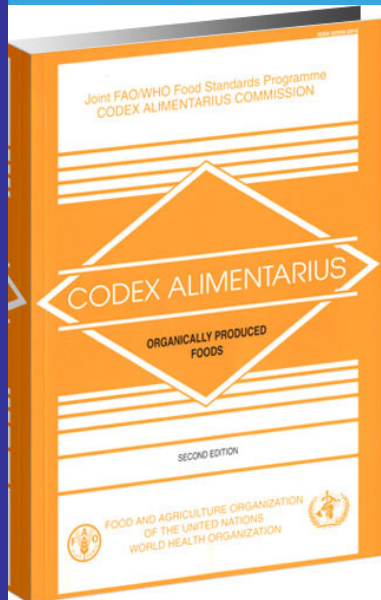
+



= 10 Bq L⁻¹ for ¹³⁷Cs



+



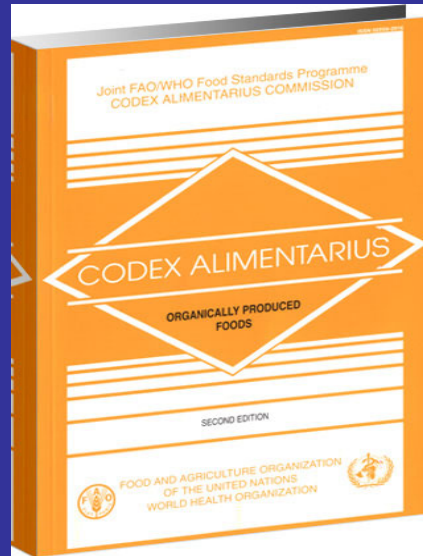
= 1000 Bq L⁻¹ for ¹³⁷Cs

100 x more

Incoherence in non-edible vs. edible



+

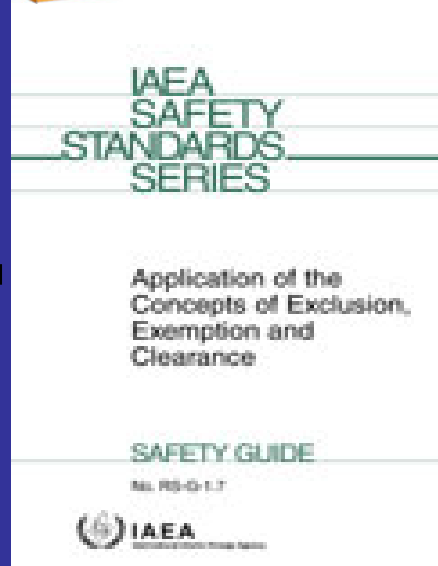


= 1000 Bq kg⁻¹ for ¹³⁷Cs

10 x more



+



= 100 Bq kg⁻¹ for ¹³⁷Cs



Parents in Fukushima are angry over rule changes which mean that school children can be exposed to 20 times more radiation than was previously permissible.

Photograph: Carlos Barria/Reuters



公園を利用する皆さんへ

新浜公園につきましては、4月22日の環境放射線量測定の結果、基準値を上回ったため、公園利用にあたっては次の点に留意して下さい。

- 公園の利用は、1日あたり、1時間程度として下さい。
- 公園の利用後は、手や顔を洗い、うがいをして下さい。
- 砂場の利用は控え、土や砂を口に入れないよう注意して下さい。

(問い合わせ先) 福島市公園緑地課 Tel 525-3765

www.friendcamera.blogspot.com

Shin-Kenji

Sign in park in Fukushima City expresses apologies from city for declaring one-hour park-usage time limit due to radiation level on soil and equipment.

Summary

- Children are not just small adults
- Children's tissues morph into adults at different rates and at different times
- Some differences in radiation effects with age are explainable, others are not

Summary

- Children are at more risk than adults for some effects, similar risk for some effects and more resistant for others
- Modeling may be procrustean, but it can obscure the fact that in some areas we have precious little data often due to high background noise and little or no radiation effect

Last disclosure

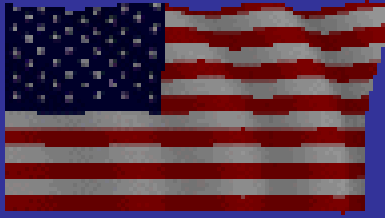
This lecture has been previously
tested on childhood audiences
with variable results



Indifference



Suspicion



I hope you enjoyed it more

Thank you

Questions ?