

# Hiroshima / Fukushima: Gender Matters in the Atomic Age

**Mary Olson, Nuclear Information and Resource Service (NIRS)**

[www.nirs.org](http://www.nirs.org) / [maryo@nirs.org](mailto:maryo@nirs.org)

Presentation posted: <http://tinyurl.com/Olson2016>

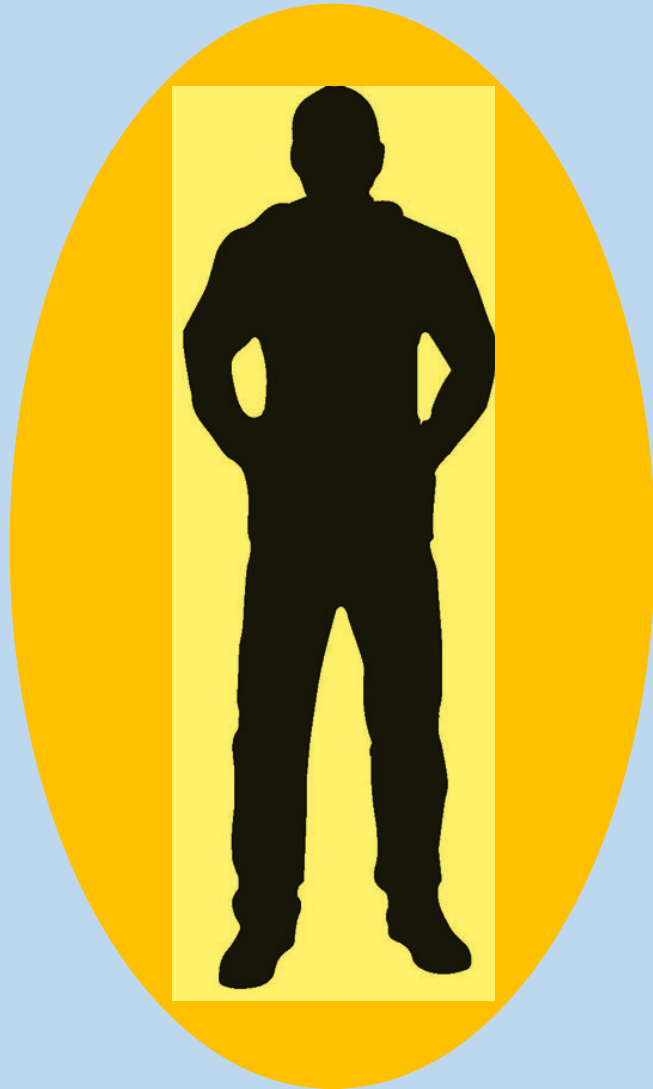
*Original paintings by Loren Olson*

*Silhouette figures by Saro Lynch-Thomason*

I will speak of our human lifecycle—however  
radioactivity also impacts all life on Earth



Radiation regulation has been based on  
“Reference Man”



# Policy is a decision

When a dangerous industry is regulated, policy-makers decide how many deaths are “OK.”

1 cancer in a million people exposed is often the goal.

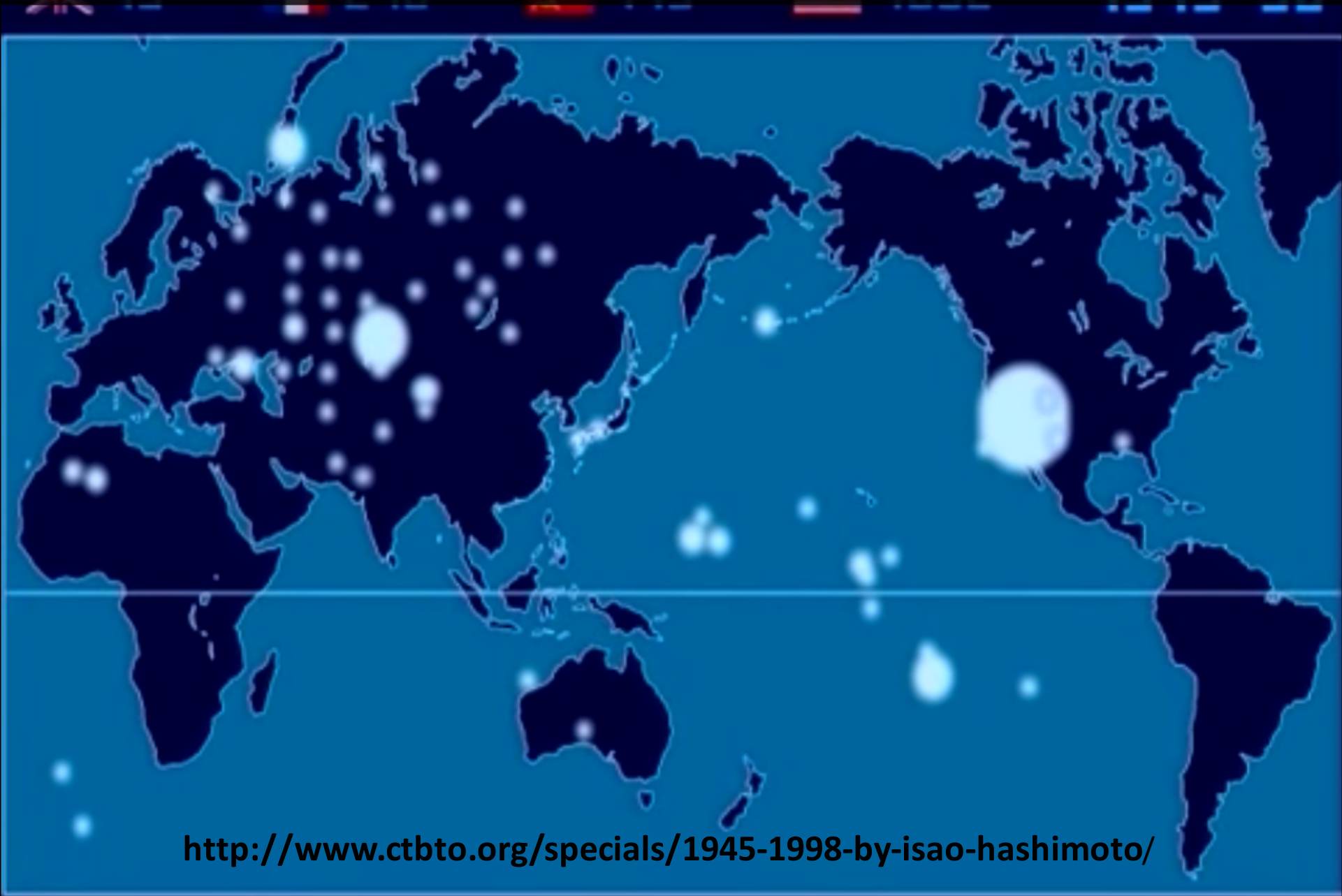
Regulation of public (lifetime) exposure to ionizing radiation **starts** at 1 fatal cancer in 286 = OK. This assumes male adults.

If the goal were 1 cancer in 1 million baby girls, then industrial nuclear operations would have to cease and sites would be CLEANED UP!



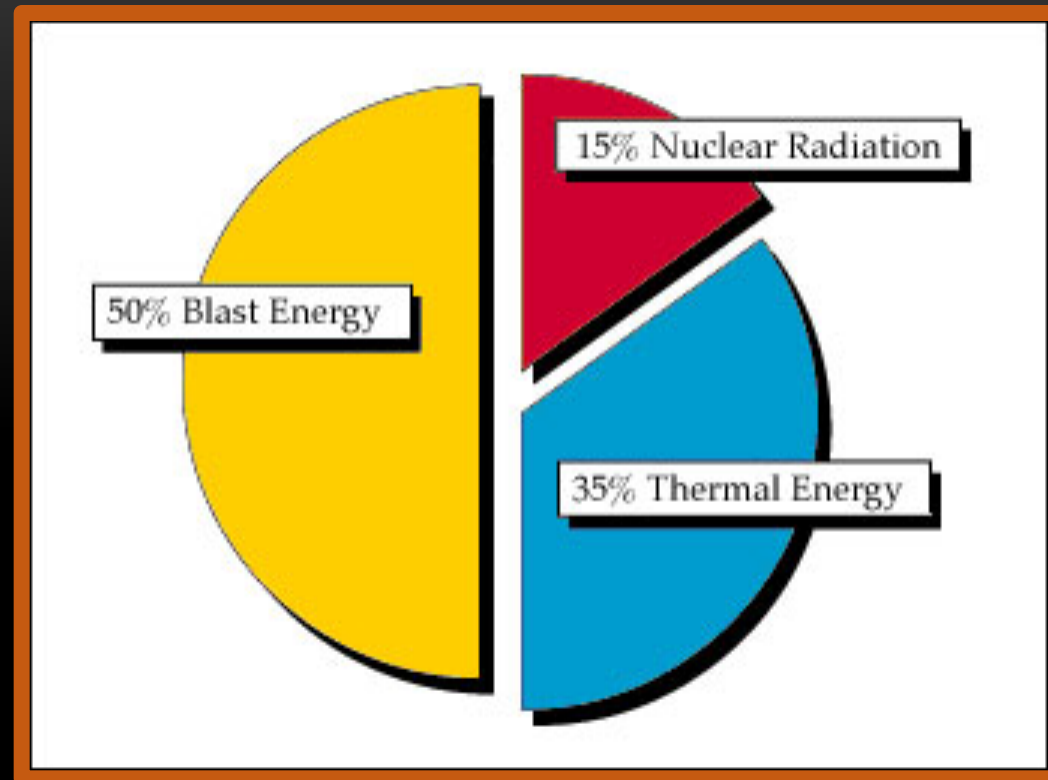
Source: Mary Olson, unpublished calculation



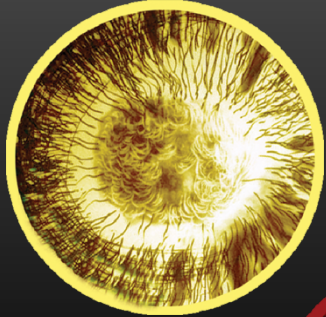


<http://www.ctbto.org/specials/1945-1998-by-isao-hashimoto/>

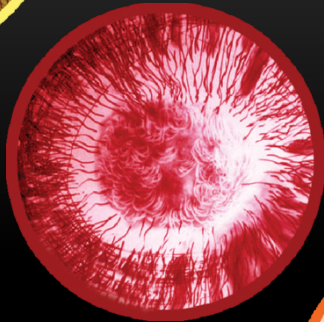
# The energy profile of a nuclear explosion:



# Icons used in this paper:



**Blast / Shock**



**Fireball / Thermal**



**Immediate Gamma / Neutron Radiation**



**Fall-Out / Persistent Radioactivity**



People survived the bombs in shelters,  
often underground.

Radiation doses were high enough to  
literally cook human flesh.

Inside shelters the levels of gamma and  
neutron radiation was reduced.

Some estimated radiation exposures  
were comparable to medical and  
occupational exposures today.

Exposure was from one quick flash.





# Ionizing Radiation: No Safe Dose

- All regulatory agencies acknowledge that every exposure to ionizing radiation carries risk of harm:

**There is no “safe” dose of ionizing radiation:**

**It is not safe for adult males.**

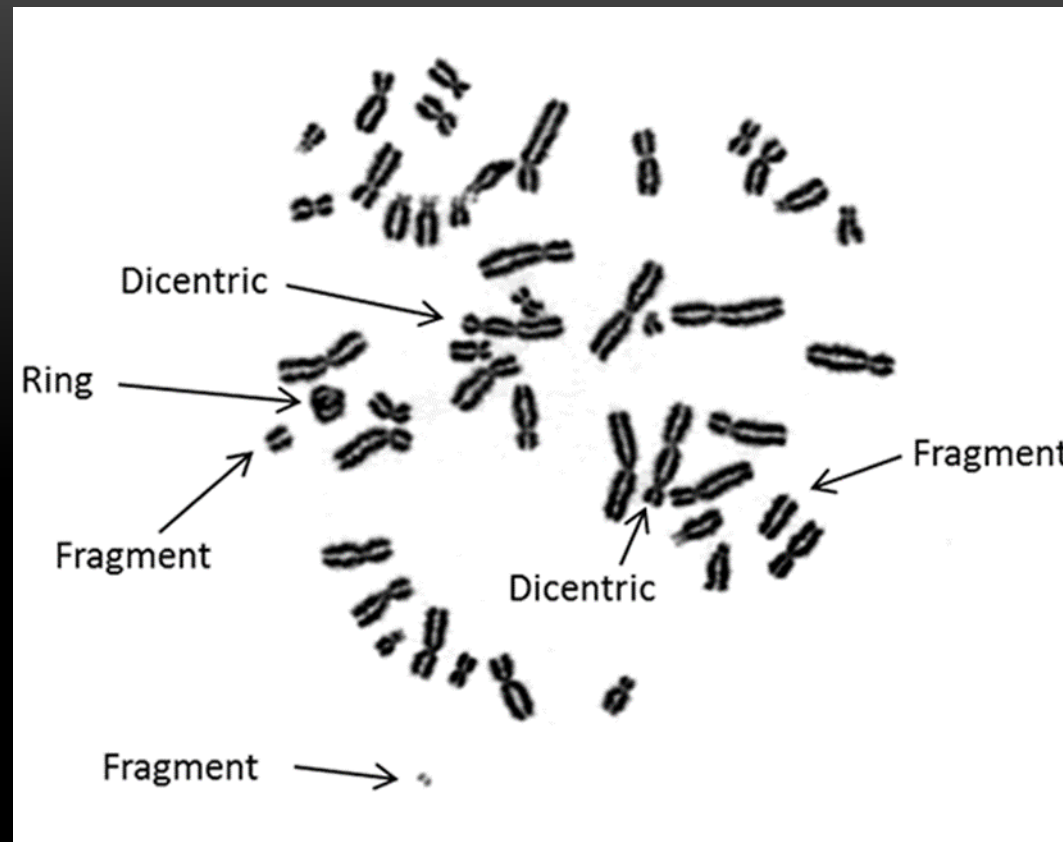
**Recent findings:**

**Ionizing radiation is even less safe for children and for females.**





# Radiation Induced Chromosomal Aberrations, as seen with microscope

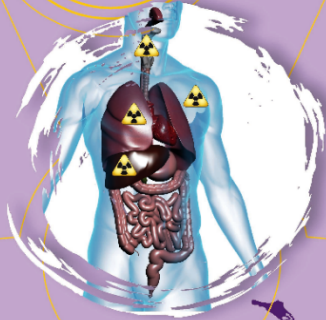
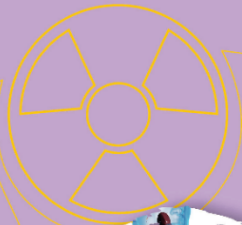


# RADIATION AND HEALTH

Radiation is different from any other poison.



Radioactivity lasts for many thousands of years. If it gets into the land, water, plants and animals, it might be too dangerous to go there, to hunt, or to collect tucker for many generations.



IT BREAKS THE STORIES OUR BODIES HOLD THAT KEEP US HEALTHY. DAMAGED STORIES CAN BE PASSED ON TO OUR CHILDREN.

Radiation causes cancer. The most common cancers caused by radiation are cancer of the thyroid, breast, lung and blood. Sometimes it can take many years before the cancer grows.



In a nuclear reactor, radioactivity is increased a million times.

Uranium in the water can cause kidney damage.

Mining uranium increases people's exposure to radiation.



There is no safe dose of uranium.



# RADIATION HAS INTERGENERATIONAL CONSEQUENCES

IT BREAKS THE STORIES OUR BODIES HOLD THAT KEEP US HEALTHY. DAMAGED STORIES CAN BE PASSED ON TO OUR CHILDREN.

**URANIUM** leave it in the ground



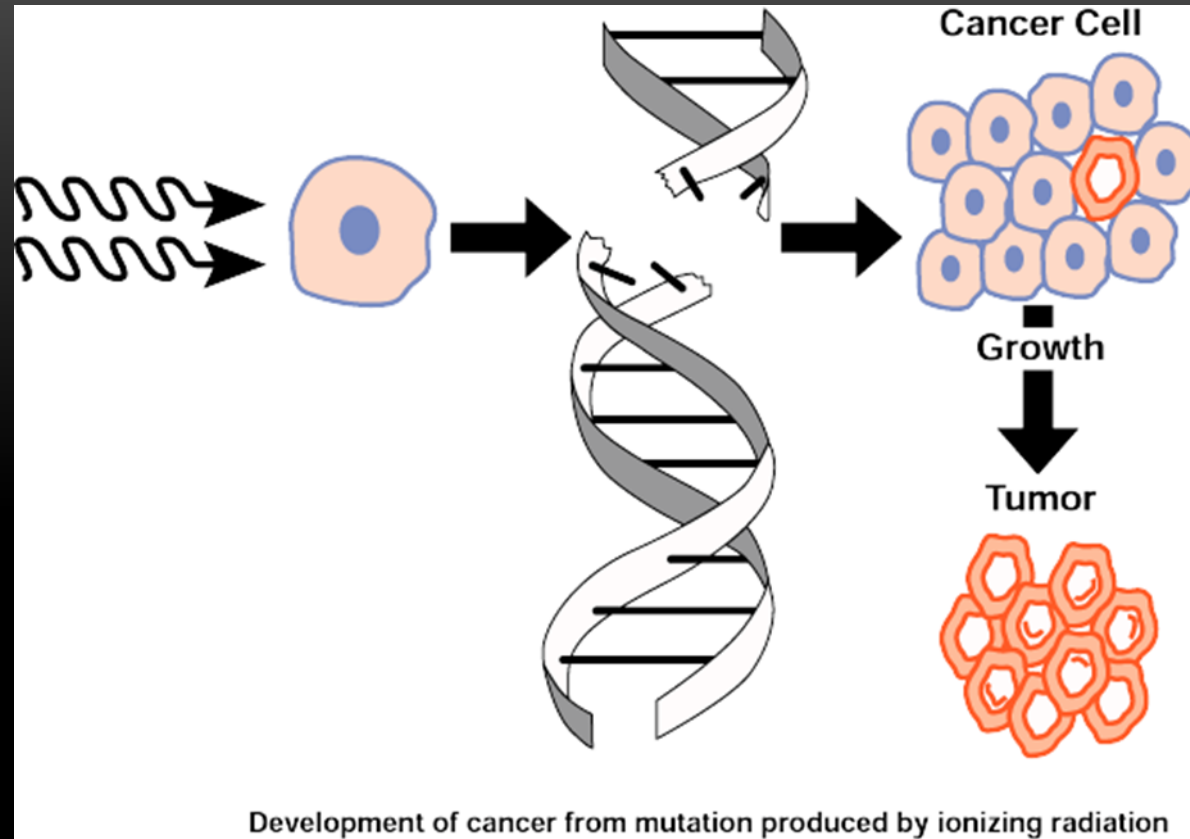


# Ionizing Radiation: Non-Cancer Medical Impacts





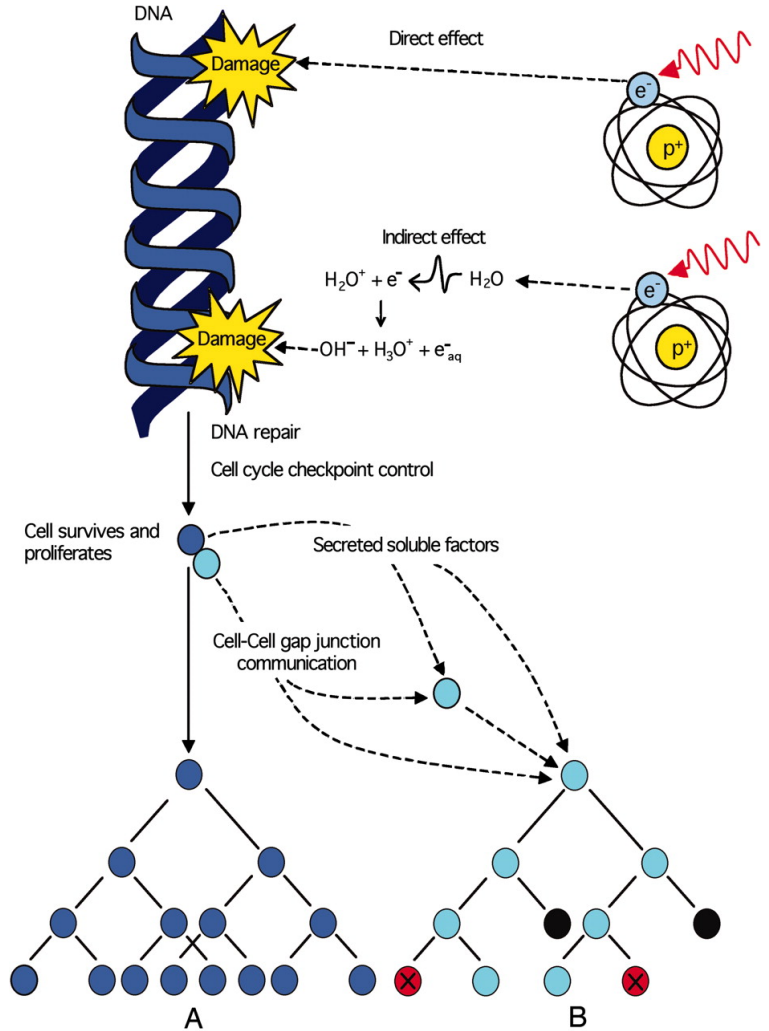
# Medical Impacts of Ionizing Radiation: Cancer



Ionizing radiation harms our cells.



**Ionizing radiation induces direct DNA damage and indirect damage through the radiolysis of water.**



**William F. Morgan, and Marianne B. Sowa PNAS  
2005;102:14127-14128**

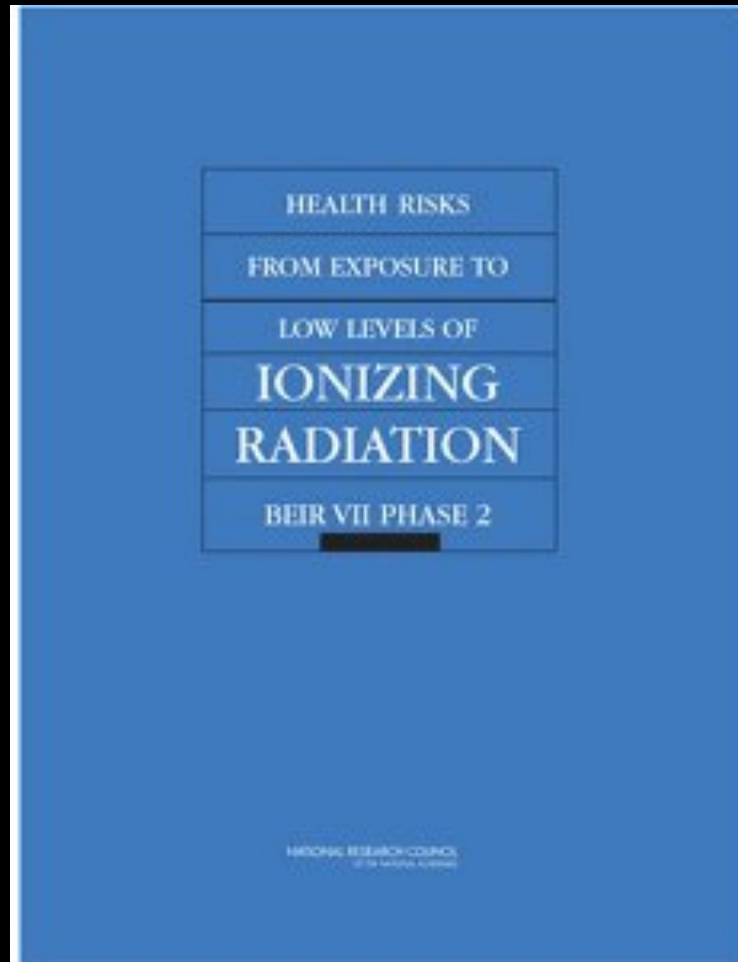




Radiation is more harmful to children



**Children Between Birth and 5 Years**



U.S. National Academy of Science:  
Biological Effects of Ionizing Radiation (BEIR VII Phase 2)  
published 2006.



# Survivor Lifespan Study

- Data recording (ABCC) began in 1950. Deaths between 1945 and 1950 were not recorded.
- Survivors were strong; stronger than a typical population.
- Survivors (more than 90,000) were grouped by the age that they were at the time of the bomb.
- Cancers, and cancer deaths, were counted in these groups.
- In 2006 the first 60 years of data was published (BEIR VII)



# Lifetime Risk of Cancer Incidence (acute exposure between birth and age five)



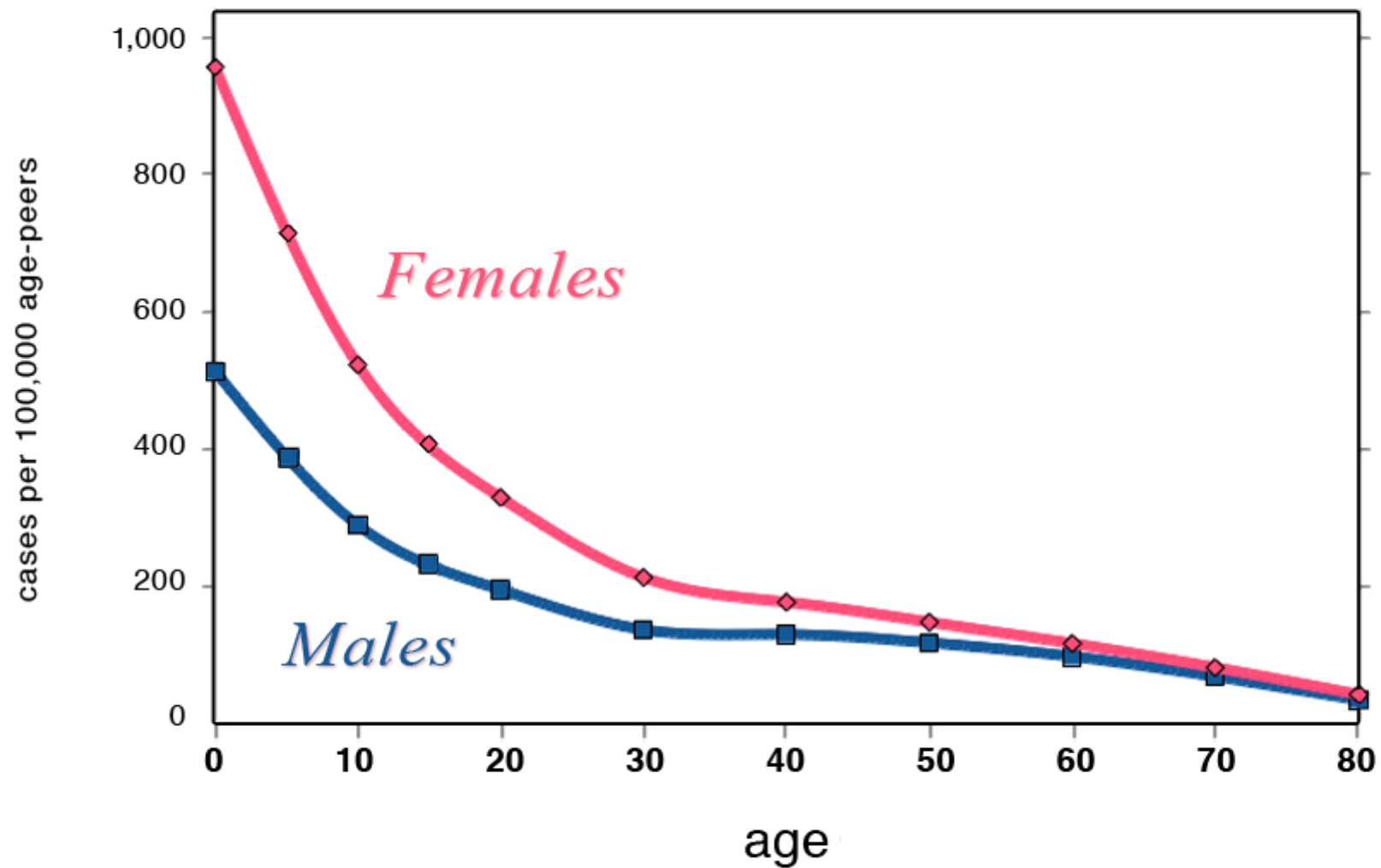
**2 Boys**



**4 Girls**

# Increased Cancer Risk by Age at Exposure to 20 mSv Radiation

Acute exposure (one time)



Data Source:

U.S. National Academy of Sciences BEIR VII Phase 2 Risk Model





# Lifetime Cancer fatalities among those exposed to ionizing radiation as adults



**2 Men**



**3 Women**

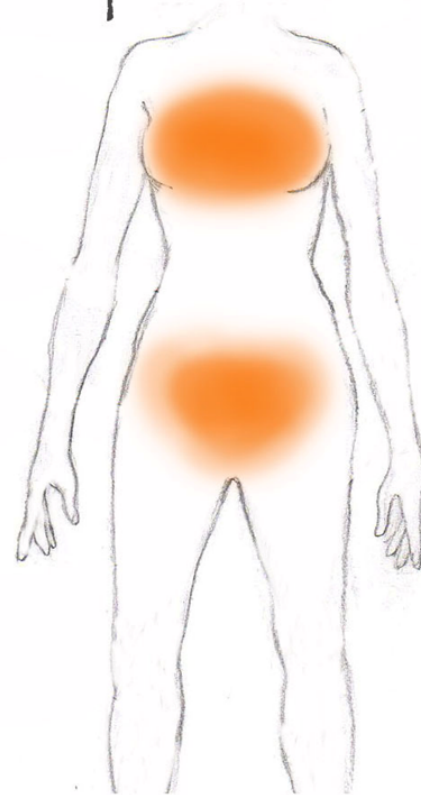


# Why is Gender a risk-factor for more cancer?

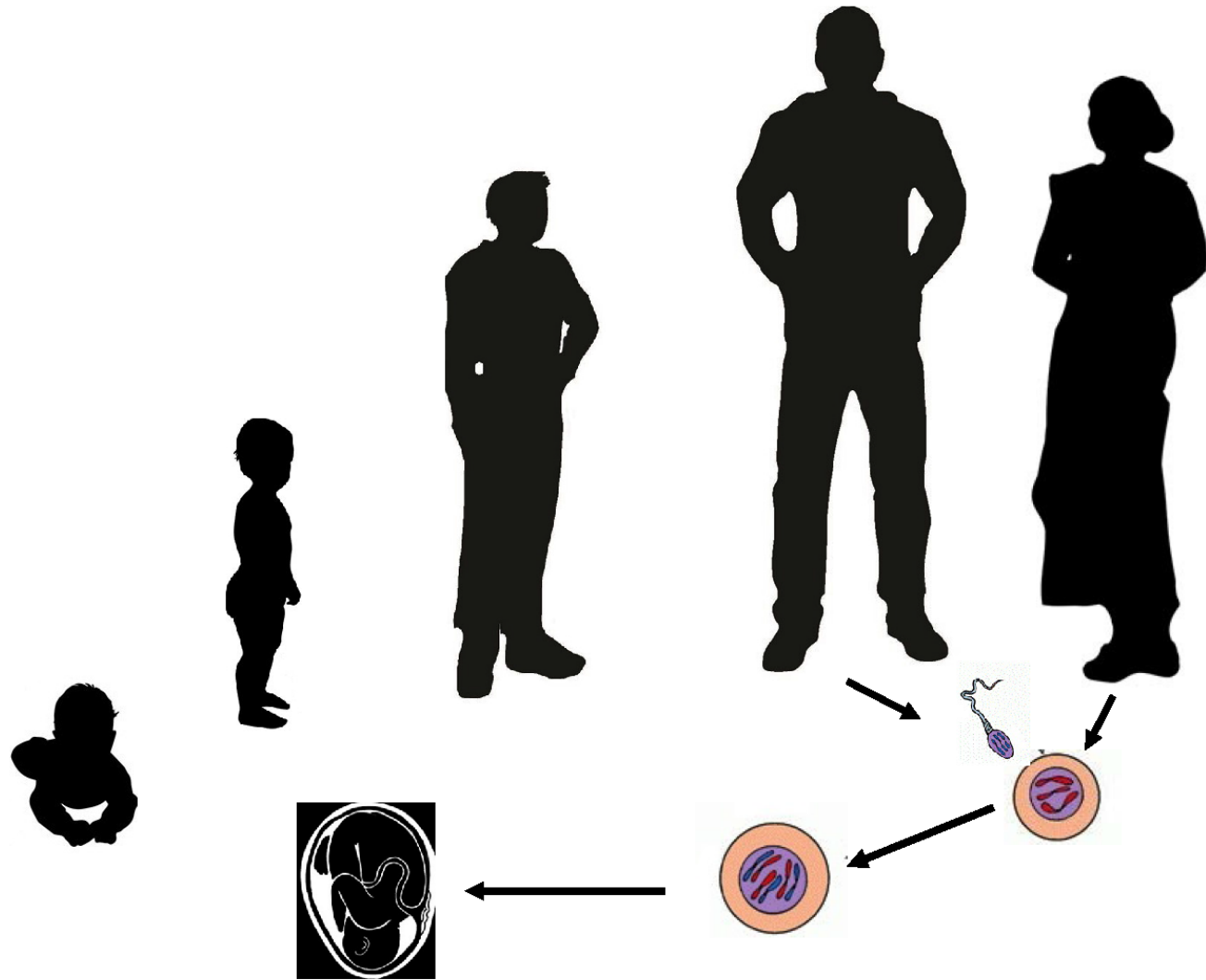


Dr. Rosalie Bertell

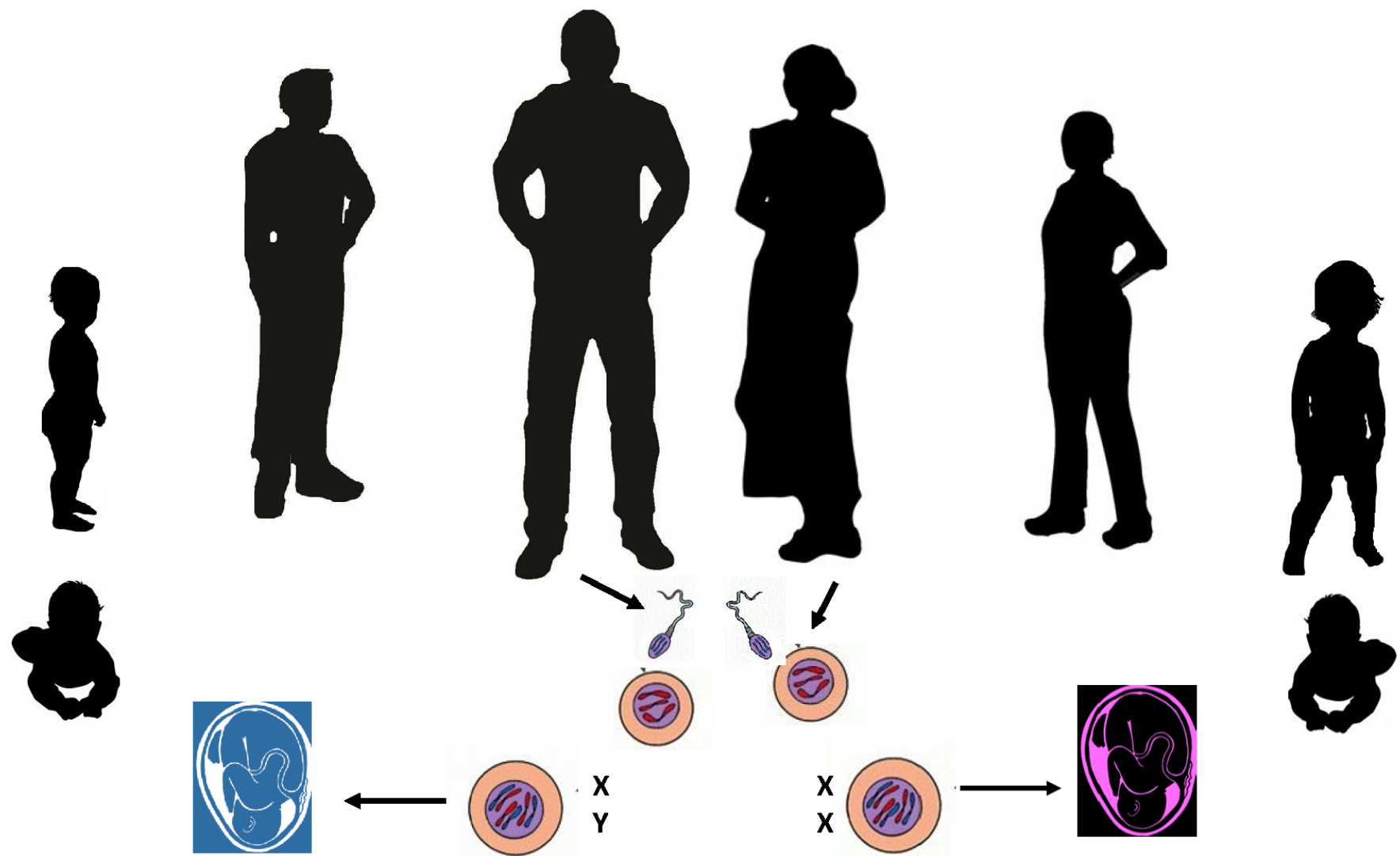
Females have 50% more  
high-risk tissue  
compared to males







Human Lifecycle – typical presentation



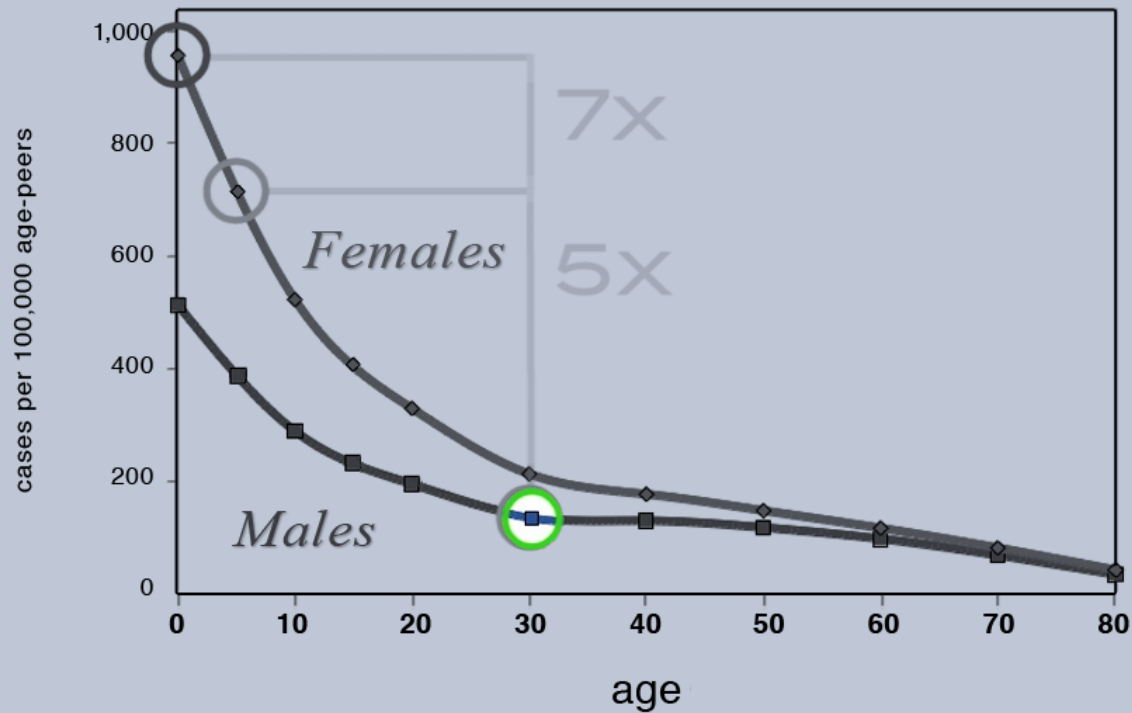
Full Human Lifecycle





Green circle = VISIBLE in radiation policy decisions  
Gray = INVISIBLE

Increased Cancer Risk by Age at Exposure to 20 mSv Radiation  
Acute exposure (one time)

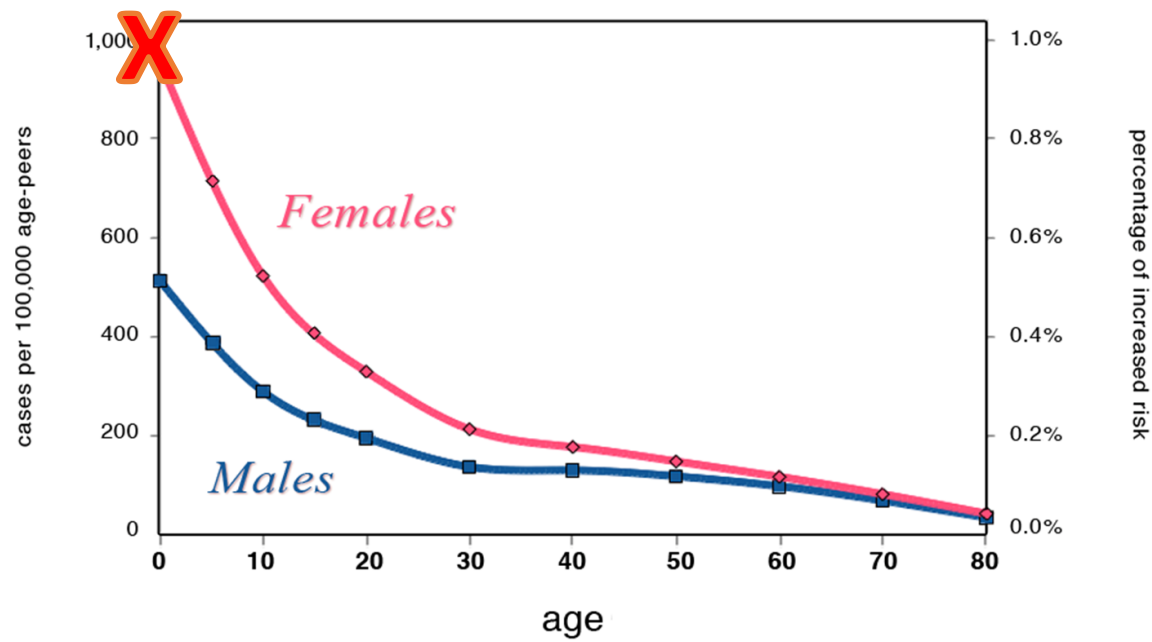


U.S. National Academy of Sciences BEIR VII Phase 2 Risk Model

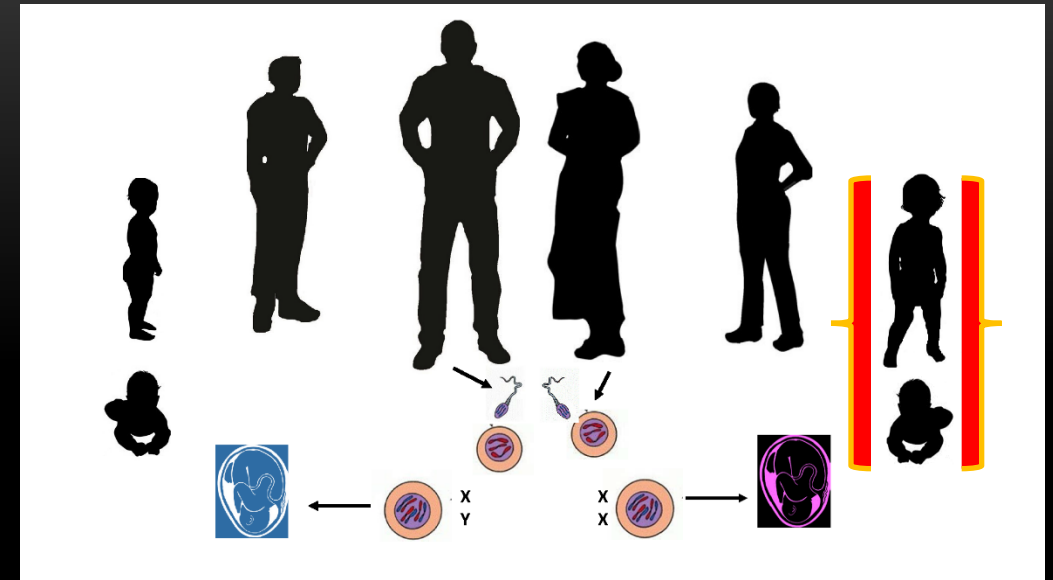


# Responsible radiation regulation: Life Cycle Protection

Increased Cancer Risk by Age at Exposure to 20mSv Radiation  
Acute exposure (one time)



U.S. National Academy of Sciences BEIR VII Phase 2 Risk Model



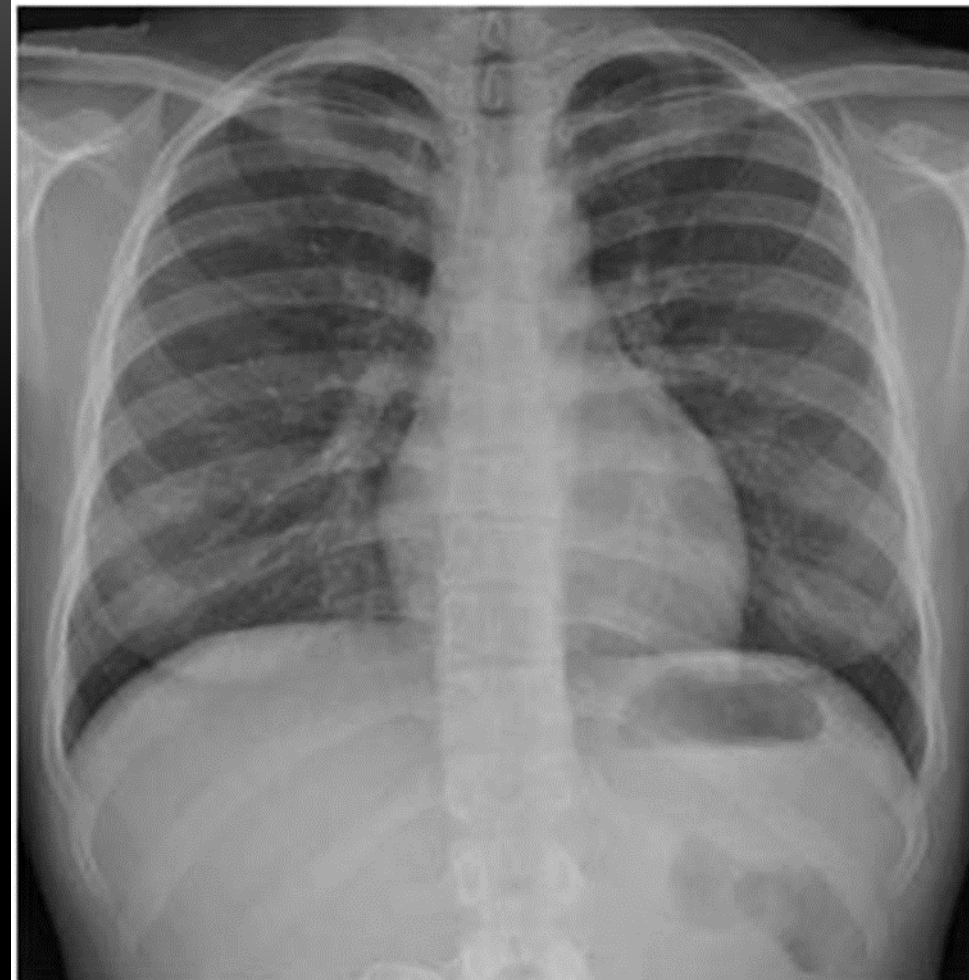


# Radiation Exposure in Pregnancy: Three Generations





A-Bombs: One fast pulse of **external** ionizing radiation – like an X-ray



Medical X-Ray image



# BRITISH MEDICAL JOURNAL

LONDON SATURDAY JUNE 28 1958

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## A SURVEY OF CHILDHOOD MALIGNANCIES

BY

ALICE STEWART, M.D., F.R.C.P., JOSEFINE WEBB,\* M.B., and DAVID HEWITT, M.A.

*From the Department of Social Medicine, Oxford University*



- “...children who have been x-rayed in utero are...twice as likely to die of a malignant disease before their tenth birthday as other children.”
- “Childhood cancer is a post-birth defect.”

--Dr. Alice Stewart

# Data Sets

Because non-lethal exposures to ionizing radiation may or may not result in harm...

And because harm that is cancer takes many years to appear... and cancer is caused by many other things...

A large number of people, with radiation exposure tracked for a period of time is required for research.

This is called a data-set.

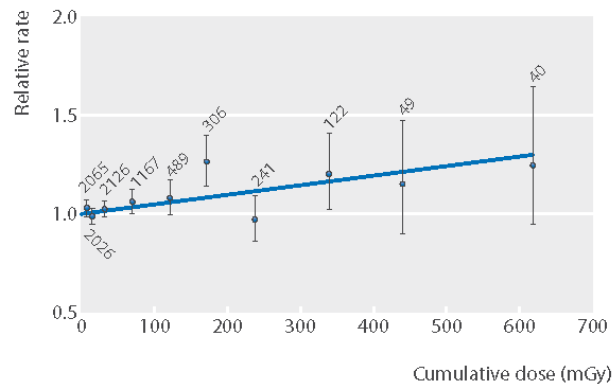


OPEN ACCESS



## Risk of cancer from occupational exposure to ionising radiation: retrospective cohort study of workers in France, the United Kingdom, and the United States (INWORKS)

David B Richardson,<sup>1</sup> Elisabeth Cardis,<sup>2,3,4</sup> Robert D Daniels,<sup>5</sup> Michael Gillies,<sup>6</sup> Jacqueline A O'Hagan,<sup>6</sup> Ghassan B Hamra,<sup>7</sup> Richard Haylock,<sup>6</sup> Dominique Laurier,<sup>8</sup> Klervi Leuraud,<sup>8</sup> Monika Moissonnier,<sup>9</sup> Mary K Schubauer-Berigan,<sup>5</sup> Isabelle Thierry-Chef,<sup>9</sup> Ausrele Kesminiene<sup>9</sup>

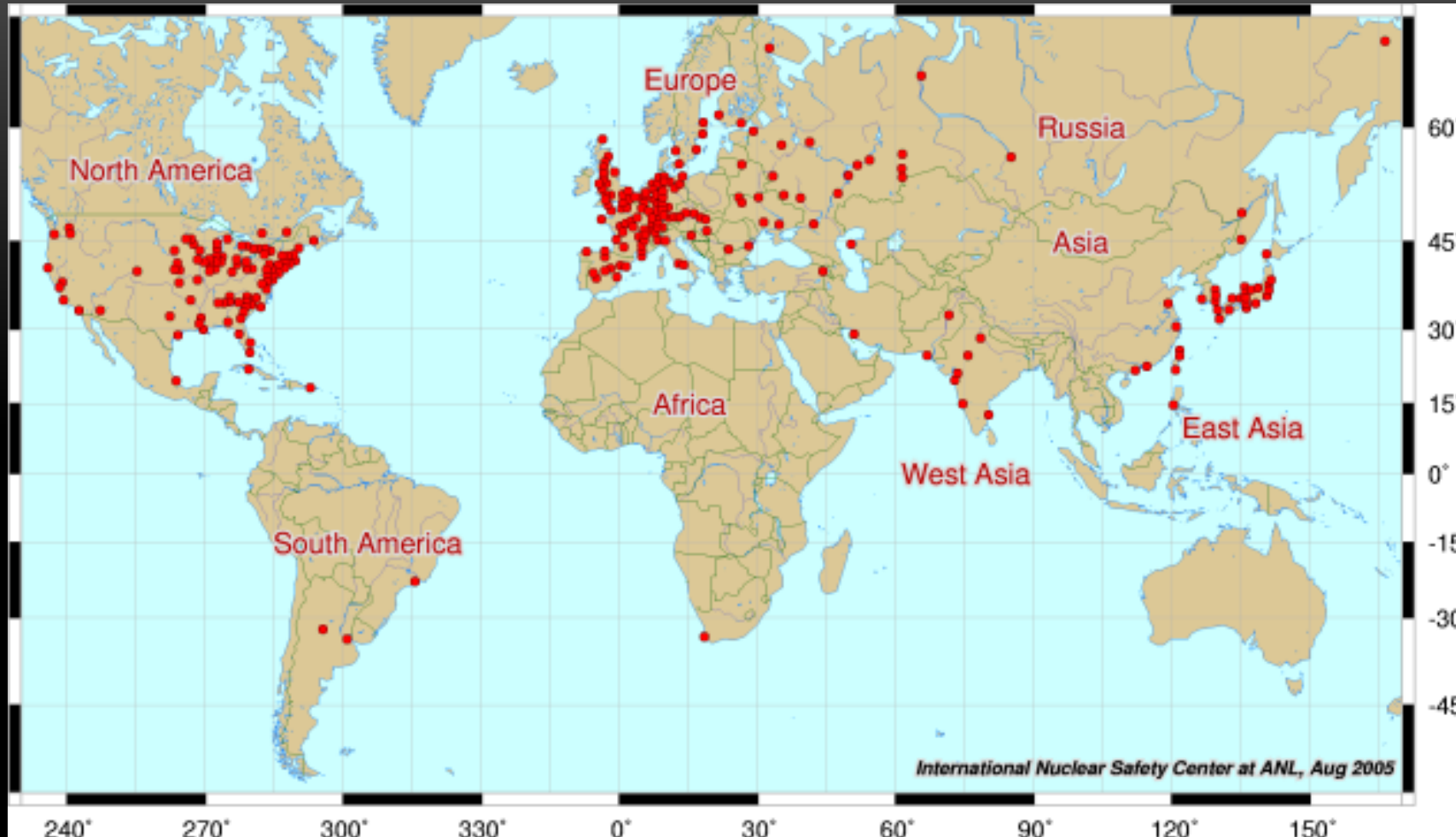


Relative rate of mortality due to all cancer other than leukaemia by categories of cumulative colon dose, lagged 10 years in INWORKS. Vertical lines=90% confidence

- **“Study question:** Is protracted exposure to low doses of ionizing radiation associated with an increased risk of solid cancer?”
- “Although high dose rate exposures are thought to be more dangerous than low dose rate exposures, the risk per unit of radiation dose for cancer among radiation workers was similar to estimates derived from studies of Japanese atomic bomb survivors.”



Nuclear Power Stations: In 2015 there were 391 operable reactors worldwide







# Chernobyl (1986), Fukushima (2011)



## Lifetime exposure

**EXAMPLE** (not observed)

20 mSv a year for  
70 years

US Nuclear Regulatory  
Commission predicts:

Cancer death = **1 in 7**

["Reference Man"]

**Male** lifecycle adjusted:

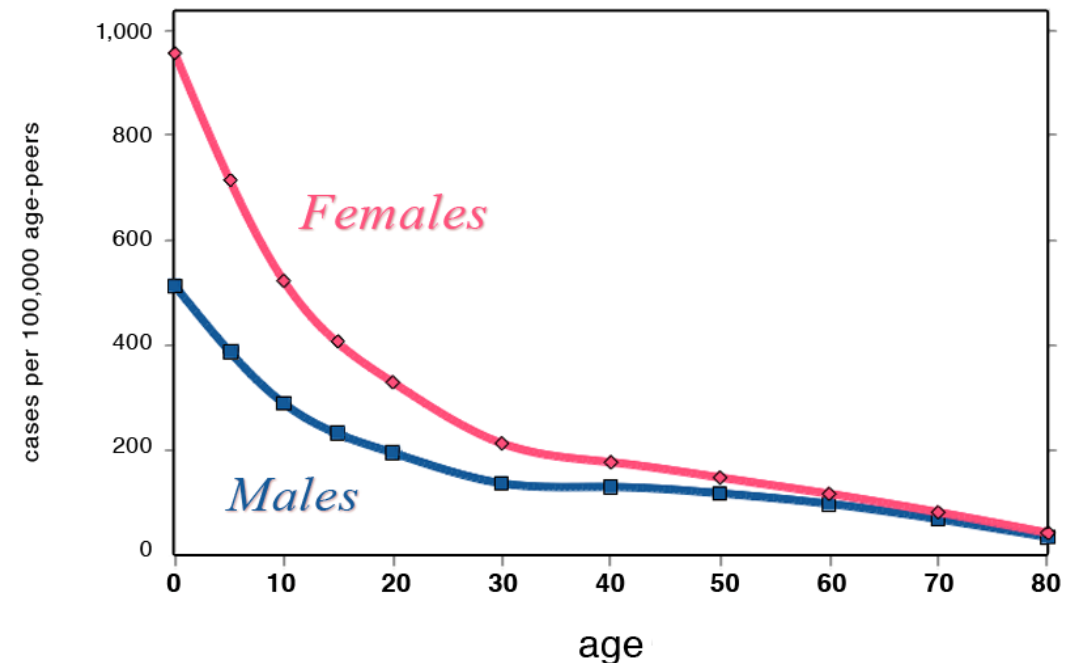
Cancer death = **1 in 5**

**Female** lifecycle adjusted:

cancer death = **1 in 3**

This graph is based on a one-time exposure  
to 20 mSv (acute) radiation [BEIR VII]

Increased Cancer Risk by Age at Exposure to 20 mSv Radiation



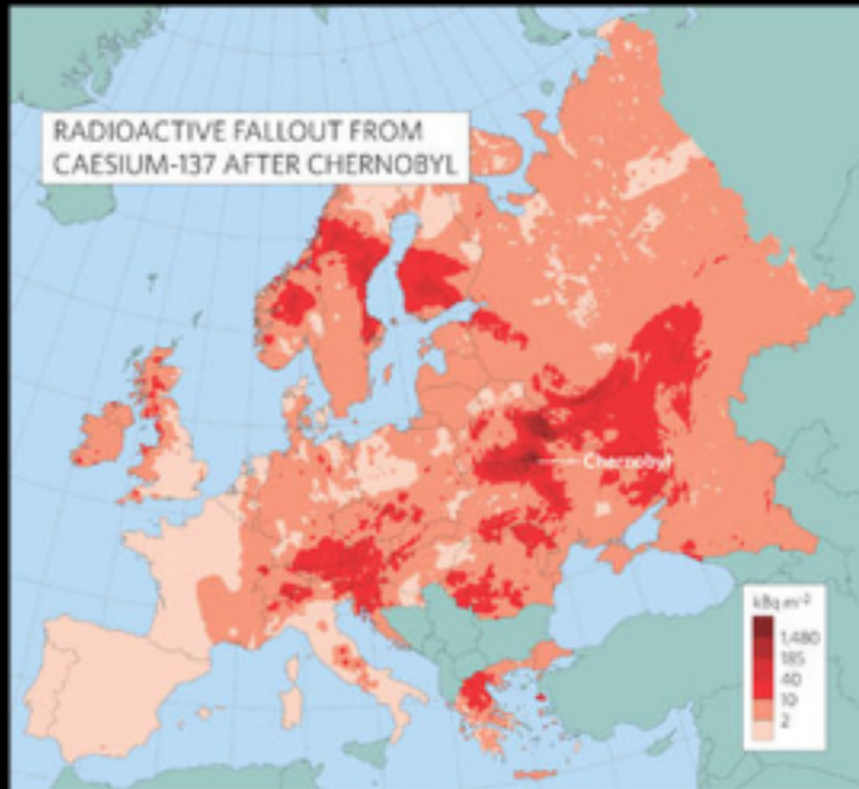
U.S. National Academy of Sciences BEIR VII Phase 2 Risk Model

Source: preliminary calculations by Mary Olson

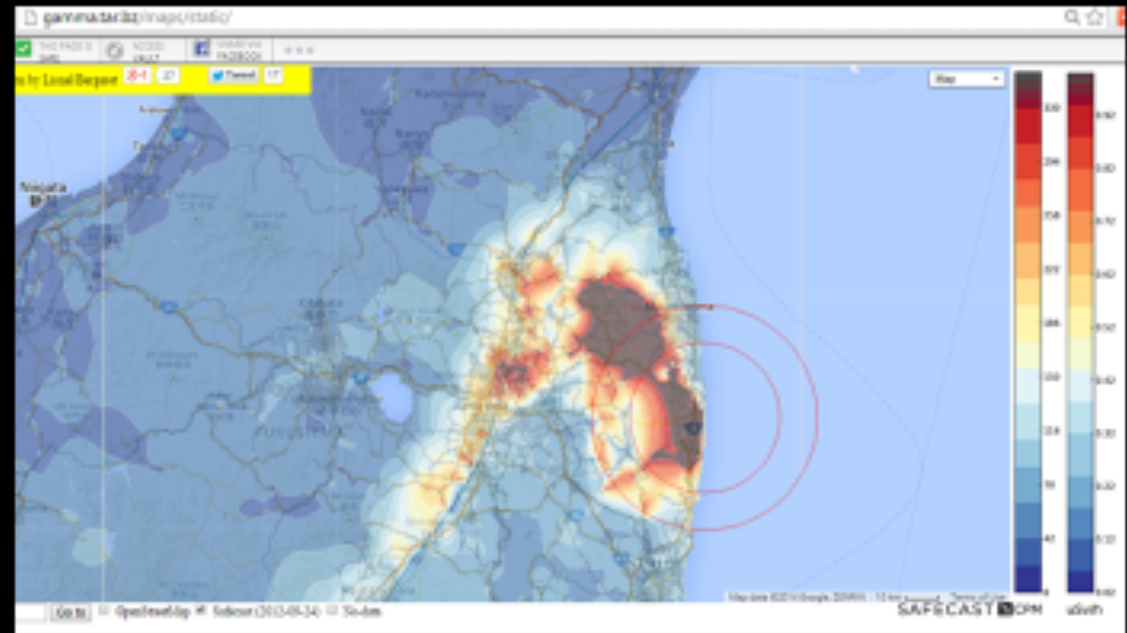




# Environmental Contamination: Chernobyl and Fukushima



40% of Europe contaminated above 4,000 Bq / m<sup>2</sup>  
by Chernobyl reactor explosion in 1986



Gamma levels in proximity to Fukushima Daiichi, map  
constructed by Lionel Bergeret from SAFECAST data

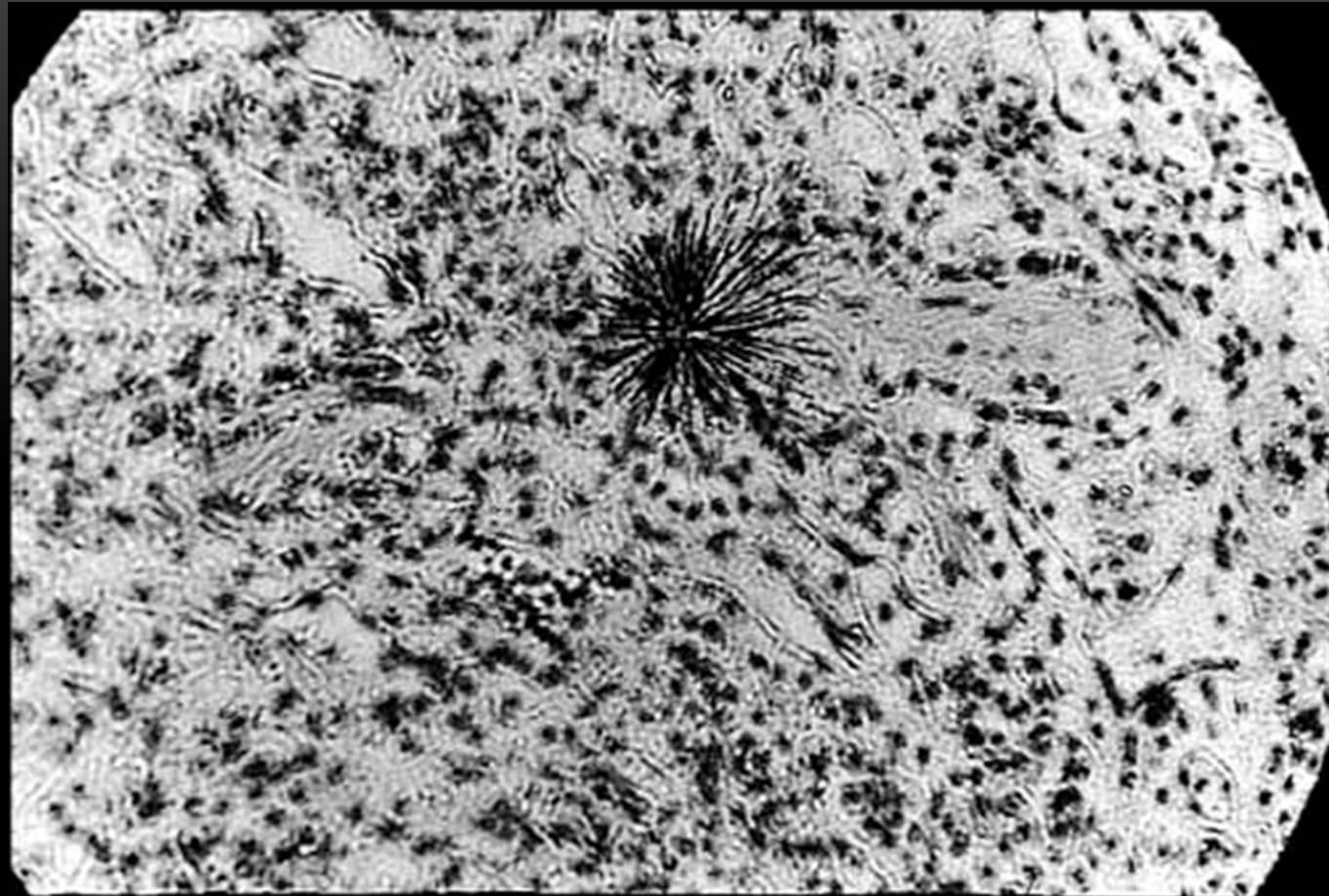
# Diaspora

- Definition: the dispersion of any people from their original homeland.
- There is no moral ground in which to require people to stay in their homes after a meltdown. These communities have become Diasporas:
  - Harrisburg... [Three Mile Island]
  - Pripyat... [Chernobyl]
  - Futaba, Namie, Tomioka... [Fukushima]

A Diaspora is not a good “data set.”



# Visible damage from Plutonium emitting alpha radiation in lung tissue

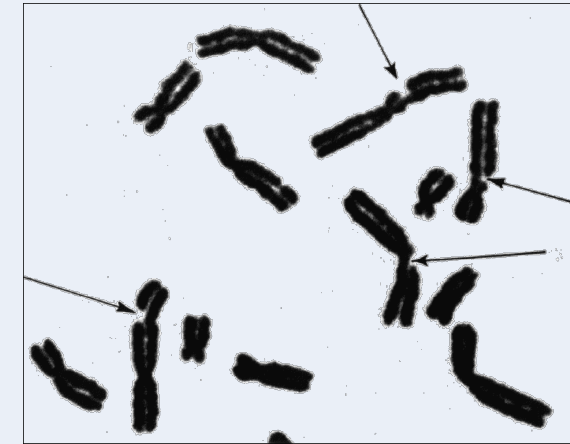
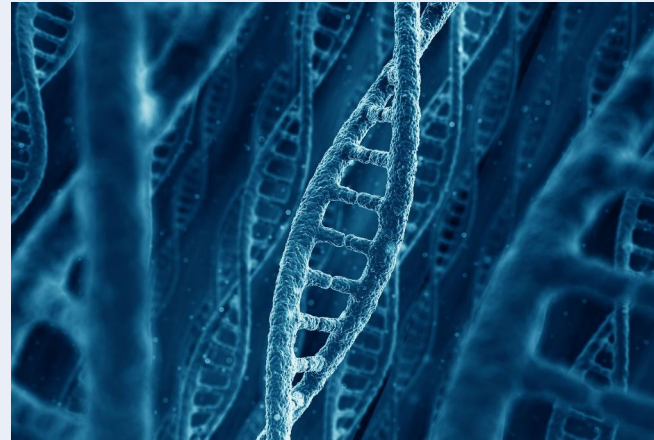
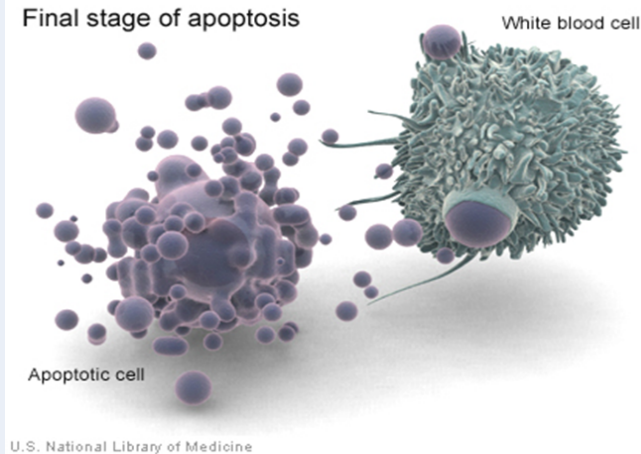


# Dr Donnell Boardman: Radiation is a physical event

- Every radiation exposure is unique;
- An exposure so small it cannot be measured may still result in cancer;
- Radiation is a PHYSICAL event, and like any collision, no two are exactly alike;
- The body's repair mechanisms are miraculous, but not perfect;
- Imperfect repairs may result in cancer (out of control cell reproduction).

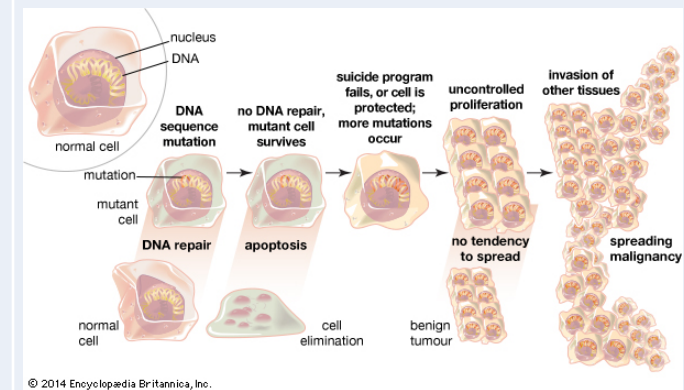
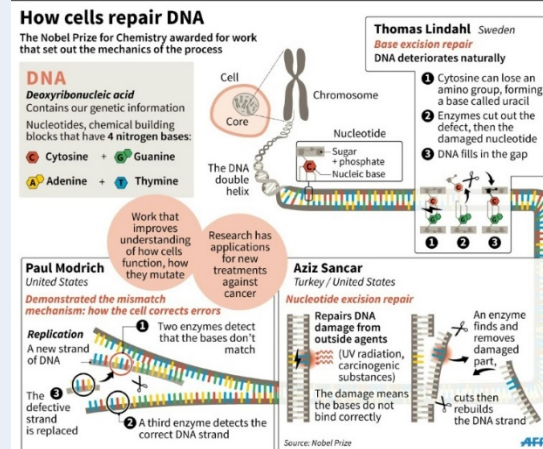


# Internal exposure outcomes:



What type of radioactivity?  
 Where in the body does it concentrate?  
 How long does it stay in the body?

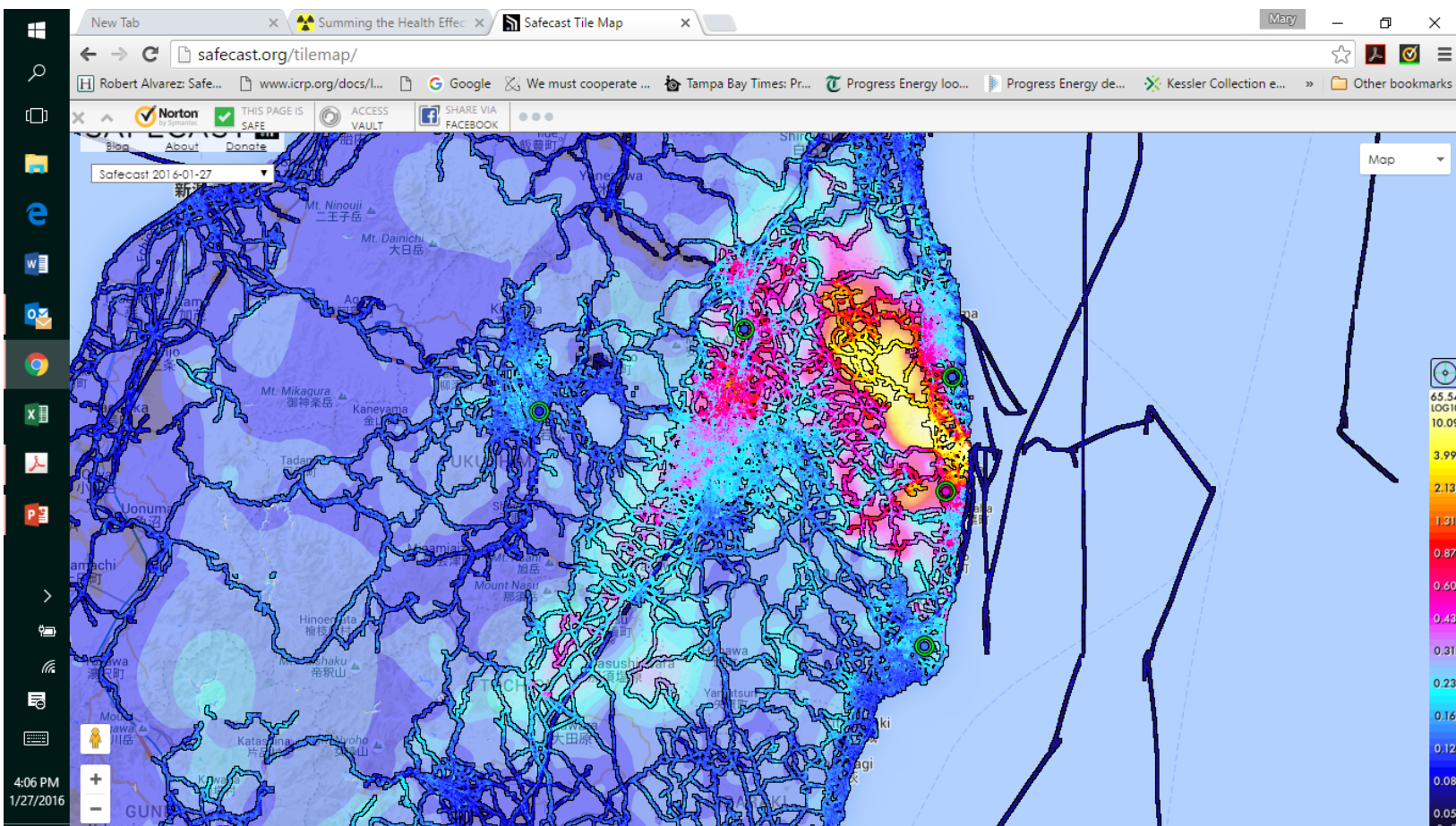
Alpha, beta, gamma are all more damaging when emitted inside our body.



# Dr. Dennis Nelson: “DOSE” is not accurate

- The concept of a “dose” is based on toxic substances that can be diluted to the point where they are not toxic.
- Radiation is not like poison. It is a physical event that results in physical damage.
- Now we know that bodies are not the same. Age, gender, genetic factors can all influence the outcome of a radiation exposure.
- A “Rem” or Sievert” does not describe the complexity of radiation harm.

# Safecast.org / Crowdsourcing detection



I made this bGeiger detector from a SAFECAST kit available on Amazon.com



# Meta-analysis of published findings on radiation from Chernobyl

“...mutation rates increased strongly in contaminated areas compared to control sites with normal background radiation.

“Furthermore, there were significant differences in mean effect size among taxa, including interspecific differences.

“The magnitude of the biological effect revealed by our meta-analysis of radiation-caused mutations can be classified as unusually large.”



OPEN

## Strong effects of ionizing radiation from Chernobyl on mutation rates

SUBJECT AREAS:  
ECOLOGICAL GENETICS  
EVOLUTIONARY GENETICS

Anders Pape Møller<sup>1</sup> & Timothy A. Mousseau<sup>2</sup>

[www.nature.com/scientificreports](http://www.nature.com/scientificreports)

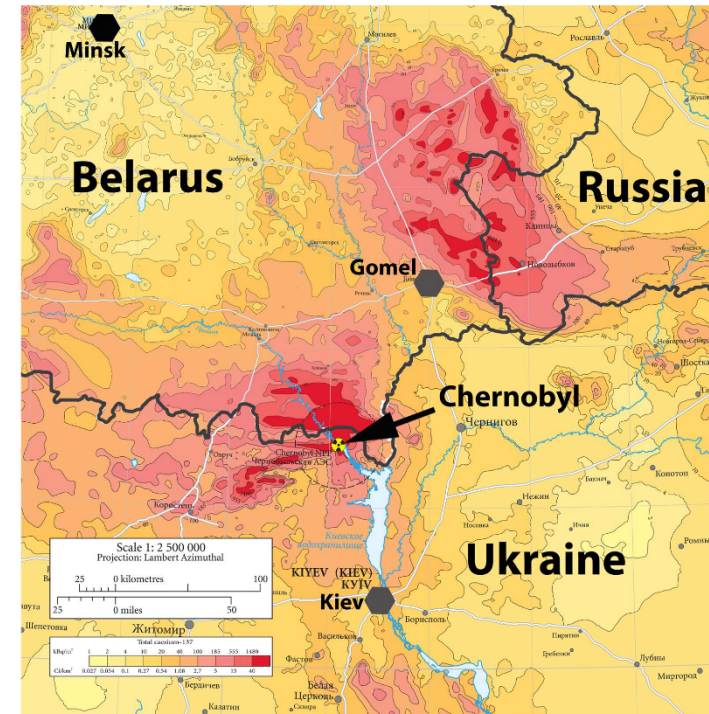


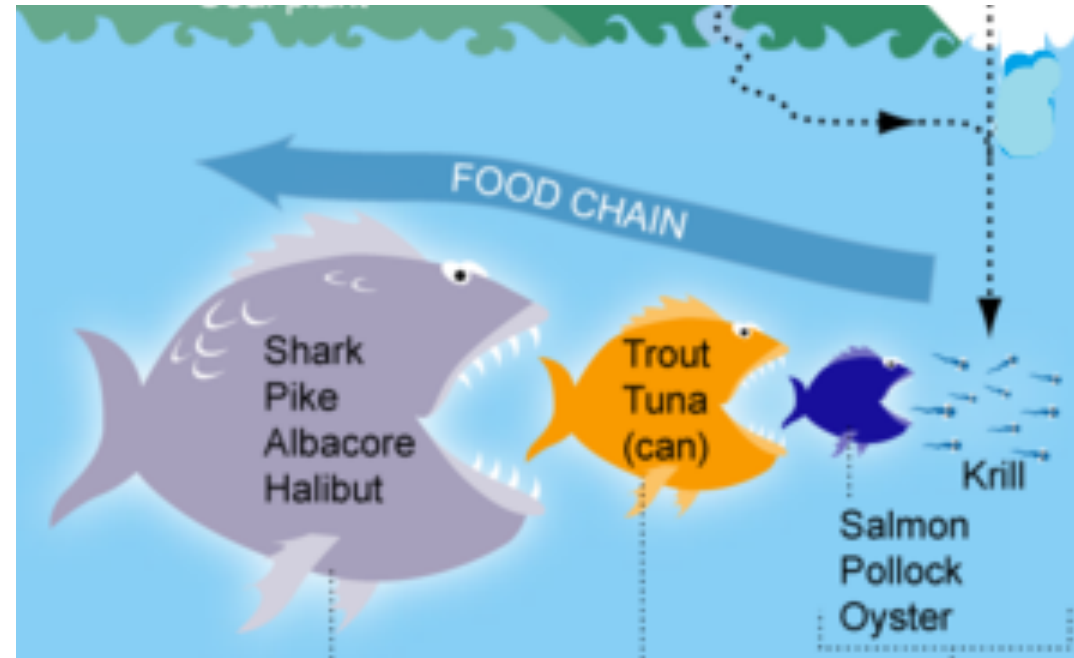
Figure 1 | Distribution of radioactive contamination in the Chernobyl region. Adapted with permission from ref. 2.

# Bio-Accumulation

## Aquatic food-chain

Concentration of heavy metals (including many radionuclides) is higher in larger fish since each step in the chain has a higher concentration than the one below.

Tritium is radioactive hydrogen and while it does not concentrate, tritium goes anywhere in the body that water goes, including across the placenta.





International Physicians for the Prevention of Nuclear War European affiliates

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### Press Release IPPNW Germany

## Spikes of radioactive emissions during inspection and refuelling

Gundremmingen Nuclear Power Station, Bavaria, Germany



For the first time anywhere in the world, recent German data reveal huge spikes in radioactive releases during the refuelling of NPPs.

In September 2011, Gundremmingen NPP located between Ulm and Augsburg in Southern Germany emitted much larger amounts of radioactive noble gases during inspection/refuelling than are emitted during normal power operation. According to the International Physicians for the Prevention of Nuclear War (IPPNW) in Germany, the normal emission concentration during the rest of the year is about 3 kBq/m<sup>3</sup>, but during inspection/refuelling (in the afternoon and evening of September 22nd) this

Insert searchword >>

### International Congress

Berlin, Feb 26-28, 2016  
[Congress Homepage](#)

### ippnw bulletin

The bulletin cover features the title 'ippnw bulletin' in a stylized font. Below the title is a photograph of a person wearing a white protective mask and a dark jacket, holding a white object. The cover also contains some text, likely the title of the article or issue.

# Averaging—a means to “meet” regulation

- Across time
- Across geographic areas
- Across numbers of individuals
- Across ages
- Across genders
- Imposing these upon the future—opportunity cost
- *When exposures are not actually averaged, neither are the consequences*











FOSTER — KLEISER

**Nuclear  
War**

**No Cure  
Only  
Prevention**

BALTIMORE PHYSICIANS FOR SOCIAL RESPONSIBILITY - (301) 235-7760





# John F. Kennedy: April 2, 1960

“Radiation, in its simplest terms - figuratively, literally and chemically - is poison .... there is no amount of radiation so small that it has no ill effects at all on anybody. There is actually no such thing as a minimum permissible dose. Perhaps we are talking about only a very small number of individual tragedies - the number of atomic age children with cancer, the new victims of leukemia, the damage to skin tissues here and reproductive systems there - perhaps these are too small to measure with statistics. But they nevertheless loom very large indeed in human and moral terms.”

[http://www.jfklibrary.org/Research/Research-Aids/JFK-Speeches/Milwaukee-WI\\_19600402-Wisconsin-Assoc-of-Student-Councils.aspx](http://www.jfklibrary.org/Research/Research-Aids/JFK-Speeches/Milwaukee-WI_19600402-Wisconsin-Assoc-of-Student-Councils.aspx)