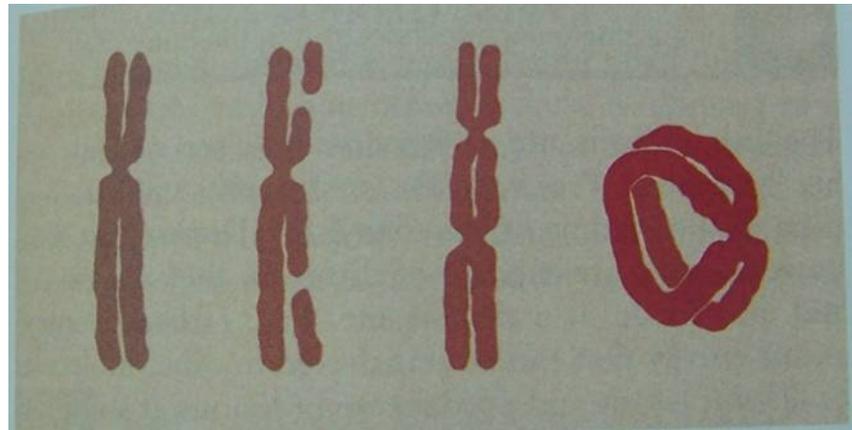


Radiation Effects

Radiobiology

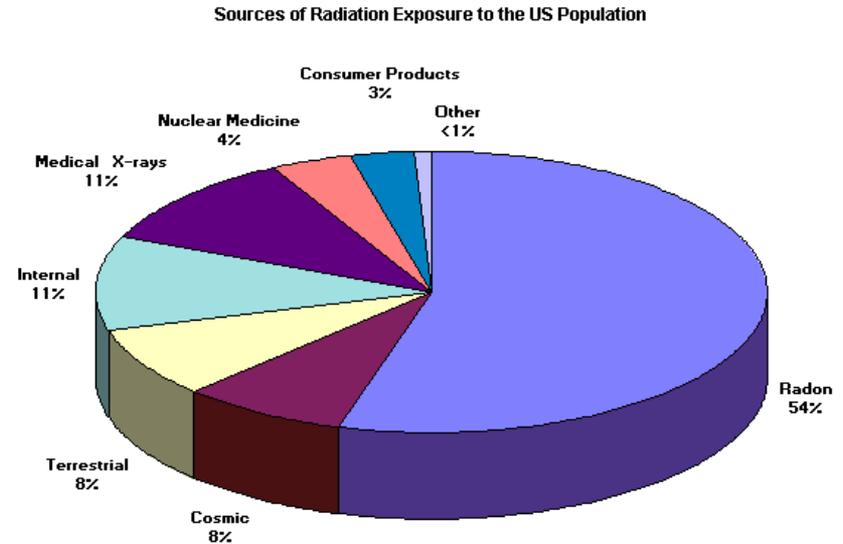
Steve Curtis

Desert Research Institute



Background Radiation

- Cosmic
- Terrestrial
- In our Bodies
- Total Radiation
 - About 300 mR per
 - Equals about 15 X-Rays
 - Over half is from Radon



Internal vs. External Exposure

- Exposure vs. Dose
 - Energy Deposition = Dose
- External
 - Time, Distance, Shielding
 - Can Control Exposure
- Internal (Ingestion or Inhalation)
 - Near Critical Cells
 - Cannot Control Exposure



External Exposure

- Alpha is of no concern
- Beta is of minor concern
 - Mostly Skin Effects
- Gamma is of most concern
 - Penetrating
 - Dosimeters
- What do I do?
 - Time, Distance, Shielding
 - Anti-Cs to Stop Internal Exposure



Internal Dose

- Biological half-life
- Elements spread to parts of the body
 - Close to DNA When Decay Occurs
- Heavy Elements (mostly transuranics)
 - Alpha Particle
 - Also Toxic
- Light Elements
 - Beta Particle and Gamma Rays

What Can Be Done?

- Bioassay
 - Feces
 - Urine
 - Blood
- Stable Iodine
- Chelating Agents
- Blood Transfusions
- Bone Marrow Transfusions

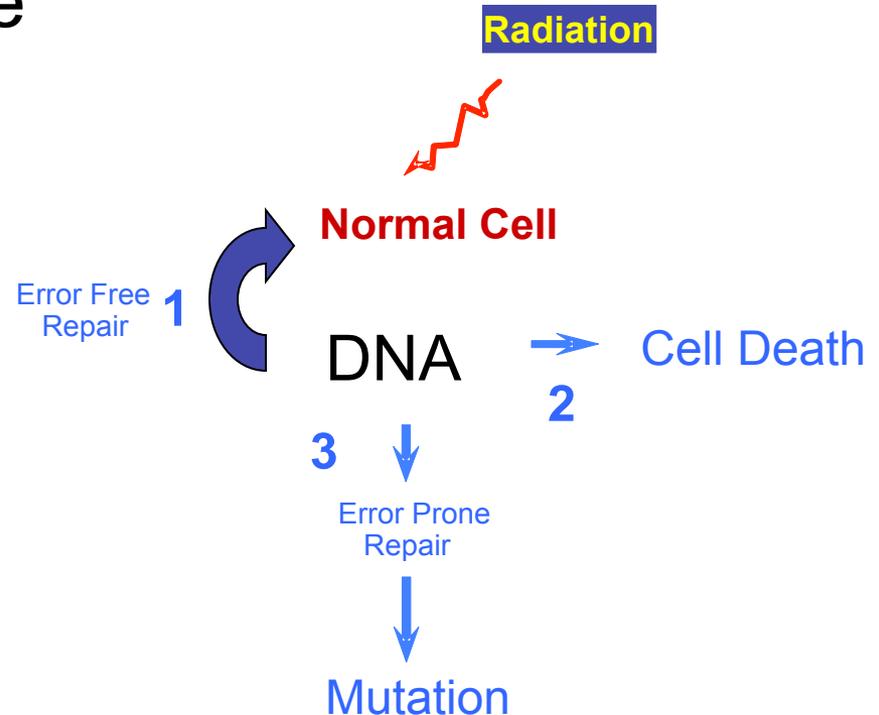


What Does Radiation Do?

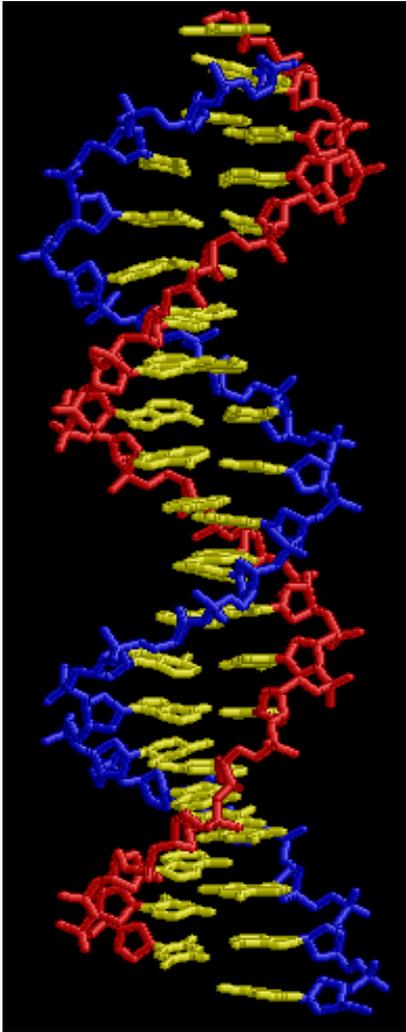
- Changes the Chemistry in our Bodies
 - Cells are the bodies' workhorses
 - DNA is the body's Master Plan
 - Water is 70% of Body Mass
- Water Chemistry Affects our Cells
 - Free Radicals
 - DNA Effects
 - Natural Anti-Oxidants

What Should Concern Us?

- Our bodies cannot sense radiation
 - Dose must be calculated
 - Radiation sensors
 - Bioassay
 - Background Radiation
- Radiation Damage
 - 0 No effect
 - 1 Repaired Damage
 - 2 Cell Death
 - 3 Unrepaired Damage (Mutations)



DNA Effects



Possible Damage Agents

Oxidative Processes

Toxins

Radiation

Short-Term Effects (Acute)

Massive Cell Death

Body Functions Cease

“Radiation Sickness”

Levels of 10,000,000 X Background

Long-Term Effects (Stochastic)

Unrepaired Damage

Mutations

Abnormal Protein Production

Unwanted Reproduction → Cancer

Possible Illnesses

- Cancer
- Premature Aging
- Damage to the Immune System
- Bad Mutations
 - Produce Genetic Diseases in the Organism
 - Produce Genetic Diseases in Progeny
- More Pronounced Effects in Dividing Cells
 - Fetus, Children
 - Crypt Cells, Stem Cells in Bone Marrow

Additional Radiation Sources

- Man-Made Sources
 - Spent Fuel
 - Medical
 - Industrial
- Increased Background
- World-Wide Fallout
- Weapons of Mass Destruction
 - Radiological Dispersal Device
 - Improvised Nuclear Device

Man-Made Sources

- Uses
 - Medical
 - Nuclear Power Reactors
 - Research
 - Industrial Uses
 - (Pipe Inspection and Soil)
- Material
 - Fission Sources
 - Transuranic Elements
 - Activation Products

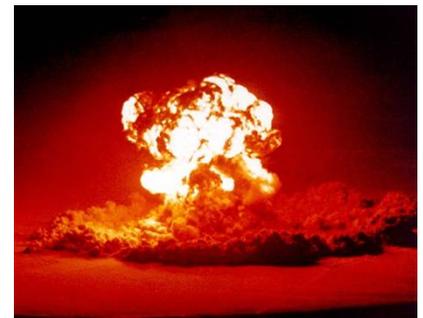


High Background and World-Wide Fallout

- Background
 - Denver is 2X Normal Background
 - Some areas on Earth are 50X Normal
- World-Wide Fallout
 - Cs-137 is the main constituent remaining
 - Sr-90 is also found
 - Not a significant factor in background radiation

Weapons of Mass Destruction

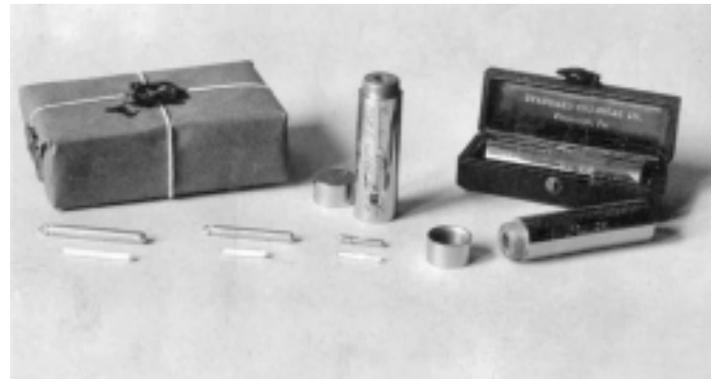
- Radiation Dispersal Device
 - Low public health danger
 - High public perception danger
 - High economic cost
- Radiation Exposure Device
 - Easy to find and isolate
 - Danger for those close in
- Improvised Nuclear Weapon
 - Ultimate Devastation
 - Very difficult to implement



Possible Additions?

- Medical Response
- Decontamination
- University Reachback
- Federal Reachback

What You Might See



Instruments

