

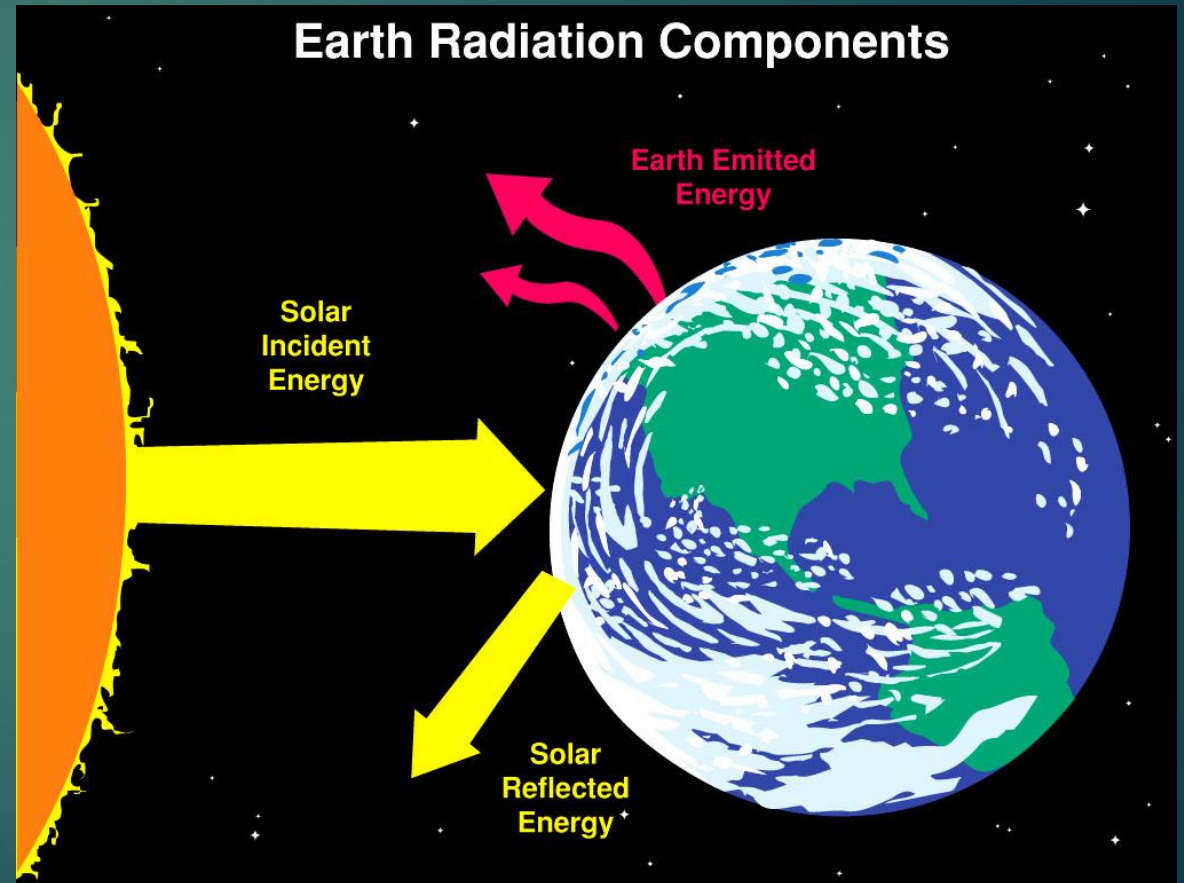


Biological Effects of Radiation

RADIATION AND THE HUMAN BODY UNIT

Radiation is everywhere

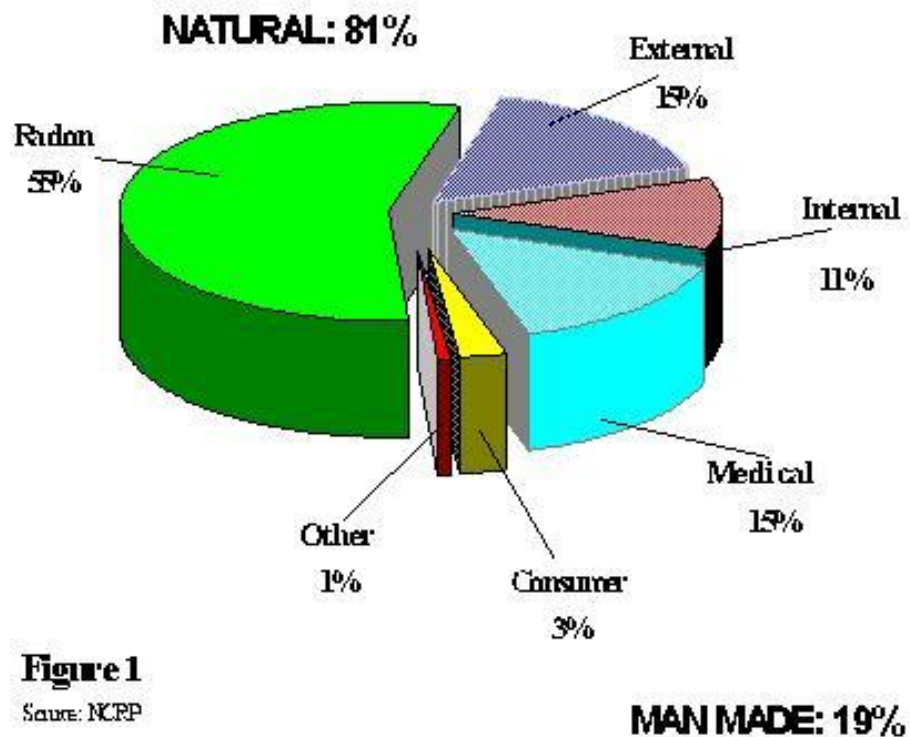
- ▶ And has been since the creation of our planet.
- ▶ Life evolved in the presence of significant radiation
- ▶ Natural sources of radiation: terrestrial (ground), cosmic (space), within our own bodies, the air, and food we consume



Certain foods, materials, and areas contain more radiation than others

Sources of Radiation Dose

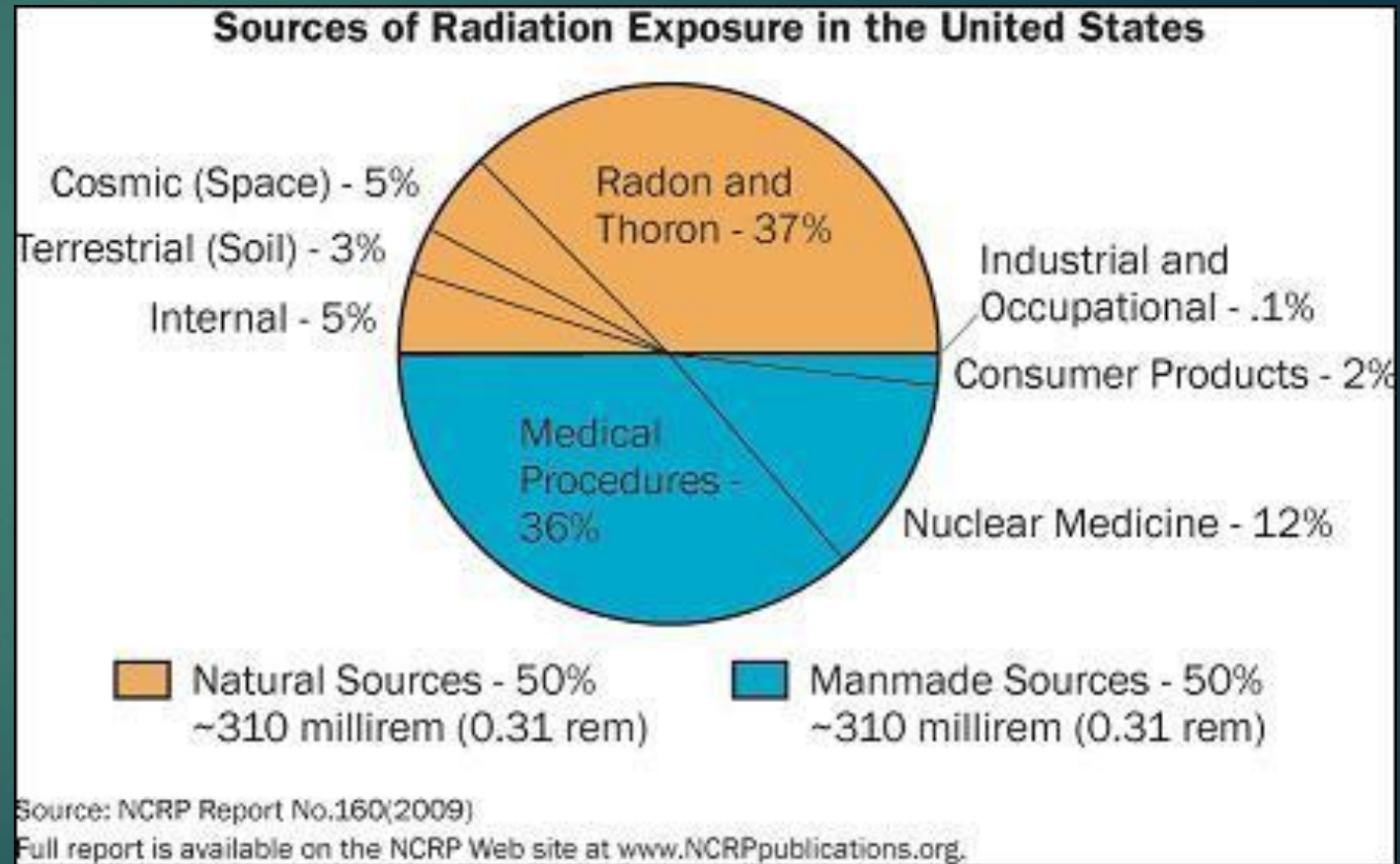
U.S. National Annual Average Effective Dose Equivalent = 360 mrem



- ▶ Bananas, brazil nuts
- ▶ Stone, brick, or concrete homes
- ▶ Living in certain areas of the world exposes one to high natural radiation
 - ▶ Higher altitudes=greater exposure to cosmic radiation
 - ▶ Areas with naturally uranium-enriched soil
 - ▶ Ex. Colorado—high altitudes and more uranium in soil leads to higher annual radiation doses

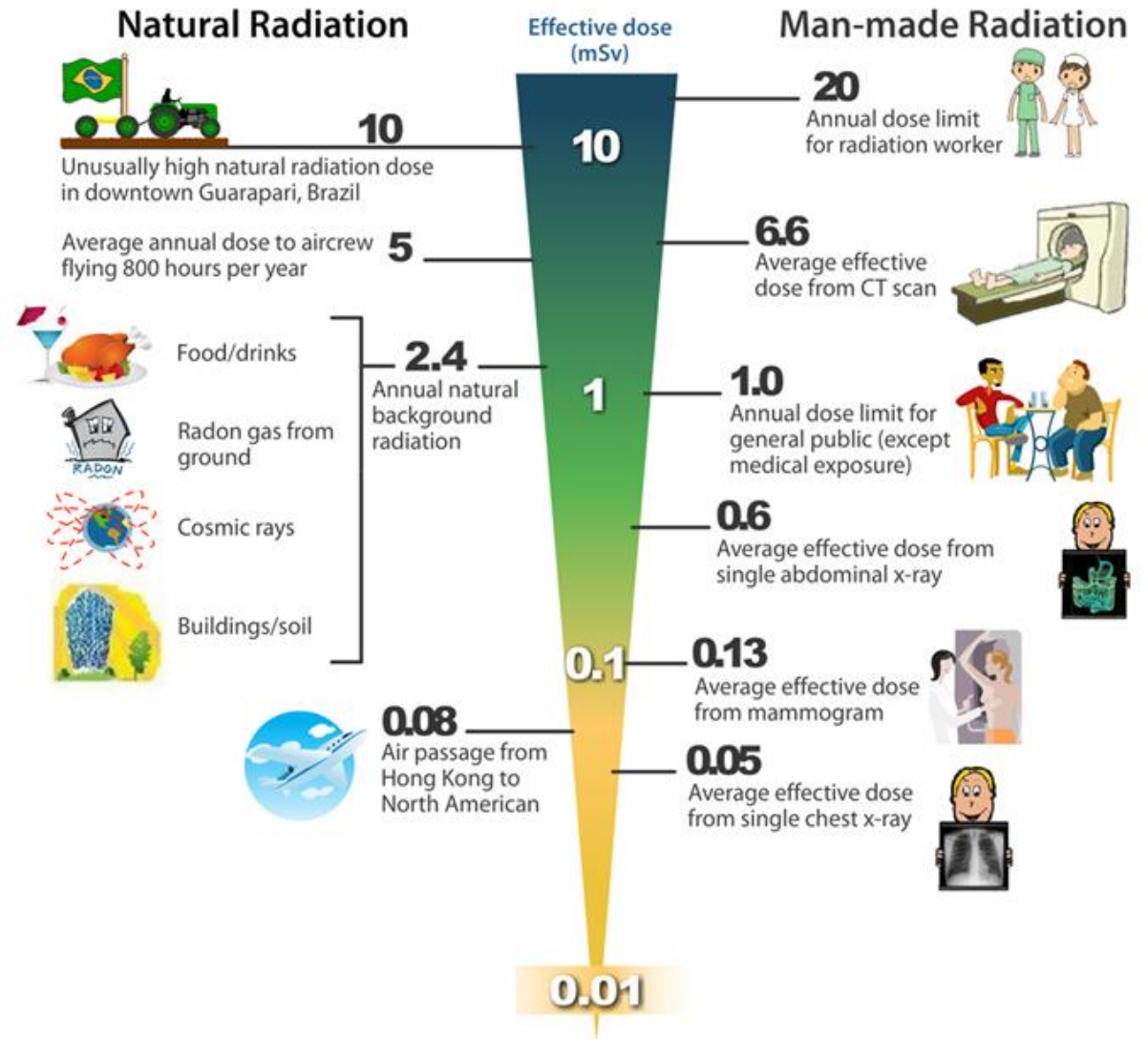
Human-made sources of radiation

- ▶ Medical
 - ▶ CT scans, X-rays, etc. contribute large amounts of human-made radiation comparatively
 - ▶ 150 mrem
- ▶ Commercial
 - ▶ Tobacco, fertilizer, LED watches, welding rods, exit signs, smoke detectors
 - ▶ Contribute ~10 mrem
- ▶ Human-made radiation has a different source, but affects us the same way as natural radiation



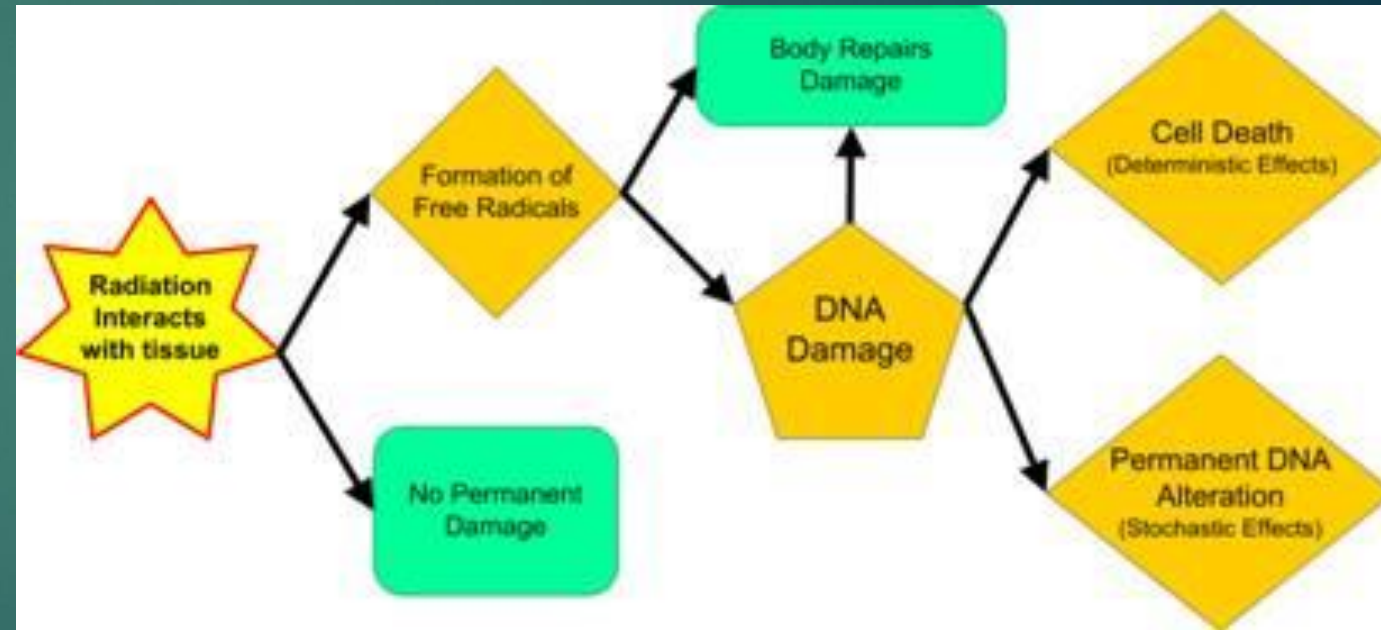
Overall radiation in human body

Radiation in Daily Life



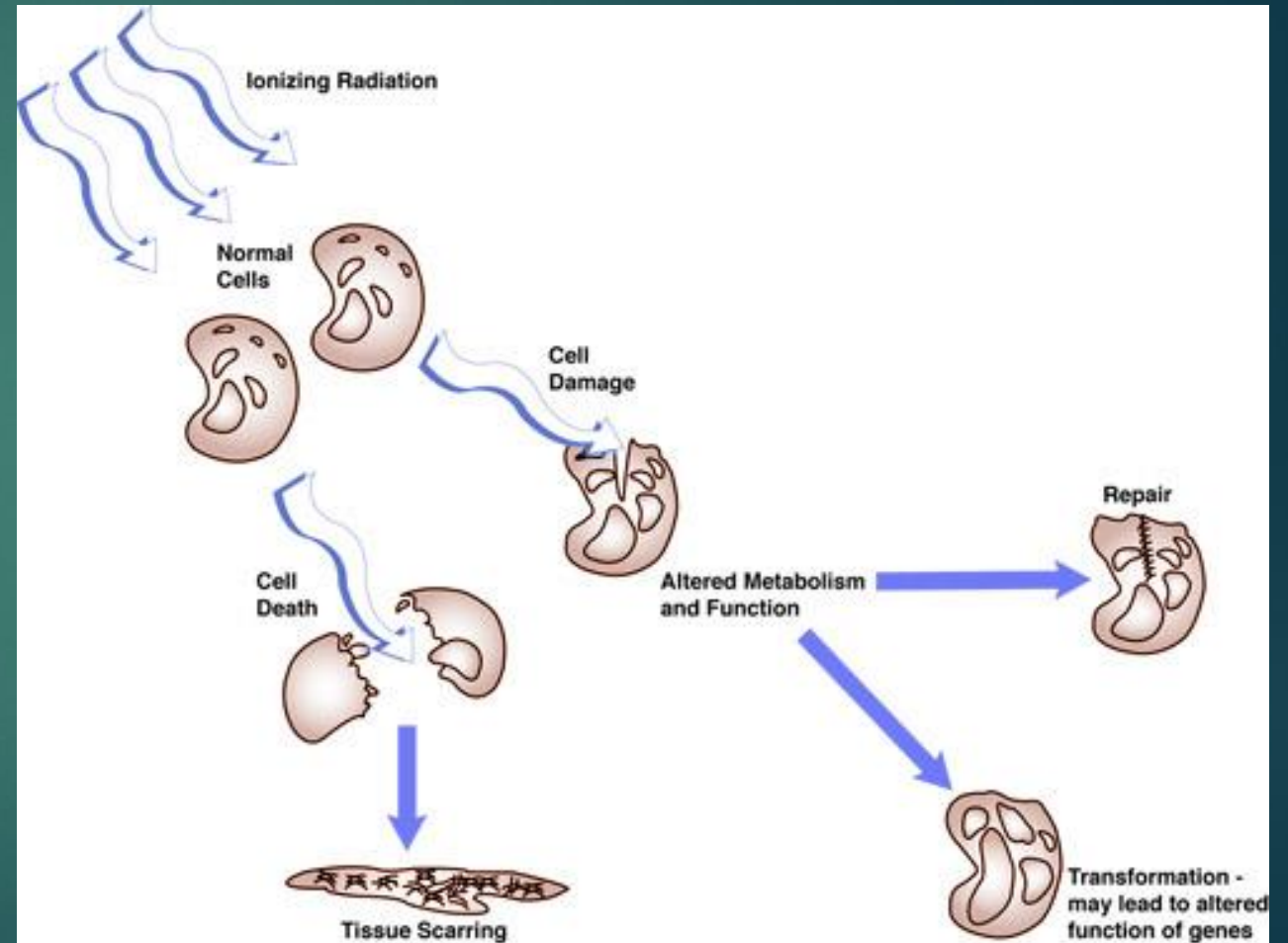
What does this mean for our health?

- ▶ Natural sources of radiation have not been shown to show any adverse health effects in humans
- ▶ Low levels of radiation have a **negligible** effect on cells
- ▶ Higher levels damage macromolecules such as **DNA** in cells
- ▶ **Extremely high** levels damage cells to the point of cell death



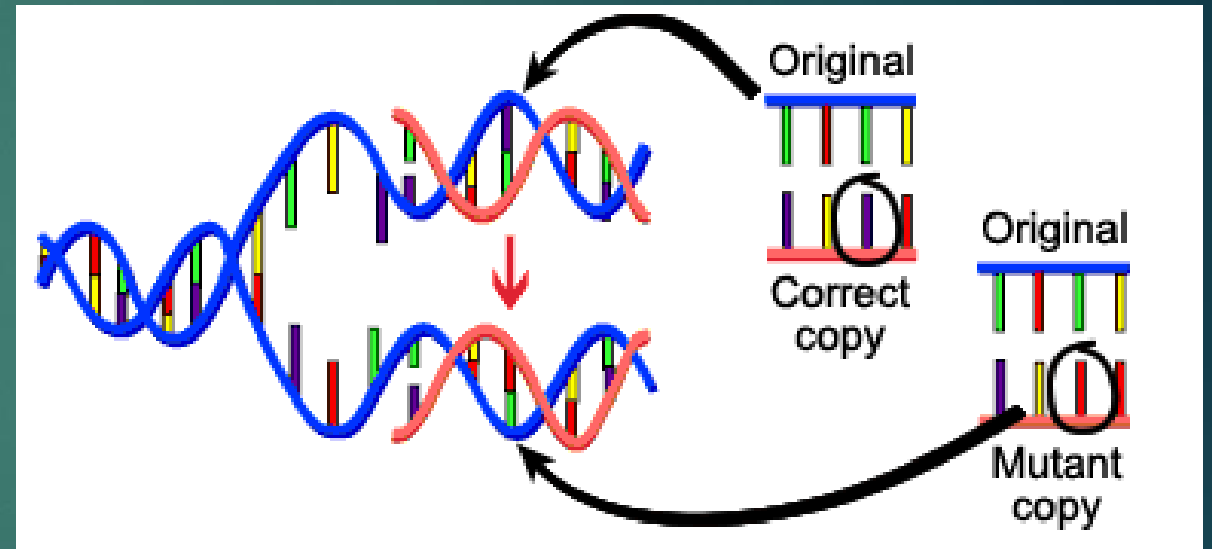
Cellular Effects of Radiation

- ▶ The body has repair mechanisms against ionizing radiation
- ▶ biological effects of radiation on living cells may result in three outcomes:
 - ▶ (1) injured or damaged cells repair themselves, resulting in no lasting damage
 - ▶ (2) cells die
 - ▶ (3) cells incorrectly repair themselves resulting in a change (mutation)



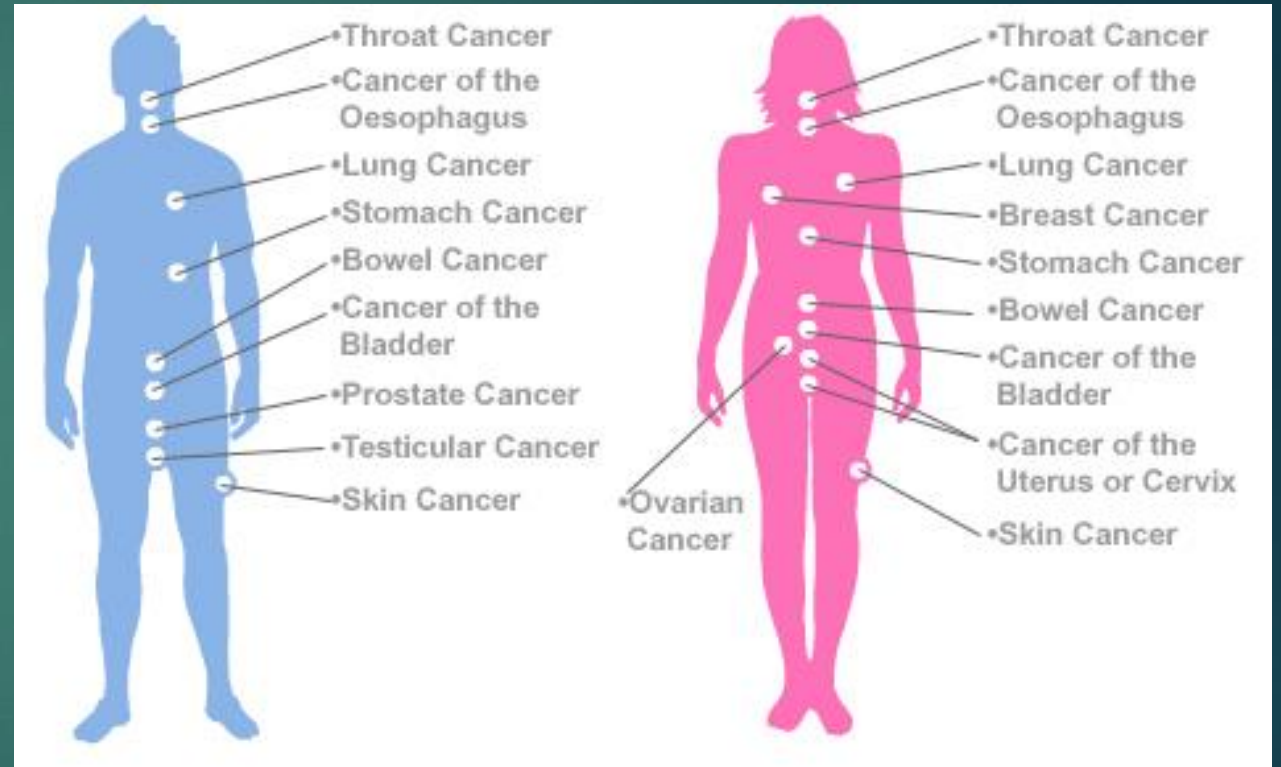
Mutation

- ▶ When cells incorrectly repair themselves, it can result in a **mutation**.
 - ▶ Alteration/change of a single base of DNA or larger sections of a gene
- ▶ Mutations can and do occur naturally.
- ▶ Some mutations can be harmful, some can be helpful, and others can have no effect at all on the organism.



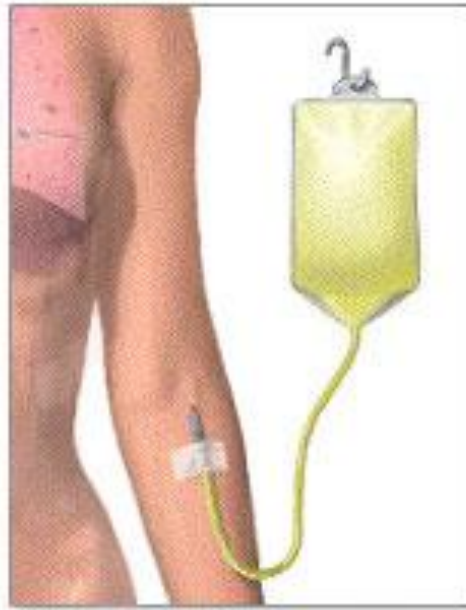
Radiation and Cancer

- ▶ Associations between cancer caused by radiation occur in populations where people have been exposed to extremely high radiation (50,000+ mrem)
- ▶ Types of cancers associated with extremely high doses of radiation: colon, breast, bladder, liver, lung, leukemia, esophagus, ovarian, stomach cancers, pancreatic cancers
- ▶ National Cancer Institute: Other sources (physical and chemical damage such as smoking) contribute far more to developing these cancers than radiation



So if radiation can help cause cancer, why is it a cancer treatment?

Intravenous radiation therapy



Machine radiation

