Assessing Potential Biological Damage from Radiation

Radioactive nuclides are sources of high-energy particles and/or photons. This radiation can break chemical bonds and ionize molecules. In order to assess the potential for biological damage from a particular source of radiation, the following characteristics need to be considered.

1. Energy of radiation

   - **results from $\rightarrow$ kinetic energy of particles and dosage**
   - measured in "rads" ("radiation absorbed dose")
   - 1 rad = 1 x 10^{-2} J deposited per kg tissue

2. Penetrating ability

   - **results from $\rightarrow$ particle charge**
   - uncharged particles (e.g., γ rays and neutrons) have greater penetrating ability than charged particles (e.g., α, β^- and β^+)
   - also affected by the kinetic energies of the particles
   - low energy α stopped by dead layer of skin (external exposure)
   - low energy β^- and β^+ penetrate about 1 cm (external exposure)
   - γ rays and neutrons extremely penetrating

3. Ionizing ability

   - **results from $\rightarrow$ particle mass**
   - α > neutron > $\beta^- \approx \beta^+$ > γ

4. Chemical properties

   - **results from $\rightarrow$ periodic trends**
   - damage from an ingested/inhaled radioactive nuclide depends on its residence time
     e.g.) strontium-90 versus krypton-85 (both β^- emitters); strontium-90 would be expected to have a much longer residence time in the body because it is chemically similar to calcium (krypton-85 is an inert gas)

5. External vs. internal exposure