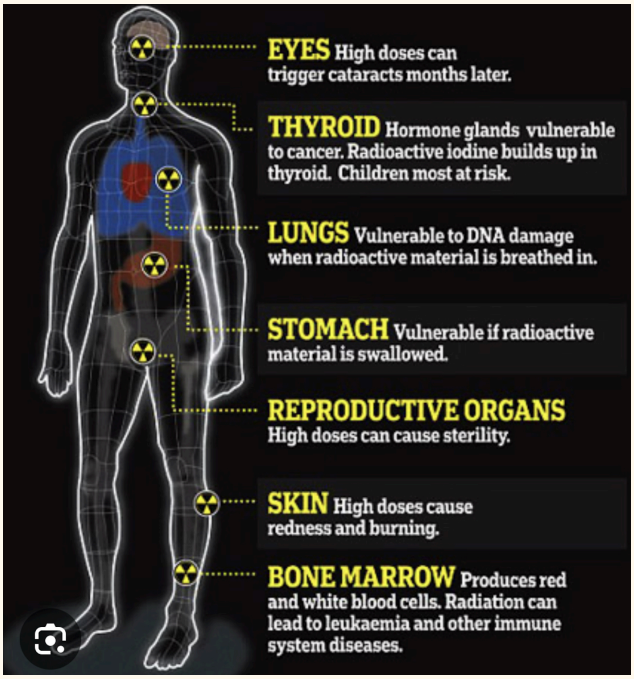
RADP 215 - Radiation Protection Assignment: Radiation Risk

Radiosensitivity of different cell types/Law of bergonie and Thiboneau

—

By Simi Dhanoa



Introduction

Radiation affects cells differently: some are highly sensitive and easily damaged, while others are more resistant. Radiosensitivity describes how likely a cell or tissue is to be injured by radiation, which is important in medical radiography. The Law of Bergonie and Tribondeau explain these differences. This essay will outline that law and give examples of highly sensitive, moderately sensitive, and resistant.

Law of Bergonie and Tribondeau

In 1906, French scientists Jean Bergonie and Louis Tribondeau studied how radiation affects different types of cells. They found that cells are most radiosensitive if they divide quickly, are immature or unspecialized, and have future divisions ahead of them. In simpler terms, young, actively dividing cells are the most sensitive, while mature, specialized cells that divide rarely are the most resistant (Stakiewicz et al., 2022). This principle helps radiographers identify which tissues and organs are more vulnerable during imaging and apply proper protection.

Highly Radiosensitive cells

Cells that divide rapidly and are not yet fully mature are considered highly radiosensitive. Bone marrow stem cells, which continuously produce red and white blood cells and platelets, are particularly vulnerable; damage here can result in anemia, reduced immunity, and bleeding disorders. The epithelial cells lining the gastrointestinal tract also divide quickly, and radiation exposure to these tissues may cause nausea, vomiting and diarrhea. Reproductive cells are among the most sensitive of all, since they are young, undifferentiated, and rapidly dividing; damage in these cells may lead to infertility, genetic mutations, or developmental defects. Finally, lymphocytes and immature oocytes are extremely sensitive and can be damaged by even very small doses of radiation.

High Radiosensitivity	Moderate Radiosensitivity	Low Radiosensitivity
Embryo-fetus cells	Endothelial cells	Muscle cells
Stem cells (bone marrow, spermatogonia)	Connective tissue (fibroblasts)	Nerve cells (adult neurons)
Lymphocytes	Liver, Kidney cells	Mature Red Blood cells (no nucleus)
Epithelial lining cells (GI tract, skin, oral mucosa)	Cartilage	
Oocytes (immature)		

Moderate Sensitive Cells

Some cells are damaged only at higher radiation doses. For example, skin cells may show redness, peeling, or burns after exposure. The lens of the eye, which can develop cataracts if radiation is absorbed. Endothelial cells, which line blood vessels, may be damaged, leading to circulation issues. Cartilage and connective tissues such as fibroblasts are moderately sensitive too, especially in children since their tissues are still actively growing and dividing. Liver and Kidney cells fall into this category because, although they are more resistant than bone marrow, they can still be harmed if exposed to higher levels of radiation.

Low sensitive Cells

Mature, highly specialized cells that rarely divide are considered radioresistant. Examples include nerve cells in the brain and spinal cord, muscle cells, and mature red blood cells. These cells are resistant because radiation primarily affects DNA during cell division, and these tissues divide very slowly or not at all. Mature red blood cells are especially resistant, as they lack a nucleus and DNA, meaning Radiation cannot directly alter them. Although resistant overall, even these tissues can be injured at very high radiation doses.

Conclusion

Radiosensitivity is important to understand because it explains how easily different cells can be damaged by radiation . The Law of Bergonie and Tribondeau provides a framework for recognizing which tissues require extra care during imaging. For radiographers, this knowledge is essential for applying safety practices that reduce exposure. By following the ALARA principle (As Low As Reasonably Achieveable), sensitive tissues can be protected, long-term cancer risks minimized, and both patients and health care workers kept safe.

References

Statkiewicz Sherer, M.A., Visconti, P.J., Riteniur, E.R., & Haynes, K.W. (2022). Radiation protection in medical radiography (9th ed.). Elsevier

Vishwakarma, Sandeep, Aradhana Singh, and Deepak Singh.2015. “Radiation and Its Effect to the Environment.” ResearchGate, June 2015, https://www.researchgate.net/figure/Radiation-Level-and-its-Effect-on-Human-Body_fig3_361279453