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**PAPER # RADIATION PROTECTION**  
**SUBMITTED TO # MISS ATOOFAH**

**QUESTION NO # 1**

Explain the law of Bergonie and Tribondeau concerning radio sensitivity and physical factors affecting radio sensitivity?

**ANSWER No # 1**

**Law of Bergonie and Tribondeau :**

In 1906, two French scientists, Bergonie and Tribondeau, theorized and observed that radio sensitivity was a function of the metabolic state of the tissue being irradiated. This has come to be known as the law of Bergonie and Tribondeau and has been verified many times. Basically, the law states that the radio sensitivity of living tissue varies with maturation and metabolism.

In diagnostic imaging, the law serves to remind us that fetuses are considerably more sensitive to radiation exposure as are children compared with the mature adults.

- Stem cells radiosensitive, mature cells are radioresistant.
- Younger tissues and organs are radiosensitive.
- Tissues with high metabolic activity are radiosensitive.
- A high proliferation rate for cells and a high growth rate for tissue result in increased radiosensitivity.

**Physical factors that affect radiosensitivity :**

A number of Physical factors affect the degree of radiation response.

**Linear energy transfer:**

It is another method of expressing radiation weighting factor ( $W_r$ ) used in radiation protection. LET is expressed in units of track length in soft tissue (keV/um).

**Relative biologic effectiveness:**

As the LET of radiation increases, the ability to produce biologic damage also increases. This effect is quantitatively described by the relative biologic effectiveness (RBE).

**Protraction :**

A higher dose is required to produce the same effect. This lengthening of time can be accomplished in two ways.

If the dose is delivered continuously but at a lower dose rate, it is said to be protracted.

**Fractionation :**

If the 6-Gyt dose is delivered at the same dose rate, but in 12 equal fractions of 500 mGyt, all separated by 24 hours, the mouse will survive. In this situation, the dose is said to be fractionated.

Radiation dose Fractionation reduces effect because cells undergo repair and recovery between doses. Dose Fractionation is used routinely in radiation oncology.

## **QUESTION No # 2**

Write a short note on :

A) Effect of irradiation of Macromolecules.

### **Irradiation of Macromolecules :**

When Macromolecules are irradiated in solution in vitro, three major effect occur :

- Main chain scission
- Cross-linking
- Point lesions

#### **Main - chain scission:**

- Breakage of the backbone of the long chain macromolecules.
- Result in reduction of a long single molecule into many smaller molecules.
- Reduce viscosity of the solution.

#### **Cross - linking:**

- Behave as though they had a sticky substance on end, attached to neighbouring macromolecules or to another segment of the same molecule.
- This process is called cross-linking.
- Increased viscosity of a macromolecular solution.

#### **Point lesions:**

- Radiation interaction with macromolecules also can result in disruption of a single chemical bonds, producing point lesions.
- No viscosity change.
- Cannot measure.

### **B) Radiolysis of Water :**

- Human body contains approximately 80% water molecules.
- When water is irradiated, this action is called Radiolysis of Water.
- Water is irradiated, it is ionized and dissociates into two ions and breaks down to free radicals.

### **C) Effect of radiation on cell:**

- When the human body (its cells) is exposed to radiation (xray and gamma rays) electrons are emitted from atoms and molecules.
- These electrons bounce around, dispersing energy into surrounding areas.
- Result in formation of radicals.
- Cell membrane damage can cause cell death (apoptosis) and breaks in cellular DNA, can cause cell death or mutation.
- Leukemia incidence increases.

#### **D) Fractionation :**

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#### **Protraction :**

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#### **QUESTION No # 3**

Write a summary of the early effects of radiation on the human body?

#### **ANSWER No # 3**

##### **Early effects of radiation on human body :**

- Radiation can harm either the whole body (somatic damage) or eggs and sperm (genetic damage).
- Its effects are more pronounced in cells that reproduce rapidly, such as the stomach lining, hair follicles, bone marrow and embryos.
- Penetration of particles like alpha beta in living organisms can cause serious malfunctions in normal cell processes causing illness or even death.
- It can also lead to long term health effects such as cancer and cardiovascular disease.
- High radion dose can lead to mutation.
- A change in genes.
- Most important high effect on fetus.
- Effects on skin.
- Effects on Gonads.
- Hematologic effects (blood examination).
- Cytogenetic effects (genetic analysis).

**THE END**