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(INU)

Answer No:01

Law of Bergonie and Tribondeau: -

The law of Bergonie and Tribondeau states that: -

- The radio sensitivity of a biological tissue is directly proportional to the mitotic activity and inversely proportional to the degree of differentiation of its cells.
- This law underpins the field of radiation-oncology, although such a general law may not apply in all cases.

Factors affecting radio sensitivity: -

- LET (Linear energy Transfer): ↑ RS
- Dose rate: ↑ RS
- Temperature: ↑ RS
- Age
- Metabolic rate
- Oxygen effect

Answer No: - 02

Short Notes: -

1) Effect of irradiation of macromolecules: -

- In the dry or frozen states, macromolecules are damaged directly by interactions with ionizing radiation.
- Since γ -rays and high-energy electrons randomly ionize orbital electrons in their path, larger molecules are more likely to suffer an interaction with these radiations.
- In each interaction, energy is transferred to the struck molecule, resulting in irreversibly broken covalent bonds.

2) **Radiolysis of water:** -

- It is the dissociation of molecules by ionizing radiations.
- Water dissociates under alpha radiation into a hydrogen radical and a hydroxyl radical, unlike ionization of water which produces a hydrogen ion and a hydroxide ion.
- Water when exposed to radiation, water undergoes a breakdown sequence into hydrogen peroxide, hydrogen radicals, and the assorted oxygen compounds, such as ozone, which when converted back into oxygen releases great amounts of energy.

3) **Effect of radiation on cell:** -

- The radiation may alter the cell DNA.
- Radiations lead to cancer of the cells.
- It causes suppression of the mitosis.
- Further leads to:
 - i. **The main chain scission:-**
It is the breakage of the backbone of the long chain macromolecule. The result is the reduction of a long, single molecule into many smaller molecules, each of which may still be macromolecular.
 - ii. **Cross linking:-**
Some macromolecules have small, spur like structures that extend off the main chain. Others produce these Spurs as a consequence of irradiation. This side structures can behave is the head a sticky substance on the end, and they attached to a neighboring macromolecule are to another segment of the same molecule. This process is crosslinking.

- iii. **Disruption of single chemical bonds, causing point lesions:-**
Radiation interaction with macromolecules also can result in disruption of single chemical bonds, producing. Legends. Legends are not detectable, but they can cause a minor modification of the molecule, which in turn can cause it to malfunction within the cell.
- iv. Genetic damage.
- v. Malignancy of specific tissue, like breast cancer etc.
- vi. Can cause infertility as gonads are radiosensitive.

4) **Fractionation and Protraction:** -

- i. **Fractionation:** -
 - The method to reduce patient exposure, in which we give high dose but with breaks in between the doses.
- ii. **Protraction:** -
 - The method to reduce patient exposure, in which we give the dose continuously but the dose given is low.

Answer No: - 03

Effects of radiation on human body: -

- After radiation exposure, the human body response in predictable ways.
- If the intensity of the response increases with increasing radiation dose it is called a deterministic response and occurs within days of exposure.
- If the frequency of an injury increases with increasing radiation dose, it is called a stochastic effect and is not observable for years.
- Most patients who do not recover will die within a few to several months after exposure.

- There are, in fact, three separate syndromes that are related and that follow are rather distinct course of clinical responses.
 - 1) **Hematologic death:** -
 - Symptoms i.e. nausea, vomiting and diarrhea develops, with time of onset from later than 1 hour to about 24 hours after exposure and may persist for several days.

 - 2) **Gastrointestinal death:** -
 - depletion of the epithelial cells lining lumen of the GI tract.
 - Intestinal bacteria gain free access to the body.
 - Hemorrhage through denuded areas.
 - Loss of absorption capacity.

 - 3) **Central nervous system death:** -
 - Nausea, vomiting and burning sensation in the skin within a few minutes of exposure.
 - The patient become nervous and confused with loss of vision, balance and consciousness within the first hour.
 - Central nervous system syndrome is characterized by raised intracranial pressure, vasculitis and meningitis.

Further complications of radiation exposure on human body includes

- Damage to the skin.
- Hair loss
- Dry desquamation.
- Moist desquamation.
- Blister formation.
- Ulceration.
- Necrosis.
- It also affects the gonads.

- It affects the hematopoietic system.
- It also has cytogenetic effects.
- Chromosome aberrations i.e.
single heat and multi heat chromosome aberrations.
- Reciprocal translocation.

Etc. etc.