

RADIATION BIOLOGY

OBJECTIVES:

1. DEFINE IONIZATION
2. EXPLAIN THE DIRECT THEORY OF RADIATION DAMAGE
3. EXPLAIN THE INDIRECT THEORY OF RADIATION DAMAGE
4. DESCRIBE THE IONIZING AND PENETRATING ABILITY OF THE THREE TYPES OF RADIATION
5. EXPLAIN THE LAW OF BERGONIE & TRIBONDEAU
6. LIST THE MORE RADIOSENSITIVE SYSTEMS IN THE BODY
7. LIST THE MOST RADIORESISTANT SYSTEM IN THE BODY
8. EXPLAIN THE DIFFERENCE BETWEEN STOCHASTIC AND NON-STOCHASTIC RADIATION EFFECTS
9. EXPLAIN WHY THE FETUS IS PARTICULARLY RADIOSENSITIVE DURING THE FIRST TRIMESTER

**IONIZATION IS:
THE PROCESS BY WHICH RADIATION
DISSIPATES ENERGY AND PRODUCES
ION PAIRS**

- THE MOST SIGNIFICANT INTERACTION OF RADIATION WITH MATTER BECAUSE IONIZATION CAUSES THE DAMAGE
- CONVERTING WATER MOLECULES TO HYDROGEN PEROXIDE

IONIZATION V.S. PENETRATION

ALPHA PARTICLE - HIGHEST / LOWEST

BETA PARTICLE - MEDIUM / 100 TIME HIGHER

GAMMA & X-RAYS - LOWEST / HIGHEST

- BECAUSE OF PENETRATION & IONIZATION

BETA PARTICLES ARE BEST FOR RAD.

THERAPY > I-131(MIXED BETA/GAMMA)

P-32 (PURE BETA)

- GAMMA & X-RAYS ARE BETTER FOR

DIAGNOSTIC

STUDIES BECAUSE OF LOW IONIZATION

> Tc-99m, I-123, 111-In, ETC.

LAW OF BERGONIE AND TRIBONDEAU

THE RADIOSENSITIVITY OF A CELL DEPENDS ON:

- 1) AMOUNT OF MITOTIC ACTIVITY
- 2) NUMBER OF UNDIFFERENTIATED CELLS
- 3) LENGTH OF TIME IN ACTIVE
PROLIFERATION

LD/50

LETHAL DOSE WHICH WILL KILL 50% OF POPULATION

(IF A LARGE POPULATION IS EXPOSED TO A
UNIFORM WHOLE BODY DOSE)

- LD/50 FOR MAN = 200 - 500 RAD
- DEATH WOULD OCCUR NEAR THE SAME TIME

STOCHASTIC V.S. NON-STOCHASTIC RADIATION EFFECTS

STOCHASTIC EFFECTS

- HAVE NO THRESHOLD
- PROBABILITY OF OCCURRENCE INCREASE AS THE DOSE INCREASES
- GENETIC EFFECTS AND CANCER
- EFFECTS HARD TO DOCUMENT AS RADIATION INDUCED
 - EXCEPT FOR LEUKEMIA

NON-STOCHASTIC EFFECTS

- A THRESHOLD EXIST
- EFFECTS BECOME MORE SERIOUS AS DOSE INCREASES
- CATARACT FORMATION (TAKES AT LEAST 100-200 RADS, ACUTE DOSE)

RADIATION EFFECTS ON FETUS

FETAL RADIOSENSITIVITY HIGHEST DURING FIRST TRIMESTER

STAGE 1 > 1-10 DAYS POST CONCEPTION IF
SIGNIFICANT DAMAGE OCCURS, THE RESULTS
COULD BE PRENATAL DEATH

STAGE 2 > 3-6 WEEKS POST CONCEPTION
- TIME OF MAJOR ORGANOGENESIS
- RESULTS COULD BE MALFORMATIONS
AND/OR PRENATAL DEATH

STAGE 3 > 2-3 MONTHS POST CONCEPTION
RELATIVELY RADIORESISTANT