INTRODUCTION
Ever since the discovery of X-rays by Roentgen in 1895 and the discovery of radioactivity by Henri Becquerel in 1905, nuclear science has evolved great interest due to its tremendous potentiality both in the physical and biological sciences. However, the current rapid development of nuclear energy into a major industry has evolved strong assertions as to its potential hazard. With the decrease in the world's natural resources for energy such as coal, petroleum, there has been enormous increase in the atomic power plants. This has resulted in an increase in the background radiation. The human beings and other living organisms will be exposed to more radiation than the accepted permissible levels. The effects of radiation on human beings have been studied in
detail on the atomic bomb survivors of Hiroshima and Nagasaki. However, still there is a wide gap between the basic studies on the biological effects of radiation and the gross clinical implications of radiations.

It has been repeatedly discussed that external and internal radiation produces various biochemical and histopathological lesions, may be by direct hits or indirectly by the production of free radicals. However, internal radiation presents a more serious problem than external radiation. In case of external radiation, the exposure is terminated as soon as the source is removed from an individual. In internal radiation, the radionuclides are localized into the body and irradiate continuously until they are eliminated by biological turnover and physical decay. In addition, because the internally deposited radionuclides are in intimate contact with the tissue that they irradiate, minute quantities can produce serious effects.

It is a well established fact that different species display different radiosensitivity. Radiosensitivity is a relative term indicating the amount of radiation required to produce a specific effect in a biological system compared to the amount of radiation required to produce the same effect in
another biological system. The various species so far studied show a characteristic three component curve if the mean survival time is plotted as a function of dose over a range from a few hundred to hundreds of thousands roentgens (Bond et al., 1965; Bond and Sugahara, 1969; Taylor et al., 1971; Fliedner, 1973). The different species differ in their response to radiation. Individuals are more sensitive to radiation during prenatal life than during postnatal life. Again radiosensitivity of the embryo varies with age. Old animals are again radiosensitive. Possible intrinsic factors underlying the relation are:

1. Oxygen tension in critical tissues
2. Growth rate i.e. weight change
3. Hormonal effect, and
4. Chromosomal configuration.

In fact it has been pointed out that the period of maximum sensitivity to radiation in mice corresponds to the peak in the rate of change in body weight (gram/day) occurring at 3-4 weeks of age.

Further, different tissues or organs of the same individual differ in their response to radiation. The difference mainly depends upon two things:

1. Proliferative capacity
2. Individual sensitivity of different compartments.
Bergonie and Tribondeau (1906) formulated the general principles of radiosensitivity. The law is stated in three parts:

1. Radiation is more effective on cells with greater reproductive capacity, meaning that cells in active mitosis are more sensitive.

2. The cells having a longer dividing or mitotic future are more sensitive, indicating that cells requiring the greater number of divisions before maturity is reached, are more sensitive.

3. Cells are more radioreistant in proportion to the degree of morphologic and physiologic differentiation.

The law, however, makes no reference to the sensitivity related to the phase of mitosis or mitosis versus resting stage. The law has limited application. Exceptions are many. Lymphocytes and oocytes which are highly differentiated and which lack mitotic capacity are known to be highly radiosensitive. However, the law still represents an excellent guideline.

Mammalian cell populations can be divided into three groups or sub-populations: (1) those that continuously move around the cell cycle from one mitosis to the next (continuously dividing cells), (2) those that leave the cell cycle but can
be induced to synthesize DNA and divide by an appropriate stimulus (\(G_0\) cells), and (3) those that have permanently left the cell cycle and will die without dividing again (non-dividing cells). Continuously dividing cells are those of the bone marrow and of the crypts of the small intestine, the \(G_0\) cells of the liver and other organs and the non-dividing cells are the end point cells like the erythrocytes, polymorphonuclear leucocytes and the keratinized cells of the epidermis.

A variety of physical, chemical and biological agents influence the cell cycle and its phases, thus indicating that the cell cycle is a flexible mechanism that allows the cell to respond with appropriate modifications of its proliferative capacities to the influences of the external environment. Epifanova (1967) in a review of the biochemistry of hormones effects on target cells concluded that the replication of DNA occurs only during a discrete and well defined period of the cycle and that between one mitosis and the next one there is an orderly sequence of events known as \(G_1\), \(S\), \(G_2\) and \(M\) phases of the cell cycle.

Under normal conditions, liver cells rarely divide. However, the mammalian liver possesses a remarkable regenerative capacity following surgical removal (hepatectomy) and other
specific stimuli which cause remarkable liver damage. The cells remain in a resting state for extended periods, do not synthesize DNA or enter mitosis, however, they may be engaged in intense metabolic activity. These cells \((G_0)\) respond to specific stimuli which alter their biochemical activity. The altered activity occurs in the context of preparation for cell division and DNA synthesis ensues.

The radiosensitivity of different phases of the cycle has been studied by many workers. It has been shown that different cell lines respond differently to X-irradiation in the various stages of their cycle. When the cells are irradiated progression through the life cycle stops and resumes later. This phenomenon is known as "progression delay". The duration of the delay is dependent on these factors: (1) the phase of the cycle of the cell at the time of irradiation, and (2) the radiation dose. Delay is considerable long for cells irradiated in mitosis, short for cells in \(G_1\), increases to a maximum for cells during \(S\) and declines for cells in \(G_2\) in most cell lines. For L cells and human kidney cells the delay is longer for cells irradiated in \(G_2\) than for those in \(S\). Higher doses cause longer relative delays, however, the pattern does not change. What happens during delay is not well understood but cells
use this time to repair or recover from radiation damage before progressing through the life cycle.

The death of an organism after an exposure to radiations results from either one of the following three reasons or a combination of the three:

1. Bone marrow or haematopoietic syndrome: disturbance produced by radiations in the cell renewal systems in the bone marrow i.e. granulocytic cell renewal system, lymphocytic cell renewal system.

2. Gastrointestinal syndrome: disturbance produced by radiations in intestinal cell renewal system.

3. Central nervous systems syndrome: disturbance produced by radiations in the nervous tissue.

The production of any one of the syndromes depends upon the radiation dose. The failure of CNS requires very high amount of dose while the haematopoietic system needs the lowest.

There is now growing evidence that the members of the rodent family Cricetidae are comparatively highly radioresistant. Golley et al. (1965) have reported that the cricetids such as the old field mouse (Peromyscus polionotus), the cotton mouse (Peromyscus gossypinus) and the harvest mouse (Reithrodontomys humilis), representing different habitats (deserts to wet regions) are highly radioresistant as compared to house mouse.
(Mus musculus) family Muridae. Chang et al. (1964) have also shown that the Mongolian gerbil (Meriones unguiculatus), a closely related species of Indian desert gerbil, display a high degree of resistance to gamma radiation. The Indian desert gerbil (Meriones hurrianae, Jerdon) has also been shown to be highly radioresistant (Bhartiya, 1970; Kumar and Srivastava, 1971b) to external gamma radiations. Reports regarding the behaviour of these wild species to internal emitters are not available or are scanty.

Calcium like phosphorus is an important constituent of the bone and plays a great part in blood clotting mechanism by helping in the conversion of prothrombin to thrombin. It is a necessary ion in promoting normal cardiac, smooth and skeletal muscle functions. Radioactive calcium like radiophosphorus and radiostrontium is a bone seeking radionuclide. The effect of radiophosphorus ($^{32}P$) on the liver of mice, rats and other animals have been studied in details (Grad and Stevens, 1950; Warren et al., 1950; Koletsky and Christie, 1951; Bhartiya, 1970; Bhartiya and Kumar, 1970; Gupta, 1970; Sengupta and Srivastava, 1971; Sengupta, 1972; and Kumar and Mehta, 1973). However, limited studies have been made with radiocalcium ($^{45}Ca$) as source of emission. Radiocalcium ($^{45}Ca$) is a pure $\beta$-emitter with half
life of 165 days. The energy associated with the isotope is \( \beta^{-0.25} \) meV. Radiocalcium was chosen for two reasons: (1) it is highly bone-seeking, and (2) the biological effects shown by radiocalcium (\( \text{Ca}^{45} \)) are typical of the bone-seeking radionuclides e.g. \( \text{Ra}^{224} \), \( \text{Pu}^{239} \) and \( \text{Sr}^{90} \) (Cleaver, 1971).

In the present investigation, studies have been done on the histopathological and biochemical changes in the liver of Swiss albino mice and Indian desert gerbil (\( \text{Meriones hurrianae} \), Jerdon). This will provide a basis for an intensive discussion on the comparative radiosensitivity of the two animals. Further, it derives its importance from the fact that increasing amounts of such radionuclides are released into environment. Therefore, besides man, naturally occurring wild species become an ultimate choice for experimentation so as to predict the possible hazards of the radioactive fallout.