Preface

It is a well known fact that bacteria as well as higher organisms possess enzymatic system for the repair of radiation damage (Kimball, 1978; Walker, 1985). Presumably, this machinery was evolved to cope with the offensive doses of radiations constantly falling upon the primitive earth. During the billion years of ecological evolution, the stratosphere has been tremendously changed with the formation of ozone layer under the catalytic action of cosmic radiations. Meanwhile the biological evolution has also started at the expense of natural selection pressures. Now it raises a fundamental question as to why the radiation repair system had not been eliminated in the presence of ozone layer which prevents the offensive exposure of radiations.

During the late 1960s, several speculations were made about the possible role of radiation repair system under the present environmental conditions. At least two possibilities are well documented:

(1) Their role in normal metabolism e.g. genetic recombination (Howard-Flanders and Theriot, 1966).

(2) They could also play an active role in the repair of damages induced due to non physiological environmental conditions (Bridges et al., 1969).
Earlier work by Ahmad and coworkers (1978, 1980 and 1987) experimentally supported the second idea. Our special interest was on the damages induced by non physiological ionic strength due to the fact that the first sign of life has been supposed to have appeared in the ocean (Prosser, 1973). Even this is not unlikely to think that the 'so called' radiation repair systems might have evolved to protect the cells against the offensive exposure of radiations and, also, to alleviate the hazardous effects of environmental fluctuations such as:

1. Ionic strength- in view of higher salt concentration in ocean and upper crust of earth.

2. pH- in view of reducing environment and heavy acid rains on the primitive earth.

3. Thermal- in view of high frequency of volcanic eruptions and due to other geophysical alterations.

These physiological fluctuations are still persisting in the present environment while the hazardous doses of radiations are the speculations of the past.

In order to study the probable role of these repair processes under non physiological ionic strength, we selected several radiation sensitive mutants of \textit{E.coli} B and K-12 and bacteriophage lambda. Survival patterns of the bacterial strains and $\lambda$-\textit{E.coli} complexes were determined under high and
low ionic strength conditions. Different combinations of Mg$^{++}$ ion concentration with or without 5% NaCl were, therefore, taken to investigate the damaging effect of non physiological ionic strength. The rationale of using the 5% NaCl was to conform with the natural non physiological conditions existing in the ocean as well as in the saline soils and lakes. The low and high Mg$^{++}$ ion concentration was selected because it was used by several workers (Webb, 1970; Soltis and Lehman, 1984).

In the first chapter of this dissertation, the DNA repair systems and the different kinds of the lesions induced due to various damaging agents have been described to introduce the subject.

Second chapter includes general methodology, bacterial and phage strains, composition of buffers and media, etc. employed during the course of these studies.

Third chapter embodies the data on the survival of *E. coli* K-12 and *E. coli* B strains on exposure to various non physiological ionic strength conditions.

The fourth chapter incorporates the results of the studies on the survival of bacteriophage lambda consequent upon the various ionic strength treatments.
The biochemical studies employing the radioisotopic tracer techniques as well as some \textit{in vitro} work has been presented in the fifth chapter.

Sixth chapter deals with the general discussion to coordinate briefly the entire data on ionic strength induced lesions and their repair.

In the last, summary and bibliography are documented.