The vertebrate eye has evolved from a great variety of invertebrate photosensitive organs, ranging from a simple increase in the sensitivity of surface cells, unicellular eye spots consisting of one specialized receptor cell with associated pigment mass, to the more complex multicellular eye. The vertebrate eye shows no evolutionary differentiation within the phylum as it is seen in the progress of invertebrate eye. In vertebrates, the eye of a fish is as complex and developed as that of a bird or a man. The variations in the eye structure manifested in the major classes within the phylum are minor in nature and have evolved essentially as adaptations to habitats. All vertebrates have a three layered retina, a pigmented epithelium and the same dioptic apparatus of a cornea and an epithelial lens with the same nutrient mechanism. Each part of the vertebrate eye is extremely specialized. The perfection of the eye as an optical instrument is a token of supreme vision in the struggle for survival. The vision is an integrated process of all the specialized tissues of the eye - viz., cornea, lens, retina etc. The cornea and the lens are transparent and form an integral part of the refractive media of the eye. They play an indispensable role in the image-forming system.

The lens mainly takes part in the process of accommodation. Its mechanism varies depending on the refractive index of the surrounding
medium and the lens material. In general, in vertebrates the accommodation is achieved with the change in the shape of the lens except in fish where it occurs by the change in the position of the lens. To maintain its unique role in the process of vision, the lens has to keep its transparency throughout the life of an organism. The transparency of the lens depends on various factors such as highly ordered cellular arrangement, fiber size, uniformity of dimension and shape, molecular structure and regularity of packing (Kuck, 1970 a, b). The primary function of the lenticular metabolism appears to be directed towards maintaining its organised structure resulting in lens transparency.

The lens is devoid of blood supply. For its vital requirements, it depends mainly on the aqueous humour and to some extent on the vitreous humour. Interference with normal lens metabolism, interference with active transport across the cell boundaries, breakage of the lens capsule, inflammation, injuries and many other types of damages to lens cause alterations in its transparency and thus bring about lens opacity which is generally known as cataract. The lens opacification obstructs vision.

This visual disability mainly due to the lenticular opacification accounts for most of the blindness in the world. According to National Eye Institute meeting held on October 1973, 1.25 million people are afflicted with this type of visual disability annually. Thus cataract is responsible for forty per cent of all blindness in India and about twenty per cent of all blindness in United States. According to the reports of Indian Council of Medical Research, (Fasalbhoi & Naikami, 1977) New Delhi, the number of blind in India adds up to a staggering total of nine millions. Among nine million
blind, nearly six million people suffer from cataract which is the biggest cause of blindness in India. And it has been reported that India has to suffer a capital cost of Rs.12000 crores for maintaining them. Cataract thus has a tremendous impact on the economy of the nation. At the individual level also, cataract impairs the productivity.

With the awareness of cataract problem, the investigators have been trying since last few decades to find out the changes occurring in the cataract formation. During this work, a loss in the soluble proteins and total protein contents (Mach, 1963; Chariton & Van Heyningen, 1968; Harding, 1972; Maraini & Paccatini, 1972; Maraini & Rangl, 1973), a lowered protein synthesis (Davila, 1963; Maraini et al., 1971), a loss in the contents of glutathione and ascorbic acid (Van Heyningen, 1962; Consul & Nagpal, 1969), changes in the enzyme activity patterns (Friedburg, 1966; 1967; Friedburg & Mayer, 1968; Friedburg, 1972; Friedburg & Monthey, 1973; Friedburg, 1973), changes in the sodium and potassium contents (Andreae, 1970; Van Heyningen, 1972; Maraini & Rangl, 1973) and a change in the content of water (Piria, 1968) have been observed in the senile cataracts. Besides these biochemical changes, the morphological levels such as alterations in the thickness of the lens (Veekare et al., 1973) variations in refractive index within the lens (Philipson & Fagerhala, 1973) have also been observed. Nevertheless, these studies describe only the end result of processes paving way for cataract because no lens is removed from a normal human until the opacity is complete. These difficulties prevent researchers to trace the nature of chemical changes.
underlying the formation of lens opacities. However, these intricate problems have led to deviate the researchers to work on the induced cataracts in experimental animals where the possibility of overwhelming the above drawbacks are possible. Such studies may help in finding the chemistry and physiology of the lens in a free and early stages of cataract and also in the elucidation of the mechanisms of cataract formation.

In view of the above, studies are in progress since long for investigating the animal models for cataract and mechanisms involved in its formation. These studies will help in gaining the information of the changes which occur during lenticular opacification in human beings and thus may help in evaluating the mechanisms of cataract formation in the humans. Before concentrating into the animal models, the knowledge of the chemistry of the normal eye lens which is of great importance in understanding and appreciating the changes through which lens passes while deviating from normal transparent to abnormal opacity condition is essential. In the elucidation of the chemistry and physiology of a normal vertebrate lens, contributions of Petersen (1972) on the water and protein content; Forner (1994), Francolin & Rabsey (1959), Nateski et al. (1960), Wood & Burgess (1951), Malseal & Goodman (1964), Malseal (1965), Rabsey (1965), Spector (1963) on water soluble proteins; Blick & Bliskind (1936), Hancke (1940), Ritchie & Van Heyningen (1956), Heath (1952), Kinoshita (1964) on the concentrations of glutathione and ascorbic acid; Van Heyningen & Waley (1961), Leman (1965) on the RNA content; Kuck (1965) on the free carbohydrates content of the lenses revealed the importance of those organic
constituents in the maintenance of the normal lenticular metabolism. Besides those a few workers (Sallit, 1943; Harris & Gehritz, 1951; Heinrichs & Harris, 1967; Ascoro et al., 1952; Ramak et al., 1969; Van Heyningen 1959; Kuck, 1970 by Paterson, 1972; Agarwal & Ram, 1976) have also studied the inorganic constituents such as sodium, potassium and calcium of the lens and discussed their importance in maintaining the integrity of the lens. As most of these studies are concerned with the mammalian lens, it is essential to define the importance of organic and inorganic constituents of the lens in the maintenance of its transparency from different classes of vertebrates other than mammals.

Keeping the above facts in mind, the present work is designed to determine some of the biochemical parameters which have importance in the lens transparency. This type of study may help in evaluating the importance of some chemical constituents of the lens and also may give clue in assessing the evolutionary change in the composition of the vertebrate lens. In addition to this, the effect of galactose (a sugar cataractogenic substance) on the lenses of rat and guinea pig in vitro has also been investigated. Besides these, a number of cataract cataracts and a few normal lenses have been studied for various biochemical parameters.

Animals used are:

<table>
<thead>
<tr>
<th>GROUP</th>
<th>COMMON NAME</th>
<th>SCIENTIFIC NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fish</td>
<td>1. Murrel</td>
<td>Ophiocanthus sandius Day</td>
</tr>
<tr>
<td></td>
<td>2. Barbus</td>
<td>Barbus prionurus Day</td>
</tr>
<tr>
<td></td>
<td>3. Catfish</td>
<td>Scopobronchus fasciis Day</td>
</tr>
<tr>
<td>GROUP</td>
<td>COMMON NAME</td>
<td>SCIENTIFIC NAME</td>
</tr>
<tr>
<td>-----------</td>
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<td>-----------------------</td>
</tr>
<tr>
<td>Amphibian</td>
<td>1. Frog</td>
<td>Rana pipiens Daud</td>
</tr>
<tr>
<td></td>
<td>2. Toad</td>
<td>Bufo melanostictus Schneider</td>
</tr>
<tr>
<td>Reptile</td>
<td>1. Garden Lizard</td>
<td>Calotes versicolor Daudin</td>
</tr>
<tr>
<td></td>
<td>2. Wall lizard</td>
<td>Halmastylus brocki Grey</td>
</tr>
<tr>
<td>Bird</td>
<td>1. Pigeon</td>
<td>Columba livia Strickland</td>
</tr>
<tr>
<td>Mammal</td>
<td>1. Rat</td>
<td>Rattus norvegicus Berkmanhaut</td>
</tr>
<tr>
<td></td>
<td>2. Guinea pig</td>
<td>Cavia porcellus Linnaeus</td>
</tr>
<tr>
<td></td>
<td>3. Small bat</td>
<td>Taphozoa longissima Longissima</td>
</tr>
</tbody>
</table>

Parameters studied were:

1. Protein
2. Total sulphhydryl groups
3. Ribonucleic acid
4. Alpha, beta and gamma crystallins
5. Amino acid composition
6. Incorporation of labelled amino acid into lens proteins
7. Glutathiones
8. Ascorbic acid
9. Lactate output (Anaerobic glycolysis)
10. Glucose-6-phosphate dehydrogenase (G-6-PDH, E.C. 1.1.1.49, an hexose monophosphate shunt pathway enzyme)
11. Succinate dehydrogenase (SDH, E.C. 1.3.99.1, a citric acid cycle enzyme)
12. Lactic acid
13. Glucose
14. Fructose
15. Na\(^+\), K\(^+\), Ca\(^{2+}\) and water

The problem as thus envisaged comprises the following chapters.

**Chapter I**
Protein, total sulphydryl and GSH

**Chapter II**
Glutathione and ascorbic acid

**Chapter III**
Energy metabolism

**Chapter IV**
Lactic acid, glucose and fructose

**Chapter V**
Inorganic constituents

**Chapter VI**
Summary and conclusion

Bibliography