SUMMARY AND CONCLUSION
The aim of lens research, directly or indirectly is the elucidation of mechanism or mechanisms which result in loss of normal lens transparency. The study of senile cataract is of great practical interest to the ophthalmologist, and to the scientist in the field of cataract research. Most research work is concerned with various types of experimental cataract of a highly specific nature. Nevertheless, it appears likely that all precataractous changes much in common so that the information obtained from experimental cataractogenesis may be pertinent to the development of senile cataract.

The clinical examinations of eye were done in order to classify the different types of senile cataract viz., immature, mature and hypermature. The blood and lens samples were collected from the different groups of senile cataract along with normal controls. Lens from control samples were obtained either from accidental death or after the keratoplast surgery. Erythrocytes separated after removal of serum from it and subjected to the various biochemical analyses along with the lens viz., glucose 6-phosphate dehydrogenase (G6PD), transketolase (TK), transaldolase (TA) of HMP shunt and glutathione reductase (GSH-R), reduced glutathione (GSH) and glutathione peroxidase (GSH-PO). The lens protein and blood sugar were also analysed.
Metabolism of erythrocyte and lens are more or less similar, analysis of one may likely to reflect the other. The hexose monophosphate shunt act as a source for pentoses essential for the synthesis of nucleic acid and NADPH. The NADPH is necessary for the reduction of oxidised glutathione through the glutathione reductase system.

The activity of glucose 6-phosphate dehydrogenase is increased in lens (Table 9 and Figure 7) though not prominent in erythrocyte (Table 8 and Figure 7); as the age advances which in turn related to the maturity of cataract (Table 5 and Figure 4). As a result, the NADPH production also increased which is utilised in the glutathione system. The other important key enzymes in the HMP shunt were transketolase and transaldolase. It is observed in the present study that the enzyme transketolase activity was progressively decreased both in erythrocyte and lens with maturity of cataract which in turn increase age signifying the principal role of this enzyme in cataractogenesis. This reduction in transketolase activity in lens and erythrocyte clearly shows the fact that the degradation of glucose/pentose through HMP shunt becomes prevented or limited (Table 10, 11 and Figure 8). The net result of this will be that G6PD in HMP shunt is active and may produce enough of
pentose, ribose 5-P and xylulose 5-P which cannot be metabolised further due to lack of transketolase and transaldolase both in lens and erythrocyte (Tables 12, 13 and Figure 9), even though the transaldolase activity in lens is increased up to the maturity which then suddenly falls back. This indicate the production of fructose 6-phosphate is partially met by transaldolase which cannot continue. In fact, that is what observed in hypermature cataract in which a saturation point has reached after which this enzyme activity fails to maintain further and drops suddenly.

Perhaps this could be explained on the basis of lysis of lens membrane/alteration in membrane permeability followed by protein leakage through vacuole and thereby protein precipitation. The disturbances in transaldolase activity, thus, decreases the availability of pentose required for the nucleic acid synthesis and thereby protein synthesis. It is worth to remember at this stage that the concentration of lens total protein and soluble protein significantly decreased along with an increase in insoluble protein (Table 7 and Figure 6). The above change in protein concentration was observed along with the maturity of cataract which in turn advances with age. In short, change in the concentration of lens proteins, as a result of metabolic defect as mentioned earlier, an ionic imbalance is resulted. It can also alter the
structure of membrane proteins through lysis or rupture and permeability to these proteins become increased and the proteins leak out through the membrane holes. The decrease in soluble protein is due to the conversion of soluble protein to insoluble protein as seen in cataract. It was also possible that the oxidative changes are responsible for the steady increase in insoluble protein in cataractous groups (Table 7 and Figure 6).

NADPH produced from the G6PD catalysed reaction act as a coenzyme in the conversion of GSSG to GSH, with the enzyme GSH-R. The activity of GSH-R was decreased in all the cataractous groups (Tables 14, 15 and Figure 10) which decreases with increase in age and maturity. Similarly the product formed in the above reaction i.e., GSH is also reduced in all the cataractous groups (Tables 16, 17 and Figure 11) even though the NADPH was sufficiently available (Table 9 and Figure 7) the reduction in GSH-R and GSH observed (Tables 16, 17 and Figure 11) in lens and erythrocytes during the development of cataract is not only due to NADPH but also due to low concentration of GSH-R in both erythrocytes and lens. The GSH/GSSH ratio may also contribute towards the decrease in the activity of GSH-R. Even though, the GSH is continuously synthesised in lens, the concentration of this substance is reduced significantly in lens and erythrocytes, and can be read along with the low activity of GSH-R. Probably
this may be due to the oxidations of GSH to GSSG by GSH-PO. And the oxidised form of glutathione, GSSG can leave the lens more rapidly than GSH, possibly due to the increased permeability of the lens membrane towards GSSG. The net effect will be distortion of structural and functional integrity of the lens resulting in the formation of senile cataract.

The activity of GSH-PO was remarkably high in lens but not in erythrocytes (Tables 18, 19 and Figure 12) during the maturity of cataract. The GSH-PO is involved in the reaction of GSH

\[ \text{GSH-PO} \quad \text{GSSG} \quad \text{H}_2\text{O} \]

as enzyme. During the reaction, the GSH is oxidised to GSSG along with the conversion of H\textsubscript{2}O\textsubscript{2} to H\textsubscript{2}O. The GSSG in turn regenerated to GSH in presence of GSH-R using NADPH as coenzyme. The H\textsubscript{2}O\textsubscript{2} can take part in this reaction only if GSH is available. In the present study, GSH was limited, and therefore the reaction could not proceed further in the "same direction". Therefore, conversion of H\textsubscript{2}O\textsubscript{2} becomes difficult and its concentration increases in lens. This in turn results in the peroxidation of membrane lipids along with certain oxidative damage to structural proteins. All these factors together may bring about the formation of senile cataract.