CHAPTER V

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The most serious problem associated with the lens is its loss of transparency. This condition, known as cataract, is the leading cause of blindness in the world. The disorder sometimes occurs in children, but most frequently occurs in adults aged 50 and above. To date, there is no universally accepted pharmacological agent to either inhibit or reverse the progression of lens opacity. The only treatment is surgical removal of the lens, followed by implantation of an artificial lens at the time of surgery or the subsequent use of corrective lenses. The following statistics concerning cataract confirms to its economic and public health importance:

- Cataract is the leading cause of blindness worldwide, accounting for about 42 percent of all blindness, in spite of the availability of an effective surgical treatment.
- With increasing life expectancy, the number of cases of blindness from this disorder may double by the year 2010.
- Regarding Medicare beneficiaries, cataract is the most common condition for which eye care services are sought, accounting for 43 percent of visits to ophthalmologists and optometrists combined.
- In the United States, cataract surgery is the most frequently performed surgical procedure among 30 million Medicare beneficiaries. Approximately 1.35 million cataract operations are performed annually at an estimated cost of $3.5 billion.
Cataract is a grave medical problem. An eventual cure for cataract strongly depends on increased understanding of the basic molecular processes occurring in the normal and cataractous lens. Not only are the basic processes of differentiation and aging important reasons for studying the lens, they also provide the framework for learning more about mechanisms involved in presbyopia and cataract. A fundamental understanding of the molecular mechanisms responsible for these ocular disorders will bring researchers closer to discovering ways to prevent these diseases and developing effective drugs to treat them.

During the process of cataractogenesis various biochemical changes are found both in the aqueous humor as well as the lens. There is depletion of soluble protein with an increase in insoluble proteins, decrease reduced glutathione (GSH) and ascorbic acid.

The soluble protein, insoluble protein and total protein content in normal human lenses are 298.89 μg/mg, 76.64 μg/mg, and 376.03 μg/mg, respectively. Whereas in case of cataractous lenses are 142.79 μg/mg, 259.09 μg/mg, and 401.99 μg/mg respectively.

The TSH, GSH and PSH values in normal lenses are 42.65 μM/g, 8.63 μM/g, and 34.01 μM/g respectively whereas in case of cataractous lenses are 38.90 μM/g, 4.08 μM/g, and 34.07 μM/g respectively.

The Ascorbic acid contents in normal lenses are 1.04 mg/g whereas in the case of cataractous lenses are 0.20 mg/g respectively.

The levels of TSH, GSH and PSH in lenses of NS type of cataract are 42.02 μM/g, 5.98 μM/g and 34.88 μM/g respectively.
In PSC type of cataract the levels are 41.57 uM/g, 5.22 uM/g and 38.07 uM/g respectively.

In CS type of cataract the levels are 39.28 uM/g, 4.19 uM/g and 32.18 uM/g respectively.

In NS-PSC type of cataract the levels are 36.75 uM/g, 4.44 uM/g and 31.99 uM/g respectively.

In PCS-CS type of cataract the levels are 38.77 uM/g, 4.60 uM/g and 34.18 uM/g respectively.

In NS-CS type of cataract the levels are 42.14 uM/g, 4.02 uM/g and 35.47 uM/g respectively.

In Mature type of cataract the levels are 36.55 uM/g, 2.70 uM/g and 33.85 uM/g respectively.

In Brown type of cataract the levels are 34.18 uM/g, 1.51 uM/g and 32.00 uM/g respectively.

The levels of Ascorbic acid and total protein in lenses of NS type of cataract are 0.82 mg/g and 412.12 µg/mg respectively.

In PSC type of cataract the levels are 0.81 mg/g and 399.02 µg/mg respectively.

In CS type of cataract the levels are 0.79 mg/g and 402.11 µg/mg respectively.

In NS-PSC type of cataract the levels are 0.56 mg/g and 386.94 µg/mg respectively.

In PSC-CS type of cataract the levels are 0.77 mg/g and 362.14 µg/mg respectively.
In NS-CS type of cataract the levels are 0.63 mg/g and 352.22 μg/mg respectively.

In Mature type of cataract the levels are 0.31 mg/g and 417.41 μg/mg respectively.

In Brown type of cataract the levels are 0.22 mg/g and 609.23 μg/mg respectively.

Electrophoresis

Thus it can be concluded that with an increase in age, the amount of insoluble protein increases and no protein was found beyond the range of 29 kDa mol wt. protein. A detailed conclusion could not be drawn in absence of Gel-Scanner.

CONCLUSION
1. Decrease in amount of soluble protein in cataractous conditions.
2. Increase in amount of insoluble proteins including brown and yellow fractions of protein in cataractous lenses.
3. Insignificant change in total protein found in normal as well as cataractous lenses.
4. Decrease in amount of TSH.GSH.PSH in all types of cataractous lens.
5. Increase in amount of ascorbic acid and total protein contents in normal lenses with increase in different age groups.
6. Decrease in amount of ascorbic acid and total protein contents in different cataractous human lenses except in case of brown cataract where there is large increase in amount of total protein.

7. Increase in amount of urea soluble protein, UDTTS, and UDDTIS with an increase in age.

8. The amount of US, UDDTS, UDDTIS shows variations in different types of cataracts.

9. Maximum changes in these parameters are found in brown cataract.

10. Minimum changes in these parameters are found in NC type of cataract.

The changes in normal and cataractous lenses are co-related with aging and the pathological conditions (cataract) in this study. It indicates the alteration in the different parameters may have effect on lens metabolism. Such types of study also helps to solve the clinical problems of ophthalmologist which occasionally occurs after certain age and various factors which affects the metabolism of lens as abnormal metabolism leads to the formation of cataract.

**FUTURE LINE OF ACTION**

Following should be the goals of the Lens and Cataract Programme for the coming years:

1. To understand the physiological basis of lens transparency on the cellular and molecular levels.
2. To determine the causes and mechanisms of cataract formation.

3. To characterize the controls of lens cell division and differentiation and their roles in the formation of posterior sub-capsular and secondary cataracts.

4. To understand lens development and the diseases associated with defects in this process.

PROGRAMME OBJECTIVES

The objectives for the Lens and Cataract Programme of government of India include both laboratory and clinical research:

1. To determine if there are novel markers that differentiate he normal aging process from the diseased (cataractous) state.

2. Definitively test hypotheses of cataract.

3. Map, identify, and characterize genes which, when mutated, cause congenital or age-related cataract; determine if there are genetic factors that interact with environmental factors to confer susceptibility to age-related cataract.

4. Identify genes and pathways that control eye development, especially those critical for lens induction, cell fate determination, and cell differentiation.

5. Define the contributions of crystallins to normal lens function.

6. Characterize the control of the cell cycle in lens epithelial cells by identifying cell cycle regulators, growth factors, receptors, and signal transduction pathways.
7. Characterize, at the molecular level, the ion channels, transporters, and gap junction proteins needed to maintain lens homeostasis; determine what roles perturbations in these systems play in cataract formation.

8. Define the mechanisms that regulate the cellular and subcellular architecture of the lens, with special emphasis on the contribution of minor constituents and their progressive modification during aging and opacification.

9. Understand the basis of lens accommodation and presbyopia at the molecular and mechanistic levels.

To date, there is no universally accepted pharmacological agent to either inhibit or reverse the progression of lens opacity. The only treatment is surgical removal of the lens, followed by implantation of an artificial lens at the time of surgery or the subsequent use of corrective lenses. Although cataract cannot be avoided but there should be general awareness among people pertaining to the causes and factors leading to cataract formation should be propagated. The pharmaceutical companies should come out with different types of affordable intra-ocular lens and more advanced artificial lens. The most traditional and conventional theory of protecting the eyes from the sun should not be ruled out as a precaution.