II

REVIEW OF LITERATURE
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The ability to replace damaged parts is a prime advantage of biological system. The molecules that compose human cells typically have half lives lasting a few minutes to several days. Within six months or so, ninety percent of the molecules that make up our bodies are replaced by new ones. Lens cells however must function for a life time, a spectacular span.

Over the past twenty years the aging of human lens has been a subject of intense research because the incidence of cataract rises exponentially with age (Duncan, et. al., 1997). The lens is accessible as an invitro system of study and has no direct blood supply, it survive both in the globe itself and in organ culture media (Piatigorsky, et.al., 1978 and Rakic. et.al., 1997). The optical homogeneity of the lens is unique, composed of fully differentiated fiber cells and the symmetry of growth of the cell was studied and identified by David Brewster, an anatomist of late 18th century (Brewster, 1833 & Duncan, 1984). The symmetry is maintained through out the growth of the lens from the age of 10 to 80 years. The unique structure, homogeneity and basic simplicity of the lens make a fruitful system for basic studies of tissue growth, development and differentiation (Duncan, 1981, Bloemendal, 1981 and Mc Avoy. et. al., 1990). The advent of Extra Capsular Cataract Extraction Surgery (ECCE) has opened up a valuable field of research with aging (Apple. et. al., 1992 & Wormstone, et. al., 1997). Ocular biochemistry and histomorphology of human lens has been a favourite field of study for scientist, world wide. A number of
laboratories turned to the direct study of human lens and cataract. Moreover, the regular arrangements of flattened hexagonal cross sections of fiber cells epitomize lens tissue to most researchers and clinicians. A Co-operative programme was emerged in Japan and Europe, with the support from the American Co-operative Cataract Research Group (ACCRG).

Since the mechanisms of cataract formations are multifactorial (Foster. et al., 2003) studies have generally focused on the changes in lens metabolism and morphology. Embryonic development of lens has been studied morphologically (Pei & Rhodin, 1970; Hunt, 1961; Weiss and Jackson, 1961; Brine and Porte, 1961; Smelser, 1965; Mann, 1964 and Cohen; 1958; 1965); biochemically (Rabaey 1965; Sloot, 1963; Zwaan and Keda, 1968; Stemmermann and Wallner, 1955) and morphogenetically (Coulombre and Coulombre, 1969; Coulombre 1965; Zwaan and Williams, 1968). The fine structure of mature lens has been studied by Brini & Porte (1961), Dickson and Crock (1972), Farnsworth, et al., (1974), Futagami (1962), Hogan, et al., (1971), Kuwabara (1968 and 1970), Leeson (1971), Kuwabara & Imaizumi, (1974), Wango and Gavin, (1961). Light microscopic studies by Rabi, (1990) displayed drawings of lens fiber cells from mammals, birds and reptiles indicating that the ordered cellular array was not present in the lens interior. Recently Rae, et al., (1983) showed a similar packing of cells in frog lens using light microscopic examination of histologic sections. Recently studies reveals that disordered cell packing of fiber cell has been supported at the ultrastructural level in well preserved mammalian tissue Costello, et al., 1992; Al Ghoul, et al., 1996). Histologically normal lens and lenses displaying senile cataract have the same degree of evolution so as to provide a qualitative histomorphologic description of differentiated lens fiber cells in all regions of normal and cataractous human lens (Francois & Troncosa, 1978). Mophology of the normal

The concept of catractogenesis is the precipitation and coagulation of soluble lens proteins (Khurana & Khurana, 2000). A lot of work on the transparency of cornea and lens has been studied by Benedek, (1971). Maintenance of lens transparency was a challenging problems especially in aging. The lack of repair mechanism makes the cell vulnerable to certain stresses. Lens transparency is lost in a number of ways like fibrous metaplasia, opaque fibers, accumulation of pigment or formation and deposition of extra cellular materials (Scott, 1979). All of such processes disrupt the normal cellular architecture of the lens, destroying the integrity of the lens epithelium and loss of cell to cell contact of lens cells leading to catrarsact (Wunderlich, et.al., 2000). Hightower, et.al., (1987) studied the regional distribution of free calciums in selenite cataract. They reported that calcium’s level (Ca++) increases in cataract formation, hence used as a basis for classification of

Eye irritation is also caused by chemical pollutants, mostly connected with the exposure of aldehydes and photochemical oxidants (Godish, 2004). Metabolism in the eye is of great interest because the ocular organ is highly susceptible to damage by sunlight, UV radiation, oxygen, various chemicals and pollutants (Rose, et.al., 1998 and Zigman, 1995, 1983). Epidemiological surveys also suggested that industrialized countries (areas) show high risk of vision impairment (WHO, 1996). Environmental factors also cause the aging of crystallin lens (Rehman & Cotlier, 1982; Jain, 1972; and 1984; Jain, et.al., 1984; Tso MoM, 1985 and Miranda, 1979).


The aging of human crystallin lens (opacification) is a significant public health problem in the next two decades (Verma, et.al., 2000). Hence this review is devoted to recent advances in our knowledge of the changes that occur in the epidemiology, cell biology, morphology and physiology of the intact lens, particularly with the severity and incidence of opacification.

**Objectives of the study**

The human eye lens has limited means of repair and regeneration. Its transparency is lost in a number of ways. Biochemical and histomorphological changes involve disruption of the ordered structure of the lens either by quantitative, qualitative or structural alteration in lens fibers and its components. Human activity also generates a tremendous amount of chemical toxic poison (neurointoxicants) into the environment and they gain entry into the human body by adsorption, dissolution, evaporation and finally causes deleterious effect to the eyes, liver, heart, lung, skin and
skeletal system of the human body. Although the knowledge of cataract and its remedy is centuries old, the basis for lens transparency came initially from biochemical and biophysical studies of the lens. The goal of cataract research is directed towards retarding or preventing cataract. So the aims of the present study is –

- To investigate the incidence of cataract in the Ernakulam District by an epidemiological survey.
- A population survey was carried out in the major areas of Ernakulam District to assess the role of various potential risk factors for cataractogenesis.
- To evaluate the histomorphological and biochemical mechanism involved in the formation of cataract in the study area using the human cataractous lens obtained from the patient underwent cataract surgery (ECCE) at the Department of Ophthalmology, District General Hospital, Ernakulam, Kerala, and normal human eye lens collected from the Research Department of Little Flower Eye Hospital, Angamali, Ernakulam, Kerala.