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The impairment of cognitive and higher functions of brain during aging and association of several neurodegenerative disorders with brain aging, are increasingly becoming a huge socio-economic problem in most of the developed countries as well as some of the third world countries including India, owing to a steady increase in the proportion of aged population in the society. Aging of brain is associated with morphological, biochemical and functional impairment which includes region specific neuronal loss, loss of synaptic connectivity, glial changes, accumulation of lipofuscin pigments and other oxidatively damaged products of lipid, protein and DNA [Rao, 1997; Tian et al., 1998]. Multiple factors both genetic and epigenetic, may work in concert to bring about various changes associated with aging of brain [Reiter et al., 1998; Jiang et al., 2001]. While genetic theories propose differential expression of several key genes during aging or existence of genetic loci specific for aging, the overwhelming evidence indicates that epigenetic factors like oxidative injury play a central role in the phenomenon of aging. Oxidative stress has been implicated particularly with brain aging owing to the vulnerability of the organ to oxygen radical mediated injury [Hamilton et al., 2001].

Several aspects of brain aging are being investigated thoroughly in order to elucidate the damage pathways involved in age-related neuronal degeneration and dysfunction [Jesberger and Richardson, 1991; Mattson, 2003; de Magalhaes and Sandberg, 2005; Mattson and Magnus, 2006]. In this context mitochondrial dysfunction, DNA damage and apoptosis in aged brain have received wide attention and also generated a fair degree of controversy [Ferrandiz et al., 1994; Harman, 1992; Hamilton et al., 2001; Pollack and Leeuwenburgh, 2001]. Interestingly all these processes are linked with increased intracellular oxidative stress as is evident from various in vitro as well as in vivo studies [Kaur et al., 1998; Leutner et al.,]
Since there is overwhelming evidence in favour of an enhanced oxidative load during brain aging, the effect of the latter on age-related mitochondrial dysfunctions, genomic alterations or apoptotic activation is also being examined actively by different groups [Shigenaga et al., 1994; Izzotti et al., 1999; Calabrese et al., 2000].

The present study has attempted to contribute to this important area of brain aging research. In this study in vitro experiments have been conducted with various subcellular components of rat brain to identify various biochemical and molecular damage to mitochondria and DNA under oxidative stress. The same are then compared between young and aged rat brain to establish the involvement of oxidative injury in the phenomenon of brain aging. Likewise, several parameters of apoptotic activation in brain of young and aged animals have been compared and their relationships with oxidative stress have been discussed. The results of this study will be important in evaluating possible dietary and therapeutic process in retarding age-related brain deficits. In particular, this study will be important to further investigate if caloric restriction or anti-oxidant rich dietary regimens can be beneficial during brain aging.