



## Neurotransmitter enzymes profile in age-related memory impairment in *Drosophila melanogaster*.

**Haddadi, M.<sup>1</sup>, S.R. Jahromi<sup>1</sup>, T. Shivanandappa<sup>1</sup>, and S.R. Ramesh\*<sup>1</sup>.**

<sup>1</sup>Department of Studies in Zoology, University of Mysore, Manasagangotri, Mysore-570 006, India. \*Email: rameshuom@gmail.com

Oxidative stress induces alterations in the structure and functions of cellular macromolecules that result in many pathological conditions including the aging process. According to the free radical theory of aging, oxidative stress is implicated in the age-related functional decline. Brain is more vulnerable to free radical damages due to its higher rate of metabolism and lower capacity for regeneration as compared to the other organs. Therefore, we have previously showed that oxidative stress can be considered as the main causal factor involved in the impairment of cognitive ability (Haddadi *et al.*, 2014). Induction of oxidative stress is accompanied by reduction in acetylcholine levels in neuronal degeneration. The active brain requires the synthesis of acetylcholine as reflected by the activity of choline acetyl transferase (ChAT). On the other hand, neuronal plasticity underlying memory formation needs appropriate activity of Cholinesterase enzymes. Therefore, age-associated alterations in the activity of neurotransmitter enzymes can be considered as a part of age-related memory impairment (AMI). Hence, in the present study, we have made a comparative study on the activity of neurotransmitter enzymes between 5-day and 50-day old flies before and after conducting long olfactory conditioning training paradigm.

Acetyl cholinesterase (AChE) and Butyryl cholinesterase (BChE) activities were determined by the method of Ellman *et al.* (1961). Immunohistochemical localization was conducted using monoclonal anti *Drosophila* choline acetyl transferase (ChAT) antibody, and whole brain samples of flies were observed under a Zeiss LSM710 confocal microscope to evaluate ChAT activity (Seki *et al.*, 2010).

Long training paradigm was performed by employing classical olfactory conditioning, wherein octanol was associated with 12 pulses of 90 V DC electric shocks. Methylcyclohexanol served as a counterpart odor in the absence of electric shock (Yu *et al.*, 2006).

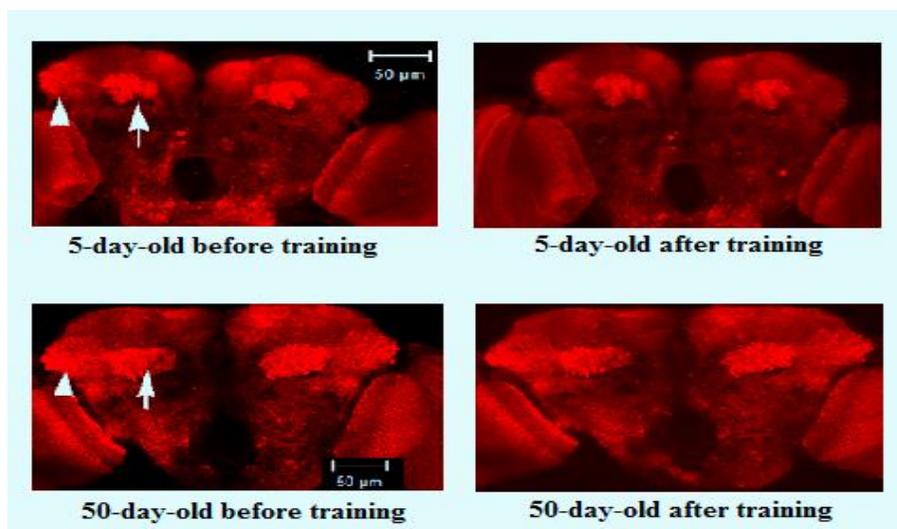


Figure 1. Activity of ChAT.

Our results showed that due to aging, the activity of the enzyme ChAT was decreased, whereas the activity of AchE and BchE enzymes were unchanged. Biochemical investigations carried out after training showed that in mushroom bodies extrinsic neurons

(MBENs) and lateral horn (LH) neurons of the brain of both the age group flies, the activity of ChAT was not affected by training (Figure 1).

In the case of young flies the activity of ChE enzymes was significantly increased in trained flies, but the extent of enhancement was considerably higher in AchE (Figure 2). Surprisingly, 50-day-old trained flies exhibit decreased enzyme activity compared to untrained ones. AChE shows more reduction compared to BChE (Figure 2).

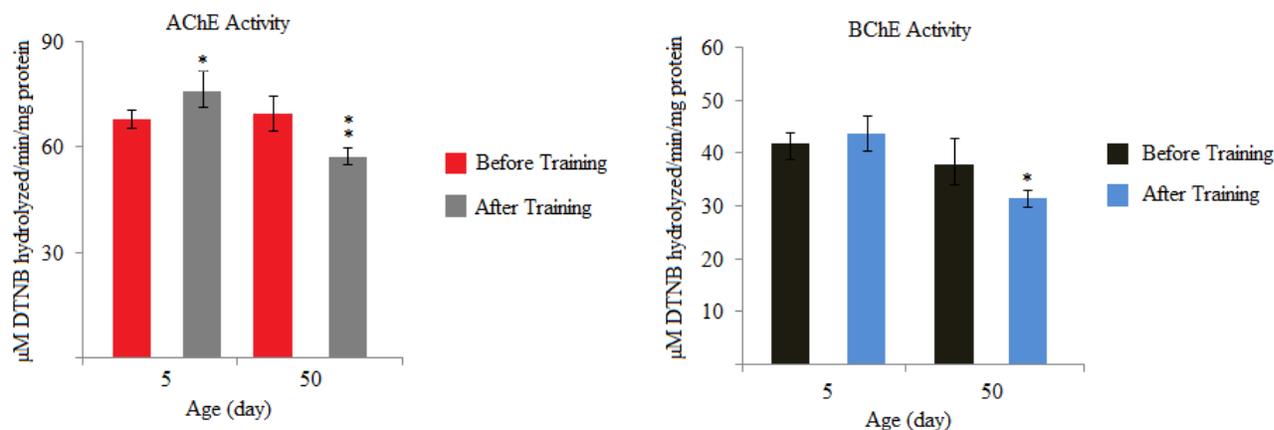


Figure 2. Activity of ChE enzymes.

Age-related decrease in the activity of ChAT accompanied with constant activity of ChE enzymes were observed in older flies. Lack of enhancement in the activity of ChAT and noticeable decrease in ChE enzymes at the time of training in aged flies can induce a process, which could lead to lower levels of acetylcholine, compromising the neuronal plasticity and impaired memory in the aging brain.

References: Ellman, G.L., K.D. Courtney, V. Andres, and R.M. Featherstone 1961, *Biochem. Pharmacol.* 7: 88-95; Haddadi, M., S.J. Reiszadeh, B.K.H. Sagar, R.K. Patil, T. Shivanandappa, and S.R. Ramesh 2014, *Behav. Brain Res.* 259: 60-69, DOI: <http://dx.doi.org/10.1016/j.bbr.2013.10.036>; Seki, Y., J. Rybak, D. Wicher, S. Sachse, and B.S. Hansson 2010, *J. Neurophysiol.* 104: 1007-19; Yu, D., D.B.G. Akalal, and R.L. Davis 2006, *Neuron* 52: 845.



### The effect of pyrogallol on the pre-adult fitness of *Drosophila bipectinata*.

**Krishna, M.S., and Uchenna Watson.** Drosophila Stock Centre, Department of Studies in Zoology, University of Mysore, Mysore. \*Corresponding author: drosokrish@gmail.com

#### Abstract

The effect of pyrogallol (an antioxidant) on the pre-adult fitness has been studied using an outbred population of *D. bipectinata*. It was noticed that there was a decrease in the egg to larva, larval to pupal, and pupal to adult development and the rate of development in the pyrogallol treated *D. bipectinata* flies, which had significantly lower pre-adult viability and rate of development, when compared to the untreated flies. The SOD levels were significantly greater in untreated flies than the