Mechanisms of High-Salt Diet-Induced Learning Deficit in Drosophila

Hung, Yi-Shan (School: Taipei Municipal Zhongshan Girls High School)

Salts are important for nerve conduction. However, excessive salt causes defects in learning and memory in mice. To investigate the mechanisms of salt-induced learning impairment, I used Drosophila melanogaster, also known as fruit flies, as a model because it has complex behaviors and nice genetic tools for cellular and molecular manipulations To begin with, I found that high-salt diet may affect the hunger state in flies, which makes it inappropriate to use appetitive conditioning to examine learning and memory. Therefore, I applied olfactory aversive conditioning where flies learn to associate odors with electric shocks to evaluate learning and memory ability in flies. I found that feeding flies with high-salt food (1% or 2% NaCl) for four days reduce their short-term memory. This effect is reversible when flies were put into the normal diet again. Since it was indicated that high-salt diet-induced learning and memory impairment was related to microtubules. I applied immunofluorescent staining to evaluate microtubule-related features in the learning and memory center of Drosophila brain, the mushroom body. I found that glutamylated microtubules were reduced in the γ1 and peduncle (γ1pedc) compartment of mushroom body after high-salt diet. This result indicates that high-salt diet may compromise learning and memory in flies by reducing the amount of glutamylated microtubules in the γ1pedc compartment of the mushroom body. This study firstly proved high-salt diet-induced learning and short-term memory deficit in Drosophila, and it is reversible. Furthermore, my result indicates that these defects are correlated with low levels of glutamylated microtubules.

Awards Won:

First Award of $5,000