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Mechanosensitive Proteins in Regulating Heart Rate in Larval Drosophila

Sohaira Ahmad

The family of channels known as transient receptor potential (Trp) is large and includes both stretch-activated channels and heat receptors. The heart will continue electrical pacing in several areas to preserve some cardiac output when a higher-order pacing zone fails. Pathological situations also result in cellular alterations in the heart, such as an increased expression of Trp proteins. When engaged, the TrpA1 class of receptors causes behavioural responses to both internal and external environmental temperatures. These receptors are expressed in sensory neurons to sense thermal experience. The hemolymph is pumped by the heart through a valve into the aorta, where it is directed to the larvae's front region. The most posterior part of the heart is where the master pacemakers are situated. The goal was to determine whether increased TrpA1 receptor expression in the larval heart aided the pulsatile effect in sustaining heart rate, given that TrpA1 receptors also serve as stretch-activated channels and that pulsatile perfusion of the heart aids in maintaining heart rate.

TrpA1 receptor overexpression in the heart was achieved in Drosophila lines by mating virgin females. Analysis and recommendations: The operations were carried out following de Castro's instructions to expose the larval heart tube in situ. At room temperature of 20–21 Degree C, the saline was aerated, and its pH was adjusted to 7.1 with either NaOH (1 M) or HCl (1 M). Ag/AgCl glass electrode and Accumet model 10 pH meter (Fisher Scientific) were used. Heart rate measurements (HR) were measured using both video recordings and direct inspection through a dissecting microscope. By analyzing the effects on TrpA1 receptors expressed in body wall muscles, the effect of HC-030031 on inhibiting TrpA1 was investigated. In statistical analysis, the change in heart rate was examined using an ANOVA along with a Kruskal-Wallis One Way Analysis of Variance on Ranks and the Normality Test (Shapiro-Wilk). A rank-sum non-parametric test was used to examine the variations in the resting membrane potentials of the body wall muscles.

The heartbeat was monitored every 30 min for up to 4 hrs to see if the larvae's heart would survive for a long period with supra-perfusion. This was done for the parental TrpA1-UAS line, Tinc>TrpA1, and both with and without temperature activation of the TrpA1 channel. The heart rate did gradually decrease over 4 hours at 20 degrees C, with supra-perfusion for both the parental TrpA1-UAS line and the Tinc>TrpA1 line. When comparing the Tinc>TrpA1 line to the parental TrpA1-UAS, there was no discernible difference in the average percent change over time between time points. Body wall muscles were utilized to study the effects of rising temperature to 30 ˚C, and to determine whether HC-030031

prevented the response of activating TrpA1 with temperature because contracting myocytes make it harder to maintain intracellular electrical recordings. The membrane potential was unaffected by DMSO, which was used to dissolve HC-030031 before adding it to the physiological saline. This was also true at 20 Degree C. When the saline was changed to DMSO-containing saline for one minute, followed by the same quantity of DMSO and HC-030031, the parental line (UAS-TrpA1) of the 24B>TrpA1 cross did not exhibit any discernible change in membrane potential at 20 ˚C.

JOURNAL REFERENCE

Marguerite, N.T., S. McCubbin and R.L. Cooper, 2021. Mechanosensitive proteins in regulating heart rate in larval *Drosophila.* J. Pharmacol. Toxicol., 16: 37-46.

KEYWORDS

Drosophila, TrpA, Heart, HC-030031, mechanosensation, pulsatile perfusion