ABSTRACT

The retina is an approachable part of the brain for studying information processing. Direction selective ganglion cells (DSGCs) are retinal neurons which can sense motion direction as implied by the name. They exhibit robust spiking responses to an object moving in one direction but weak in its opposite direction. It is known that the major driving force of this directionality is the asymmetric suppression through the inhibitory pathway. An interneuron - starburst amacrine cell (SAC), which co-releases γ-amino butyric acid and acetylcholine, has long been thought as the source of inhibition. Nevertheless, much about the mechanism remains controversial. This study is aimed to resolve the pattern of interactions among SACs and DSGCs. Fluorescent tracers were filled into a physiologically identified DSGC and a neighboring SAC subsequently. Immunostaining of $GABA_A$ receptors was then performed. Therefore, the dendritic relationship and the inhibitory synaptic connection between the DSGC and the SAC can be revealed. We demonstrated that the dendrites of the SAC were found to contact the DSGC without preference for any direction. Furthermore, no asymmetry of the inhibitory synaptic inputs on the DSGC was observed. These results lead to the conclusion that neither the geometric arrangement nor the inhibitory synaptic inputs between SACs and DSGCs is likely to mediate the directionality. Multiple layer interactions are necessary to fulfill this complicate processing.