2. Abstract

Male silkmoths, *Bombyx mori* exhibit a characteristic zigzagging behavior consisting of a straight-line walking, zigzagging turns and a looping. The timing for shifting the turning direction is synchronized to the sideways head movements controlled by neck motor neurons (NMNs) including a cervical ventral NMN (cv1-NMN). It has been suggested that this programmed behavior is instructed by two types of activity patterns descending from the brain to the thoracic ganglion; one is a phasic excitation and the other is a state-dependent activity similar to the flipflop in electric memory circuits. These activities are shown by certain descending interneurons (DNs) contained in two subsets of DNs, Group-I and -II DNs (GI, II DNs). However, it is not yet well understood which DNs are directly related to instructing this behavior. In order to understand neural control mechanisms of this programmed behavior, I investigated the morphological relationship between these DNs and the cv1-NMN which is an index of this programmed behavior. I applied a double labeling technique combining backfilling of the cv1-NMN and intracellular staining of single DNs. Three-dimensional confocal images revealed overlapping regions between the GI, II DNs and the cv1-NMN. GII-A, D DNs which showed typical flipflop activities, GII-C DNs which showed phasic excitation and GI-B

DNs which showed long lasting inhibition had many overlapping regions on the cv1-NMNs. The present results indicate that the programmed behavior is instructed by these types of DNs. Furthermore visual information probably modulates this programmed behavior since the programmed zigzagging behavior is affected by visual stimuli. The morphological observations demonstrate that the output area (varicose arbors) of a certain groups visual interneurons corresponded to the input area (smooth arbors) of G-I, II DNs. These results suggest that the visual interneurons transmit their visual information to the GI, II DNs and modulate the programmed behavior controlled by GI, II DNs.