

Mosaic Organization of Body Pattern Control in the Optic Lobe of Squids

Tsung-Han Liu (劉聰翰), PhD student

Tsung-Han Liu (劉聰翰)¹, Chuan-Chin Chiao (焦傳金)^{1,2,3}

¹*Institute of Molecular Medicine, National Tsing Hua University, Hsinchu, Taiwan*

²*Institute of Systems Neuroscience, National Tsing Hua University, Hsinchu, Taiwan*

³*Department of Life Science, National Tsing Hua University, Hsinchu, Taiwan*

Cephalopods in nature undergo highly dynamic skin coloration changes that allow rapid camouflage and intraspecies communication. The optic lobe is thought to play a key role in controlling the expansion of the chromatophores that generate these diverse body patterns. However, the functional organization of the optic lobe and neural control of the various body patterns by the optic lobe are largely unknown. We applied electrical stimulation within the optic lobe to investigate the neural basis of body patterning in the oval squid, *Sepioteuthis lessoniana*. Most areas in the optic lobe mediated predominately ipsilateral expansion of chromatophores present on the mantle, but not on the head and arms; furthermore, the expanded areas after electrical stimulation were positively correlated with an increase in stimulating voltage and stimulation depth. These results suggest a unilaterally dominant and vertically converged organization of the optic lobe. Furthermore, analyzing 14 of the elicited body pattern components and their corresponding stimulation sites revealed that the same components can be elicited by stimulating different parts of the optic lobe and that various subsets of these components can be coactivated by stimulating the same area. These findings suggest that many body pattern components may have multiple motor units in the optic lobe and that these are organized in a mosaic manner. The multiplicity associated with the nature of the neural controls of these components in the cephalopod brain thus reflects the versatility of the individual components during the generation of diverse body patterns.

References

Boycott BB (1961) The functional organization of the brain of the cuttlefish *Sepia officinalis*. Proc Biol Sci 153:503–534.

Author contributions in this study

CC Chiao designed research; TH Liu performed research; TH Liu and CC Chiao analyzed data and wrote the paper.

Main research location

Life Science Building II, National Tsing Hua University, Hsinchu, Taiwan

Accepted in *Journal of Neuroscience*. 2017 January in press.