Evolutionary of neural circuits in insect mediating sensory information processing

Nicholas James Strausfeld
Department of Neuroscience, University of Arizona, Tucson.

One aim of comparative neuroanatomy is to resolve synapomorphic attributes across taxa. Comparative studies are central to understanding how the early organization of the nervous system evolved to provide cephalization and the segmental specialization of integrative circuits. In extant insect, each ganglion has the same ground pattern of discrete neuropils and connections. Taxon-specific variations of this organization reflect the ganglion's sensory periphery and thus the recognition and encoding of parameters that are of ecological significance to that particular taxon. To understand functional principles involved requires the recognition of similarities circuit organization. Local interneuron arrangements that integrate information amongst olfactory glomeruli are organized in a fundamentally similar manner to those that integrate information amongst optic glomeruli of the visual system or sensory territories in thoracic ganglia. In this talk, I propose that all sensory integrative circuits are organized according to a ground pattern shared not only amongst segmental ganglia but across taxa. Homologous arrangements in extant insects are the result of divergent evolution from homonomous stem taxa that lived approximately 530 million years ago.