Session 5.
Basic principles in functional organization of insect brain.

E5-1 MODULAR ORGANIZATION OF THE INSECT MEMORY CENTER: COMMON STRUCTURE WITH MAMMALIA. N CEREBRAL CORTEX . MAKOTO MIZUNAMI
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The mushroom body (MB) is the most conspicuous neuropil structure in the in sect brain, and is critical to olfactory and other forms of associative memory .Here I report that in the cockroach two types of repetitive modular subunits of different sizes are present in the output neuropil of the MB. The first, which we refer to as a sheet, is a thin (1 mm) meshwork formed by hundreds of axons of Kenyon cells. We estimated that 200,000 Kenyon cells of the cockroach MB are organized into 200-1000 parallel sheets. The sheets are further organized into a larger structural grouping, referred to here as aslab, with a width of 3-18 mm. The typical number of slabs is 30. A major class of MB output neurons exhibited segmented dendritic arbors with intervals between segments corresponding to the spacing between slabs. We conclude that the insect memory center, like the mammalian cerebral cortex, consists of two types of repetitive modular subunits.

E5-2 Behavioral and neural basis of adaptive behavior in insects: Odor-source searching strategies and neural mechanisms. BEHAVIORAL AND NEURAL BASIS OF ADAPTIVE BEHAVIOR IN INSECTS: ODOR-SOURCE SEARCHI NG STRATEGIES AND NEURAL MECHANISMS. RYOHEI KANZAKI Institute of Biological Sciences, Univ. of Tsukuba Tsukuba Science City, Ibaraki 305, Japan

Insects have rather a small number of constituent neurons of the centralnervous system (CNS), especially of the brain, and eventually display rather simple patterned movements; a so-called 'instinctive behavior', which principally does not occur with memory and learning. The diversity of behaviors observed in insects have been shaped by millions of years of biological evolution. The behavioral strategies employed by insects must be efficient and adaptive to circumstances which change every moment. Controlling such behavior exclusively relies on the CNS of the insects. Insects will become an excellent model for understanding adaptive control in biological system. As an example of that, in the present study we demonstrate the strategies and the neural basis for controlling the odor-source searching behavior in insects.

E5-3 NEUROETHOLOGICAL ANALYSIS OF AN INSECT CIRCADIAN PACEMAKING SYSTEM. KENJI TOMIOKA Dept. Phys., Biol. & Informat., Fac. Sci., Yamaguchi Univ. 1677-1 Yoshida, Yamaguchi 753, Japan

Solving the neural mechanism of circadian rhythms is an important goal because daily rhythms are running in such a wide variety of animals. The cricket,*Gryllus bimaculatus*, provides a unique model system for neuroethological study of the circadian pacemaking system. In the cricket, the circadian locomotor rhythm is driven by two, bilaterally paired optic lobe pacemakers. The pacemakers interact one another to keep their synchronous movement and a stable temporal structure in animal's behavior. The mutual interaction includes mutual coupling and mutual activity suppression during the subjective day. The signals required for these mutual interactions are mediated by light-sensitive neurons connecting bilateral pacemaker loci. Since these neurons seem to be a phase regulator of the circadian pacemaker, the elucidation of their input and output systems would lead to understanding the circadian clock mechanism.