Despite their simple structures, insects survive in the environment with rather sophisticated behavior. They perform behaviors programmed in the CNS as well as a chain of reflex responses. Moreover insects can even learn patterns, colors, and odors by their micro-brains with only one millionth of nerve cells of our macro-brain. Our aim is to clarify how they perceive, process and integrate environmental cues to evoke their behavior.

**Searching Maneuver by Exploiting Sensory Cues in the Environment**

To manipulate environmental cues without disturbing insects' activity, we have developed computer-aided locomotion-compensators, including a digital servo-sphere for ambulatory insects and a micro locomotion compensator (MLC) for mites. In the instrument, an insect performs an orientation behavior in a sensory space programmed in an endless plane. We examine sensori-motor algorithms of the insect from its behavioral performance.

**Chemo-Sensory Cues for Insects**

We have been engaged in the studies of semiochemicals, in particular aggregation pheromones of Dictyopteran insects, by employing micro analytical chemistry and quantitative behavioral analysis. Besides specific chemicals, insects learn general odors associated with reward or punishment. We compare two different olfactory behaviors to know the basis of olfactory recognition.

**Acoustic Signals**

We also study acoustic signals of insects. Their responses towards a synthetic sound source enables us to analyze the evolution of signals as well as their sound orientation mechanisms.

The basic analysis of insect’s behavior provides not only the idea of more efficient pest control methods but also some seeds for a new technology.
Keywords

Insect behavior, Semiochemicals, Pheromone, Signal, Virtual reality, Learning, Robotics, Sensory ecology

Recent Publications

Adaptive traits of *Riptortus pedestris* nymphs (Heteroptera: Alydidae) for locating host plants.

An odor stimulator controlling odor temporal pattern applicable in insect olfaction study.

Active antennal searching suggesting anticipatory capability in pill bugs (*Armadillidium vulgare*).

Advertisement call recognition with pulse rates in the field cricket *Teleogryllus taiwanemma* (Insecta: Orthoptera: Gryllidae)

The spatial orientation of the mould mites, *Tyrophagus putrescentidae* (Schrank) (Acarina: *Acaridae*) in the computer-programmed olfactory field.

Virtual reality experiments on a digital servosphere: guiding male silkworm moths to a virtual odour source.
Sakuma, M (2002)