Brain and behavior studies in dogs

Abstracts of Symposium held July 16th, 2003 in the Nencki Institute of Experimental Biology, Warsaw, Poland
Organizer: P. Kuśmierek, Nencki Institute, Poland

Interactions between classical (Pavlovian) and instrumental reactions: early Konorski's studies

Zieliński K.
Department of Neurophysiology, Nencki Institute of Experimental Biology, Warsaw, Poland

In 1928 Konorski discovered the basic distinction between classical (or Pavlovian) and instrumental (or operant) conditioning. Learning of the relations between stimuli is governed by the principles of classical conditioning, whereas subject's knowledge of the consequences of a specific action is acquired according to the rules of instrumental conditioning. He invented the methods for evaluation of the motivational value of conditioned stimuli using the summation (combined-cue) test. This test is commonly used for demonstration of the opposite response tendencies of an inhibitory CS and an excitatory CS. Originally, Konorski demonstrated an inhibitory effect of classically conditioned intermittent alimentary stimulus on execution of the instrumental response for food reinforcement elicited by contextual stimulus. On the contrary, the previously trained classically conditioned inhibitory stimulus enhances the response of pressing the bar for food in the same situation. The most popular use of the summation test is the method of conditioned suppression, in which training of the classically conditioned defensive response is superimposed on the on-going instrumental responding for appetitive reinforcement. Konorski showed the unusual resistance of an over-trained classically conditioned food stimulus to transfer into instrumental stimulus when execution of definite motor action is required for food reinforcement.

Perirhinal cortex of the dog brain

Woźnicka A., Kosmal A.
Department of Neurophysiology, Nencki Institute of Experimental Biology, Warsaw, Poland

The dog's perirhinal cortex is situated along the posterior rhinal sulcus and constitutes a transitional zone between the entorhinal cortex and the temporal and occipital neocortices. Based on cytoarchitectonic criteria determined in Nissl-stained sections, the perirhinal cortex can be divided into areas 35 and 36, (according to Brodmann's nomenclature) and caudally located postrhinal cortex. Area 35 occupies predominantly the fundus of the posterior rhinal sulcus and its medial bank bordering laterally the entorhinal cortex. Area 36 is a continuation of area 35 in the lateral bank of this sulcus.

Both areas show substantial regional variation in cytoarchitectonic. In the area 35 three subfields can be distinguished along the antero-posterior axis: rostral (35r), intermediate (35i) and caudal (35c). The most characteristic features of the area 35 are a very wide layer I, cluster arrangement of layer II cells, poorly populated small cells in layer III and prominent layer V, containing large, darkly stained neurons. Regional variations in 35r and 35i subfields concern predominantly structure of layer II. In contrast, subfield 35c can be characterized by less differentiated cortical layers with unclear separation of layers II and III, and by layer V containing a medium-sized neurons, smaller then those in 35r and 35i.

Area 36 consists of the dorsal (36d) and ventral (36v) subfields. They differ from the area 35 by better developed layers III and VI, and reduced layer V. Layer III in subfield 36d is composed of irregularly distributed, medium-sized, darkly stained neurons. Subfield 36v can be distinguished by smaller cells of layer III and distinct radial pattern of infragranular layers.

The postrhinal cortex is a posteromedial extension of the perirhinal cortex. Distinctive cytoarchitectonic features of this cortex are prominent layer V, containing densely packed, dark neurons and well developed granular layer IV.

Agonistic behaviour among different breeds of shepherd dogs

Fiszdon K., Kaleta T., Szywała A.
Department of Genetic and Animal Breeding, Warsaw Agricultural University, Warsaw, Poland

The agonistic behaviour in 6 different herding and guarding breeds had been studied. Studies included the following breeds: German shepherd dog, berger de Brie, bouvier des Flandres, Doberman, rottweilers and giant schnauzer, total 494 dogs. Survey among the owners and own observation were performed in order to establish the relationships between the breed, sex and pretraining and behaviours as domination, scent marking, submissive reaction and overt aggression towards people. We also observed behaviour of the above listed breeds when exposed to provocation. We found significant differences in all these behaviours among different breeds, and between sexes. The less frequent dominant or submissive behaviour was found in bouvier, whereas both behaviours were quite common in GSD. Attacks on people and attempt to bite were significantly less frequent in berger de Brie. Different breeds reacted differently to provocation with a threatening pose, long barking and immediate attack.

Auditory recognition in dogs

Kuśmierek P.
Department of Neurophysiology, Nencki Institute of Experimental Biology, Warsaw, Poland

It has been established that intact perirhinal cortex (PRh) is essential for performance on visual, tactile, and olfactory memory tasks. Recent experiments in dogs have shown that PRh is not necessary for auditory recognition memory. On the other hand, lesions to the auditory association cortex, as well as to the tonotopic auditory areas impair auditory recognition. However, in both cases the deficit is a perceptual rather than mnemonic one, as demonstrated by analysis of performance to particular stimuli as well as by subsequent differentiation test.

The question arises, why is the role of the PRh in auditory recognition different from its role in recognition in other modalities. It has been suggested that in a behavioral experiment auditory stimuli may be processed on the level of features rather than of objects. Therefore, auditory recognition is resistant to lesions of the PRh, which is believed to play a role in object formation.

It is possible that such lesion could impair performance recognition of acoustically defined objects. Furthermore, investigation of olfactory recognition could probably clarify this matter. A dissociation of effects of PRh lesions upon recognition of simple odors versus meaningful (e.g., human) scents would support the supposition that this brain area is specifically involved in object recognition.

Canine spatial cognition: a comparison of egocentric, allocentric and complex working memory abilities

Christie L.-A., Milgram N.W.
University of Toronto, Toronto, ON, Canada

(Abstract not received)

Some factors affecting human scent identification by special police dogs – preliminary results

Jezierski T., Górecka A.
Institute of Genetics and Animal Breeding, Jastrzębiec, Poland

Police in many countries has performed identification of persons on the base of scent by specially trained dogs. A technical method for this identification is a scent line-up for matching the odour of a perpetrator collected at the crime scene to the scent sample of a person suspected. The general aim of the project was to assess the influence of various factors on the diagnostic value of scent identification by dogs as the rate of correct and false positive indications by dogs. In this part of the study the effect of individual dog, the preference (attractivity) or aversion for the scent of particular persons and the 'freshness' of the scent sample (storage period) were taken into account. Six experimental dogs that underwent basic and special training for scent identification and eight certified police dogs were taken as a research material. Altogether 11993 trials were performed. There were marked differences between dogs; the best and the worst dog indicated correctly in 72.7% and 32.1% of trials respectively, and the false positive indications occurred in 15.6% and 52.8% of trials for the best and the worst dog respectively. Less than 25% of mistakes were observed during identification of more than 95% of examined scents and therefore it was concluded that most of human scents were not 'attractive' for dogs. It was also found that storing the scent sample for more than 100 days resulted in decrease of correct identifications by dogs.

Parallel processing streams in the auditory cortex of higher mammals

Rauschecker J.P.
Department of Physiology and Biophysics, Georgetown University School of Medicine, Washington, DC 20057, USA

Neurons in primary auditory cortex (A1) respond best to tones of a single frequency. By contrast, the complexity of preferred acoustic stimuli increases in areas of nonprimary auditory cortex surrounding A1. Specialized response properties are encountered at a higher incidence in some areas compared to others. Neurons in the anterolateral belt area (AL) of the macaque, for instance, respond more selectively to species-specific vocalizations than neurons in the caudolateral area (CL). Spatial selectivity, on the other hand is greater in CL than in AL. Furthermore, the anatomical projections from these belt areas target specific regions in parietal and prefrontal cortex that are known to subserve the processing of space and object information, respectively. In humans, functional imaging has made specialized processing streams evident by lighting up cortical areas that are jointly activated during specific tasks, such as auditory motion processing or the identification of phonemes. These results from primates are compared to carnivores, such as the cat and dog, in which the frequency representations in A1 and neighboring areas are reversed. The anterior auditory field (AAF) seems to play a role in spatial processing, whereas the posterior field (PAF) is more involved in auditory object processing. Thus, the evidence from both primates and carnivores is consistent with the notion of parallel processing streams in the auditory cortex specialized for the identification and localization of sounds.