

Audiogenic epilepsy in rat

0:00

In this video the epileptic attack evoked by application of audiogenic stimulus will be demonstrated in rats. There will be also demonstrated possibility of pharmacological modulation of the initial functional state of the nervous system which is essential for application of epileptogenic stimulus. It is known that the body's response to an unexpected or intense sound is the motor response. It is a phylogenetically old, unconditional orientation reaction that prepares organism to fight or flight reaction.

1:09

Experimental epilepsy in animals can be defined as a motor reaction which is disproportionate to a particular situation. Under physiological conditions, the nerve impulses are transmitted after receptor irritation by well-defined pathways to subcortical and cortical areas of central nervous system. The irritation area surrounded by area of inhibition is activated in the auditory analyser. After processing, the impulses are transmitted into descendent pathways and the result is the final response of organism – reflex. Imbalance between irritation and inhibition processes in brain leads to temporary uncoordinated spread of nerve impulses in different directions and by different pathways at the same time. Epileptic attack develops.

2:15

Rat is the animal that lives in dark or low-light environment majority of its life. Its auditory perception is very good developed. It is able to perceive sounds from 22 Hz to 100 kHz. It is particularly sensitive to sounds of high frequency and intensity.

2:39

About 90 % of infantile rats respond to sounds by anxiety motor reaction. Some of them develop epileptic reaction after audiogenic stimulation even without pharmacological premedication. The cause of this epileptogenic susceptibility of rats is not known. It is interesting that neither extirpation of auditory or motor area of cerebral cortex nor total removal of the cerebral cortex will prevent epileptic attack development.

3:16

The experiment is carried out in a sound-insulated room. The strong acoustic stimulus (e.g. ringing) 3 – 5 min. long is applied to infantile rats. According to their different motor reactions can be recognized their initial functional states of the nervous system. According to their reactions rats are divided into 2 groups. Groups are distinguished by using of different colour marks.

4:03

Highly irritable rats are marked by red colour on their heads.

4:24

The group of less irritable rats – their heads are marked by blue colour.

4:40

On the right side – there are the audiogenic irritable rats with the predominant irritation process and with the increased seizure alertness.

On the left side – there is the group of audiogenic non-irritable rats with the prevalence of inhibition process and without increased seizure alertness.

5:05

The initial functional state of nervous system will be pharmacologically affected. The inhibition process will be supported by injection of sodium bromide. It is central inhibitory substance. It is important to understand that NaBr is not specific anticonvulsant compound. The irritation process will be supported by injection of caffeine.

5:39

To primarily highly irritable rats with intensive motor activity marked by red colour 10 % solution of sodium bromide at the dose of 1ml/100 g of body weight is applied intraperitoneally to enhance inhibition process.

6:02

To non-irritable rats that stayed calm during audiogenic stimulation and that were marked by blue colour 10 % solution of caffeine at the dose of 1 – 1.25ml/100 g of body weight is applied intraperitoneally to enhance irritation process.

6:25

At time interval approx. 15 – 20 min. after applications the strong acoustic stimulus (ringing) 3 – 5 min. long is applied again. The initial functional state of nervous system of rats was pharmacologically affected.

6:42

The group of primarily irritable rats with pharmacologically (by injection of sodium bromide) supported inhibition process don't react to audiogenic stimulus by development of epileptic attack.

7:04

On the other hand the group of primarily non-irritable rats with pharmacologically (by injection of caffeine) supported irritation process react to audiogenic stimulus by epileptic attack.

7:23

The attack starts by running of rat around the perimeter of the cage- so called "manège" running.

7:30

The animal reacts to audiogenic stimulation by initial motor agitation.

7:50

Sometimes, on the beginning of attack can be present mild cramps similar to tremor.

7:58

Dyspnea is present.

8:05

Initial motor agitation develops to tonic-clonic cramps of all skeletal muscle groups.

8:21

Cramps used to be interrupted by phases of hypo- or akinesia.

8:32

Sometimes escape-type movements (high or long jumps) are present.

8:54

The akinesia phase is alternated by phase of cramps.

9:00

After termination of cramps phase akinesia is present again.

9:28

And again phase of tonic-clonic cramps is present alternated by phase of hypo- or akinesia.

9:46

The phases of hypokinesia or akinesia are gradually prolonged.

10:15

In the position lying on one side of body there can be observed so called "running in place".

10:29

Tonic cramps of muscles of back lead to opisthotonus that can be alternated by emprostotonus caused by tonic cramps of abdominal muscles.

10:53

During attack increased salivation, urination and less frequently defecation can be present.

11:06

Clinical signs of audiogenic epileptic attack in experimental animals are similar to symptoms of epileptic attacks in humans. E.g. "adversive syndrome" i.e. deviation of head and eyes on one side and simultaneous occurrence of tonic-clonic cramps is present in grand mal attacks. Akinesia is typical for petit mal attacks. This similarity of symptoms makes it possible to use experimental animals not only for demonstration but also for study of epileptic attack.

11:47

The attack usually finishes by exhaustion of animal.