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Electroencephalography in Determining Mood in Animals

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Abstract

Index terms—

1 INTRODUCTION

From the moment of their existence, animals exhibit innate and acquired behaviors. Innate behavior; is an instinctive stereotyped movement pattern or reflex-type behavior that occurs due to a stimulus without the need for experience (Aydemir and Bilge 2022). For example, the female animal suckling her young after pregnancy. Apart from this, it is observed that animals exhibit behaviors such as the defense of the area, competition behaviors, and communication in social groups.

It is observed that they exhibit various behaviors for temporary periods that occur under the influence of illness, pain, and medication. But; as a result of factors such as anxiety and stress, they exhibit abnormal behaviors such as phobia (Aydemir and Bilge 2022). Such behaviors are passed down through generations through genes specific to the species.

In many behaviors, it can be acquired later with environmental adaptations (Aydemir and Bilge 2022). Apart from the normal behavior typical of all animals species; aggression behaviors in line with environmental effects such as fear, different light wavelengths, different sound frequencies, heat, stress (status-related attack, intermale attack), predatory attack, idiopathic anger attack (idiopathic rage), fear-based attack (fear-induced), territorial and instinctive attack (maternal), environmentally damaging behaviors, coprophagia, social behavior and agonistic behaviors, urination or defecation outside the designated place, urine marking, wool (cloth) sucking, abnormal behaviors such as aggression are exhibited **??**Sambraus 1998 Thanks to the electroencephalography obtained from these behavioral disorders, it is possible to comment on the relations between the species.

2 III. DISCUSSION

When many studies on animals and humans are examined; is observed that there is a close relationship between the emotional states of animals and humans. As an indicator of this close relationship; is stated that facial expressions in mice reflect internal emotional states, just like facial expressions in humans **??**Dolensek et

3 Mood

4 Brittlebank et al. (1993) in the results of a study;

In the case of depression, people are prejudiced against overgeneralization; reported that animals exhibit simple behaviors such as avoidance and approach as an indicator of their internal emotional state. In the results of another study, Grandjean et al. (2016) determined that increased amygdala-PFC functional connectivity and white matter structural changes in the cingulum showed similarity in mice and humans against chronic stress. The results of a study by Xunxun Chu (2019) reported that the naturally induced depression models in macaques are very similar to the human depression model.

5 Sleeping Disorder

When examining studies on sleep disorders, Gadad et al. (2013) and Crawley (2012) reported in the results of the study that there is a similarity between the symptoms of sleep disorders between animal models and humans. According to **??**aramillo et Andersen and Tufik (2003), in the results of the studies against a living thing that affects from the outside; observed that they exhibit temporary or permanent changes in behavior. Moreover; they also found that their mice showed sleep disorders. Armitage (2007) found in a study that electroencephalography findings were more than 80% of patients with depression and that these people had sleep disorders.

6 Epilepsy

7 Genetic

Among the factors affecting behavior in model animals; genetic factors, age, gender, physiological, and hormonal conditions are included. In the results of a study using mice as model animals, **??**ambiaghi et al. (2012) reported that tuberous sclerosis complex caused by benign tumors in different organs and serious neuropsychiatric symptoms such as epilepsy, intellectual disability, autism, anxiety, and depressive behavior can be determined by EEG method. Also, **??**ambiaghi et al. (2012) found that anxiety and depression were reduced in mutant mice treated with rapamycin in their EEG power spectrum results. **??**arter (1978) reported that it produced a trance-like stupor in all monkeys associated with marked EEG changes and hypothermia in adult and preadolescent rhesus monkeys. Researchers have also found that characteristic EEG and behavioral changes are age-related. In another study, Cai et al. (2020) examined expression networks, locomotive, and cognitive behaviors, and EEG and gene-circuit-behavior analyses in genetically modified monkeys. The results of the study; reported that decreased ?-synchronization in front-parietal-occipital networks was associated with abnormal locomotive behaviors. Blackburn-Munro (2004), who conducted a study on genetically manipulated animals, stated that there are many pathological changes similar to various chronic pain in humans in animal models of chronic pain, using it together with classical physiological and biochemical measurements according to EEG results. Moreover; reported that the evaluation of pain and stress with the EEG method in animals is an alternative method.

Tuberous sclerosis Complex is a multisystem genetic disorder caused by mutations in the Tsc1 or Tsc2 genes that lead to hyperactivation of the London Journal of Engineering Research

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Electroencephalography in Determining Mood in Animals They also stated that low alpha synchronization due to thirst after drinking, which is created not only by water consumption but also by surrogate m TOR pathway, a key signaling pathway for synaptic plasticity.

9 Pain

Joyce and David (2019), who conducted a study on rats, mice, and monkeys, examined the electroencephalography of acute and chronic pain.

In the results of the study, the researchers observed that the transition from acute pain to chronic pain resulted in significant changes in brain function.

Moreover; they reported that brain activations in acute pain are related to the sensory aspect of noxious stimuli, including the primary somatosensory cortex, insula, cingulate cortex, thalamus, retrosplenial cortex, and periaqueductal gray. In the results of the study, they stated that the human acute pain model can be applied to sheep and that these electroencephalogram changes can provide a good measure for acute pain in sheep. They reported that these relationships are a frugal indicator between EEG data and behavior. They found a slight but significant reduction in theta and alpha mean dominant frequency (MDF) with behavioral changes in rapamycin-treated wild-type mice, suggesting a mild brain dysfunction associated with the drug treatment studies by Salinsky et al. (2004), Leocani et al., (2000Leocani et al., (, 2010)), Klimesch (1999), and Klimesch, (1997). They reported that this resulted in a mild brain dysfunction associated with drug therapy.

They also observed that EEG slowing in humans is associated with neurological disorders or even lower working memory, IQ or drug-induced lethargy, and cognitive impairment in healthy subjects.

10 Dependence

Howard (2000) examined the electroencephalography of the brain functioning in various animal models with alcohol dependence. The researcher reported that there are physiological and behavioral advantages and disadvantages to alcohol withdrawal syndrome. The researcher also stated that it may affect enhanced autonomic nervous system activation, sensory hyperreactivity, convulsions, anxiety, and dysphoria.

When other similar studies are examined, Walker and Zornetzer (1974), Ehlers and Chaplin (1991), Poldrugo and Snead (1984), and Perrin et al. (1975) reported that EEG abnormalities were associated with alcohol withdrawal in various model animals, including mice, rats, cats, and primates.

11 IV. CONCLUSIONS

There are various behaviors that they exhibit depending on the various moods observed in humans and various model animals. [1]

[1] Electroencephalography in Determining Mood in Animals

GB JP Great Britain Journals Press

Figure 1:

Figure 2:

All these behaviors exhibited are a psychological indicator of the emotional state of the animal (Bilge and Aydemir 2022; Aydemir and Bilge 2022; Aydemir et al. 2021). These psychological indicators are very similar to humans. For example; Behaviors such as depression, social avoidance, anhedonia, passive coping, and learned helplessness observed in humans are similar to the behaviors exhibited in animals (Tye 2018; Muir et al. 2018). Moreover; is observed that many model animals such as mice and monkeys exhibit similar behaviors in many diseases such as depression, chronic stress, sleep disorders, and epileptic seizures observed in humans (Brittlebank et al. 1993; Grandjean et al. 2016; Gadad et al. 2013) and Crawley 2012; According to Jaramillo et al. 2016; Dhamne et al. 2017; Citraro et al. 2019; Roebuk et al. 2020; According to Cai et al. 2020; According to Gandal et al. 2010; Dringenberg 2000). This gives information about the behavior between humans and animals. Various behavioral tests, biomarkers, and Electroencephalograms are used to measure this information (Roach et al. Mathalon, 2008; Koenig et al., 2005). Electroencephalograms (EEG) are a non-invasive technique that allows the measurement of electrical brain activity in a human or model animal. It can also record brain signals thanks to its high temporal resolution (Ward 2003; Lopes and MEG 2013). These recorded signals are a good source for obtaining information about the neurological status of the model creature (Saminu et al., 2021).

II. ELECTROENCEPHALOGRAPHY (EEG) IN MODEL ANIMALS

Electroencephalography in model animals is a method used to functionally examine the electrical signals produced as a result of neurological activities in the brain (Ward 2013-2015; Bear et al. 2016; Lopes and MEG 2013). Thanks to this method, information is obtained about normal and abnormal functioning in the brain. Electroencephalography reflects the total slow dendritic potentials of many cortical pyramidal neurons. EEG rhythms in different frequency bands arise from dynamic interactions between populations of neurons and are associated with several different cognitive processes. With this association, EEG recordings show abnormalities in brain functioning (Ward 2013-2015; Bear et al. 2016; Lopes and MEG 2013).

It has also been used in the diagnostic criteria of various psychiatric disorders such as schizophrenia, bipolar disorder, sleep disorder, attention-deficit/hyperactivity disorder (ADHD), and Alzheimer's disease, especially in recent years (Roach et al. Mathalon, 2008; They observed that repetiti

deficits, decreased activity, anxiety, learning problems, reduced fear conditioning, olfactory disorders, hyperactivity, and various autistic-like behavioral disorders occur in the model animal (Jaramillo et al. 2016; Dhamne et al. 2017; Balzamo). et al. 1998; Gadad et al. 2013; Crawley 2012

; Cao et al. 2020; Radyushkin et al. 2009; Liu et al. 2017).

Figure 3:

(2003),

Figure 4:

Neurodevelopmental disorders, mood disorders, olfactory disorders, visual attention dysfunction, sleep disorders, brain dysfunction, learning disorders, various adjustment, and autistic-like

behavior disorders, autism, attention deficit, hyperactivity, anxiety, aging, traumatic brain injury in various model animals. It has been observed that various behaviors such as repetitive grooming, social deficits, decreased activity, anxiety, fear conditioning, calmness, staring, anxiety, fear, learning disability, intermodal recognition memory and depression are exhibited.

23Electroencephalography in Determining Mood in Animals It has been observed that these behaviors closely resemble each other among various species of electroencephalography.

Figure 5:

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