SUMMARY

The doctoral thesis entitled **"Electrophysiological evaluation of the nervous system activity in dogs"** was motivated by the study of electrodiagnostic neurophysiology tests and the relevance of their application in the diagnosis of central and peripheral nervous system disorders in dogs.

The thesis extends over 211 pages and is divided into two parts according to the usual rules: the first part, the bibliographic study of the topic, representing 22.74% of the paper and the second part of the research occupies 77.26% of the work. The results obtained are supported by 76 figures and 19 tables.

The first part, entitled "***The current state of knowledge"*** is the brief bibliographic study on the electrophysiological diagnostic tests used in neurological disorders in dogs. This part is divided into two chapters describing the importance of electrophysiology in the clinical evaluation of the dog with encephalopathy and the use of electrodiagnosis in the investigation of dogs with various neuromuscular disorders. The information obtained by conducting this study was later used in the development, interpretation and comparison of the results obtained in personal researches.

The first chapter, entitled "*The importance of electrophysiological examinations in the diagnosis of central nervous system disorders in dogs*" performs a brief description of the information that we can obtain by means of electroencephalographic examination (EEG) and of the testing of potential auditory elements evoked by the brainstem (BAERs), factors which influence the results obtained, but also the importance of electroneurophysiology in guiding the diagnosis of intracerebral disease in dogs.

The 2nd chapter deals with "*The importance of electrophysiological examinations in the diagnosis of peripheral nervous disorders in dogs*", making a review of electrodiagnostic tests specific to the peripheral nervous system, also presenting the advantages offered by electromyography, the motor nerve conduction velocity, repetitive stimulation and F wave testing in exploring the neuromuscular system, by means of the identification, characterization, localization and assessment of neurological damage.

The 2nd part "**Personal research**" is composed of 4 chapters that present and discuss the results of the research performed.

Chapter III "*Research on the incidence of nervous system diseases in dogs*" is a study conducted between October 2012 and July 2016 on a total of 2125 dogs, of which 175 with encephalopathy and 67 with neuromuscular disorders, which came at the Medical Clinic of the Faculty of Veterinary Medicine Iasi. During this period, the prevalence rate of encephalopathies and neuromuscular disorders in dogs relative to the total morbidity was of 8.26% (175 out of 2125 dogs), 3.2% (67 out of 2125 dogs) respectively, and in relation to the morbidity caused by neurological problems it was of 72.31% (175 out of 242 dogs) and 27.69% (67/242 dogs) respectively. Of all the dogs in which they found the presence of encephalopathies, in most cases we diagnosed disorders of the brain hemispheres and of thalamus representing 70.28% of cases, followed by 8% of deafness, by the central vestibular syndrome with 5.7% of patients and multifocal intracranial diseases with 5.2% of individuals. The relatively high number of dogs recorded metabolic encephalopathy with 10.8% of all patients investigated. Of the total of prevalent neuromuscular disorders we can mention the spinal ones with 76.1% of patients, followed by nerve injuries with 19.3% of cases, muscle diseases with 2.9% from individuals, while injuries of peripheral motoneuron competing with diseases of the neuromuscular junction were represented by 1.49% of the dogs. The most frequent location of encephalopathies was the cerebral hemispheres and the thalamus (70.28% of dogs), and the most common condition was idiopathic epilepsy (42.14% of patients), while in case of neuromuscular diseases the spinal diseases (76.11 % of cases) predominated, degenerative disorders being the most representative (47.05% of individuals). Regarding the distribution of dogs with neurological disorders in relation to their breed, crossbreed dogs were predominant (46 cases), followed by Pekingese (16 cases); Bichon (14 dogs), Chihuahua, Labrador and German Shepherd (with 11 individuals) and with 7 cases each, the breeds Dalmatian, Bulldog and Yorkshire Terrier. The age of dogs with neurological disorders ranged widely from 2 months to 16 years, with an average of 4.32 years. Regarding the gender of dogs, males were predominant by means of 146 (60.3%) individuals, while females were present in a number of 96 (39.7%).

The 4th Chapter entitled "*Study on the importance of electrophysiological aspects in the central nervous system disorders in dogs*". The first part of this chapter contains a "Study regarding the importance of electroencephalography in encephalopathy in dogs" conducted on 138 dogs with a history of recurrent epileptic seizures. Electroencephalographic examination (EEG) revealed that idiopathic epilepsy is the most common aetiology of epileptic seizures in dogs and is responsible for more than half of the cases investigated (73.9%) herein; structural and reactive epilepsy recorded in a number of 26.1% of individuals, and the most common problems within them were hydrocephalus, and uremic encephalopathy, respectively. The background activity of EEG routes using medetomidine as anesthetic protocol was dominated by the presence of delta and theta waves, while the other physiological rhythms were less present. The most frequent paroxysms of this study were represented by the rapid spaeks recorded in 92% of patients with encephalopathy. The high variability in the number of epileptic dogs presenting specific EEG changes could be due to using the different acquisition protocols of bioelectric and anesthetics potentials, and to the use of different doses of anesthetic and varied recording time. EEG testing is essential in patients with congenital hydrocephalus experiencing subclinical epileptic attacks, which enables the establishment of an early and appropriate therapy. In babesiosis, electroencephalographic graphoelements were attributed both to tissue hypoxia and to multiple tissue and metabolic dysfunctions. Electroencephalographic changes occurred in patients with uremic encephalopathy have been shown to be directly proportional to its severity, representing the useful parameters for the assessment of the disease progression and of the response to treatment; while insulinomas were positively correlated with the intensity of hypoglycaemia. Thus, our study reiterates the importance of electrophysiological evaluation of the metabolic causes in convulsive disorders.

In the second part of this chapter entitled "Study regarding the importance of assessing the auditory potentials evoked by the brainstem in dogs (BAERs testing)" we present the results obtained from BAERs analysis and evaluation in 12 healthy dogs, 14 diagnosed with deafness, 12 with congenital hydrocephalus, 10 with central vestibular syndrome (CVS) and 13 with idiopathic epilepsy. The average values of the relative standard deviation of latency, of the amplitudes of waves I, II, III and V, and of intervals I-III, III-V, IV recorded in our study in the

group of healthy dogs were slightly lower or equal to those described by now in the research literature as a direct consequence of the use of surface electrodes instead of subcutaneous ones, demonstrate that the method of using surface electrodes is repeatable and valid. Hearing problems after reviewing BAERs testing could be classified in bilateral sensorineural deafness in 28% of patients, unilateral recorded in 35.71% of dogs, 14.3% of individuals experienced conductive deafness, and hearing loss was reported in 21.42% of cases. The decrease in the amplitude of wave I, accompanied by the dispersion of the other waves (the absence of waves) in patients with CVS was reported currently only in brain tumours in humans as a consequence of the complete destruction of functionality of the auditory pathway associated with extensive damage to the bridge and midbrain. In our case, these modifications may be associated with ischaemia or infarction of the cochlea, due to the basilar and labyrinthine artery compression. For patients diagnosed with idiopathic epilepsy (without treatment with anticonvulsants), latency and amplitude values were within the reference limits, demonstrating the non-affection of the auditory pathway in them. In hydrocephalus, BAERs testing revealed the amplitudes of waves III and V which were higher than the reference values and the increased latency time of interval I-V, even if the degree of hydrocephalus has varied. These BAERs anomalies are due to the inhibition of neurons in the auditory cortex or the descending auditory pathways. BAERs testing can be used as an electrophysiological method in assessing the course of disease, being a less expensive method than the advanced imaging techniques, proving to be superior to the computed tomography examination by identifying lesions of the auditory pathways smaller than 3 mm located on the cerebral trunk.

Chapter V entitled "*Study regarding the importance of electrodiagnosis in the peripheral nervous system disorders in dogs*" consists of 5 chapters. The first chapter subchapter presents “Electrophysiological aspects in spinal disorders", the first category of diseases within the neuromuscular system. The largest share in this category of disorders belonged to degenerative disorders with 47.05% of patients, followed by traumatic ones 37.25%, vascular with 9.80% and abnormalities with 5.88% of cases. During this period, the rate of prevalence of degenerative diseases in dogs compared to total morbidity was of 1.12% (24 of the dogs out of 2125 examined), and in relation to the morbidity due to neuromuscular diseases it was of 16.08% (24

patients out of 67 dogs). This category of diseases was represented by protrusion herniated disc (n = 7) and extrusion herniated disc (n = 15) and in 2 patients spondylosis was reported. Traumatic diseases were found in 19 patients (37.25%), being represented by fractures (n 6), subluxations (n = 3), disc herniation - traumatically induced (n = 7), post-traumatic intramedullary hematoma (n = 1), contusions and compression (n = 2). The main causes for the occurrence of these diseases were represented by automobile accidents, falls from a high floor, domestic violence and fights between dogs. Following the distribution of cases with traumatic disorders depending on the symptoms, more than half of the patients (63.15% - 12 dogs) showed signs of thoracic-lumbar syndrome, while the lumbar-sacral syndrome was found in 5 (26.31%) dogs and the cervical one only in 2 individuals (10.52%). Vascular diseases (fibrous cartilaginous embolism) were found in 5 females, with ages ranging within very wide limits (1-12 years), with non-chondrodystrophic breeds, while spine abnormalities found in 3 patients were represented by hemivertebra.

The second subchapter represents a “Study on the importance of electrophysiological aspects in acute idiopathic polyradiculoneuritis in dogs" performed on 9 dogs with signs of peripheral motoneuron. Acute idiopathic polyradiculoneuritis (AIP) in the group of dogs in the study was characterized through a pathological picture installed acutely that included: symmetrical motor disorders with an aspect of flaccid tetraparesis, osteotendinous areflexia, numbness, generalized pain, alterations of the autonomic nervous system, albumino-cytological dissociation of cerebrospinal fluid associated with a negative titer of anti-acetylcholine antireceptors. Electrophysiologically, AIP was translated into the reduction of the motor driving speeds, the increase of latencies of F waves of the nerves examined, moderate to severe electromyographic changes and physiological values of repetitive stimulation at the level of neuromuscular junctions. Thus, it was demonstrated that electrodiagnostic tests in AIP have a crucial role in establishing the disease diagnosis and in the early initiation of therapy with chances of healing without motor deficits because they are the only methods that highlight anomalies affecting peripheral nerves affection.

The third subchapter entitled "Electrophysiological aspects in concurrent acute idiopathic polyradiculoneuritis with the acquired form of MG (myasthenia gravis) in West Highland White

Terrier (Westie) dogs" describes the symptoms and electrodiagnostic elements characteristic of both entities. The signs of peripheral motoneuron accompanied by the albumino-cytological dissociation of CSF (Cerebrospinal fluid), the increase of distal latencies and decrease of VCNm of the nerves analysed associated with the prolongation of F waves latency led the diagnosis towards a disease of the peripheral nerve, while the positive titer of the acetylcholine anti-receptor antibodies along with cMAP three decrement of 18% in the repetitive stimulation of the tibial nerve showed a neuromuscular junction disorder. All these elements combined established the diagnosis of concurrent AIP with the acquired form of myasthenia gravis (MG). The simultaneous appearance of AIP and MG with its acquired form in the same patient is rare in human medicine (16 cases in the last 40 years), this being the first report described in animals.

The 4th subchapter "Electrodiagnostic aspects in proximal neuropathy" consists of two parts. The first part deals with "Sciatic/tibial nerve paralysis" from the right side of a Pekingese patient, occurred after a car accident. Electroneuromyography was the only method that allowed the identification, characterization and assessment of the severity of injury, showing the moderate spontaneous activity composed of fibrillation potentials and slow sharp waves in all muscles innervated by the right sciatic, while on the left side the exam was physiological with a lack of motor nerve conduction in the right sciatic and tibial nerve, with amplitudes and motor velocity situated within the benchmarks for the same nerves investigated on the left side.

In the second part of the chapter we describe "Avulsion of brachial plexus" seen in 3 patients, which occurred post-traumatically, accompanied by the impossibility of making the extension of the elbow and the body drag associated with proprioceptive deficits, important indicators of a significant injury. The electrophysiological study in case of all patients involved an electroneurographic and electromyographic examination. Electromyograms of patients showed moderate to severe spontaneous activity and the stimulo-detection exam showed values slightly below the minimum benchmark, but with records of polyphasism and dispersion in the cMAP of the nerves examined (radial, ulnar) in 2 patients, while in the case of the third patient the motor nerve velocity could not be recorded, suggesting a progressive degeneration in the distal portion of the motor axons, which corroborated with the EMG indicates a complete block of conduction above the dorsal ganglia of the nerve root.

The 5th subchapter "The electrodiagnostic of muscular diseases" focuses on masticatory muscle myositis found herein in 2 patients. This local autoimmune inflammatory myopathy, presented with limited clinical signs to one part of the jaw muscle represented by digastrics rostral, temporals, masseters, pterygoid (lateral, medial) consisting of ptialism and pain in the face and head, difficulty in prehension of food and the impossibility of consumption of liquids. The spontaneous electromyographic activity recorded at the level of the masticatory muscles confirmed neuromuscular affection, while the study of the conduction velocity allowed the exclusion of the assumption of a generalized neuropathy. EMG of the rest of appendix muscle oriented the diagnosis towards masticatory muscle myositis.

The 6th Chapter contains "General conclusions and recommendations" resulting from the completion of studies of the thesis. The paper concludes with the presentation of the bibliographical journal (353 titles from Romanian and foreign literature) used during research.