University of Florida College of Veterinary Medicine Syllabus

I. Course information
Course Name: VEM 5110D – Animal Systems I Veterinary Neuroscience
Phase: I
Semester: Fall
Year: Freshman
Course Credits: 7
Course Grading: Letter

II. General information
Course Coordinator of Animal Systems I: Dr. Don Bolser
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III. Course description
Course goals; Educational goals of the course: The goal is to prepare DVM students to understand the etiology of clinical cases they will encounter in which neurological malfunctions are causative factors.
Course objectives:
To obtain a systematic overview of basic nervous system anatomy and physiology. To study organization of the sensory and motor systems of the brain.

Course Outline & schedule: The course lasts four weeks. It has 27 lectures, 5 labs, and 1 exam. The exam consists of a lab identification part and a written part. The lab exam counts as 30% of the final grade, and the written is 70%.

Lecture 1 – Major Divisions
Lecture 2 – Cranial Nerves
Lecture 3 – Neurohistology
Lecture 4 - Blood supply to the brain and spinal cord
Lecture 5 – Development of the nervous system
Lecture 6 – Developmental abnormalities
Lecture 7 – Transport of ions and molecules
Lecture 8 – Membrane biophysics
Lecture 9 – Membrane potentials I
Lecture 10 - Membrane potentials II
Lecture 11 – Neurophysiology I
Lecture 12 - Neurophysiology II
Lecture 13 – Sensory systems, auditory
Lecture 14 – Sensory systems, vestibular
Lecture 15 – Spinal cord
Lecture 16 – Somesthesis
Lecture 17 – Nociception and pain
Lecture 18 – Autonomic and enteric nervous system
Lecture 19 – Visual system
Lecture 20 – Neurochemistry
Lecture 21 – Cerebral blood flow and blood brain barrier
Lecture 22 – Olfaction and taste
Lecture 23 – Motor systems I
Lecture 24 – Motor systems II
Lecture 25 – The emotional brain
Lecture 26 – The neurological examination
Lecture 27 – Neuroplasticity and rehabilitation

Lab 1 – Major divisions and cranial nerves
Lab 2 – Neurohistology
Lab 3 – Sensory systems
Lab 4 – Neurophysiology
Lab 5 – Motor and limbic systems
Additional labs: 5 open labs (see schedule)
IV. Course Materials: Learning Objectives and Key words (bolded)

**Major Divisions** Learn the major regions of the brain; landmarks for identification, and main features in each region.

**Cranial Nerves** Learn the twelve cranial nerves – their names, locations, functional components and targets of innervation.

**Blood supply to the brain and spinal cord** Learn the arterial supply to and venous return from the brain and spinal cord, and species variations. Learn the relationships between the blood vessels and meninges.

**Neurohistology** Learn the various neuronal and glial cell types found in the central and peripheral nervous systems. Understand the relationship between dendritic architecture and integrative function. Learn the regional differences in cytoarchitecture and the functional implications.

**Developmental abnormalities** Learn the clinical signs and functional losses that occur with various developmental abnormalities of the nervous system.

**Transport of ions and molecules** Learn about the varieties of protein-mediated transport of molecules across the plasma membrane. Be familiar with the types of transport proteins; ion transport and ion channels.

**Membrane biophysics** Learn the dynamics of permeability and diffusion.

**Membrane potentials I and Membrane potentials II** Learn about electrical influences on ion diffusion, and transport of ions across cell membranes. Nernst equation; resting membrane potential.

**Neurophysiology I and Neurophysiology II** Learn about the use of electrical signal propagation in neurons, and the synaptic interactions among neurons: action potentials, presynaptic potentials, postsynaptic potentials, synaptic integration.

**Neurochemistry** Understand the cellular and molecular processes that underlie chemical communication among neurons. Know the major classes of central nervous system (CNS) neurotransmitters, including key processes for their formation and elimination. Know the predominant classes of receptors that mediate the action of CNS neurotransmitters. Gain an appreciation for the predominant functional roles of major CNS neurotransmitters.

**Cerebral blood flow and blood-brain barrier** Understand the anatomical and functional attributes of the blood-brain barrier. Learn the main features of cerebral blood flow dynamics. Learn about the composition, circulation, and absorption of cerebrospinal fluid. Learn about the role of glucose in cerebral energy metabolism.

**Spinal cord** Learn about the anatomical organization of the spinal cord segments, nerve roots, dermatomes, cauda equine, gray vs. white matter distribution according to rostrocaudal level, dorsal horn organization, motoneuron pools.

**Somesthesis** Learn about the varieties of peripheral receptors and afferents. Understand the organization of the dorsal column system for fine touch and proprioception from the postcranial body. Understand the organization of the trigeminal system for fine touch and proprioception from the face. Understand the organization of the spinothalamic system for crude touch, pain and temperature information from the postcranial body, and the trigeminal contribution for similar information from the face and oral cavity. Learn about the thalamocortical projections related to the above somatosensory functions.
**Nociception and pain** Understand the definition and types of pain, and the difference between nociception and pain. Learn about the specialized anatomy of nociceptors and their sensory nerves, and the CNS pathways involved in nociception and pain. Learn about nociceptive reflexes and pain responses.

**Autonomic nervous system** Learn the anatomical and physiological characteristics of the sympathetic and parasympathetic systems. Learn about the organization of the enteric nervous system. Understand the organization of visceral afferents and their central pathways. Appreciate the means by which integration of somatic and visceral information occurs.

**Visual system** Learn the cellular organization of the retina and the physiological responses of rod and cone photoreceptors. Appreciate the difference between visual fields and retinal fields. Learn how optic nerve fibers sort at the chiasm into the optic tracts. Learn the pathways involved in form vision, including the lateral geniculate nucleus and visual cortex. Understand the anatomy of the retino-tectal system, and its role in visual orienting and startle responses. Understand the basis for photic reflexes. Learn about the basis of eye movement control.

**Auditory system** Learn the structure and basic physiology of the cochlea, middle ear, and outer ear. Learn the central pathways by which auditory information is handled.

**Vestibular system** Learn the structure and basic physiology of the semicircular canals. Learn the central pathways by which vestibular information is handled.

**Olfaction and taste** Understand how the olfactory system differs among microsmatic and microsmatic mammals. Learn how different classes of odorant molecules are represented by different glomeruli in the olfactory bulb. Learn the behavioral significance of the vomeronasal system and how it differs anatomically from the main olfactory system. Understand the forebrain pathways by which olfactory information is distributed. Learn the functional considerations of compromised olfactory function. Learn about the different kinds of taste sensations, and the difference between taste and flavor. Learn the central pathways by which taste information is handled.

**Motor systems I** Learn about motor units and the somatotopy of motoneuron pools. Understand the anatomy and physiology of muscle spindles and Golgi tendon organs. Learn the anatomical basis of these reflexes: myotatic, flexor, crossed extension. Learn the composition and function of the three ventromedial tracts: vestibulospinal, reticulospinal, tectospinal. Learn about the cortical control of movement through the corticobulbar and corticospinal projections. Learn how the cerebral cortex communicates with the cerebellum via projections to the pontine nuclei. Learn the anatomy and function of the rubrospinal tract. Understand the concept of central pattern generators.

**Motor systems II** Learn about the role of the basal ganglia in movement and its disorders. Learn about networks involving the cerebral cortex, basal ganglia, and thalamus for limbic, sensory-motor and associative functions. Learn the organization and function of the vestibulocerebellum, inoccerebellum, and cerebrocerebellum.

**The emotional brain** Understand the parallel pathways for discriminative vs. affective dimensions of experience. Learn the cortical and subcortical brain regions that mediate different aspects of emotional experience.

**The neurological examination** Appreciate the clinical signs that accompany dysfunction of the twelve cranial nerves. Understand the significance of various postural responses and movement patterns. Learn the difference between lower and upper motor neuron signs. Appreciate the relationship between knowing anatomy and locating the site of a lesion.

**Neuroplasticity and rehabilitation** Neuroplasticity as a response to damage or change in external stimuli. Appreciate how neuroplasticity relates to structural and functional changes in neural circuitry. Learn how neuroplasticity is measured in single neurons, in populations of neurons, and behaviorally. Understand the difference between short-term and long-term neuroplasticity. Appreciate the
relationship between rehabilitation and developing new patterns of neural activity. Understand the role of clinical research and randomized trials in developing new treatments for neurorehabilitation.

Required text: The Canine Brain by D.F. Buxton and R.W. Compton
PDF posted on course website.
Required text: SCAVMA notes

Additional Resources/ equipment:
All lecture Power Point files; many images, the SCAVMA notes, and Buxton dog brain atlas are posted on the UF Connect website.

Students will use digital slides of neurohistological sections that will be posted on the website.

V. Evaluation/ Grading/ Testing:
Don't forget to evaluate your instructors, visit the UF Evaluation site at:
https://evaluations.ufl.edu/evals/

VI. Administrative Policies: see Student Handbook @

Remediation: has been done
Attendance: students are independent
Academic Honesty: required
Professional Behavior: treat other students and instructors with respect; dress as you wish.
Deadline: taking exams early or late must be justified to the instructor.
Accommodations for Students with Disabilities: Students requesting special classroom or testing accommodations must first register with the Dean of Students Office. This office will provide documentation to the student who must then provide this documentation to the Instructor when requesting such accommodation(s).