Course Change Proposal
Form A

Academic Group (College): Health and Human Services
Academic Organization (Department): Physical Therapy
Date: 2/4/2011
Submitted by: Dr. McKeough

Type of Course Proposal:
New x ___ Change ___ Deletion ___

Does this course fulfill a requirement for single-subject or multiple subject credential students? Yes ___ No X ___
For Catalog Copy: Yes x ___ No ___
CCE (Extension): Yes ___ No X ___

Prefix & No.
PT 614
Title:
Neuroscience for Physical Therapy
Units:
3

This course replaces experimental course Subject Area (prefix) and Catalog Nbr (course number):

If changing an existing course, should new version be considered a repeat of the original version? If so, the same Course ID will be maintained. If not, a new Course ID will be assigned. Note: In PeopleSoft terminology, the Course ID is the unique system identifier, not the Catalog Nbr.
Yes ___ No ___

Change from:

Subject Area (prefix) & Catalog Nbr (course no.):

Title:

Units:

Change to:

Subject Area (prefix) & Catalog Nbr (course no.):

Title:

Units:

JUSTIFICATION:

This is a new course developed to meet the accreditation requirements for the Doctor of Physical Therapy degree.

NEW COURSE DESCRIPTION: (Not to exceed 80 words, and language should conform to catalog copy. See http://www.csus.edu/ummanual/acad.htm - Guidelines for Catalog Course Description)

This course is designed to prepare clinicians to better understand the neurological control of human behavior. A systems approach is used to examine the major anatomical and physiological principles and mechanisms by which the nervous system controls behavior under normal and pathological conditions. Because the course is being taught to health care professionals, clinical correlates of each system will also be presented. One class session is dedicated to presentation of human gross anatomical specimens.

Note:

Prerequisite: BIO 633, PT 600, PT 602, PT 608, PT 630,
Enforced at Registration: Yes x No
Corequisite: PT 604, PT 606, PT 618, PT 620, PT 622
Enforced at Registration: Yes ___ No X
Graded: Letter x ___ Credit/No Credit___
Instructor Approval Required? Yes ___ No X ___
Course Classification (e.g., lecture, lab, seminar, discussion): Lecture C-O2
Title for CMS (not more than 30 characters)
PT 614 Neuroscience for PT
Cross Listed? Yes ___ No X ___
If yes, do they meet together and fulfill the same requirement, and what is the other course.

How Many Times Can This Course be Taken for Credit? once

Can the course be taken for Credit more than once during the same term? Yes ___ No X ___
FOR NEW COURSE PROPOSALS OR SUBSTANTIVE CHANGES ONLY:

Description of the Expected Learning Outcomes: Describe outcomes using the following format: "Students will be able to: 1), 2), etc." See the example at http://www.csus.edu/aaf/example.htm

At the completion of this course, the student will be able to:

Goal 1.0 Demonstrate Professional Effectiveness

1.1 Compare and contrast normal biological, physiological, and psychological mechanisms of the human body with pathophysiological factors that lead to impaired body functions and structure.
   1.1.1 Discuss the etiology and clinical features of major disorders.
   1.1.2 Describe how pathological processes affect normal function.
   1.1.2.1 Understanding of how the nervous controls behavior
       1.1.2.1.1 describe the three basic functions of the nervous system
       1.1.2.1.2 describe a functional system within the nervous system
       1.1.2.1.3 describe the information processing operations performed by the nervous system
   1.1.2.2 Understanding of the organization of the central and peripheral divisions of the nervous system
       1.1.2.2.1 identify the 7 primary regions within the central nervous system (CNS) and describe the functions controlled by each
       1.1.2.2.2 identify the lobes within each hemisphere and describe the functions controlled by each
       1.1.2.2.3 discuss longitudinal and segmental axes of the nervous system and the organization of longitudinal and segmental pathways. Explain the typical deficits caused by damage to both longitudinal and segmental systems.
       1.1.2.2.4 diagram or identify the major gyri, sulci, and fissures of the cerebral hemispheres
       1.1.2.2.5 diagram and discuss the organization of sensory and motor structures in the gray matter in a cross section of the spinal cord and discuss how these structures change from one spinal region to another
       1.1.2.2.6 identify the primary components of the peripheral nervous system (PNS)
       1.1.2.2.7 discuss the classification of primary afferent (first order) neurons
       1.1.2.2.8 describe the structure and function of the meninges
       1.1.2.2.9 describe how information is transmitted from the brain to a muscle
   1.1.2.3 Understanding the types of cells found in the nervous system
       1.1.2.3.1 diagram bipolar and multipolar neurons
       1.1.2.3.2 describe the functions performed by the different regions of a multipolar neuron
       1.1.2.3.3 describe the function of the various cell types found in the CNS
       1.1.2.3.4 diagram a synapse and discuss the major events in synaptic transmission
       1.1.2.3.5 describe the experimental methods used to determine anatomical connections in the nervous system
       1.1.2.3.6 discuss the degeneration and regeneration of neural tissue and how that may relate to loss and recovery of function
   1.1.2.4 Understanding of the changes in the nervous system across the life span
       1.1.2.4.1 describe the role of the crest cells during the development of the nervous system
       1.1.2.4.2 describe the development of somites and their role in determining the organization of the PNS in the mature nervous system
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       1.1.2.4.4 describe how the 90 degree angle in the adult nervous system develops from the linear neural tube
       1.1.2.4.5 discuss the primary clinical sequel and the underlying pathophysiology of a central nervous system that fails to close completely during development
       1.1.2.4.6 describe the common effects of aging on the nervous system
   1.1.2.5 Understanding of the organization and function of the somatic motor system (control of voluntary movement)
       1.1.2.5.1 diagram, label, and discuss the pathway used to control isolated finger movement
       1.1.2.5.2 describe, in detail, the origin of the corticospinal tract, its somatotopic organization and the functional correlates of these features
       1.1.2.5.3 diagram, label, and discuss the pathway used to control movement of the trunk
       1.1.2.5.4 diagram, label, and discuss the structural and functional characteristics of muscle spindles and Golgi tendon organs
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       1.1.2.5.6 compare and contrast upper and lower motor neuron lesions
       1.1.2.5.7 diagram and label the structures that comprise the basal ganglia
       1.1.2.5.8 compare and contrast the roles of the basal ganglia and cerebellum in motor control
       1.1.2.5.9 identify the common disease entities of the basal ganglia and cerebellum
       1.1.2.5.10 compare and contrast the clinical presentations of patients with lesions in the basal ganglia and cerebellum
1.1.2.5.11 compare and contrast clinical manifestations of “pyramidal” and “extrapyramidal” system
dysfunction
1.1.2.5.12 describe how to perform, interpret, and document the results of evaluation of the functional
integrity of the somatic motor system

1.1.2.6 Understanding of the organization and function of the somatic sensory system
1.1.2.6.1 draw a detailed diagram (including first, second, and third order neurons, synaptic connections,
and somatotopic organization) of the pathway by which information from the body about touch
and limb position reaches consciousness. Describe the clinical tests used to evaluate this
system. Describe the clinical effects of lesions at the spinal cord, brainstem, thalamus, and
cortical levels of this system
1.1.2.6.2 draw a detailed diagram (including first, second, and third order neurons, synaptic connections,
and somatotopic organization) of the pathway by which information from the body about pain
and temperature reaches consciousness. Describe the clinical tests used to evaluate this system.
Describe the clinical tests used to evaluate this system. Describe the clinical effects of lesions
in the spinal cord, brainstem, thalamus, and cerebral cortex.
1.1.2.6.3 correlate damage to all levels of the dorsal column-medial lemniscal and anterolateral systems
with their expected signs and symptoms.
1.1.2.6.4 compare and contrast the endorphin and gait theories of pain and analgesia
1.1.2.6.5 define and discuss the terms adequate stimulus, discharge frequency, and spontaneous
discharge
1.1.2.6.6 describe how sensory receptors encode the intensity and duration of stimuli
1.1.2.6.7 describe the relationship between fiber diameter, myelination, conduction velocity, and sensory
modality for somatic sensory fibers
1.1.2.6.8 describe how to perform, interpret, and document the results of evaluation of the integrity of
the somatic sensory system

1.1.2.7 Understanding of the anatomical relationship of the major levels and components of the nervous
system with their blood supply
1.1.2.7.1 diagram and describe the circle of Willis (using medial, lateral, and crosssectional views,
include the aorta)
1.1.2.7.2 diagram and describe the venous supply of the brain
1.1.2.7.3 diagram and describe the arterial and venous supply of spinal cord
1.1.2.7.4 give at least two examples of mechanisms involved in the regulation of CNS blood flow

1.1.2.8 Understanding of the organization and functional significance of the cerebral cortex and major
diencephalic structures (thalamus and hypothalamus)
1.1.2.8.1 describe and account for the global appearance of the cerebral cortex
1.1.2.8.2 describe the cellular organization of the cerebral cortex
1.1.2.8.3 describe the origin and destination of the fibers of the corpus callosum
1.1.2.8.4 diagram and label the primary cortical projection regions for the following functional systems:
motor, somatic sensory, visual, auditory, speech production, speech comprehension, and the
visceral nervous system
1.1.2.8.5 identify and discuss the areas where major multimodal association occurs, i.e., the locations
where multiple modalities are integrated
1.1.2.8.6 compare and contrast the clinical manifestations of damage to the dominant and nondominant
hemispheres
1.1.2.8.7 describe the consequences of damage to the frontal lobes anterior to the primary motor and
premotor areas
1.1.2.8.8 discuss “primary, secondary, and tertiary” as they relate to projection regions in the cerebral
cortex
1.1.2.8.9 discuss the clinical manifestations of the different types of aphasia and the anatomical
correlates of each
1.1.2.8.10 describe behavioral and cellular tests commonly used to evaluate the functional integrity of the
cerebral cortex
1.1.2.8.11 explain the pathology and electrophysiology of seizure disorder

1.1.2.9 Understanding of stroke and traumatic brain injury
1.1.2.9.1 compare and contrast the impairments and functional limitations usually associated
cerebrovascular accidents (CVA) of the left and right hemispheres. Include discussion of the
"prototypical" patient with left and right hemiplegia
1.1.2.9.2 describe the 5 warning' signs of a stroke
1.1.2.9.3 apply the concept of neuroplasticity to the common pattern of recovery of function following
stroke
1.1.2.9.4 describe the mechanisms of: transient ischemic attack (TIA), intra-arterial thrombus, embolus,
lacunar strokes and diffuse ischemia injury
1.1.2.9.5 describe the mechanism of hypertensive hemorrhage and identify the most commonly involved
sites
1.1.2.9.6 describe the mechanisms and complications of subarachnoid hemorrhage. Include discussion
of primary and secondary types of injury
1.1.2.9.7 describe the mechanism of diffuse axonal injury (DAI)
1.1.2.9.8 describe the clinical and anatomical abnormalities found in pseudobulbar palsy
1.1.2.9.9 describe the risk factors (predictors) related to the incidence and outcomes of stroke and TBI

1.1.2.10 Understanding the vestibular system
1.1.2.10.1 describe the 2 classes of receptors in the vestibular system and explain how each responds to its adequate stimulus
1.1.2.10.2 diagram the primary pathway by which the vestibular system influences posture
1.1.2.10.3 diagram the primary pathway by which the vestibular influences eye movement
1.1.2.10.4 describe how vestibular induced nystagmus is produced
1.1.2.10.5 discuss the role of the vestibular receptors and neck proprioceptors in determining a sense of body position in space
1.1.2.10.6 accurately assess and record a client’s sitting and standing balance

1.1.2.11 Understanding the visual system
1.1.2.11.1 diagram the support structures and receptors of the eye and describe how a visual stimulus moves from the environment onto the retina
1.1.2.11.2 describe the unique anatomical characteristics of the fovea and optic disk, and discuss the functional correlates of these structures
1.1.2.11.3 diagram the central pathway from the retina to the primary visual cortex including the retinotopic organization of the central visual pathway
1.1.2.11.4 given a diagram of the visual system and the visual field deficits, identify specific deficits and locate the anatomical lesion that may have produced it
1.1.2.11.5 describe why pupillary reactivity is commonly used as an indicator of brain damage
1.1.2.11.6 perform, explain and interpret a clinical test of the extracocular motor system

1.1.2.12 Understanding the auditory system
1.1.2.12.1 describe the physical properties of an auditory stimulus and its propagation
1.1.2.12.2 use an appropriate illustration to describe the path traveled by an auditory stimulus from the environment through the chambers of the ear and auditory receptors to the first order neurons identifying all important structures along the way
1.1.2.12.3 use an appropriate illustration to describe the mechanical arrangement of support structures and receptors in the cochlea which enable it to respond to auditory stimuli
1.1.2.12.4 diagram the central auditory pathway and indicate the locations where damage could cause unilateral deafness

1.1.2.13 Understanding the primary function of the 12 pairs of cranial nerves
1.1.2.13.1 accurately evaluate and record the function of the 12 cranial nerves
1.1.2.13.2 diagram the central pathway by which information about pain and temperature from the head reaches consciousness
1.1.2.13.3 describe the corticobulbar innervation of cranial nerve nuclei, paying particular attention to the patterns of bilateral or predominantly crossed projections from the motor cortex to these nuclei

1.1.2.14 Understanding the limbic system
1.1.2.14.1 generally, describe the functions controlled by the limbic system
1.1.2.14.2 diagram Papez’s circuit
1.1.2.14.3 discuss the role of the limbic system in consolidating long-term memory

1.1.2.15 Understanding of the organization and function of the visceral nervous system
1.1.2.15.1 compare and contrast the somatic and visceral nervous systems
1.1.2.15.2 describe the sensory and motor components of the visceral nervous system
1.1.2.15.3 compare and contrast the anatomy of the sympathetic and parasympathetic divisions of the autonomic nervous system
1.1.2.15.4 compare and contrast the physiology of the sympathetic and parasympathetic divisions of the autonomic nervous system
1.1.2.15.5 describe the general relationship between the hypothalamus and the anterior and posterior lobes of the hypophysis (pituitary gland)
1.1.2.15.6 list the neurotransmitters used by the different components of the visceral nervous system
1.1.2.15.7 list the common clinical manifestations of visceral nervous system dysfunction

1.1.2.16 Understanding of the organization and function of the ventricular and cerebrospinal fluid system
1.1.2.16.1 describe the structure and function of the ventricular system
1.1.2.16.2 describe the function, production, and circulation of cerebrospinal fluid

1.1.2.17 Understanding of neuroanatomy: given appropriate tissue samples identify the following structures
1.1.2.17.1 vasculature: circle of Willis, anterior spinal artery, venous supply of the brain and spinal cord
1.1.2.17.2 gross anatomy:
1.1.2.17.2.1 from a lateral view of the surface of the brain: frontal, parietal, temporal, and occipital lobes; central and lateral fissures; precentral and postcentral gyri; superior, middle, and inferior frontal gyri; superior, middle, and inferior temporal gyri; Broca’s area; Wernicke’s area
1.1.2.17.2.2 from a medial view of a midsagittal section: medulla, pons, midbrain, hypothalamus, thalamus, septum pellucidum, corpus callosum, cingulate gyrus, parietooccipital and calcarine sulci; optic nerve, optic chiasm, and
1.1.2.17.2.3 optic tract, meninges
from a coronal or sagittal section: medial longitudinal fissure, corpus callosum, fornix, caudate nucleus, thalamus, hypothalamus, internal capsule, putamen, globus pallidus, external capsule, claustrum, extreme capsule, insular cortex, lateral fissure
1.1.2.17.2.4 spinal cord: conus medullaris, filum terminale, cauda equina; cervical, thoracic, lumbar, and sacral regions; cervical and lumbar enlargements; posterior, lateral, and anterior funiculi; dorsal and ventral horns; intermediolateral cell column, dorsolateral funiculus (Lissauer’s tract), fasciculus gracilis, fasciculus cuneatus, spinothalamic tract, lateral corticospinal tract
1.1.2.17.2.5 ventricular system: lateral ventricles, choroid plexus, foramen of Monro, third ventricle, cerebral aqueduct, fourth ventricle, foramen of Magendie, foramen of Lushka
1.1.2.17.3 microscopic anatomy of the neuron: cell body, nucleus, dendrites, axon, nodes of Ranvier, axon terminal (bouton) vesicles. presynaptic membrane, synaptic cleft, postsynaptic membrane, receptor sites
1.1.2.18 describe the most common imaging techniques used to study the nervous system: CT, MRI, fMRI, myelogram
1.1.2.19 Understanding of neurophysiology
1.1.2.19.1 discuss how resting membrane potential is attained and maintained
1.1.2.19.2 at the level of the neuron, discuss what constitutes information in the nervous system, how it is coded, and how it is transmitted
1.1.2.19.3 discuss chemical and electrical synaptic transmission
1.1.2.19.4 discuss neuroplasticity during development, after injury, during recovery of function, during learning

Goal 2.0 Demonstrate Professional Behaviors
2.1 Recognize cultural, ethnic, age, economic, and psychosocial differences and apply a humanistic and holistic approach to the delivery of a clinical service.
2.1.1 Practice physical therapy demonstrating cultural competence with all individuals and groups.
2.1.2 Work effectively with challenging patients.
2.1.3 Respect personal space of patients/clients and others.
2.1.4 Demonstrate behaviors that are non-judgmental with regards to patients/clients’ lifestyles.
2.1.5 Respect roles of support staff and delegate appropriately.
2.2 Communicate effectively for varied audiences and purposes.
2.2.1 Demonstrate effective interpersonal (verbal, nonverbal, electronic) communication skills considering the diversity of populations and environments.
2.2.2 Facilitate therapeutic communication and interpersonal skills.
2.2.3 Discuss difficult issues with sensitivity and objectivity.
2.2.4 Appropriately utilize communication technology efficiently, professionally, and effectively.
2.2.5 Respect roles of support staff and communicate appropriately.
2.4 Recognize the need for personal and professional development.
2.4.1 Participate in self-assessment to improve clinical and professional performance.
2.4.2 Welcome and seek new learning opportunities.
2.4.3 Assume responsibility for professional lifelong learning.
2.4.4 Accept responsibility and demonstrate accountability for professional decisions.
2.4.5 Recognize own biases and suspend judgments based on biases.
2.5 Demonstrate entry level generic abilities, including:
2.5.1 Professional accountability and commitment to learning.
2.5.1.1 Recognition of one’s own limitations.
2.5.1.2 Effective use of constructive feedback.
2.5.1.3 Effective use of time and resources.
2.5.1.4 Demonstrate integrity, compassion, and courage in all interactions.

Goal 4.0 Demonstrate Scholarship
4.1 Apply basic principles of statistics and research methodologies within the practice of physical therapy.
4.1.1 Formulate and reevaluate positions based on the best available evidence.
4.1.2 Evaluate the efficacy and efficiency of physical therapy procedural interventions.
4.1.3 Critically evaluate and interpret professional literature as it pertains to practice, research, and education.
4.1.4 Utilize contemporary technology consistently to access evidence.

**Attach a list of the required/recommended course readings and activities [Note: it is understood that these are updated and modified as needed by the instructor(s).] This attachment should be forwarded only to your Dean's office, not Academic Affairs.
Assessment Strategies: A description of the assessment strategies (e.g., portfolios, examinations, performances, pre-and post-tests, conferences with students, student papers) which will be used by the instructor to determine the extent to which students have achieved the learning outcomes noted above:

<table>
<thead>
<tr>
<th>Assessment Type</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exam 1</td>
<td>33.3%</td>
</tr>
<tr>
<td>Exam 2</td>
<td>33.3%</td>
</tr>
<tr>
<td>Final examination</td>
<td>33.3%</td>
</tr>
</tbody>
</table>

There are 3 lecture exams during the semester. For excused absences ONLY, make-up exams are available through the University Testing Center with a 10 point penalty due to the additional study time.

If you disagree with the scoring of a question, submit a written request for reconsideration with the appropriate reference to justify your answer within 2 working days of receiving your test.

The final exam in this course will not occur as posted on the university schedule but is set by the department during final exam week to avoid multiple exams in one day. You will be notified when the final exam schedule is determined.

ASSIGNMENTS (For details see Assignments on the Homepage)
There are 10 voluntary written assignments in the course. Completion of all 10 assignments will result in the addition of 3 percentage points to the semester average, 9 assignments 2 percentage points, and 8 or fewer assignments 0 percentage points. All assignments are due at the beginning of class on the assigned date. No assignment will be accepted late unless prior arrangements have been made with the instructor.

For whom is this course being developed?
- Majors in the Dept _x___
- Majors in other Depts ___
- Minors in the Dept ___
- General Education ___
- Other ___

Is this course required in a degree program (major, minor, graduate degree, certificate)? Yes _x_ No ___

If yes, identify program(s): DPT

Does the proposed change or addition cause a significant increase in the use of College or University resources (lab room, computer facilities, faculty, etc.)? Yes ___ No _x___

If yes, attach a description of resources needed and verify that resources are available.

Indicate which department or programs will be affected by the proposed course (if any). Physical Therapy

The Department Chair’s signature below indicates that affected programs have been sent a copy of this proposal form.

Approvals: If proposed change, new course or deletion is approved, sign and date below. If not approved, forward without signing to the next reviewing authority, and attach an explanatory memorandum to the original copy.

Signatures: ___________________________ Date: ________________

Department Chair: ___________________________ Date: ________________

College Dean or Associate Dean: ___________________________ Date: ________________

CPSP (for school personnel courses ONLY)

Associate Vice President
and Dean for Academic Programs

Distribution: Academic Affairs (original), Department Chair and College Dean. Dean’s office to send original after approval to Academic Affairs, at mall zip 6016. An electronic copy must also be sent.

9/10/2008
PT 614 – Neuroscience for Physical Therapists

Spring Semester

COURSE CREDIT 3 units: 3 hours of lecture

LOCATION TBA

TIME TBA

INSTRUCTOR TBA

E-mail
Office Hours
Phone

COURSE DESCRIPTION
This course is designed to prepare clinicians to better understand the neurological control of human behavior. A systems approach is used to examine the major anatomical and physiological principles and mechanisms by which the nervous system controls behavior under normal and pathological conditions. Because the course is being taught to health care professionals, clinical correlates of each system will also be presented. One class session is dedicated to presentation of human gross anatomical specimens. Open to Physical Therapy majors only.

PREREQUISITES
BIO 633 Review of Human Gross Anatomy
PT 200 Pathokinesiology
PT 202 Evidence Informed Practice I
PT 208 PT/Patient/Professional Interactions
PT 630 Pathophysiology

CO-REQUISITES
PT 204 Principles of Human Movement
PT 618 Foundations for Patient Management
PT 206 Therapeutic Measurements & Techniques
PT 220 PT Interventions I
PT 222 Evidence Informed Practice II

REQUIRED TEXT
**Course Objectives** (All course objectives reference the overall educational goals and outcomes of the Department of Physical Therapy.)

At the conclusion of this course, the student is expected to:

**Goal 1.0 Demonstrate Professional Effectiveness**

1.1 Compare and contrast normal biological, physiological, and psychological mechanisms of the human body with pathophysiological factors that lead to impaired body functions and structure.

1.1.1 Discuss the etiology and clinical features of major disorders.

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1.1.2.2.4 diagram or identify the major gyri, sulci, and fissures of the cerebral hemispheres

1.1.2.2.5 diagram and discuss the organization of sensory and motor structures in the gray matter in a cross section of the spinal cord and discuss how these structures change from one spinal region to another

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1.1.2.5.4 diagram, label, and discuss the structural and functional characteristics of muscle spindles and Golgi tendon organs
1.1.2.5.5 define spasticity and describe other clinical signs that commonly accompany spasticity. Identify the location of CNS lesions that produce these signs.
1.1.2.5.6 compare and contrast upper and lower motor neuron lesions
1.1.2.5.7 diagram and label the structures that comprise the basal ganglia
1.1.2.5.8 compare and contrast the roles of the basal ganglia and cerebellum in motor control
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1.1.2.6.1 draw a detailed diagram (including first, second, and third order neurons, synaptic connections, and somatotopic organization) of the pathway by which information from the body about touch and limb position reaches consciousness. Describe the clinical tests used to evaluate this system.
Describe the clinical effects of lesions at the spinal cord, brainstem, thalamus, and cortical levels of this system.

1.1.2.6.2 Draw a detailed diagram (including first, second, and third order neurons, synaptic connections, and somatotopic organization) of the pathway by which information from the body about pain and temperature reaches consciousness. Describe the clinical tests used to evaluate this system. Describe the clinical tests used to evaluate this system. Describe the clinical effects of lesions in the spinal cord, brainstem, thalamus, and cerebral cortex.

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1.1.2.6.5 Define and discuss the terms adequate stimulus, discharge frequency, and spontaneous discharge.

1.1.2.6.6 Describe how sensory receptors encode the intensity and duration of stimuli.

1.1.2.6.7 Describe the relationship between fiber diameter, myelination, conduction velocity, and sensory modality for somatic sensory fibers.

1.1.2.6.8 Describe how to perform, interpret, and document the results of evaluation of the integrity of the somatic sensory system.

1.1.2.7 Understanding of the anatomical relationship of the major levels and components of the nervous system with their blood supply.

1.1.2.7.1 Diagram and describe the circle of Willis (using medial, lateral, and crosssectional views, include the aorta).

1.1.2.7.2 Diagram and describe the venous supply of the brain.

1.1.2.7.3 Diagram and describe the arterial and venous supply of spinal cord.

1.1.2.7.4 Give at least two examples of mechanisms involved in the regulation of CNS blood flow.

1.1.2.8 Understanding of the organization and functional significance of the cerebral cortex and major diencephalic structures (thalamus and hypothalamus).

1.1.2.8.1 Describe and account for the global appearance of the cerebral cortex.

1.1.2.8.2 Describe the cellular organization of the cerebral cortex.

1.1.2.8.3 Describe the origin and destination of the fibers of the corpus callosum.

1.1.2.8.4 Diagram and label the primary cortical projection regions for the following functional systems: motor, somatic sensory, visual, auditory, speech production, speech comprehension, and the visceral nervous system.

1.1.2.8.5 Identify and discuss the areas where major multimodal association occurs, i.e., the locations where multiple modalities are integrated.
1.1.2.8.6 compare and contrast the clinical manifestations of damage to the dominant and nondominant hemispheres
1.1.2.8.7 describe the consequences of damage to the frontal lobes anterior to the primary motor and premotor areas
1.1.2.8.8 discuss “primary, secondary, and tertiary” as they relate to projection regions in the cerebral cortex
1.1.2.8.9 discuss the clinical manifestations of the different types of aphasia and the anatomical correlates of each
1.1.2.8.10 describe behavioral and cellular tests commonly used to evaluate the functional integrity of the cerebral cortex
1.1.2.8.11 explain the pathology and electrophysiology of seizure disorder

1.1.2.9 Understanding of stroke and traumatic brain injury
1.1.2.9.1 compare and contrast the impairments and functional limitations usually associated cerebrovascular accidents (CVA) of the left and right hemispheres. Include discussion of the “prototypical” patient with left and right hemiplegia
1.1.2.9.2 describe the 5 warning signs of a stroke
1.1.2.9.3 apply the concept of neuroplasticity to the common pattern of recovery of function following stroke
1.1.2.9.4 describe the mechanisms of transient ischemic attack (TIA), intra-arterial thrombus, embolus, lacunar strokes and diffuse ischemia injury
1.1.2.9.5 describe the mechanism of hypertensive hemorrhage and identify the most commonly involved sites
1.1.2.9.6 describe the mechanisms and complications of subarachnoid hemorrhage. Include discussion of primary and secondary types of injury
1.1.2.9.7 describe the mechanism of diffuse axonal injury (DAI)
1.1.2.9.8 describe the clinical and anatomical abnormalities found in pseudobulbar palsy
1.1.2.9.9 describe the risk factors (predictors) related to the incidence and outcomes of stroke and TBI

1.1.2.10 Understanding of the vestibular system
1.1.2.10.1 describe the 2 classes of receptors in the vestibular system and explain how each responds to its adequate stimulus
1.1.2.10.2 diagram the primary pathway by which the vestibular system influences posture
1.1.2.10.3 diagram the primary pathway by which the vestibular influences eye movement
1.1.2.10.4 describe how vestibular induced nystagmus is produced
1.1.2.10.5 discuss the role of the vestibular receptors and neck proprioceptors in determining a sense of body position in space
1.1.2.10.6 accurately assess and record a client’s sitting and standing balance

1.1.2.11 Understanding the visual system
1.1.2.11.1 diagram the support structures and receptors of the eye and describe how a visual stimulus moves from the environment onto the retina
1.1.2.11.2 describe the unique anatomical characteristics of the fovea and optic disk, and discuss the functional correlates of these structures

1.1.2.11.3 diagram the central pathway from the retina to the primary visual cortex including the retinotopic organization of the central visual pathway

1.1.2.11.4 given a diagram of the visual system and the visual field deficits, identify specific deficits and locate the anatomical lesion that may have produced it

1.1.2.11.5 describe why pupillary reactivity is commonly used as an indicator of brain damage

1.1.2.11.6 perform, explain and interpret a clinical test of the extraocular motor system

1.1.2.12 Understanding the auditory system

1.1.2.12.1 describe the physical properties of an auditory stimulus and its propagation

1.1.2.12.2 use an appropriate illustration to describe the path traveled by an auditory stimulus from the environment through the chambers of the ear and auditory receptors to the first order neurons identifying all important structures along the way

1.1.2.12.3 use an appropriate illustration to describe the mechanical arrangement of support structures and receptors in the cochlea which enable it to respond to auditory stimuli

1.1.2.12.4 diagram the central auditory pathway and indicate the locations where damage could cause unilateral deafness

1.1.2.13 Understanding the primary function of the 12 pairs of cranial nerves

1.1.2.13.1 accurately evaluate and record the function of the 12 cranial nerves

1.1.2.13.2 diagram the central pathway by which information about pain and temperature from the head reaches consciousness

1.1.2.13.3 describe the corticobulbar innervation of cranial nerve nuclei, paying particular attention to the patterns of bilateral or predominantly crossed projections from the motor cortex to these nuclei

1.1.2.14 Understanding the limbic system

1.1.2.14.1 generally, describe the functions controlled by the limbic system

1.1.2.14.2 diagram Papez’s circuit

1.1.2.14.3 discuss the role of the limbic system in consolidating long-term memory

1.1.2.15 Understanding of the organization and function of the visceral nervous system

1.1.2.15.1 compare and contrast the somatic and visceral nervous systems

1.1.2.15.2 describe the sensory and motor components of the visceral nervous system

1.1.2.15.3 compare and contrast the anatomy of the sympathetic and parasympathetic divisions of the autonomic nervous system

1.1.2.15.4 compare and contrast the physiology of the sympathetic and parasympathetic divisions of the autonomic nervous system
1.1.2.15.5 describe the general relationship between the hypothalamus and the anterior and posterior lobes of the hypophysis (pituitary gland)
1.1.2.15.6 list the neurotransmitters used by the different components of the visceral nervous system
1.1.2.15.7 list the common clinical manifestations of visceral nervous system dysfunction

1.1.2.16 Understanding of the organization and function of the ventricular and cerebrospinal fluid system
1.1.2.16.1 describe the structure and function of the ventricular system
1.1.2.16.2 describe the function, production, and circulation of cerebrospinal fluid

1.1.2.17 Understanding of neuroanatomy: given appropriate tissue samples identify the following structures
1.1.2.17.1 vasculature: circle of Willis, anterior spinal artery, venous supply of the brain and spinal cord
1.1.2.17.2 gross anatomy:
   1.1.2.17.2.1 from a lateral view of the surface of the brain: frontal, parietal, temporal, and occipital lobes; central and lateral fissures; precentral and postcentral gyri; superior, middle, and inferior frontal gyri; superior, middle, and inferior temporal gyri; Broca’s area; Wernicke’s area
   1.1.2.17.2.2 from a medial view of a midsagittal section: medulla, pons, midbrain, hypothalamus, thalamus, septum pellucidum, corpus callosum, cingulate gyrus, parietooccipital and calcarine sulci; optic nerve, optic chiasm, and optic tract, meninges
   1.1.2.17.2.3 from a coronal or sagittal section: medial longitudinal fissure, corpus callosum, fornix, caudate nucleus, thalamus, hypothalamus, internal capsule, putamen, globus pallidus, external capsule, claustrum, extreme capsule, insular cortex, lateral fissure
   1.1.2.17.2.4 spinal cord: conus medullaris, filum terminale, cauda equina; cervical, thoracic, lumbar, and sacral regions; cervical and lumbar enlargements; posterior, lateral, and anterior funiculi; dorsal and ventral horns; intermediolateral cell column, dorsolateral funiculus (Lissauer’s tract), fasciculus gracilis, fasciculus cuneatus, spinothalamic tract, lateral corticospinal tract
   1.1.2.17.2.5 ventricular system: lateral ventricles, choroid plexus, foramen of Monro, third ventricle, cerebral aqueduct, fourth ventricle, foramen of Magendie, foramen of Lushka
1.1.2.17.3 microscopic anatomy of the neuron: cell body, nucleus, dendrites, axon, nodes of Ranvier, axon terminal (bouton) vesicles. presynaptic membrane, synaptic cleft, postsynaptic membrane, receptor sites

1.1.2.18 describe the most common imaging techniques used to study the nervous system: CT, MRI, fMRI, myogram

1.1.2.19 Understanding of neurophysiology
1.1.2.19.1 discuss how resting membrane potential is attained and maintained
1.1.2.19.2 at the level of the neuron, discuss what constitutes information in the nervous system, how it is coded, and how it is transmitted
1.1.2.19.3 discuss chemical and electrical synaptic transmission
1.1.2.19.4 discuss neuroplasticity during development, after injury, during recovery of function, during learning

Goal 2.0 Demonstrate Professional Behaviors

2.1 Recognize cultural, ethnic, age, economic, and psychosocial differences and apply a humanistic and holistic approach to the delivery of a clinical service.
2.1.1 Practice physical therapy demonstrating cultural competence with all individuals and groups.
2.1.2 Work effectively with challenging patients.
2.1.3 Respect personal space of patients/clients and others.
2.1.4 Demonstrate behaviors that are non-judgmental with regards to patients/clients’ lifestyles.
2.1.5 Respect roles of support staff and delegate appropriately.

2.2 Communicate effectively for varied audiences and purposes.
2.2.1 Demonstrate effective interpersonal (verbal, nonverbal, electronic) communication skills considering the diversity of populations and environments.
2.2.2 Facilitate therapeutic communication and interpersonal skills.
2.2.3 Discuss difficult issues with sensitivity and objectivity.
2.2.4 Appropriately utilize communication technology efficiently, professionally, and effectively.
2.2.5 Respect roles of support staff and communicate appropriately.

2.4 Recognize the need for personal and professional development.
2.4.1 Participate in self-assessment to improve clinical and professional performance.
2.4.2 Welcome and seek new learning opportunities.
2.4.3 Assume responsibility for professional lifelong learning.
2.4.4 Accept responsibility and demonstrate accountability for professional decisions.
2.4.5 Recognize own biases and suspend judgments based on biases.

2.5 Demonstrate entry level generic abilities, including:
2.5.1 Professional accountability and commitment to learning.
2.5.1.1 Recognition of one’s own limitations.
2.5.1.2 Effective use of constructive feedback.
2.5.1.3 Effective use of time and resources.
2.5.1.4 Demonstrate integrity, compassion, and courage in all interactions.
Goal 4.0 Demonstrate Scholarship
4.1 Apply basic principles of statistics and research methodologies within the practice of physical therapy.
4.1.1 Formulate and reevaluate positions based on the best available evidence.
4.1.2 Evaluate the efficacy and efficiency of physical therapy procedural interventions.
4.1.3 Critically evaluate and interpret professional literature as it pertains to practice, research, and education.
4.1.4 Utilize contemporary technology consistently to access evidence.

OUTCOME OBJECTIVE
Students will leave the course with an understanding of how the nervous system controls behavior under normal and pathological conditions.

TEACHING STRATEGIES AND LEARNING ACTIVITIES
Case-method teaching, lecture by instructors and/or guests, demonstration, instructional videos, discussion groups, role playing, reading assignments, internet assignments, multiple writing assignments, laboratory practice.

ATTENDANCE
Daily attendance and timeliness is expected. Courtesy and professional responsibility requires notification of the instructor for any absence in advance. Failure to notify the professor of an absence can result in lowering your participation grade and is considered unprofessional. Students are responsible for any missed work and may be required to complete make-up assignments.

ACADEMIC HONESTY
The university policy regarding academic honesty is in effect in this course and any alleged violations will be handled in accordance with the policies described in the University Catalogue. (www.csus.edu/admbus/umanual/UMA00150.htm)

BEHAVIORAL EXPECTATIONS
Students are responsible for appropriate behaviors as defined by the generic abilities. Failure to comply with behavioral expectations during class may result in a student first being warned that behavior is inappropriate, then, if inappropriate behavior continues, a student may be asked to leave a class. Repeated failure to comply with behavioral expectations can lead to failure in the course. Cell phones and beepers should be off or silent (set to vibration mode) during the class. No text messaging is permitted in class.

SPECIAL ACCOMMODATIONS
During the course of the year, some students may utilize prearranged accommodations. If you are a student with a learning disability, physical disability, or other special needs, please let me know as soon as possible if you need special accommodation. These kinds of confidential discussions are best handled during my office hours or by special appointment. You can expect confidentiality and cooperation regarding any circumstances and needs that have been verified through the Office of Services to Students with Disabilities (SSWD) Lassen Hall 1008, (916) 278-6955.

ASSESSMENT & ASSIGNMENTS

<table>
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9
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<td>Exam 2</td>
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<td>Final examination</td>
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There are 3 lecture exams during the semester. **For excused absences ONLY, make-up exams are available through the University Testing Center with a 10 point penalty due to the additional study time.**

If you disagree with the scoring of a question, submit a written request for reconsideration with the appropriate reference to justify your answer within 2 working days of receiving your test.

The final exam in this course will not occur as posted on the university schedule but is set by the department during final exam week to avoid multiple exams in one day. You will be notified when the final exam schedule is determined.

**ASSIGNMENTS (For details see Assignments on the Homepage)**

There are 10 voluntary written assignments in the course. Completion of all 10 assignments will result in the addition of 3 percentage points to the semester average, 9 assignments 2 percentage points, and 8 or fewer assignments 0 percentage points. **All assignments are due at the beginning of class on the assigned date. No assignment will be accepted late unless prior arrangements have been made with the instructor.**

**GRADING SCALE**

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Please note that this syllabus may be changed at any time at the discretion of the instructor with prior notification of the students.
PT 614 – Neuroscience for Physical Therapists
Examination One

Introduction and Overview of the Nervous System

1. What is the behavior that occupies the majority of waking hours for most humans?
   A. moving
   B. sensing
   C. thinking
   D. achieving goals

2. Which of the following is not a basic function performed by the nervous system?
   A. initiation of action
   B. perception
   C. contraction
   D. sensation

3. Which of the following is not a component of a functional system within the nervous system?
   A. specialized receptors
   B. dedicated projection system
   C. control center with access to effectors
   D. convergence

Match the area of the nervous system on the left with the function that it controls on the right. Each function may be used once, more than once, or not at all.

4. ___ sacral cord                    A. all “head functions” except smell
5. ___ medulla                        B. primary subcortical relay station
6. ___ brain stem                     C. cognition, memory, language
7. ___ diencephalon                   D. heart rate, respiratory rate, digestion
8. ___ cerebral hemisphere            E. sphincter function

Match the area of the nervous system on the left with the function that it controls on the right. Each function may be used once, more than once, or not at all.

9. ___ frontal lobe                   A. vision
10. ___ parietal lobe                  B. hearing, aspects of learning
11. ___ occipital lobe                 C. movement, future planning, personality
12. ___ temporal lobe                  D. sensation, body image

13. The sensory and motor innervation of the hollow organs of the body are provided by the:
    A. autonomic nervous system
    B. sympathetic fibers
    C. somatic nervous system
    D. visceral nervous system

14. In the emergency department, a patient presents with dense hemiplegia (sensory and motor impairment) involving the entire right side of the body (face, arm, and leg). A lesion involving which of the following structures would account for these signs?
    A. Brainstem
    B. Cervical spinal cord
    C. Left cerebral hemisphere
    D. Lumbar spinal cord
    E. Peripheral nerves
15. Transection of C5, C6 & C7 spinal nerves on the left would produce which of the following symptoms?
   A. hemiplegia and hemisensory deficits of the left upper and lower extremities
   B. incontinence of bowel and bladder
   C. absence of all sensory, motor and visceral functions in the left upper extremity
   D. inability to flex the elbow; impaired sensation along the anterolateral aspects of the upper arm, forearm, volar surface of the first, second, and third digits

16. Which of the following structures accounts for why the dorsal or posterior surface of the brain and the dorsal or posterior surfaces of the spinal cord are in different planes of space?
   A. cervical enlargement of the spinal cord
   B. cephalic flexure
   C. fourth ventricle
   D. somites

17. The function of first-order sensory neurons (primary afferents) is to:
   A. transmit information from its site of entry in the CNS to the contralateral thalamus
   B. transmit information from the sensory receptor to the CNS
   C. transmit information from the thalamus to the cerebral cortex
   D. transmit information from the CNS to an effector organ

18. For the nervous system, information is defined as:
   A. anything that occurs in the external environment
   B. an event that is important to achieving a goal
   C. an event that is important to survival
   D. a significant change in energy level

19. The coding system used by the nervous system to convey information is.
   A. discharge frequency
   B. response amplitude
   C. salutatory conduction
   D. topographic and somatotopic organization

20. The primary function performed in the white matter of the nervous system is the _________ of information.
   A. processing
   B. transmission
   C. initial detection
   D. production

The Neuron

21. Reinnervation of an effector organ is most dramatically influenced by which of the following events?
   A. stimulation of the denervated effector
   B. the number of developing axonal sprouts
   C. a developing axonal sprout making contact with the distal Schwann cell tube (band of Bungner)
   D. receiving therapy during the recovery period

22. If injury to an axon (axonotomy) occurs before the first node of Ranvier from the cell body, it will result in:
   A. little or no effect on cell function
   B. cell death
   C. a slower recovery
   D. a faster recovery
23. A transient ischemic attack (TIA) is produced by what type of lesion?
   A. neuropaxia
   B. reversible demyelinating neuropaxia
   C. axonotmesis
   D. neurotmesis

24. At the level of the neuron, information is portrayed as:
   A. saltatory conduction
   B. transient electrical activity
   C. the amplitude of the action potential
   D. EPSP and IPSP

Match the events in the recovery of function following axotomy of a peripheral nerve listed in the right-hand column with the order in which they occur in the left-hand column.

25. First   A. reinnervation of an effector organ
26. Second   B. death of all but one axonal sprout
27. Third   C. sealing the cut end of the axon
28. Fourth   D. growth of axonal sprouts
29. Fifth   E. development of a growth cone

**Development & Growth of the Nervous System**

30. The neural groove develops in the neural plate because of rapid mitotic development of:
   A. Hensen’s node
   B. crest cells
   C. somites
   D. the basal plate

31. Dermatomes, myotomes, and sclerotomes in the mature body are derived from:
   A. a placode
   B. the primitive streak
   C. notocord
   D. somites

32. What structure in the mature spinal cord developed from the basal plate?
   A. dorsal columns
   B. dorsal horn
   C. ventral horn
   D. central canal

33. The primary class of neuropathology resulting from incomplete closure of the neural tube is:
   A. dwarfism
   B. cleft palate
   C. polio myelitis
   D. spina bifida

34. Which development deficit is most severe?
   A. meningocele
   B. myeloschisis
   C. spina bifida occulta
   D. meningomyelocele

35. Which of the following is not due to neuroembryology?
   A. the hollow ventricular system
   B. the use of a frequency code to portray information
   C. the dorsal horns of the spinal cord housing the cell bodies of sensory neurons
   D. sulci and gyri
The Peripheral Nervous System

36. Lesion of the cutaneous branch of the anterior primary division of the T10 spinal nerve will produce an inability to:
   A. contract the rectus abdominus muscle
   B. sense shortening of the internal oblique muscle
   C. produce voluntary movement of the umbilicus
   D. sense light touch on the skin surrounding the umbilicus

37. The fact that muscles in the extremities receive neural innervation from multiple spinal segments is accounted for by:
   A. somatotopic organization
   B. plexes
   C. cutaneous nerves contain both sensory and motor neurons
   D. muscular nerves contain both somatic and visceral neurons

38. Complete ablation of all somatic and visceral function of a restricted region of the body is indicative of a lesion in the:
   A. central nervous system
   B. peripheral nervous system
   C. autonomic nervous system
   D. visceral nervous system

39. Which grade of peripheral nerve injury requires surgical repair before recovery of function is possible?
   A. neurotmesis
   B. crush
   C. axonotmesis
   D. neuropraxia

40. If lesioned, which of the following structures would cause the greatest functional limitation?
   A. Dorsal root
   B. Ventral root
   C. Dorsal root ganglion
   D. Spinal nerve

The Central Nervous System

41. Which of the following structures is not part of the brainstem?
   A. midbrain
   B. diencephalon
   C. pons
   D. medulla

Muscle and Muscle Receptors

42. The rate of change of muscle length is reported by:
   A. beta lower motor neurons
   B. Golgi tendon organ primary afferents (Ib)
   C. muscle spindle secondary afferents (II)
   D. muscle spindle primary afferents (Ia)

43. The function of a Golgi tendon organ is to:
   A. reflexively regulate the force of a muscular contraction
   B. inform the CNS which motor units are contracting
   C. protect the muscle from excessive force via inhibitory reflex connections
   D. inform the CNS when threshold length has been exceeded
44. In order to re-learn midline orientation in static erect standing, in the absence of vision, a patient would increase their sensitivity to body position by increasing the discharge frequency of ________ motor neurons.
   A. gamma static
   B. gamma dynamic
   C. beta
   D. alpha

45. Small motor units are comprised of what type of muscle fiber?
   A. fast glycolytic
   B. fast oxidative and glycolytic
   C. slow oxidative
   D. slow oxidative and glycolytic

46. In what two ways does the CNS control force production during a voluntary muscular contraction?
   A. using muscle spindles and Golgi tendon organs
   B. increasing discharge frequency and the size principle
   C. utilizing larger motor units comprised of fatigue resistant muscle fibers
   D. using dorsolateral and ventromedial systems

**Motor System**

47. Given its organization and distribution of resources (cortical and subcortical motor centers, descending pathways, and lower motor neuron pools), the motor control system may be seen as concerned with controlling what two elements of movement?
   A. speed and accuracy
   B. agonists and antagonists
   C. posture and manipulation
   D. length and tension

48. An innervation ratio with few muscles fibers per motor neuron indicates that a muscle is well adapted for:
   A. speed
   B. endurance
   C. high force production
   D. precise control

49. What are the symptoms produced by the lesion shown here?
   A. absence of discriminative touch on the side of the lesion, generalized below the lesion level
   B. spastic paralysis and hyperreflexia on the side of the lesion, generalized below the lesion level
   C. flaccid paralysis, areflexia, and atrophy in the C8 myotome on the right
   D. absence of pain and temperature sensation on the side opposite the lesion, generalized below the lesion level

50. Which of the following is not a component of the majority of the corticospinal tract?
   A. originates from primary motor, premotor, and primary sensory areas of cortex
   B. crosses the midline after passing through the pyramid of the medulla
   C. descends through the spinal cord in the contralateral lateral column (funiculus)
   D. terminates by monosynaptic connection with alpha lower motor neurons

51. Motor neurons located in the dorsolateral ventral horn are most likely to innervate:
   A. shoulder and pelvic girdle muscles
   B. distal limb muscles
   C. proximal limb muscles
   D. extensor muscles
52. The upper motor neurons in the dorsolateral motor system that cross the midline do so in the ______ while upper motor neurons in the ventromedial motor system that cross the midline to terminate bilaterally do so in the ______.  
A. brainstem, spinal cord  
B. cerebral hemispheres, brainstem  
C. diencephalon, pons  
D. spinal cord, brainstem

53. What is the distribution of the symptoms produced by the lesion shown here?  
A. the right side of the body below the lesion level  
B. the left side of the body below the lesion level  
C. the C8 myotome on the right  
D. the C8 myotome on the left

54. During a voluntary movement produced by a concentric muscle contraction, what mechanism insures that the antagonist does not oppose the action of the agonist?  
A. insuring that the agonist is producing more force than the antagonist  
B. proper temporal sequencing of agonist and antagonist muscles  
C. inhibition of the stretch reflex in the antagonist  
D. using the proprioceptive feedback produced by the movement

55. Which of the following is not a symptom of upper motor neuron lesion?  
A. hyperreflexia  
B. clonus  
C. spastic paralysis  
D. fasciculations

56. Postural and balance components of a movement are controlled by the ______ component of the motor system.  
A. dorsolateral  
B. ventromedial  
C. cerebellum  
D. basal ganglia
Neuroanatomy: fill-in all labels of the illustrations (1 point each)
Briefly discuss the following terms

Control of behavior: achieving goals

Goal: desired outcome of action

Action (movement): preselected activities whose consequences will help produce the desired outcome (Goal)

NS is proactive: selecting goal, acquiring necessary information, producing desired outcome

In broad terms, describe the global structure and function of the nervous system

The nervous system consists of billions of neurons organized into functional systems that control behavior by producing purposeful action designed to accomplish a goal.

Identify and briefly describe the two leading theories of brain function.

1. Cellular connectivism, neuron doctrine, localization

   The control of functional systems is performed by specific locations throughout the NS

2. Aggregate field, mass action

   All parts of the NS are equally responsible for controlling all functions

Define a functional system within the nervous system and briefly discuss its primary components

Definition: Group of neurons that coalesce to control a particular aspect of behavior

Components

Input: specialized receptors and dedicated projection pathways

Control center: group of central neurons that perceive and respond to the specialized information

Output: provides the control center with access to effector organs

Briefly describe the 3 basic functions performed by the nervous system

Sensation

Sensory receptors: specialized cells, detect energy changes in the environment
Afferent pathways: groups of neurons conveying sensory information toward and within the CNS

Perception

Interpreting the meaning of the energy changes
Performed by the cerebral cortex

Action

Planning and producing purposeful acts designed to accomplish a goal (coordinated motor output)
Control center: group of neurons controlling that function
Efferent pathway: groups of neurons conveying motor information away from the CNS
Effector organs muscles and glands

Briefly describe the 4 basic information processing functions performed by the nervous system

Information: a significant change in energy

Sensing information: by specialized sensory receptors
Transmitting information: from the sensory receptors to the CNS by first order (primary) sensory neurons (afferent)

Perceiving information: cerebral cortex

Initiating adaptive responses: output from the control center to effector organs

Briefly describe the functional subdivisions of the nervous system
Somatic: senses and responds to changes in the external environment
Visceral: maintains the environment inside the body within physiological limits (homeostasis)

Briefly describe the organizing principles found throughout the nervous system
Longitudinal systems
Extend the entire length of the central nervous system
Crossed such that the right hemisphere controls somatic and visceral functions of the left side of the body

Segmental systems
Uncrossed
Control the somatic and visceral functions of a restricted region of the same side of the body (dermatomes, myotomes, sclerotomes)

Topographical organization
Neurons transmitting similar types of information are organized into pathways located in similar positions across multiple segmental levels
Neurons responsible for controlling similar functions are organized into nuclei.

Somatotopic organization
Most functional systems include a representation of the body surface
Amount of space allocated to a particular body part is proportional to its control

Phylogenetic organization
Structures concerned with sustaining life are located deep in the core of the brain
Fastest and most highly differentiated systems are located on the surface.

Briefly describe how the nervous system controls behavior
All behavior is subdivided into components
Behavioral components are controlled by serially organized, independent, information-processing systems
Even the simplest behavior requires the coordination of several distinct brain areas
Each component of behavior is processed serially and all components are processed simultaneously in parallel (serial and parallel processing)

Clinical Aspects
Briefly describe why, following brain damage, functional deficits appear on the side of the body opposite the lesion.

Major longitudinal systems, both motor and sensory, are crossed so that following damage to a region of the brain, the functions that they controlled from the opposite side of the body would become impaired.

Briefly describe what determines which functions will be impaired following brain damage.

According to the localizationist theory, impairments are determined by the location in the CNS that was damaged. That is, regions within the CNS are specialized for controlling aspects of behavior or aspects of functional tasks.