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A WEBSITE FOR THE GRADUATE STUDY OF NEUROPSYCHOLOGY

A dissertation submitted to the Wright Institute Graduate School of Psychology, in partial fulfillment of the requirements for the degree of Doctor of Psychology

by
MICHAEL HENRY DEBELLIS
JUNE, 2008

CERTIFICATION OF APPROVAL

I certify that I have read NEUROPSYCHOLOGYSKETCHES.COM: A WEBSITE FOR THE GRADUATE STUDY OF NEUROPSYCHOLOGY by Michael Henry DeBellis, and that in my opinion this work meets the criteria for approval of a dissertation submitted in partial fulfillment of requirements for the degree of Doctor of Psychology at the Wright Institute Graduate School of Psychology.

G A Richardson 21 March 2008

Gregg Richardson, PhD
Chair

3/21/08

Edgar Angelone, PhD, ABPN
Second Reader

June, 2008

NEUROPSYCHOLOGYSKETCHES.COM: A WEBSITE FOR THE GRADUATE STUDY OF NEUROPSYCHOLOGY

by
MICHAEL HENRY DEBELLIS

The Internet has become a valuable resource for those interested in the field of neuropsychology, but a Google search of that term yields nearly *seven million* hits, making it difficult for practitioners, instructors, researchers and particularly students to efficiently locate trustworthy and useful information. This dissertation is actually a website, presented here in printed form for purposes of degree requirements, but in reality a virtual location that is regularly updated and offers a great deal more information, through its many links, than can be presented in this paper format. This paper version provides both basic theoretical and practical information about neuropsychological domains (attention, memory, etc.), neuroanatomy (including original sketches by this author), neuropathology, assessment tools and report-writing. Also included are

lists of links to sites which offer more advanced information (and further links), and to sites offering training opportunities, university programs, neuropsychological journals, and neuropsychology organizations.

Dedication

This dissertation is dedicated to Gregg Richardson, PhD, who first saw that neuropsychology was the best fit for my skills, to Edgar Angelone, PhD, who allowed me to learn from him as teaching assistant and private forensic neuropsychology employee, and to Dr Richard Wanlass, who sought me for a hospital internship and provided me with a whole new training experience.

Acknowledgments

I wish to acknowledge all those who have contributed to this website—Dr Edgar Angelone for his PowerPoint presentation, Dr Gregg Richardson for his report template, and all those who authored and maintain the websites to which this website links.

Notes on the Website-as-Dissertation

First, a written document such as this is different in several ways from a website. First, most websites appear in landscape orientation, presenting information in a format wider than it is tall; written texts are more often in portrait orientation, such as seen here. I have tried to keep web pages narrow to accommodate its presentation in this written format, but this was not possible for some pages, where shrinking the page would have made the type font too small to read.

Second, because the very nature of a website is to permit access to large amounts of information not residing on the site itself (i.e., links to other sites), I will in this text version present only the pages I have drawn or written, and will also omit printing the two long PowerPoint presentations and course syllabi.

Third, all links within and outside this website are single-click accessed. No double-click or right-click functions are supported.

Finally, because the site is intended to be an evolving project, with future links and additional artwork added, this text version can only present the site on a given date. The version here is that of 20 March 2008.

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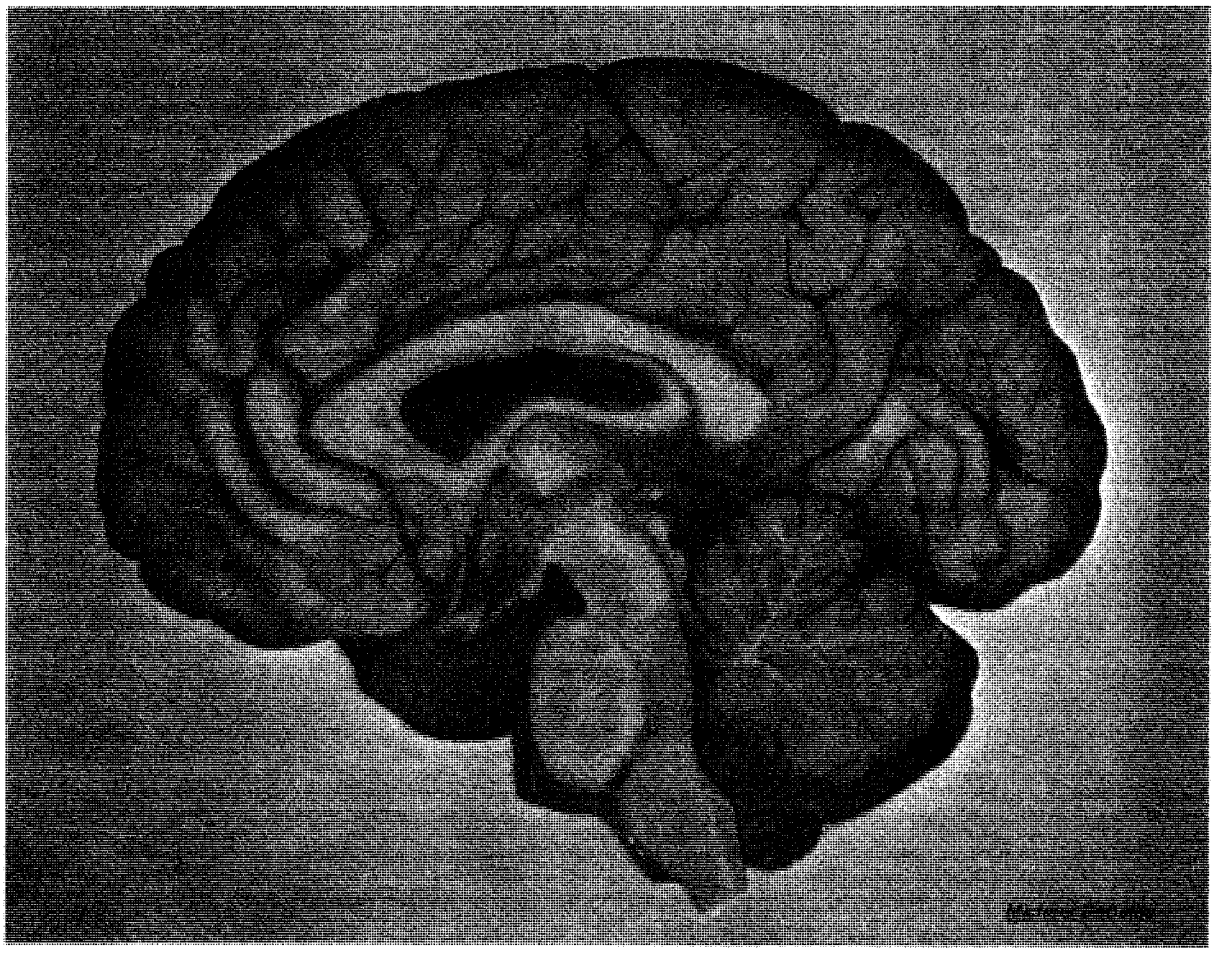
http://web.mac.com/mikedebellis/neuropsychologysketches/Home.html

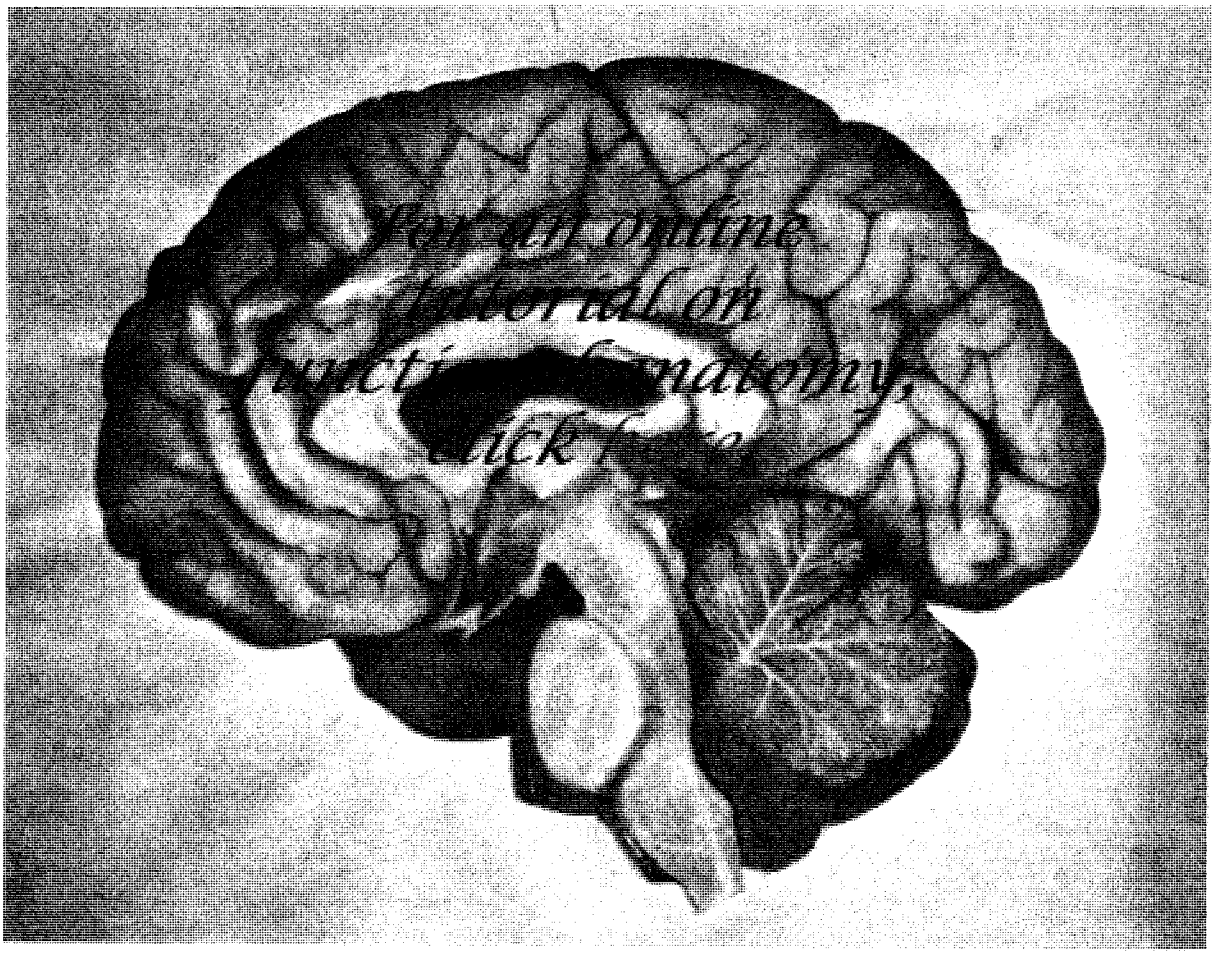
neuropsychologysketches.com



This website was constructed to serve as an online educational tool for graduate students of clinical psychology who wish to learn more about neuropsychology using online resources. This site is not intended as a substitute for rigorously established journal findings or professional medical/health related advice. All artwork is by the site designer, Michael DeBellis.

The number in the counter above indicates how many individuals have visited this website as of 20 March 2008.

Neuroanatomy



Ventricular System Choroid Plexus Pons Occipital Lobes Parietal Lobes Frontal Lobes Temporal Lobes Cerebellum Brainstem Pineal Gland Mammillary Bodies Thalamus Basal Ganglia

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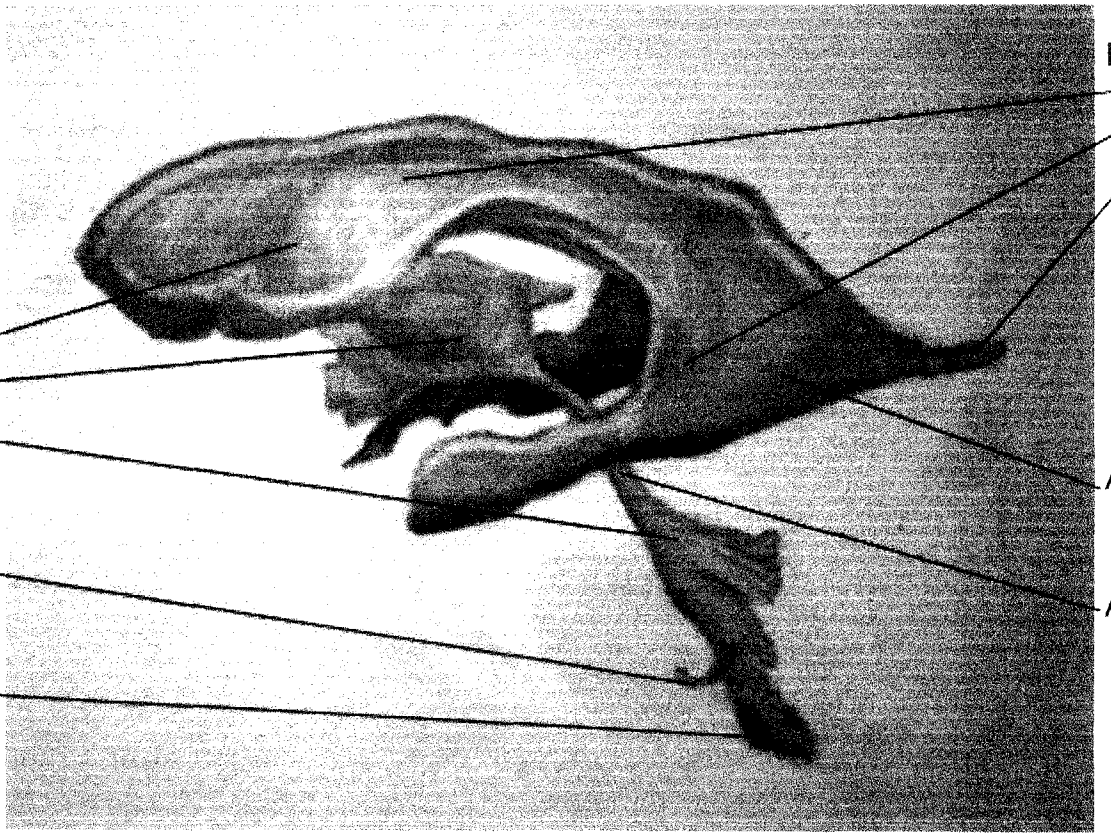
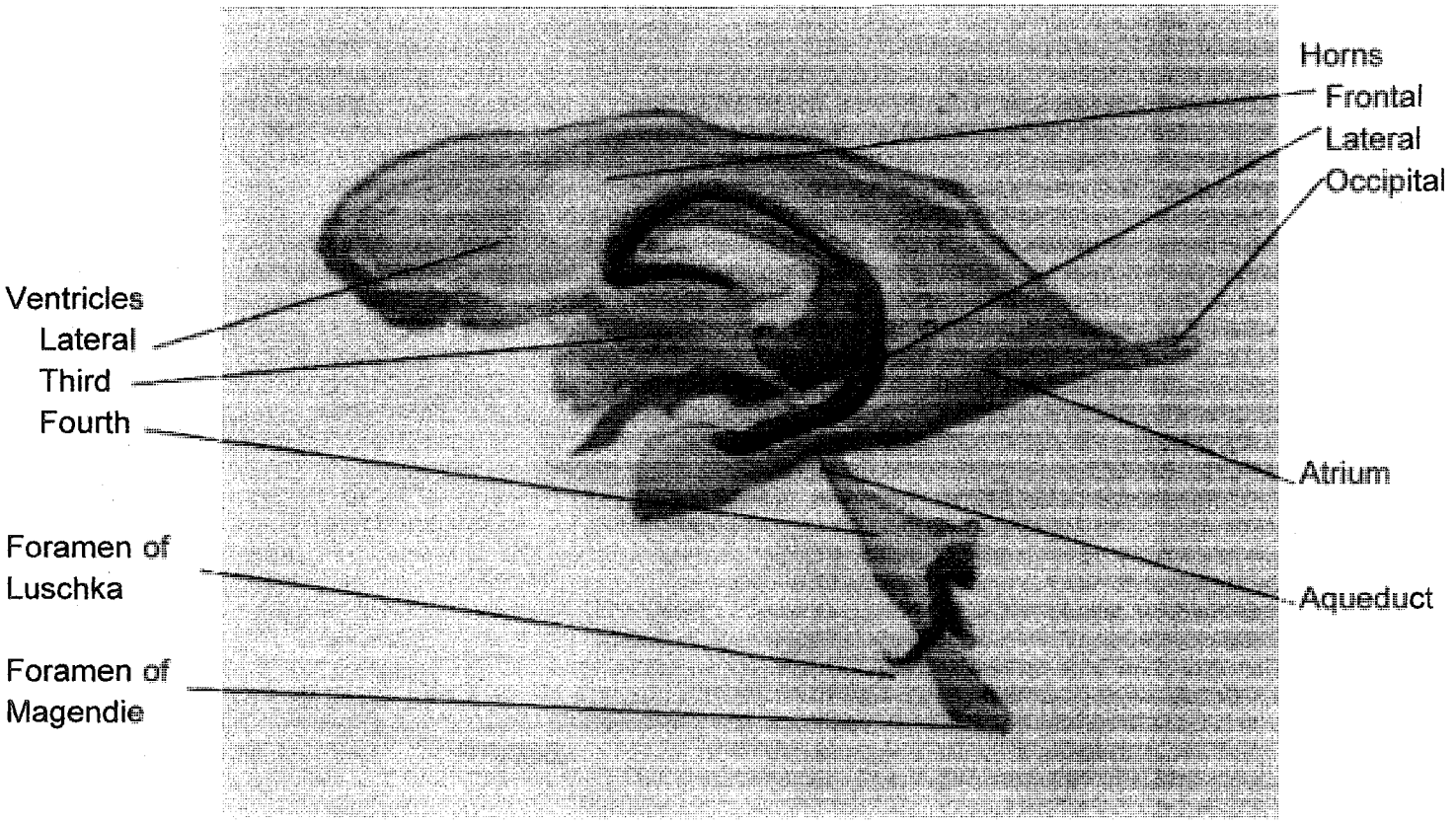
Ventricular System



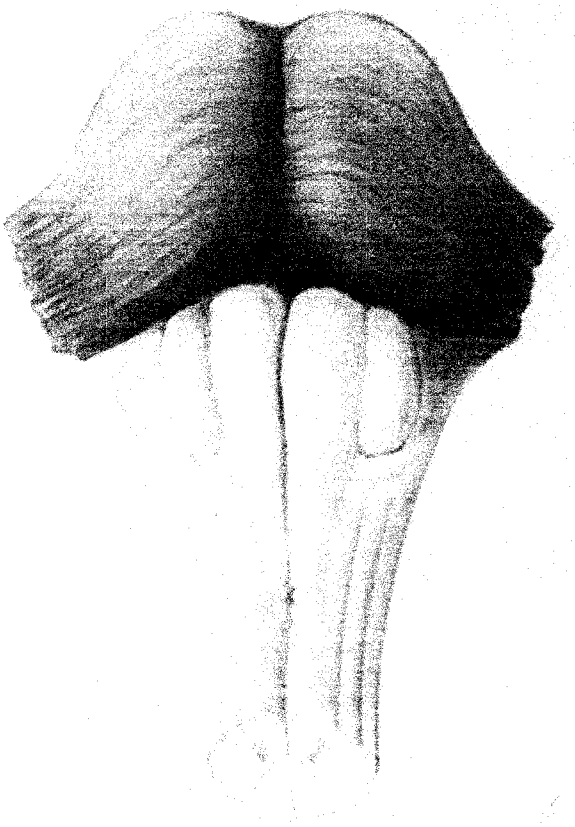
Cerebrospinal fluid is produced by the choroid plexus in the fourth and lateral ventricles. Once produced, the cerebrospinal fluid flows from the large, hornlike, lateral ventricles (first and second ventricles) through the foramen of Monro. It then circulates into the third ventricle, whose walls are partly comprised of the thalamus and hypothalamus, then moves through the cerebral aqueduct into the fourth ventricle, which is surrounded by the the pons, medulla and cerebellum. Finally, it exits through either the foramen of Luschka and/or the foramen of Magendie into the subarachnoid space. From there it travels up to the arachnoid granulations to be reabsorbed into the bloodstream.

Choroid Plexus



Cerebrospinal fluid is produced by the choroid plexus (shaded orange above) in the fourth and lateral ventricles. Once produced, the cerebrospinal fluid flows from the large, hornlike, lateral ventricles (first and second ventricles) through the foramen of Monro. It then circulates into the third ventricle, whose walls are partly comprised of the thalamus and hypothalamus, then moves through the cerebral aqueduct into the fourth ventricle, which is surrounded by the the pons, medulla and cerebellum. Finally, it exits through either the foramen of Luschka and/or the foramen of Magendie into the subarachnoid space. From there it travels up to the arachnoid granulations to be reabsorbed into the bloodstream.

Pons



The pons is a knob-like structure located on the brain stem that has several important functions. First, it relays sensory information between the cerebellum and cerebrum.

The pons also regulates respiration. The lower pons houses the apneustic centers while the upper pons houses the pneumotaxic centers. Together these centers function as antagonists, regulating respiration rate. The apneustic center intensifies the rate of respiration while the pneumotaxic center inhibits the rate of respiration.

Most blood arriving to the pons is supplied by the pontine arteries, small arteries that branch off the basilar artery. Blood is also delivered to the pons by the anterior inferior and superior cerebellar arteries. Cranial nerves V-VIII are also located in the pons.

Ventricular System Choroid Plexus Pons Occipital Lobes Parietal Lobes
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Pineal Gland Mammillary Bodies Limbic System Thalamus Basal Ganglia

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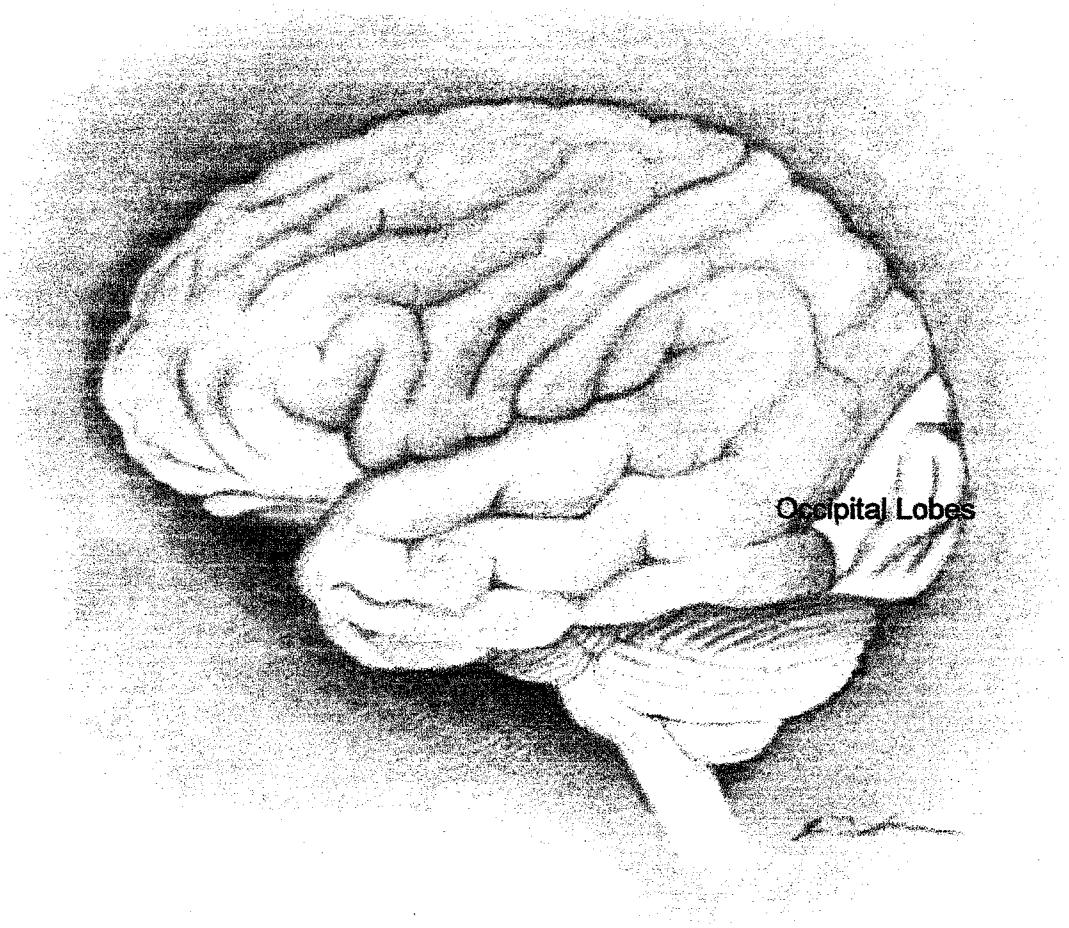
Occipital Lobes



Anatomy of the Occipital Lobes

Although the occipital lobes are the smallest and most posterior, they are classified as part of the forebrain. They rest on the tentorium cerebelli, a process of dura mater that separates the cerebrum from the cerebellum. They are structurally isolated in their respective cerebral hemispheres by the cerebral fissure. The front edge of the occipital lobe is separated from the parietal lobe by the parieto-occipital sulcus. The sides of the lobe merge with the parietal lobes along a vague boundary defined by several lateral occipital gyri, which are separated by the lateral occipital sulcus.

Viewed medially in sagittal midline section, the lobe is divided horizontally by the calcarine sulcus. The portion of the cerebellum above this sulcus is called the cuneus; the lingual gyrus lies immediately below this sulcus.

Functions

Retinal Sensors convey stimuli through the optic tracts to the lateral geniculate bodies, where optic radiations continue to the visual cortices. Each visual cortex receives raw sensory information from the outside half of the retina on the same side of the head and from the inside half of the retina on the other side of the head.

Cells on the posterior aspect of the occipital lobe grey matter are arranged as a spatial map of the retinal field. Functional neuroimaging

reveals that when the retinas are exposed to strong patterns, similar patterns are observed in occipital tissue.

If one occipital lobe is damaged, the result can be homonymous vision loss ("field cuts") in the corresponding visual area. Occipital lesions can also cause visual hallucinations. Lesions in the parietal- temporal-occipital association area are associated with color agnosia, movement agnosia and alexia.

Ventricular System Choroid Plexus Pons Occipital Lobes **Parietal Lobes**
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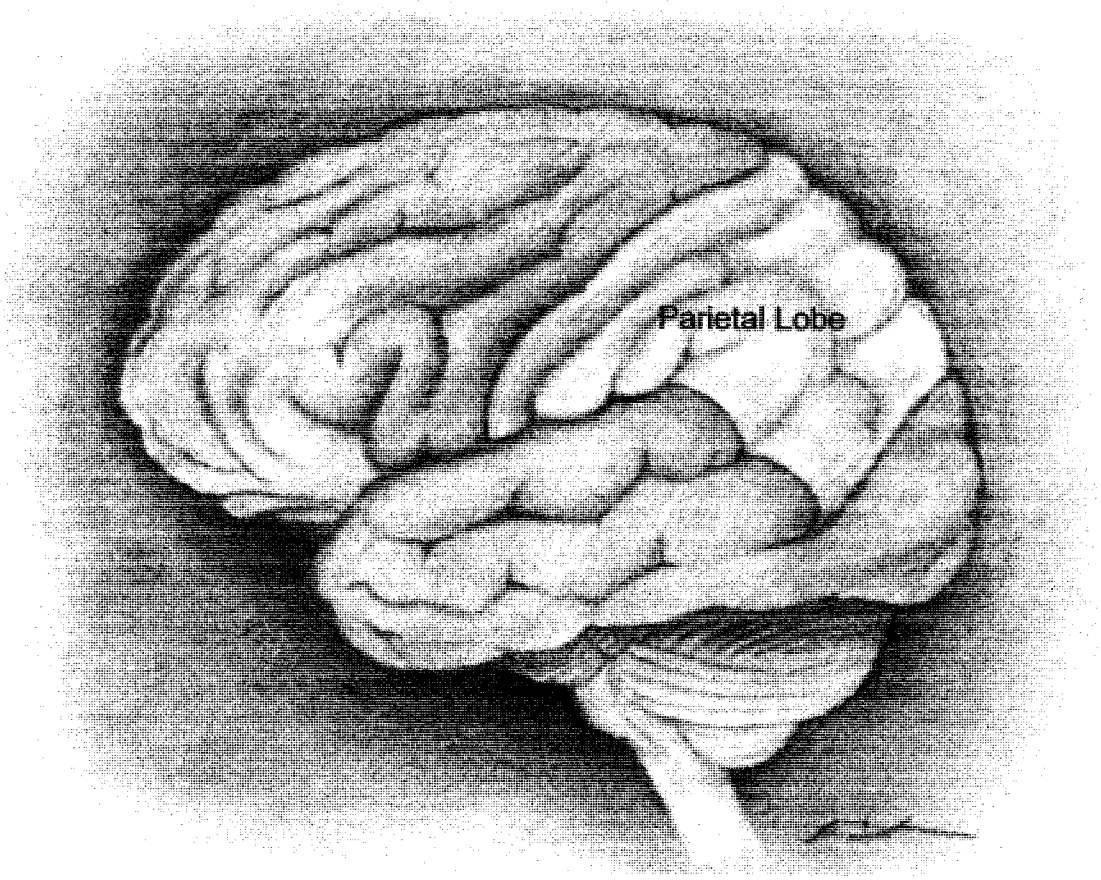
Parietal Lobes



The parietal lobes play an important role in the integration of sensory information from the body and in the mental manipulation of visual objects. Specific areas of the parietal lobes are involved in visuospatial processing.

Research on macaques suggests that different regions of the parietal cortex represent different spatial regions. The lateral intraparietal lobe contains a two-dimensional topographic map of retinotopically-coded space representing the saliency of spatial locations. The ventral intra-parietal area contains a map of the body. The medial intraparietal area maps manual reaching and actually changes when a tool increases the macaque's reach. The anterior intraparietal area helps map location and shape into grasping coordinates.

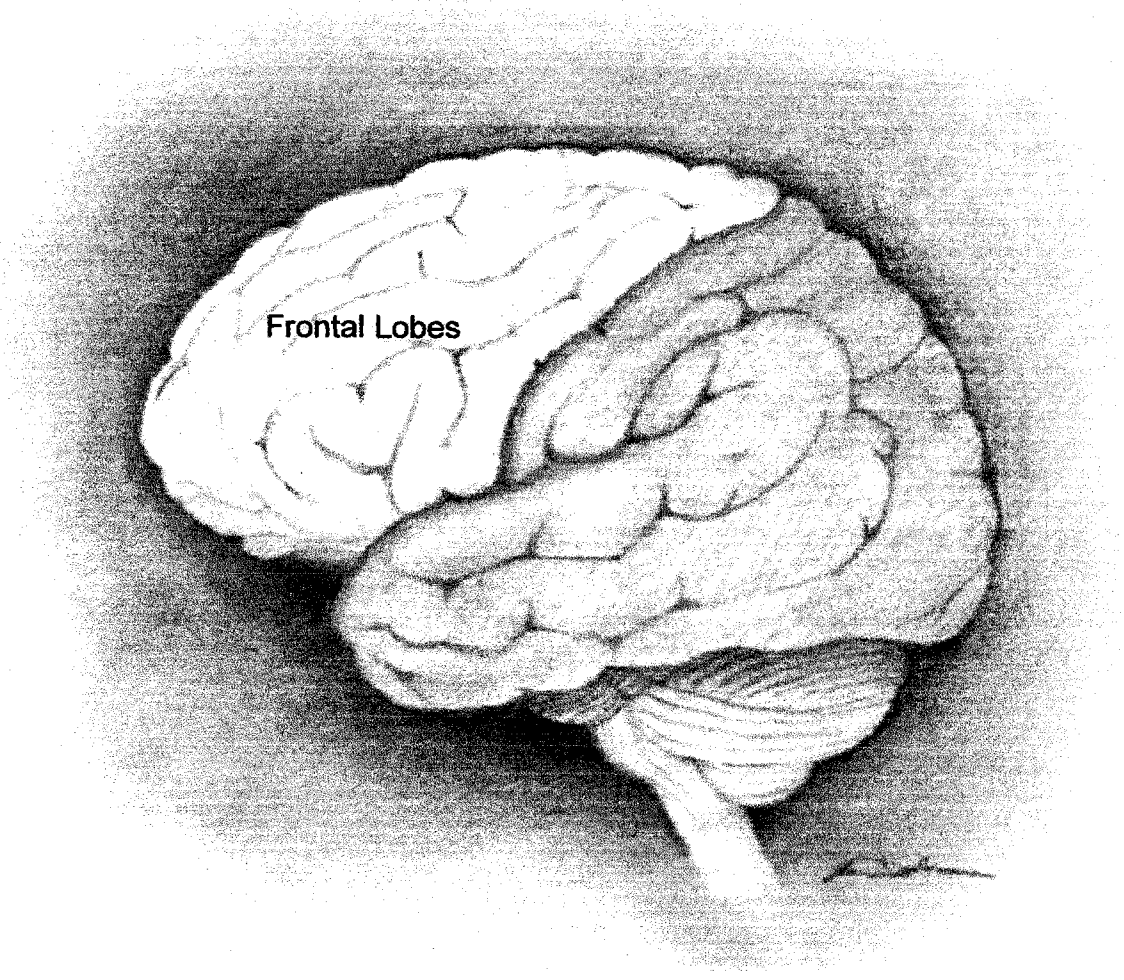
Parietal Lobe Syndromes

Balint's Syndrome is associated with bilateral parietal lesions.

Gerstmann's Syndrome associated with a lesion to the dominant parietal lobe.

Hemispatial Neglect is usually associated with large lesions to the non-dominant hemisphere.

Frontal Lobes



In the human brain, the most anterior divisions are the frontal lobes. They extend back to the central sulcus, with the precentral gyrus comprising the primary motor cortex, which controls voluntary body movements. The frontal lobes have many functions, playing roles in impulse control, judgment, language, memory, motor functioning, problem solving, sexual behavior, socialization and spontaneity, and in the planning, coordinating, controlling and execution of behavior.

The executive functions of the frontal lobes involve the ability to recognize the future consequences of current actions, to choose between good and bad (or better and best) actions, to override and suppress unacceptable social responses, and to determine similarities and differences between things and events.

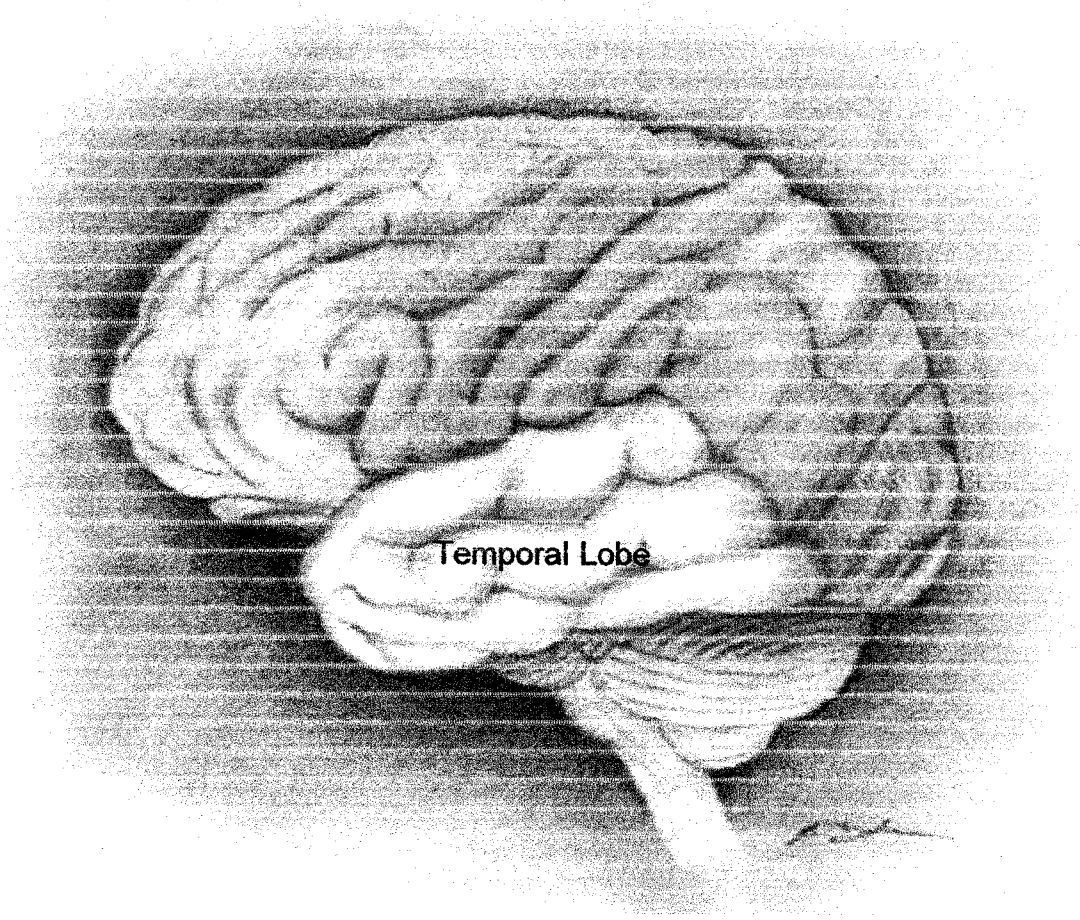
The frontal lobes also play an important part in the storage of remote memory. These memories are often associated with emotions derived from limbic system input and modified by higher frontal lobe centers to generally fit socially acceptable norms.

The frontal lobes receive rich neuronal input both from the Ascending Reticular Activating System of the brainstem and from the limbic regions.

Psychological tests that measure frontal lobe function include Trails B, tests of judgment, WAIS Similarities, the drawing of alternating

patterns, HRNB Finger Oscillation, The Wisconsin Card Sorting Task, and The Stroop Color-Word Task (see Tools).

Temporal Lobes



The temporal lobes are divisions of the cerebral cortex. They lie at the sides of the brain, beneath the lateral or Sylvian fissure. Posterior to the temporal lobes lie the occipital lobes, where visual information first reaches the cortex. Both superior and posterior to the temporal lobes lie the parietal lobes. The temporal lobes enclose the hippocampi and amygdalae, two very important structures involved in memory.

There are three major gyri in each temporal lobe. A gyrus is a "hill" or convolution on the surface of the brain caused by the folding of the cortex. The superior temporal gyrus contains an area which receives auditory signals directly from the cochlea (inner ear). This area is referred to as the primary auditory cortex or Heschl's area. The functions of the middle temporal gyrus are currently unclear. The inferior temporal gyrus is active in the process of object recognition.

Adjacent areas in the temporal lobes are involved in secondary auditory processing. These areas play important roles in speech, for which the left temporal lobe appears to be responsible in 99% of right-handed individuals and 70% of left-handed individuals.

Wernicke's area, which spans the region between the temporal and parietal lobes, plays a key role in auditory comprehension processing. The left temporal lobe is also involved in naming and verbal memory.

The medial temporal lobes are closer to the midline of the brain. Deep inside these, the hippocampi play a central role in declarative semantic memory, are believed to play a major role in the solidification of short-term memory into long-term memory, and are also believed to play a large role in memory for spatial location.

The ventral areas of the temporal lobes are closest to the midline and involved in processing visual stimuli. The more ventral fusiform gyrus (ventromedial) is the primary area for more complex visual tasks such as facial recognition. Individuals with autism tend to have less fusiform gyrus activity and tend to rely on inferior temporal lobe activity when recognizing faces.

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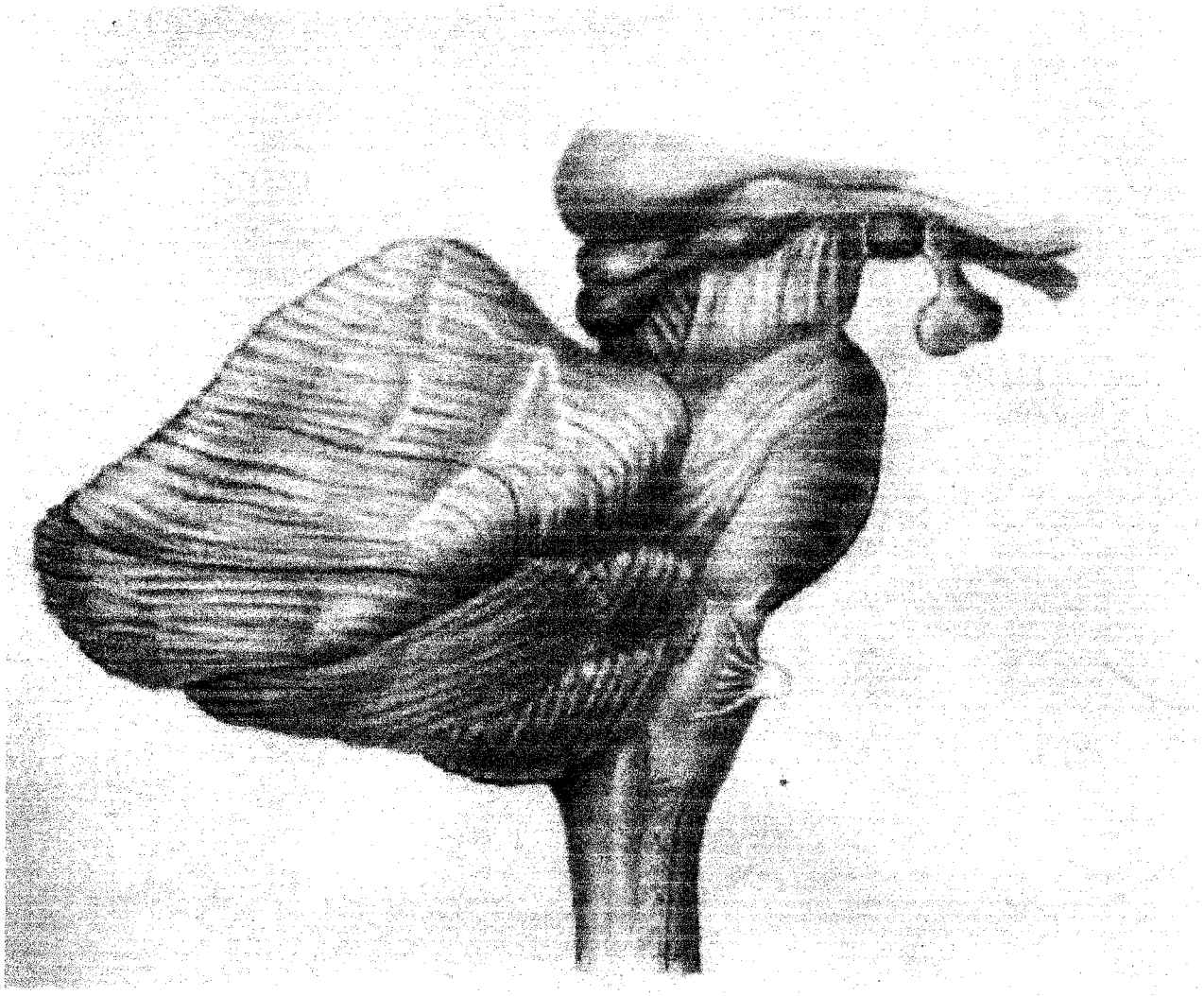
Cerebellum



The three neuroanatomical divisions of the cerebellum are the flocculonodular node, anterior lobe, and posterior lobe, illustrated above. Phylogenetically, the cerebellum may also be divided into the archicerebellum, paleocerebellum, and neocerebellum, terms that more clearly reflect their evolutionary age. The anterior and posterior lobes are separated by the primary fissure. The posterior and flocculonodular lobes are separated by the posterolateral fissure.

Archicerebellum

The archicerebellum, also known as the vestibulocerebellum, is located in the flocculonodular lobe, which is composed of the flocculus and the nodulus, a long cylindrical lobe arching over the fourth ventricle. The archicerebellum is associated with the flocculonodular lobe and is mainly involved in vestibular and eye movement functions. It receives input from the inferior and medial vestibular nuclei, creating a feedback loop that allows for the constant maintenance of balance. The archicerebellum is also associated with the lateral vestibular nucleus in the brainstem.

Paleocerebellum

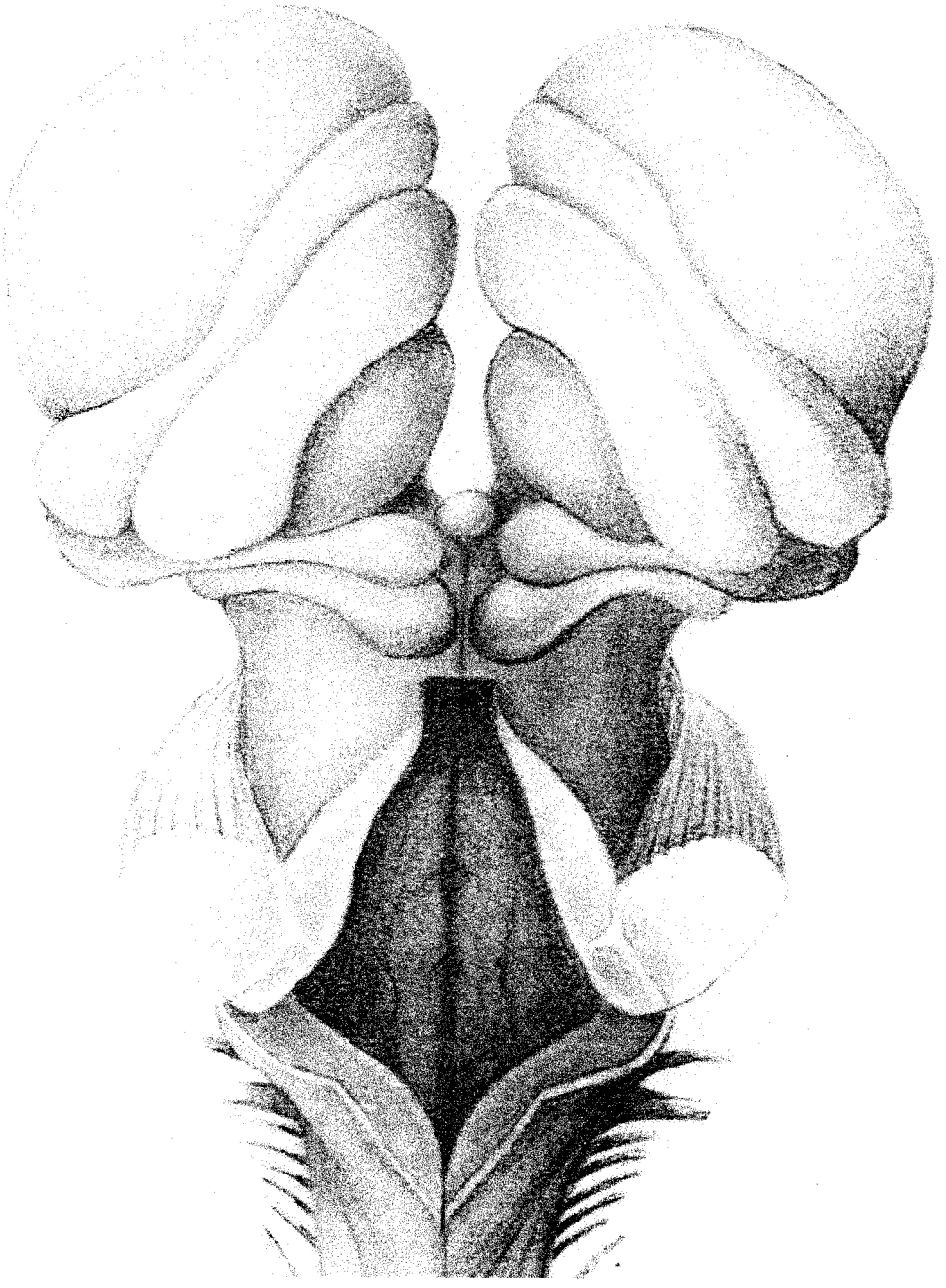
The paleocerebellum, also known as the spinocerebellum, is made up of the uvula, pyramid and anterior lobe. It controls proprioception related to muscle tone. The paleocerebellum receives kinesthetic inputs

from the spinocerebellar tracts, which carry information about the position of the body in space, and initiates muscle contraction in the legs. The paleocerebellum also sends axonal projections to the fastigial, globose and emboliform deep cerebellar nuclei.

Neocerebellum

The neocerebellum, also known as the cerebrocerebellum, makes up the more lateral portion of each cerebellar hemisphere. It receives input from the pontocerebellar tract and projects that information into deep cerebellar nuclei. The pontocerebellar tract originates in the pontine nuclei, which receive their input from the cerebral motor cortex. The neocerebellum is associated with motor control, particularly the coordination of such fine-motor movements as those required for typing and playing the piano. It is also associated with the dentate nucleus, one of the deep cerebellar nuclei.

Brainstem



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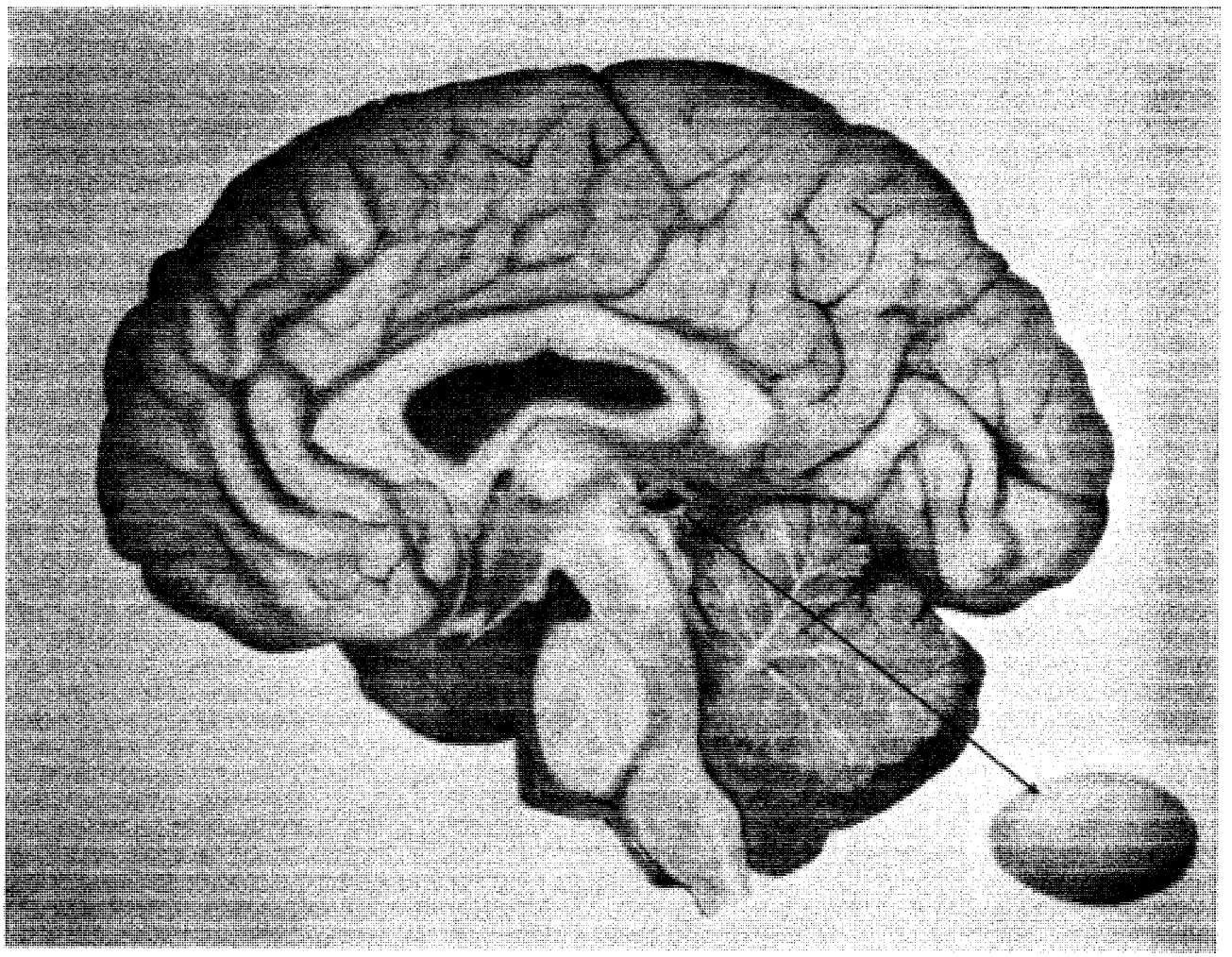
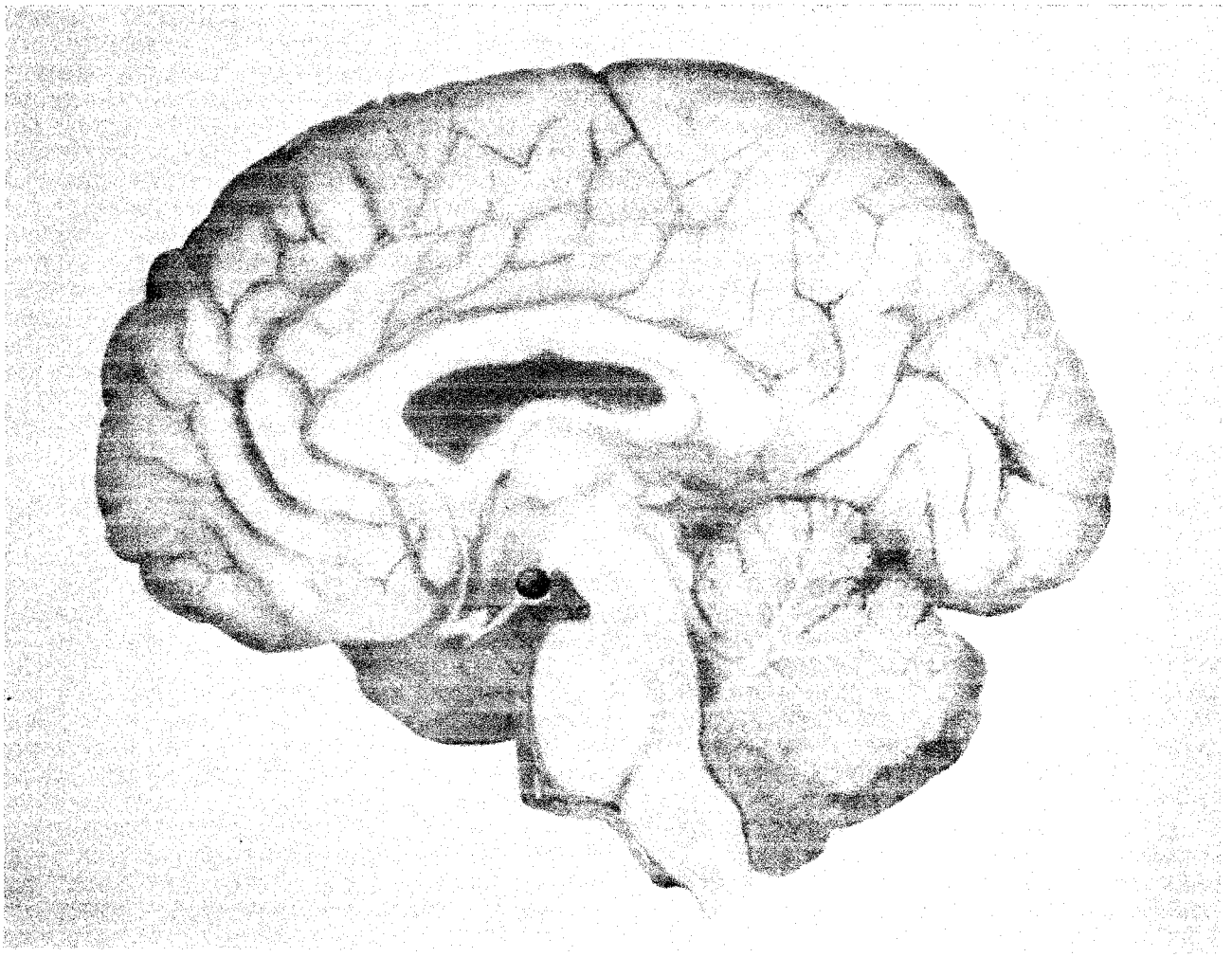
Pineal Gland



The pineal gland is a brain-structure approximately the size and shape of a pea. It rests on top of the posterior brainstem, above the superior colliculi, and beneath the stria medularis. The pineal gland produces melatonin (5-methoxy-N-acetyltriptamine), a hormone, which is instrumental in the regulation of circadian rhythms. Research suggests that melatonin helps regulate hibernation, sexual development, metabolism and seasonal breeding in animals.

The pineal gland is also a distinctive brain structure in that it is *circumventricular*, i.e., a permeous area of the brain in which the blood-brain barrier is interrupted.

Mamillary Bodies



The mammillary bodies are a part of the limbic system which play an important role in the consolidation of memories. Damage to the mammillary bodies has consistently been shown to result in amnestic states. The most common cause of this damage appears to be thiamine insufficiency caused by prolonged, excessive alcohol use.

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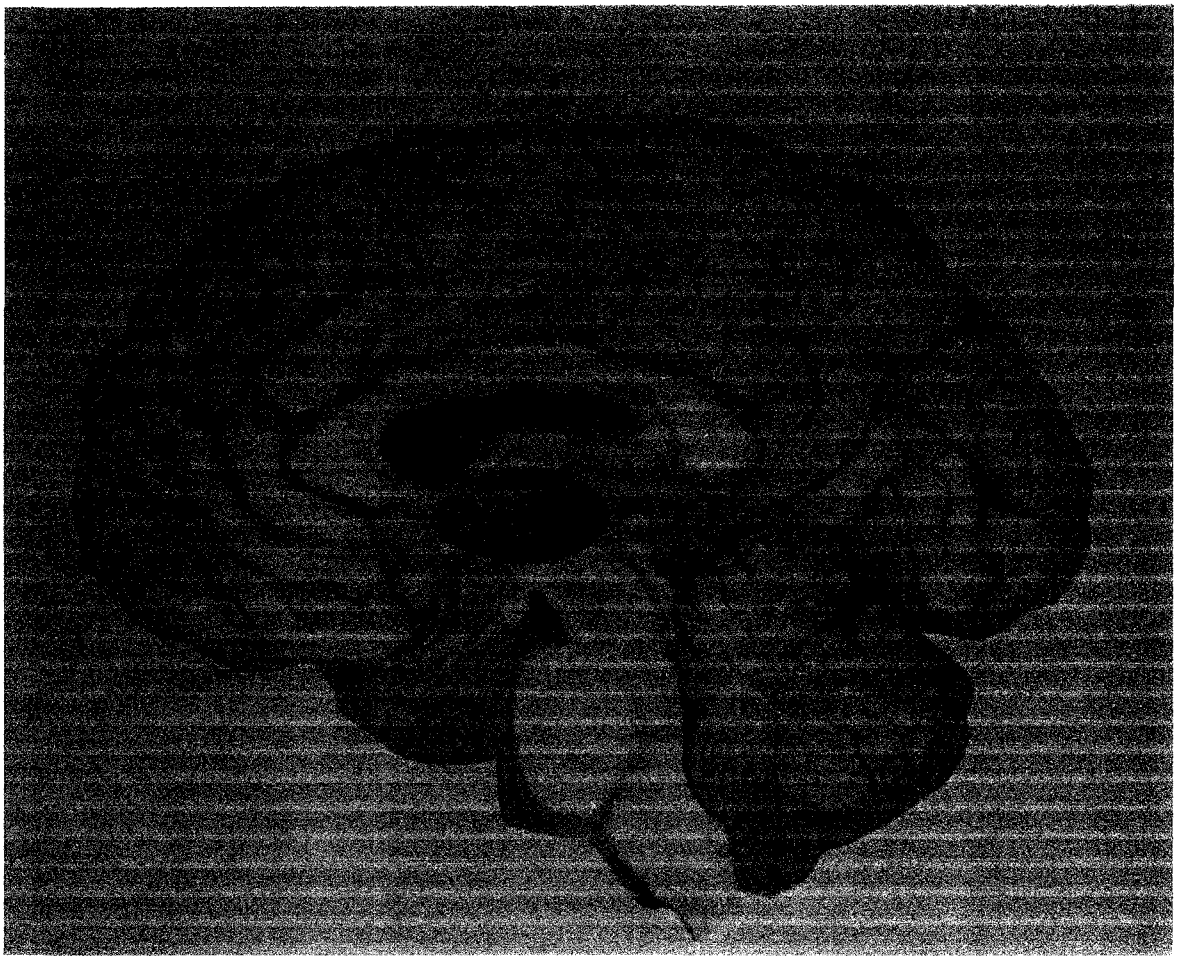
Thalamus



A key component of the diencephalon, the thalamus is considered the major sensory relay station of the brain by most experts in the field. The structures which comprise the thalamus can be grouped anatomically into the medial nuclear group, lateral nuclear group, and anterior nuclear group, plus the internal medullary lamina, intralaminar nuclei, midline thalamic nuclei and thalamic reticular nucleus. I use the acronym "mail mat" to remember these seven structures.

The thalamus can also be divided into three functional units—the relay nuclei, the intralaminar nuclei and the reticular nucleus. Relay nuclei project receive information from the cortex and send information back to it. Intralaminar nuclei receive input predominantly from the basal ganglia. The reticular nucleus receives input only from the thalamic nuclei and the cerebral cortex, then sends it on to various areas of the thalamus.

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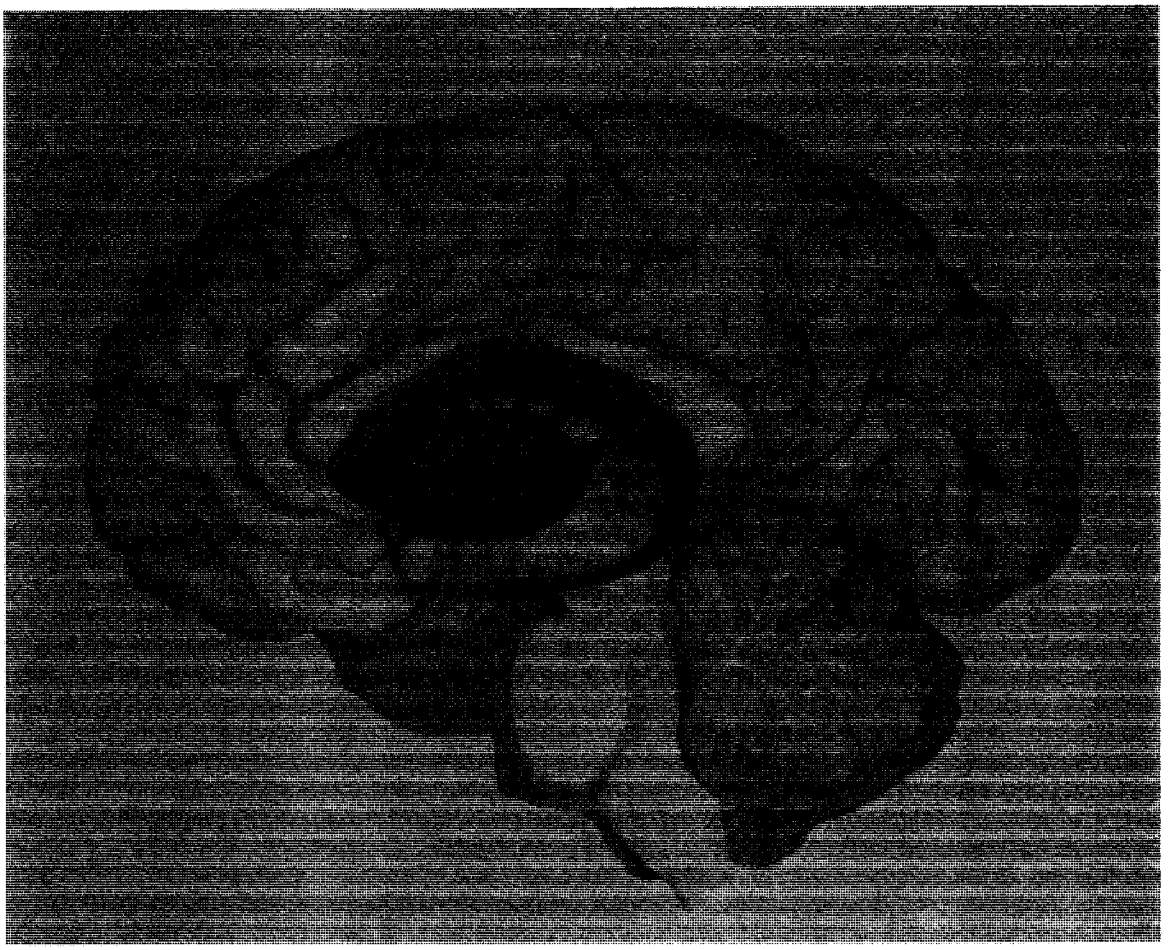
Basal Ganglia



The five neuroanatomical divisions of the basal ganglia (or nuclei) are the (1) putamen, (2) caudate nucleus, (3) subthalamic nucleus, (4) globus pallidus, and (5) substantia nigra. The basal ganglia are white matter structures which play a crucial role in body movement. Damage to these structures can lead to disorders of movement such as hemiballismus, Huntington's disease and Parkinson's disease.

Information arriving at the basal ganglia enters through the putamen and caudate nucleus, structures collectively referred to as the striatum. This information is then sent from the striatum to the substantia nigra and subthalamic nucleus.

Neuropathology

Below is a helpful list of conditions which have required neuropsychological testing to enrich the understanding of the extent of impairment. All underlined names connect to helpful links. For those which are not underlined I recommend using http://www.ninds.nih.gov/disorders/ ***to search for additional information.***

A

Absence of the Septum Pellucidum
Acid Lipase Disease
Acquired Epileptiform Aphasia
Acute Disseminated Encephalomyelitis
Attention Deficit Hyperactivity Disorder
Adie's Syndrome
Adrenoleukodystrophy
Agenesis of the Corpus Callosum
Agnosia

Aicardi Syndrome
AIDS - Neurological Complications
Alcohol-related Cognitive Deficits
Alexander Disease
Alpers' Disease
Alternating Hemiplegia

Amyotrophic Lateral Sclerosis
Anencephaly
Aneurysm
Angelman Syndrome
Angiomatosis
Anoxia
Antiphospholipid Syndrome
Anton's Syndrome

Aphasia - Broca's
Aphasia -Wernicke's
Aphasia - Global
Aphasia - Transcortical Conduction
Aphasia - Mixed Transcortical
Aphasia - Transcortical Motor
Aphasia - Transcortical Sensory
Aphasia - Conduction
Aphasia - Anomic

Apraxia - Melokinetic
Apraxia - Ideomotor
Apraxia - Ideational
Apraxia - Dissociation
Apraxia - Conduction
Apraxia - Conceptual

Arachnoid Cysts
Arachnoiditis
Arnold-Chiari Malformation
Arteriovenous Malformation
Asperger Syndrome

Ataxia - Hereditary
Ataxia - Immune
Ataxia - Infections
Ataxia - Mass Lesion
Ataxia - Paroxysmal
Ataxia - Polyneuropathy
Ataxia - Supratentorial
Ataxia - Systemic
Ataxia - Toxins & Drugs
Ataxia - Trauma
Ataxia - Vascular
Ataxia - Vestibular

Ataxia Telangiectasia
Ataxias and Cerebellar/Spinocerebellar Degeneration
Attention Deficit-Hyperactivity Disorder
Autism
Autonomic Dysfunction

B

Back Pain
Barth Syndrome
Batten Disease
Becker's Myotonia
Behcet's Disease

Bell's Palsy
Benign Essential Blepharospasm
Benign Focal Amyotrophy
Benign Intracranial Hypertension
Bernhardt-Roth Syndrome

Blepharospasm
Bloch-Sulzberger Syndrome
Brachial Plexus Birth Injuries
Brachial Plexus Injuries
Bradbury-Eggleston Syndrome

Brain and Spinal Tumor
Brain Injury
Brown-Sequard Syndrome
Bulbospinal Muscular Atrophy

C

Canavan Disease
Capgras Syndrome
Carpal Tunnel Syndrome
Causalgia
Cavernomas
Cavernous Angioma

Cavernous Malformation
Central Cervical Cord Syndrome
Central Cord Syndrome
Central Pain Syndrome
Central Pontine Myelinolysis

Cephalic Disorders
Ceramidase Deficiency
Cerebellar Degeneration
Cerebellar Hypoplasia
Cerebral Aneurysm

Cerebral Arteriosclerosis
Cerebral Atrophy
Cerebral Beriberi
Cerebral Gigantism
Cerebral Hypoxia

Cerebral Palsy
Cerebro-Oculo-Facio-Skeletal Syndrome
Charcot-Marie-Tooth Disease
Chiari Malformation
Cholesterol Ester Storage Disease

Choreoacanthocytosis
Chronic Inflammatory Demyelinating Polyneuropathy (CIDP)
Chronic Orthostatic Intolerance
Chronic Pain

Cockayne Syndrome Type II
Coffin Lowry Syndrome
COFS
Colpocephaly
Coma and Persistent Vegetative State

Complex Regional Pain Syndrome
Congenital Facial Diplegia
Congenital Myasthenia
Congenital Myopathy
Congenital Vascular Cavernous Malformations

Corticobasal Degeneration
Cranial Arteritis
Craniosynostosis
Creutzfeldt-Jakob Disease
Cumulative Trauma Disorders
Cushing's Syndrome
Cytomegalic Inclusion Body Disease
Cytomegalovirus Infection

D

Dancing Eyes-Dancing Feet Syndrome
Dandy-Walker Syndrome
Dawson Disease
De Morsier's Syndrome
Dejerine-Klumpke Palsy

Dementia - Alzheimer's
Dementia - Lewy Body
Dementia - Multi-Infarct
Dementia - Semantic
Dementia - Subcortical
Dementia - Vascular
Dementia - Parkinsons
Dementia - Korsakoff's
Dementia - Huntington's
Dementia - Pick's
Dementia - Binswangers
Dementia - Frontotemporal
Dementia - Pugilistica
Dementia - Frontal Lobe Type
Dialysis Encephalopathy Syndrome

Dentate Cerebellar Ataxia
Dentatorubral Atrophy
Dermatomyositis
Developmental Dyspraxia

Devic's Syndrome
Diabetic Neuropathy
Diffuse Sclerosis
Dysarthria - Spastic
Dysarthria - Flaccid
Dysarthria - Hyperkinetic
Dysarthria - Hypokinetic
Dysarthria - Ataxic
Dysarthria - Mixed
Dysautonomia
Dysgraphia

Dyslexia - Acquired
Dyslexia - Developmental
Dysphagia
Dyspraxia
Dyssynergia Cerebellaris Myoclonica
Dyssynergia Cerebellaris Progressiva
Dyskinesia
Dystonias

E

Early Infantile Epileptic Encephalopathy
Empty Sella Syndrome
Encephalitis
Encephalitis Lethargica
Encephaloceles
Encephalopathy
Encephalotrigeminal Angiomatosis

Epilepsy
Epidural Hematoma
Erb-Duchenne and Dejerine-Klumpke Palsies
Erb's Palsy
Essential Tremor
Extrapontine Myelinolysis

F

Fabry's Disease
Fahr's Syndrome
Familial Dysautonomia
Familial Hemangioma
Familial Idiopathic Basal Ganglia Calcification
Familial Periodic Paralyses

Familial Spastic Paralysis
Farber's Disease
Febrile Seizures
Fisher Syndrome
Floppy Infant Syndrome
Friedreich's Ataxia

G

Gangliosidoses
Ganser's Syndrome
Gaucher's Disease
Gerstmann's Syndrome
Gerstmann-Straussler-Scheinker Disease
Giant Cell Arteritis

Giant Cell Inclusion Disease
Glioblastoma Multiforme
Globoid Cell Leukodystrophy
Glossopharyngeal Neuralgia
Guillain-Barre Syndrome

H

Hallervorden-Spatz Disease
Head Injury
Headache
Hemicrania Continua
Hemifacial Spasm

Hemiplegia Alterans
Hereditary Neuropathies
Hereditary Spastic Paraplegia
Heredopathia Atactica Polyneuritiformis
Herpes Zoster

Herpes Zoster Oticus
Hirayama Syndrome
Holmes-Adie syndrome
Holoprosencephaly
HTLV-1 Associated Myelopathy

Hughes Syndrome
Hydranencephaly

Hydrocephalus - Acquired
Hydrocephalus - Congenital
Hydrocephalus - Normal Pressure
Hydrocephalus - Communicating
Hydrocephalus - Non-communicating
Hydrocephalus - Ex-vacuo

Hydromyelia
Hypercortisolism
Hypersomnia
Hypertonia
Hypotonia
Hypoxia

I

Immune-Mediated Encephalomyelitis
Inclusion Body Myositis
Incontinentia Pigmenti
Infantile Hypotonia
Infantile Neuroaxonal Dystrophy

Infantile Phytanic Acid Storage Disease
Infantile Refsum Disease
Infantile Spasms
Inflammatory Myopathy
Iniencephaly

Intestinal Lipodystrophy
Intracranial Cysts
Intracranial Hypertension
Isaac's Syndrome

J

Joubert Syndrome

K

Kearns-Sayre Syndrome
Kennedy's Disease
Kinsbourne syndrome
Kleine-Levin Syndrome
Klippel-Feil Syndrome

Klippel-Trenaunay Syndrome (KTS)
Klüver-Bucy Syndrome
Korsakoff's Amnesic Syndrome
Krabbe Disease
Kugelberg-Welander Disease
Kuru

L

Lambert-Eaton Myasthenic Syndrome
Landau-Kleffner Syndrome (acquired epileptiform aphasia)
Lateral Femoral Cutaneous Nerve Entrapment
Lateral Medullary Syndrome
Learning Disabilities

Leigh's Disease
Lennox-Gastaut Syndrome
Lesch-Nyhan Syndrome
Leukodystrophy
Levine-Critchley Syndrome

Lipid Storage Diseases
Lissencephaly
Locked-In Syndrome
Lou Gehrig's Disease

Lupus - Neurological Sequelae
Lyme Disease - Neurological Complications

M

Machado-Joseph Disease
Macrencephaly
Megalencephaly
Melkersson-Rosenthal Syndrome
Meningitis

Meningitis and Encephalitis
Menkes Disease
Meralgia Paresthetica
Metachromatic Leukodystrophy
Microcephaly

Migraine
Miller Fisher Syndrome
Mitochondrial Myopathies

Mobius Syndrome

Monomelic Amyotrophy
Motor Neuron Diseases
Moyamoya Disease
Mucolipidoses
Mucopolysaccharidoses

Multifocal Motor Neuropathy
Multiple Sclerosis
Multiple System Atrophy
Multiple System Atrophy with Orthostatic Hypotension

Muscular Dystrophy
Myasthenia - Congenital
Myasthenia Gravis
Myelinoclastic Diffuse Sclerosis
Myoclonic Encephalopathy of Infants

Myoclonus
Myopathy
Myopathy - Congenital
Myopathy - Thyrotoxic
Myotonia
Myotonia Congenita

N

Narcolepsy
Neuroacanthocytosis
Neurodegeneration with Brain Iron Accumulation
Neurofibromatosis
Neuroleptic Malignant Syndrome

Neurological Complications of AIDS
Neurological Complications Of Lyme Disease
Neurological Consequences of Cytomegalovirus Infection
Neurological Manifestations of Pompe Disease
Neurological Sequelae Of Lupus

Neuromyelitis Optica
Neuromyotonia
Neuronal Ceroid Lipofuscinosis
Neuronal Migration Disorders
Neuropathy - Hereditary

Neurosarcoidosis
Neurotoxicity
Nevus Cavernosus
Niemann-Pick Disease
Normal Pressure Hydrocephalus

O

Occipital Neuralgia
Occult Spinal Dysraphism Sequence
Ohtahara Syndrome
Olivopontocerebellar Atrophy
Opsoclonus Myoclonus

Orthostatic Hypotension
O'Sullivan-McLeod Syndrome
Overuse Syndrome

P

Pain - Chronic
Pantothenate Kinase-Associated Neurodegeneration
Paraneoplastic Syndromes
Paresthesia

Paroxysmal Choreoathetosis
Paroxysmal Hemicrania
Parry-Romberg
Pelizaeus-Merzbacher Disease
Pena Shokeir II Syndrome

Perineural Cysts
Periodic Paralyses
Peripheral Neuropathy
Periventricular Leukomalacia
Persistent Vegetative State

Pervasive Developmental Disorders
Phytanic Acid Storage DiseasePinched Nerve
Piriformis Syndrome

Pituitary Tumors
Polymyositis
Pompe Disease
Porencephaly
Postherpetic Neuralgia

Postinfectious Encephalomyelitis
Post-Polio Syndrome
Postural Hypotension
Postural Orthostatic Tachycardia Syndrome
Postural Tachycardia Syndrome

Primary Dentatum Atrophy
Primary Lateral Sclerosis
Primary Progressive Aphasia
Progressive Hemifacial Atrophy

Progressive Locomotor Ataxia
Progressive Multifocal Leukoencephalopathy
Progressive Sclerosing Poliodystrophy
Progressive Supranuclear Palsy
Prosopagnosia
Pseudotumor Cerebri

R

Ramsay Hunt Syndrome I (formerly known as)
Ramsay Hunt Syndrome II (formerly known as)
Rasmussen's Encephalitis
Reflex Sympathetic Dystrophy Syndrome

Refsum Disease
Refsum Disease - Infantile
Repetitive Motion Disorders
Repetitive Stress Injuries
Restless Legs Syndrome
Retrovirus-Associated Myelopathy

Rett Syndrome
Reye's Syndrome
Rheumatic Encephalitis
Riley-Day Syndrome

S

Sacral Nerve Root Cysts
Saint Vitus Dance
Salivary Gland Disease
Sandhoff Disease
Schilder's Disease

Schizencephaly
Seitelberger Disease
Seizure Disorder
Septo-Optic Dysplasia

Shaken Baby Syndrome
Shingles
Shy-Drager Syndrome
Sjogren's Syndrome
Sleep Apnea

Sleeping Sickness
Sotos Syndrome
Spasticity
Spina Bifida
Spinal Cord Infarction

Spinal Cord Injury
Spinal Cord Tumors
Spinal Muscular Atrophy
Spinocerebellar Atrophy
Spinocerebellar Degeneration

Status Epilepticus
Steele-Richardson-Olszewski Syndrome
Stiff-Person Syndrome
Striatonigral Degeneration
Stroke
Sturge-Weber Syndrome

Subacute Sclerosing Panencephalitis
Subcortical Arteriosclerotic Encephalopathy
SUNCT Headache
Swallowing Disorders
Sydenham Chorea

Syncope
Syphilitic Spinal Sclerosis
Syringohydromyelia
Syringomyelia
Systemic Lupus Erythematosus

T

Tabes Dorsalis
Tardive Dyskinesia
Tarlov Cysts
Tay-Sachs Disease
Temporal Arteritis
Tethered Spinal Cord Syndrome
Thomsen's Myotonia
Thoracic Outlet Syndrome
Thyrotoxic Myopathy
Tic Douloureux

Todd's Paralysis
Tourette Syndrome
Transient Ischemic Attack (Mini-stroke)
Transmissible Spongiform Encephalopathies
Transverse Myelitis
Traumatic Brain Injury
Tremor
Trigeminal Neuralgia
Tropical Spastic Paraparesis
Tuberous Sclerosis

V

Vascular Erectile Tumor
Vasculitis including Temporal Arteritis
Von Economo's Disease
Von Hippel-Lindau Disease (VHL)
Von Recklinghausen's Disease

W

Wallenberg's Syndrome
Werdnig-Hoffman Disease
Wernicke-Korsakoff Syndrome
West Syndrome
Whiplash

Whipple's Disease
Williams Syndrome
Wilson's Disease
Wolman's Disease

X

X-Linked Spinal and Bulbar Muscular Atrophy

Z

Zellweger Syndrome

Assessment

Cognitive Domains

Assessment Tools

Test Norms

Sample Template

There are many styles of report writing in use by neuropsychologists. Some prefer to use a template they have devised and type in data during or after the interview. Others prefer to dictate reports orally and have them transcribed. There is also a program called Shortkeys which relies on typed codes that produce entire paragraphs which can be tailored to the client at hand.

Cognitive Domains

1) Academic Skills

2) Attention Deployment

Arousal
Sustained Attention

3) Attention Encoding

Span of Attention
Resistance to Interference
Mental Manipulation
Divided Attention

4) Executive Functions, Problem-Solving Skills, Reasoning Abilities

Planning
Flexibility of Thinking
Reasoning

5) Language Comprehension

Single-Word
Complex

6) Language Production

Naming
Single-Word
Complex

7) Arithmetic Skills

8) Visuospatial Skills

Perception
Construction

9) Learning/Memory

Verbal
Visual
Motor

10) Sensorimotor Functioning

Common Assessment Tools

Auditory Consonant Trigrams (ACT)
This tool is used to test levels of memory and attention. The client listens to a string of three consonants (the consonant trigram) immediately followed by a mental task such as counting backwards. After that task, the client is asked to recall the trigram. Research suggests that this tool measures left-hemisphere divided attention and working memory, with poor performance associated with disturbances in that hemisphere. This test has been normed for individuals between the ages of 16 and 69.

Bender Visual Motor Gestalt Test
This test evaluates visual-perceptual and visual-motor functioning, yielding possible signs of brain dysfunction. Although used to assess emotional problems and developmental maturity in the past, it is not highly regarded for these purposes now.

Boston Diagnostic Aphasia Examination **(BDAE)**
This is a comprehensive battery of language skills in adults, and is often administered by speech pathologists.

Boston Naming Test (BNT)
There are currently several versions of this test on the market. Each consists of pen-and-ink drawings of common objects which the patient is instructed to name. When the patient is unable to name the objects, semantic and then phonemic cues are given. One version of this test also includes a recognition trial. This is a very popular and highly useful test of word-finding ability and is part of the Boston Diagnostic Aphasia Examination but often used separately. This test can be used to assist in determining the location of brain lesions.

The b Test
This test is used to assess level of effort in patients age seventeen and older. The test taker is instructed to scan stimulus materials and correctly cross out all of the b's without making any mistakes of commission or omission.

Beck Anxiety Inventory (BAI)
This is a 21-item self-report inventory designed to measure levels of anxiety.

Beck Depression Inventory (BDI)
This is a 21-item self-report inventory designed to measure levels of depression.

California Verbal Learning Test (CVLT)
This test is comprised of a word-list which is used to assess multi-trial learning, serial-position information, semantic organization, and other aspects of verbal learning and recall. It is similar to the Rey Auditory Verbal Learning Test but offers normative data for semantic organization and other aspects of verbal memory, as well as a forced-recognition trial which can be used to assess malingering.

Cognitive Symptom Checklist (CSC)
This instrument is a self-report inventory which assesses the level of *self-perceived* cognitive impairment in both adolescents and adults.

Controlled Oral Word Association Test (COWAT)
This is a test of verbal fluency in which the patient is asked to generate as many words as possible which begin with three specified letters, as well as the names of as many animals as possible, within specified time limits.

Cognistat (The Neurobehavioral Cognitive Status Examination)
This is a quick neuropsychological screening test which examines language, memory, arithmetic, attention, judgment, and reasoning. It can be administered in under 10 minutes.

Clock Drawing Task
This is a screening tool used to detect visuospatial perception and construction deficits. The client is instructed to draw the face of an analog clock with numbers in the appropriate positions, then to place the hands to indicate a given time. It also yields information about the client's planning and organization strategies.

d2 Test of Attention
This test measures concentration and selective attention. The test taker is instructed to scan pages and identify target stimuli, in this case d's.

Delis-Kaplan Executive Function System (D-KEFS)
This battery of subtests is designed to assess both verbal and nonverbal executive functioning.

Digit Vigilance Test (DVT)
This is a test of visual scanning and tracking skills, concentration and processing speed. The patient is required to sequentially scan a large array of numbers, row by row, and draw a slash through the number which the administrator has specified.

Halstead-Reitan Neuropsychological Battery (HRNB)
This is a powerful fixed battery that measures performance across neurocognitive domains to generate information about the localization, lateralization, severity and progressiveness of brain injury and impairment. Many neuropsychologists consider this test the gold standard of neuropsychological batteries. It requires extensive and specialized study to learn and takes nearly six hours to administer. Subtests include Tactual Performance, Finger-tapping, Speech Sounds Perception, Seashore Rhythm, Trails A and B, Strength of Grip, Sensory Perception, Tactile Finger Localization, Fingertip Number Writing, Tactile Form Recognition, and Aphasia Screening. Note that Trails is widely used independently of the larger battery. (See the powerpoint on this website for more information.)

Kaplan Baycrest Neurocognitive Assessment (KBNA)
This is a concise fixed battery which can be administered in as little as an hour and a half. It provides a wide range of information on functioning in most neurocognitive domains.

Luria-Nebraska Neuropsychological Battery (LNNB)
This battery was designed to assess all neuropsychological domains in terms of Luria's understanding of cognitive functioning, and uses pattern analysis to infer cognitive strengths and weaknesses.

Malingering Tests
Many tests have been devised to identify performance patterns characterized by insufficient effort, suggesting possible attempts to fake impairment for personal gain. These tests are not generally available to the public.

Minnesota Multiphasic Personality Inventory (MMPI and MMPI-2, MAPI)
This is a clinical personality assessment tool designed to assess emotional functioning and psychopathology. An older test, some of its constructs (e.g., "psychaesthenia" and "hysteria") are no longer regarded as valid, but a great body of research and reinterpretation has led to its continued usefulness for many practitioners.

Memory Assessment Scales (MAS)
This is a comprehensive fixed battery which can be used to measure both verbal and visual memory encoding and retention. It consists of 12 subtests used to measure list learning, verbal span, prose memory, verbal span, visual recognition, visual reproduction and memory for names and faces.

Millon Clinical Multiaxial Inventory (MCMI)
This self-report inventory is highly sensitive to personality disorders as understood by its author, Theodore Millon.

Multilingual Aphasia Examination (MAE)
This brief battery is used to measure receptive and expressive language skills. Areas of assessment include oral expression, sentence repetition and verbal associative, spelling and articulation.

North American Reading Test (NART)
This reading test is most commonly used to establish a client's level of premorbid intelligence, given that vocabulary is widely considered to have the strongest correlation with IQ.

Quick Neurological Screening Test
This is a brief neurological assessment used to identify motor, sensory, and perceptual impairments.

Paced Auditory Serial Attention Test (PASAT)
This test of divided and rapid attention requires the patient to attend carefully numbers which are spoken rapidly by a recorded administrator. Cassette and computer forms of this test are available, each with separate norms.

Repeatable Battery for the Assessment of Neuropsychological Status (RBANS)
Designed as a brief, repeatable measure of cognitive impairment, this battery includes two forms.

Rey Auditory Verbal Learning Test (RAVLT)
This test evaluates the client's ability to learn a list of fifteen unrelated words. The list is presented more than once to provide evidence of learning over time. A distractor list is used to gain information about proactive and retroactive interference. Short- and long-delay recall trials are used to assess longer-term retrieval, and a recognition trial offers information about encoding vs. retrieval. It has also been used as an indicator of possible malingering.

Rey 15-item Memory Test (RFIT)
This simple memory test is used as a measure of possible malingering.

Rey-Osterrieth Complex Figure Test (ROCF)
This test of visual-spatial and visual memory skills requires the client first to copy a complex geometric design, then to reproduce it from memory, both immediately and after a delay. One version of the test includes a delayed recognition trial.

Symptom Checklist 90 (SCL-90)
This self-report inventory is used to evaluate the client's subjective complaints.

Stroop Color-Word Test (Stroop)
This test measures word-reading and color-naming speed, as well as a client's ability to inhibit reading in favor of ink-color naming when words are printed in colors different from those spelled out.

Test of Memory Malingering (TOMM)
This test of visual learning and forced-choice recall is widely used to evaluate possible memory malingering.

Tower of London
This test of three-dimensional visuospatial planning and problem-solving is part of the D-KEFS, but is also available in other forms under other names.

Trail-Making Tests A and B (Trails)
These tests measure visual scanning, motor tracking, numerical and alphabetic sequencing, and the ability to switch mental sets. Trails B was once a government test which is now part of the Halstead-Reitan Battery. It has also been published in other forms (e.g., as part of the D-KEFS) with their own norms. Some consider this test the most sensitive single measure of cognitive impairment.

Verbal (Word) Fluency Tests
These tests, which occur independently and as part of larger batteries, measure a client's ability to quickly retrieve words by sound (e.g., initial letter) and/or by category.

Wechsler Adult Intelligence Scale (WAIS)
This battery is one of the most widely used measures of psychometric intelligence, and is now in its third version (WAIS-III). It consists of 13 subtests which measure both verbal and "performance" (largely visuospatial) intelligence, as well as working memory and processing speed. Age and gender norms are provided in the scoring manual while additional racial age norms have been published in neuropsychological journals.

Wechsler Memory Scale (WMS)
This battery consists of 13 subtests which measure various aspects of verbal and visual memory. It provides a fairly comprehensive assessment of memory and is co-normed with the WAIS-III, leading to these two tests often being administered together. The WMS is the more purely neuropsychological of the Wechsler scales. It consists of sub-scales for Information and Orientation, Logical Memory, Memory for Faces, Verbal Paired Associates, Family Pictures, Word Lists, Visual Reproduction, Letter-Number Sequencing, Spatial Span, Mental Control and Several Recognition Trials.

Wechsler Test of Adult Reading (WTAR)
This test uses reading skill level to estimate pre-morbid intellectual functioning, and is thus comparable to the NART (see above).

Wide Range Achievement Test (WRAT)
This commonly used test of reading, spelling, and written arithmetic skills, now in its fourth version (WRAT4), is often administered with the WAIS-III to obtain information about intelligence vs. academic achievement, the same information obtained with the Woodcock-Johnson.

Wisconsin Card Sort Test (WCST)
This test requires the client to discern the rules governing the sequential appearance of symbols of different shapes, colors and numbers, rules which change over time. It measures attention, analytic skill and concept-formation, and is considered one of the more difficult executive function tests.

Woodcock-Johnson
This test measures both cognitive performance and achievement such as intellectual ability, specific cognitive abilities, scholastic aptitude, oral language and academic achievement. It is commonly used to diagnose learning disabilities.

Word Memory Test (WMT)
This test is used as a measure of possible malingering.

Test Norms

Norm selection is an essential component of an assessment. All valid test instruments provide norms which are stratified by age, gender, level of education, race/ethnicity, and/or other criteria in their administrator's manuals. If a test comes into common usage, other researchers may produce additional sets of norms for different groups, such as the elderly. These norms are made available in neuropsychology journals (see journals) and books. Over time, different sets of norms may be combined to produce meta-analyses.

The following template was created by Gregg Richardson, PhD, of the Behavioral Medicine department at Kaiser Hospital, Oakland, California. It contains phrases intended to prompt the report-writer to ask all pertinent questions during interview and cover all pertinent information in the sections following Tests Administered. Note that this template is designed for use with the tests listed, and would need modification if other tests are used.

NEUROPSYCHOLOGICAL ASSESSMENT REPORT

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Patient Name: **MR:**

Date of Testing: **Examiner:**

Referral: The patient, a -year-old, -handed, -born [occupation] of descent, is referred by for evaluation of .

HPI: The patient reports that

(S)he usually awakens am, arises, nap during the day, is usually in bed , asleep, the night. he reports a appetite, has lost or gained significant weight over the past year, appear either obese or undernourished . Daily mental and physical energy are. exercise

he lives with in their home of years. live in the area and see h. he socializes with friends.

Personal History: The patient reports that he was born on in. To the best of h knowledge h mother's pregnancy and delivery were without complication, and he achieved normal developmental milestones. H schooling started and progressed normally; a student, he also extracurricular activities. After graduating from high school he. he married children

Family History: The patient reports that h father () h mother (). siblings. psychiatric, neurological, substance abuse.

Medical History: The patient reports no unusual illness or injury as a child or teen.

Scans

Current medications include .

supplements, herbs or alternative medications

he reports psychotherapy.

substance abuse.

Test Behavior: The patient appeared on time, dressed and groomed, and was with the examiner. he described h mood as "" and displayed an appropriate range of affect using vocal tone, facial expression, and body language. he was aware of the purpose of testing and expressed interest in learning the results. he exerted full effort on all tests, and this set of results is considered valid.

Tests Administered: Kaplan Baycrest Neurocognitive Assessment (KBNA)
Learning and Memory Battery (LAMB) – Taylor Figure
Clock Drawing
Trails A and B (HRNB)
Go/No-Go and Three-Position Hand Sequence
Stroop Color and Word Test
Patient Health Questionnaire (PHQ-9)

Attention/Concentration: The patient [e.g., was WNL] in this domain. he was oriented, able to perform a variety of rote and novel mental sequencing tasks with accuracy (%ile overall), and to complete a variety of verbal and visuospatial tasks—all without evidence of impersistence or of significant internal or external distractibility.

Processing Speed: The patient in this area. Mental sequencing tasks were performed in of the time allotted. Trails A was at the %ile, and Trails B at the %ile. fluency. primary Stroop scores were . he performed at adequate speed on untimed tasks.

Language: The patient in this domain. he spoke fluently in conversation, with good prosody, and without paraphasias or significant problems finding words. H oral description of a situation picture employed adequate phrase length and grammar, and provided adequate descriptions of essential persons, actions, implied relationships, and implied prior and future events. he had no difficulty following instructions and formal auditory comprehension was without error. repetitions . Confrontation naming was. Phonemic fluency was at the %ile, and semantic fluency at the %ile. Single-word reading was WNL for regular, irregular and pseudowords, and sentence-reading . he was able to perform both of the arithmetic calculations described in the readings quickly and accurately.

Visuospatial: The patient in this domain. H direct copy of a complex figure displayed strategy, size, proportion, placement of detail, precision. A freehand clock drawing displayed good strategy, an accurate setting, proportionally spaced numbers, and clear differentiation of hand lengths. he had no difficulty reading clocks with or without numbers. On the situation picture, he clearly perceived a single scene with three areas of activity.

Motor: The patient in this domain. he neither reported nor displayed problems with gait or balance. Handwriting and drawings suggested no tremor or other manual dyscontrol, and he displayed no disinhibition on a go/no-go task. he had no difficulty learning a sequence of three hand-positions and transferring this sequence to h non-dominant

hand. he had no difficulty learning a pattern of bilateral, simultaneously alternating hand positions. Manual ideomotor praxis was intact bilaterally for intransitive and transitive tasks, and buccofacial praxis for tasks and emotional expression.

Executive Functions: The patient in this domain. he had no difficulty initiating, continuing, or terminating tasks appropriately. Complex figure and clock drawings displayed immediate and consistent awareness of the larger gestalts organizing the figures, and he used semantic clustering when learning a word list. Neither Trails task contained errors in sequencing or set-switching. Judgment in hypothetical emergencies was sound. H ability to discern different sets of visual objects from within the same larger group was WNL. H ability to inhibit an overlearned response when a novel one was required (Stroop interference) was at the %ile, word-reading and color-naming.

Memory: The patient in this domain in the verbal and visual modalit. Motor learning (see above) was based on limited testing.

Total recall over four learning trials of a word-list was at the %ile, with repetitions intrusions; h learning slope () and use of semantic clustering (). Delayed free recall was % of trial-four recall (/), and delayed cued recall /; neither delayed trial included repetitions or intrusions, and overall delayed recall (hits) was at the %ile. Yes/No recognition memory for the word list was , including /12 hits and /24 false positives.

Trial-one recall for the complex figure was at the %ile, trial-four recall at the %ile, and delayed recall at the %ile. Recognition memory for drawings used earlier in the naming task included /20 hits and /20 false positives ().

Emotional Factors: The patient reports. Responses to the PHQ-9 included , suggesting

Summary and Conclusions: The patient, a -year-old

Discussion: The patient's overall history, presentation and test results suggest

Plan: Results discussed with patient. Copy to .

[Examiner], [Ph.D.]
[Clinical Neuropsychology]

Neuropsychology Links

Great Websites

Journals

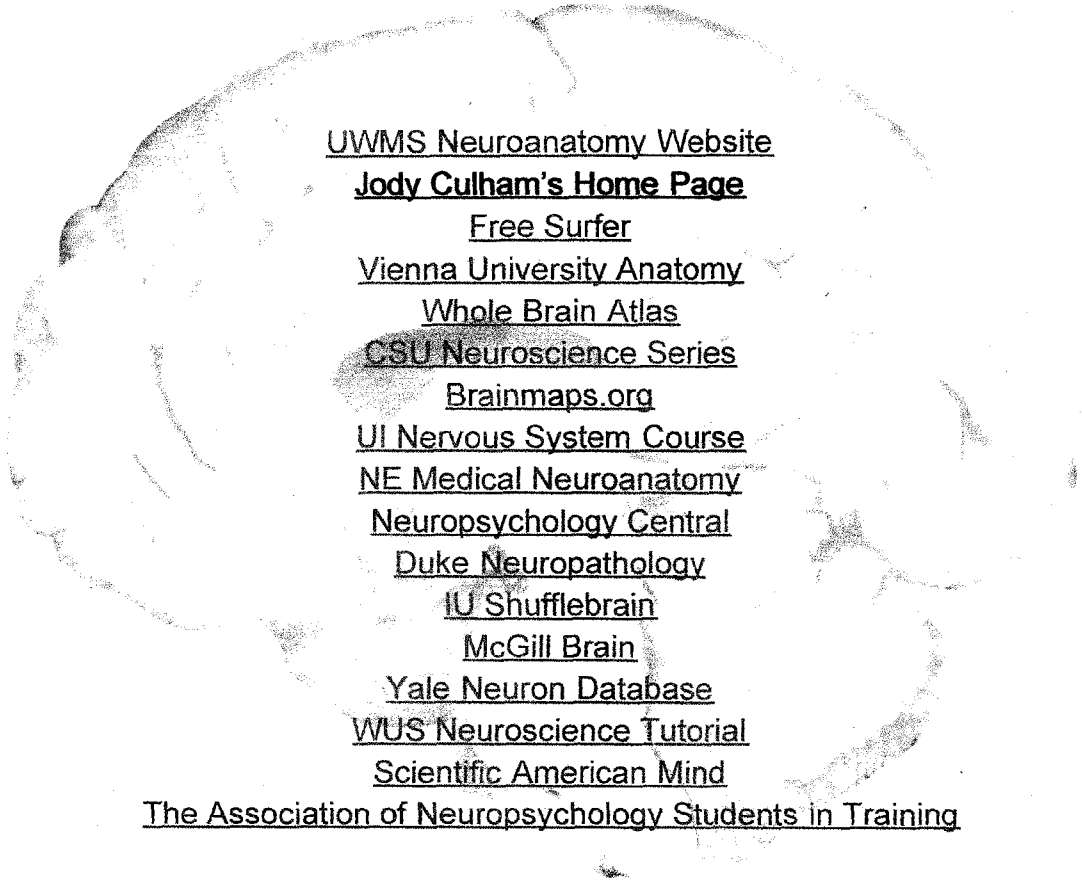
Organizations

Training Sites

Thesaurus

The last two items above, Training Sites and Thesaurus, are websites and will not be printed out for this paper version of the dissertation.

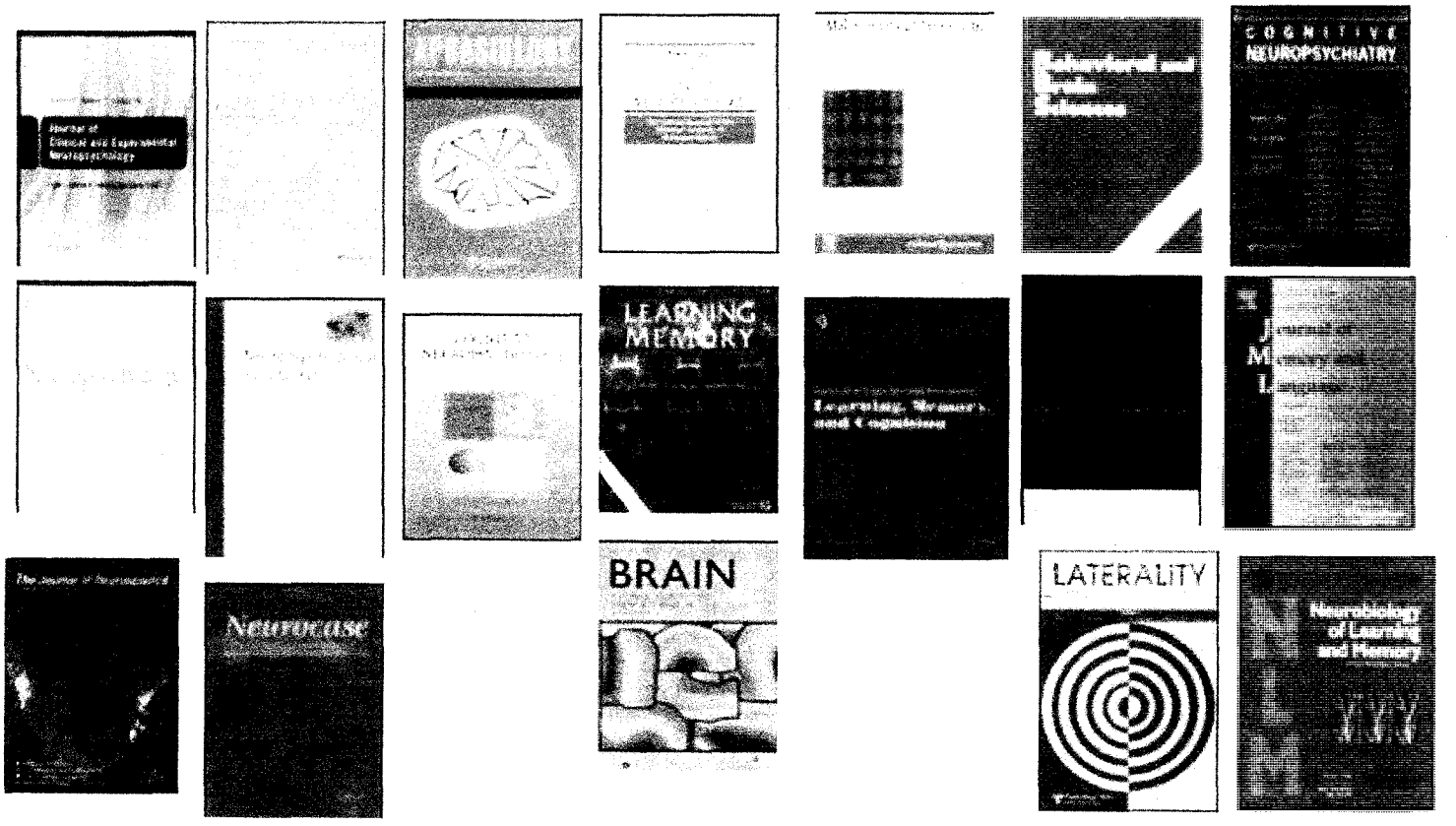
Great Websites



UWMS Neuroanatomy Website
Jody Culham's Home Page
Free Surfer
Vienna University Anatomy
Whole Brain Atlas
CSU Neuroscience Series
Brainmaps.org
UI Nervous System Course
NE Medical Neuroanatomy
Neuropsychology Central
Duke Neuropathology
IU Shufflebrain
McGill Brain
Yale Neuron Database
WUS Neuroscience Tutorial
Scientific American Mind
The Association of Neuropsychology Students in Training

Neuropsychology Journals

The journals which appear below are some of the more popular ones used by neuropsychologists. Many of them are offered online for a small subscription fee. Some of them are free. They are also available in bound form and mailed to the subscriber. If you click on one of these journal covers, you will be linked to the corresponding website.



Organizations

American Academy of Neurology
American Academy of Clinical Neuropsychology
The American Board of Clinical Neuropsychology (ABCN)
American Board of Professional Neuropsychology
American Psychological Association Division (40) Clinical Neuropsychology
American Society of Neuroradiology
Association of Postdoctoral Programs in Clincal Neuropsychology (APPCN)
Brain Injury Association
British Association of Cognitive Neuroscience
The Charles A. Dana Foundation
European College of Neuropharmocology
International Society of Behavioral Medicine
International Society for Neural Regulation
The International Neuropsychology Society
National Academy of Neuropsychology
New York Neuropsychology Group
Northern California Neuropsychology Forum
National Institute of Neurological Disorders and Stroke
Society for Behavioral Endocrinology
Society for Neuroscience

Coursework

Powerpoints

Syllabi

Powerpoint Presentations

Mental Status Examination

Halstead-Reitan Overview

I would like to acknowledge Richard L Strub and F. William Black for their enlightening pulication, The Mental Status Examination in Neurology (4th Edition), which was used in the construction of my powerpoint titled Mental Status Examination.

The two PowerPoint presentations above are lengthy and designed for classroom use. They are not reproduced for this paper version of the dissertation.

Course Syllabi

Syllabus I

Syllabus II

Syllabus III

The syllabi above are for the Wright Institute's three-trimester course, Advanced Assessment: Neuropsychological, and are available to students in updated form on the website.

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(This list includes both general references used in the development of this site and websites not listed under Great Websites or Organizations.)

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