Hemorrhages Result From:
- ______________________
- Hypertension
- Structural defects in blood vessels
- ______________________
- Exposure to toxins

John Olney and “Excitotoxicity”
- Observed damage following stroke is not consistent with the idea that cells die due to oxygen and ______________________
  - One would expect that a deprived brain would uniformly have damage
  - Damage more often found in certain areas, typically in the middle of the cortex

New Theory of Brain Damage
- Olney suggested that excess glutamate following stroke is responsible for damage
  - Neurons may swell and burst
  - Calcium moves into neuron, possibly ______________________
  - Interactions with NO may damage neurons

Chronic Traumatic Brain Injury (CTBI)
- Repeated concussions may produce:
  - ______________________
  - Memory and personality changes
- ______________________
- The APOE4 gene, implicated in Alzheimer’s, may influence CTBI

Brain Tumors
- Tumors do not arise from ______________________, which do not typically replicate
- Tumors do arise from glia and the tissues of the meninges
- Infiltrating (malignant) tumors lack defined boundaries
  - Usually return after surgical removal
  - Often shed cells or metastasize
- ______________________ (benign) tumors rarely reoccur after surgery or metastasize

Symptoms of Tumors
- General symptoms occur due to displacement and ______________________
  - Headache, vomiting, seizures, double vision, reduced heart rate, reduced alertness
• ________________ symptoms relate to the location of the tumor (e.g., occipital tumors affect vision)

Types of Tumors
• ________________ (from Glial cells) range in severity
  – Astrocytomas
  – Medulloblastomas
• ________________ (from meninges) are usually benign

Treatment for Tumors
• Surgical Removal
• Chemotherapy
  – ________________
    – Reduces the blood vessels that serve the tumor
    – Kills the tumor by starving it of nutrients

Epilepsy
• ________________ originate in an identifiable part of the brain and then spread outward
  • Generalized seizures symmetrically affect both sides of the brain and do not appear to have a focus or clear point of origin

Characteristics of Partial Seizures
• Simple partial seizures cause movements or sensations appropriate to the location of the starting point, or focus, of the seizure activity
  – little change in ______________________________
  – Jacksonian seizure: starts in one place, and gradually can spread to close areas
  • Starts in finger and spreads throughout the hand

Characteristics of Partial Seizures
• Complex partial seizures normally begin in the ____________________ and are associated with alterations in consciousness
  – memory loss and confusion
  – sense that environment is either very familiar or foreign

Characteristics of Generalized Seizures
• ________________ seizures
  – Cycling of tonic and clonic phases followed by coma
• ________________ seizures
  – Loss of consciousness, but patient doesn’t fall over
  – 3/sec spike and wave pattern

Causes of Epilepsy
• Partial Seizures:
  — Paroxysmal depolarizing shift (PDS)
• Large abrupt depolarization of affected neurons
  • Triggers a train of _______________________________
  • Followed by a period of hyperpolarization
  • ______________________________ overwhelms the GABA-inhibitory system and high
    frequency action potentials begin to occur

Causes of Epilepsy
• ________________________________:
  — Rhythmic activation connection between the thalamus and the cortex

Treatments for Epilepsy
• Effective medications are usually ____________________________
• Surgery may be used to remove seizure focus or restrict seizures to one hemisphere
• In children, ketogenic (heavy in fat, low in sugar) diets may be useful

Neurocysticercosis (Brain Worms)
• Infection with the pork tapeworm
• When encysted worm dies, the immune response initiates focal seizures
• Treatments include ________________________________ , surgery and antiworm
  medication

Brain Infections
• __________________________ (e.g., West Nile virus) is an inflammation of the brain caused
  by viral infection
• Meningitis is inflammation of the meninges, resulting from infection by bacteria, viruses
  or fungi
• __________________________ is caused by viruses transmitted by ticks

AIDS Dementia Complex (ADC)
• Causes:
  — Direct action of __________________________
  — Indirect results of opportunistic infections
• Affects ___________________________, cognition and movement
• Treated with antiretroviral medications

Transmissible Spongiform Encephalopathies (TSEs)
• Psychological disturbances:
  — __________________________
  — Anxiety
- Progressive loss of cognition
- Motor disturbances
- Death

Types of TSEs
- ____________________ (sheep)
- Bovine spongiform encephalopathy (BSE or “mad cow”; cattle)
- Creutzfeldt-Jakob disease (humans)
- ____________________ (humans)
- New variant Creutzfeldt-Jakob disease (vCJD; humans)

What Causes TSEs?
- TSE infectious agents differed from viruses:
  - lack of inflammation
  - immunity to hospital sterilization techniques
- Prusiner isolated abnormal proteins called “prions”

Prions
- ____________________ encoded by genes
- Uninfected animals encode the protein, but if they have the TSE, the protein is folded differently
- Can be genetically inherited or incorporated through the digestion of the

Migraine Headaches
- Symptoms include excruciating pain, an aura, nausea and vomiting
- Brainstem “_________________________” may be responsible:
  - Possibly the Raphe nuclei
  - Serotonin levels are low at the onset of a headache
  - CGRP is released by the trigeminal nerve (V), leading to dilation of blood vessels
  - Triptans (serotonin agonists) may be helpful

Psychological Disorders

Schizophrenia
- Positive Symptoms
  - Hallucinations
  - Disorganized speech
- ____________________
Negative Symptoms
– Social withdrawal
– Mood disturbance

Schizophrenia May Have Several Outcomes

Prevalence of Schizophrenia
• Affects 0.5–1% of the world’s population
• 2.5 million Americans have schizophrenia
• __________________ are equally likely to be diagnosed to schizophrenia

Age at diagnosis:
– Very rarely diagnosed in children as young as 6 years of age
– Mode: 18–25
– Diagnoses may occur as late as a person’s 40s

Disruptions in functioning
• Thought and __________________
• __________________ and Perception
• Motor Skills and Life Functioning

Example of Disruptions of Language

Disruptions of Thought and Language
• __________________
• Poverty of speech
• Loosening of associations
• __________________ associations
  – Linking rhyming words
• Lack of insight

Disruptions of Attention and Perception
• Problems directing their own focus and attention
• Breakdown of __________________
• Noises louder & colors more intense

Disruptions of Attention and Perception
• ___________________(auditory, & visual)
  – False sensory experience that has a compelling sense of reality

Disruption in Motor Skills and Life Functioning
• strange __________________
• peculiar sequence of gestures
• agitation or catatonic immobility

Disruption in Motor Skills and Life Functioning
• limited ______________________
• can't cope with school or hold a job
• ignore personal hygiene

Development of Schizophrenia
• ______________________ Phase
  — Patients do not show enough symptoms to be categorized as Schizophrenic, but still show some symptoms
  — Can last for many years
• ______________________ Phase
• Treatment Phase

Types of Schizophrenia
1) Schizophrenic ______________________
• systematized delusions (false beliefs)
• extensive auditory hallucinations
• think others are conspiring against them

Four Types of Schizophrenia
2) Schizophrenic ______________________
• eat dirt or own body products
• silliness, ______________________, unclean

Types of Schizophrenia
3) Schizophrenic ______________________
• episodes of being withdrawn and non communicative
• frozen or excited ______________________
• Limb will stay in the position you put it

Four Types of Schizophrenia
4) Schizophrenic ______________________/Undifferentiated
• absence of delusions, hallucinations, & incoherence
• ______________________, peculiar behavior

Identify which type of Schizophrenia is demonstrated below
• Mickey laughed while a doctor was telling him about an accident his mother had been in
• Donald believes he is the King of France and that people around him are plotting to take him down
• Tweety was finally caught by Sylvester when he was unable to run, because of getting stuck in one position
• Bugs lost his job due to poor hygiene and his inability to communicate to customers

Causes of Schizophrenia
1) Biological

______________________

Neurological Causes of Schizophrenia
• Enlarged ______________________
• Shrunken Hippocampus

A Possible Genetic Marker

Schizophrenia and the Hippocampus
• Cell bodies in a control participant are ______________________
• Cell bodies in a participant diagnosed with schizophrenia appear relatively ______________________

A Comparison of Auditory Hallucinations and Listening to Real Voices

Causes of Schizophrenia
1) Biological
• ______________________ – overabundance of dopamine
  – Leads to overactivity
  – May be the basis for hallucinations and delusions

Support for the Biological Hypothesis
• Drugs that increase ______________________ activity in Schizophrenics intensifies symptoms
• Drugs that block dopamine receptors ______________________
• Seems to work for the hallucinations and delusions
• Does not help with social withdrawal symptoms

Problems With a Dopamine Hypothesis
• 25% of patients do not respond to ______________________
• Atypical antipsychotic medications (clozapine) act primarily on neurotransmitters other than dopamine
• Drugs change dopamine activity immediately, but patient may not ______________________ for weeks
• PCP produces symptoms similar to schizophrenia by blocking the NMDA glutamate receptor

Genetic Causes of Schizophrenia
• _________________Index of 46%
• For fraternal twins only 14% chance
• Children of a Schizophrenic patient: 14% chance

FMRI scans of Schizophrenics: At rest

FMRI scans of Schizophrenics: During a Cognitive test

Patterns found in FMRI scans of Schizophrenics
• Lower amounts of ______________________
• Lower amount of _____________________________

Causes of Schizophrenia
2) Psychological
• early childhood experiences
— _________________
— Physical abuse

Causes of Schizophrenia
3) Sociocultural
• 8 times more schizophrenics among ______________________
• poverty or social stress trigger schizophrenia or schizophrenics can’t hold jobs which leads to poverty status

Causes of Schizophrenia
4) __________________________ Model
• predisposition for schizophrenia
• triggers when person encounters great stresses

Treatments for Schizophrenia
• In the past
— Most schizophrenics locked in asylums
— Given ______________________
— Mid 1930’s: Insulin Coma Therapy

Insulin Coma Therapy
• Give patients ______________________
—Aids in the digestion of glucose (sugar)
• When enough insulin was given, patients went into a coma
—1-10% __________________________
• Main treatment used through the 60’s

Treatments for Schizophrenia
• Late 1950’s
— First true drug for treating Schizophrenia
— __________________________ (as now taken for allergies)
• Now
— Dopamine Blocking Drugs

Treatments for Schizophrenia
• Magnetic stimulation of the brain seems to reduce __________________________

Two Major Categories of Mood Disorder
• Major depressive disorder (______________________): Lengthy, uninterrupted periods of depressed mood
• Manic depressive disorder (______________________): Cycling between periods of elevated mood (mania) and depression
• While sharing the common feature of depression, these are unique and separate disorders

Genetic Contributions to Depression
• Concordance rate between identical twins is about 40%
• __________________________ support a role for genetics in depression
• Families with depressed members also have very high rates of anxiety disorders

Environmental Influences on Depression
• __________________________ such as the “Dutch Hunger Winter” may lead to depression
• Environmental stress may trigger an episode of depression

Brain Structure and Function in Depression
• Happy moods are associated with activity in the __________________________
• Depression is correlated with increased right frontal lobe activity and decreased left frontal lobe activity
• Left hemisphere damage due to stroke and other medical causes is associated with depression
Depression Is Associated with Abnormal Sleep Patterns

Depressed people:
• fall asleep faster
• enter ______________________
• spend little time in Stage 3 or 4
• awaken ______________________

Biochemistry of Depression
• Possibly due to problems in the HPA Axis, depressed people show elevated:
  – ______________________ levels
  – thyroid hormone levels
  – ______________________ levels

Monoamines and Depression
• ______________________ depletes available monoamines and produces profound
depression
• Antidepressant medications act on monoamines
  – MAO inhibitors suppress MAO, which breaks down monoamines
  – ______________________ antidepressants inhibit the reuptake of serotonin and
norepinephrine
  – Selective serotonin reuptake inhibitors (SSRIs) inhibit the reuptake of serotonin
  – However, cocaine is a monoamine reuptake inhibitor that does not reduce depression
• People attempting suicide have low serotonin levels

Treatment for Depression
• ______________________
• The role of exercise
• Cognitive-behavioral therapy
• Medication plus psychotherapy
• ______________________(ECT)

Bipolar Disorder
• Periods of mania alternate with depression
• Mania is characterized by:
  – Inflated ______________________ (grandiosity)
  – Reduced need for sleep
  – Talkativeness
  – _________________
  – Distractibility
  – Goal-oriented behavior
  – Excessive involvement in pleasurable activities
Prevalence of Bipolar Disorder
• Affects 0.4–1.2% of the population
• _______________________________ are equally likely to be diagnosed with bipolar disorder
• Rare prior to puberty; approaches adult prevalence in adolescence
• May be more prevalent among artistic and creative people

Genetics of Bipolar Disorder
• Concordance rates between ______________________ may be 70% or even higher
• Adoption studies support a strong role for genetics in bipolar disorder
• _______________________________ are probably involved
• Bipolar disorder is 3–4 times more common in families with members diagnosed with major depressive disorder

Brain Structure and Function in Bipolar Disorder
• Little is known about structural and functional correlates of bipolar disorder
• _______________________________ activity may be elevated
• Enlargement of the ______________________ may occur

Biochemistry of Bipolar Disorder
• _______________________________ may be involved
  – Bipolar is associated with a decreased need for sleep
  – Sleep _______________________________ may trigger mania
  – Patients have more monoamine binding sites than healthy controls
• Thyroid hormone deficiencies may be involved

Use of Lithium Carbonate to Treat Bipolar Disorder
• Lithium carbonate has little effect on people who do not have bipolar disorder
• Lithium does not affect _______________________________ levels, but may influence related enzymes and second messengers
• Lithium enhances _______________________________ reuptake
• If lithium can’t be tolerated, patients may use SSRIs, benzodiazepines, neuroleptics and anticonvulsant drugs

Anxiety Disorders
• Anxiety disorders take many different forms
• Anxiety has two components:
  – strong _______________________________
  – _______________________________ reactions due to anticipated danger
Common Features of Anxiety Disorders
• Genetics may predispose a person to an anxiety disorder, but not to a specific type
• ___________________________, serotonin and GABA systems may be involved
• “________________________” infants may be vulnerable to anxiety disorders
• Anxiety disorders are treated with medication and psychotherapy

Generalized Anxiety Disorder
• Excessive ______________________ for six months
• No focused fear object, as in a phobia
• Autonomic underarousal

Obsessive-Compulsive Disorder
• Repetitive, intrusive thoughts accompanied by ritualistic, repetitive behaviors
• Concordance rate of 68%
• Birth ______________________, infection and injury may also cause OCD
• Abnormal activity in the ______________________, prefrontal cortex, orbitofrontal cortex and cingulate gyrus

Treatment of OCD
• Antidepressant medication, especially clomipramine, a ______________________ reuptake inhibitor
• Behavioral treatment
• Both are effective

Panic Disorder
• Panic attacks involve intense fear and ______________________ arousal
• Repeated panic attacks along with worrying about attacks characterize panic disorder
• .5% experience panic disorder, with more females than males having the disorder
• About half have ______________________ or another anxiety disorder

Correlates of Panic Disorder
• Sodium lactate can initiate an attack in a patient with panic disorder, probably by stimulating the ______________________
• Antidepressants effective in panic disorder reduce activity in the locus coeruleus
• A circuit connecting the hippocampus, orbitofrontal cortex, and cingulate gyrus may mediate panic attacks

Posttraumatic Stress Disorder (PTSD)
• Recurrent dreams of trauma, flashbacks, hyperarousal and avoidance of stimuli associated with trauma characterize PTSD
• 5–10% experience PTSD
• 2/3 of patients are ______________________
• Automobile accidents, combat and ______________________ are common traumas that result in PTSD

Correlates of PTSD
• A smaller than normal ______________________
• Reduced ______________________activity
• Propanolol blocks glucocorticoids in the brain and may prevent PTSD if administered immediately following a traumatic experience
• Treatment consists of medication and/or cognitive-behavior treatment

Autism
• Diagnosed before the age of 3 years
• Criteria focus on:
  – communication ______________________
  – social abnormalities
  – ______________________behavior
• Approximately 2/3 of patients are mentally retarded
• A small number may exhibit savant behavior
• 1–2 people out of 1000 have autism, but rates are increasing
• Males outnumber females by about 4:1

Correlates of Autism
• ______________________ twin concordance rates may be 90%
• Childhood immunizations, parenting style do NOT produce autism!
• Brains are large, possibly due to high levels of ______________________
• Structural abnormalities are found in the cerebellum, amygdala, hippocampus and entorhinal cortex
• ______________________ levels may be high
• Treatment usually consists of intensive behavior training, but this is a lifetime condition

Attention Deficit Hyperactivity Disorder (ADHD)
• May affect 3–5% of population
• Characterized by difficulties with sustained attention, ______________________ and hyperactivity
• May be overdiagnosed or improperly diagnosed

Correlates of ADHD
• Genetics probably have a strong role
• Behavior is similar to people with known ______________________, leading to hypothesis that frontal lobes may be underactive
Smaller volumes of the caudate nucleus, the cerebrum and the cerebellum are correlated with more severe symptoms.

• Activity may be low

Treatment of ADHD

• Stimulant medications, including methylphenidate (____________) and dextroamphetamine, are commonly prescribed
  – 70–80% benefit from medications
  – Medications do not have different effects in people with ADHD than in healthy controls
  – Side effects include low appetite, sleep disturbance and possible suppression of growth

• Medications do not improve academic performance

• Extent of medication use is controversial

Antisocial Personality Disorder (APD)

• Antisocial behavior is characterized by a lack of guilt or empathy

• Juvenile offenders probably respond to environmental factors; genetics probably predispose some to continue antisocial behaviors in adulthood

• May be underactive

• Damage to the orbitofrontal cortex is correlated with antisocial behavior

• Treatment is generally ______________________

Brain Activity in Murderers