TEST 1 KEY POINTS

Research (puzzle box):
- goals: generalization & reduction
- Aristotle – chicken embryos
- Galen - dissection
- Gall – phrenology
- Mendel - genetics
- Flourens - ablation
- longitudinal vs cross-sectional
- independent & dependent variables
- stereotaxic surgery

Genetics (clasp hands)
- fraternal twins and identical twins
- passed on intact
- sex-linked
- autosomal
- genes
- chromosomes
- traits:
  - dominant or recessive
  - passed on intact
  - impact structures
    - BBB
    - predisposition

Neuron Anatomy (fencer)
- 10 parts
  - membrane
  - dendrites (rough, thick and short)
    - ligand-gated sodium channels
  - dendritic spines
  - soma
  - nucleus
  - axon hillock
  - axon (smooth, thin and long)
    - initial segment
    - voltage gated sodium channels
  - vesicles
  - terminal buttons
    - calcium channels
  - endoplasmic reticulum
- myelination
  - cable conduction vs saltatory conduction
  - nodes of Ranvier

Neural Impulse (waves)
- afferent (sensory) and efferent (motor)
- absolute refractory period & relative refractory
- summation (or integration):

- temporal
- spatial
- EPSP
- IPSP
- resting potential vs action potential
- threshold

Glial cells:
- oligodendrocytes
- astrocytes
- microglia
- radial glia
- Schwann cells
- satellite cells

Synapses (a fish THIS big)
- axon-soma (inhibitory)
- axon-dendrite (chemical)
- axon-axon (gap junctions)
- ionotropic effects
  - start in 10 ms
  - end in 30 ms
  - short term
  - local impact
- metabotropic effects
  - G-protein
  - start in 30 ms
  - long lasting (up to hours)
  - global (impact many neurons)

Neurotransmitters (punch palm):
- typically, only 1 released
- amines
  - glutamate
  - GABA
- monoamines - MAO
  - indolamines
    - serotonin
    - melatonin
  - catecholamines - COMT
    - dopamine
    - noradrenaline
    - epinephrine
- acetylcholine

Drugs (sip):
- affinity, lipid solubility
- withdrawal, tolerance & sensitization
- diffusion, binding, reuptake (transporters), deactivation
- drug metabolism phases
  - phase 1: oxidation reactions
  - phase 2: conjugations

Stimulants, depressants & hallucinogenics

Xanthine: caffeine, theobromine & theophylline
- caffeine – most used drug

Alcohol
- 5 ounces of wine (12 ounces of beer) = 14 grams of alcohol
- each drink adds .02% blood alcohol level
- liver removes .01% per hour
- fully absorbed into blood in 30-90 minutes
- metabolize .05 ounces per hour
- drunk at .1%
    - 6 drinks in an hour
    - 7 drinks in 3 hours
    - 8 drinks in 5 hours
    - 9 drinks in 8 hours
    - 10 drinks in 10 hours
- alcoholism: Type I (late onset) and Type II (early onset)
- sons of alcoholic mothers

Cocaine:
- binds to dopamine transporter, blocks reuptake
- half-life of 20-30 minutes, back to normal by 60 minutes
- consistent high use
    - kills transporters – less uptake
    - decrease in enzyme that synthesized dopamine (tyrosine hydroxylase) – less dopamine
    - hallucinations, mood disturbances, repetitive behaviors, delusions (paranoid)
    - symptoms very similar to schizophrenia
    - decreased attention and motor skills
    - decreased effectiveness of working memory and prospective memory
- prenatal exposure produces structural abnormalities in brain
    - mental retardation – deficits in working memory
- an ingredient in Coca Cola (originally)

Amphetamines:
- longer-lasting than cocaine
- half-life of 10 hours
- euphoria for 4-24 hours, followed by crash
- hijacks transporters (push more dopamine out)
- blocks
- consistent high use
    - small striatum of basal ganglia (skill learning, habit formation, motor coordination)
    - rest of limbic system enlarged

Nicotine:
- reaches brain in 10-20 seconds
- half-life of 90 minutes
- broken down by the liver
- releases epinephrine

Blood-Brain barrier

Disorders

myasthenia gravis – acetylcholine

Parkinson's – dopamine

MS - glutamate

FYI: (not on the test)

Here is how addiction works. We'll use cocaine as an example.

Cocaine leaves more dopamine in the synapses by disrupting its reuptake (recycling). Instead of going back into the cell for reuse, dopamine is left out in the synapse. Consequently, with so much dopamine out there, it takes very little more to trigger a neural connection.

The body tries to adjust to the new amount of dopamine present. As the tolerance increases, users take more cocaine to compensate. Eventually, they are taking very high levels of cocaine just to get as high as they used to.

Actually, you can never get as high as you used to (for a given dose). The first time you have a drug (or experience) is always the biggest impact it will ever have. Like your first love, first job and first car, your first hit of cocaine, heroin, or caffeine is always the largest.

Cocaine makes the brain more ready to receive cocaine-generated stimuli. Here's how it works. Cocaine increases the level of a protein (deltaFosB), with no tolerance ceiling. This genetic transcription protein elevates BDNF (brain-derived neurotrophic factor) which increases the number and complexity of dendrites in the nucleus accumbens. The result: drugs increase your sensitivity to positive reinforcement. Being rewarded impacts you more than it did before. But the only reward that matters to you now is cocaine.

DeltaFosB acts as a master control switch for addiction. Once it is turned on, it efficiently transcribes events that produce an addictive state and inefficiently transcribes other events. This switch stays on for months after you stop using the drug, It increases positive reinforcement for drug-related events and decreases the sensitivity to aversive drug-related events.