Neurotransmitters

• Chemical substances in the presynaptic neuron’s terminal buttons that diffuse across the synaptic cleft to transmit a neural impulse
• They influence the receiving neuron
Neurotransmitters

- 50-100 have been identified
  - Each has its own chemical structure
  - Each can fit into a specific receptor site on the dendrite of a receiving cell
- Example: Like a key fitting into a lock
Neurotransmitters

- Some act to excite other neurons (excitatory synapses) – Cause neurons to fire
- Some act to inhibit receiving neurons (inhibitory synapses) – Prevent neurons from firing
  - Very important!! When we burn our finger and the burning sensation goes away, it is our inhibitory synapses
Neurotransmitters

- Involved in processes ranging from muscle contraction to emotional responses
- Excesses or deficiencies of neurotransmitters have been linked to psychological disorders
  - Depression and Schizophrenia
Neurotransmitters

• Acetylcholine (ACh) (first neurotransmitter to be discovered)
  – Controls muscle contractions and is involved in memory formation
  – Excitatory (causes receiving neurons to fire) at synapses between nerves and muscles that involve voluntary movement
  – If it is blocked, Ach can’t get to the site and muscles will not be capable of contracting…so…?
Neurotransmitters

• Acetylcholine
  – Deficiencies are connected with paralysis
Neurotransmitters

• Acetylcholine
  – Curare
    • A toxin that South American Indians use on blow darts
    • Prevents ACh from lodging within receptor sites in neurons; result is paralysis and often death (can’t breath)
Neurotransmitters

- Acetylcholine
  - Prevalent in the Hippocampus
  - Involved in the formation of memories
  - Level of ACh to the brain decreases, memory function will be impaired
    - Alzheimer's Disease
    - Gradual deterioration in mental processes such as memory, language, and problem solving
Neurotransmitters

• GABA
  – Gamma-aminobutyric acid
  – Inhibitory neurotransmitter
    • Calms people down, lowers anxiety
    • Without the inhibitory effect, brain activity is so accelerated that the person senses an anxiety overload
GABA and Drugs

• Alcohol contains GABA (acts as an agonist for GABA)
  – This is why people drink to “calm-down” or “relax”

• Xanax or Valium
  – Strengthen the effects of the low-levels of GABA
Neurotransmitters

• Serotonin
  – Inhibitory or excitatory neurotransmitter
  – Involved in emotional arousal and sleep
  – Helps regulate a person’s mood and appetite
Neurotransmitters

• Serotonin
  – Deficiencies are linked to:
    • Overeating
    • Alcoholism
    • Depression
    • Aggression
    • Insomnia

"No wonder you have insomnia... lying there awake all night."
Neurotransmitters

- Dopamine
  - An inhibitory or excitatory neurotransmitter
  - Involved with voluntary muscles, learning and memory, and emotional arousal
    - Levels increase when:
      - You fall in love - giddiness
      - You get scared
Neurotransmitters

- Dopamine
  - Deficiencies are linked to Parkinson’s disease
  - People lose control over their muscles—have jerky uncontrollable movements
Neurotransmitters

Too much Dopamine…..

- Schizophrenia
  
  - People have more receptor sites for dopamine in an area of the brain that is involved in emotional responding
    - Overutilize the dopamine available in the brain
    - Leads to hallucinations and disturbances of thought and emotion
How do high or low levels of Dopamine affect a person?

• High Levels-
  – Undistracted
  – Works intensely on tasks

• Low Levels-
  – Unattentive
  – Distractible, moves from one thing to another, has difficulty completing a job
  – Difficulty thinking ahead
  – Impulsive
Neurotransmitters

• Endorphins
  – Inhibitory, pain controlling neurotransmitters
  – Naturally produced in the brain and bloodstream
    • Lock into receptor sites for chemicals that transmit pain messages to the brain
    • Once the endorphin “key” is in the “lock”, the pain-causing chemicals are locked out
    • Similar to the drug morphine and heroin (why it can hurt so much to go through withdrawal)
Substances (such as drugs) that affect Neurotransmitters

• Agonists
  – Chemical substances that mimic or enhance the effects of a neurotransmitter on the receptor cites of the next cell, increasing or decreasing the activity of that cell, depending on what the effect of the original neurotransmitter (excitatory or inhibitory) was going to be

• Antagonist
  – Chemical substances that block or reduce a cell’s response to the action of other chemicals or neurotransmitters (makes original neurotransmitter do opposite action)