Benjamin Fenster
PSYC-001 (Johnson)
1 August 2001

Chapter 2 – Biopsychology

I. Natural Selection
   a. Discovered by boty Charles Darwin and independently by Alfred Russle Wallace
   b. Five Hypotheses of Evolution (from Darwin)
      i. Deep Time (Earth is very old – then believed to be millions of years)
      ii. Common ancestry (Species evolved from common roots)
      iii. Species produce daughter species
      iv. Gradual changes in populations
      v. Works via Natural Selection
   c. Process of Natural Selection
      i. Environmental Pressure (dynamic) forces animals and organisms to compete
      ii. Competition for resources
      iii. Selection of fittest phenotype (observable traits) from variation
      iv. Frequency of genotype (genes representing phenotype) increases
   d. Reproduction is important. Survival is necessary only to reproduce.

II. Genetics
   a. Gregor Mendel (1866)
      i. Founded Classical Genetics
      ii. Genetic Information transmitted in discrete units (travel in pairs)
      iii. Experimented with Pea Plants
   b. Chromosomes = Structures in cell-nuclei. Contain DNA
   c. DNA = Double-Helix model (Watson and Crick, 1953). A-T, C-G = Pairs
   d. Gene = Sections of DNA that code for proteins. Approx. 30,000 in Humans

III. Endocrine System
   a. Hormones in blood system are used to communicate
   b. Reproductive
      i. Determination/Differentiation of gender (Testosterone transforms the female fetus into a male)
      ii. Reproductive behaviors & sex drive
      iii. Estrous cycle, pregnancy, lactation
   c. Parental behavior (whether the father stays after conception, etc)
   d. Biological Rhythm
      i. Circadian (Day-to-day tasks)
      ii. Seasonal (monthly cycles, annual cycles – prominent in birds)
   e. Aggression & Social Behavior
   f. Learning & Memory
   g. Mood & Emotion

IV. Nervous System
   a. Uses Neurotransmitters to transmit information
   b. Neurons = Communication cells
   c. <Refer to figure 2.4, page 55 for division of Nervous system>
   d. Spinal cord responsible for reflexes not involving brain. Perception of pain *follows* reaction, since brain is required to process.
   e. <Refer to figures 2.7 and 2.8 on pages 59 and 60 for structure of neuron>
      i. The Axon hillock sits between the cell-body and axon, and determines when the neuron will "fire." Acts as a control center.
   f. Myelin sheath = Amplifier for neurons' signals
   g. Nodes of Ranvier = Spaces between myelin sheath. Signals essentially jump from node to node.
   h. "Firing" process
      i. Electrical potential inside neuron (opposed to outside) = -70mv
      ii. K+ and Cl- ions are inside the axon. Na+ and Cl- ions are outside. A higher concentration of sodium exists outside, making the inside of the axon negative.

iii. Graded potential = More stimulation at the end of the dendrites causes the electrical potential to rise.
iv. When potential = -55mv, depolarization occurs – the neuron "fires." Na+ enters the cell. (Some K+ leaves, but not nearly as much)
v. When the potential has reached +50mv to +55mv, enough K+ leaves the cell to return it to a negative state.
vi. The electrical charge "fired" pushes vesicles toward the synaptic cleft.
vii. Neurotransmitters in the vesicles are spilled into the cleft where they will react with the dendrites at the ends of a neighboring cell.
viii. "All or Nothing!" Neuron either fires, or doesn't – no variable strength.
ix. Chemical-Electrical process.

V. The Brain
a. Studied by removing sections and observing affect on animal.
b. Three Layers
i. Brain Stem / Cerebellum
1. Medulla > Breathing, heart rate
2. Pons > Sleep & dreaming
3. Reticular Activating System (RAS) > Arousal, sleep, dreaming. Electrical stimulation can awaken animal.
4. Cerebellum > Regulate and control motor movements. Highly affected by alcohol.
ii. Limbic System (a.k.a. mesolimbic system)
1. Emotional Expression, motivation.
2. "Reward System"
3. Learning, memory.
4. Amygdala > Anger, rage, fear
5. Hippocampus > Learning & memory.
a. Patients with damage can remember events prior to the damage, but not afterward.
b. Modulates memory storage with other areas of the brain.
6. Septum > Pleasure. Stimulation can cause extreme pleasure.
7. Hypothalamus > Homeostasis (keeping body physiologically stable): Eating, drinking, sex, control of endocrines.
8. Thalamus > Relay station for sensory information en route to other parts of the brain.
iii. Cerebrum and Cerebral Cortex (outer layer)
1. Convolutions, memory, higher-order cognition.
2. "Uniquely Human" thinking
3. Associative Cortex (integration & processing)
4. Frontal Lobe
a. Decision-making, executive functions.
b. Phineas Gage (from Vermont). Railroad accident removed his frontal lobe. Personality changed completely.
c. Motor Cortex > Control planning and executing motor
d. <Refer to Figure 2.16, page 72 for motor cortex diagram>
e. Bruca's Area (left) > Control speech. Expression aphasia
5. Parietal Lobe
a. Relating visual and spatial information
b. When damaged, senses can neglect one side of body (sensory neglect)
c. Somatosensory cortex – receiving sensory information (analogous to motor cortex)
d. <Refer to Figure 2.16, page 72 for somatosensory cortex diagram>
6. Occipital Lobe
a. Visual Cortex

b. Processes visual information
c. Different cells used in identification of different objects (special cells for angles, lines, faces, etc)

7. Temporal Lobe
    a. Auditory cortex.
    b. Certain visual perception (eg: facial recognition)
    c. Audio analysis
    d. Wernicke's area (left) – interpreting speech
    e. Sensory aphasia (similar to Parietal lobe)

c. Plasticity
    i. Brain can reorganize itself by creating connections with new neurons.
    ii. Originally thought to occur only in childhood. Now understood to occur in adults as well.
d. Lateralization of Function
    i. Two hemispheres connected by corpus collosum
    ii. Hemispheres are asymmetrical
    iii. Language controlled by left-hemisphere in 96% of right-handers & 70% of left-handers.
    iv. Right-side > Spatial orientation
    v. Visual information is split by field of vision (not by eye) to be analysed by opposing sides of the brain.
    vi. Split-Brain:
        1. Presentations to Right visual field result in verbal identification, but no identification with left hand (unless verbally identified first)
        2. Presentations to left visual field result in no verbal identification, but correct identification with the left hand.