**AP BIOLOGY: A REVIEW**

**Modified by Pat Mote from a Handout Created by Larry Calabrese**

**BIG IDEA 1: EVOLUTION**

 1. Natural Selection

 2. Mutation: causes and effects

 3. Hardy Weinberg

 4. Effect of sickle cell; peppered moth; DDT

 5. Artificial Selection; overuse of antibiotics

 6. Fossils: significance; dating; vestigial structures; nucleotide sequence comparisons;

 7. Evidences for evolution

 8. DNA and RNA genetic codes

 9. Metabolic pathways (similarities between domains)

10. Organelle support in cells (cytoskeleton)

11. Linear chromosomes; membrane bound organelles; endomembrane systems and nuclear

 envelope

12. Phylogenetic trees and cladograms

13. Speciation

14. Extinction of species (due to ecological stress); human impact

15. Isolation barriers to speciation

16. Chemical resistance (to antibiotics)

17. Emergent diseases

18 Evolution within a structure (heart chambers, limbs, brain, immune system)

19. Primitive earth; monomers producing polymers

20. RNA hypothesis

21. Geological evidence supporting origin of life

22. Experiments (Miller’s)

23. Common ancestry; common genetic code.

**BIG IDEA 2: ENERGY FOR GROWTH, REPRODUCTION, HOMEOSTASIS**

1. Free energy vs. entropy

2. 2nd Law of Thermodynamics

3. Endergonic vs. exergonic reactions

4. Energy pathways: Krebs cycle, Glycolysis, Calvin cycle, Fermentation

5. Reproductive strategies (seasonal or periodic reproduction to conserve energy)

6. Metabolic rate vs. body size

7. Trophic levels and energy

8. Autotrophs vs. heterotrophs and energy

9. Fermentation vs. respiration

10. Hydrolysis vs. dehydration synthesis

11. Energy capturing: NADP, NAD, Oxygen

12. Light reactions of photosynthesis vs. Calvin Cycle

13. Cell respiration: ATP production, electron pathways

14. Chemiosmosis

15. Use of carbon in ecosystems

16. Use of nitrogen in ecosystems

17. Properties of water

18. Surface to volume ratios

19. Examples of increasing surface area: hairs, alveoli, villi, microvilli

20. Role of cell membrane

21. Types of membrane proteins

22. Cell walls vs. cell membranes

23. Passive vs. active transport

24. Sodium-potassium pump; glucose transport

25. Exocytosis vs. endocytosis

26. Archaea and bacteria lack internal membranes and organelles but have cell wall

27. Negative vs. positive feedback

28. Operons

29. Plant response to water limitations

30. Problems with negative malfunction: diabetes, dehydration (less ADH)

31. Phototropism vs. photoperiodism

32. Effect of biotic and abiotic factors (temperature, water availability, sunlight)

33. Symbiosis, predator-prey relationships

34. Food webs and food chains

35. Population density; algal blooms

36. Obtaining nutrients and eliminating wastes: gas exchange, digestive mechanisms (food

 vacuoles, gastrovascular cavities), nitrogenous waste production and elimination

37. Homeostatic control: excretory system in flatworms, earthworms, vertebrates

38. Circulatory systems in fish, amphibians, mammals

39. Countercurrent exchange

40. Disruption at molecular level: dehydration, physiological responses to toxicity

41. Disruption to ecosystems: invasive species, human impact, salination

42. Defense mechanisms affecting homeostasis: immune systems

43. Cell- mediated vs. antibody-mediated (humoral) immunity

44. Regulation of gene expression: homeotic genes, embryonic induction, apoptosis

45. Timing and coordination of physiological events: circadian rhythms, pheromones; internal

 and external signals

46. Innate vs. learned behaviors

47. Hibernation, estivation, migration, courtship

48. Resource partitioning, niche vs. habitat

**BIG IDEA 3: STORAGE, RETRIEVAL, AND TRANSMISSION OF INFORMATION**

1. DNA, RNA, plasmids

2 Significance of historical experiments: Watson and Crick, Avery-MacLeod, Hershey and Chase

3. DNA replication

4. RNA processing

5. Sequence of genetic code

6. Phenotypes and protein differences

7. Genetic engineering

8. Electrophoresis

9. Restriction enzymes

10. PCR

11. Genetically modified foods; transgenic animals; cloned animals

12. Cell cycle; mitotic events

13. Meiotic events

14. Laws of segregation and independent assortment

15. Linked genes

16. Effect of nondisjunction or chromosomal disorders: sickle cell anemia, Tay-Sachs disease,

 Klinefelter’s syndrome

17. Sex-linked genes

18. Nonnuclear inheritance: chloroplasts, mitochondria

19. Regulation of genes: promoters, enhancers

20. Regulatory proteins; transcription factors

21. Signal transmission between cells; cytokines, mating pheromones, ethylene, Cyclic-AMP

22. Transformation, transduction

23. Crossing-over

24. Viral replication

25. Cell to cell communication: plasmodesmata, neurotransmitters, antigen-presenting cells

26. Endocrine signals: insulin, estrogen, thyroid hormones

27. Receptor proteins and signaling.

28. G-protein and signaling

29. Transduction pathways (ligand channels, second messengers)

30. Visual and audio communication: bird songs, bee dances, coloration, territorial behavior

31. Innate and learned responses

32. Neuron structure and function

33. Action potentials

34. Neurotransmitters and the synapse

35. Brain regions: vision, hearing, abstract thought and emotions, neurohormonal production,

 hemispheres of cerebrum

**BIG IDEA 4: BIOLOGICAL SYSTEMS INTERACT**

1. DNA controls protein formation

2. Polar vs. non polar compounds

3. Function of subcellular organelles

4. Interaction and coordination between organs: stomach and small intestines, kidney and

 bladder, root, stem, leaf

5. Interaction between systems: respiratory and circulatory, nervous and muscular, plant

 vascular and leaf

6. Interactions of populations: predator-prey, symbiotic relationships, introduction of species

7. Density dependent vs. density independent factors

8. Energy flow in ecosystems (matter recycles)

9. Food web vs. food chains

10. Effects of competition on populations

11. Enzyme function and characteristics; change of shape of enzyme; cofactors, co-enzymes

12. Variations within molecules produce different functions: chlorophylls, hemoglobin, MHC

 proteins

13. Multiple gene copies (heterozygote advantage)

14. Environmental factors influence traits: flower color and soil pH; sex determination in

 reptiles, seasonal fur color in arctic animals

15. Keystone species