

BIOL 110: Dr. Staples's MT3 Review sheet – Major Terms & Concepts 4/14/2005

Starr Chapter:

9. **DNA Structure & Function**: DNA = GATC; **Griffiths & Avery pneumococcus**. **Transforming** material = **hereditary material (DNA)**; **Hershey-Chase blender expt**: bacteriophage DNA (³²P), NOT protein (³⁵S), = genetic material. **Chargaff**, **Franklin/Wilkins**, **Watson & Crick**: DNA = *symmetrical double helix, sugar-phosphate backbone outside, A-T (2 H-bond), G-C (3) bases H-bonded inside*. **Antiparallel structure**, 5'-3', 3'-5'. **DNA Replication** = **semiconservative**, 5'→3'; old templates for new strands. **DNA polymerase**, **DNA ligase**, **DNA repair**. **Complementary base-pairing**, whole-Organism cloning by nuclear transplantation (Dolly).
10. **From DNA to Proteins**: "Gene Expression"; (from Genotype to Phenotype!!) **Central Dogma of Molecular Genetics**: DNA → **transcribed** into **RNA** message → **translated** into **Protein** product ("Gene Expression"). Genetic code, **CODONS**, **mRNA**, **tRNA**, **rRNA**, **ribosomes**. Mutations – substitution mutations, frameshift mutations. DNA repair: proofreading by Dpol, excision repair.
11. **Studying and Manipulating Genomes**: Biotechnology, **Restriction Enzymes** (from bacteria; defend against bacteriophages/viruses; cut DNA), molecular cloning (**plasmids**/vectors = mini-chromosomes). **Polymerase Chain Reaction (PCR)**, DNA fingerprints, Gel Electrophoresis, **Gene Libraries**, **Probes**, **DNA Hybridization** (complementary base-pairing between probe DNA and target DNA). Genetic engineering – bacteria, plants, animals (transgenic), "gene therapy".
12. **Processes of Evolution**: change allele frequencies in **populations** over time; driven by mutations and natural selection. Natural & artificial selection – Dogs, Cattle, food crops. Biogeography, comparative morphology (eg: whale ankles, snake pelvis), fossils. **Lamarck's Acquired Characteristics**, **Charles Darwin ('Chucky-Dee')** – HMS Beagle, Galapagos Islands, **Finches (beaks)**, Malthus – populations exceed capacity of environment, breeds competition. "**On the Origin of Species**" **Natural Selection**. **Traits – polymorphisms → adaptive traits = selected**. **Gene pool**, **mutations → new alleles**. Fitness. Natural Selection, Gene flow, Genetic Drift. **Directional selection**-(peppered moths); **Stabilizing selection** (intermediate favored; human birth weight), **Disruptive selection** = extremes favored; (large/small African finch beaks). Missing links (eg: *Archaeopteryx*). **Genetic equilibrium**.
13. **Early Life & Microbiology**: First Atmosphere, Chemical/Molecular evolution. Stanley Miller Experiment (simple gases [methane, ammonia, hydrogen, water], no oxygen, electricity/ "lightning"). RNA world, Proto-cells, first life probably = **anaerobic chemoheterotrophic prokaryotes**.
- **PROKARYOTES**: **Eubacteria**, **Archaea**. *Photoautotrophic, chemoautotrophic, photoheterotrophic, chemoheterotrophic*. Parasite/pathogen, saprobe. **Coccus**, **bacillus**, **spirillum**. Gram stain, **peptidoglycan cell wall**, glycocalyx/ capsule/ slime layer. Flagella, pili. **Prokaryotic fission**. *Endosymbiotic evolution of eukaryotes*.
 - **PROTISTANS**: **fungus-like** (slime molds), **animal-like protozoans** (amoeboid, foraminiferans – plankton, ciliates (paramecium- pellicle, gullet, contractile vacuole), flagellates- Giardia, trypanosomes (sleeping sickness). **Parasitic sporozoans**: Toxoplasma, Plasmodium (malaria). **Plant-like**: Euglena (flagella), Chrysophytes (diatoms, dinoflagellates- red tides). Red algae (sushi, agar), brown algae ("seaweed"), green algae (Volvox, sea lettuce) –plant precursors; all photosynthetic.
 - **FUNGI**: symbioses: **lichens** (pioneer species) = algae/ cyanobacteria + fungus; **mycorrhiza** = "fungus roots" with plants, Decomposers, extracellular digestion and absorption, heterotrophs & saprobes, parasites. **Spores**, **mycelia**, **hypha**. Major groups = reproductive structures: **Basidiomycota**/club fungi (mushrooms), **zygomycota** (bread mold), **ascomycota** (sac fungi). Meiosis → spores (n), dispersal and growth (mitosis), fuse with other haploid gametophores → 2n zygote.....
 - **VIRUSES**/bacteriophages, Viroids, Prions. **Lytic**, **lysogenic life cycles**. **Enveloped Virus** (animal virus).

***Principles of Biology* Midterm 3 (Spring 2005): STUDY QUESTIONS**

Possible Short Essay Topics (be prepared to draw diagrams as well!):

1. Briefly describe how the experiments of Griffith, and Hershey & Chase identified and proved that DNA is the Genetic/Hereditary Material. *Use diagrams as much as possible.*
2. List and describe 5 main characteristics of DNA's chemical structure, as deduced by Watson and Crick. *Use diagrams as much as possible.*
3. Name and describe, using diagrams, the term used to describe the method of DNA replication (synthesis) in cells.
4. Diagram and define the three molecules and processes involved in the Central Dogma of Molecular Genetics – how DNA genotype becomes protein Phenotype.
5. Briefly describe and diagram how DNA can be amplified by either molecular cloning into a plasmid/vector using restriction enzymes, or by the Polymerase Chain Reaction.
6. Describe four major sources of evidence that Darwin observed during his voyage on the Beagle, that lead to his theory of Evolution by Natural Selection, put forth in his book *On the Origin of Species*.
7. Contrast Darwin's theory of Natural selection with Lamarck's ideas of Acquired Characteristics. Give examples of each man's view of the origin of some observable characteristic in nature (for example: giraffe's necks, elephant's trunks, peacock feathers, moth/butterfly coloration, etc.).
8. Describe, citing specific examples, the three possible Outcomes of Natural Selection.
9. Describe how Stanley Miller's experiment simulated early conditions on Earth, and how it provided evidence for the possible origin of simple life forms on early earth.
10. Contrast 4 major differences between algae and fungi. What type of mutually beneficial relationship might be formed between an alga and a fungus, and why can it be such a good "pioneer species"?