

BIOL 230 (Part III) – Major Terms & Concepts (this is NOT an exhaustive list!!) **11/14/2009**

Sadava, et al., 2007; Chapter Number:

11. **DNA REPLICATION**: **semiconservative**, **DNA Repair**: Proofreading, mismatch repair, excision repair – “seeker” proteins, endonucleases, Dpo1, Ligase, **Deoxyribonucleoside triphosphates**.

Telomeres, Telomerase,(GGAATT)n.....

DNA sequencing, dideoxy Nucleotide triphosphates (“chain-terminators”, ddNTPs)

Polymerase Chain Reaction (PCR) – denature, anneal **DNA Primers**, elongate; **Taq DNA Polymerase**. *In Vitro* molecular cloning.

16. (16a.) **Restriction Endonucleases**; DNA gel electrophoresis, DNA denaturation, Probe, **Hybridization**; **DNA Sequencing**, ddNTPs; **PCR**, **Taq DNA polymerase**, specific synthetic DNA Primers.

12. **Beadle & Tatum** – **One-Gene-One Polypeptide**; auxotrophic mutants; Arg-; biochemical pathways = genetic pathways!

The **Central Dogma**; messenger, adapter Gene expression. DNA → RNA → Protein

TRANSCRIPTION **Promoter**, RNA polymerase; Ribonucleoside triphosphates

Codons: triplet “words”, nonoverlapping, degeneracy, “Wobble”, Start, Stop

TRANSLATION, tRNA, methionine, AUG; Reading Frame; **Ribosome** – large (peptidyl transferase) and small subunits, Ribozyme; Amino (N) terminus, Carboxyl (C)- terminus;

Aminoacyl tRNA synthetases (activating enzyme); AMP, “charged” tRNA; Translation initiation complex; **N→C** synthesis; A-site, P-site;

Release Factor; Posttranslational Regulation – delivery signals; Antibiotic regulation

Point mutations – **silent**, **missense**, **nonsense**, **frameshift**; Chromosomal mutations – deletion, inversion, reciprocal translocation; Spontaneous Mutations, Induced Mutations

13. **Viral & Prokaryotic Genetics**

Lytic vs. **Lysogenic** Phage reproductive cycles – regulation (early genes, late genes, capsid); Cro Protein (↑lytic), cI Protein (↑lysogenic);

Conjugation, **Transformation**, **Transduction**; R-Factors, F-factors/plasmids.

Operon, Operator, Promoter, Inducer, **Repressor**

Positive control, Negative control, *i* Gene **Inducible** promoter, **Constitutive** promoter cAMP, cAMP-repressor Protein (**CRP** or CAP)

Lac Operon; Inducer (lactose), **Trp Operon**

14. **Eukaryotic Genome & Gene Regulation**:

Nuclear envelope, compartmentalization. Satellite DNA, telomeres, telomerase.(GGAATT)n...

Transposons, transposase; Structural Genes

Control: **Transcription**, **Post-Tsc/RNA Processing**, **Translation**, **Post-translation**.

Promoter, **Transcription Factors**, **Enhancer**, **Silencer**, **Activator**, **Repressor**; **Coordinate Regulation**; **Alternate Splicing**.

Primary transcript/ Pre-mRNA; **Spliceosome**

Introns, **Exons**, **RNA Splicing** -- **snRNPs**

5'-GTP “Cap”, **3'-polyA “Tail”**.

Rpol I (rRNA), **II (mRNA)**, **III (tRNA and snRNAs)**.

Alternate splicing, mRNA stability; Heterochromatin, Euchromatin; **XIST** gene; X-inactivation, Barr Body.

Signal Sequences, Signal Recognition Particle

Polysomes, protein modification, Ubiquitin,

Proteasome. [[& See Ch. 14 Review slide!!]].

16b. **Cloning Genes** Recombinant DNA, Restriction Endonucleases; Restriction sites, “sticky ends”, ligate/splice DNA; Hybridization, **Vectors** – plasmid, virus, antibiotic-resistance markers (selectable marker gene, polycloning site, disruptable marker gene, *Origin* of replication (& circular for bacteria))

Genetic Cloning; **DNA Library**, bacterial colony; cDNA, Reverse Transcriptase

Cloning Genes; Clone = many copies of a piece of DNA, or making an identical individual organism or cell (naturally or artificially / *in vitro*).

Cloning vector – (*in vivo* cloning) replicon (*Ori*, telomeres?, centromeres?), Restriction site (PCS), Selective markers (antibiotic resistance, nutritional ability, etc.). **Gene Libraries**: **cDNA**, **genomic DNA**. **Reverse Transcriptase**. Labeled cDNA

probe, hybridization, **Gene Chips (DNA Microarrays)**.

Expression vectors (need Tscn start and stop, Ribosomal Binding Site for translation, etc.) to make gene product in recombinant host (such as bacteria or yeast).

Reporter Genes (reporter vectors) – visible gene product “reports” activity of any attached promoter!!

Recombinant DNA. Transgenic organisms.

*** **Be ready to transcribe and translate a DNA gene sequence!!** ***

BIOL 230: Cell & Molecular Biology -- Midterm 3 (Fall 2009): Study Questions
Possible Short Essay Topics (be prepared to draw diagrams & give thorough explanations as well!):

1. Describe the three processes, and the molecular players (major enzymes, and resulting polymers) that define the direction and flow of genetic information in living systems. What is the name of this fundamental theory voiced by Sir Francis Crick?
2. Compare and contrast the initiation, elongation and termination of Replication, Transcription, and Translation. Be sure to include main enzymes involved, the nature of the polymer produced, differences in reading the template, and differences in the polymerization process (*ie: numbers and directions of "bubbles" and "forks"*).
3. Diagram the 4 major components that initiate translation of a genetic message. Distinguish between the start and stop sites of transcription on a DNA template, and the start and stop sites of translation on an RNA transcript.
4. Describe and Diagram how a messenger RNA is read and encoded into the language of amino acids/polypeptide from the nucleic acid code. Include the direction of reading a transcript, the direction of polypeptide synthesis, what sets the "frame" of reading the nucleic acid code, and how translation is terminated.
5. Describe and illustrate the differences between four different types of point mutations in DNA. Which type(s) of mutations are likely to be the most severe, and why? What factors determine the severity of the phenotype (physical changes) in an organism resulting from a point mutation?
6. Diagram the lytic and lysogenic reproductive cycles of a bacteriophage. When might one replicative cycle be advantageous over the other? How is the switching between these two reproductive cycles genetically regulated (be sure to mention the regulatory proteins involved)?
7. Describe and diagram the three different methods of "horizontal" transmission of genetic information between bacterial cells. *What must happen to the transferred DNA for it to be stably inherited and transmitted to later generations?*****

8. **Diagram 6 DNA and protein components that compose and regulate the *Lac* operon (*hint: not all are specific to this operon*). Describe the function of each, and how Inducible Operons are energetically efficient systems for a cell (what 2 conditions must be met for it to be turned ON?).**
9. Compare and contrast regulation of the *Lac* Operon and the *Trp* Operon. When is each turned ON or OFF? What controls the activity of the regulatory proteins involved (both positive and negative regulation)? Explain how each type of regulation is appropriate for an operon encoding catabolic or anabolic enzymes.

10. Describe and Diagram the interactions between 4 protein and DNA factors involved in ONLY Eukaryotic gene regulation. How does coordinate gene regulation differ between Prokaryotes and eukaryotes?

11. Describe at least 5 ways that gene structure and transcription differ between Prokaryotes and Eukaryotes. What differences between prokaryotes and eukaryotes also exist in the translation of an mRNA transcript?
12. Describe the 4 steps that may occur in Post-Transcriptional Processing a eukaryotic primary transcript into a mature mRNA ready for translation. Describe how unique mechanisms in Eukaryotic gene regulation produce exceptions to Beadle and Tatum's theory of the relationship between genes and proteins (state the theory).

13. Compare the advantages and disadvantages of eukaryotic gene regulation at the Transcriptional level, versus regulation at the Post-Translational level. Cite specific examples of each type of regulation.

❖ **Preparation note:** A good strategy for answering comparison and contrast questions is to make a TABLE with a column for each **category/topic** to be compared. Then compare related **characteristics** in the listed rows below each topic.

❖ **Remember:** All questions are important study tools for the entire exam, though the questions in **BOLD** are the most likely questions to be asked in essay form on the test..... And there might be some other hints.....