

## **Study Guide: Highlights and Themes from Midterm #2 Lecture Series**

### **Lecture Series 5 – Cell Cycle & Cell Division**

#### Systems of Cell Division

- Bacterial Cell Division

#### Interphase and the Control of Cell Division

- The Eukaryotic Cell Cycle

- Cell Cycle Control

  - Internal and External

#### Eukaryotic Chromosomes

- Organization of Chromosomes

  - Levels of Packing

  - Histones

  - Cohesins and Condensins

#### Mitosis = Cloning

- All the steps

- Cytokinesis in Animal vs Plant Cells

- Evolutionary Development Issues

#### Meiosis = Diversity

- All the steps – twice!

- Alternation of Generations

#### *Genetic Variation Provided by Sex:*

- Independent Assortment of Chromosomes*

- Crossing Over Events of Non-Sister Chromatids*

- Random Fertilization*

#### Meiotic Errors

- Nondisjunction

- Aneuploidy

#### Programmed Cell Death

- Apoptosis

## **Lecture Series 6 – DNA and Its Role in Heredity**

DNA: The Genetic Material

Griffiths' rough and smooth *Streptococcus pneumoniae*

Hershey-Chase Blender Experiment

The Structure of DNA

Models and X-ray crystallography

DNA Replication

Meselson and Stahl's experiment proved *semiconservative model*

The Mechanism of DNA Replication

Enzymes involved

Lagging strand problem and resolution

DNA Proofreading and Repair

DNA repair mechanisms

Thymine dimers, depurination and deamination

Lost telomeric DNA replaced by telomerase

Practical Applications of DNA Replication

DNA sequencing

Polymerase Chain Reaction

## **Lecture Series 7 – From DNA to Protein: Genotype to Phenotype (aka The Central Dogma)**

The Hypothesis of one-gene, one-polypeptide

Transcription: DNA-Directed RNA Synthesis

Steps: Initiation, Elongation, Termination

RNA Processing: Capping, Tailing, Splicing, UTRs

snRNP's

Spliceosomes

Introns vs Exons

The Genetic Code

*Degenerate but not ambiguous*

The three types of RNA: tRNA, mRNA, and rRNA

Why are aminoacyl-tRNA synthetases so important not to mutate or otherwise mess with???

Translation: RNA-Directed Polypeptide Synthesis

Steps: Initiation, Elongation, Termination

Rem: Elongation includes codon recognition, peptide bond formation & translocation

Regulation of Translation

Polysome aka polyribosome

Posttranslational Events

Signal sequences and multiple modifications

## **Lecture Series 8 – Eukaryotic Genome & Gene Expression**

Compare and contrast Bacteria with Eucarya

Genome size vs complexity issue

Levels of chromatin packing

Mutations: Heritable Changes in Genes

Small scale or point mutations: silent, missense, nonsense, & frameshift

Large scale at chromosome level: deletion, duplication, inversion, & reciprocal translocation

Frequency of Repetitive Sequences (rem: teleomeres)

Transposition (Transposons or Jumping Genes)

Function of Transposase

The Structures of Protein-Coding Genes

Introns vs Exons revisited

**END MT#2 MATERIAL**

---

Gene families and Pseudogenes

Differential Gene Expression

Transcriptional Control

DNA binding protein motifs

Proximal vs distal control

Histones control access via acetylation level

## Posttranscriptional and Posttranslational Control

- Alternative RNA splicing

- Proteasomes degrade “old & tired” proteins

## Operon Control: Regulation in Bacteria

- Inducible/Repressible Enzymes

- lac vs trp operons

- + vs - control

- cAMP/CRP complex

- Where is the Operator?*

## Comparison of Control Features in Bacteria and Eucarya