**AP BIOLOGY 2021-22 January 18, 2022**

**Today’s Agenda (Day 89)**

1. Housekeeping Items

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1. Homework Check:

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1. Class Activity:

🡪 CONT’D: Chapter 15

1. **Section 15.2 – Sex-linked genes exhibit unique patterns of inheritance**
2. **Section 15.3 – Linked genes tend to be inherited together**
3. Section 15.4 – Alterations of chromosome number or structure cause some genetic disorders
4. Section 15.5 – Some inheritance patterns are exceptions to standard Mendelian inheritance

HOMEWORK:

* READ: Chapters 14 – 18
* COMPLETE: Ch 16 Reading Guide
* STUDY: Chapter 15 Test

Chapter 15 – Chromosomal Basis of Inheritance

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| aneuploidy | Barr body | chromosome theory of inheritance | Deletions | Down syndrome | duplications |
| genomic imprinting | Inversions | linkage map | linked genes | monosomy | nondisjunction |
| parental types | Polyploidy | recombinant types | sex-linked genes | Translocations | trisomy |

Chapter 16 – Molecular Basis of Inheritance

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Antiparallel | DNA ligase | DNA pol I | DNA pol III | DNA replication | double helix |
| Euchromatin | Helicase | Heterochromatin | Histone | lagging strand | leading strand |
| mismatch repair | Nucleases | Nucleosomes | nucleotide excision repair | Okazaki fragments | Phages |
| Primase | Primer | replication fork | semiconservative | Telomeres |  |

REMINDERS:

* TEST: Chapter 15 🡪 January 20
* Ch 16 Vocabulary – Jan. 24
* **QUIZ: Ch 15\_16 Vocabulary 🡪 Jan. 25**
* Ch 16 Reading Guide – Jan. 26
* **TEST: Chapter 16 🡪 January 27**

**AP BIOLOGY 2021-22 READING GUIDE**

# Chapter 16: The Molecular Basis of Inheritance

## Concept 16.1 DNA is the genetic material

1. What are the two chemical components of chromosomes?

1. Why did researchers originally think that protein was the genetic material?

1. Distinguish between the virulent and nonvirulent strains of *Streptococcus pneumoniae* studied by *Frederick Griffith*.
2. What was the purpose of Griffith’s studies?
3. Use this figure to summarize the experiment in which Griffith became aware that hereditary information could be transmitted between two organisms in an unusual manner.

Diagram

Description automatically generated

1. Define ***transformation.***

1. What did Oswald Avery determine to be the ***transforming factor***? \_\_\_\_\_\_\_\_\_\_\_ Explain his experimental approach.

1. Sketch a ***T2 bacteriophage*** and label its ***head****,* ***tail sheath****,* ***tail fibe****r,* and***DNA***.

1. How does a bacteriophage destroy a bacterial cell? Look ahead to Chapter 19, Figure 19.5, to explain this.

1. How did Hershey and Chase “label” viral DNA and viral protein so that they could be distinguished? Explain why they chose each radioactive tag in light of the chemical composition of DNA and protein.
2. Describe the means by which Hershey and Chase established that only the DNA of a phage enters an *E. coli* cell. What conclusions did these scientists draw based on these observations?
3. What are **Chargaff’s Rules**? How did he arrive at them?

1. List the three components of a nucleotide.

1. Who built the first model of DNA and shared the 1962 Nobel Prize for discovery of its structure?

1. What was the role of Rosalind Franklin in the discovery of the ***double helix***?

1. Distinguish between the structure of *pyrimidines* and *purines*. Explain why adenine bonds only to thymine.

1. How did Watson and Crick’s model explain the basis for Chargaff’s rules?

1. Given that the DNA of a certain fly species consists of 27.3% adenine and 22.5% guanine, use Chargaff’s rules to deduce the percentages of thymine and cytosine.

1. Name the five nitrogenous bases and put a checkmark in the correct column for each base. Also indicate if the base is found in DNA (D), RNA (R), or both (B).

|  |  |  |  |
| --- | --- | --- | --- |
| **Nitrogenous Base** | **Purine** | **Pyrimidine** | **D, R or B** |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |

1. Explain the **base-pairing rule**.

1. Describe the structure of DNA relative to each of the following:
   1. Diagram

      Description automatically generateddistance across molecule \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

* 1. distance between nucleotides \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

* 1. distance between turns \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

* 1. components of the backbone \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

* 1. components of the “rungs”\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Explain what is meant by 5' and 3' ends of the nucleotide.

1. What do we mean when we say the two strands of DNA are ***antiparallel***?

## Concept 16.2 Many proteins work together in DNA replication and repair

1. What is the ***semiconservative model of replication***?

1. Who performed the experiments that elucidated the correct mechanism of DNA replication?

1. How did Meselson and Stahl create “heavy” DNA for their experiments?

1. Use Figure 16.11 to explain how Meselson and Stahl confirmed the semiconservative mechanism of DNA replication.

Logo

Description automatically generated with medium confidence

1. Define the ***origins of replication***.
2. Distinguish between the *leading* and the ***lagging strands*** during DNA replication.

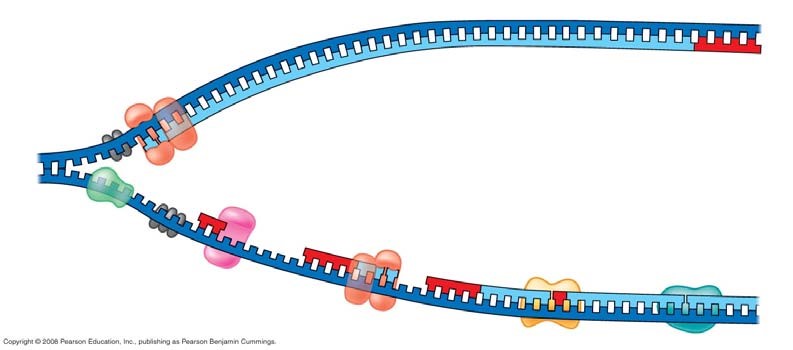
1. What is the direction of synthesis of the new strand?

1. What are *Okazaki fragments*? How are they welded together?

1. Which enzyme . . .?

|  |  |
| --- | --- |
| a. untwists and separates strands |  |
| b. holds DNA strands apart |  |
| c. synthesizes RNA primer |  |
| d. adds DNA nucleotides to new strand |  |
| e. relieves strain caused by unwinding |  |
| f. joins DNA fragments together |  |
| g. removes RNA primer and replaces with DNA |  |

1. Label the following figures. Include ***3' and 5' strands, RNA primer, primase, SSBP, topoisomerase, helicase, leading strand, lagging strand, DNA pol I, DNA pol III, DNA ligase, parental DNA*,** and ***new DNA***.



1. *Put it all together!* Make a detailed list of the steps that occur in the synthesis of a new strand.
2. Explain the roles of each of the following enzymes in DNA proofreading and repair.

|  |  |
| --- | --- |
| **Enzyme** | **Role** |
| DNA polymerase |  |
| Nuclease |  |
| Ligase |  |
| Repair enzymes |  |

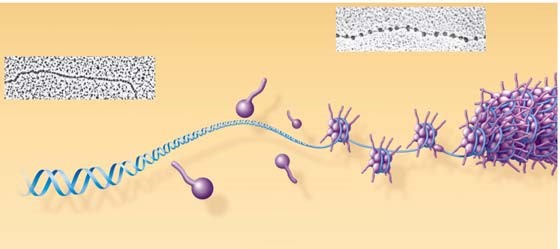
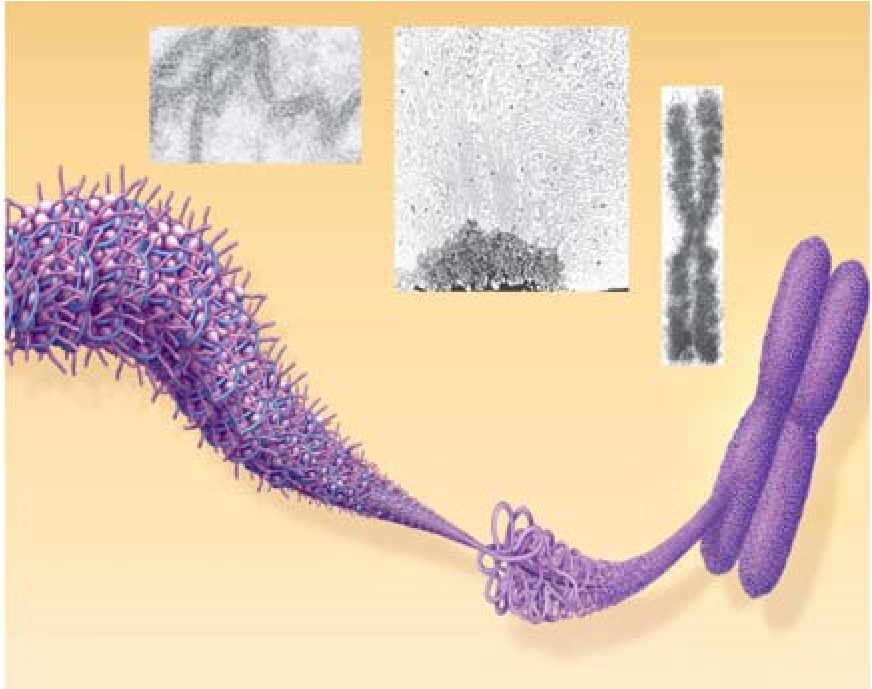
1. What is a ***thymine dimer***? How might it occur? How is it repaired?

1. Make a sketch of a chromosome and label the ***telomeres***.

1. Explain telomere erosion and the role of ***telomerase***.
2. Why are cancer cells immortal, but most body cells have a limited life span?

## Concept 16.3 A chromosome consists of a DNA molecule packed together with proteins

1. On the diagrams below, identify the following: ***30-nm fiber, metaphase chromosome, double helix, histone proteins, nucleosomes, protein scaffold*, and *looped domains (300-nm fiber)*.**



1. Distinguish between ***heterochromatin*** and ***euchromatin***.