Summer Research Assignment 2024

Junior and Senior Students

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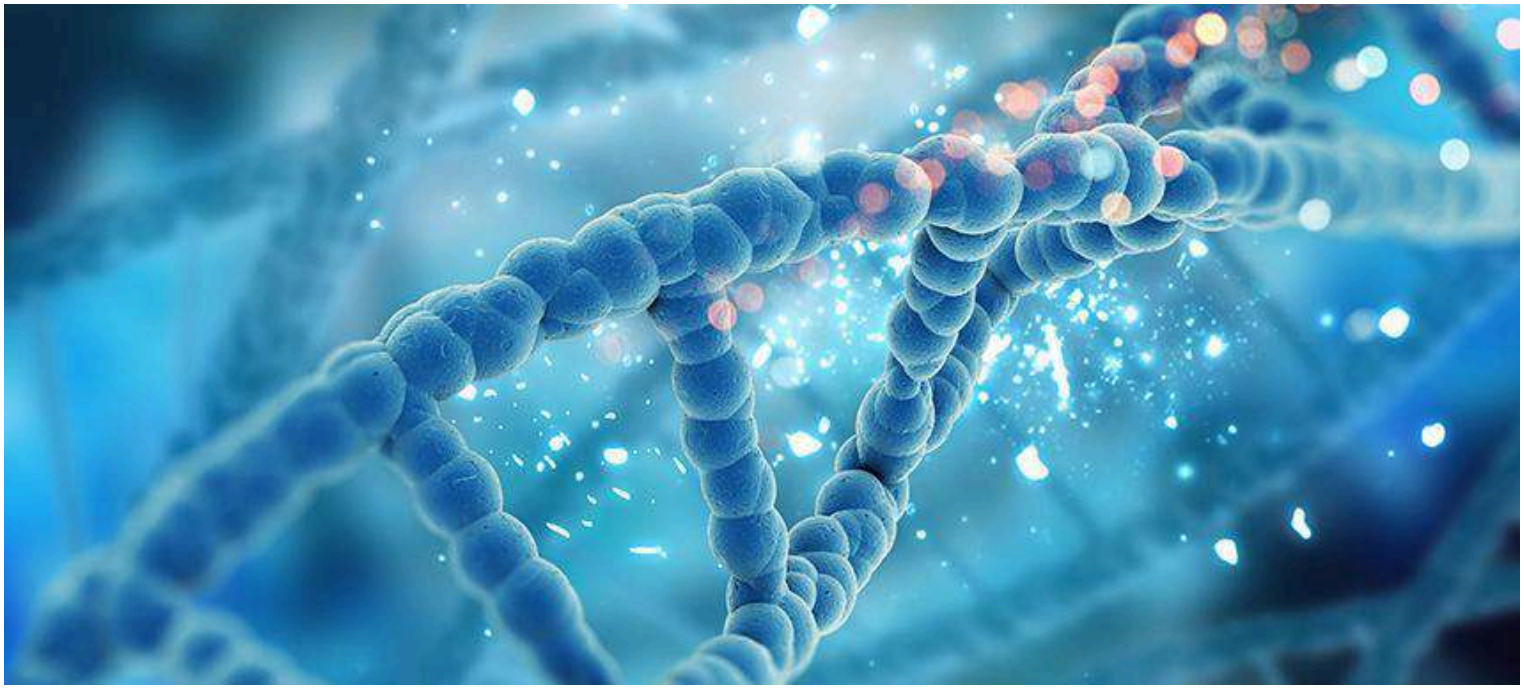
Welcome! The year ahead is packed with intriguing concepts and interesting lab work. To be successful in this course, it is extremely important that you understand the underlying molecular biology concepts associated with our experiments. The summer assignment will promote an early start to academic thinking and skill application while fostering reading and vocabulary development to enhance student knowledge.

Due Date: Please bring in a printed/handwritten copy for our first class together in September

Instructions for Assignment:

Throughout the summer, Mrs. Sbarro will be periodically checking her emails. If you have any questions, please email!

This assignment is to be completed independently. Any collaboration, posting of answers, or sharing of answers goes against the RHS Academic Integrity Guidelines. This assignment will not be accepted past the due date.

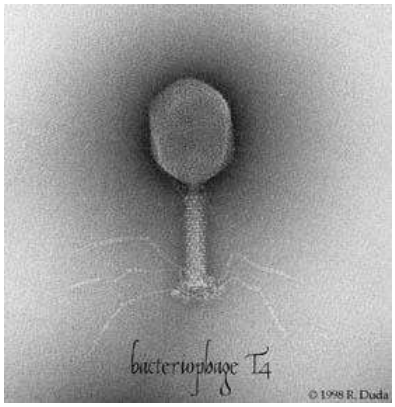


Topic 1: DNA Structure and Replication

1. Watch the video about Griffith's experiment and answer the following questions: https://www.youtube.com/watch?v=92HWRdvDF_s

Describe the results of the final mouse experiment and why this was significant:

2. Use the following website to correctly label the structure of the bacteriophage found below indicating where both the nucleic acids and amino acids are located http://sahsrojas.pbworks.com/w/page/3695057/BacteriophagePer5



2. What is the main purpose of a bacteriophage?

3. Read about the Hershey Chase Experiment below. https://bio.libretexts.org/Bookshelves/Introductory_and_General_Biology/Biology_(Kimball)/05%3A_DNA/5.02%3A_The_Hershey_-_Chase_Experiments

   Summarize their experimental question:

   Hypothesis:

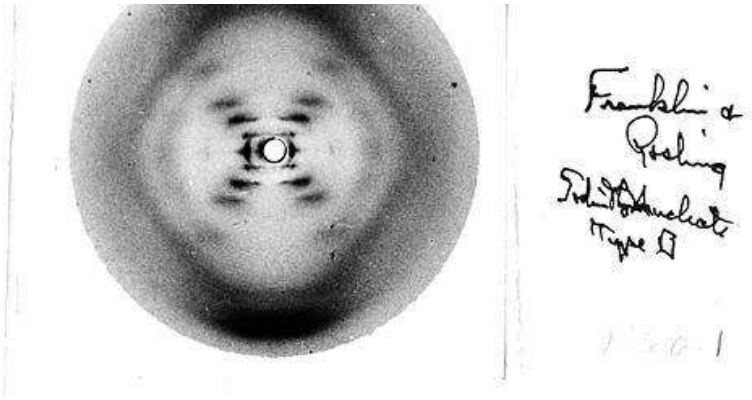
   Methods:

   Results (specific):

   Conclusion:

4. Explain Erwin Chargaff contribution to the discovery of the structure of DNA.

5. Explain why diffraction was used to take Franklin's picture below. Explain how Franklin used the picture as means to deduce the helical structure of DNA.



6. What scientistics won a nobel prize for constructing the first 3D model of DNA?

7. Watch the following animation: https://www.biointeractive.org/classroom-resources/how-dna-packaged Explain supercoiling of DNA, when and how it is done. Include a properly labeled picture for the leve of coiling from DNA to Chromosome.

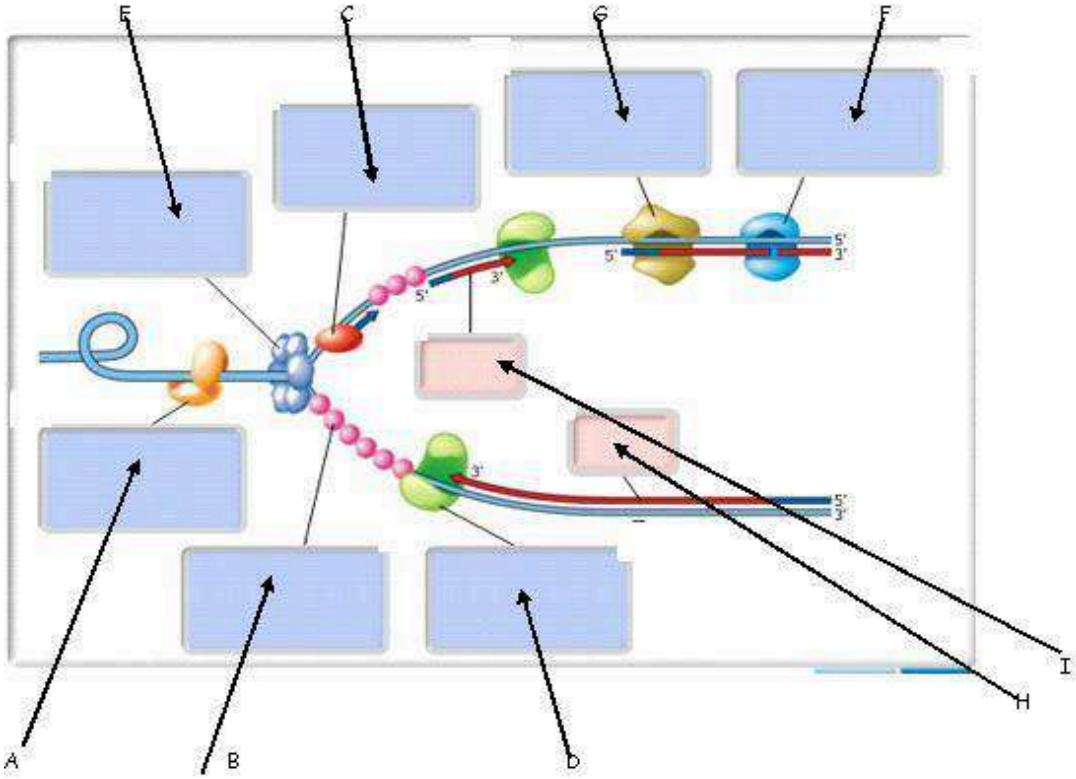
8. Watch the video below on the 5' and 3' ends of DNA and RNA. https://www.youtube.com/watch?v=IV53GZGr11g

    a. Draw a nucleotide correctly numbering the carbons.

    b. Which carbon bonds to the base?
    c. Which carbon bonds to the hydroxyl?
    d. Which carbon bonds to the phosphate group?

9. Read the article and watch the animation about DNA replication. Then label the following figure:
https://bio.libretexts.org/Bookshelves/Introductory_and_General_Biology/Book%3A_General_Biology_(Boundless)/14%3A_DNA_Structure_and_Function/14.03%3A_DNA_Replication/14.3C%3A_DNA_Replication_in_Eukaryotes#:~:text=DNA%20replication%20in%20eukaryotes%20occurs,are%20aided%20by%20several%20enzymes.

https://www.youtube.com/watch?v=3ltc21PfR9M



DNA Replication		
Letter	Name	Function
A		
B		
C		
D		
E		
F		

G		
H		
I		

10. Explain why replication results in a leading and lagging strand.

Topic 2: Transcription and Gene Expression

1. Explain the function, location and common sequences of the DNA promoter.

2. Explain the function of the following regulatory sequences in Eukaryotes:
   a. Enhancer:

   b. Silencer:

   c. Activators:

3. Explain three examples where the environment has an influence on gene expression.
   a.

   b.

   c.

4. Watch the video below and answer the following questions.
   https://www.youtube.com/watch?v=kp1bZEUgqVI

   a. What is epigenetics and briefly summarize his grammar analogy.
   b. Briefly differentiate between epigenetic and nucleosome gene regulation.
   c. How is it possible for twins to have the same dna, but have different gene expression?
   d. Explain epigenetic tags (methyl groups & acetyl groups) and they impact transcription in eukaryotic organisms.

5. Where does mRNA synthesis take place?

6. What are the three stages of mRNA synthesis?
    a.
    b.
    c.
7. Explain three differences between prokaryotic and eukaryotic protein synthesis.
    a.
    b.
    c.
8. List three post-transitional modifications that are made pre-mRNA.
    a.
    b.
    c.

Topic 3: Translation

1. Where does translation take place?
2. Watch the video below and describe the Initiation, Elongation and Termination process.
   https://www.youtube.com/watch?v=5bLEDd-PSTQ
3. Differentiate between free and bound ribosome. Noting their location, product and product destination.
4. What are the three parts of an amino acids and how are two amino acids bonded together?
   https://www.youtube.com/watch?v=xSGHOLfDoGA
5. Read about the levels of protein folding. Describe the folding at each level including the types of bonds present. Draw a diagram for each level (it does not have to be a scientific drawing, but it should help you to remember the difference between them.)
   https://www.khanacademy.org/science/biology/macromolecules/proteins-and-amino-acids/a/orders-of-protein-structure#:~:text=To%20understand%20how%20a%20protein,secondary%2C%20tertiary%2C%20and%20quaternary.

Primary:

Secondary:

Tertiary:

Quaternary:

Topic 4: Other

1. Define bioinformatics and provide two uses.