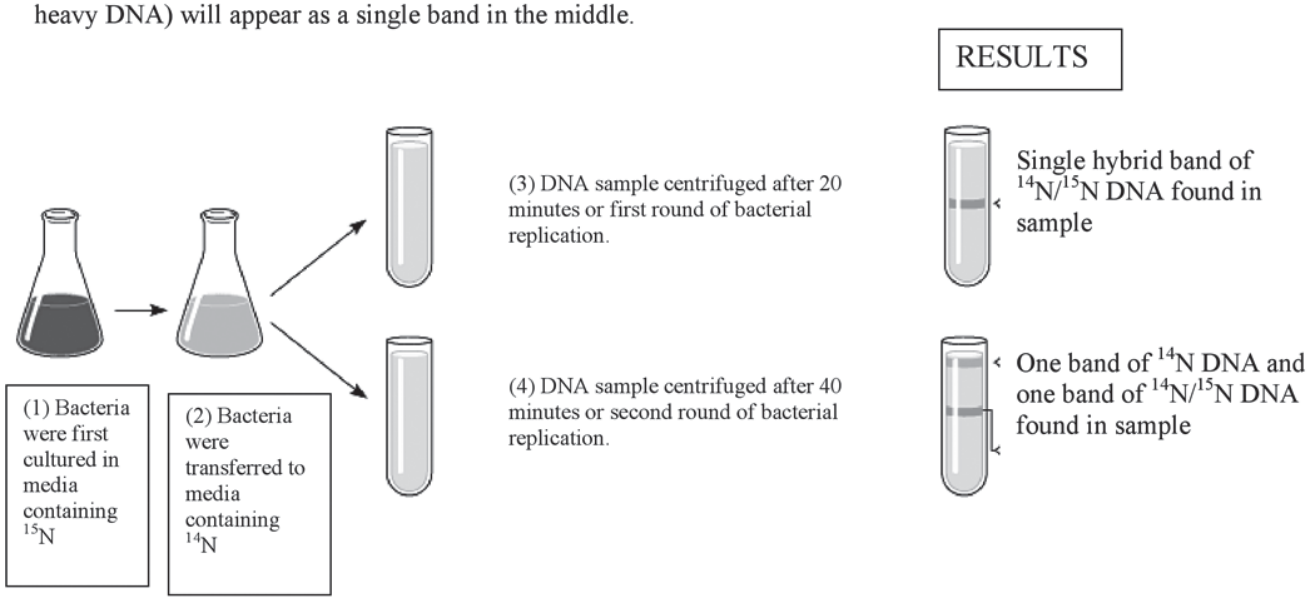
Lesson 3: Replication of DNA

If you did not complete Instructional Activity III from yesterday (Building Crime Scene DNA), complete this part prior to the parts for today.

Instructional Activity 1: The Three Models of DNA Replication

1. Using the colored pencils, markers, or crayons, demonstrate the difference between the conservative, semiconservative, and dispersive models.
    a. Under each diagram define the terms (conservative, semiconservative, and dispersive)
2. Based on what you know about how biological molecules are synthesized, which model would best support the biological theme of continuity and change? Conservation of energy? Support your answer.

FIGURE 4: Results of Meselsohn–Stahl experiment. Bacteria were first cultured in growth media containing the heavier isotope ^{15}N and then transferred to growth media containing the lighter isotope ^{14}N. A sample was centrifuged after 20 minutes (one round of replication) and a sample was centrifuged after 40 minutes (two rounds of replication). Light (top) and heavy (bottom) DNA will separate via centrifuge. Hybrid (light and heavy DNA) will appear as a single band in the middle.



3. Draw conclusions, in writing, from the results of the Meselson-Stahl experiment illustrated in the image provided.
4. After the first replication, which of the three models is proven to be invalid? Support your answer.
5. After the second round of replication, which of the two remaining models is supported?
6. What evidence from the experiment supports the model of DNA replication described by Watson and Crick?

Instructional Activity II: Student Model of DNA Replication

- Using your Crime Scene DNA from yesterday, you are to complete all steps of DNA Replication (recall your reading of the jobs of the various enzymes and the directionality of replication)
- **Use a purple bead (with 4 holes) to represent ribose for your RNA primer**
- **Use the enzyme name cards to assist you in explaining the process of replication**
- Ask your instructor to come observe as you replicate (using all steps) a portion of the DNA strand
    - It is advised that you attempt and get your idea down, then call your instructor over when you are in the middle of the DNA structure to demonstrate.
- Answer the following questions based on what you have learned from this model:
    7. Do the strands of DNA in your model run in an antiparallel direction? Support your answer.
    8. At the first step in replication, did you "unzip" the DNA molecule between the bonds connecting the strands? What type of bonds connect the strands in the double helix? (BONUS: What is the name of the enzyme that does the "unzipping"?)
    9. Can you identify the "leading" and "lagging" strands?
    10. What is the significance of the 3' → 5' and 5' → 3'?
    11. What is the role of the DNA polymerase in replication?
    12. How do the activities of replication differ on the leading and lagging strands? Why?
    13. In what direction is the template strand "read"? In what direction is the newly synthesized strand assembled?
    14. What is the replication "bubble"?
    15. Did you correctly model Okazaki fragments with respect to replication of the lagging strand?
    16. Did you correctly pair A – T and C – G when making a strand complementary to the original DNA template strand?
    17. What are the roles of RNA primer and RNA primase in DNA replication?
    18. What are the roles of telomeres and telomerases in DNA replication in eukaryotes?

Hints: