Post-it Note® Science: DNA Replication, Transcription and Translation

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Abstract

DNA replication, transcription and translation are essential to the student's understanding of cellular functions, yet are typically difficult concepts to grasp. Exercises that allow students to visualize these processes using DNA models can enhance the student's understanding. These exercises can be used as visual aids during a lecture on the processes or as a separate laboratory exercise to reinforce the material taught in lecture. Materials used are inexpensive and generally found in all classrooms.

Students use Post-it-notes® to construct DNA and RNA molecules and manipulate these "molecules" in the processes of replication, transcription, and translation. Plastic petri plates are used as transfer RNA to carry Post-it-note ® amino acids**.** The final product is a "polypeptide chain" made of post-it-notes®**.**

Materials

For each student:

- Pen or Pencil
- One pad of yellow post-it-notes®
- One pad of pink post-it-notes®
- One pad of blue post-it-notes®
- Genetic Code Table
- 5 plastic petri plate tops
- 1 piece 8.5" x 11" white paper

Outline

DNA Replication:

- Obtain one package of yellow post-it-notes. Make a strand of DNA by sticking 19 notes together.

- On the first note mark 3'. Assign each of the remaining notes a letter from the following base sequence: TAC AAA AGA ATA ACA ATT

3'	**T**	**A**	**C**	……..

- Write the complementary sequence in the space provided.

  Parent strand: TAC AAA AGA ATA ACA ATT

  Complementary Strand ____ ____ ____ ____ ____ ____

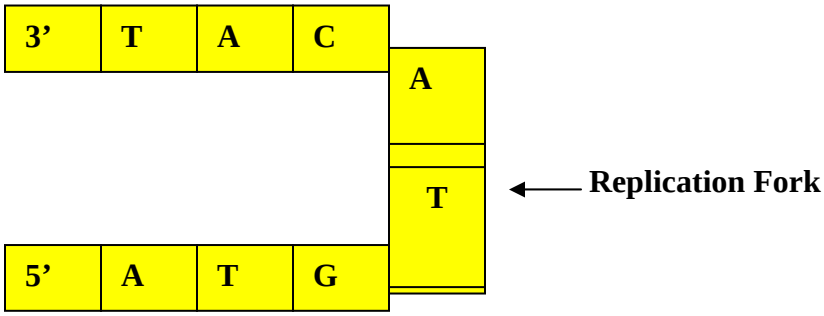
- Using this strand as a template, construct the complementary DNA strand in the same fashion. This time the strand will begin with the 5' end.

5'	**A**	**T**	**G**

- When both strands are completed put them together with the blank sides facing one another. Your DNA helix is complete.

Replication of the DNA Helix

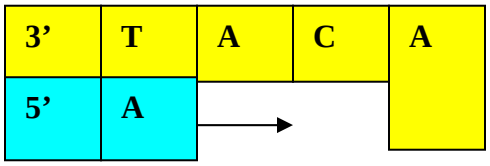
- "Unwind" the helix by laying it on the lab bench and separating the strands so that the "replication fork" appears after the first three nucleotide bases.



Using blue post-it-notes®, begin building the "leading" strand beside the coding strand. Remember that the leading strand replicates from the 5' end towards the replication fork.

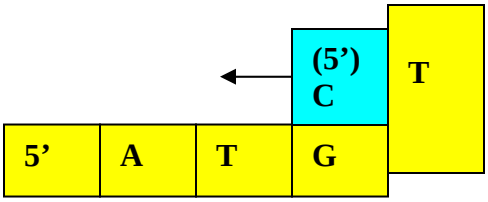
Using blue notes build the "lagging strand" from its 5' end beginning at the replication fork and working toward the 5' end of the parent strands. Continue to add bases, widening the replication fork until both strands are complete. Remember to begin replicating the "lagging strand" from the replication fork each time, working toward the end of the strand. This strand will be replicated in fragments, which will be joined when the strand is complete. When both helices are complete separate the top and bottom helices. Notice that you now have two new helices, each with one yellow parent strand and one blue daughter strand.

Replication



Newly-formed helix

3'	**T**	**A**	**C**
5'	**A**	**T**	**G**



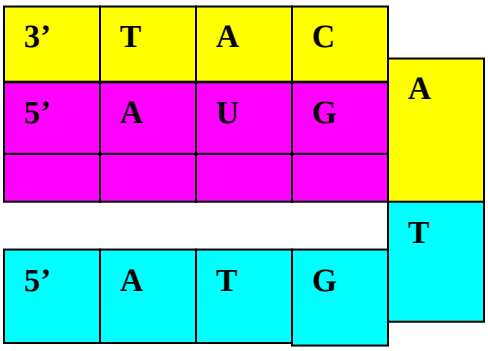
Transcription

- Use one of the helices
- Unwind the helix as you did in the replication exercise.
- Using the strand that begins with TAC at the 3' end, determine the complementary messenger RNA sequence and write it in the space below.

Parent strand: TAC AAA AGA ATA ACA ATT

MRNA: ____ ____ ____ ____ ____ ____

- Using pink post it notes® transcribe the coding strand to mRNA
- When you have reached the end of the DNA coding strand, remove the pink strand and set it aside. Reanneal the DNA helix by putting the strands back together and set aside.
- Save the pink mRNA strand for the next exercise



TRANSCRIPTION

Translation

- Place a sheet of 8.5x11 paper in landscape orientation. Using a pen, divide the paper in half. This is your ribosome.
- On the left half of the page, mark the letter P. This is the peptidyl site.
- On the right half of the page, mark the letter A. This is the aminoacyl site.
- Remember that three nucleotide bases make up a codon.
- Using the Genetic Code Table provided, determine the amino acid sequence of your strand of mRNA.
- Write the amino acid sequence in the space below using the three letter abbreviation for the amino acid. Determine the anticodon for each codon and write it in the space provided.

DNA	TAC	AAA	AGA	ATA	ACA	ATT
MRNA:	AUG	UUU	UCU	UAU	UGU	UAA
AMINO ACID SEQUENCE	MET	_____	____	____	____	_____
ANTICODON	_____	____	____	____	_____	_____

- Write the three letter code for each amino acid on a separate yellow Post-it-note®.
- Place each note on a separate petri plate. These are your "charged" transfer RNA's.
- Place a small piece of tape on the underside of the plate. Write the appropriate anticodon on the tape.
- Move the mRNA into position on the P site of the ribosome.
- Bring the appropriate tRNA into position on the ribosome on the P site.
- Move the second tRNA into the A site.
- Remove the amino acid (post-it-note) from the tRNA on the P site and stick it onto the amino acid (post-it-note) on the A site.
- Now slide the mRNA to the left so that the second codon and tRNA are in the P site and the third codon is on the A site. Move the appropriate tRNA into the A site.
- Remove the peptide chain (post-its) from the P site tRNA and stick them to the A site amino acid.
- Repeat until you reach a stop codon.
- When the stop codon is reached, remove the amino acid chain and set aside.
- "Denature" the mRNA and dispose of it properly, put the tRNA away. Recycle the ribosomes.

MRNA:	AUG	UUU	UCU	UAU	UGU	UAA
AMINO ACID SEQUENCE	MET	_____	____	____	____	_____