

Protein Synthesis Simulation

Materials: see the back of this page

- 20 DNA fragment cards
- 64 tRNA cards (put the anti-codon on one side and the word on the back)
- Worksheets (1 per student)

Preparation:

1. Tape the t-RNA cards around the room with the anti-codons showing.
2. Place the DNA fragments in the nucleus (front desk)

Activity Overview:

Set the scene by describing the classroom to the students as one big cell, with the front desk as the nucleus and the student desks as the ribosomes (etc.). Students will start at the nucleus by picking a DNA fragment and transcribing it to mRNA. They should not leave the nucleus for this step. They then go to one of the ribosomes to write out the corresponding tRNA sequence. Next they will search the room for the matching anti-codons on the tRNA cards. On the back of each card they will find a word (representing an amino acid) and the words should form a sentence (the protein). If the final sentence does not make sense, they have a mutation and should go back to figure out where they made a mistake.

This activity can also be done in groups, with one student doing the transcription *in the nucleus*, another student working as *the ribosome*, and a 3rd searching the room for the anti-codons.

Note: from "Biology With Junk" (Wartski)

For a 50 min. class period, precede this activity with a brief review of transcription and translation and follow it with a discussion of mutations. Some students will have time to complete 2 sentences.

20 Sentences;

- 1) Your mother wears a rubber band.
- 2) Your mother dresses you *funny*.
- 3) We have dog breath.
- 4) The Beatles are the best rock band.
- 5) An *old* rubber band breaks when pulled.
- 6) Biology is the best subject.
- 7) Drink water every *day*.
- 8) I love *rock* and roll music.
- 9) We are all demented puppies.

10) Biology is so much fun.

- 11) Education is the door to the future.
- 12) Your father wears *a dress*.
- 13) Your *brother* wears nothing.
- 14) We are all in this together.
- 15) We must be informed every *day*.
- 16) Rock and roll music is the best.
- 17) Biology is all around you.
- 18) Read a little every *day*.
- 19) DNA is the code of life.
- 20) DNA must be read for life.

tRNA card with Words (that go on the back):

UAG = Stop (period)
 AUG = Initiator (Start)
 AAA = *Your*
 AAC = mother
 ACG = funny
 ACA = breath
 AGU = Beatles
 AUC = band
 CAC = rubber
 CCA = when
 CUC = love
 GAA = all
 GAU = and
 GCG = fun
 GGC = to
 GUA = a
 GUU = nothing
 UAU = this
 UCG = be
 UGC = you
 UUA = DNA
 UUU = life

CCG = is
 CCU = subject
 CGA = *drink*
 AAG = *wears*
 ACC = **have**
 AGA = the
 AGC = best
 AUU = an
 CAG = breaks.
 CCC = Biology
 CUG = roll
 GAC = demented
 GCA = so
 GCU = education
 GGG = future
 GUC = dress
 UAA = we
 UCA = together
 UCU = informed
 UGG = read
 UUC = code

CGC = water
 CGG = every
 CGU = day
 AAU = dresses
 ACU = **dog**
 AGG = are
 AUA = rock
 CAA = *old*
 CAU = pulled
 CUA = I
 CUU = music
 GAG = puppies
 GCC = much
 GGA = *door*
 GGU = father
 GUG = brother
 UAC = in
 UCC = **must**
 UGA = around
 UGU = little
 UUG = for

- 1) ATGAAAA CAAGGTACA CATCTAG
- 2) ATGAAAA CAATTGCACGTAG
- 3) ATGTAAACCACTA CATAG
- 4) ATGAGAA GTAGGAGAA GCATAATCTAG
- 5) ATGATTCAA CACATCCAGCCACATTAG
- 6) ATGCCCCGAGAA GCCCTTAG
- 7) ATGCCACGCCGGCGITAG
- 8) ATGCTACTCATAGATCTG(- II IAG
- 9) ATGTAAAGGGAA GACGAGTAG
- 10) A'IGCCCCCGGCA GCCGCGTAG

- 11) ATGGCTCCGAGAGGAGGCAGAGGGTAG
- 12) ATGAAAGGTAAAGGTAGTCTAG-
- 13) ATGAAAGTGAAAGG ITTAG
- 14) ATGTAAAGGGAATACTATTCATAG
- 15) ATGTAATCCTCGTChCGGCGTTAG
- 16) ATGATAGA CGAGAA GCTAG
- 17) AT C,C000CGGAATGA PGCTAG
- 18) ATGTGGGTATGTCGGCGTTAG
- 19) ATGTACCAGATrCI GTTTTAG
- 20) ATGITATCCTC AG

If you like this lab be sure to see the ad on the last page for more from th u-~--~'~'-'

Name (s):

Protein Synthesis Simulation

1. Start at the "nucleus". Pick up a DNA strand and write the number *of* the DNA strand here:
2. Staying in the "nucleus", transcribe the DNA into mRNA. Write the mRNA sequence here:
3. Go to one *of* the "ribosomes" and write the tRNA sequence that corresponds to your mRNA here:
4. Split the tRNA sequence into anti-codons (groups *of* 3 letters)
5. Look around the room for the tRNA cards that match your anti-codons. Write down the words in order.

If you complete this correctly, you should have a sentence. *If* it does not make sense, you have made a mistake and need to go back and start over. Check your answer with the teacher when you are done and then answer the questions on the back *of* this sheet.

If you have time, you may complete another DNA sequence for bonus points.

Questions:

1. Why did you have to stay in the "nucleus" to write down the mRNA?
2. Which part of this activity represents transcription?
3. Which part of this activity represents translation?
4. What happens in the ribosomes during protein synthesis?
5. What does the final sentence represent in terms of protein synthesis?
6. What does each word represent in terms of protein synthesis?
7. All DNA sequences started with ATG and ended with TAG? Why?
8. How does this activity differ to doing protein synthesis problems using the genetic code?