Protein Synthesis Game

«««« By Kayla Mazzolin

Kayla Mazzolin was a pre-service teacher at York University in the IS Division when she wrote this article. Kayla was a recipient of the 2012 Don Galbraith Pre-service Teacher Award of Excellence with this submission. She spent last year teaching science in England.

Curriculum Connection: Grade 12 University Biology, SBI 4U

This game is great to use as a review tool for students enrolled in SBI 4U. It applies to the Protein Synthesis chapter of the Molecular Genetics unit and addresses expectations D2.1, D2.4, D3.2 and D3.3.

How to Play the Protein Synthesis board game

Game pieces

Teachers have the option of using Lego, plasticine, or other buildable materials for their game pieces. The idea is that students are building proteins, so it's ideal to use a material that can be added to.

Cut out the question cards shown on the following pages. Once they are cut, write the difficulty level on the back of each card. The difficulty level is indicated at the bottom of each page. Teachers with larger classes can make more question cards.

Some activities involve drawing. Teachers may decide to supply students with a sketchpad and a pencil as part of the game board.

Game Play

This game is played in partners of two. There must be a minimum of two teams playing (four players) up to a maximum of four teams playing (eight players).

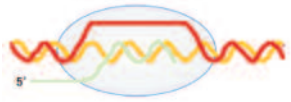
Players start in the nucleolus with one building block and add pieces to their "mRNA" transcript per each space they pass over. On each turn, a team has a chance to complete an activity on one card and advance along the board. If the team successfully completes the card they have chosen, they can advance the number of spaces that the card is worth (Cards from page 1 are worth 3; cards from page 2 are worth 2; cards from page 3 are worth 1). Whether the activity is completed successfully or not, the turn always ends after one card. If there are special instructions on the board, follow those instructions.

When the team reaches the lysosymes, they must complete one card from each difficulty level (each correct answer moves only one space at this stage). The first team to "make a completed protein" wins!

Game Cards

Together you and your partner have one minute to answer the following question: **What is Garrod's Hypothesis?** One gene, one enzyme	You have one minute to draw the item below. Your partner must guess what you are drawing before time runs out. **THE LAC OPERON**
Together you and you partner have one minute to answer the following question: **Name one of the codon sequences for the amino acid glycine.** GGU, GGC, GGA, GGG	Together you and you partner have one minute to answer the following question: **Define these types of mutations: substitution, deletion, and insertion.**
Together you and you partner have one minute to unscramble the following word. Move an extra space if you can also provide the correct definition within the minute. **CIBU RICCADONELI** Ribonucleic Acid; The nucleic acid found in RNA	

Game Questions Page 1 (Level 3 difficulty)

One of you will read the word below aloud to your partner. After they know the word, they have one minute to spell it backwards. They cannot backtrack on their spelling. **TRANSCRIPTION**	You have one minute to draw the item below with your eyes closed. Your partner must guess what you are drawing before time runs out. **SICKLE CELL ANEMIA**
Together you and you partner have one minute to answer the following question: **Name the three stop codons.** UAA, UAG, UGA	Together you and you partner have one minute to answer the following question: **Describe the process of ELONGATION.** mRNA synthesized using DNA template strand. Is synthesized in 5' to 3' direction. Uracil complements adenine.
Together you and you partner have one minute to answer the following question: **Which colour is the template strand?**  Orange	Together you and you partner have one minute to answer the following question: **Why do we use RNA?** The Central Dogma: So DNA doesn't leave the nucleus
Together you and you partner have one minute to answer the following question: **Uracil replaces which nitrogenous base in RNA?** Thymine	Together you and you partner have one minute to answer the following question: **What is the difference between a nonsense and a missense mutation?** Missense: wrong amino acid Nonsense: change to a stop codon

Game Questions Page 2 (Level 2 difficulty)

One of you will read the following word to your partner. They have one minute to provide the definition. **SILENT MUTATION** A mutation that does not cause any phenotypic change	Together you and your partner have one minute to unscramble the following word. Move an extra space if can also provide the correct definition within the minute. **NUTTOMIA** Mutation
Together you and you partner have one minute to answer the following question: **What is the almost universal start codon? Provide its code.** Methionine. AUG	You have one minute to draw the item below. Your partner must guess what you are drawing before time runs out. **Transcriptional RNA (tRNA)**
One of you will read the following question to your partner. They have one minute to provide the answer. **What does RNA stand for?** Ribonucleic Acid	Together you and you partner have one minute to answer the following question: **List the stages of TRANSCRIPTION** Initiation; elongation; termination
Together you and your partner have one minute to answer the following question: **What is the nitrogenous base pairing in DNA?** Thymine-Adenine; Cytosine-Guanine	One of you will read the following question to your partner. They have one minute to provide the answer. **How many bases make up a codon?** Three

Game Questions Page 3 (Level 1 difficulty)

PROTEIN SYNTHESIS