Teacher Instructions for Translation

This is the final process represented in this project. The product here is a chain of amino acid stamps that are based on the DNA sequence described in Lesson 2. This lesson will result in the third panel of the 3-panel (total) art project. Please note that the art instruction and the science instruction are integrated and intended to "flow" together.

Teacher Preparation Tip: The tRNA/Amino Acid stamping tool used in this portion of the lesson needs to be created prior to this segment of instruction. The teacher should make these tools as part of the Teacher Preparation instructions in Lesson 1. Another option would be to have more advanced students create these tools as part of an extension or enrichment activity. The instructions for these stamps are explained in detail in Lesson 1. All 20 amino acids could be be made into stamps, or another option is to make only the amino acids coding for by the DNA sequence used in this project.

Prior to beginning this third panel of the art project, there should be a review of the entire process of protein synthesis as well as the function of the various types of RNA (mRNA, tRNA and rRNA). Teachers are reminded that this is an area for potential misconceptions. Students may think that the anticodon contains the only RNA on the tRNA molecule. Emphasize to them that the entire molecule is made of RNA -- not just the anticodon. In other words, tRNA is made of nucleotides containing the nitrogen bases of A, U, G, and C. The part of tRNA that matches (complements) the mRNA codon is a 3-nitrogen base unit known as the anticodon. Also emphasize that tRNA functions as a "tool" to bridge the correct amino acid to the mRNA sequence. Be sure the students understand that the process of protein synthesis is not complete until the amino acid chain undergoes folding. Although this project creates a peptide chain, the folding process is **NOT** represented.

The teacher should also create an inquiry moment that allows students to create a metaphorical association between the amino acid stamping tool and the actual tRNA molecule. Just as tRNA deposits its amino acid in the ribosome ,and the amino acid becomes part of the peptide chain, the tRNA/amino acid stamping tool leaves its amino acid behind on the posterboard. Moreover, the tool can be painted on and used again in the process, mirroring the repetitive nature of this process. (**Note**: the printmaking process in art is inherently a repetitive process, which is why the use of the medium is well suited to this portion of the project and creates yet another metaphorical connection.)

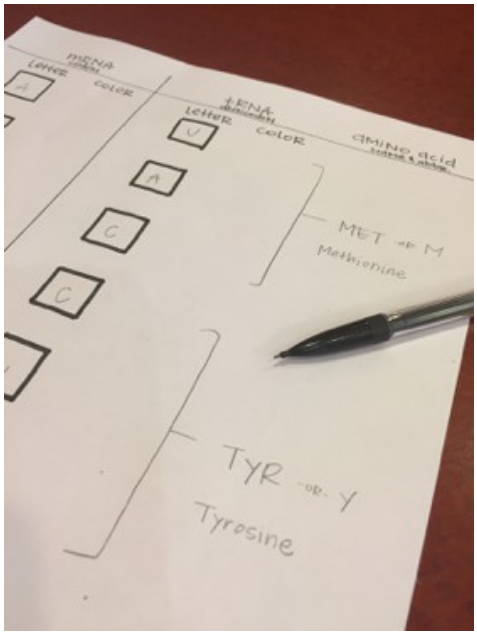
Gray paint was purposely selected for the amino acid stamp on the back of the tRNA stamp. It is classified as "neutral" on the color wheel, which helps differentiate it from any particular nitrogen base. From an aesthetic point of view, gray has an industrial "feel" that helps communicate the factory-like process of building the peptide chain. Teachers are encouraged to create an inquiry moment related to the choice of gray, so that students can build the metaphorical association themselves.

Additional tips:

- Students will need instruction on how to use a codon chart. Any traditional codon chart of the teacher's choice will work.
- If students become confused in this phase of the project, remind them that the process of protein synthesis becomes increasingly complex at this point.

Central Dogma

1. Using the Transcription/Translation Placemat, have students look for a “start” codon (AUG). Beginning with this sequence, students should find and horizontally mark off the triplets on the mRNA, working down the entire length of the placemat.



Optional: The DNA sequence used in this exercise has been designed to have 3 different and viable “reading frames.” Teachers may/may not choose to go into this amount of detail, but the option has been provided

2. Using a codon chart, have students write the appropriate amino acid next to the mRNA triplet on Transcription/Translation Placemat until reaching a “stop” codon (UAA, UAG, UGA).

3. Beginning with their first noted amino acid, students should select the tRNA/amino acid tool that has the triplet anticodon that is complementary to the first mRNA triplet in their chosen reading frame.

4. On that particular tool, students paint the 3-letter abbreviation for the amino acid in gray. (Keep the paper backing on).

5. It is important at this point that the label side of the tool is facing up and the painted amino acid abbreviation is facing down. Students hover the tool in the air, matching the anticodon to the codon. Then, with a firm and steady hand, they “stamp” the amino acid, symbolizing that it has been left behind.

6. Students refer to Transcription/Translation Placemat to find the second triplet and its corresponding amino acid, which they noted in step 2. They repeat steps 3-5 yet again until reaching a stop codon, which is “abbreviated” on one of the tools with a “——”.

Note: Artistically, this final step is the simplest portion of the process. Scientifically, this is arguably the most complex portion of the process.