

Use of a “DNA Cookbook” to Demonstrate Transcription and Protein Synthesis

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Students often have trouble visualizing the processes of transcription and translation that lead to the formation of proteins. As such, a simulation using the analogy of a cookbook containing instructions for making lemonade was developed. This simulation was designed to help students see the relationship between DNA in the nucleus containing the code (the cookbook), mRNA (a note card) which carries the code in a slightly different language from the nucleus to the ribosome, and tRNA (a cup) which functions to hold a specific amino acid (ingredient) and to properly line up the amino acids by matching anticodons (on the cup) to codons (on the note card). The protein product is represented by the mixture of all of the ingredients (the drink). By changing a base pair in the DNA, the student can see the effect of mutations. A change in the DNA results in a change in the mRNA which then requires different tRNAs (cups) containing different amino acids (ingredients) to contribute to the product (drink). What started out as a tasty drink becomes unpalatable, or a different color, or has a different taste. As in nature, most “mutations” are worse than the original.

There are unlimited possibilities as to the products that can be made. Depending on one's creativity, many different combinations are possible. In the simulation presented, coding from a 12-base pair piece of DNA resulted in a four amino acid product: lemonade.