Instructions - short

Part 1: Constructing the Nucleotides

The purpose of this step is to prepare the main units of the DNA molecule, namely the nucleotides (Figure 1A–C).

- Use a damp sponge to wet flakes on one end.
- Stick wet end of a yellow flake (deoxribose) onto the end of a blue flake (phosphate group). Keep them in position with your hands for approximately 20-30 sec
- Once the blue and yellow flakes are stuck together, take the colored flake (i.e., red, orange, white, green for the nucleobases) and stick the wet end of the colored flake onto the side of the yellow flake. See Table 1 for color codes.
- Repeat these steps until all the DNA units that you will need, according to the reference sequence (see your group sheets), have been prepared.

A B C

FIGURE 1 PlayMais nucleotides. (A) Chemical structure of a nucleotide. (B) PlayMais DNA units consisting of a phosphate (blue flake), a deoxyribose (yellow flake), and a base (colored flake). (C) PlayMais nucleotides.

Table 1 Flake Color Code

	Flake Color
Adenine base	Red
Cytosine base	Orange
Guanine base	White
Thymine base	Green
Deoxyribose	Yellow
Phosphate group	Blue

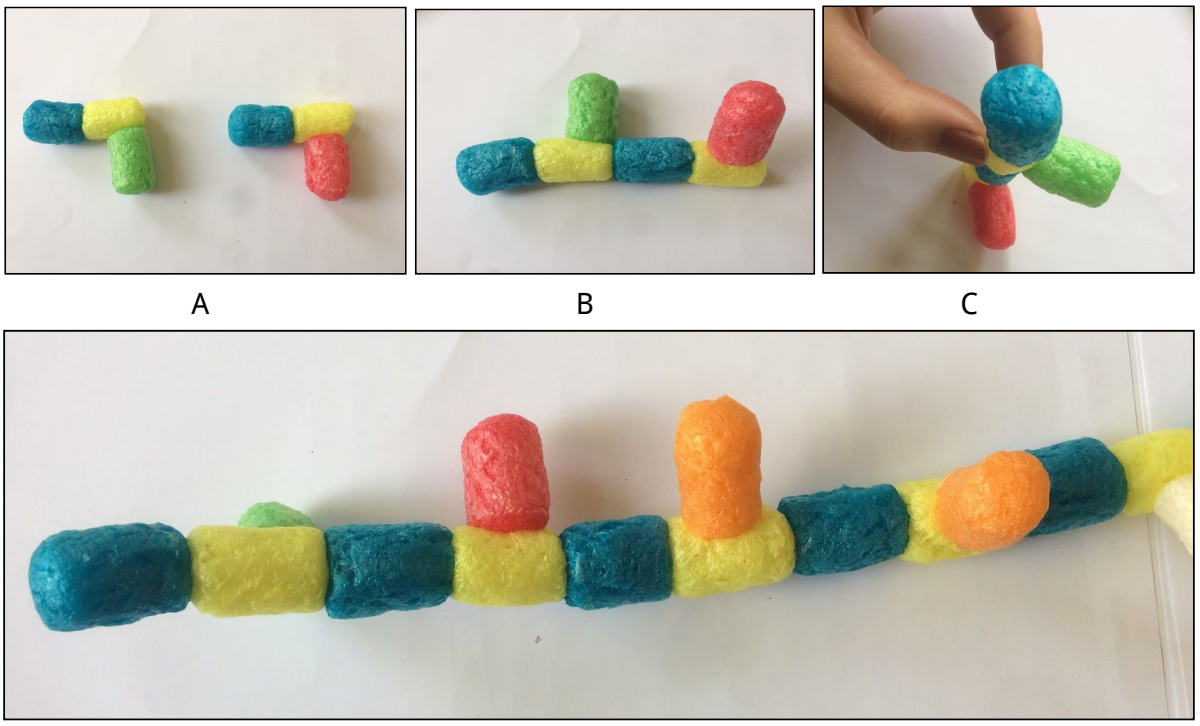
Part 2: Building the first Strand

First, one of the two DNA strands will be prepared.

- Take the first and the second nucleotides according to the reference sequence (Figure 2A).
- Wet the end of the blue flake of the second nucleotide and stick it onto the yellow flake of the first nucleotide (Figure 2B). Note: In order to facilitate the rotation of

the DNA double helix, stick the nucleotides of the first strand with its base rotated 45 compared to the base of the previous nucleotide (Figure 2C).

- Continue as described in the first steps for the remaining nucleotides of the sequence (Figure 2D).
- Mark all codons with numbers in a continuous fashion on the coding strand.



A B C D

FIGURE 2 Assembly of the first PlayMais strand. (A) Two PlayMais nucleotides are selected according to the reference sequence. (B–C) The blue flake of one of the two PlayMais nucleotides is wet and stuck onto the yellow flake of the second one, respecting the nucleobase rotation of 45 around the backbone chain. (D) First strand overview.

Part 3: Building the Complementary Strand lika a DNA Polymerase

During this step, you will act as if you were a DNA polymerase synthesizing the complementary strand. Using the remaining units, you will add them one by one to the previously built first strand. To do so, you will have to respect the law of base-pairing (Figure 3A).

- Add the first nucleotide to the last nucleotide of the first strand as shown in Figure 3A
- For the second and all other nucleotides, stick the blue flake onto the yellow flake of the previous nucleotide, maintaining a right-handed angle of 45 between the two nucleobases (Figure 3B). Second, stick the two colored flakes of the complementary nucleotides (old and new strand) together (Figure 3C). Perform this step gently, since the elasticity of the torsion will start pulling the two strands apart.
- Continue adding nucleotides until the double helix is completed (Figure 3D).

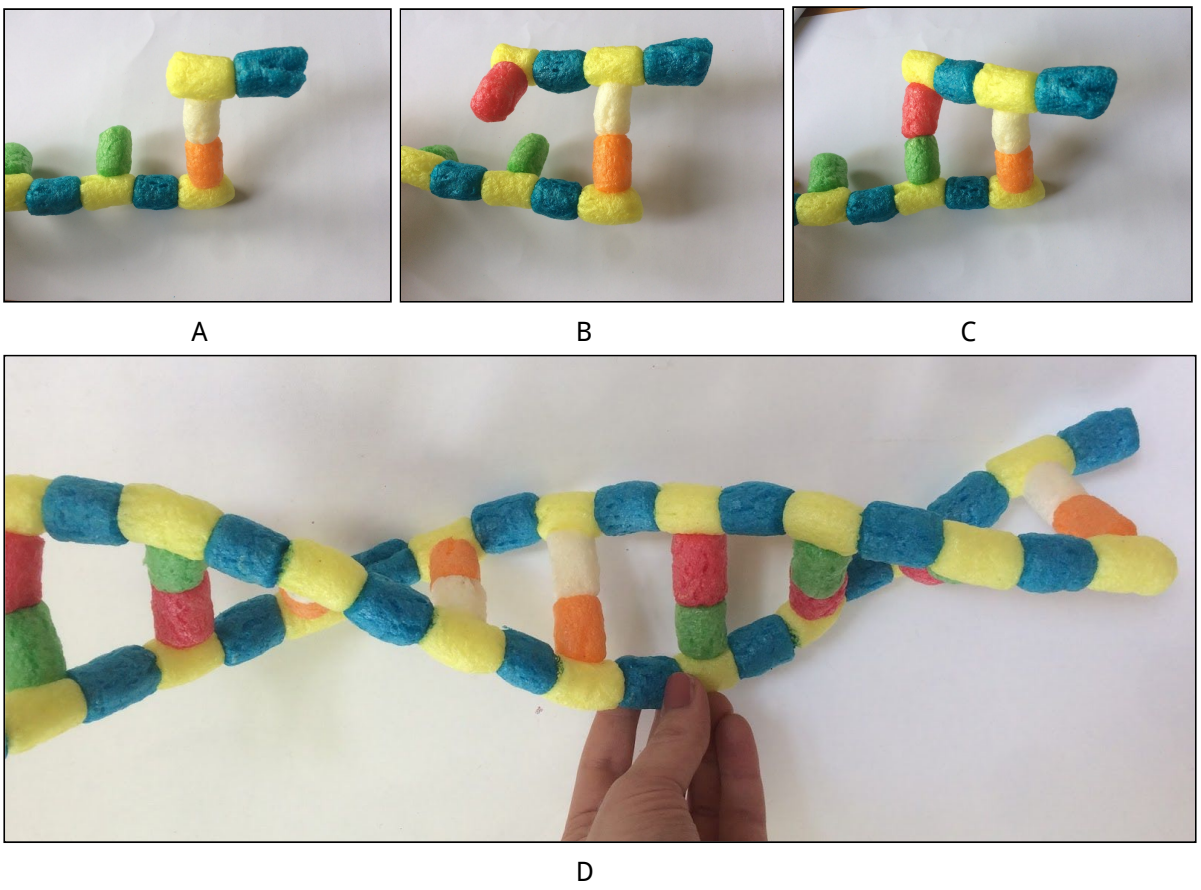


FIGURE 3 Building of the second strand. (A) The first PlayMais nucleotide added is complementary to the PlayMais nucleotide of the old strand. (B-C) The second PlayMais nucleotide is added to the first one respecting the 45 right-handed rotation. (D) Completed first part of the double strand.

Part 4: Connect all individual Parts and Decipher the Amino Acid Sequence Resulting from Transcription and Translation

- To do so, wet the blue flakes of each fragment and stick them onto the corresponding yellow flakes from the other fragment.
- Identify the Start-Codon in sequence 1.
- Transcribe and translate the sequence according to the translation process as described in the background information and using the RNA codons as given in Figure 6. Please use the one-letter amino acid code.

Part 5: Introduce Mutations/DNA modifications

- Introduce the mutation/DNA modification as given on the team sheets at an appropriate position within the region you created
- One person of each group explains the given mutation, how and where it was introduced, and the effects on the corresponding amino acid sequence to the rest of the class