

Handmade DNA: a tactile model to explore the basics of DNA

Activity 1: DNA structure answer sheet

1. What does the WOODEN BLOCK correspond to?
2. What does the WIRE correspond to?
3. What do they form together?

The model represents the three parts that each nucleotide is composed of. The chenille wire reproduces the phosphate (free ends of the wire) and the deoxyribose sugar (wire ring); the wooden blocks represent the four nucleobases. The wire + wood set constitutes the nucleotide.

4. How do nucleobases pair with each other? Can mistakes be made?

The nucleobases pair selectively: A only with T and G only with C; in some cases, errors can occur, for example, in the model, you can tie A-A or T-T, but they do not bind as well as the correctly matched pairs. Note: this model does not reflect the different sizes of the purine (G, A) and pyrimidine (T, C) nucleobases, which would normally also discourage mispairing.

5. Do the two pairs of nucleotides (A-T and G-C) bind with the same strength?

The strength of the ties is different for the two pairs, greater for G-C, tied with Velcro. In the real molecule, G-C forms three hydrogen bonds, A-T only two. This can be verified by trying to detach the various bases.

6. Are the two strands identical?

The two strands are not identical, but complementary; this property is highlighted more in Activity 2.



Optional extra questions:

7. Do the bonds between ribose and phosphate change if the nucleotide sequence changes?

The bond between ribose and phosphate is always the same; it does not depend on the base present in the nucleotides involved.

8. Is it possible to recognize a direction in each strand of the model?

Yes, in the model, it is represented by the ring-hook sequence, so at the end of the finished molecule, there is always a ring and a pair of hooks. This arrangement corresponds to the characteristic of DNA to have strands with opposite orientations, called antiparallel.

9. In the real DNA molecule, which types of bond form between the nucleobases?

In real DNA, the bonds between the nucleobases are hydrogen bonds (three between G-C and two between A-T).