

Exploring DNA With The DNA Discovery Kit®

Student Worksheets

by

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PART I. DNA Background Information

Try answering these three questions about DNA in one or two sentences by writing a sentence or two

1. What is DNA?

2. Where is it found?

3. What does it do?

PART II. BUILDING A DNA MOLECULE

A. NUCLEOTIDES AND POLYNUCLEOTIDES

Using the DNA Discovery Kit[®], construct each of the four nucleotides.

1. What parts of each of the nucleotides are the same?
2. What part is different?
3. Label the parts of the nucleotide on the diagram below.

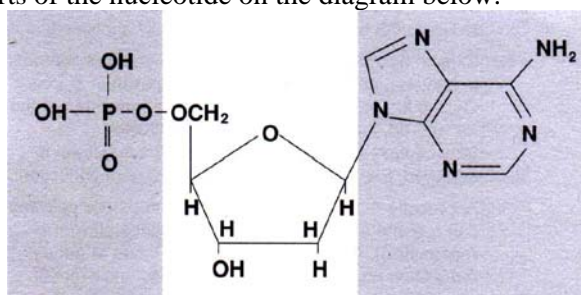


Fig.9

Locate on the model each of the atoms labeled in the above diagram. In what ways does the picture of the nucleotide look different from the model of the nucleotide?

4. What kind of bond joins the phosphate, sugar, and the base?
5. Join two di(*two*)nucleotides together. How many possible dinucleotides can be formed?
6. Construct a tetra(*four*)nucleotide. How many possible tetranucleotides can be formed?
7. Construct a deca(*ten*)nucleotide. How many possible decanucleotides can be formed? How stable do you think a polynucleotide is (how easy do you think it would be to break it up into separate nucleotides or into the component phosphates, sugars, and bases)? Notice, as you build the polynucleotide, the orientation of one nucleotide with respect to the next one. Is it the same or different as you build it up? What overall shape does the polynucleotide take? Are both ends the same, or different?

B. BUILDING A DOUBLE-STRANDED DNA

1. Examine the bases in the DNA Discovery Kit[®]. Notice that in addition to the place where the base can be joined with the sugar, there are also magnets on the red oxygen, blue nitrogen, and white hydrogen. They represent the tendency of these atoms to form “hydrogen bonds”:

O with H-N

N with H-N or H-O

If you make pairs between all possible bases (purines-purines, pyrimidines-pyrimidines, purines-pyrimidines) you will discover 10 non-redundant pairing. For how many of these can you demonstrate hydrogen bonding?

2. DNA is composed of two polynucleotide molecules that are bonded to each other through hydrogen bonds between the bases. Try constructing a segment of a DNA molecule that shows this. You can do this by constructing a single polynucleotide and then try to hydrogen bond different nucleotides to those in the existing polynucleotide so that they, too, can be joined to form a second polynucleotide chain. Or you can start out with two hydrogen-bonded nucleotides and then add subsequent nucleotide pairs.

- Can all possible nucleotide pairs you made earlier be used to construct a double stranded DNA segment? If not, which ones can?
- How many different sequences can you construct using six nucleotides?
- Can you construct a double stranded DNA segment in which both strands are anti-parallel?parallel?

3. Some questions to think about:

- Why do you think DNA is double-stranded instead of single-stranded?
- Does a DNA consisting of a million nucleotide pairs have more information than a single-stranded polynucleotide consisting of a million nucleotides?
- Which is easier to do: separate two strands of DNA or disassemble the nucleotides in a single strand? Why?
- How do you suppose the two strands of DNA come apart during replication?