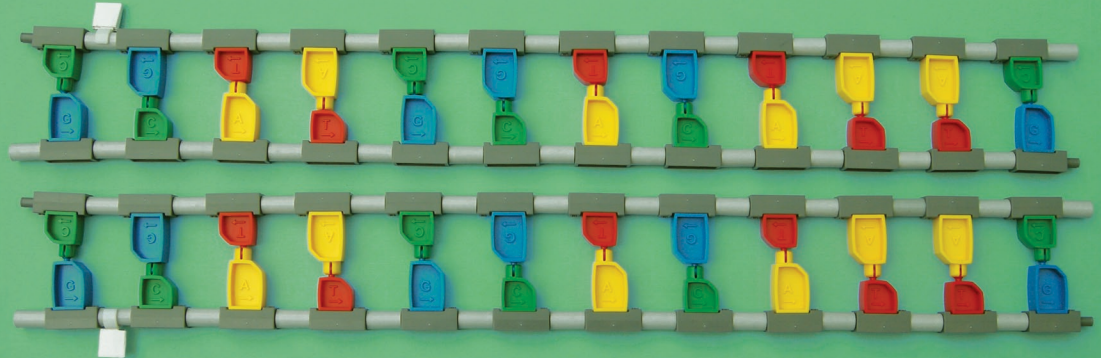


DNA/RNA

Booklet 2: Advanced DNA Topics



Models and lessons created
by Kathleen M. Vandiver.
Graphics by Amanda Mayer.
©MIT. All Rights Reserved.

Version 2/4/2016

Table of Contents

Table of Contents.....	Page 1
Using Your Booklet and Kit.....	Page 2
PART I: NUCLEOTIDE CHEMISTRY	
Sugar Chemistry.....	Page 3-4
Phosphate Chemistry.....	Page 5-7
Base Chemistry.....	Page 8-9
PART II: REPLICATION, DAMAGE, AND REPAIR	
Advanced DNA Replication.....	Page 10-21
How DNA Damage Causes Mutations.....	Page 22
DNA Damage and Replication.....	Page 23-31
DNA Repair.....	Page 32-34
PART III: MUTATIONS	
Overview of Mutations.....	Page 35
Substitution Mutations.....	Page 36-41
Addition and Deletion Mutations.....	Page 42-48
Chart of DNA Codons.....	Page 49
Check Your Understanding.....	Page 50
Answers to Helpful Questions.....	Page 51

This booklet assumes you have completed DNA/RNA Booklet 1: Introduction to Structure and Function.

Using Your Booklet and Kit

Q: = Helpful Questions (answers on Page 51)

Bold type = required actions

Underlined = new vocabulary

1. Open the kit. Count the gray DNA pieces in the small compartments.

Each compartment should have 4 similar DNA pieces. Check that the colors are in the correct places. There are:

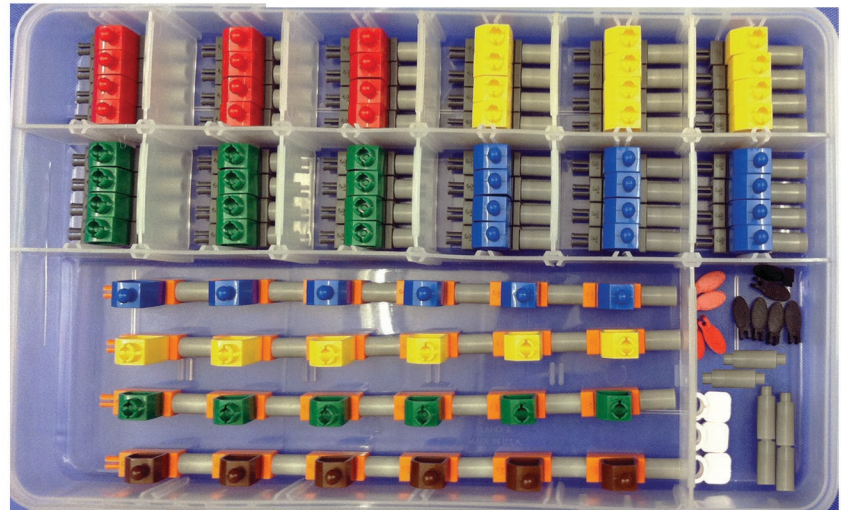
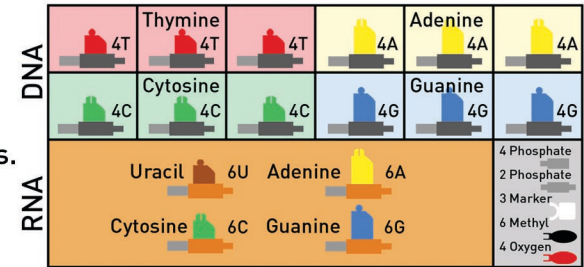
- 12 red (T)
- 12 yellow (A)
- 12 green (C)
- 12 blue (G)

2. Count the orange RNA pieces in the large compartment. Similar RNA pieces should be joined together in groups of six. There are:

- 6 brown (U)
- 6 yellow (A)
- 6 green (C)
- 6 blue (G)

3. Identify and count the pieces in the last compartment. There are:

- 6 gray cylinders (phosphates)
 - 4 with single pin*
 - 2 with double pin*
- 3 white markers
- 6 black clips (methyl)
- 4 red clips (oxygen)



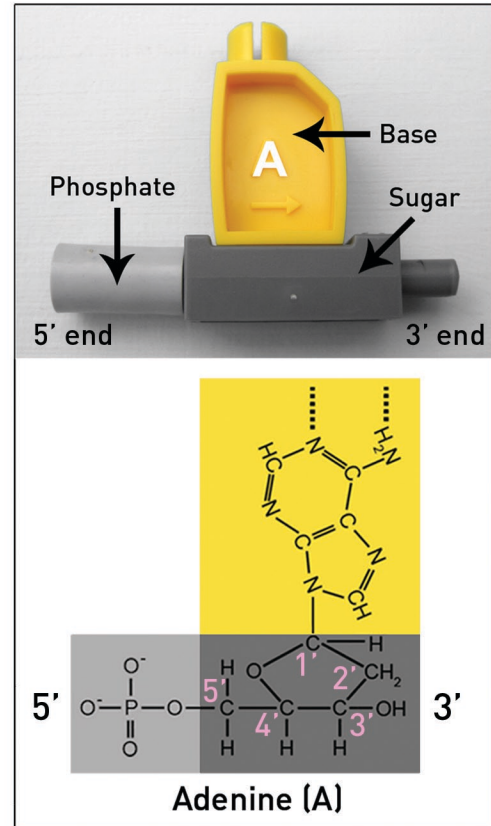
PART I: NUCLEOTIDE CHEMISTRY

You will simulate cell processes in greater detail in this booklet. The chemistry of these processes is important to understand. Begin by examining the three parts of a nucleotide more closely.

Sugar Chemistry

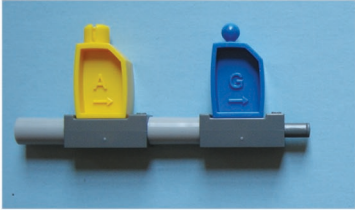
1. Pick up an adenine (A) DNA nucleotide. Identify the gray sugar component.
2. Look at the diagram to visualize the sugar's atoms. Find the carbon atoms in the sugar that are numbered 1' through 5' in pink. (The mark next to the number is called "prime.")
3. Locate the 3' carbon and the 5' carbon in the diagram. They are positioned on opposite ends of the sugar. These carbons establish the two ends of the nucleotide.

DNA Nucleotide

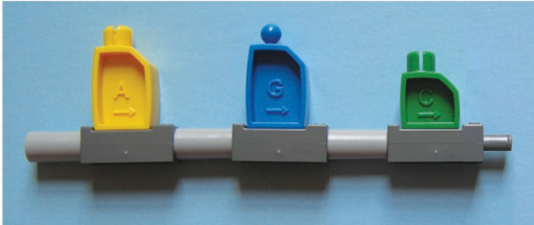


The 5' end of the sugar is always attached to a phosphate group. The 3' end is free. The enzyme DNA polymerase can only lengthen a DNA strand by adding nucleotides to the free 3' end. Thus elongation can only occur from one end of a strand.

4. Find the 3' mark on the A in your hand. Add a G onto this 3' end.



5. Add a C onto the 3' end of the G. Check your DNA strand with the photo below.



Q: Which number carbon is free (can be added onto)? Which number carbon is attached to the phosphate group?
(*HINT: Refer to the diagram on page 3*)