HUMAN DNA MODEL

Key points about DNA!

1. **Double Stranded–**

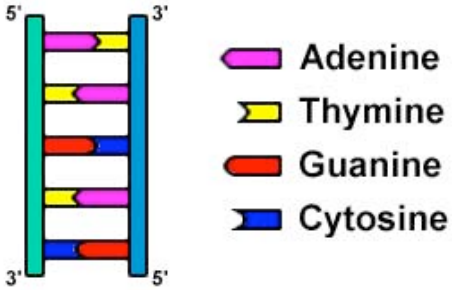
There are two sides to a piece of DNA

2. **Anti-parallel–**

The two strands go in opposite directions

3. **Complementary–**

When you know one side, you can infer the other (*A pairs with T, G pairs with C*)



4. **Helical–**

DNA is twisted like a coiled spring

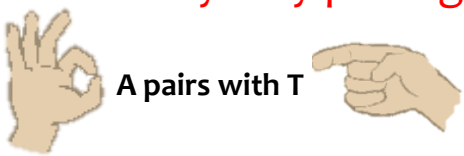
Human DNA Model!

Which of the Key Points can we show in the human DNA Model?

Double stranded – by standing in two lines

Anti-parallel – by facing opposite directions

Complementary – by pairing in a known way



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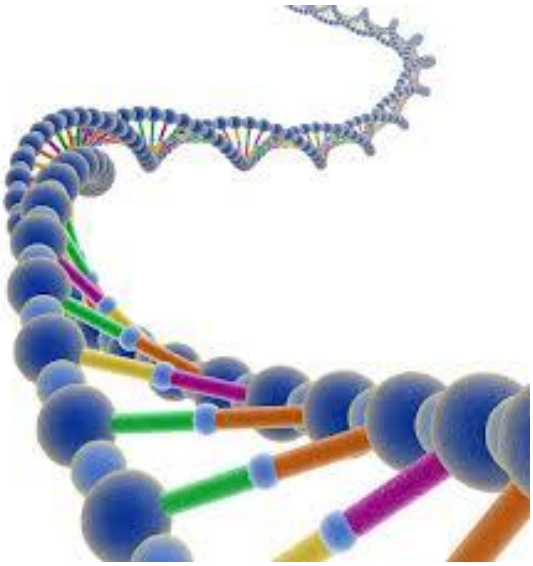
Human DNA Model

The script

The Human DNA Model demonstrates three key ideas of the Watson-Crick model of DNA:



1. DNA is double-stranded;
2. The two strands are complementary;
3. The two strands are antiparallel.

The Human DNA Model does not show the fourth key idea of the Watson-Crick model: DNA is helical.

However, the Human DNA Model is among the easiest ways to show the idea of "antiparallel" because the two lines of people face opposite directions as they shake hands, like two teams after a baseball game. Few models of DNA actually show the antiparallel nature of DNA, and of the models that do show the antiparallel aspect, most do not make it easy to see that the strands are heading in opposite directions. This one does.

Objective

Students will understand that: DNA is composed of 4 nucleotides, or building blocks: A, T, G and C

These building blocks can be strung together (to carry a message). A single string can be paired with another string (its "mate" or "complement"), to make double-stranded DNA (given A matches with T and G matches with C). **Double Stranded**

The order of nucleotides in one strand will determine the order of its mate. **Complementary**

The two mate strands face in opposite directions. **Antiparallel**

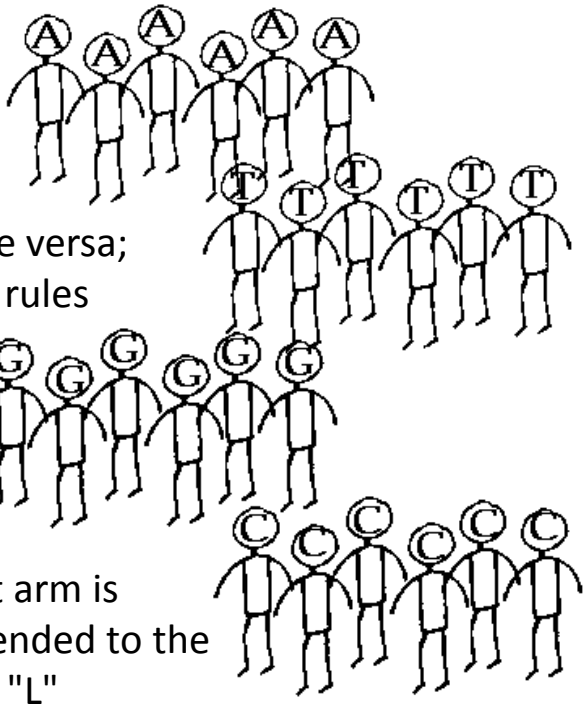
The order of the building blocks can be used to make three-letter words that can code a message; **Proteins**

DNA can be copied by "unzipping" the original double strand and filling in the two separated strings or strands with spare building blocks.

A new piece of DNA can be spliced into another piece of DNA to give new messages.

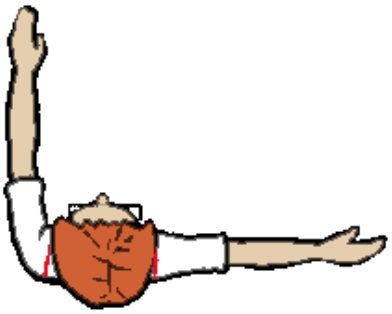
What to do

1. Divide students into 4 groups: A, T, G, C.



2. Assign the rule that A's go to T's and vice versa; and G's go to C's and vice versa. (Matching rules or bonding rules or Chargaff's rules).

3. Assign the position so each person's left arm is extended to the front, and right arm is extended to the side (in a top view, the arms form an L: the "L" position). The left arm is like the phosphate in a DNA nucleotide; the body is like the deoxyribose in a DNA nucleotide; and the right hand is like the nitrogenous base in a DNA nucleotide. The left shoulder serves as the 3' carbon of the deoxyribose, to which attaches the phosphate from the next nucleotide (the left hand of the next person behind). The right shoulder serves as the 1' carbon of the deoxyribose, to which is attached the base (the right hand).



Assign configurations for the **RIGHT** hand: **THIS IS A KEY STEP**

C's curve their hands partly open.

T's make a hook by extending a curved index finger

G's make a fist

A's make an "OK" sign by touching their index finger to their thumb

What to do (cont'd)

5. Mix the students so that all four types are mingled.

6. Randomly pull out 1/3 of the group, and line them up, left hand of one on the left shoulder of the next person ahead, right arm extended to the side, right hand in the appropriate configuration.

7. Now let the other 2/3 of the group assume the L position and the right hand configuration. Form a second line by joining the right hands of students in the second line with the right hands of the students in the first (template) line.

Note that this second line will face in the direction opposite of the original. Also, note that its sequence will be complementary to the first (but the two strands are **NOT** a mirror image of each other).

You can show how DNA can melt into two single strands by asking the two lines to release their handshakes and take one step to the left, while keeping their right hands in the C, T, G or A form. You can show how two complementary single strands of DNA can anneal (come together) by then having the two strands come back together into a double-stranded form.

You can copy DNA by splitting the two-stranded line, and filling in at the "fork" where the split is initiated. Cutting and splicing and most other DNA manipulations that depend on sequence and antiparallelism (but not on helical aspects) can be demonstrated using the human DNA model.