**Name:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_Period:\_\_\_\_\_\_\_\_\_\_Date:\_\_\_\_\_\_\_\_\_**

**Ms. Randall LE**

**Lab Activity: Build a Model DNA**

**Background:** DNA, or deoxyribonucleic acid, is the hereditary material in humans and almost all other organisms. Nearly every cell in a person’s body has the same DNA. Most DNA is located in the cell nucleus (where it is called nuclear DNA), but a small amount of DNA can also be found in the mitochondria (where it is called [mitochondrial DNA](http://ghr.nlm.nih.gov/mitochondrial-dna) or mtDNA).

The information in DNA is stored as a code made up of four chemical bases: adenine (A), guanine (G), cytosine (C), and thymine (T). Human DNA consists of about 3 billion bases, and more than 99 percent of those bases are the same in all people. The order, or sequence, of these bases determines the information available for building and maintaining an organism, similar to the way in which letters of the alphabet appear in a certain order to form words and sentences.

DNA bases pair up with each other, A with T and C with G, to form units called base pairs. Each base is also attached to a sugar molecule and a phosphate molecule. Together, a base, sugar, and phosphate are called a nucleotide. Nucleotides are arranged in two long strands that form a spiral called a double helix. The structure of the double helix is somewhat like a ladder, with the base pairs forming the ladder’s rungs and the sugar and phosphate molecules forming the vertical sidepieces of the ladder.

An important property of DNA is that it can replicate, or make copies of itself. Each strand of DNA in the double helix can serve as a pattern for duplicating the sequence of bases. This is critical when cells divide because each new cell needs to have an exact copy of the DNA present in the old cell.

**Objective**: To   build  a simplified model of DNA with candy.

**Materials:**

Hollow  Licorice  Sticks

2  red,  2  black

Gummy  bears

20  total  (in  4  different  colors)

String

2  strings

Toothpicks

10

Small  white  marshmallows

10

Ruler

Scissor

**Safety:** Clean your hands before touching food! Do not eat any items that fall onto the lab table. Work on plates at all times

**Procedure**:

1. Pick up your materials.

2. Cut the red and black licorice sticks into 2 cm strips.

3. Make  two  equal  lengths  of  licorice  strands  by  threading the pieces  of licorice onto the string,  alternating the red  and  black  pieces.

4. Gather  together  four  different  colors  of  gummy  bears,  the  marshmallows, and the toothpicks.

5. Pair two colors of the gummy bears together and then pair  other colors together.  For  example,  red  and  orange  gummy  pairs  could  be  paired  together,  and  green  and  yellow  ones  be  paired  together.

6. Take a gummy bear and thread it onto the toothpick.

7. Thread  the  marshmallow onto  the  toothpick so  that  it  is  in  the center of  the  toothpick and next to the  gummy  bear.  Thread  the  complementary  gummy  bear  onto  the  toothpick  so  that  it  is  next  to  the  marshmallow.  You should now have a toothpick with a gummy bear-marshmallow- gummy bear centered on it.

8. Repeat  step  five  to  make  more  gummy  bear- marshmallow  toothpicks,  making  sure the  gummy  bears  are  matched  with  their complementary  colors.  Make  as  many  of  these  toothpicks  as  you  have  red  pieces  on  one  of  your  licorice  strands.

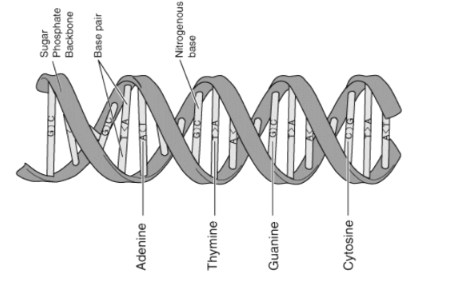
9. Take one strand of licorice and start attaching the gummy bear-­‐marshmallow toothpicks to it, connecting one of these toothpicks at each of the red pieces on the strand.  Then, take the second licorice strand and connect it to the other side of the toothpicks.

10. Again, connect the toothpicks to their the sides of the ladder and the gummy bear-­marshmallow toothpicks making the rungs of the  ladder.

11. Hold  your  candy  ladder up and  turn  the  top  counterclockwise  to  add  twists  to  the  ladder.

**What’s Happening?**

You  have  just  made  a  candy  model  of  a  molecule  (strand)of  DNA(deoxyribonucleic  acid). The  red  licorice  represents  the  sugar  “deoxyribose,  “  the  black  licorice  represents  the  phosphate  molecules, and  together  they  represent  the  sugar-­‐phosphate  backbone  of  DNA. The  gummy  bears  represent  the  bases  that  make  the  code  of  DNA.  The  four  different  colors  are  used  to  represent  the  four different  bases found in DNA: adenine  (A),  thymine(T),  guanine (G),  and cytosine (C).  It doesn’t really matter in your model how  much of base you use or where it is  placed in the  strand,  but it is important  that  bases  are  paired up  correctly:  A  with  T  and  G  with  C.  (In  real  DNA  the  order  does  matter  as  that  determines  what  type  of  organism  it  is  and  how  functional  it  will  be.)The  marshmallow  in  between  the  gummy  bears  represents  the  hydrogen  bonds  connecting the bases.  This is the point at which the DNA strands break apart to be copied and where the new strand connects to the original strand.  Twisting the ladder at the  top in a counterclockwise direction  gives  the  DNA  model  its  true  shape:  a  right-­‐handed  double  helix.



**Questions:**

1. A  single  DNA  molecule  is  about  a  million  times  longer  than  it  is  wide.    Measure the width of your model and multiply by 1 million.  How  long  would  your  model  have  to  be,  to  accurately  show  a  DNA  molecule?

2. What does your candy model represent?

3. What does DNA stand for?

4. What did each type of candy represent?

1. Red  licorice
2. Black  licorice
3. Red  gummy  bears
4. Clear  gummy  bears

e. Orange gummy bears

f. Green gummy bears

5. Why were there four colors of gummy bears?

6. Is the order of bases important in real DNA?    Why or why not?

7. What is the shape of the DNA molecule called?

8. What did you learn from this lab?

9. Show your completed model and questions to your teacher.

10.After  you’ve  gotten  your  model  graded,  you  may  eat  the  candy  (if  you like).