Edible DNA Model

Purpose
To make an edible model of DNA out of candy and review the genetic code the physical structure of DNA and base pairing.

Materials
• Red licorice
• Coloured marshmallows
• 4-5 toothpicks

Background
Deoxyribonucleic acid (DNA) is the primary chemical component of chromosomes and is the material of which genes are made. In bacteria and other prokaryotic cell organisms, DNA is distributed more or less throughout the cell. Our DNA resides mostly in the cell nucleus – as in the eukaryotic cells that make up other multicellular organisms. The energy-generating organelles known as mitochondria also carry DNA.

DNA is actually a pair of molecules that intertwine to form a double helix. Each strand is a chemically linked chain of nucleotides: adenine (A), thymine (T), cytosine (C), and guanine (G). Each nucleotide is made up of a sugar, a phosphate and a base. The two strands come together by complementary pairing of the bases – where A only pairs with T and C only with G – so what is on one strand dictates what will be on the other strand. In this way, when the strands are separated, they can act as a template to replicate the other.

The central dogma of biology is that DNA provides the information of the genes and this is expressed in RNA. The RNA then leaves the nucleus where the information is translated into proteins.

Procedure
1. Ask you students what they know about DNA. Review basic DNA structure: the double helix, the sugar-phosphate backbone, the bases (ATGC), base pairing (A-T, C-G).
2. Explain that for this activity, they will be building models of the three dimensional structure of DNA. Red licorice will be the sugar-phosphate backbone, the marshmallows the bases. Assign each base a colour (pink, orange, green, yellow). Write this on the board.
3. Give each student one piece of licorice and have them break it in two equal pieces (alternatively, cut the licorice in half the evening before and give each
Pass out coloured marshmallows and 4-5 toothpicks per student.

4. Write a short sequence of DNA on the board (4-5 bases long). The students will all assemble their DNA molecules using this sequence.

5. Create one DNA strand by attaching the marshmallows with the toothpicks to one licorice stick. Place toothpicks into the licorice. Push the marshmallow through each toothpick close to the licorice, leaving enough room for the second matching DNA strand to be attached.

6. Add the matching base pairs.

7. Attach the other backbone (licorice) so your model looks like a ladder. Carefully twist your DNA model so that it looks like a double helix.

**Extension**

With high school students, you can enrich this activity by having them replicate their newly assembled DNA models. Briefly review DNA replication, highlighting the fact that replication is **semi-conservative** — when you duplicate DNA, each new double helix contains one strand from the old helix. Give each student another piece of licorice and more toothpicks.

By using black licorice, you can also have your students make messenger RNA. Review the structure and function of **mRNA**, including the substitution of **uracil** for **thymine**. Have them assemble their mRNA molecule with a black licorice backbone and a U on the “T” marshmallow to represent uracil.