

# DNA Strands

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## Standards of Learning

Science LS.1, LS.2, LS.3, LS.13

English 7.1, 7.6, 7.8

## Objective

The students will:

- provide exposure to the components of DNA codes of common living items

## Materials

- Something to string bead such as string, yarn, hemp or dental floss
- Pony beads – green, pink, yellow and purple are suggested but any bead combination would work
- Scissors
- DNA code hand out

## Background Knowledge

Deoxyribonucleic acid is a nucleic acid that contains the genetic instructions used in the development and functioning of all known living organisms and some viruses. The main role of DNA molecules is the long-term storage of information. DNA is often compared to a set of blueprints since it contains the instructions needed to construct other components of cells, such as proteins and RNA molecules. The DNA segments that carry this genetic information are called genes, but other DNA sequences have structural purposes, or are involved in regulating the use of this genetic information. Chemically, DNA consists of two long polymers of simple units called nucleotides, with backbones made of sugars and phosphate groups joined by ester bonds. These two strands run in opposite directions to each other and are therefore anti-parallel. Attached to each sugar is one of four types of molecules called bases. It is the sequence of these four bases along the backbone that encodes information. This information is read using the genetic code, which specifies the sequence of the amino acids within proteins. The code is read by copying stretches of DNA into the related nucleic acid RNA, in a process called transcription.

Within cells, DNA is organized into X-shaped structures called chromosomes. These chromosomes are duplicated before cells divide, in a process called DNA replication. Eukaryotic organisms (animals, plants, fungi, and protists) store most of their DNA inside the cell nucleus and some of their DNA in the mitochondria (animals and plants) and chloroplasts (plants only)<sup>[1]</sup>. Prokaryotes (bacteria and archaea) however, store their DNA in the cell's cytoplasm. Within the chromosomes, chromatin proteins such as histones compact and organize DNA. These compact structures guide the interactions between DNA and other proteins, helping control which parts of the DNA are transcribed. DNA is present in the cells of all living organisms.

Each bracelet will contain two strands of beads to represent the double helix of specific DNA. The two strands will match up in the same way real DNA does. So every time a bead is placed on one strand a bead must be added to the second strand. With DNA “A” always pairs with “T” and “C” always pairs with “G.” The chart below will help keep track of the combinations.

“A” (gold beads) always pair with “T” (red beads)



“T” (red beads) always pair with “A” (green beads)  
“C” (black beads) always pairs with “G” (green beads)  
“G” (green beads) always pair with “C” (black beads)

### **Procedure**

1. Place plenty of beads on paper plates for easy access and clean up.
2. Choose a DNA strand from the samples provided.
3. Cut two pieces of string about 12 inches long.
4. Tie at least one knot about two inches from one end of each string. Make the knot big enough that the beads don't slip off.
5. Thread a bead onto the first string. Then string the accompanying bead onto string 2. For example, if “C” goes on string 1, then “G” will go on string 2.
6. Keep threading beads until the DNA strand is long enough to slip over your hand. (This may not require all the letters represented in the DNA strand.)
7. Tie a knot around the last bead of each string.
8. Tie the ends of each string together to complete the bracelet.

### **Color Code:**

A- Gold  
T- Red  
C- Black  
G- Green



## Sample DNA Codes

*Monarch butterfly (danaus plexippus)*

**gaggctaccaagtttccg**

*Grizzly bear (ursus arctos)*

**atgaccaacatccgaaaa**

*Sunflower (helianthus annuus)*

**tgagatgtagaaggtgc**

*Chimpanzee (pan troglodytes)*

**tgaccccgacacgaaaa**

*Human (homo sapiens)*

**tgacccaatacgcaaaa**

*African elephant (loxodonta Africana)*

**atgaccgacattcgaaaa**

*Apple tree (malus domestica)*

**gaattcggcagcagaga**

*Brown trout (salmo trutta)*

**ctttggctcactcttagg**

### Extension

- Research the family and genus of other species.
- Measure the length of the different DNA strands. Record the difference.
- Compare several DNA strands to Homo Sapien and discuss the differences/similarities.
- Compile informational reports on habits, life cycles and human interaction of selected species.
- Create a 3 dimensional cell including nucleus with DNA.
- Visit the following sites for other information (sites viable as of July 2003)
  - <http://ology.amnh.org/genetics/>
  - <http://sln.fi.edu/tfi/activity/bio/bio-3.html>
  - <http://www.accessexcellence.org/AE/ATG/data/released/0307-TrumanHoltzclaw/description.html>
  - <http://www.biologylessons.sdsu.edu/classes/index.html>

This lesson was adapted from [http://ology.amnh.org/genetics/stufftodo/bracelet\\_need.html](http://ology.amnh.org/genetics/stufftodo/bracelet_need.html)



