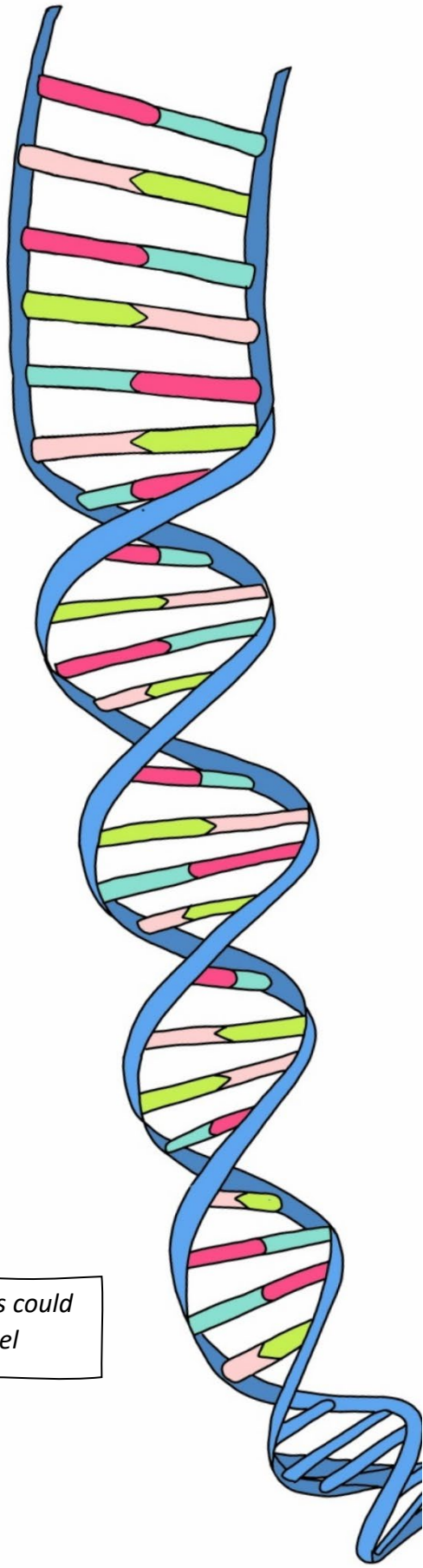
DNA MODEL



***Purpose**: How can DNA be modeled so that its components can be visualized outside of the cell?*

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 or mtDNA).

The information in DNA is stored as a code made up of four **nitrogen-containing, 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.

For this project, you will be making a ***three-dimensional model*** of the DNA double helix that represents all parts of a nucleotide, including the four different nitrogenous bases and their base pairs. An ***antiparallel*** structure must be demonstrated, and it must be ***structurally sound*** (stand on its own). Additionally, a ***key*** must be included somewhere on your model – whether physical or printed – so that I know what materials represent each structure. In total, your DNA strand ***must include at least 12 nucleotides*** attached to their matching base pairs (A = T and C = G)

BRAINSTORM:

As a class, brainstorm some ideas for what materials could be used to make a three-dimensional DNA model

DNA Part:		Materials I will use:	Number needed:
Phosphate group			
Deoxyribose sugar			
Hydrogen bonds			
Covalent bonds			
Nitrogen bases:	Adenine		
	Thymine		
	Guanine		
	Cytosine		

- *Describe your plans for making your DNA model structurally sound (How will you engineer it to stand?)*

- *What will your model look like? Draw a detailed blueprint, including all the materials you plan to use, and label the materials on your model below:*

DNA Model Checklist:

☐ Is in the ***3D shape*** of a double helix and stands on its own
☐ Has at least ***12 nucleotides*** (and their correctly matching base pairs) represented
☐ The phosphate and sugar backbone and bonds are accurately portrayed
☐ At least 8 ***different*** materials are used
☐ Includes a ***key*** and labels the different materials that represent each part of DNA

DNA Model Rubric

	Exemplary (10 pts)	Proficient (8 pts)	Developing (6 pts)	Needs Improvement (4 pts or less)
Physical Structure and Accuracy	Model clearly and accurately represents the 3D, twisted DNA double helix with correct antiparallel orientation and base pairing (A = T, C ≡ G); Model is sturdy and stands on it own or with an added support	Model mostly accurate, has minor errors in base pairing or antiparallel structure; Model is most sturdy or freestanding	Significant inaccuracies in base pairing or the antiparallel structure; Model is slightly unstable	Model lacks key structural elements or major inaccuracies; Model does not stand or hold its structure independently
Nucleotide Components	Includes all parts of a nucleotide (phosphate, sugar, hydrogen bonds, covalent bonds, nitrogen-containing bases) and at least 12 nucleotides with pairs	Includes most nucleotide components but may have fewer than 12 pairs or minor omissions	Missing some components or nucleotide pairs; Evident lack of attention to nucleotide composition	Many nucleotide components are missing or incorrect
Key / Legend	Present; Includes a clear, detailed, and accurate key classifying all materials and their corresponding DNA structures	Present, but inaccurately depicts materials used in model, or missing some clarity or detail, which makes identification difficult		Not present
Creativity and Use of Materials	Uses at least 8 distinct materials to differentiate all DNA components (phosphate, sugar, bonds, 4 different bases)	Uses 6-7 distinct materials; most DNA components are distinguishable	Uses fewer than 6 materials or materials are inconsistent or unclear	Materials do not sufficiently differentiate DNA components
Use of Class Time	Class time is used productively and for the entirety of the project (both planning and building); Student demonstrates focus and effective time management when working alone or with a partner	Class time is mostly used productively, with minor lapses in focus or time management; Some distractions from peers that requires redirection from teacher	Class time is inconsistently used, with noticeable off-task behavior or poor time management; Requires redirection	Class time is poorly used, with frequent off-task behavior or little or no progress made during worktime provided

Name(s): _____ Total: _____ / 50 points