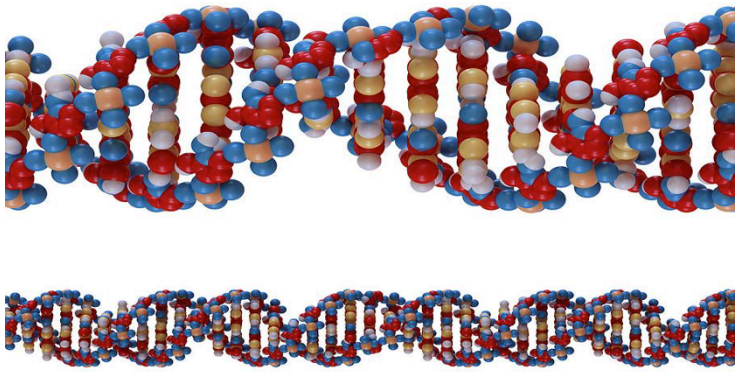
Reading Science

Name: _____ Date: _____ Group: _____

DNA, Chromosomes, and Genes

1 You probably already know about deoxyribonucleic acid (DNA), chromosomes, and genes. You know that all three of these things have something to do with heredity in organisms. You also know that all living organisms contain some type of genetic material. These three things are actually one and the same! Let us explain from the beginning.



2 What exactly is DNA? All organisms have the same basic genetic code on their DNA. However, each organism is a little different from others of its species. There are greater differences between species. This is due to small differences in the nucleotide sequences found on the DNA strand.

3 The DNA molecule is made of two long chains of chemical building blocks. These chains form a double helix structure. This double helix is unique to the DNA molecule. Each building block includes a nucleotide, a sugar, and a phosphate group. The sequence of nucleotides along the DNA strand makes up an organism's genetic code. DNA's structure allows the code to be copied and read. This information must be copied and transferred from one generation to the next. But how? This is where chromosomes and genes come in.

4 What is a chromosome? A DNA strand and a chromosome are the same thing. They are just in different forms. A chromosome is just the coiled up form of a DNA strand. Most prokaryotes have one DNA molecule. They only have one chromosome. Most eukaryotes have many DNA molecules. They have many chromosomes. Before the genetic information carried on the DNA strand can be passed to the next generation, the cell must first copy the genetic material. During reproduction, the copied genetic material is transferred from parent to offspring. The DNA strands are condensed and packaged into individual chromosomes for these processes. The structure of chromosomes makes it easier to copy the genetic material. Condensed chromosomes are also easier to transfer to the next generation during reproduction.

5 What is a gene? The gene is the basic unit of heredity. The information for each trait of an organism, such as hair color, is carried on DNA strands. A gene is the nucleotide sequences which leads to one specific trait. Each gene is found at a specific location, or locus, along a chromosome. This is called the gene's locus. (The plural of locus is loci.) Keep in mind that chromosomes are just condensed forms of DNA. The genetic information of any organism can be found at specific loci. In other words, each coding segment of a chromosome is a gene. Each gene is found at a specific locus on the chromosome.

6 The information in the genes is what gives organisms their specific traits. A small difference in the nucleotide sequence of a gene can change the trait of the organism. The gene for hemoglobin is an example. It is found at a specific locus of human chromosome number 11. One nucleotide sequence will make normal hemoglobin. Another nucleotide sequence will make sickle-cell hemoglobin. Both types of hemoglobin are made by DNA sequences in the same gene at the same locus on the same chromosome. The nucleotide sequence on the DNA strand is different by just one single nucleotide at that locus. This produces a different trait. One single nucleotide is the difference between having normal hemoglobin or sickle cell anemia.

7 Together the DNA, the chromosomes, and the genes make up the genome of the organism. The genetic information is carried as nucleotide sequences of the DNA. Each DNA molecule is condensed into separate chromosomes for reproduction. The specific nucleotide sequences of the genes give the organism its unique traits.

8 Let us review. A DNA molecule carries the genetic code as a sequence of nucleotides in a long chain. The DNA molecule coils into a form known as a chromosome. The sequences of DNA that code for specific traits are known as genes. Each gene can be found at a specific locus along the chromosome.

1 Review paragraph 4 to identify the similarities of DNA and chromosomes. Which of the statements below is true?

A DNA is found only in prokaryotic cells.

B Many chromosomes are found in prokaryotic cells.

C DNA and chromosomes perform different functions.

D A chromosome is a tightly coiled DNA strand.

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2 What exactly is DNA?

A A DNA strand is a condensed version of a chromosome

B A specific location on a chromosome

C A double helix structure consisting of a nucleotide sequence

D A gene that codes for specific traits

3 What is the best definition of a chromosome?

A A specific locus that codes for traits

B A nucleotide sequence on the DNA strand

C A specific trait of an organism, such as blue eyes

D A highly coiled version of a DNA strand

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4 A gene is the basic unit of heredity. What is the function of genes?

A Genes code for specific traits

B Genes determine the DNA sequence

C Genes create chromosomes

D Genes help with replication

5 Which of the following statements is true?

A DNA and chromosomes are found in different types of cells.

B The specific nucleotide sequences of the genes determine the individual characteristics of an organism.

C The coding segment of a chromosome is found in prokaryotic cells.

D Some living organisms do not have genetic material.

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6 Which of the following statements is FALSE?

A DNA, chromosomes, and genes work together to determine heredity in organisms.

B Genes are found in chromosomes but not DNA.

C Differences between organisms are due to specific alterations in the nucleotide sequences.

D Chromosomes and genes allow the information encoded on the DNA strand to be copied and transferred.