

DNA Structure

By Cindy Grigg



¹ An embryonic cell divides again and again. Where there was one cell there are two, then four, then eight, and so on. Each holds all the genetic information needed to create a new human being. Your fingernails grow nonstop, day in and day out. The cells of your fingernails somehow generate all of the protein that makes up your nails. How is this protein created? How, exactly, do these cells make copies of themselves? The answers to these questions are DNA replication and protein synthesis.

² When organisms reproduce, traits are passed from parent to offspring. These traits are carried in DNA, the genetic material found in a cell's nucleus. DNA acts like a blueprint for the cells of an organism, instructing the cells how to put together materials to produce certain traits.

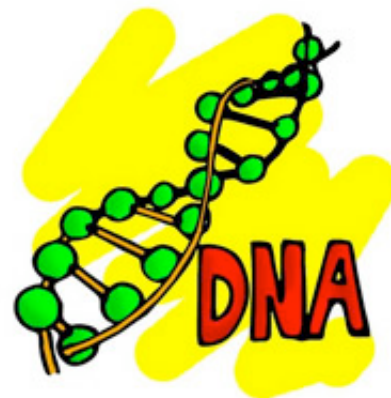
³ DNA stands for deoxyribonucleic acid (pronounced de-ox-ee-ribe-o-new-ckee-ick as-id). It's made of just a few kinds of atoms: carbon, hydrogen, oxygen, nitrogen, and phosphorus. The traits that make organisms different from one another are coded for in their DNA. Chromosomes are made of DNA. Chromosomes are genetic structures that contain the information used to direct a cell's activities and make new cells. They are found in the nucleus of a cell.

⁴ A person has 46, or 23 pairs, of chromosomes. Our cells have two copies of each chromosome. One came from the mother, and one from the father. The chromosome starts as half of the familiar X. As the cell grows, it replicates the DNA to make the other half of the X, which is identical. When the cell divides, each daughter cell receives half of each chromosome (called a chromatid). The two copies of the gene are alike on one chromosome but the "matching" pair of chromosomes may have slightly different genes (dominant or recessive alleles) as one came from the mother and one from the father. The dominant gene of the two is the one that is expressed. For example, if one parent gives a gene that carries the trait for blue eye color and the other parent gives a gene that carries the trait for brown eye color, the child would have brown eyes. The trait for brown eye color is dominant, and that is the color that would be expressed in the child.

⁵ DNA is a very large molecule with a shape like a twisted ladder. You have probably heard of the DNA molecule referred to as a double-helix. The rungs of the ladder are made up of molecules called bases. These nucleotide bases are adenine, thymine, guanine, and cytosine. The bases always pair up so that adenine is joined with thymine (A-T) and cytosine is joined with guanine (C-G). Each rung of the ladder is made of two bases - one for each side of the ladder.

⁶ The nucleotides join by hydrogen bonds. Because they bond at an angle between the two base pairs, the whole structure twists into a helix. These base pairs carry the code for the cell. How the pairs are arranged in the DNA make up the genetic code. The sides of the ladder are made up of phosphate and sugar molecules. They do not carry any information. They hold the bases in their proper order.

⁷ A DNA molecule may contain millions of base pairs. It is the arrangement of these base pairs that determines whether the organism is a fern, a ferret, a fish, or a fruit fly. In a human, this ladder



is about three million base pairs long. The two ends link together to form a ring, and then the ring gets wadded up so it can fit inside the cell.

⁸ In human cells, DNA is tightly wrapped into 23 pairs of chromosomes. One member of each chromosomal pair comes from your mother, and the other comes from your father. In other words, your DNA is a combination of your mother's and your father's. Unless you have an identical twin, your DNA is unique to you. This is what makes DNA evidence so valuable in criminal investigations. It's impossible for someone else to have DNA that is identical to yours.

⁹ Cells live for only a short time, and so they must replace themselves. As a child grows, his body adds new cells. When fingernails grow, they add new cells also. They do this by a process called cell division. Before a cell divides, it copies its own DNA. The two strands of DNA separate. The hydrogen bonds break between the nucleotides, and the strands come apart like the two halves of a zipper. Each strand's complement is recreated. An enzyme makes the complementary strand by finding the correct base in the mixture and bonding it with the original strand. In this way, the base on the old strand dictates which base appears on the new strand, and the cell ends up with an extra copy of its DNA. Then the cell divides, and each new cell receives one copy of the DNA.

¹⁰ The process of copying DNA is called DNA replication or DNA synthesis. The two resulting double strands are generally almost perfectly identical, but sometimes errors in replication or exposure to chemicals or radiation can result in a less than perfect copy. This is called mutation. Each copy has one original and one newly synthesized strand.

¹¹ This is DNA's main purpose: to make proteins within the cell. These proteins, which include enzymes that do specialized jobs, control the activities of the cell. Different cells have different activities. By controlling protein synthesis within each cell, the genes that make up DNA control the life of the entire organism.

Name _____



Date _____

DNA Structure

<p>1. DNA is _____.</p> <p><input type="radio"/> A Atoms of carbon, hydrogen, oxygen, nitrogen, and phosphorus</p> <p><input type="radio"/> B A double helix</p> <p><input type="radio"/> C Nucleotide bases and sugar-phosphate molecules</p> <p><input type="radio"/> D All of the above</p>	<p>2. Chromosomes are _____.</p> <p><input type="radio"/> A Found in the nucleus of a cell</p> <p><input type="radio"/> B Made of DNA</p> <p><input type="radio"/> C Both A and B</p> <p><input type="radio"/> D None of the above</p>
<p>3. Humans have _____.</p> <p><input type="radio"/> A 46 chromosomes in 23 pairs</p> <p><input type="radio"/> B 4 chromosomes</p> <p><input type="radio"/> C 3 million chromosomes</p>	<p>4. In DNA, adenine always pairs with _____.</p> <p><input type="radio"/> A Guanine</p> <p><input type="radio"/> B Thymine</p> <p><input type="radio"/> C Cytosine</p>
<p>5. In DNA, guanine always pairs with _____.</p> <p><input type="radio"/> A Cytosine</p> <p><input type="radio"/> B Adenine</p> <p><input type="radio"/> C Thymine</p>	<p>6. In DNA replication _____.</p> <p><input type="radio"/> A The two strands of DNA come apart.</p> <p><input type="radio"/> B A copy is made.</p> <p><input type="radio"/> C Each copy has one strand of "old" DNA and one strand of "new" DNA.</p> <p><input type="radio"/> D All of the above</p>
<p>7. What can cause a mutation when the cell copies its DNA?</p> <p><input type="radio"/> A Errors</p> <p><input type="radio"/> B Exposure to chemicals</p> <p><input type="radio"/> C Exposure to radiation</p> <p><input type="radio"/> D All of the above</p>	<p>8. With over 6 billion people living on Earth, it is common for two people to have the same DNA.</p> <p><input type="radio"/> A False</p> <p><input type="radio"/> B True</p>

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organisms	structure	valuable	newly
enzyme	evidence	alike	nucleus
dominant	unless	radiation	mutation
organism	enzymes	ferret	structures
synthesis	rung		

Directions: Fill in each blank with the word that best completes the reading comprehension.

An embryonic cell divides again and again. Where there was one cell there are two, then four, then eight, and so on. Each holds all the genetic information needed to create a new human being. Your fingernails grow nonstop, day in and day out. The cells of your fingernails somehow generate all of the protein that makes up your nails. How is this protein created? How, exactly, do these cells make copies of themselves? The answers to these questions are DNA replication and protein synthesis.

When organisms reproduce, traits are passed from parent to offspring. These traits are carried in DNA, the genetic material found in a cell's nucleus. DNA acts like a blueprint for the cells of an organism, instructing the cells how to put together materials to produce certain traits.

DNA stands for deoxyribonucleic acid (pronounced de-ox-ee-ribe-o-new-clee-ick as-id). It's made of just a few kinds of atoms: carbon, hydrogen, oxygen, nitrogen, and phosphorus. The traits that make (1) _____ different from one another are coded for in their DNA. Chromosomes are made of DNA. Chromosomes are genetic (2) _____ that contain the information used to direct a cell's activities and make new cells. They are found in the (3) _____ of a cell.

A person has 46, or 23 pairs, of chromosomes. Our cells have two copies of each chromosome. One came from the mother, and one from the father. The chromosome starts as half of the familiar X. As the cell grows, it replicates the DNA to make the other half of the X, which is identical. When the cell divides, each daughter cell receives half of each chromosome (called a chromatid). The two copies of the gene are (4) _____ on one chromosome but the "matching" pair of chromosomes may have slightly different genes (dominant or recessive alleles) as one came from the mother and one from the father. The (5) _____ gene of the two is the one that is expressed. For example, if one parent gives a gene that carries the trait for blue eye color and the other parent gives a gene that carries



the trait for brown eye color, the child would have brown eyes. The trait for brown eye color is dominant, and that is the color that would be expressed in the child.

DNA is a very large molecule with a shape like a twisted ladder. You have probably heard of the DNA molecule referred to as a double-helix. The rungs of the ladder are made up of molecules called bases. These nucleotide bases are adenine, thymine, guanine, and cytosine. The bases always pair up so that adenine is joined with thymine (A-T) and cytosine is joined with guanine (C-G). Each

(6) _____ of the ladder is made of two bases - one for each side of the ladder.

The nucleotides join by hydrogen bonds. Because they bond at an angle between the two base pairs, the whole (7) _____ twists into a helix. These base pairs carry the code for the cell. How the pairs are arranged in the DNA make up the genetic code. The sides of the ladder are made up of phosphate and sugar molecules. They do not carry any information. They hold the bases in their proper order.

A DNA molecule may contain millions of base pairs. It is the arrangement of these base pairs that determines whether the organism is a fern, a (8) _____, a fish, or a fruit fly. In a human, this ladder is about three million base pairs long. The two ends link together to form a ring, and then the ring gets wadded up so it can fit inside the cell.

In human cells, DNA is tightly wrapped into 23 pairs of chromosomes. One member of each chromosomal pair comes from your mother, and the other comes from your father. In other words, your DNA is a combination of your mother's and your father's. (9) _____ you have an identical twin, your DNA is unique to you. This is what makes DNA (10) _____ so (11) _____ in criminal investigations. It's impossible for someone else to have DNA that is identical to yours.

Cells live for only a short time, and so they must replace themselves. As a child grows, his body adds new cells. When fingernails grow, they add new cells also. They do this by a process called cell division. Before a cell divides, it copies its own DNA. The two strands of DNA separate. The hydrogen bonds break between the nucleotides, and the strands come apart like the two halves of a zipper. Each strand's complement is recreated. An (12) _____ makes the complementary strand by finding the correct base in the mixture and bonding it with the original strand. In this way, the base on the old strand dictates which base appears on the new strand, and the cell ends up with an extra copy of its DNA. Then the cell divides, and each new cell receives one copy of the DNA.

The process of copying DNA is called DNA replication or DNA synthesis. The two resulting double strands are generally almost perfectly identical, but sometimes errors in replication or exposure to chemicals or (13) _____ can result in a less than perfect copy. This is called (14) _____. Each copy has one original and one (15) _____ synthesized strand.

This is DNA's main purpose: to make proteins within the cell. These proteins, which include (16) _____ that do specialized jobs, control the activities of the cell. Different cells have different activities. By controlling protein (17) _____ within each cell, the genes that make up DNA control the life of the entire (18) _____ .

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Name _____

Date _____
(Key 1 - Answer ID # 1052828)

Circle the correct word.

1.	sihtuhsuhs	sythesis	synthesis	syntheis
2.	ropredece	repraduce	repruhdoos	reproduce
3.	acd	acid	aci	asuhd
4.	nietruhjuhn	nitragen	nitrogin	nitrogen
5.	ferret	fehruuht	fihriht	firret
6.	ridaation	redaition	radiation	radiateon
7.	triat	trait	tria	trat
8.	nucleu	nuclues	nucleus	nookleuhs
9.	daeokseeroibohnooklayihkdeaoксеeriibohnooklayihkdeoxyribonucleic			deokseeriibohnooklayihk
10.	jehnuruhle	jehnuruhlea	generally	juhnoruhlee
11.	structure	structure	stucture	sructure
12.	gunerute	generate	generete	generrate
13.	unles	unless	onliss	anlass
14.	strannd	strend	srand	strand
15.	dominent	dminant	dominant	domuhnuht
16.	rung	ruung	reng	ruhn
17.	expoure	exposure	uxpesure	exposure
18.	blueprint	blueprin	blooprihn	bleuprint
19.	strandds	standz	strands	strands
20.	finding	fiding	findig	findin
21.	ledder	ladder	ladurr	laddor
22.	prudica	poduce	produce	prodce
23.	nonstop	nonsop	nontop	nostop
24.	evidince	evidance	evidence	evidence

Name _____



Date _____

(Key 1 - Answer ID # 1052828)

25.	noole	newly	noolea	newl
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