

This unit will focus on another very important organelle called the nucleus and cover what is considered to be the **CENTRAL DOGMA** (core belief) of molecular biology; DNA is the blueprint of life. The software of the cell. We will examine the history and experiments that lead to the discovery of the structure of DNA (**double helix**) and how this molecule organized into chromosomes located in the nucleus actually controls all cell activity via protein synthesis.

Let's get to work!

If you have any problems – please sign up for extra help after school.

Mr. Collea Ms. Oliver

Go to Collea's Corner to watch the Ted-Ed video *Rosalind Franklin – DNA's Unsung Hero* and then answers the questions that follow.

Rosalind Franklin – DNA's Unsung Hero

- Cláudio L. Guerra

The discovery of the structure of DNA was one of the most important scientific achievements in human history. The now-famous double helix is almost synonymous with Watson and Crick, two of the scientists who won the Nobel prize for figuring it out. But there's another name you may not know: Rosalind Franklin. Cláudio L. Guerra shares the true story of the amazing woman behind the helix.

1.	The now famous double helix is synonymous with _	Watson	and	Crick	·
1.	The now famous double neux is synonymous with _				'

How did James Watson portray Rosalind Franklin in his book *The Double Helix*?
 Watson portrayed Rosalind Franklin as a plain dressing, belligerent scientist.

3.	/here and when was Rosalind Elsie Franklin born? _		London, England 1920		
4.	Rosalind Franklin won a scholarship to	Cambridge	to study		

 Rosalind Franklin's research on the structure of coal lead to the development of – better gas masks for the British Army during WWII.

6.	In <u>1951</u> , Rosalind F	, Rosalind Franklin joined		Kings College		X-ray
	techniques to study the	structure	of	DNA		

- 7. Why do you think the academic culture at that time was not very friendly to women?
 The academic culture (society in general) was not very friendly to women at that time because the world was very sexist, male chauvinistic and women were not expected to study the sciences.
- 8. Why did Rosalind Franklin and Maurice Wilkins clash (not get along)?
 <u>Rosalind Franklin and Maurice Wilkins clashed (not get along) because he thought she was his assistant</u>.
- 9. In <u>1952</u>, Rosalind Franklin obtained <u>photo 51</u>, the most famous x-ray picture of <u>DNA</u>.

10. How long did it take Franklin to get her x-ray image of DNA?

100 hours

11. How long did it take Franklin to get the calculations necessary to analyze DNA?

365 days

Photo 51 X-Ray Diffraction of Crystalized DNA 12. Briefly describe Watson and Crick's structure of DNA.

It was a helicoidal strand, one opposite the other with bases in the center like rungs on a ladder.

13. Why was it unfortunate that Franklin's manuscript was published in the journal last?

It was unfortunate that Franklin's manuscript was published in the journal last because it made it look like she confirmed their work instead of inspiring it.

Watson	Crick and	Wilkins	won the	Noble Prize
in 1962 for their w	vork on DNA.			
	"SCIENCE & EVERYDAY LIFE CANNOT & SHOVLD NOT BE SEPARATED." ROSALIND FRANKLIN			

Go to Collea's Corner to watch the video *The Twisting Tale of DNA* by Judith Hauck and then answers the questions that follow.

The Twisting Tale of DNA

- Judith Hauck

What do a man, a mushroom, and an elephant have in common? A very long and simple double helix molecule makes us more similar and much more different than any other living thing. But, how does a simple molecule determine the form and function of so many different living things?

1. Every cell of every living thing on earth contains all the information it needs to create and duplicate and make variations of -

itself

2. DNA, although a very simple molecule, can be quite confusing. Explain the parts of DNA and how they fit together.

DNA is made of chains of smaller molecules called nucleotides which are composed of

four different bases. Each of these bases is attached to an identical backbone molecule,

a sugar called deoxyribose and a phosphate group.

3. In your opinion, what is most confusing about the construction of DNA?

4.	DNA is	made of	chains	of four	smaller	molecules	called
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5. If you had to rename DNA, what would you call it and why?

6. You can think of DNA as a great library of information that exists to do one thing only. What is that one thing?

Direct the building of different protein molecules.

7. Its infrequent, but our own nucleotide sequences can change as the result of random errors or environmental damage (*which might remove or shift a nucleotide position*). What does this change cause?

This change causes a change in the gene, and can change the

_protein._____

8. The double helix structure, DNA, wasn't discovered until 1953. Can you name any other discoveries made in the last 100 years that have had an impact on our knowledge about life as much as the discovery of DNA?

Go to Collea's Corner to watch the Stated Clearly video *What is DNA* and then answer the questions that follow.

What is DNA?

Issues of genetics and DNA are constantly cropping up in the news from food production and health, to legal cases and ethics. We hear about DNA in movies like Jurassic Park and X-men, we learn bits and pieces about it from TV shows like Dexter and and CSI, but what exactly is DNA, and how does it work?

1.	Amino acids are referred to as the the building blocks of life						
2.	Amino acids combine to form						
3.	Proteins combine to form						
4.	Proteins have to be formed in the perfect SHAPE in order to function.						
5.	What is one of DNA's main and most understood functions?						
DNA's main and most understood function is to tell amino acids how to line up a							
	themselves into the perfect protein shapes.						
6.	What are the steps of the DNA ladder made of?						
	The steps of the DNA ladder made of four different kinds of chemicals.						
7.	DNA is located in the nucleus of the cell.						
8.	Some DNA is also found in the mitochondria and chloroplast .						
9.	Partial copies of DNA are called						

10. How is RNA different from DNA?

RNA is shorter and missing one of its sides (single-stranded).

RNA contains Uracil instead of Thymine.

11. RNA's small shape and size allow it to do what?

RNA's small shape and size allow it to fit through tiny pores in the nucleus, out to the

cytoplasm and into the ribosome.

- **12.** Ribosomes are ______ building machines.
- **13.** So what is DNA?

DNA is a molecular blueprint for a living thing.

14. So how does DNA work?

DNA creates mRNA, mRNA creates protein, proteins go on to form -life.

Go to Collea's Corner to watch the Ted-Ed video *DNA: The Book of You* by Joe Hanson and then answers the questions that follow.

The Book of You

- Joe Hanson

Your body is made of cells -- but how does a single cell know to become part of your nose, instead of your toes? The answer is in your body's instruction book: DNA. Joe Hanson compares DNA to a detailed manual for building a person out of cells -- with 46 chapters (chromosomes) and hundreds of thousands of pages covering every part of you.

1. Hanson says, "There are more cells in the human body than there are -

stars in the Milky Way Galaxy.

- 2. The entire genome ("the book of you") is contained inside the ______ of the cell.
- 3. Explain, in your own words, how some cells know to be muscle and some know to be bone.

Some cells know to be muscle and some know to be bone by going back to the instruction book (nucleus), looks it up (genes) and put it together.

4. Though all humans start off the same way, give a brief explanation about what makes us all so different.

What makes us all so different is the tiny variations in the genes on our chromosomes.

- 5. How many chromosomes does the human genome contain? _____
- **6.** It's estimated that all the chromosomes together house about 20,000 individual instructions called:



Go to Collea's Corner to watch the Stated Clearly video *What is Exactly is a Gene?* and then answer the questions that follow.

What Exactly is a Gene?

You've probably heard about Genetic Engineering or Genetically Modified Organisms (GMOs) but what exactly is a gene and what does it mean to modify the genes of a plant or animal?

1. A single strand of DNA is made up of millions of building blocks called –

nucleotides

- 2. What are the four different types of nucleotides? A C T G
- **3.** What is a gene?

A gene is a special stretch of DNA, a sequence of As, Cs, Ts and Gs, that code for something.

- 4. Genes make _____ proteins
- 5. The shape of a protein determines the ______ functions _____ that protein will have inside the body.
- 6. Hemoglobin is a protein found in _____ red blood cells
- 7. What is the function of the protein hemoglobin?

The function of hemoglobin is to capture oxygen when blood flows near the lungs and then release it later when blood flows near oxygen starved tissue (cells). 8. What is the function of the protein pepsin?

Pepsin is a digestive protein. It's unique shape allow it to break down food inside your stomach so it can be absorbed by the body.

9. What is the function of the protein keratin?

Keratin is a structural protein. It's unique shape and size allow it to link together with other keratin proteins to form hard structures like fingernails, claws and beaks.

10. What is one reason why scientists believe all life is related or *share a common ancestor*?

Scientists believe all life is related or <u>share a common ancestor</u> because the basic DNA code, the language of As, Cs, Ts and Gs, is pretty much the same for all living things.

- **11.** Humans and chimps share <u><u>96</u>% of their genetic code.</u>
- 12. Humans and fruit flies share <u>50</u>% of their genes.
- **13.** What will happen if a genetic engineer take a gene from a bacteria cell and insert it into the DNA of an animal or plant cell?

If a genetic engineer takes a gene from a bacteria cell and insert it into the DNA of an animal or plant cell, that animal or plant cell will read the new gene and produce the bacterial protein.

- **14.** List and describe three examples of how genetic engineers have mixed and matched the genes of different organisms.
 - (1) Corn that is toxic to insects but supposedly safe for human consumpion.
 - $(2) \frac{\text{Tomatoes that last twice as long in the grocery before going}}{\text{bad.}}$
 - (3) A new form of bacteria that produces the human hormone (protein) insulin which we then collect and give to people with diabetes.
- **15.** So what exactly is a gene?

A gene is a special stretch or segment of DNA that codes for something.

16. Each gene is a unique	recipe	that t	ells the	cell how to make a proteins .
17. Different creatures have di basic DNA language of –	fferent _ As	ge Ts	nes Cs	, but all genes are written in the same