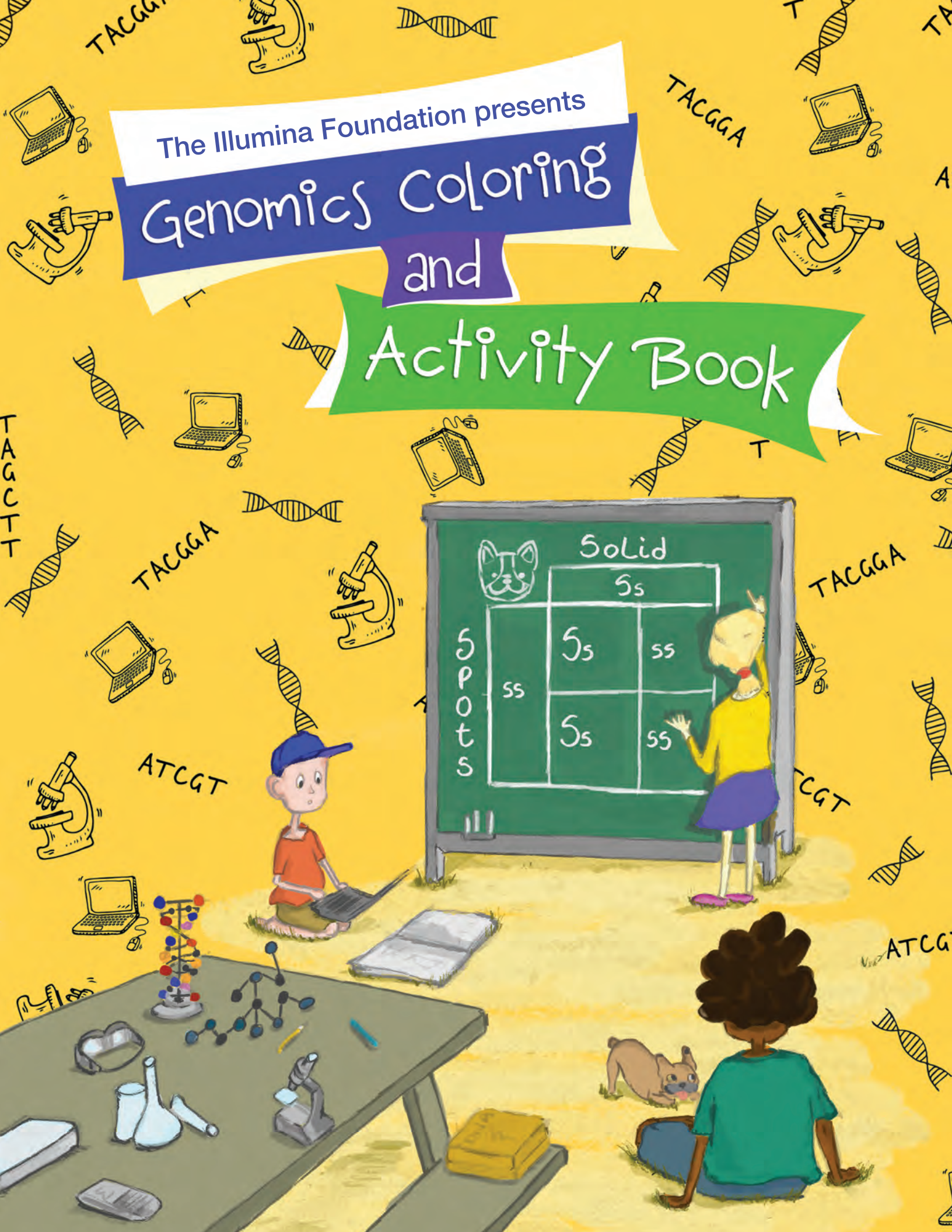


The Illumina Foundation presents

# Genomics Coloring and

# Activity Book



Solid

Ss

S  
P  
O  
T  
S

Ss

ss

Ss

ss

TACGGA

ATCGT

TACGGA

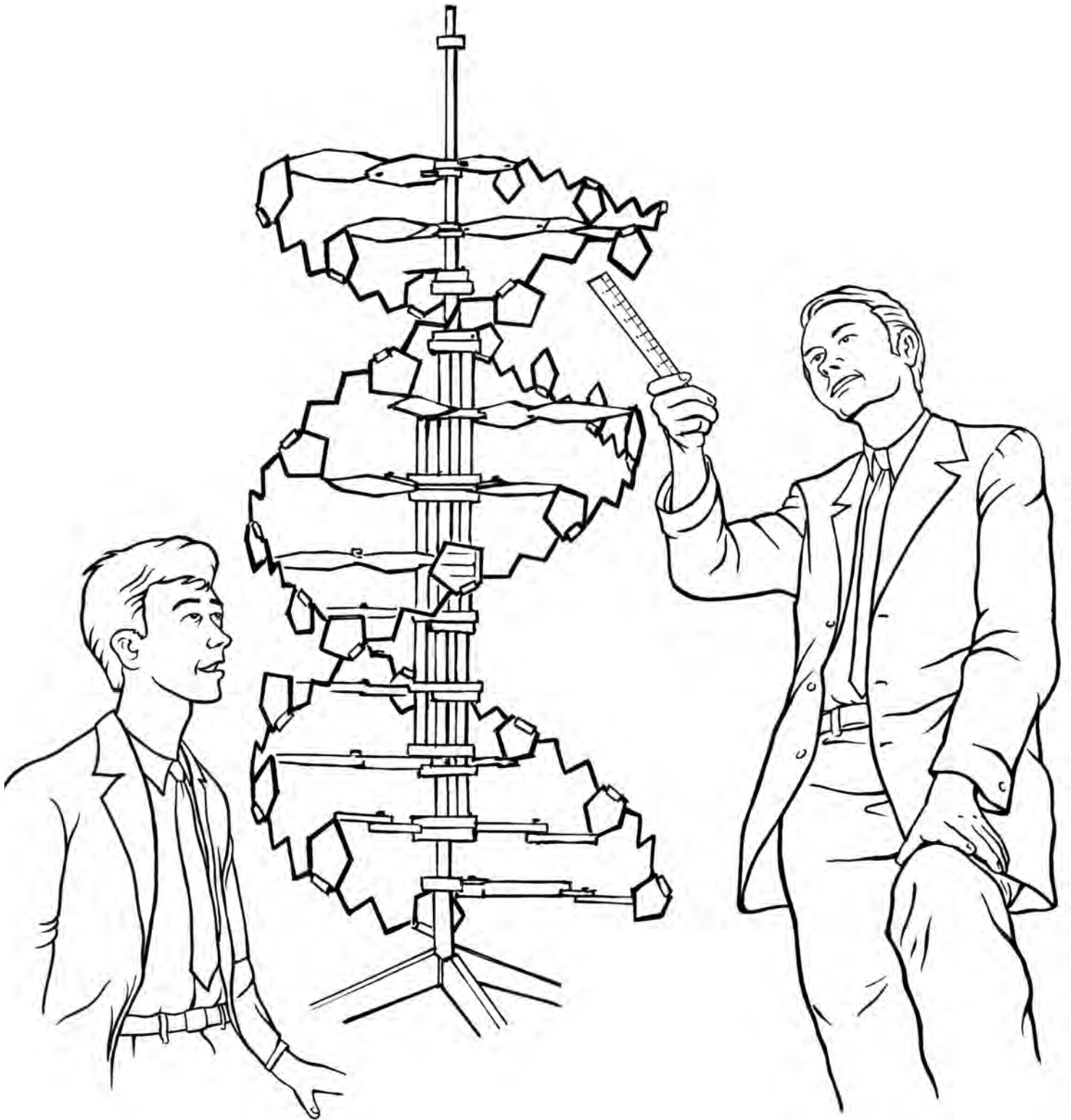
ATCGT

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Illustrated by Amy and Bret Conover  
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# Watson & Crick

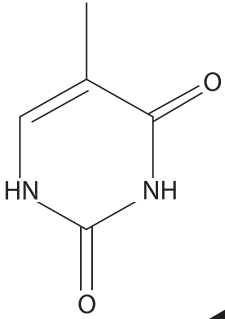
Cambridge University scientists



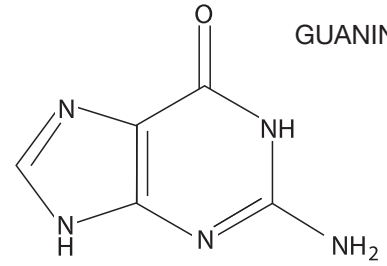
On February 28, 1953, at Cambridge University, scientists James D. Watson and Francis H.C. Crick announce they have determined the double helix structure of DNA, the molecule containing human genes.

# DNA word search

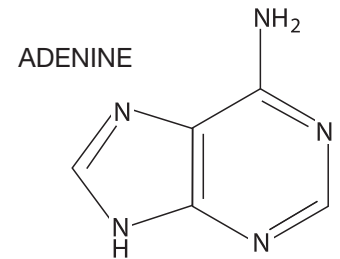
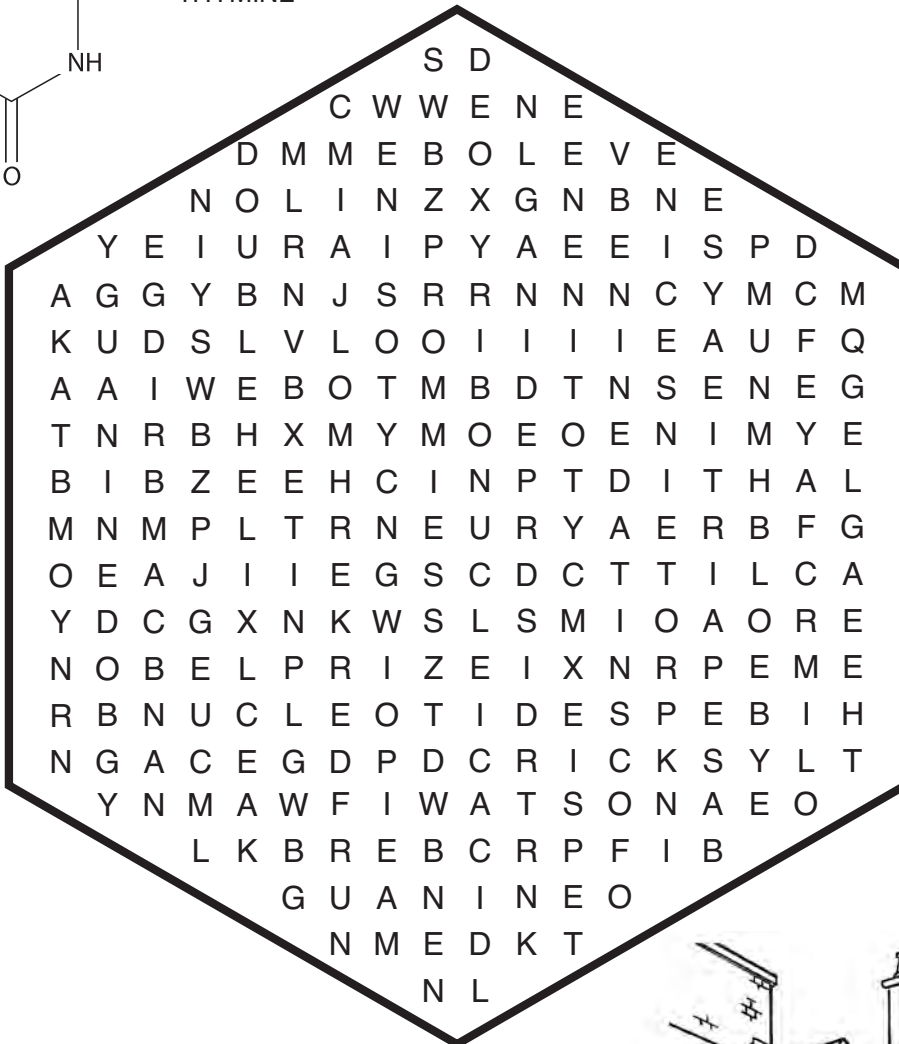
Find all the words related to DNA



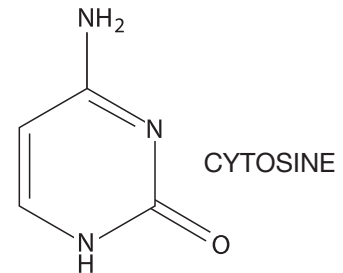
THYMINE



GUANINE



ADENINE



CYTOSINE

**CAN YOU FIND THESE WORDS?**

double helix  
The Eagle  
Cambridge  
Watson  
Crick  
deoxyribonucleic acid  
genetics  
proteins

cytosine  
guanine  
adenine  
thymine  
base pair  
nucleotides  
Nobel Prize  
genes



It was at The Eagle, a pub in Cambridge, where Francis Crick announced that he and James Watson had “discovered the secret of life.”

# Rosalind Franklin

English chemist and X-ray crystallographer



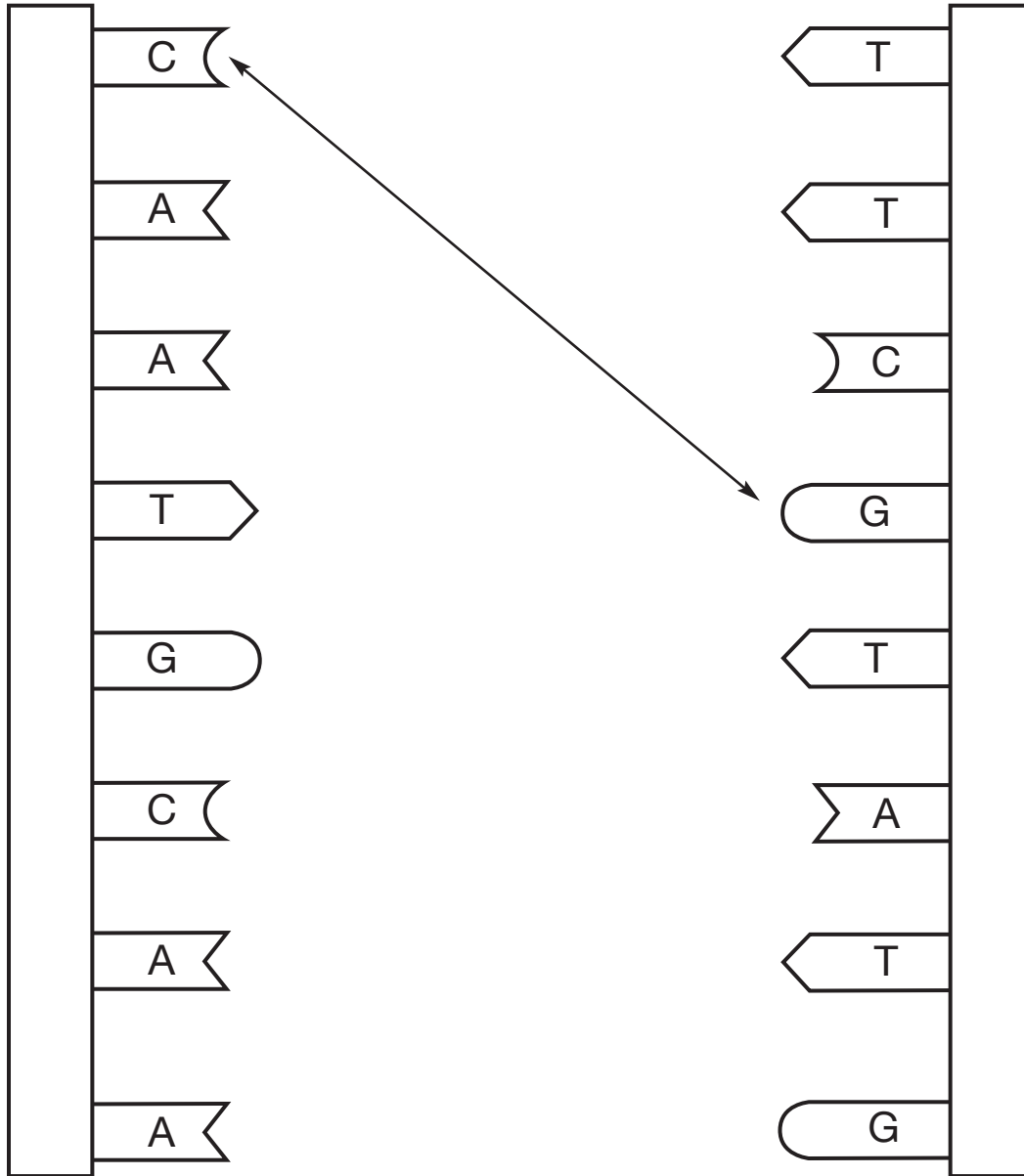
Rosalind Franklin was an English chemist and X-ray crystallographer who made important contributions to the understanding of the molecular structures of DNA, RNA, viruses, coal, and graphite.

One of her photographs provided key insights into Watson and Crick's discovery of the DNA double helix structure.

# What is DNA?

Match each base with its corresponding pair

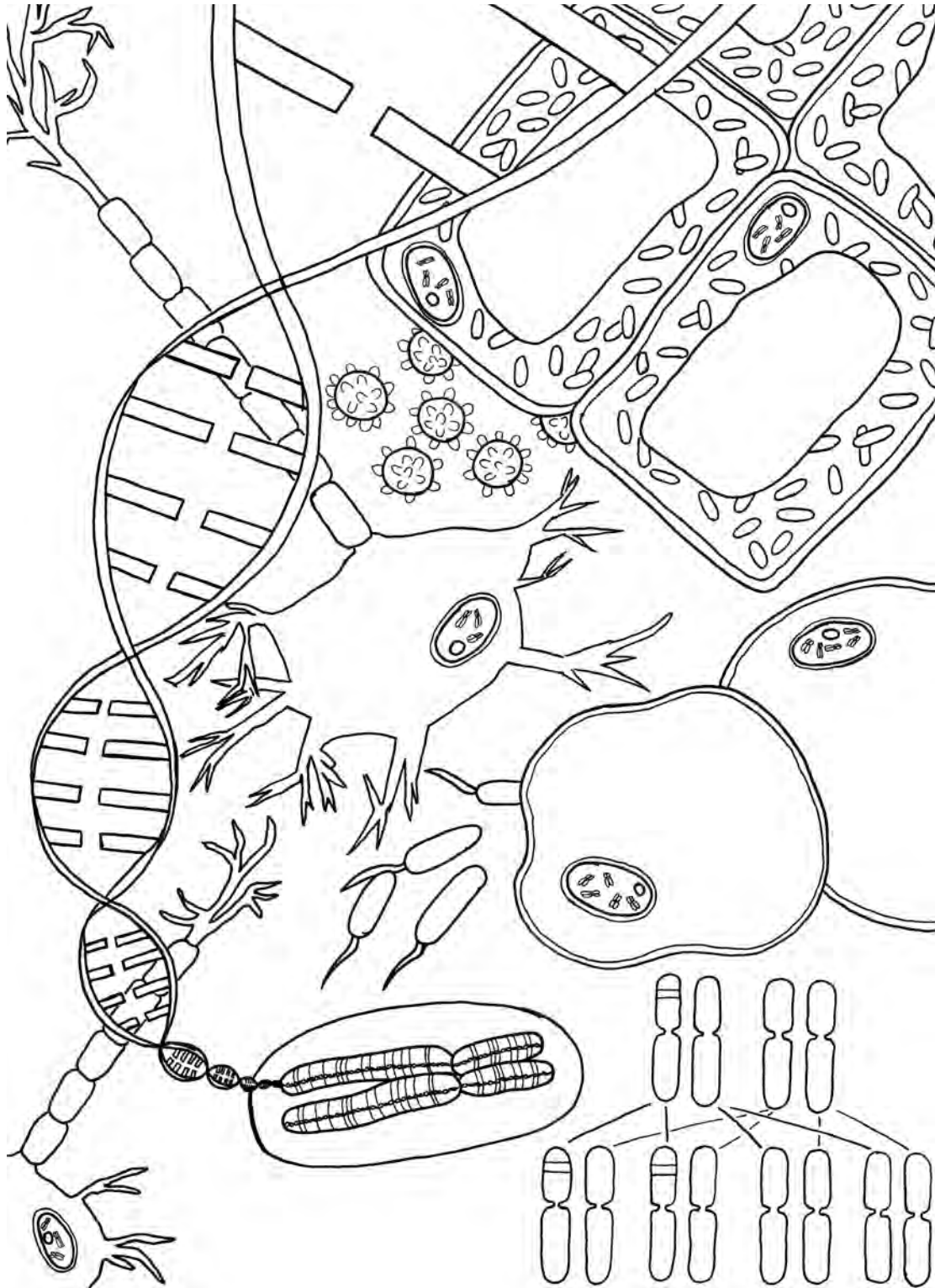
(Hint: A's always match with T's, C's always match with G's)



DNA, or deoxyribonucleic acid, is a long molecule that contains our unique genetic code. Like a recipe book, it holds the instructions for making all the proteins in our bodies. DNA contains four basic building blocks or bases—adenine (A), cytosine (C), guanine (G), and thymine (T). The order, or sequence, of these bases forms the instructions in our genome.



# What are cells?

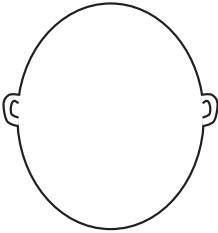


Cells are considered basic units of life. Most DNA is located in the nucleus of the cells. Trees in a forest, fish in a river, horseflies on a farm, lemurs in the jungle, worms in the soil—all these plants and animals are made of the building blocks we call cells. Other forms of life are made of a single cell, such as bacteria and protozoa.

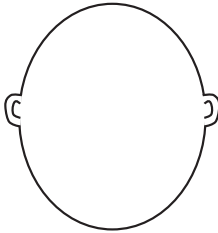
# What is a gene?

Fill in your family's traits

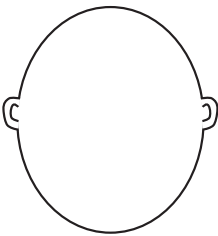
## MOM'S TRAITS



straight or curly hair?



freckles?

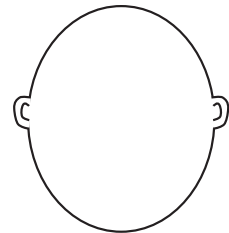


hair color?

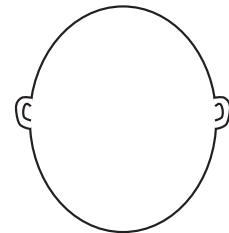


eye color?

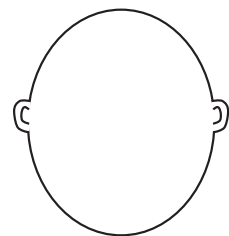
## DAD'S TRAITS



straight or curly hair?



freckles?



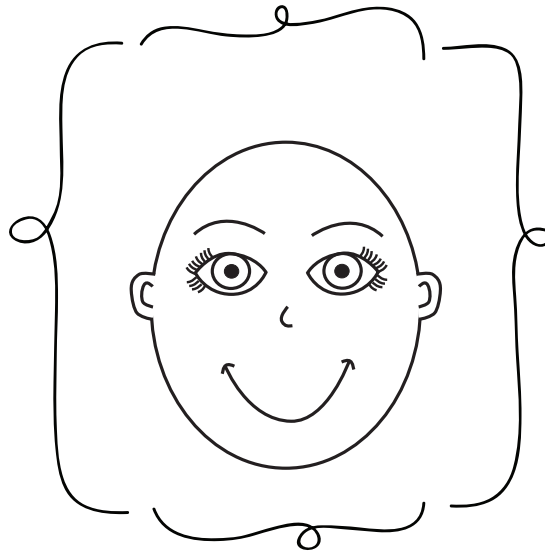
hair color?



eye color?

See how genes are passed down from your parents.

What eye color and hair color did you end up with?



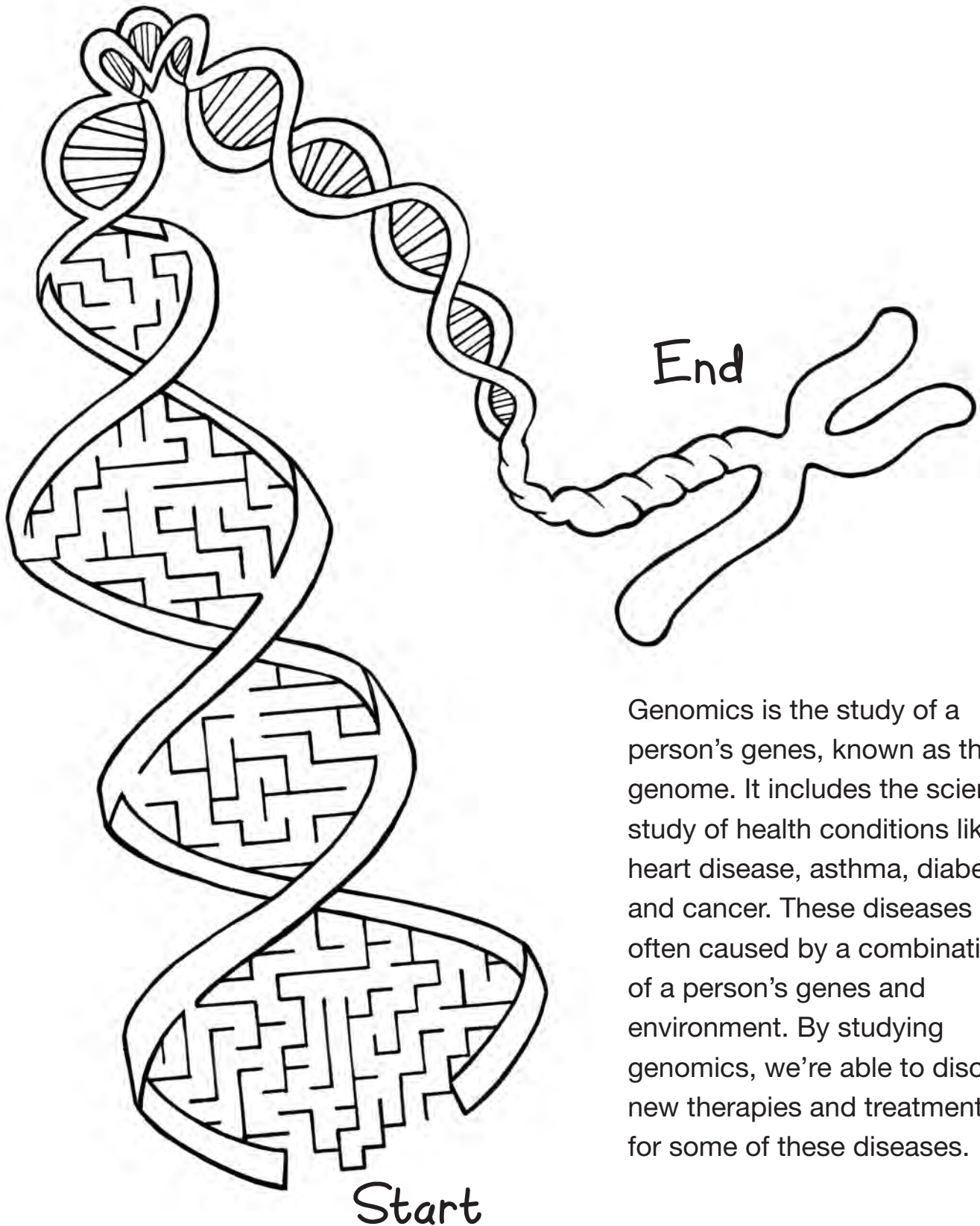
## My Traits!

A gene is a small portion of your genome that can determine your physical traits like hair color and eye color. You get one copy of the gene from your mom, and the other from your dad—and that's what makes you, you.



# Why is genomics important?

Find your way through the gene maze



Genomics is the study of a person's genes, known as the genome. It includes the scientific study of health conditions like heart disease, asthma, diabetes, and cancer. These diseases are often caused by a combination of a person's genes and environment. By studying genomics, we're able to discover new therapies and treatments for some of these diseases.

# DNA sequencing lab



# Find the hidden items

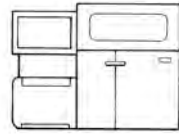


Can you find these hidden items in the sequencing lab scene?

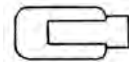
pipette



sequencer



flow cell



microscope



lab goggles



lab coat



solution bottle



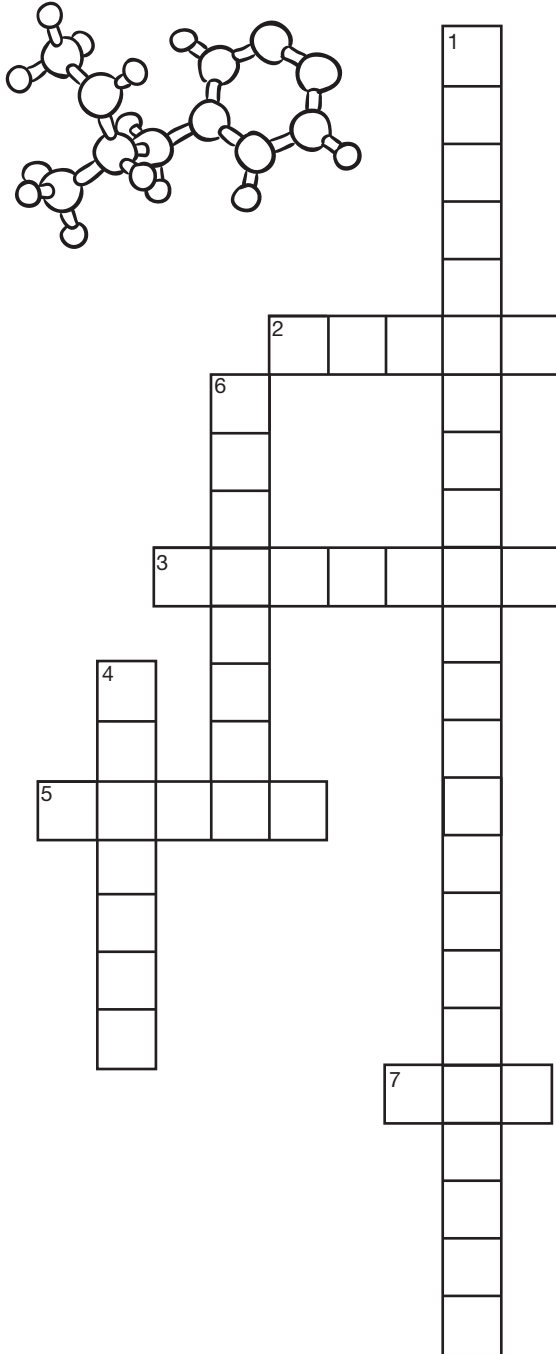
notebook





# DNA crossword puzzle

Complete the puzzle with the correct genomics term

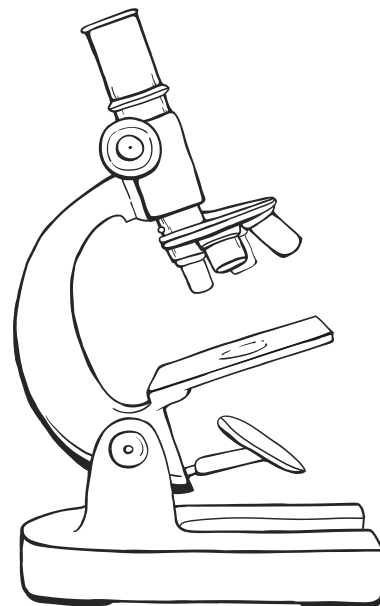


## ACROSS

2. Building blocks of DNA
3. Eye protection worn in a lab
5. Genomics is the study of a person's \_\_\_\_\_
7. Used by scientists in laboratories for many types of projects, including genomic sequencing

## DOWN

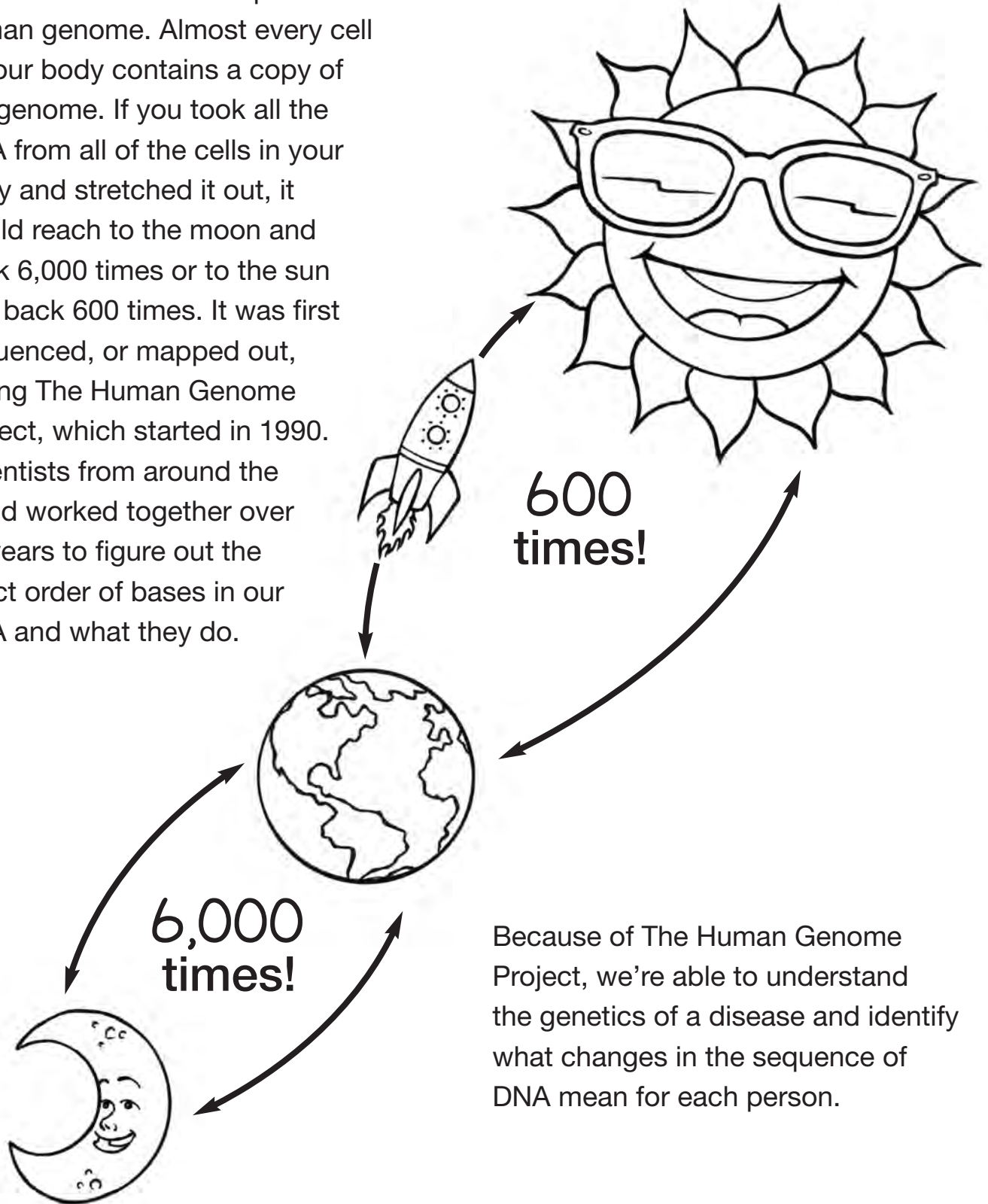
1. A technique to make large amounts of a specific piece of DNA
4. Rosalind Franklin was an English \_\_\_\_\_
6. This base pairs with guanine



# Human Genome Project

## How big is your genome?

Six billion letters make up the human genome. Almost every cell in your body contains a copy of the genome. If you took all the DNA from all of the cells in your body and stretched it out, it would reach to the moon and back 6,000 times or to the sun and back 600 times. It was first sequenced, or mapped out, during The Human Genome Project, which started in 1990. Scientists from around the world worked together over 13 years to figure out the exact order of bases in our DNA and what they do.



Because of The Human Genome Project, we're able to understand the genetics of a disease and identify what changes in the sequence of DNA mean for each person.

# Milestones in DNA history

Match the date with the event in DNA history

2001

Gregor Mendel, father of modern genetics, presents his research on experiments in plant hybridization

James Watson and Francis Crick discover the double helix structure of DNA

1989

1953

First genetic disease, Huntington's Disease, is mapped

1952

First draft of the human genome is released

Cystic fibrosis gene mutation is identified

1983

1961

Rosalind Franklin creates Photograph 51, showing a distinctive pattern that includes the helical shape of DNA

1865

2003

Chromosome 22 is the first human chromosome to be decoded

Invention of polymerase chain reaction (PCR) technology for amplifying DNA

1869

1999

The Human Genome Project is completed

Friedrich Miescher identifies "nucleic" DNA with associated proteins from cell nuclei

1883

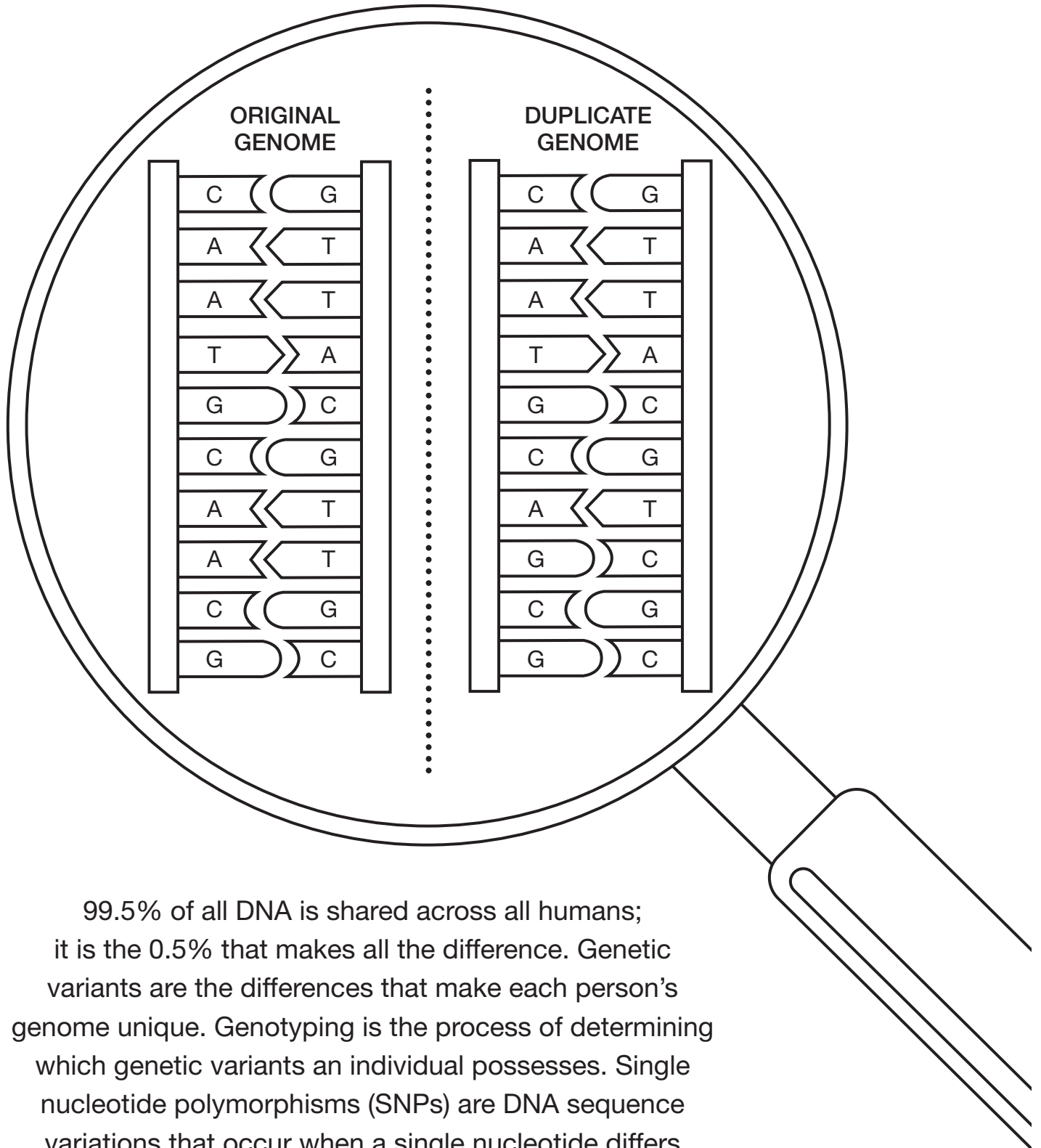
Marshall Nirenberg cracks the genetic code for protein analysis



# DNA sequence activity

Find the variant of the genome that is not like the others

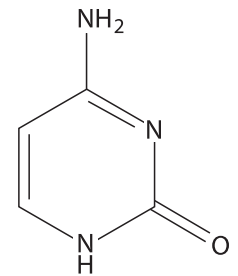
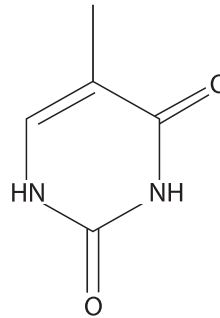
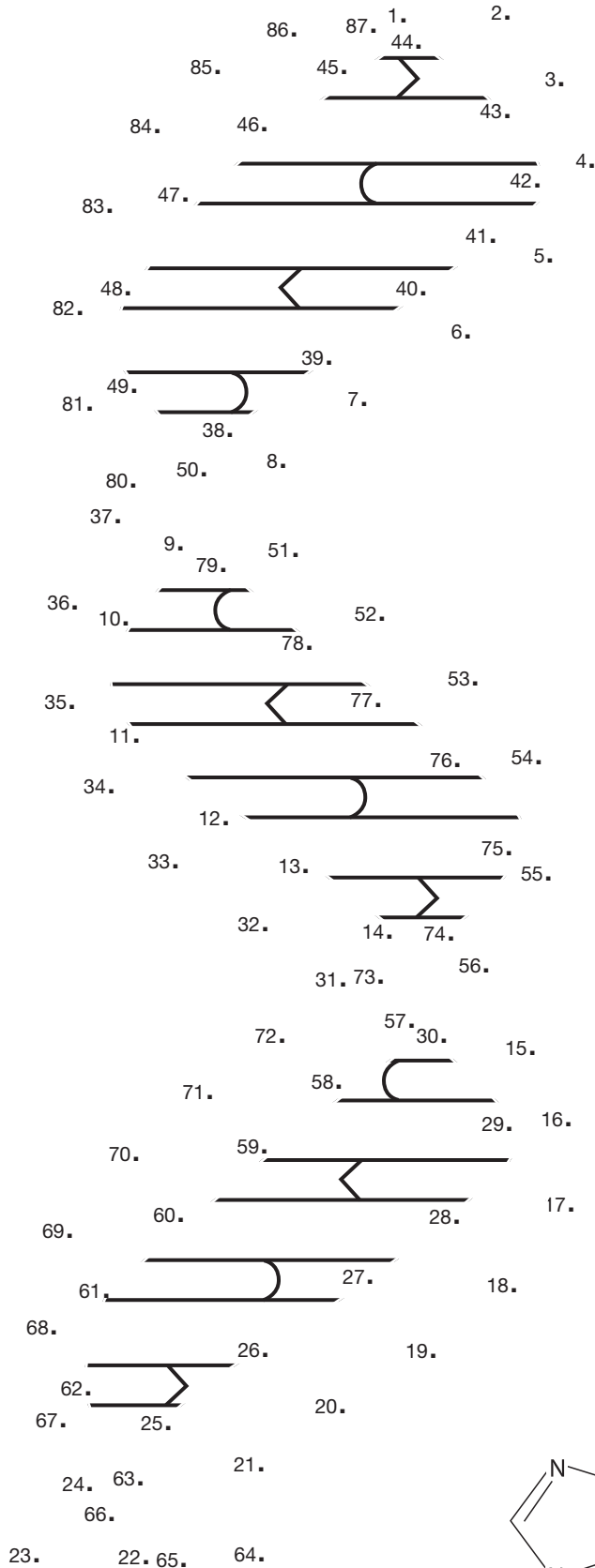
Hint: A variant is a mutation, or change, in the genome.



99.5% of all DNA is shared across all humans; it is the 0.5% that makes all the difference. Genetic variants are the differences that make each person's genome unique. Genotyping is the process of determining which genetic variants an individual possesses. Single nucleotide polymorphisms (SNPs) are DNA sequence variations that occur when a single nucleotide differs from the reference DNA sequence.

# DNA base activity

Connect the dots and color each base the correct color



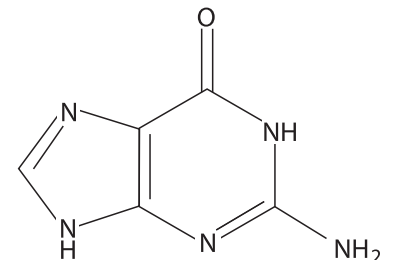
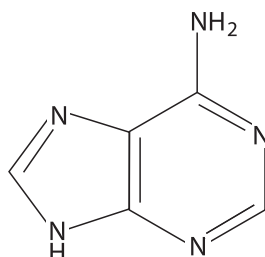
YELLOW Adenine

GREEN Thymine

BLUE Cytosine

RED Guanine

Using chemistry, scientists attach a color to each base and replicate it using PCR technology. Then, using a strong camera and microscope, they're able to determine the order of the bases in your genome.



# Global Genomics word search

Find all of the words related to genomics

A P I T E S A E S I D X E L P M O C  
L O O U E R A R K Z N A X E C R W D  
S P R Y A G R I C U L T U R E E R Z  
K U U E R T E G N K L D M M V P T M  
D L T U I K E D V O U J U R N R I N  
F A Y D U J S K J N H S A T C O J F  
J T E C T Z A L K C N A S U Z D H K  
H I O X H C E J L O A D C W M U T D  
S O I V A V S F C L U T F P B C L J  
L N R M E N I R Z O R G W E X T A F  
K S U N R Z D N N G E F H O V I E H  
D E T Z L X S Z R Y Y N J R Z V H G  
J Q Y V J M U C V F W Z K T K E C K  
F U E C S C O V H H O M L J J H I D  
H E O Z C V I N D L C C W E G E T S  
S N R X I N T L I K Y R E L F A E J  
K C U C S L C Z L Z R V A R S L N F  
D I T U N U E C H D Q Z U E E T E H  
J N Y V E A F U U J P N E F S H G G  
F G E H R S N H Z V R M P D R E M K  
M I C R O B I O L O G Y R N P R R L  
S E R Z F D D A H Z E V T B O T B D

**CAN YOU FIND  
THE DIFFERENT  
AREAS GENOMICS  
HAS AN IMPACT  
ON TODAY?**

reproductive health  
oncology  
population sequencing  
research  
complex disease  
consumer  
infectious disease  
forensics  
agriculture  
genetic health  
microbiology

The global genomics market is expected to reach \$23.88 billion by 2022. Genomics is used in a variety of areas that impact our lives such as personalized medicine, cancer research, agriculture and disease outbreaks. How do you imagine genomics impacting your life in the future?

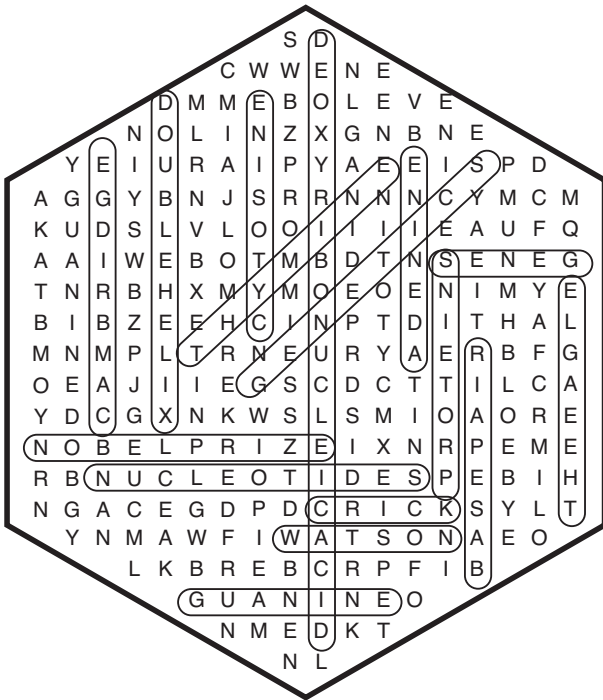




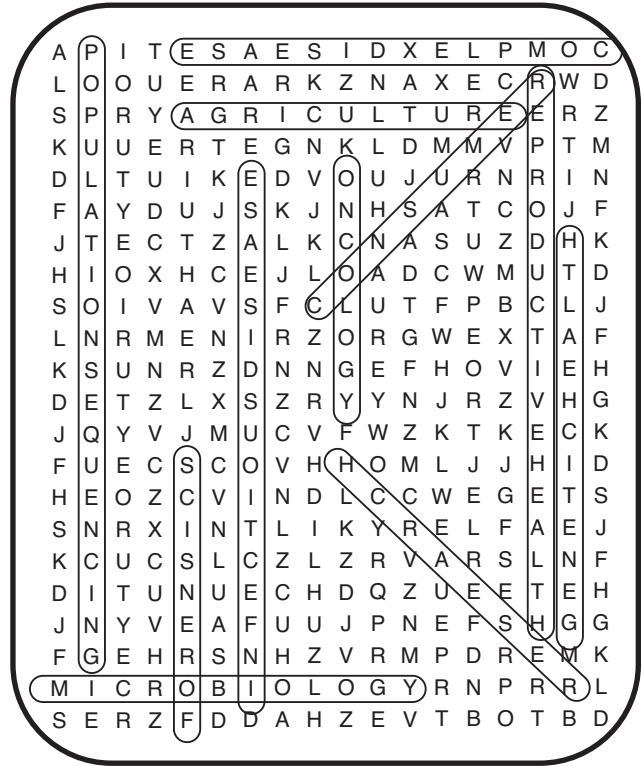
# Activity answer key

Find the answers below

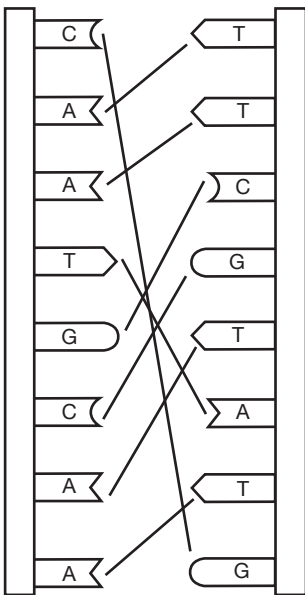
## DNA WORD SEARCH



## GLOBAL GENOMICS WORD SEARCH



## MATCHING BASE PAIRS



## DNA CROSSWORD PUZZLE

### ACROSS

- Building blocks of DNA (BASES)
- Eye protection worn in a lab (GOGGLES)
- Genomics is the study of a person's (GENES)
- Used by scientists in laboratories for many types of projects, including genomic sequencing. (PCR)

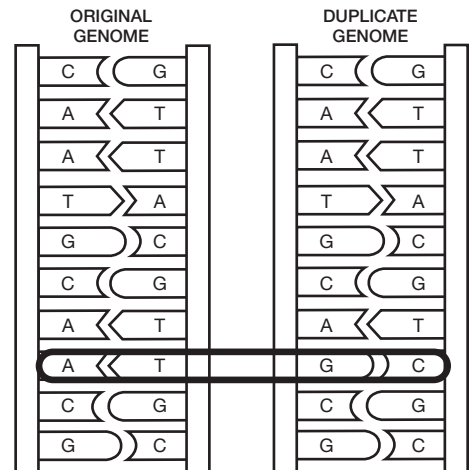
### DOWN

- A technique to make large amounts of a specific piece of DNA (POLYMERASE CHAIN REACTION)
- Rosalind Franklin was an English (CHEMIST)
- This base pairs with guanine (CYTOSINE)

## DNA MILESTONES

- |      |                                    |
|------|------------------------------------|
| 1865 | Gregor Mendel...                   |
| 1869 | Friedrich Miescher...              |
| 1952 | Rosalind Franklin...               |
| 1953 | James Watson and Francis Crick...  |
| 1961 | Marshall Nirenberg cracks...       |
| 1983 | First genetic disease...           |
| 1983 | Invention of polymerase chain...   |
| 1989 | Cystic fibrosis gene...            |
| 1999 | Chromosome 22...                   |
| 2001 | First draft of the human genome... |
| 2003 | The Human Genome Project...        |

## FIND THE VARIANT





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