

DNA

A BRIEF INTRODUCTION

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香港大學
THE UNIVERSITY OF HONG KONG



International Genetically
Engineered Machine Competition



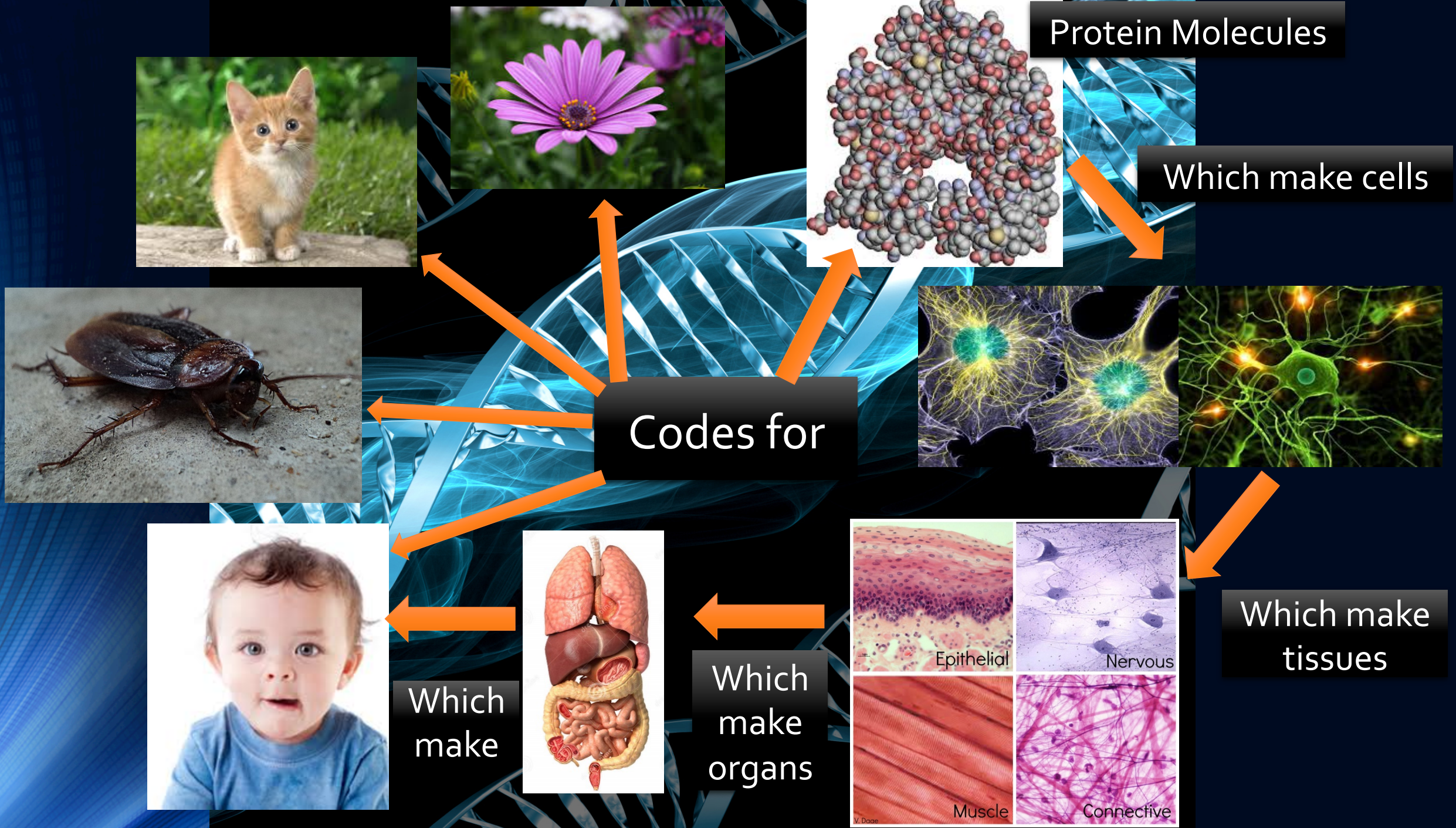


Life is inextricably linked

```
2
3 class Room(object):
4     def __init__(self, inventory, desc, short_desc):
5         self.inventory = inventory
6         self.__n = None
7         self.__s = None
8         self.__e = None
9         self.__w = None
10        self.__desc = desc
11        self.__short_desc = short_desc
12        self.__gate_n = None
13        self.__gate_s = None
14        self.__gate_e = None
15        self.__gate_w = None
16
17        if not isinstance(desc, str):
18            raise TypeError ("the input provided is not a string.")
19        elif not isinstance(short_desc, str):
20            raise ValueError ("the string provided is empty.")
21
22        # these set the gates
23        # they set the opposite gates, with checks to avoid recursion loops
24        def set_n(self, other):
25            if not isinstance(other, Room) or not other:
26                raise TypeError ("room is set None or an instance of Room")
```

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```

DNA is a very complex code



Protein Molecules

Which make cells

Codes for

Which make tissues

Which make organs

Which make

Epithelial

Nervous

Muscle

Connective

But how does DNA really
do all that it does?

DNA

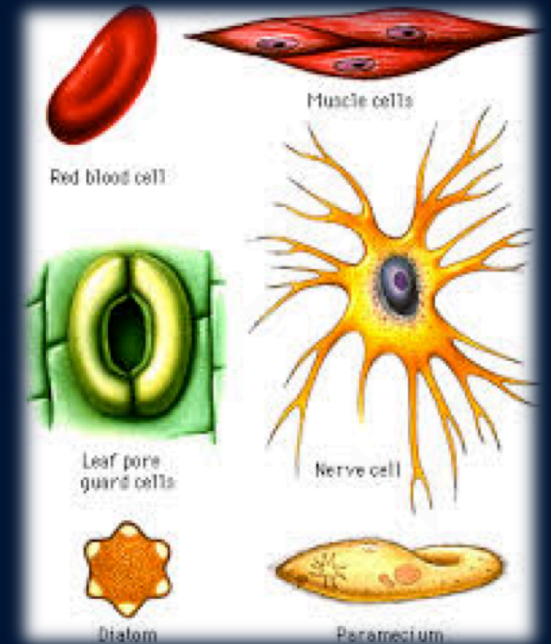
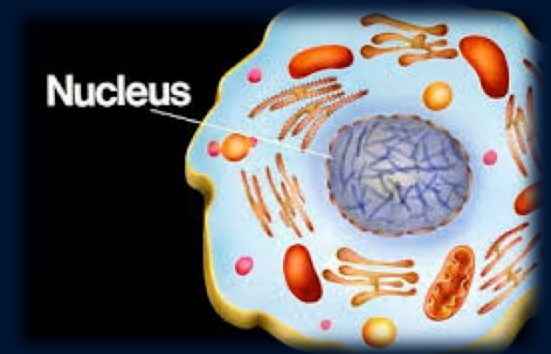
DNA stands for **deoxyribose nucleic acid**

This chemical substance is present in the nucleus of all cells in all living organisms

DNA controls all the chemical changes which take place in cells

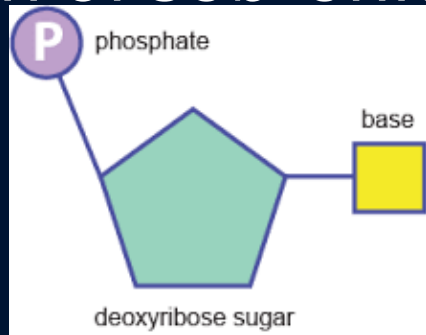
The kind of cell which is formed, (muscle, blood, nerve etc) is controlled by DNA

The kind of organism which is produced (buttercup, giraffe, herring, human etc) is controlled by DNA



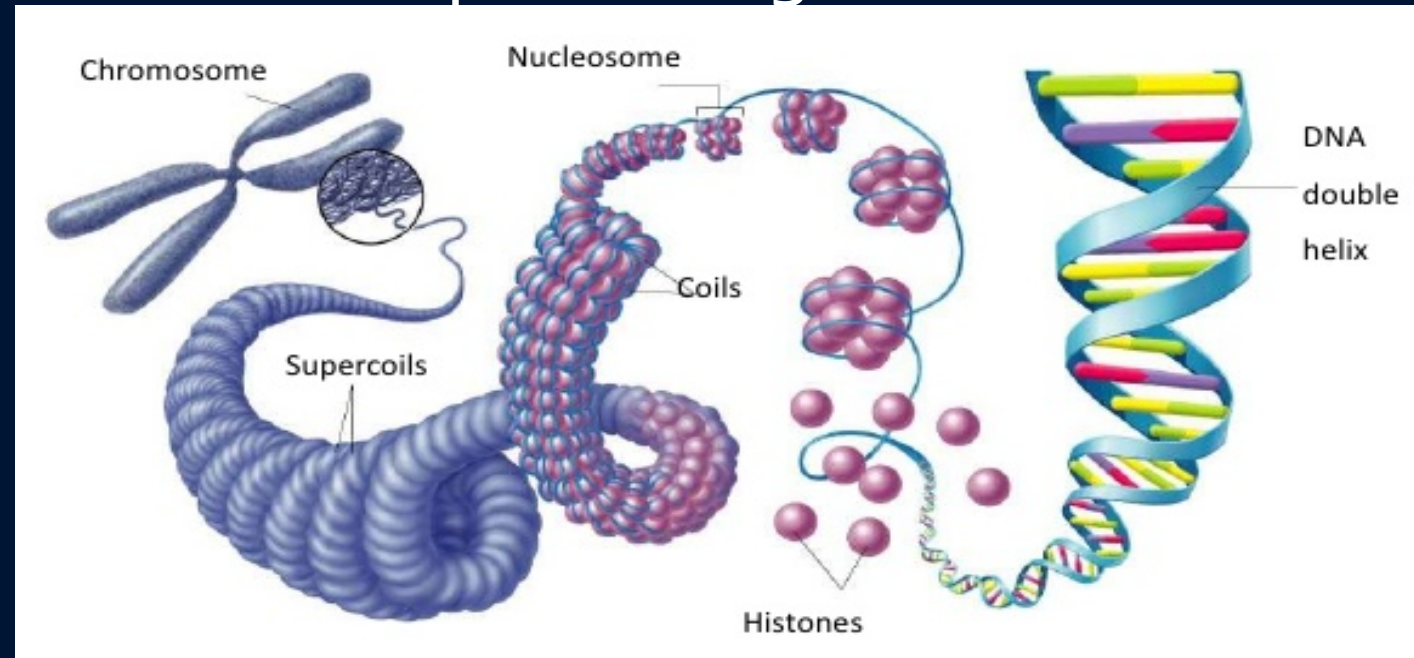
DNA molecule

DNA is a very large molecule made up of a long chain of sub-units

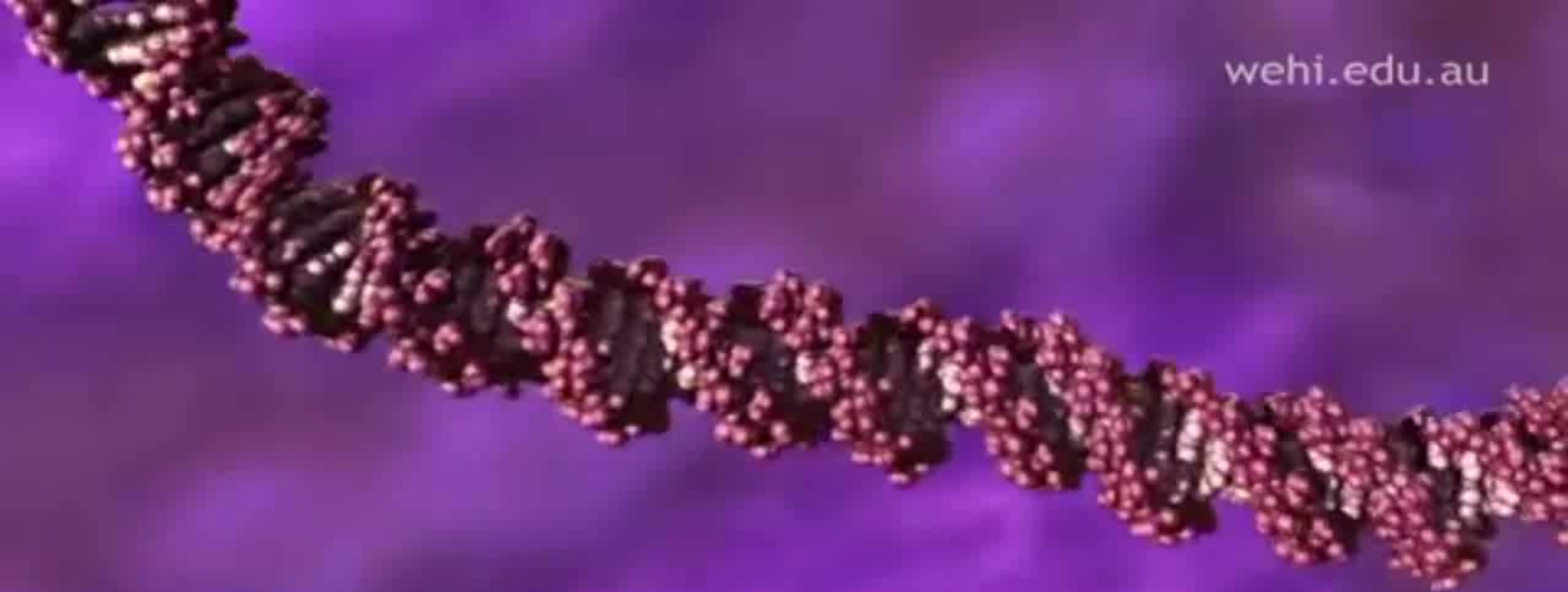


The sub-units are called **nucleotides**

Each nucleotide is made up of
a sugar called **deoxyribose**
a phosphate group **-PO₄** and
an **organic base**



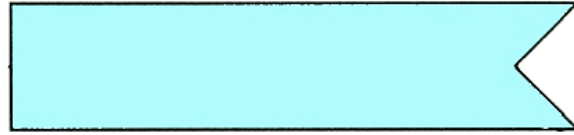
**~6 feet of DNA
in each cell!!!**



The bases

The most common organic bases are

Adenine



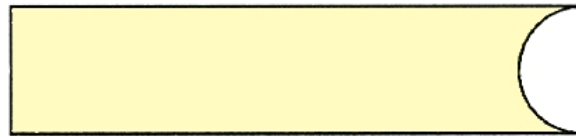
(A)

Thymine



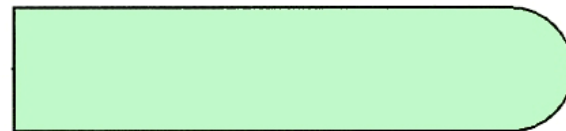
(T)

Cytosine



(C)

Guanine

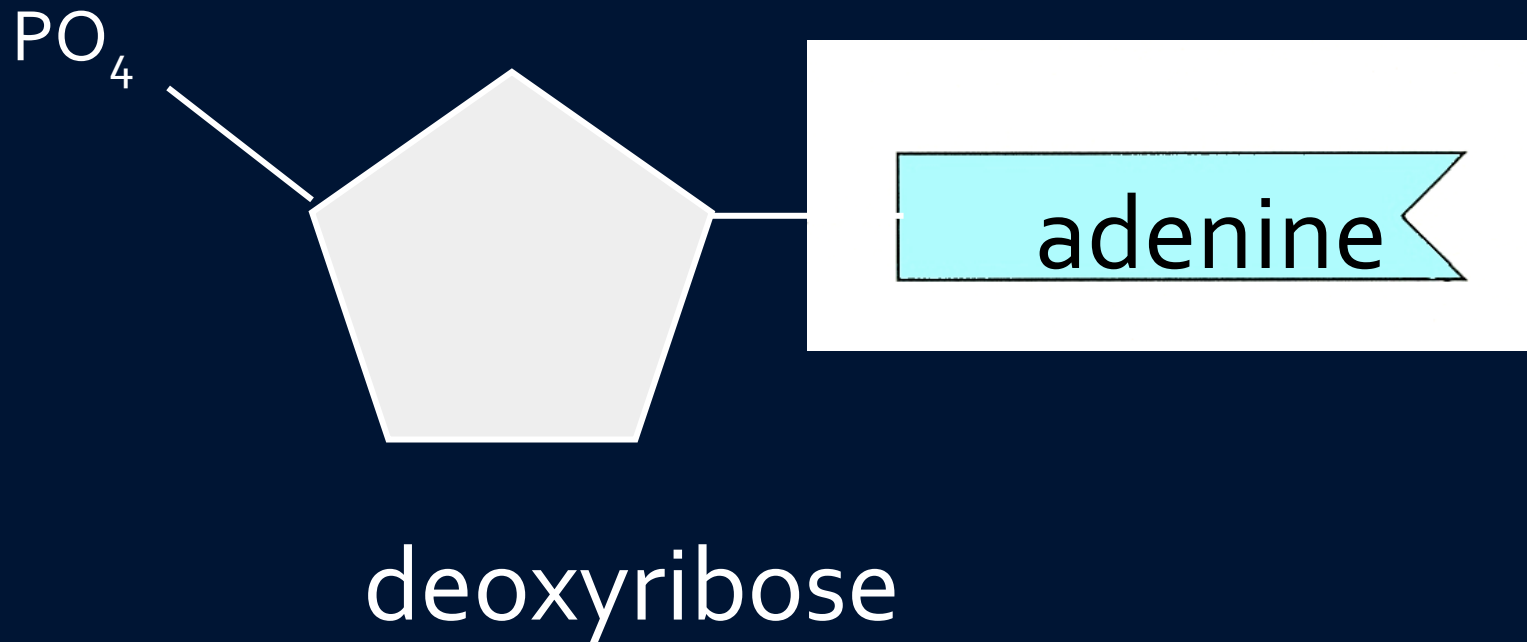


(G)

Nucleotides

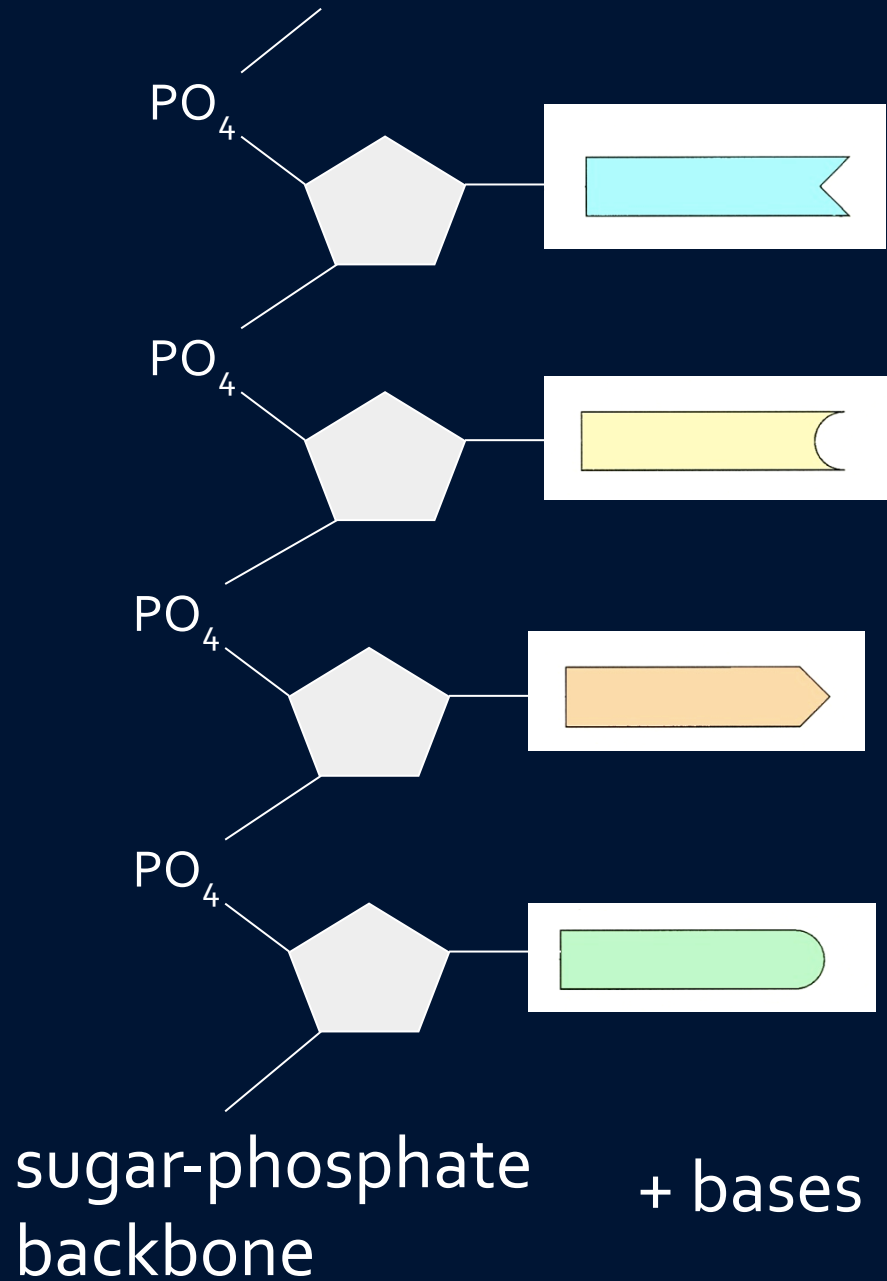
The deoxyribose, the phosphate and one of the bases

Combine to form a nucleotide



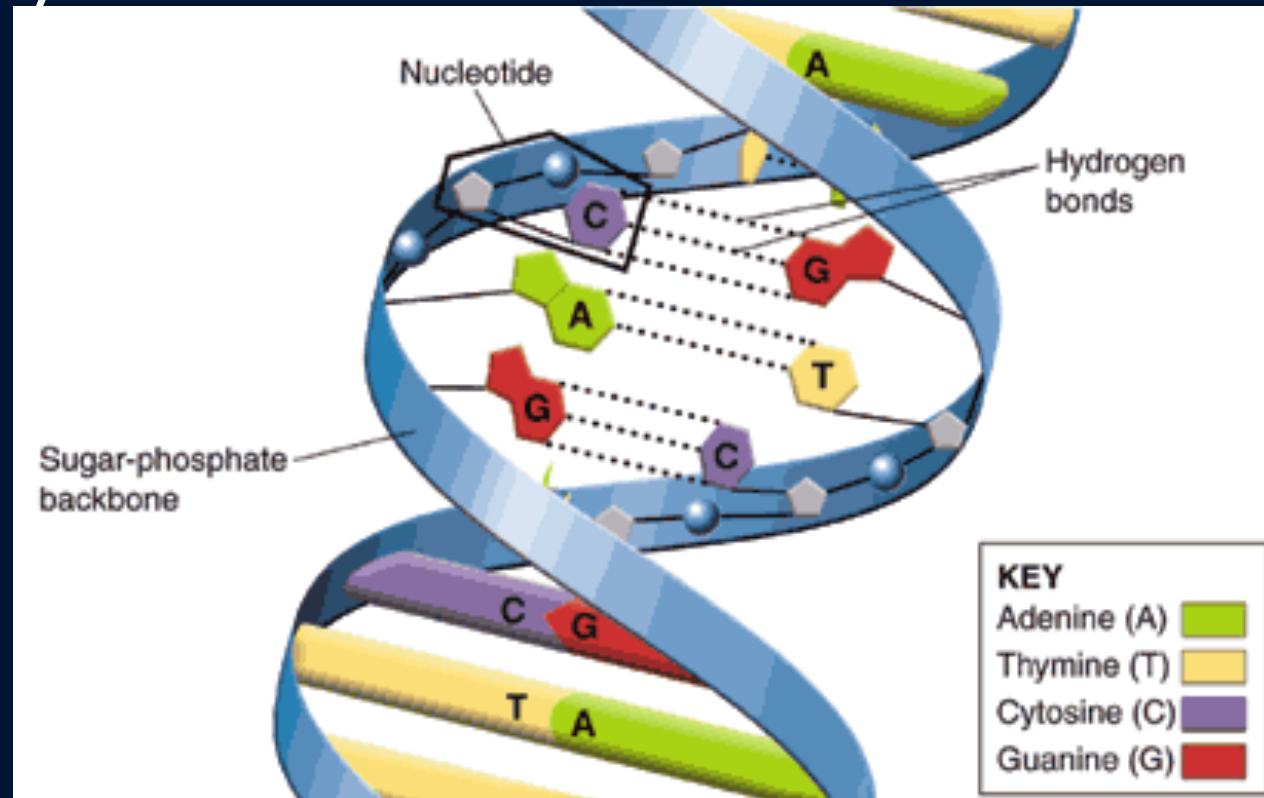
Joined nucleotides

7



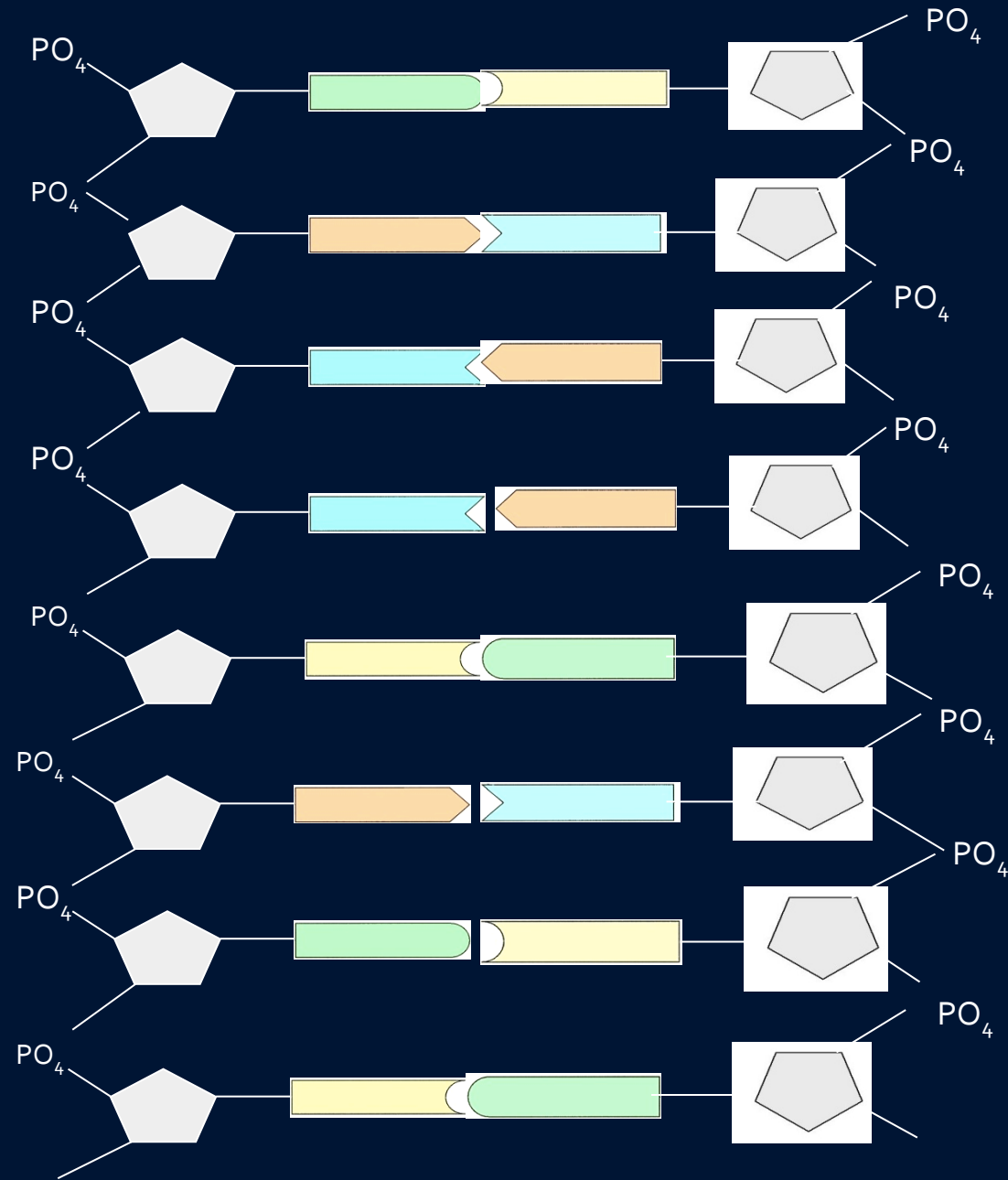
A molecule of DNA is formed by millions of nucleotides joined together in a long chain

In fact, the DNA usually consists of a double strand of nucleotides



The sugar-phosphate chains are on the outside and the strands are held together by chemical bonds between the bases

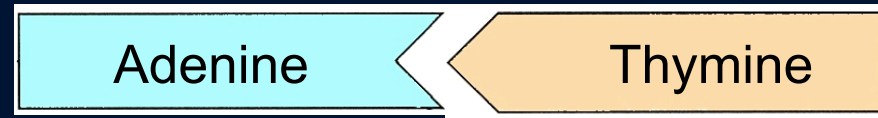
Double-stranded DNA



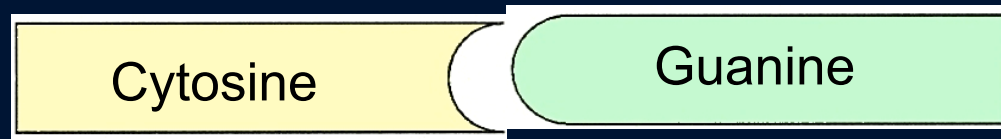
Bonding 1

The bases always pair up in the same way

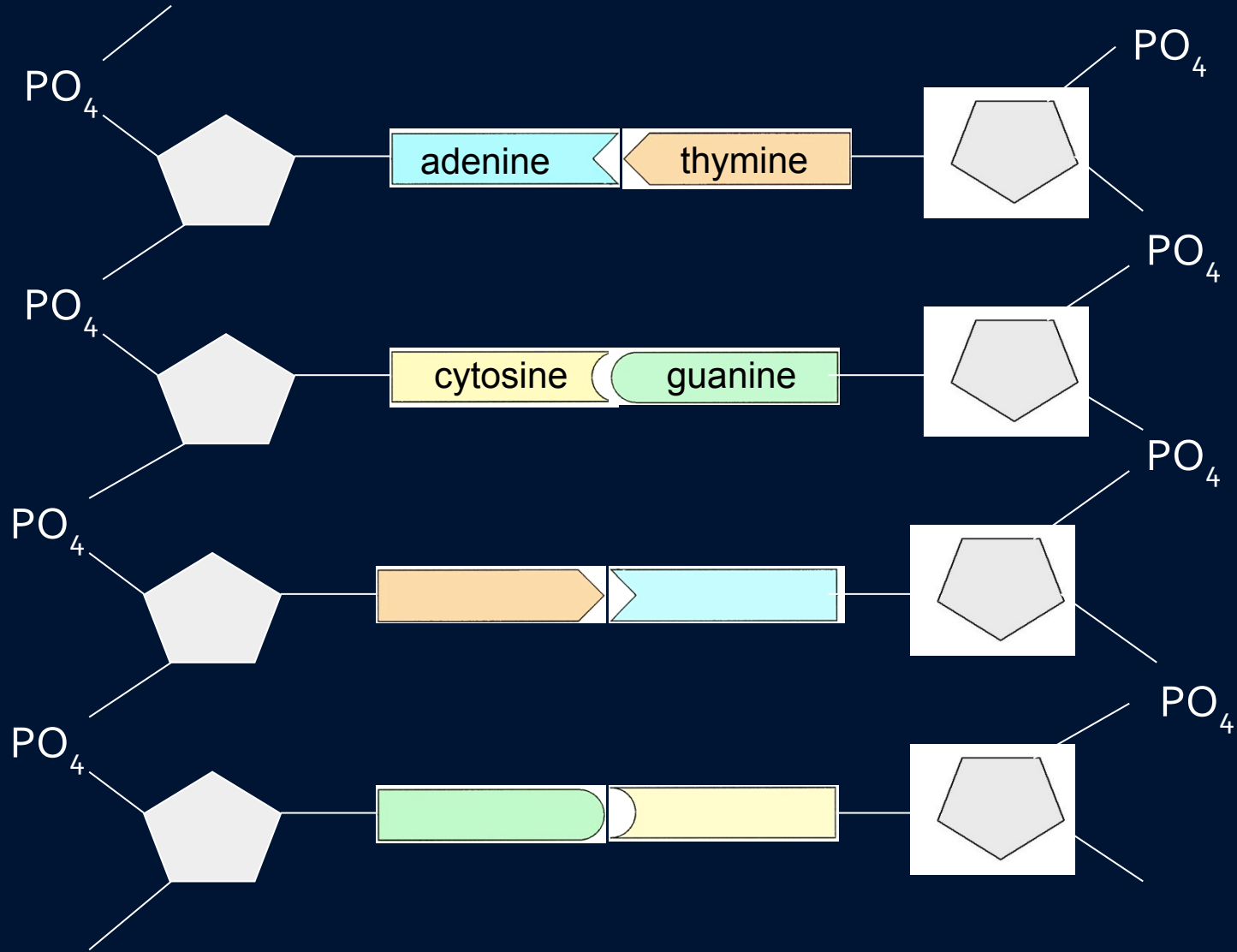
Adenine forms a bond with Thymine



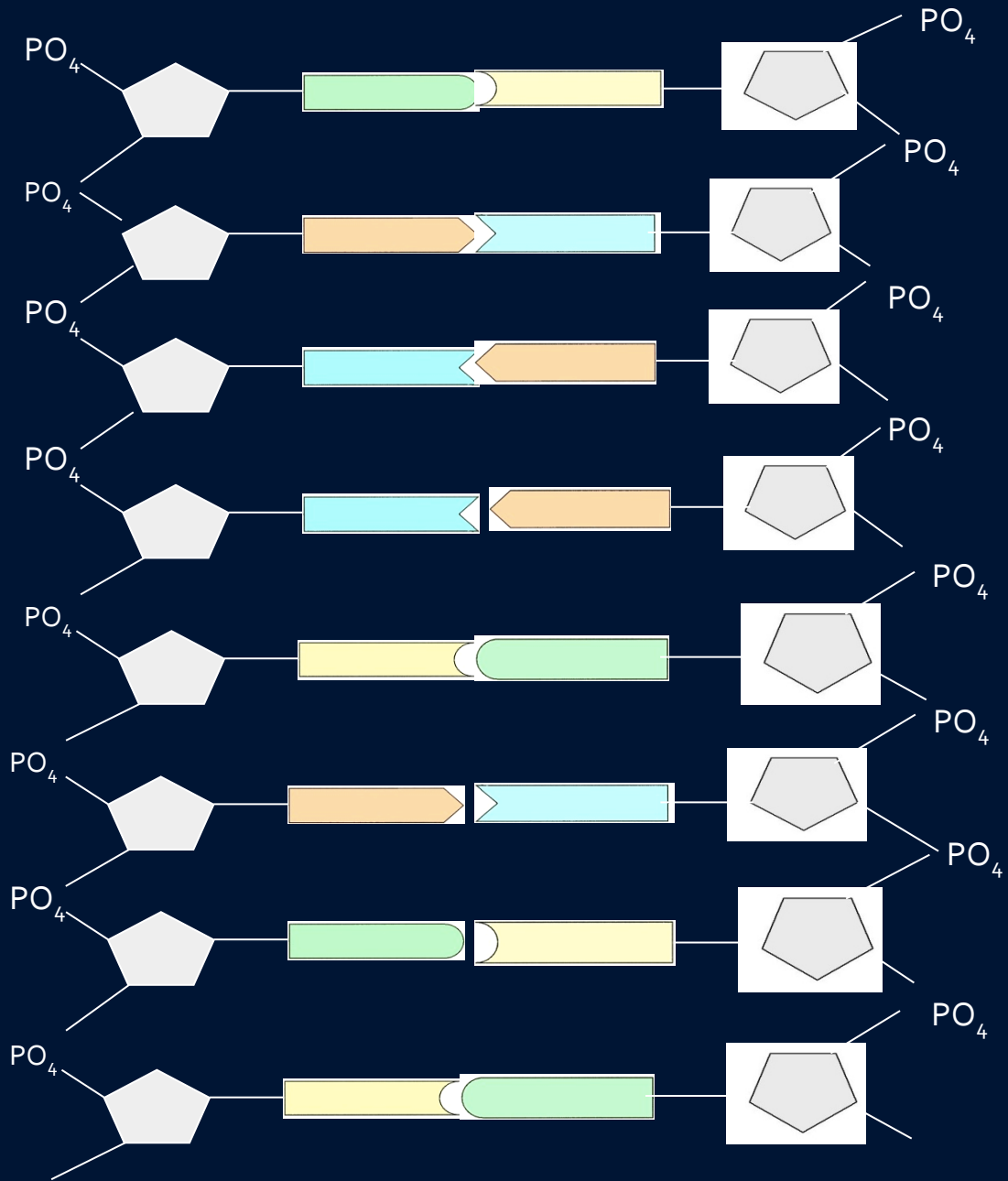
and Cytosine bonds with Guanine



Bonding 2

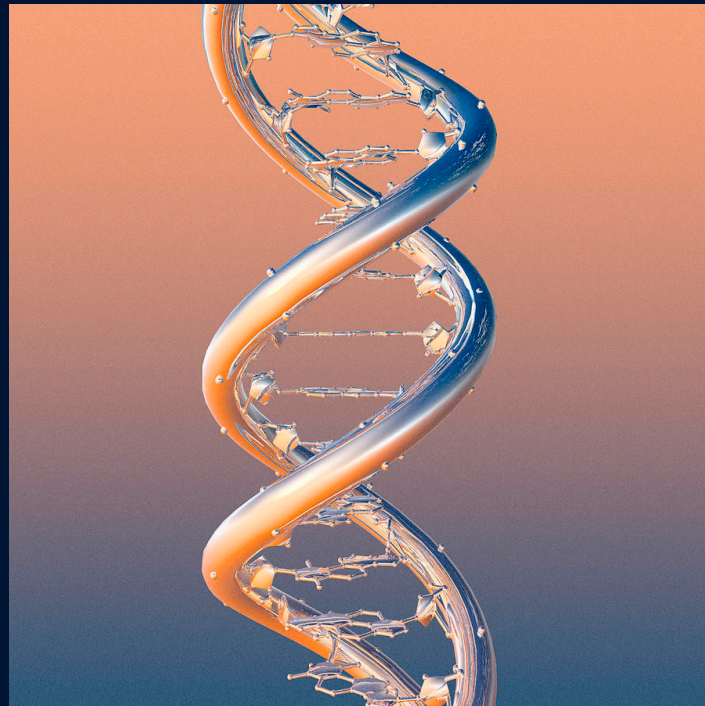


Pairing up



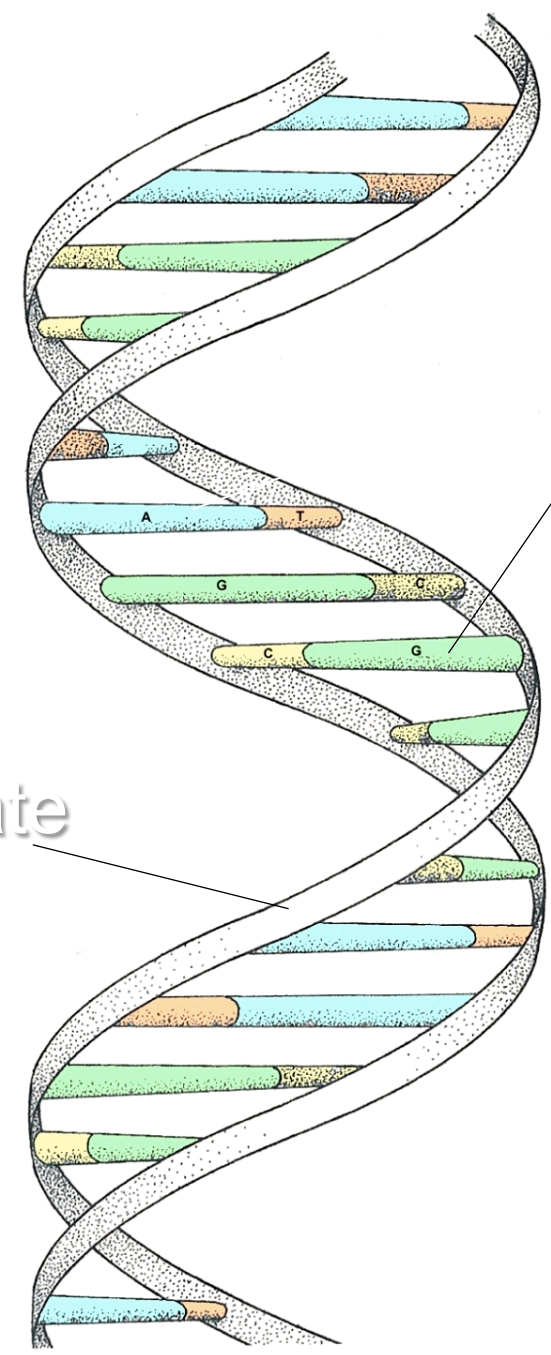
The paired strands are coiled into a spiral called

A DOUBLE HELIX



THE DOUBLE HELIX

sugar-phosphate
chain



bases

replication

Before a cell divides, the DNA strands unwind and separate

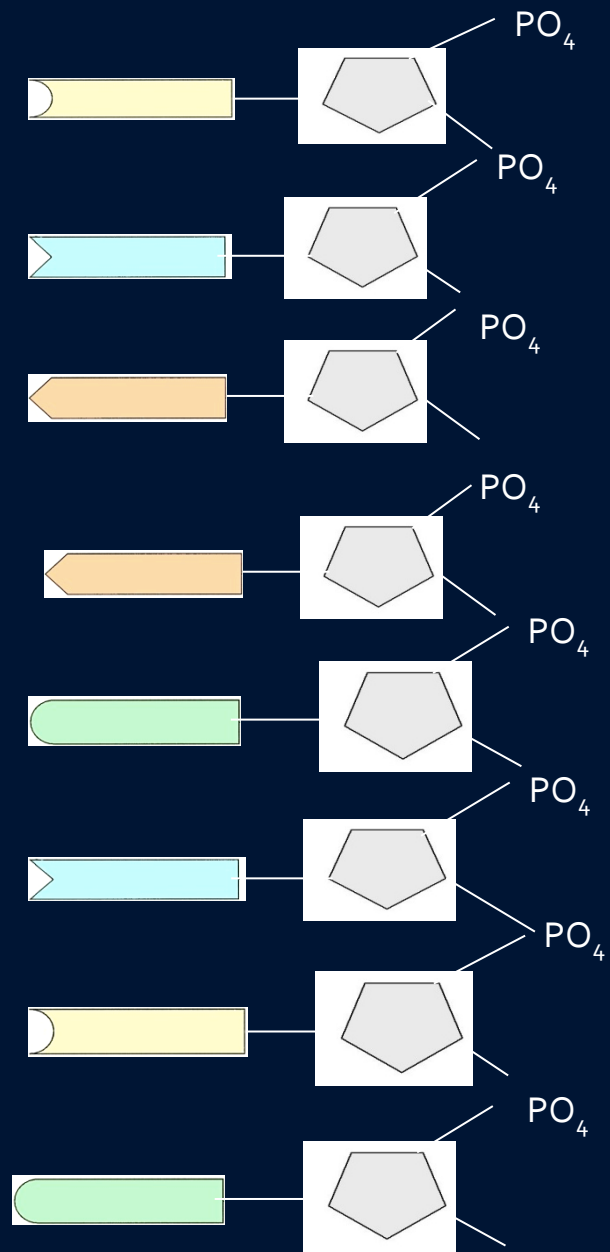
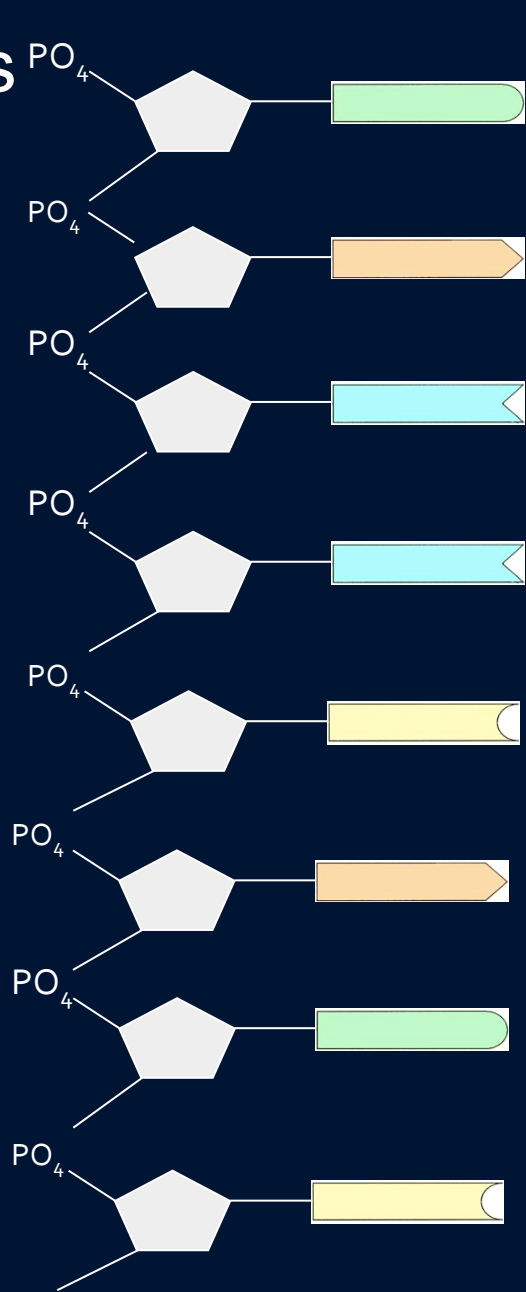
Each strand makes a new partner by adding the appropriate nucleotides

The result is that there are now two double-stranded DNA molecules in the nucleus

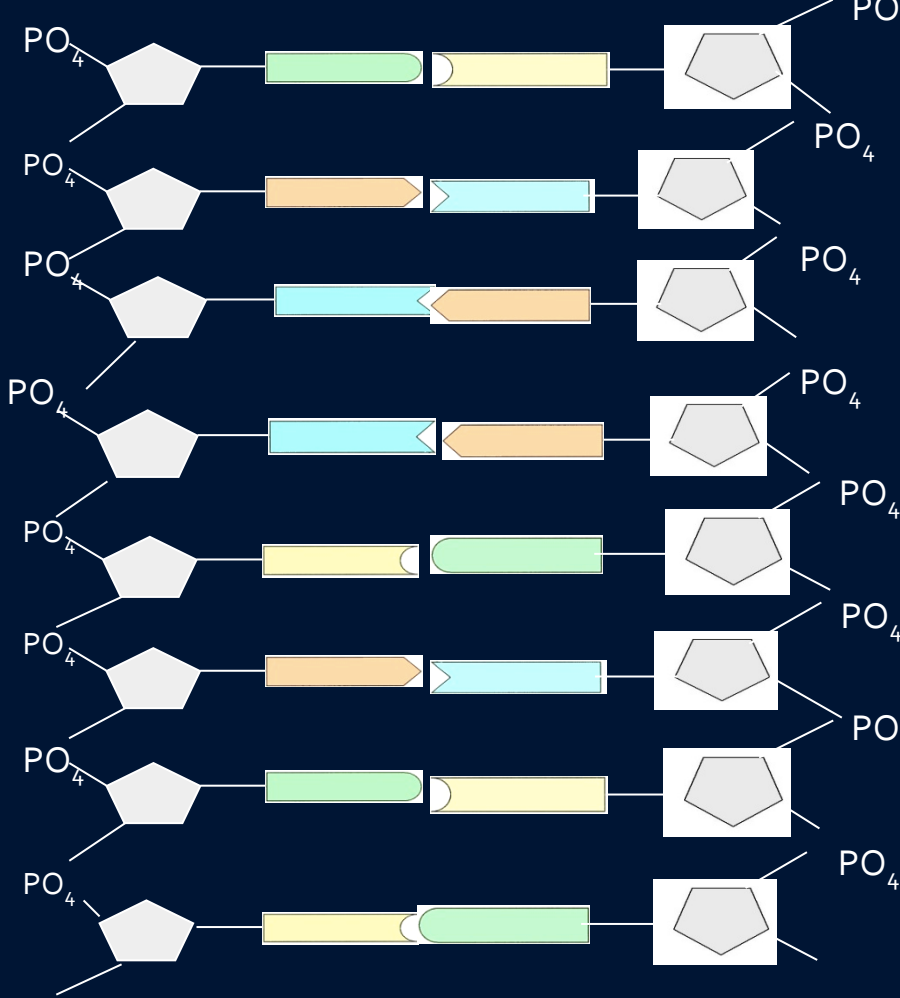
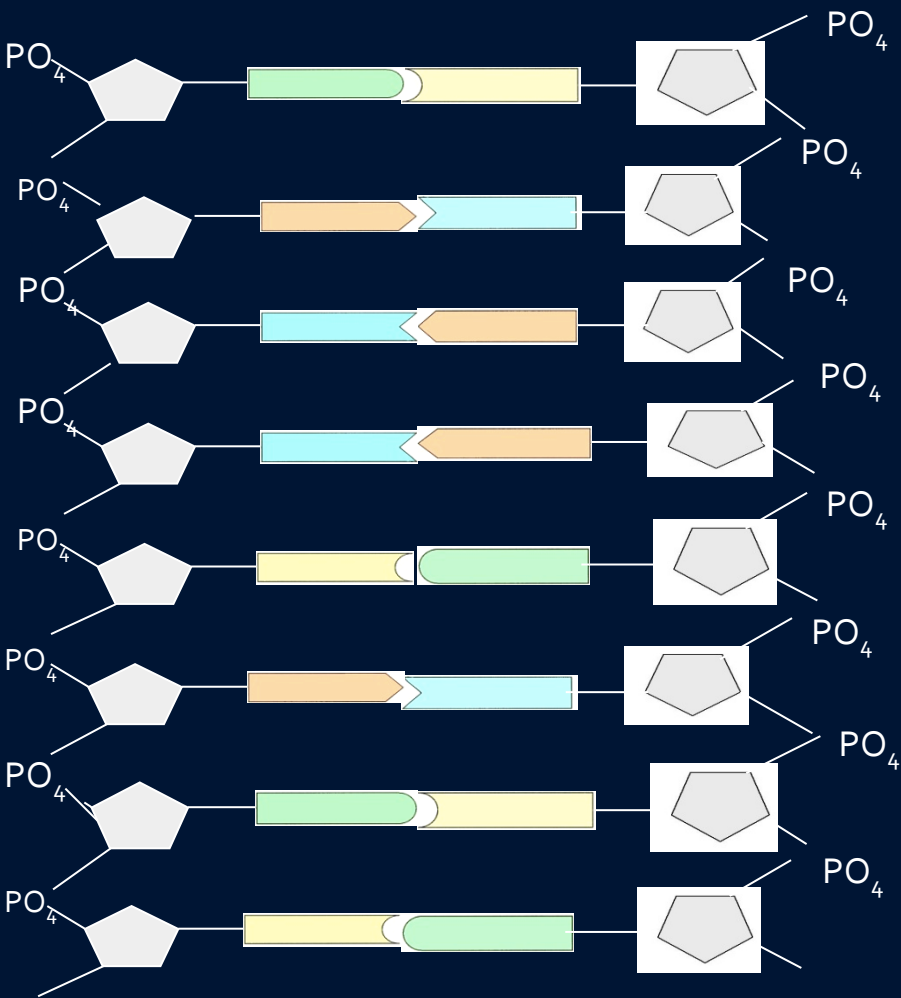
So that when the cell divides, each nucleus contains identical DNA

This process is called **replication**

The strands separate

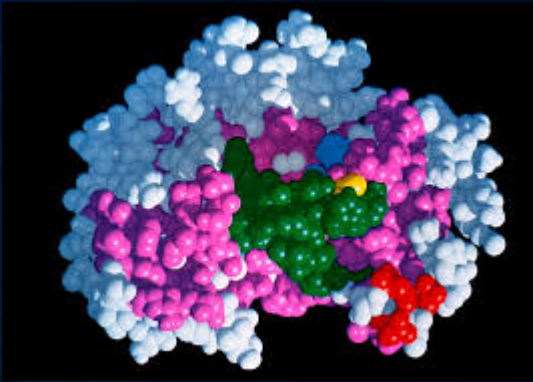


Each strand builds up its partner by adding the appropriate nucleotides



TO REMEMBER

DNA POLYMERASE



**ASSEMBLES NEW DNA
DURING REPLICATION**



Genetic code 1

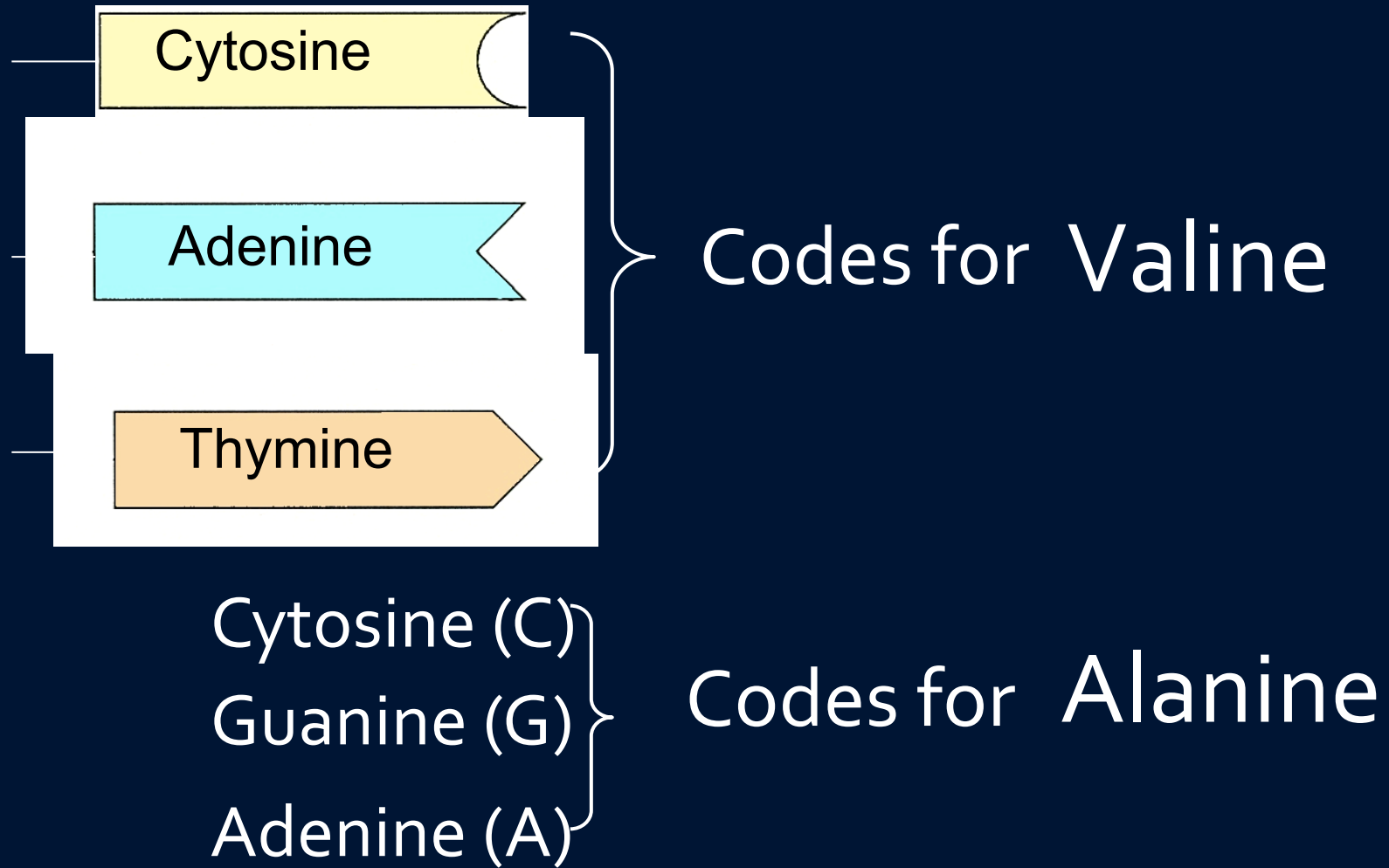
The sequence of bases in DNA forms the
Genetic Code

A group of three bases (**a triplet**) controls the production of a particular amino acid in the cytoplasm of the cell

The different amino acids and the order in which they are joined up determines the sort of protein being produced

Coding

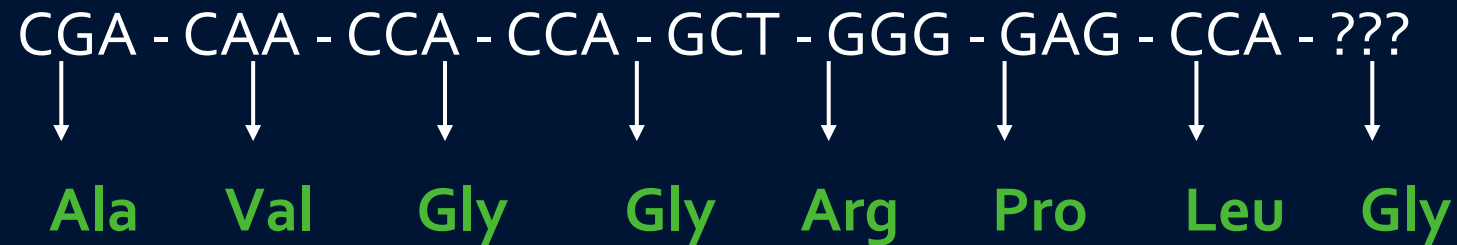
For example



Triplet code

This is known as the **triplet code**

Each triplet codes for a specific amino acid



The amino acids are joined together in the correct sequence to make part of a protein



A large, textured, reddish-pink sphere is centered on a blue gradient background. The sphere has a fine, granular texture and a slight shadow on its right side, giving it a three-dimensional appearance. The background transitions from a darker blue at the top to a lighter blue at the bottom.

DNA to Protein

DNA and enzymes

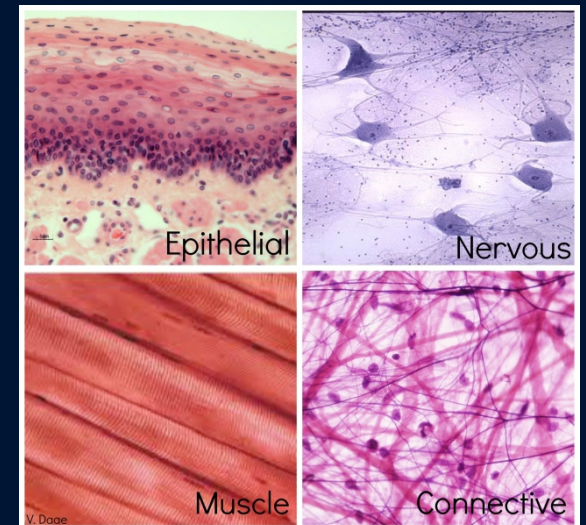
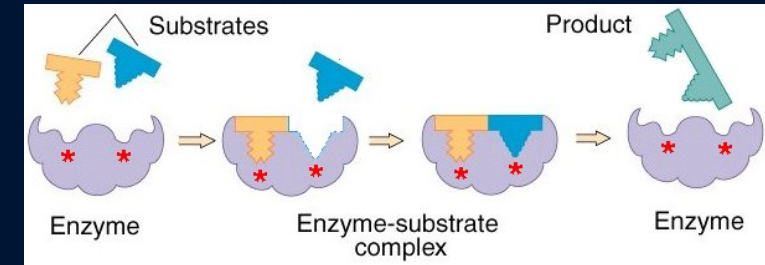
The proteins build the cell structures

They also make enzymes

The DNA controls which enzymes are made and the enzymes determine what reactions take place

The structures and reactions in the cell determine what sort of a cell it is and what its function is

So DNA exerts its control through the enzymes

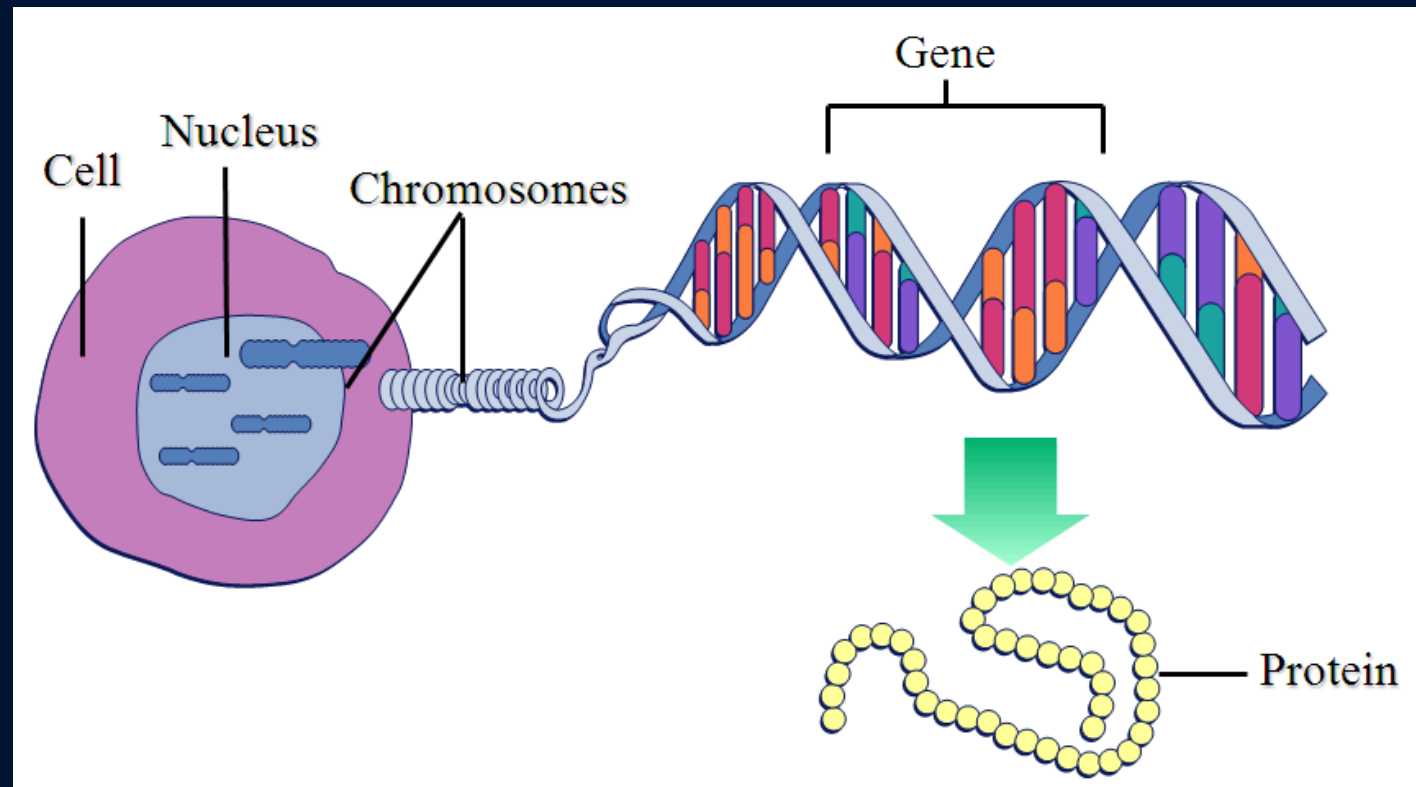


Genes

A sequence of triplets in the DNA molecule may code for a complete protein

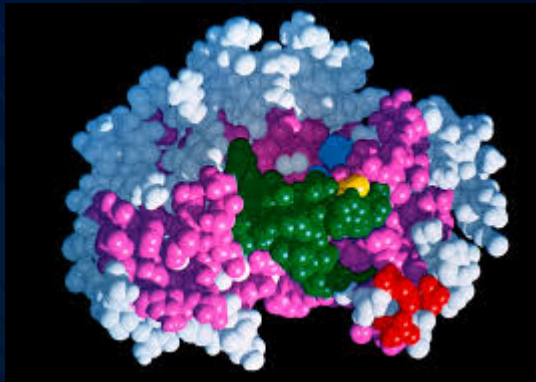
There may be a thousand or more bases in one gene

Such a sequence forms a **gene**



TO REMEMBER

RNA POLYMERASE



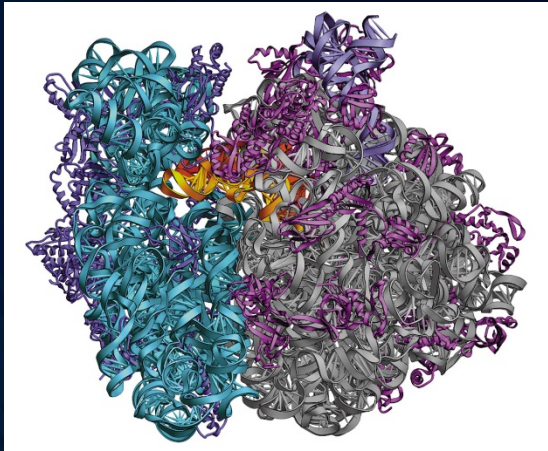
**ASSEMBLES RNA STRAND
CARRYING INFO FOR
PROTEIN SYNTHESIS**

Copies a single page
from the recipe book



TO REMEMBER

RIBOSOME



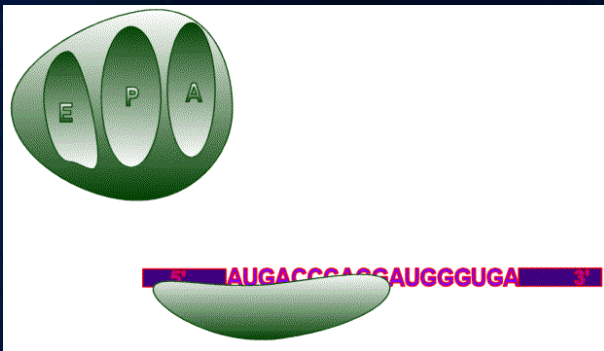
**MACHINERY THAT
TRANSLATES RNA
STRAND TO PROTEIN**

A protein making factory that follows the instructions it reads



TO REMEMBER

RIBOSOME BINDING SITE



**A SEQUENCE ON THE RNA STRAND
WHERE THE RIBOSOME ATTACHES TO
START TRANSLATING CODE INTO PROTEIN**

REVIEW

DNA POLYMERASE

RNA POLYMERASE

RIBOSOME

RIBOSOME BINDING SITE