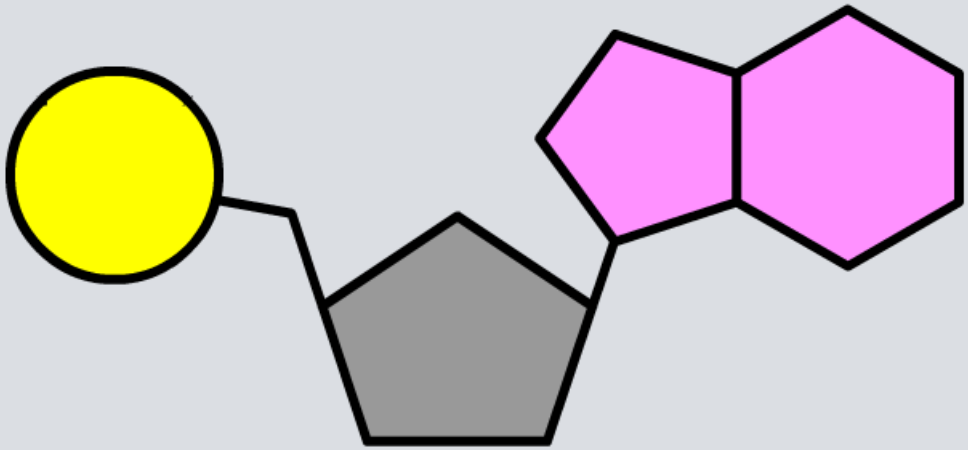
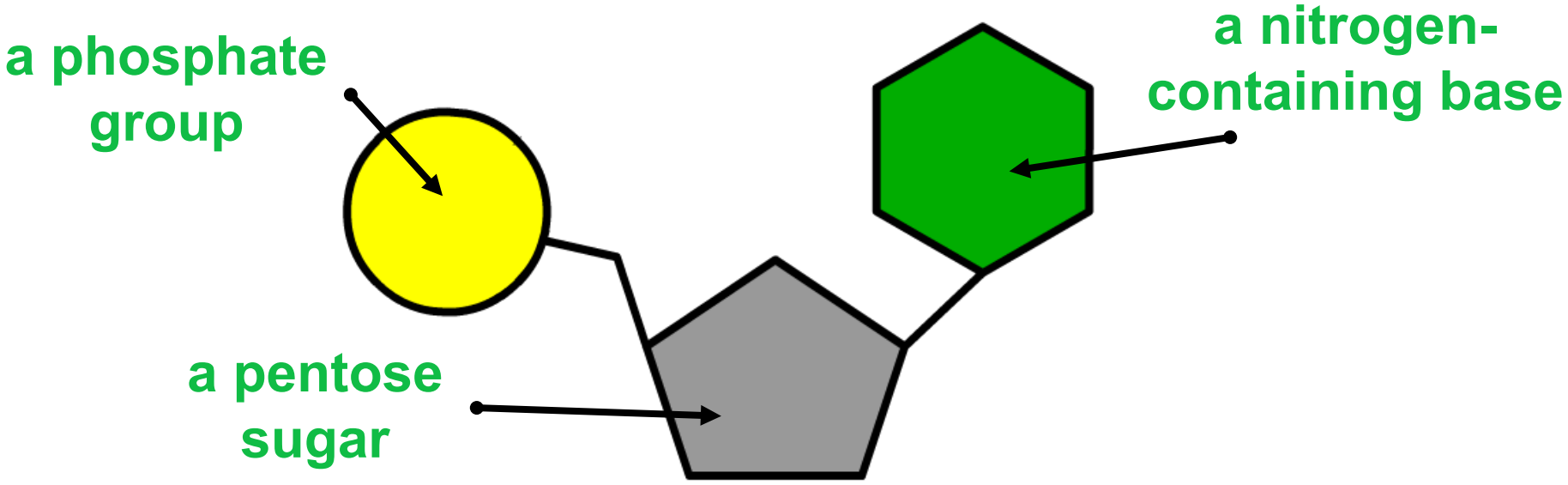
Nucleic Acids



Introduction to nucleotides

Nucleotides are nitrogen-containing organic substances that form the basis of the **nucleic acids DNA** and **RNA**.

All nucleotides contain the following three groups:

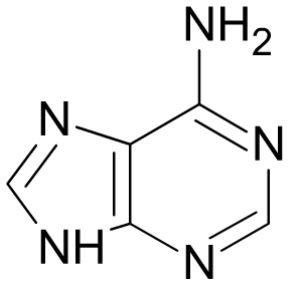


In DNA the sugar is **deoxyribose**, whereas in RNA the sugar is **ribose**.

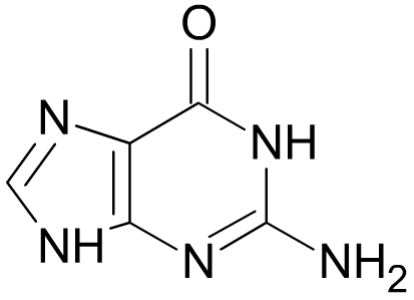
Bases

There are five bases, split into two types:

- **adenine (A)** and **guanine (G)** are **purine** bases.

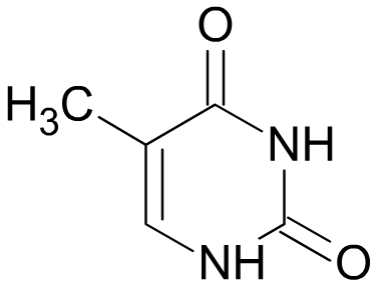


A

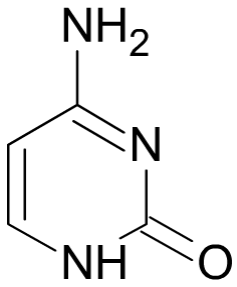


G

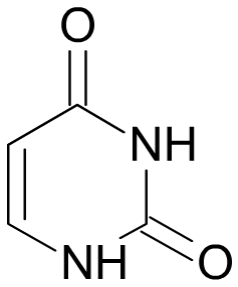
- **thymine (T)**, **cytosine (C)** and **uracil (U)** are **pyrimidine** bases.



T



C

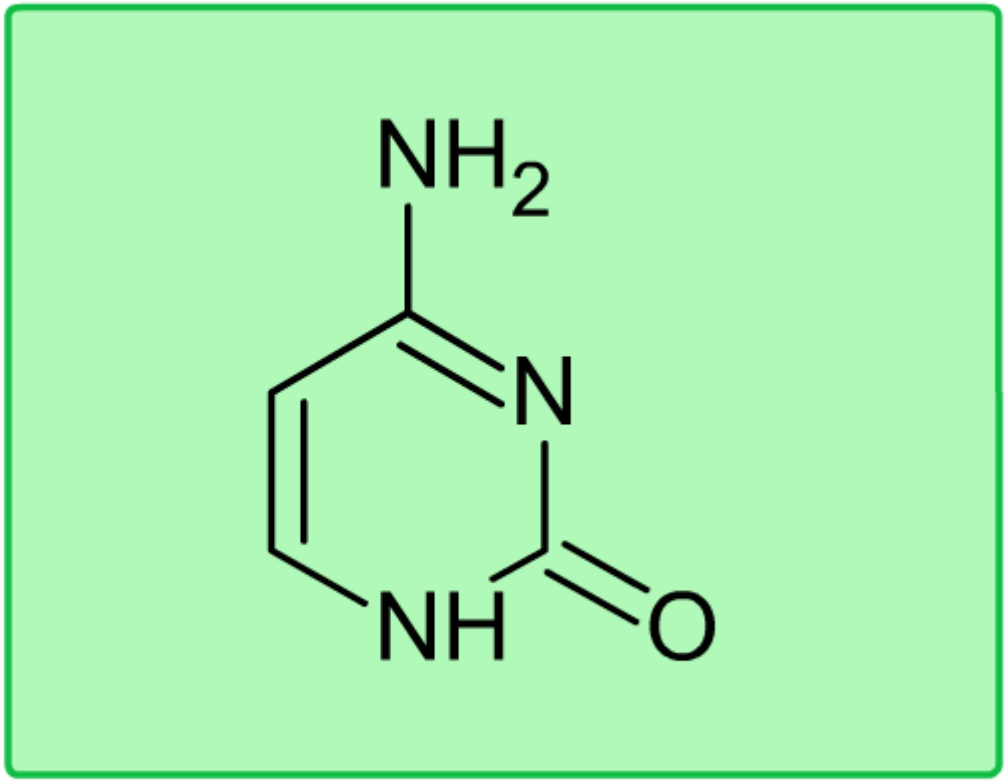


U

DNA contains A, G, T and C, whereas RNA contains A, G, U and C.

Identifying bases

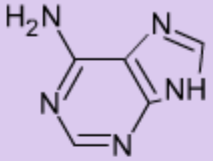
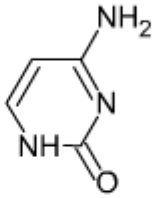
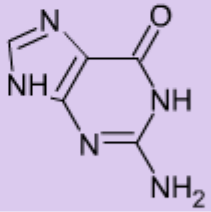
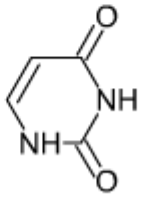
What are these bases?



- adenine
- cytosine
- guanine
- thymine
- uracil

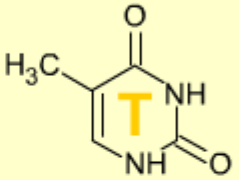
Base pairing rules

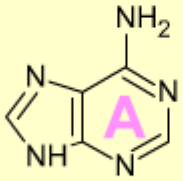
How do bases pair up in nucleic acids?

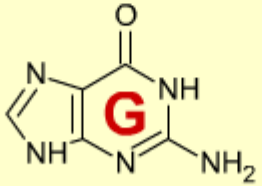
base pair 1	?	
base pair 2		?
base pair 3		?
base pair 4		?

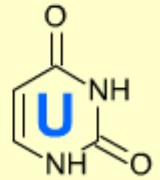
nucleic acid = RNA

Base bank









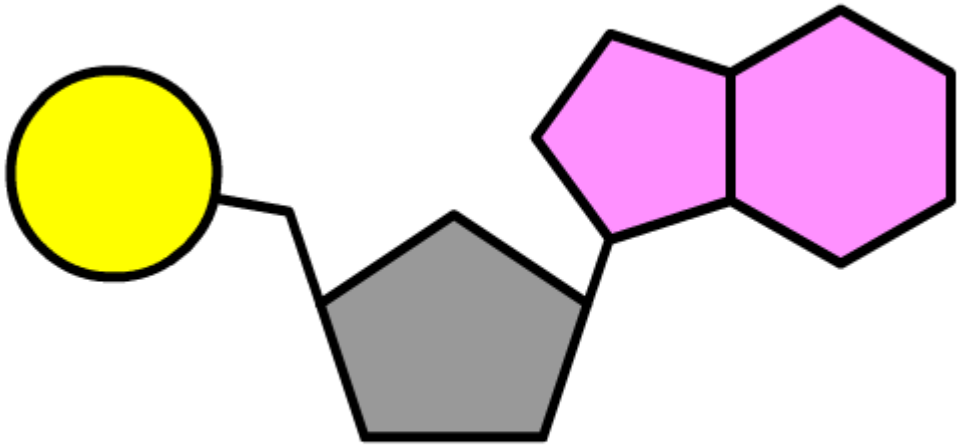
hide C S

Formation of nucleotides

How are nucleotides formed?

Nucleotides contain a **nitrogen-containing base**, a **pentose sugar** and a **phosphate group**.

Click "**play**" or the nucleotide to find out more about each of these parts.

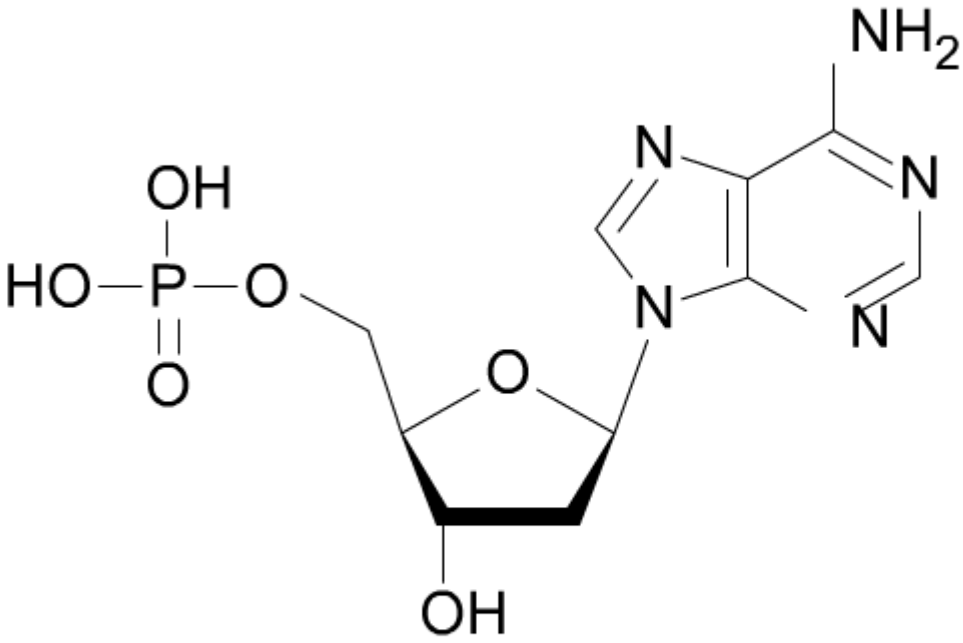


Formation of polynucleotides

How are polynucleotides formed?

Nucleotides can polymerize, forming polymers called **polynucleotides**. These form the basis of the nucleic acids DNA and RNA.

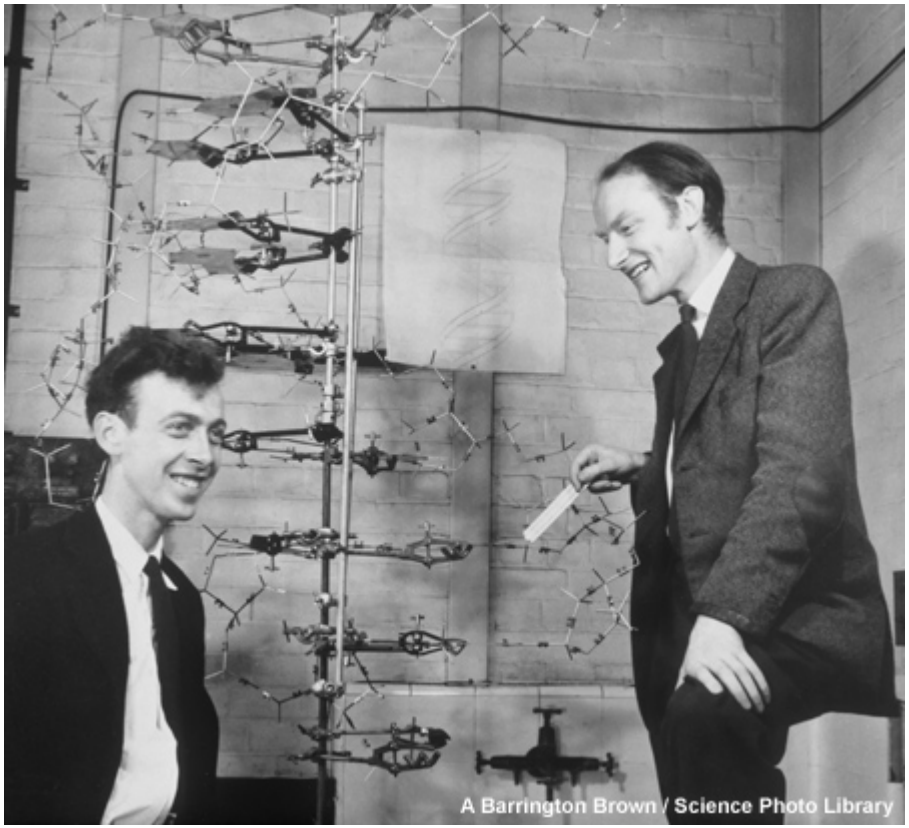
Click "**play**" or the nucleotide to find out how.



Determining the structure of DNA

The double-stranded structure of DNA was determined in 1953 by the American biologist James Watson and the British physicist Francis Crick.

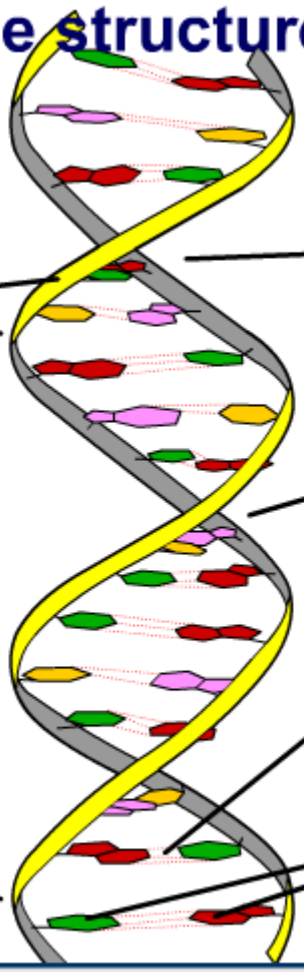
X-ray diffraction studies by British biophysicist Rosalind Franklin strongly suggested that DNA was a helical structure.



The Austrian chemist Erwin Chargraff had earlier showed that DNA contained a 1:1 ratio of pyrimidine:purine bases.

Structure of DNA

What is the structure of DNA?



A

B

C

D

E

F

G

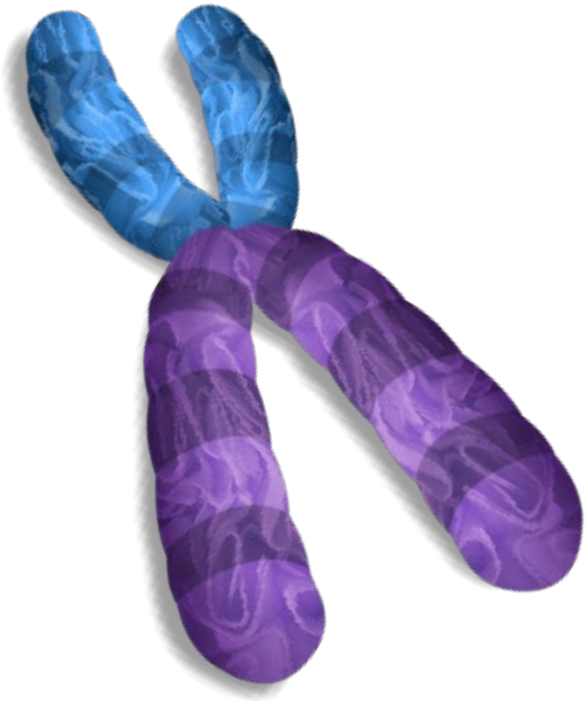
one complete turn =
10 base pairs / 3.4nm

uncoiled

How is DNA packaged?

In eukaryotic cells, DNA is packaged as **chromosomes** in the nucleus.

There is around 2 m of DNA in a cell, so to fit it needs to be tightly coiled and folded.

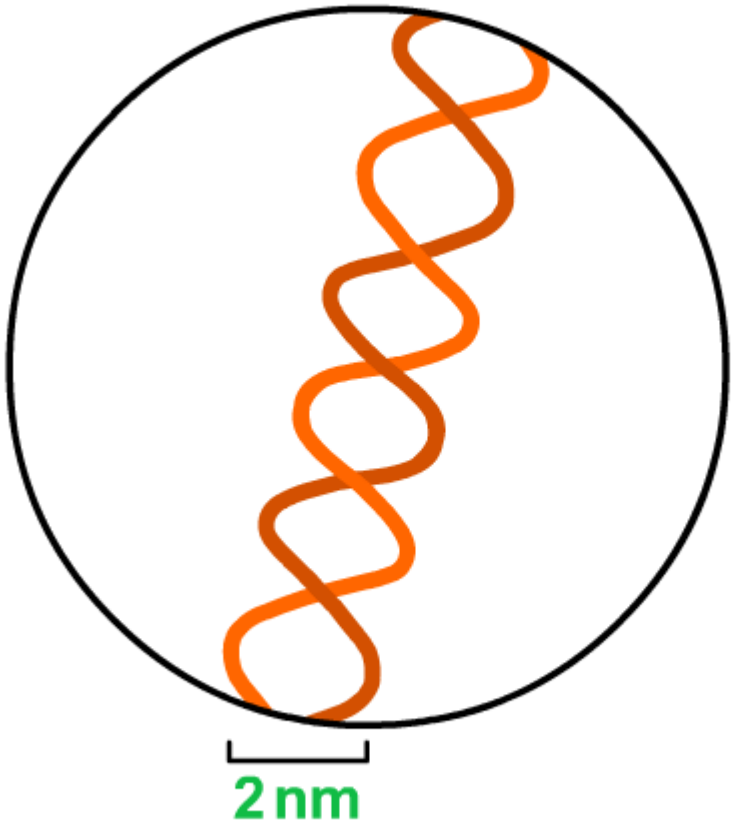


Eukaryotic DNA is associated with proteins called **histones**. Together, these form **chromatin** – the substance from which chromosomes are made.

In prokaryotic cells, DNA is loose in the cytoplasm – there are no histones or chromosomes.

Structure of eukaryotic chromosomes

How is DNA packaged in eukaryotic chromosomes?



The length of the DNA molecule in an average human chromosome is about 4.8 cm long.

How is it packaged to fit into the nucleus of a cell?

DNA double helix

nucleosome fibre

solenoid fibre

folded/coiled solenoid fibre

supercoiling

chromosome