

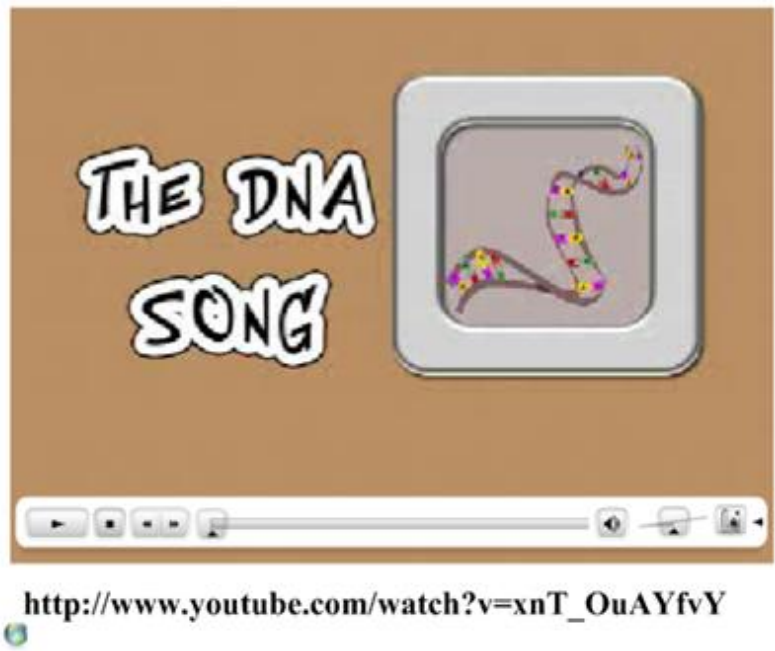
DNA Structure

(Core 3.3 & AHL 7.1)

Stephen Taylor

Bandung International School

Hip-hip hooray for DNA!



DNA!

DNA- deoxyribonucleic acid:
the recipe book for all the functions
in a living organism - the code for life

How was the structure of DNA discovered?



How is the discovery of DNA an
example of:
- cooperation?
- competition?
- internationalism?

<http://www.youtube.com/watch?v=sf0YXnAFBs8>

Some key points about the structure of DNA:



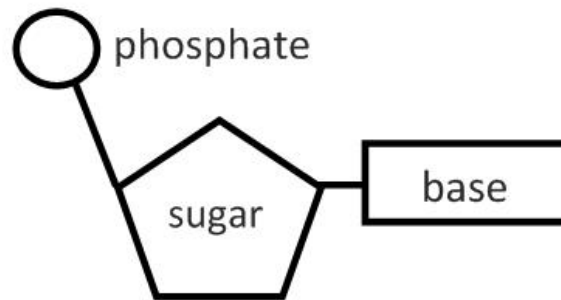
DNA is a **double-helix**: it has **two strands** that **twist around each other**.

Each strand is made of **single units called nucleotides**.

It has a **sugar-phosphate backbone**.

Bases join the two strands by hydrogen bonds. These bases are **cytosine**, **guanine**, **adenine** and **thymine**.

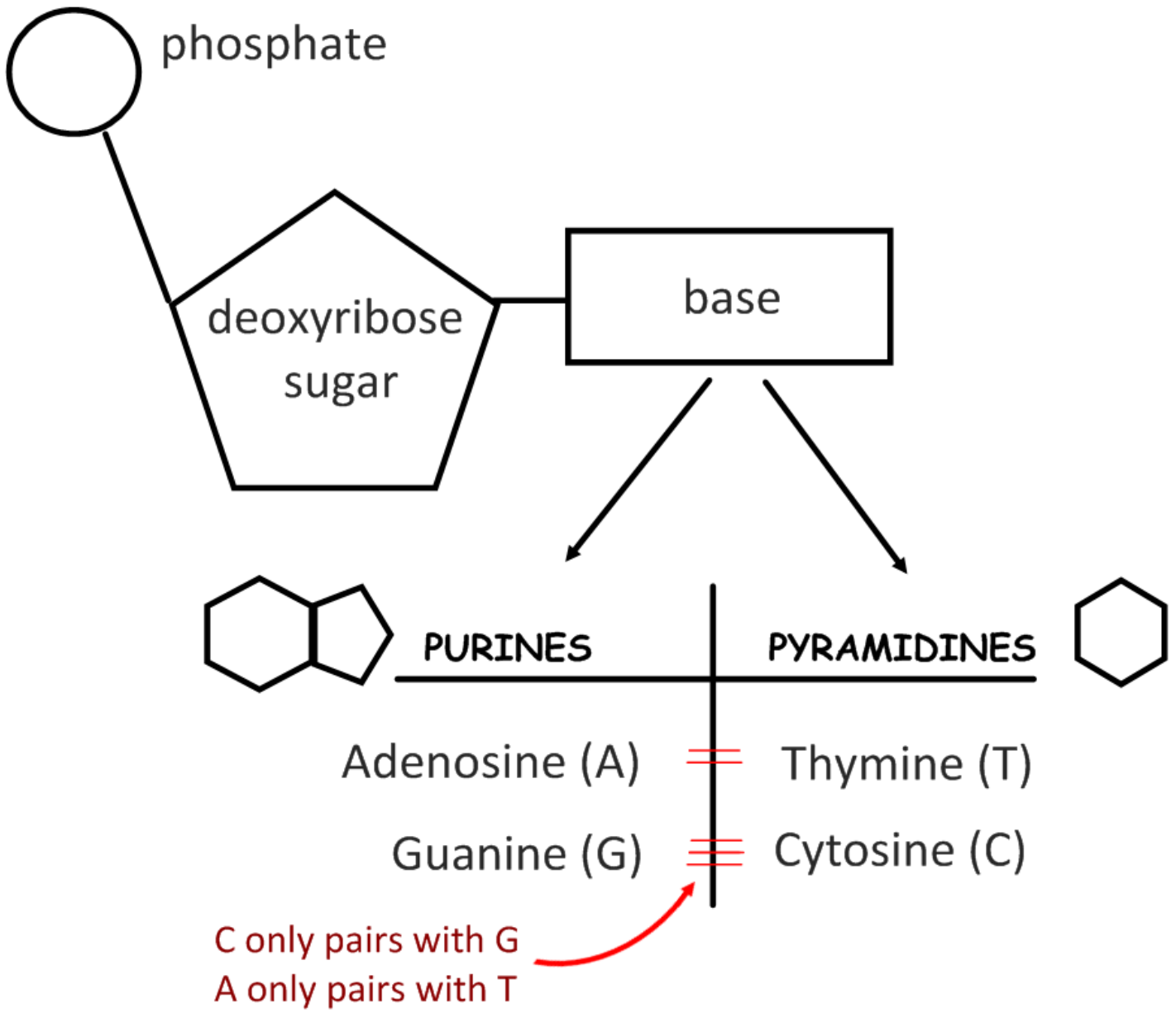
A nucleotide:



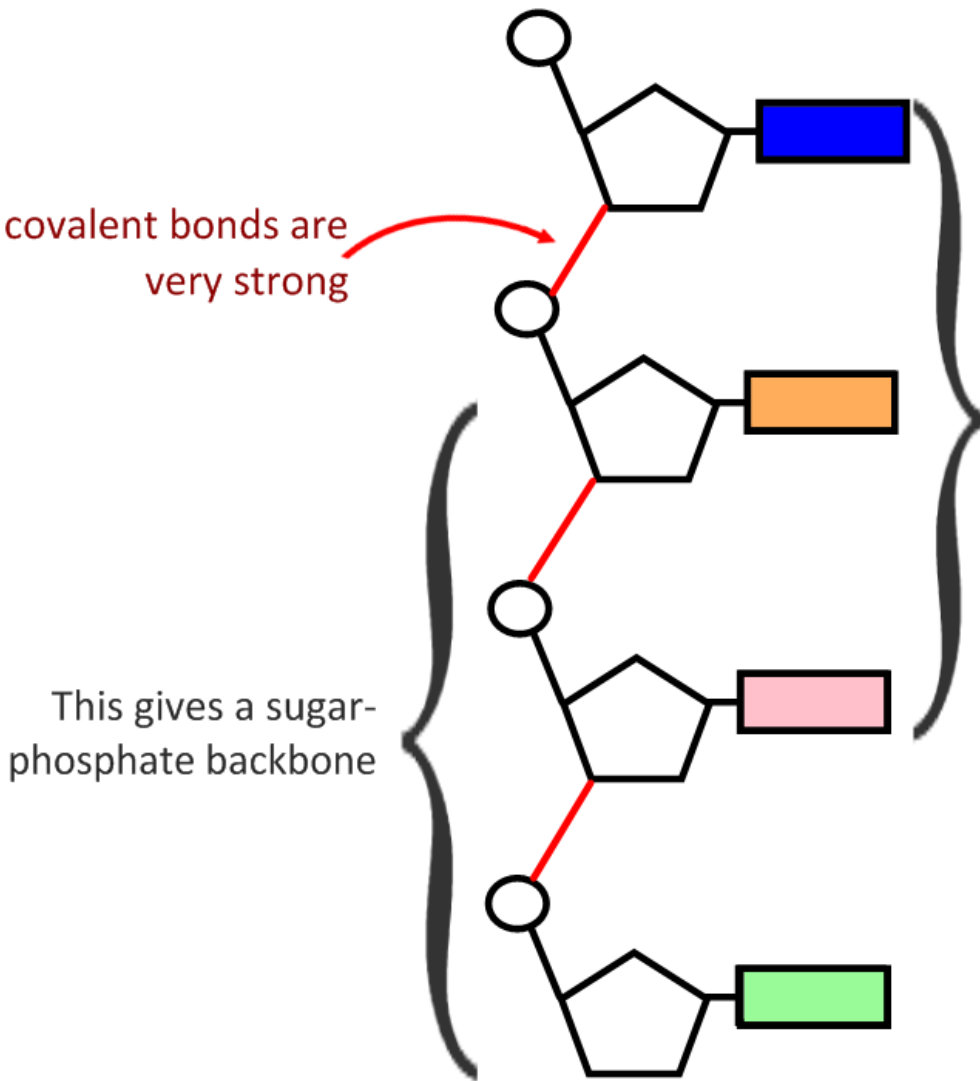
Complementary base pairing is a key idea in genetics: **C pairs with G**, **T with A**.

Each strand of DNA can be **millions of base-pairs** in length and is coiled up to make **chromosomes**.

A nucleotide: the single unit in DNA



A strand of nucleotides is joined by covalent bonds

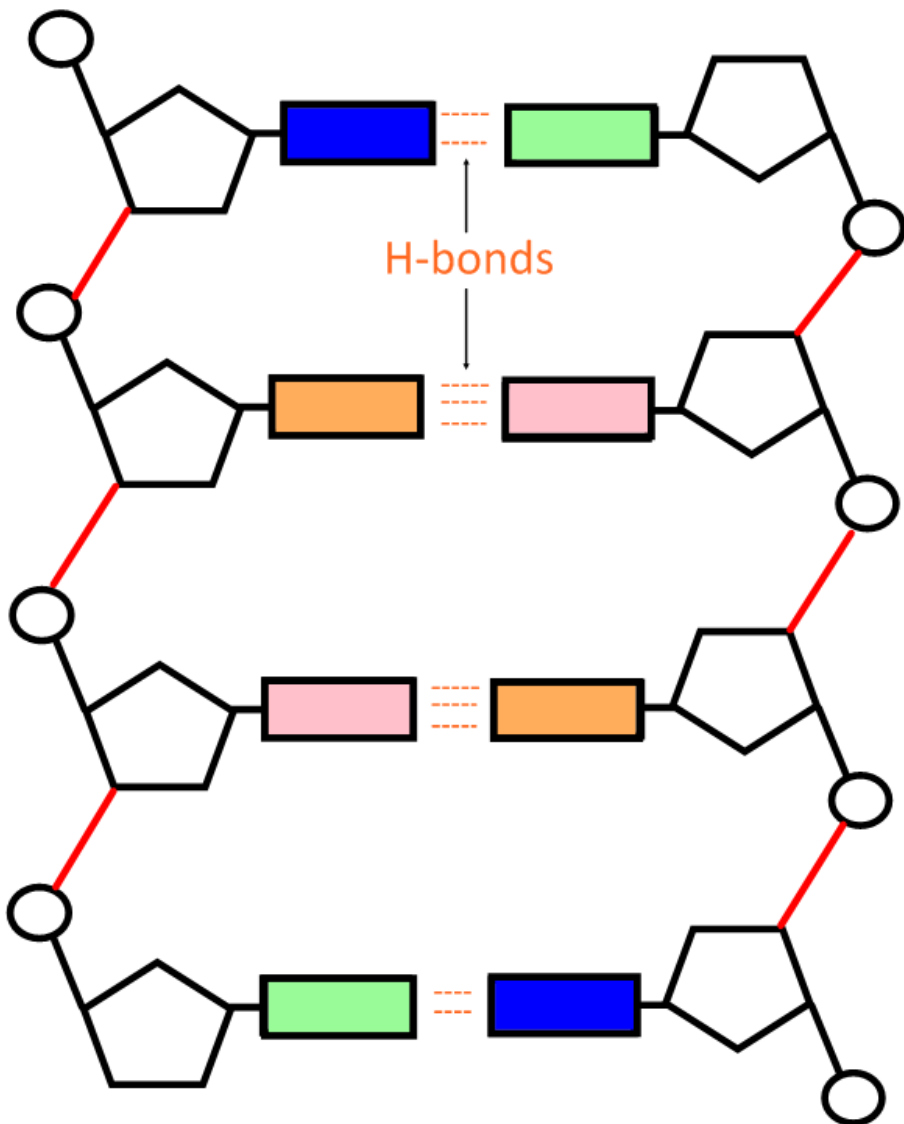


The sequence of bases makes up the **genetic code**.

The bases are 'read' in groups of three.

These **triplets** are used to send instructions in the cell: to **switch genes on and off**, to **make proteins** and **enzymes**.

DNA is a double strand of polynucleotides.

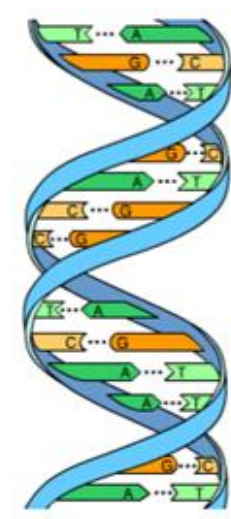


The sugar-phosphate backbone is on the outside, the bases are on the inside.

The strand is held together by hydrogen bonds between the bases.

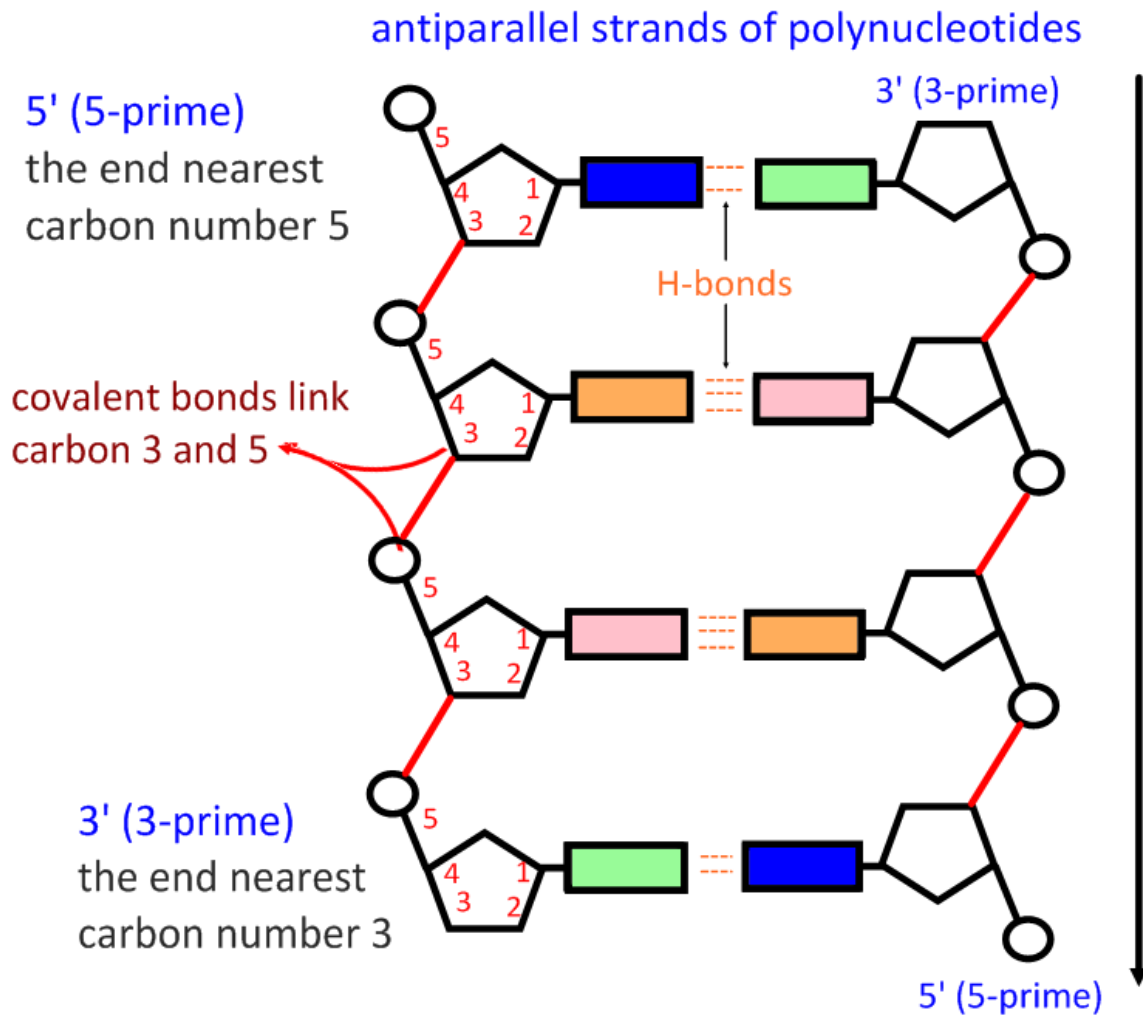
A only pairs with T. G only pairs with C. This is called complementary base pairing.

The two strands run in opposite directions. This is called anti-parallel.

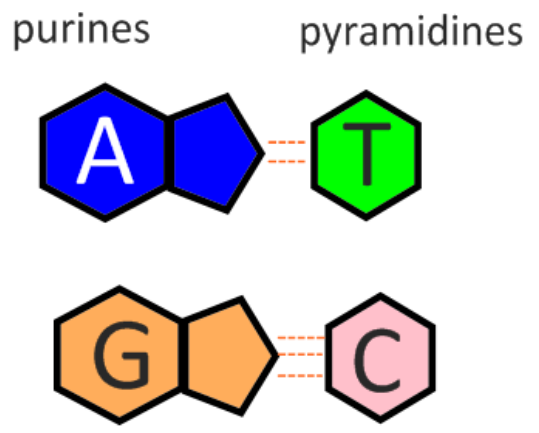


DNA twists into a double-helix, held by more hydrogen bonds.

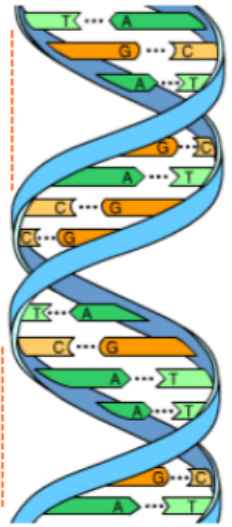
DNA structure is more complex for HL students:



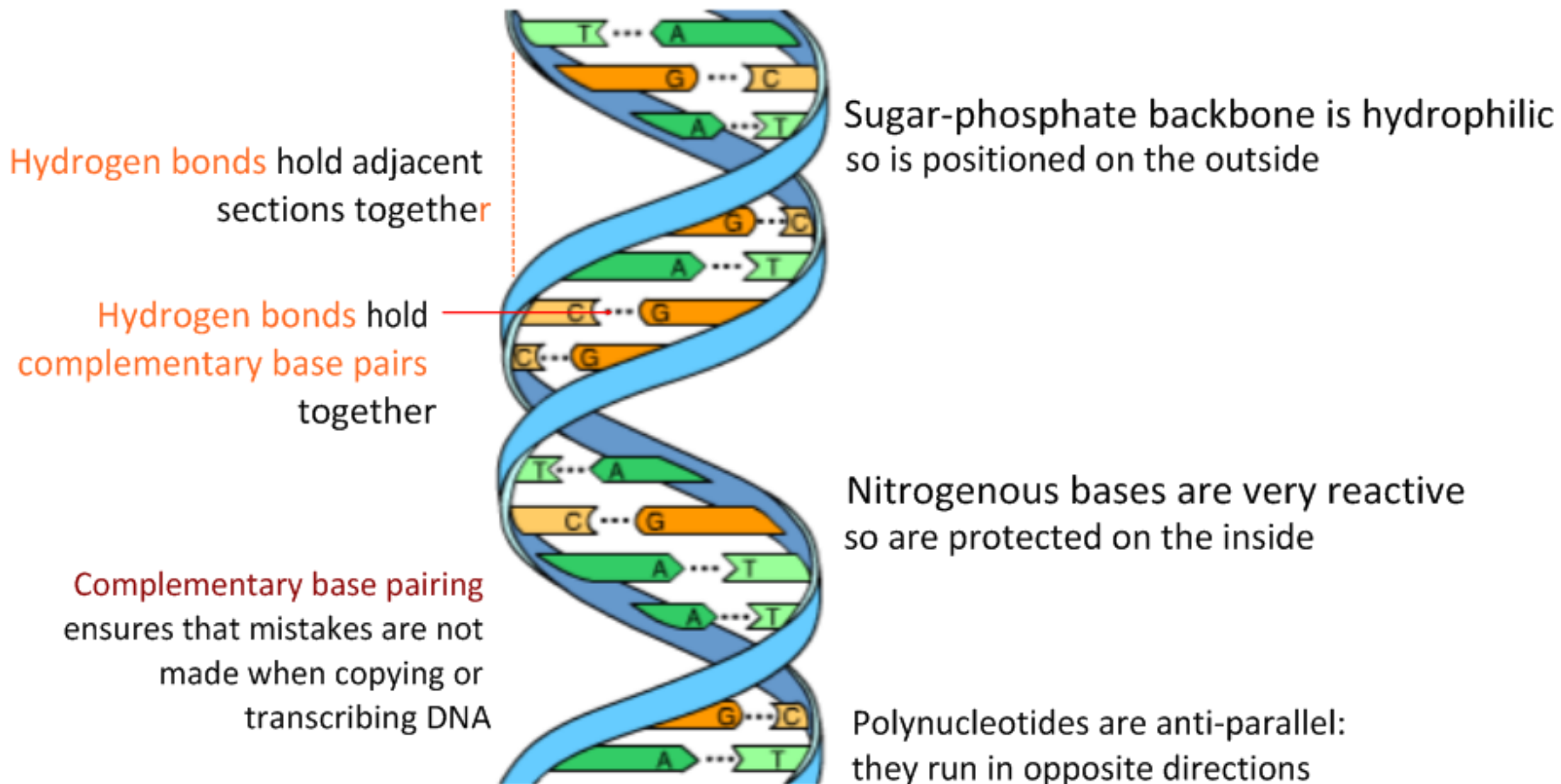
A purine must base-pair with a pyrimidine:



Hydrogen bonds also hold the structure of the double helix



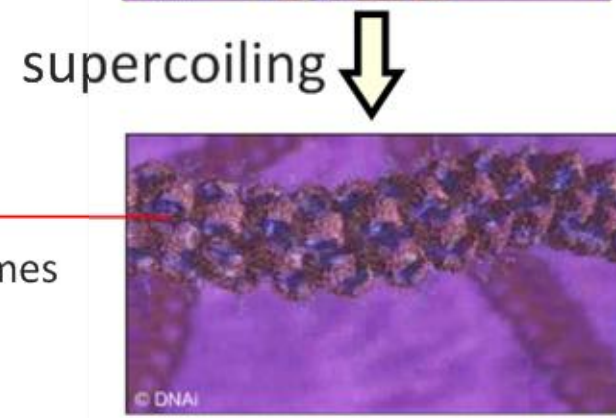
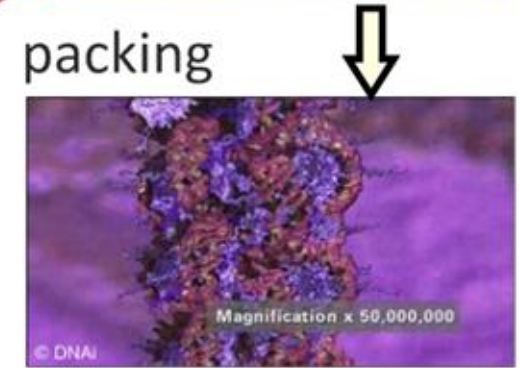
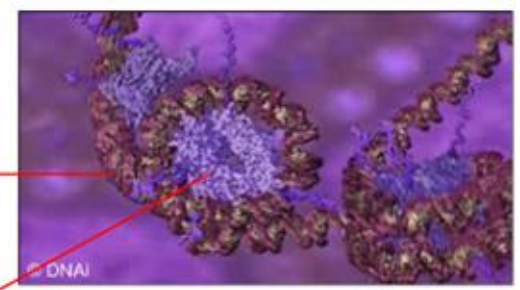
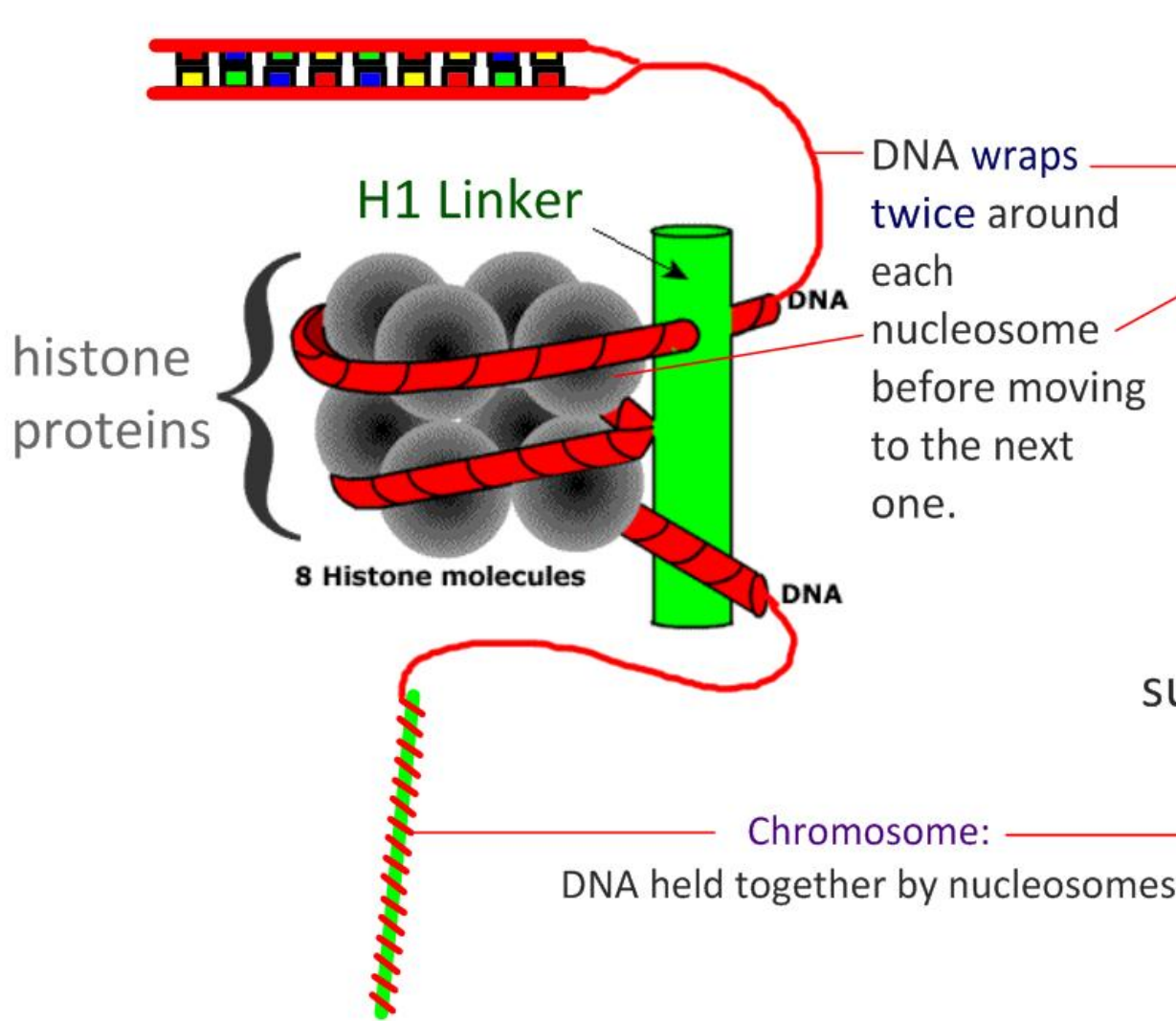
How is the double helix structure maintained?



<http://science.nhmccd.edu/biol/bio1int.htm#dna>

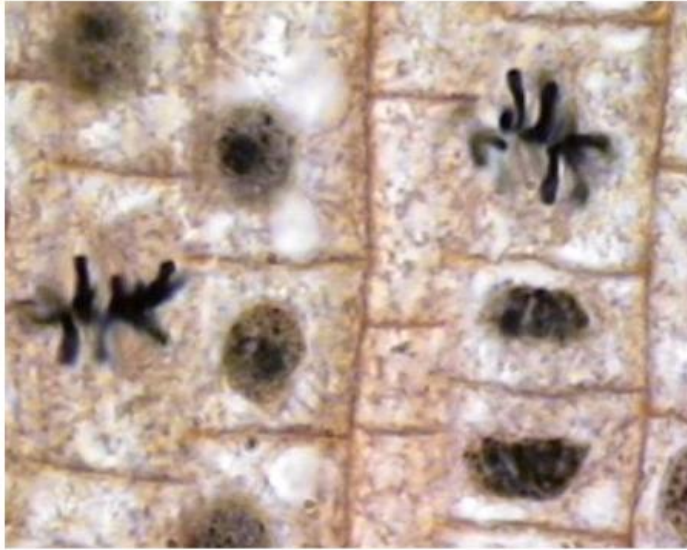


Nucleosomes hold the DNA together to form the 'frame' of chromosomes:



<http://www.dnai.org/text/mediashowcase/index2.html?id=564>

Histone proteins allow the DNA to be **SUPERCOILED**



15,000 x more dense, so takes up less space in the nucleus

Supercoiled sections of genes **cannot be expressed** (cannot be opened up for transcription)

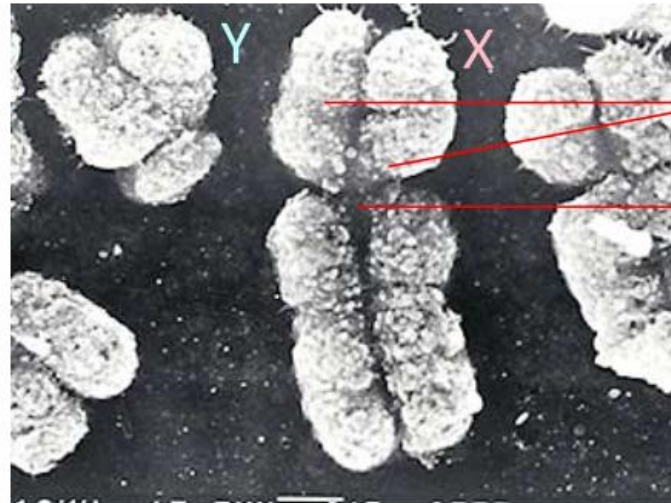
Supercoiling allows control over which genes are expressed: to express a gene, the region of the chromosome must be uncoiled.

Which phases of mitosis do you recognise in this slide? It is easy to see them, because the DNA has been supercoiled to make division easier

<http://www.lima.ohio-state.edu/biology/images/metaphase.jpg>

This SEM image shows supercoiled X and Y chromosomes in metaphase.

The sister chromatids have not separated yet. There is about 2m of DNA coiled up in there!

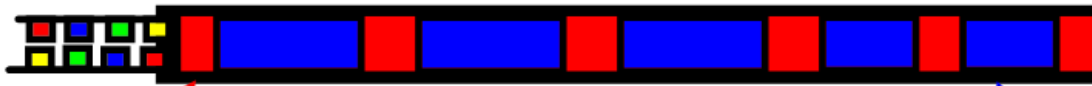


sister chromatids

centromere

<http://www.indigo.com/software/gphpcd/em24.jpg>

Nuclear DNA contains *single-copy genes* and regions of *highly repetitive sequences*.



Single Copy Genes

1.5% of genome makes polypeptides

3% codes for 'on/off' gene switches

Contains **EXONS**
(coding regions)

and **INTRONS**
(non-coding regions which are edited out)

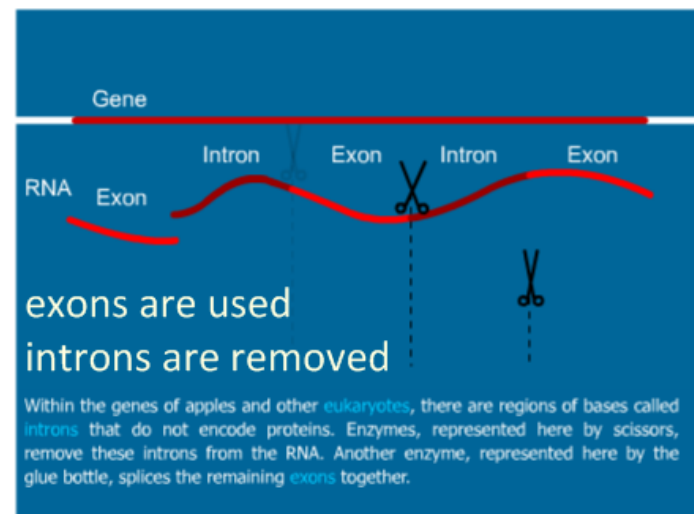
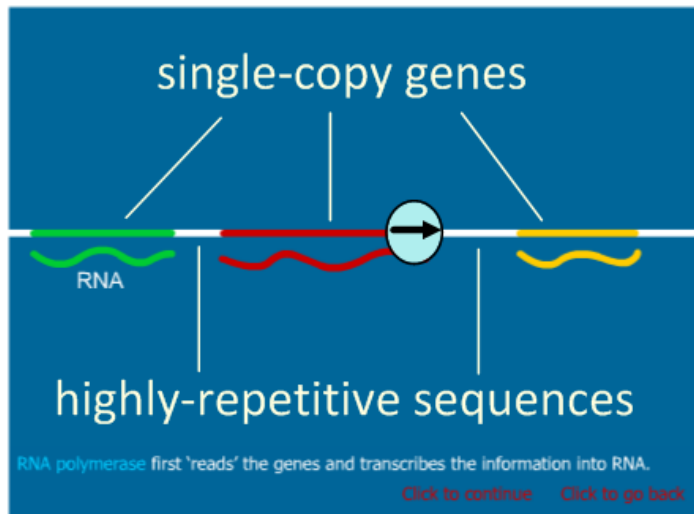
Highly Repetitive Sequences

Makes up about 5-45% of the genome

Once called 'junk' DNA

Also known as satellite DNA, each repeated sequence can be 5-300 base pairs.

HRSs are used in genetic fingerprinting



http://www.four-h.purdue.edu/apple_genomics/flash/movie3.swf

More DNA resources:

DNA Anatomy

● carbon ● oxygen ○ hydrogen ● nitrogen ● phosphorus

DNA (deoxyribonucleic acid) forms long chains of genetic material organized into chromosomes.

Each chromosome contains a single long molecule of DNA.

The linear structure of DNA occurs when deoxyribose, the sugar in DNA, bonds with phosphate at both its 3' and 5' (three prime and five prime) carbons.

deoxyribose 2' phosphate

cellular helix

deoxyribose 3' phosphate

Click to continue. click down on carbon 3 click down + drag out + click next click on oxygen + go

navigation view of deoxyribose 3' phosphate Read help with 3D? [Load here](#)

<http://www.johnkyrk.com/DNAanatomy.html>

Match the pairs (Nobel Prize):

DNA THE DOUBLE HELIX

QUESTION CLICK & DRAG

QUESTION

QUESTION

ANSWER

PURE D

PURE D50M5

PURE P50D

PURE D

http://nobelprize.org/educational_games/medicine/dna_double_helix/readmore.html

Tour of the Basics What is DNA?

WHAT IS DNA?

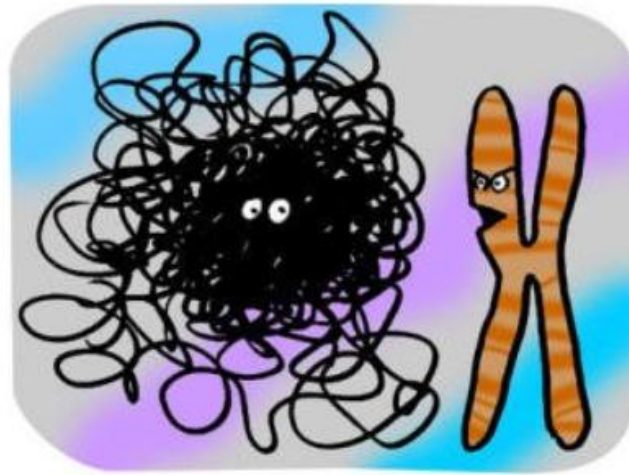
Let's examine a group of cells in your inner ear. They help support the function of hearing.

How do these cells "know" that their role is to support hearing instead of something else, like making your heart beat?

Previous Next

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<http://learn.genetics.utah.edu/content/begin/tour/>



Dude, mitosis starts in five minutes...
I can't believe you're not condensed yet.

For more IB Biology resources:
<http://sciencevideos.wordpress.com>