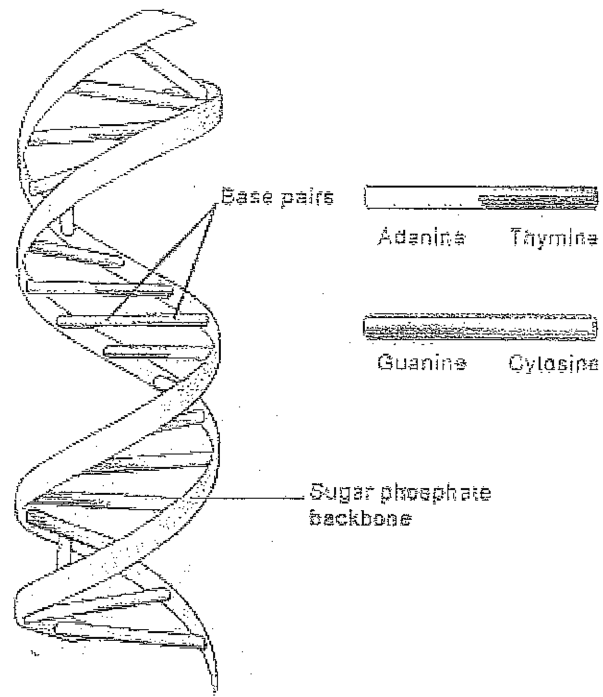
READ ME !!!!

## A quick look at the whole structure of DNA

These days, most people know about DNA as a complex molecule which carries the genetic code. Most will also have heard of the famous double helix.

I'm going to start with a diagram of the whole structure, and then take it apart to see how it all fits together. The diagram shows a tiny bit of a DNA double helix.

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**Note:** This diagram comes from the US National Library of Medicine. You can see it in its original context by following this link if you are interested.

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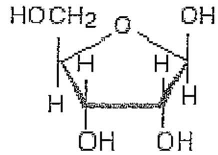
## Exploring a DNA chain

### The sugars in the backbone

The backbone of DNA is based on a repeated pattern of a sugar group and a phosphate group. The full name of DNA, deoxyribonucleic acid, gives you the name of the sugar present - deoxyribose.

Deoxyribose is a modified form of another sugar called ribose. I'm going to give you the structure of that first, because you will need it later anyway. Ribose is the sugar in the backbone of RNA, ribonucleic acid.

RIBOSE

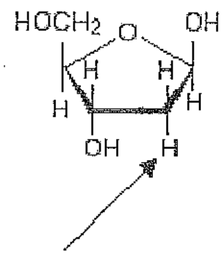



This diagram misses out the carbon atoms in the ring for clarity. Each of the four corners where there isn't an atom shown has a carbon atom.

The heavier lines are coming out of the screen or paper towards you. In other words, you are looking at the molecule from a bit above the plane of the ring.

So that's ribose. Deoxyribose, as the name might suggest, is ribose which has lost an oxygen atom - "de-oxy".

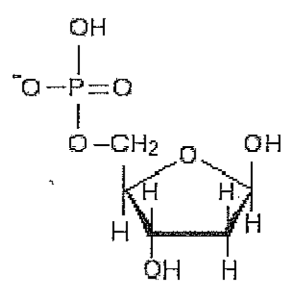
DEOXYRIBOSE




Deoxyribose has a hydrogen here rather than -OH.

### Attaching a phosphate group

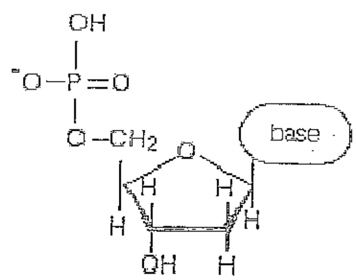
The other repeating part of the DNA backbone is a phosphate group. A phosphate group is attached to the sugar molecule in place of the -OH group on the 5' carbon.



## Attaching a base and making a *nucleotide*

The final piece that we need to add to this structure before we can build a DNA strand is one of four complicated organic bases. In DNA, these bases are *cytosine (C)*, *thymine (T)*, *adenine (A)* and *guanine (G)*.

These bases attach in place of the -OH group on the 1' carbon atom in the sugar ring.




What we have produced is known as a ***nucleotide.***

If you need these base structures in biology, they will be provided.

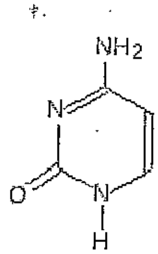
You do need to learn which two bases are:

the **purines**: adenine and guanine

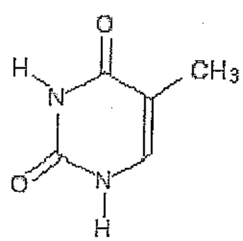
the **pyrimidines**: cytosine and thymine

IMPORTANT INFO

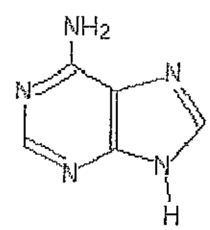
Here are their structures:



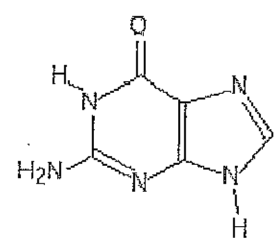
cytosine (C)



thymine (T)

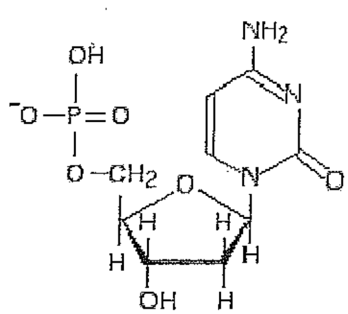


adenine (A)



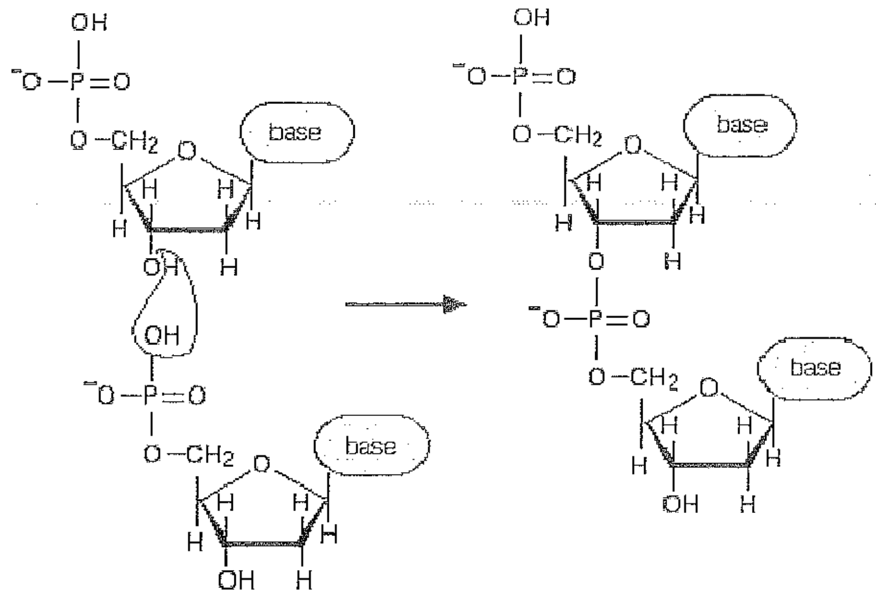
guanine (G)

For example, here is what the nucleotide containing cytosine would look like:



## Joining the nucleotides into a DNA strand

A DNA strand is simply a string of nucleotides joined together.

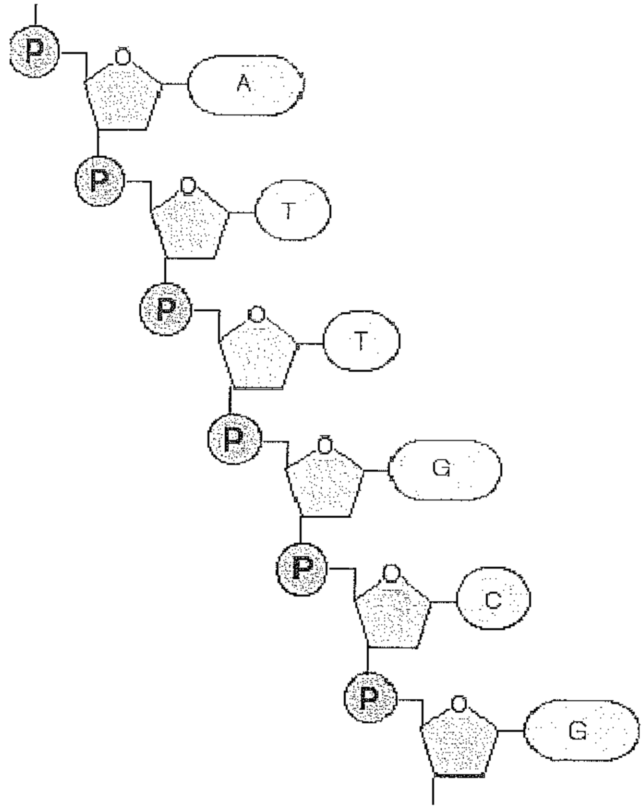



. . . and you can continue to add more nucleotides in the same way to build up the DNA chain.

Now we can simplify all this down to the bare essentials!

## Building a DNA chain concentrating on the essentials

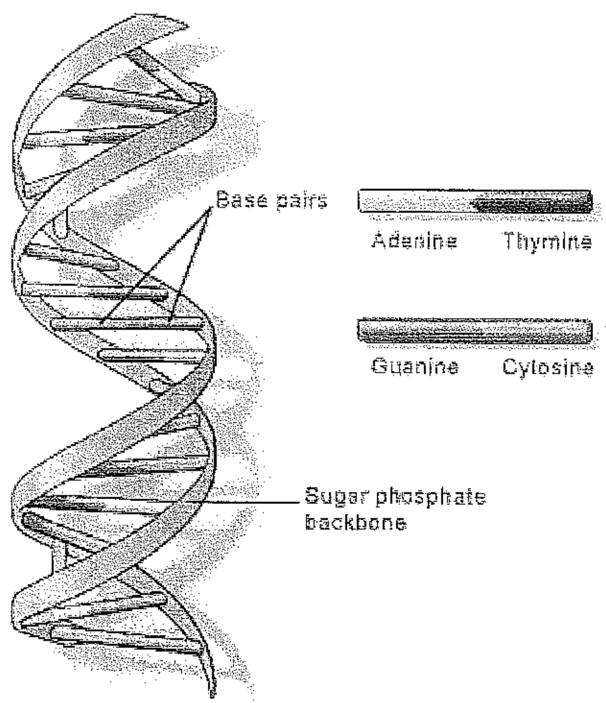
Joining up lots of these gives you a part of a DNA chain. The diagram below is a bit from the middle of a chain. Notice that the individual bases have been identified by the first letters of the base names. (A = adenine, etc). Notice also that there are two different sizes of base. Adenine and guanine are bigger because they both have two rings. Cytosine and thymine only have one ring each.




## Joining the two DNA chains together

### The importance of "base pairs"

Have another look at the diagram we started from:

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If you look at this carefully, you will see that an adenine on one chain is always paired with a thymine on the second chain. And a guanine on one chain is always paired with a cytosine on the other one.

So how exactly does this work?

The first thing to notice is that a smaller base is always paired with a bigger one. The effect of this is to keep the two chains at a fixed distance from each other all the way along.

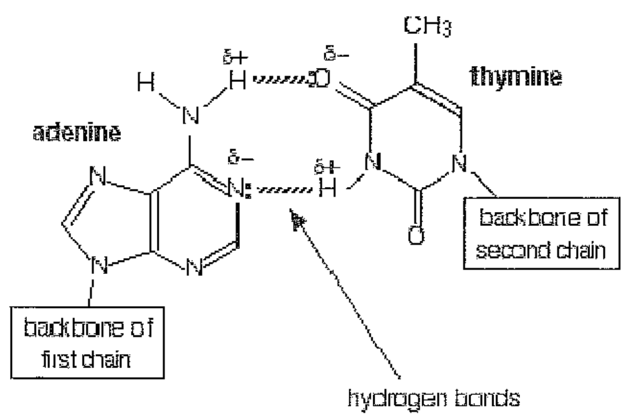
But, more than this, the pairing has to be *exactly* . . .

- adenine (A) pairs with thymine (T);
- guanine (G) pairs with cytosine (C).

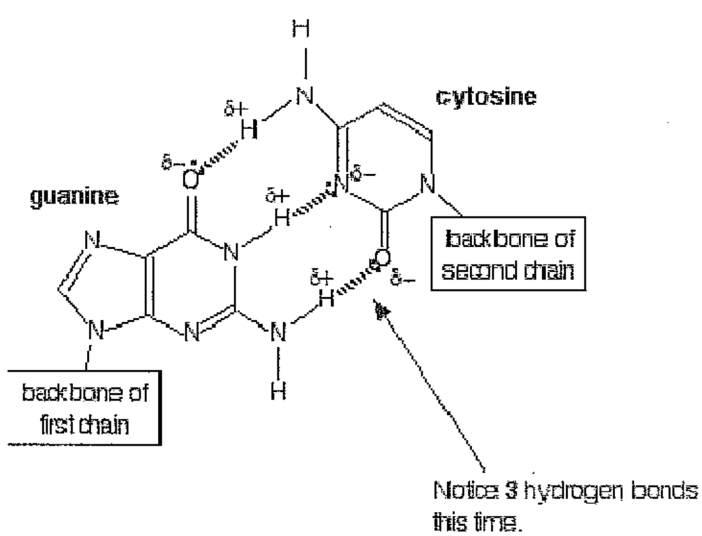
That is because these particular pairs fit exactly to form very effective hydrogen bonds with each other. It is these hydrogen bonds which hold the two chains together.

The base pairs fit together as follows.

The A-T base pair:




The G-C base pair:



## A final structure for DNA showing the important bits