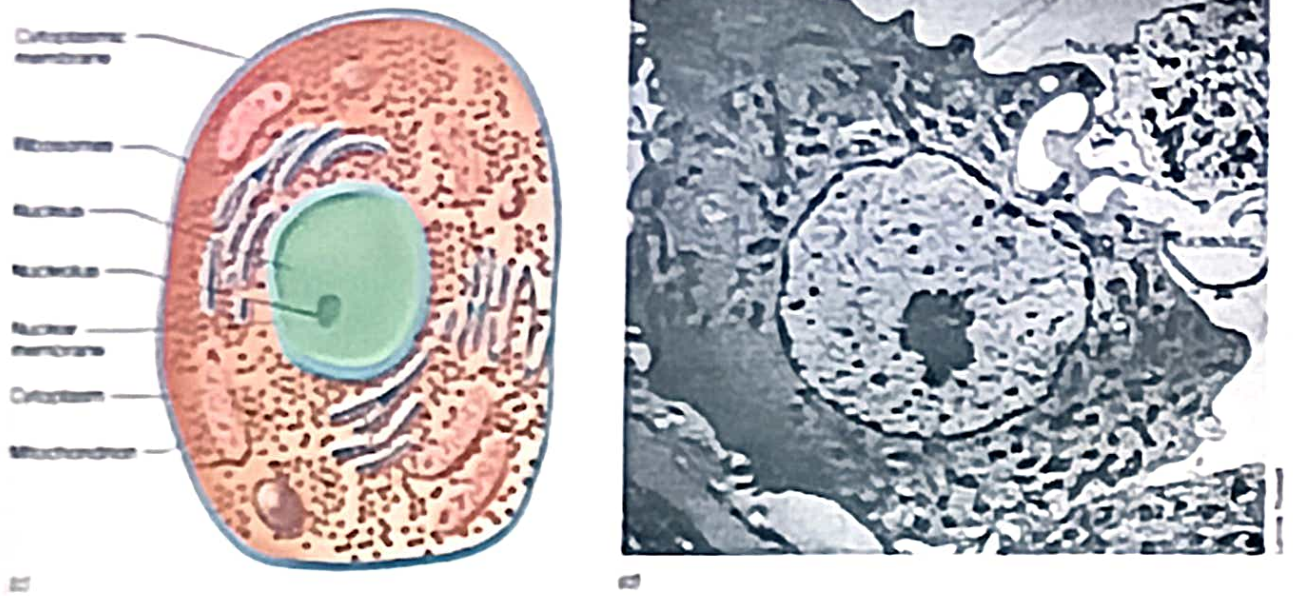
The Basics: Cell Organization

Prokaryotes

Eukaryotes

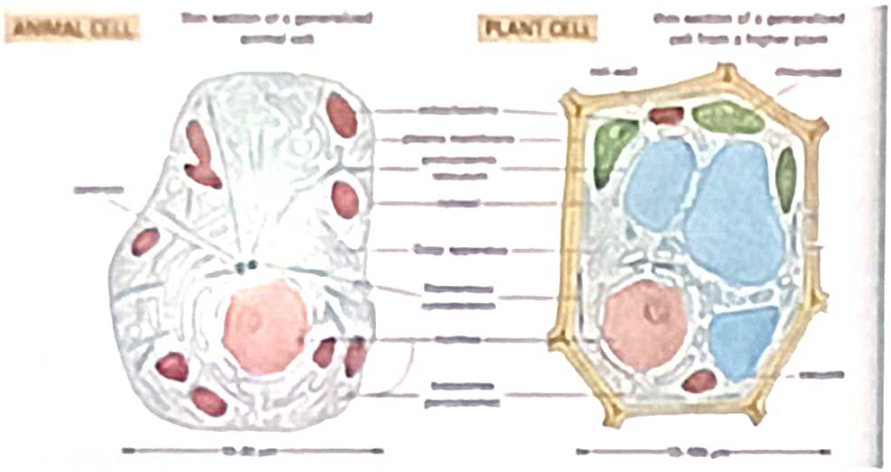


Most Biopolymers in Body are in Cells

Bacteria
Prokaryotes
(No nucleus)

←1 μm→

Eukaryotic cell (us)
(Has nucleus)



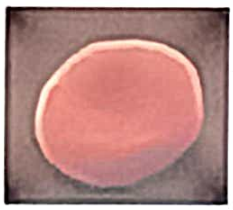
←10-30 μm→

←10-100 μm→

(Nucleus 3-10 μm)

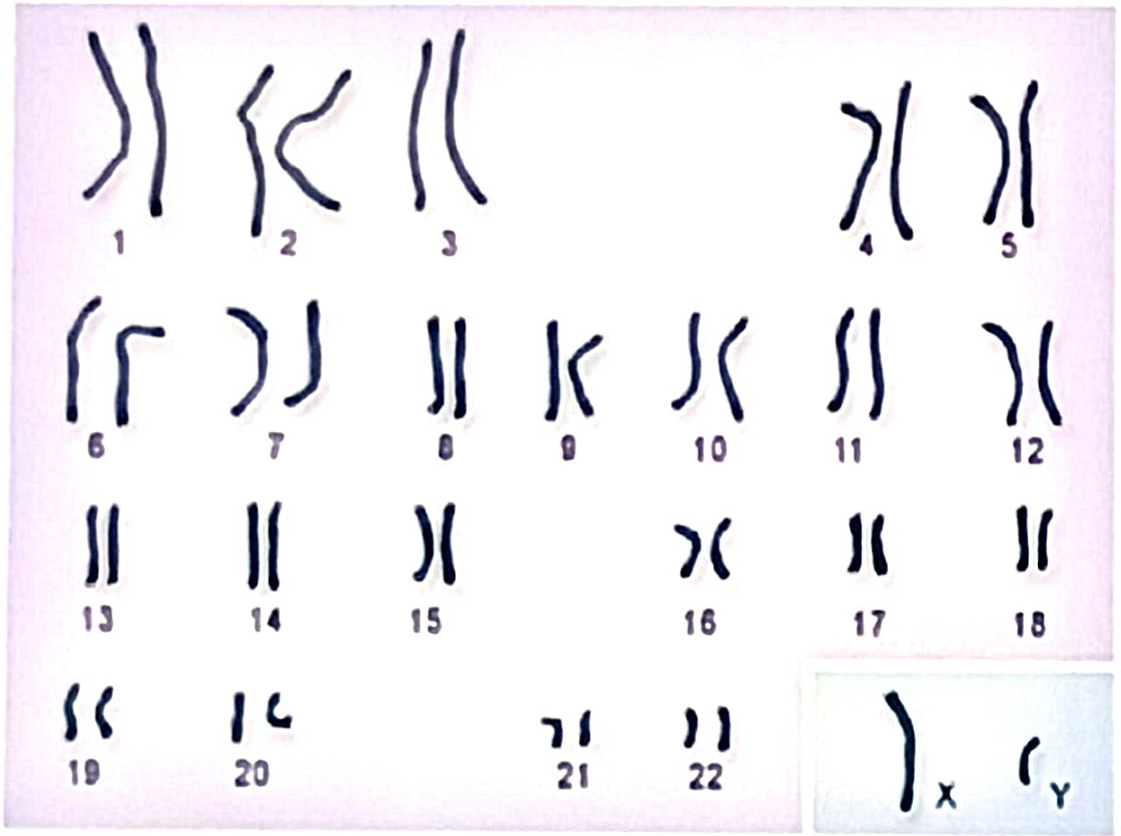
≈ 10^{14} (50-100 trillion!) cells in body

Yet there are ≈ 200 different types of cells in body. (Heart cell not equal to a brain cell...)



Each type of cell is diff. cause diff. parts [redacted]'s turned on.

You have 3 billion base-pairs, in 46 individual sections, called a chromosomes.
There are 23 pairs. An X from mother; X or Y from father (determines sex)



autosomes

sex chromosomes

U.S. National Library of Medicine

Total Length DNA is approx. 1 meter in every cell

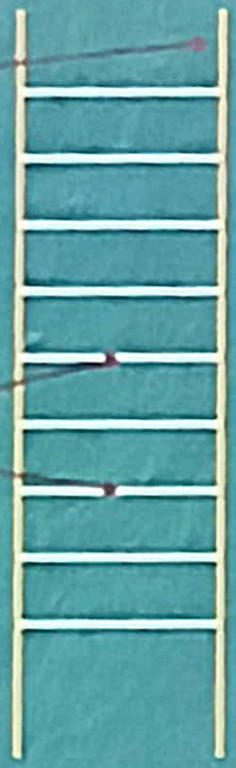
Nucleus of Cell = 5 μm long

Structure of the DNA molecule

- DNA is shaped like a double helix
- It is like a spiral staircase
- Another way to think of it is a twisted ladder

Connecting the DNA molecule

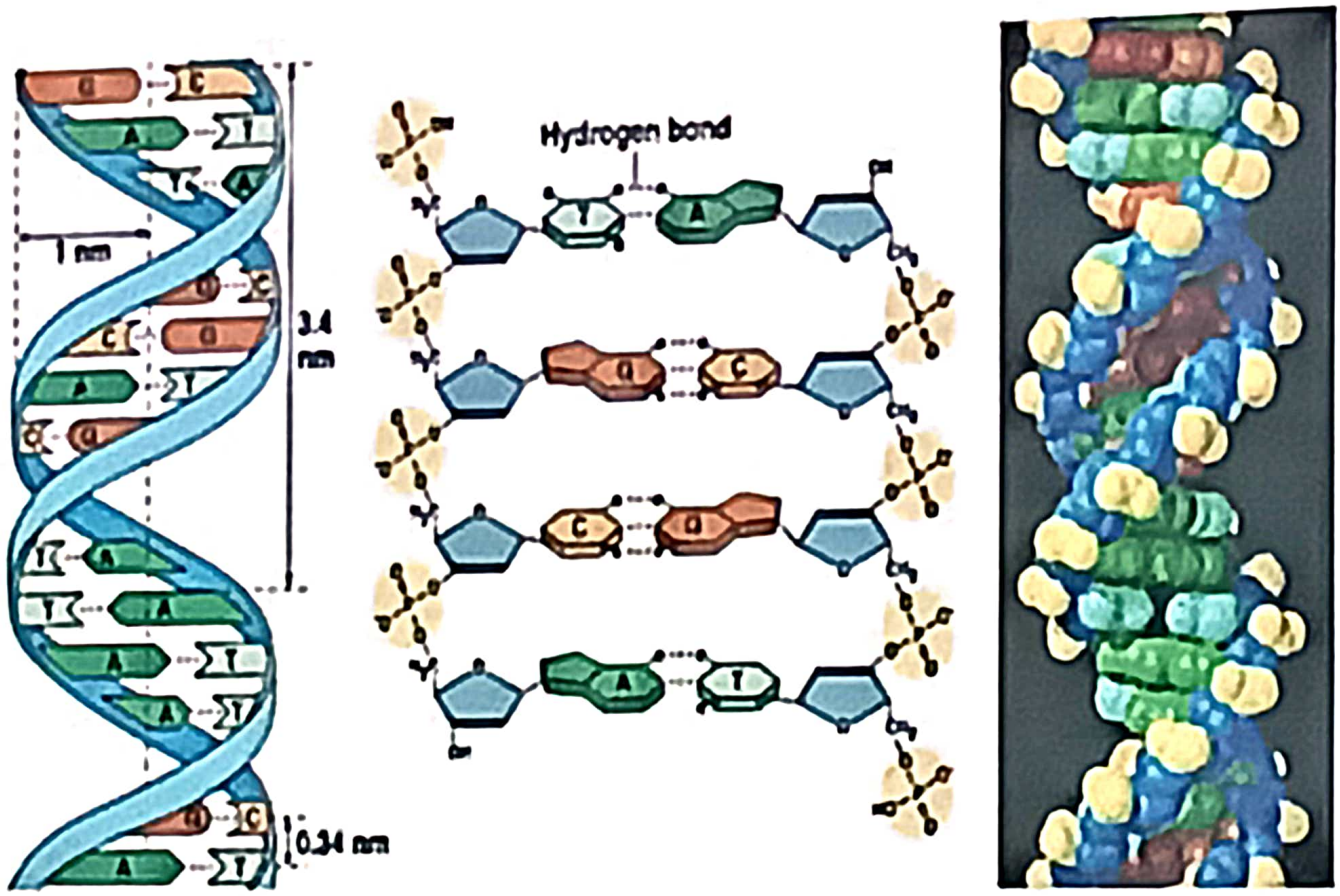
- Rails* of the DNA ladder are alternating sugar & phosphates
- Rungs* are composed of pairs of bases
  - A bonds with T*
  - G bonds with C*



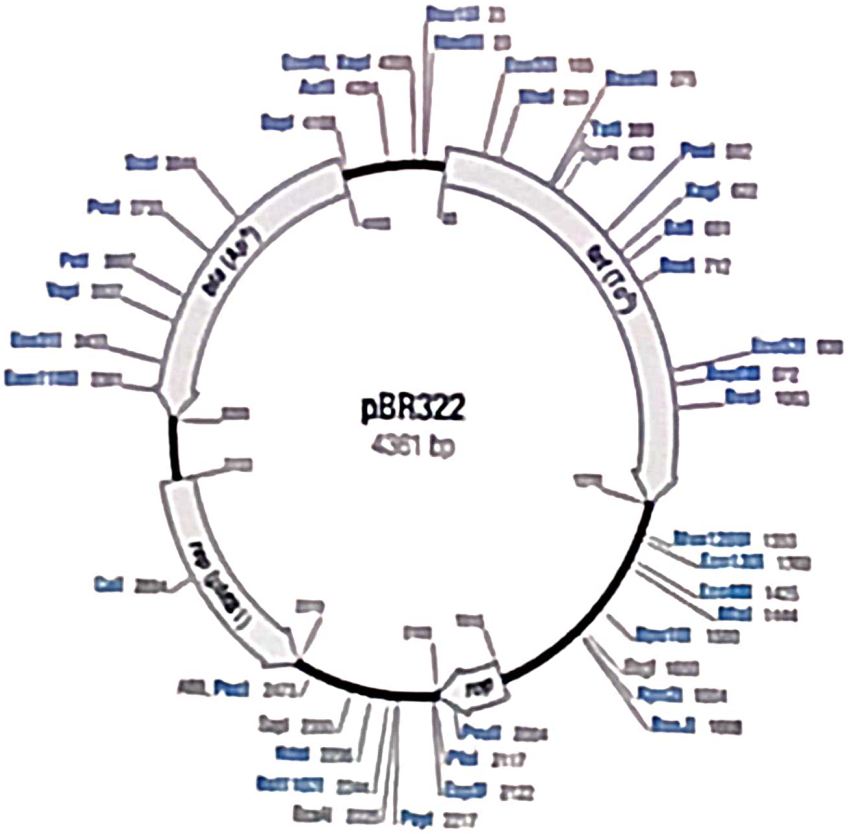
Connecting the DNA molecule

- The two strands of DNA are different
- One is called the sense strand and it is the plan to make a protein
- The other strand is the antisense strand and it is only used for protection of the sense strand

The Basics: Structure of DNA

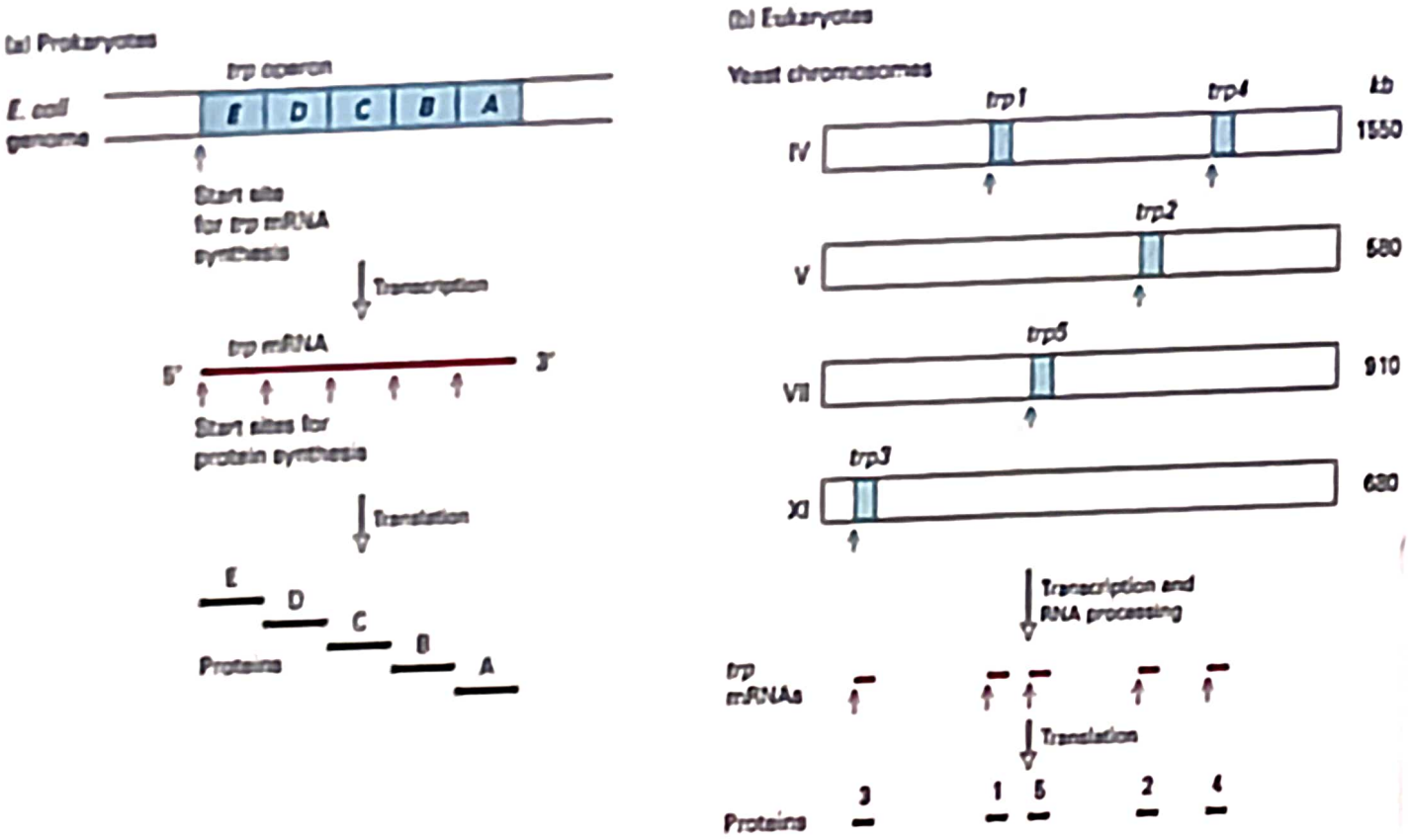


... an example of a plasmid vector



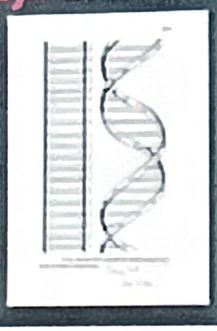
- Gene of interest
- Selective markers
- Origin of replication
- Restriction sites

The Basics: Gene Organization



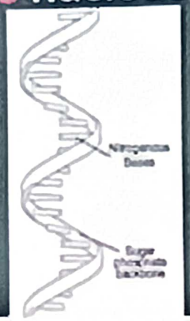
DNA

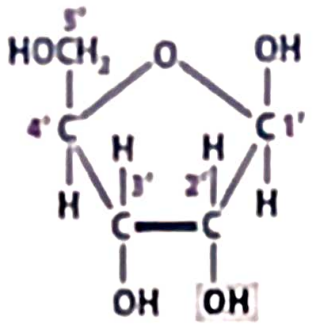
1. sugar=deoxyribose
2. bases = A, C, G, T
3. double strand
4. stays in nucleus



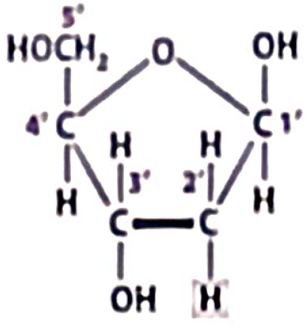
RNA

1. sugar = ribose
2. Bases=A, C, G, U
3. single strand
4. leaves nucleus

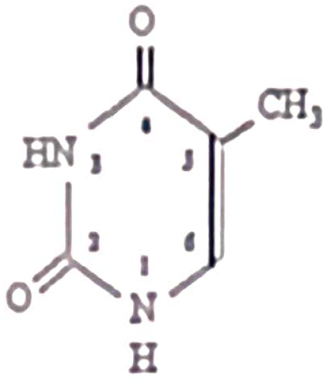




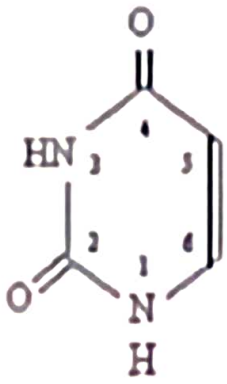
Ribose



Deoxyribose



Thymine
(DNA)



Uracil
(RNA)

There are three main differences between RNA and DNA:

- The sugar in RNA is ribose instead of deoxyribose.
- RNA is generally single-stranded.
- RNA contains uracil in place of thymine.

The Genetic Code

How is the information for a polypeptide sequence stored within an mRNA molecule? There are twenty different common amino acids, but only four different bases in RNA (*A, C, G, and U*).

Base Arrangement	Possible Combinations
1	$4^1=4$
2	$4^2=16$
3	$4^3=64$
4	$4^4=256$

A triplet arrangement would seem to be the minimum possible combination necessary to code for the 20 different amino acids. Although, there are obviously going to be a lot of codons "left over". Most amino acids are coded for by more than a single unique triplet, and therefore the genetic code is said to be **degenerate**.