

# Bioinformatics 2021

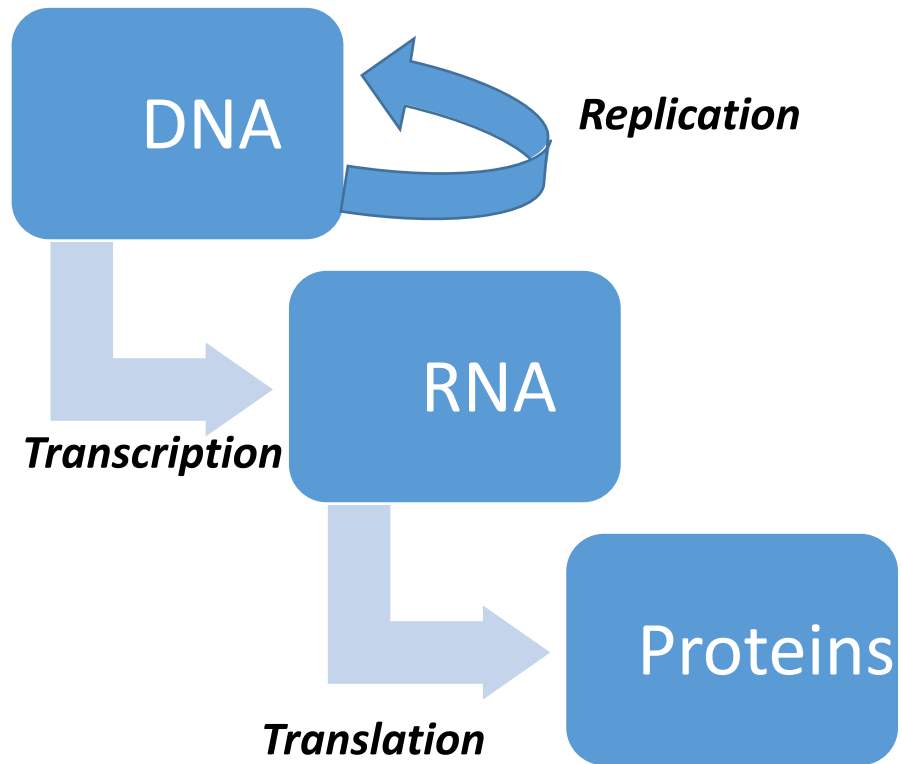
## Lecture 2

# Central dogma

- Replication
- Transcription
- Translation
- Splicing

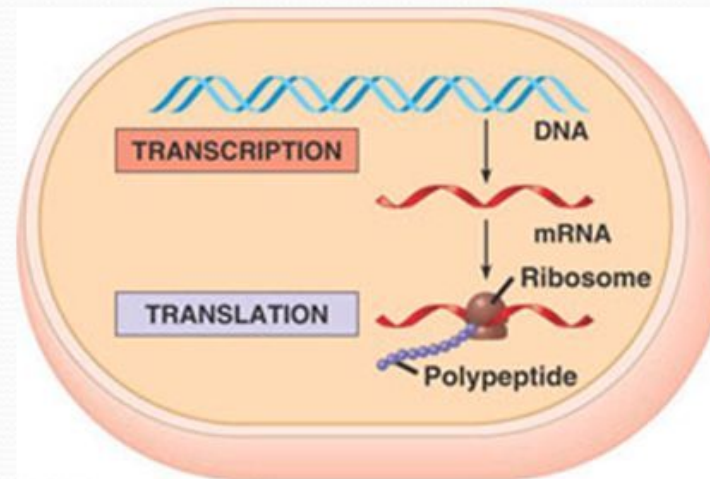
<https://www.youtube.com/watch?v=gG7uCskUOrA>

# Basic cellular mechanisms of life

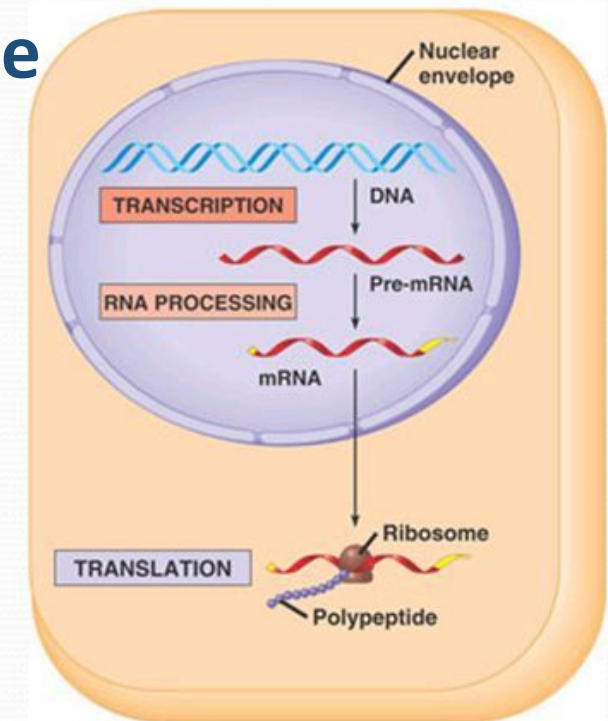


## The Central Dogma

### Decoding of the genetic code



(a) Prokaryotic cell



(b) Eukaryotic cell

# Activity 1

- Calculate the total number of cells in a 50 kg person
- This is an approximate calculation for illustration purpose
- Cell dimension is 10  $\mu\text{m}$  in diameter for a sphere
- Assumptions
  - Assume the cell to be cubical in shape[although spherical is more appropriate]
  - For conversion use  $1\text{dm}^3 = 1\text{ l} = 1\text{ kg}$ .

# Activity 1

- Q: How many cells are there approximately in an average 50 kg person?
- 10 microns diameter of a cell
- Volume =  $10 \times 10 \times 10 \text{ um}^3 = 1 \text{ cell}$  [assuming it to be a cube]
- So in  $1 \text{ mm}^3$ , there will be about 1 million cells [1 um is  $10^{-3} \text{ mm}$  or  $1 \text{ mm} = 10^3 \text{ um}$ ].
- In a  $\text{dm}^3$ , there will be  $10^{12}$  cells – 1 trillion
- $1 \text{ dm}^3 = 1 \text{ l} = 1 \text{ kg}$  [assumption]
- About 50 trillion cells.

# Activity 2

- Calculate the length of the DNA
- Human DNA-  $6.6 \times 10^9$  bp
- Each base pair – 0.34 nm

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- Calculate the length of the DNA
- Human DNA-  $6.6 \times 10^9$  bp
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**About 2m long**

- Amount of pressure and the level of packaging
- Compare the size to that of the cell **average is 6um in diameter!!!**

- DNA is just a fine, spiral coiled thread in the nucleus of every living cell.
- The human genome, encoded as DNA, contains 23 chromosome pairs, which is like 500 thousand to 2.5 million nucleotide pairs.
- What if it were to be stretched or coiled? Every human being has about ten trillion cells in their body. If all DNA cells are stretched, they can go as far as 744 million miles. Now the moon is only about 2,50,000 and the Sun is 93,000,000 miles away.

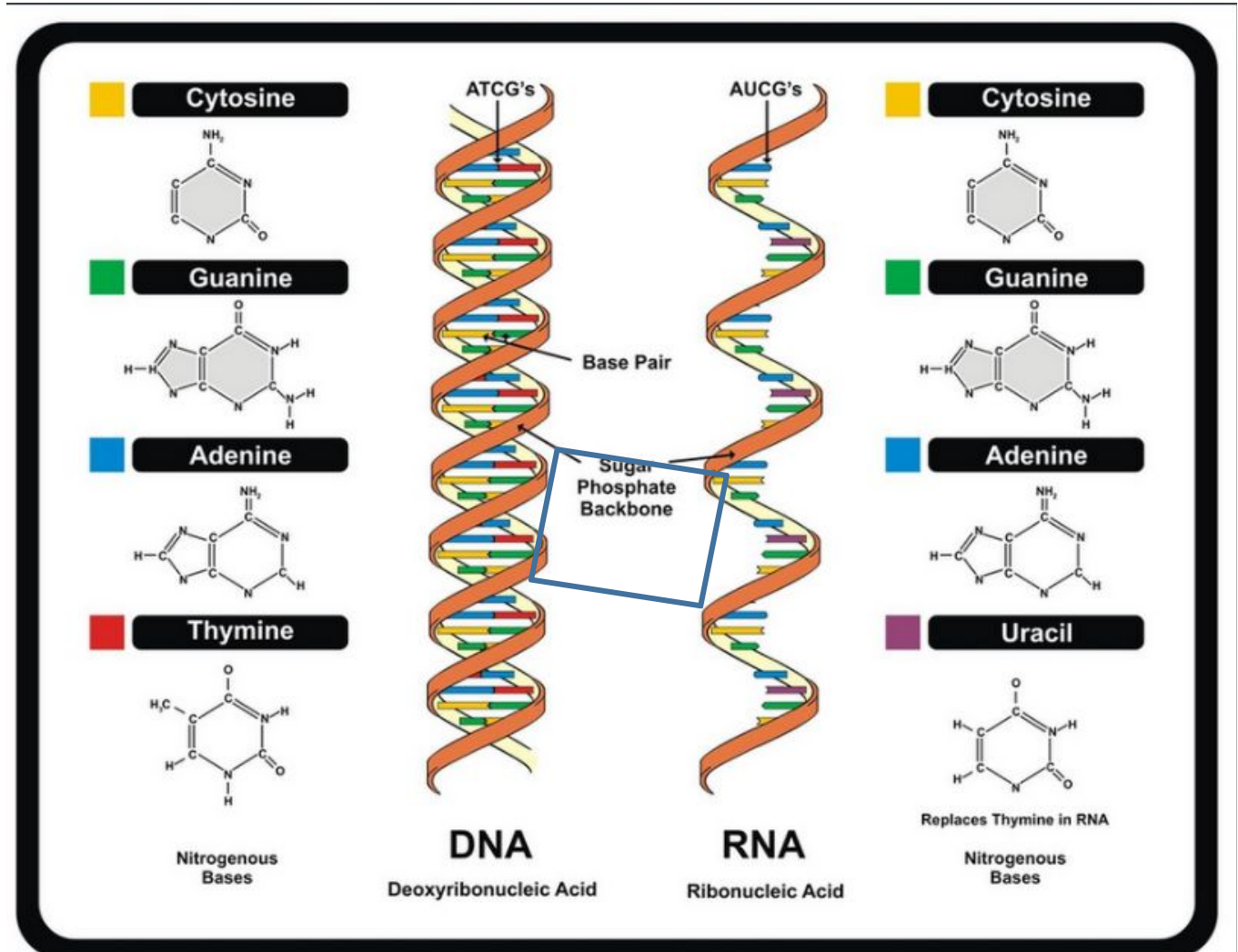


# Structure of DNA/ RNA

1. Double helix
2. Consists of 4 base pairs

Sugar- Phosphate backbone

Colored blocks are the bases.  
There are 2 strands of the backbone  
that runs in opposite direction  
The bases on the 2 strands base pair



# The rules pertaining to the basic DNA structure

- There are 4 bases- Adenine [A], Guanine[G], Thymine [T], Cytosine [C].
- A pairs with T [2 H-bonds]
- G pairs with C [3 H-bonds]

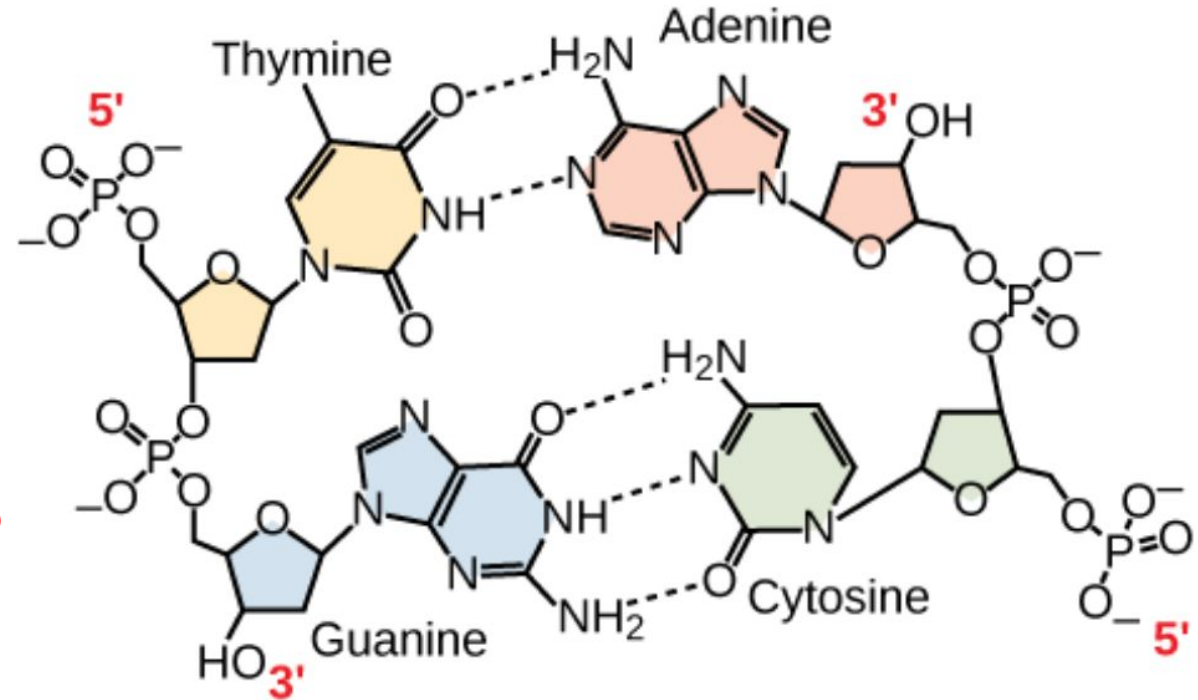
**Note!!!**

**The 2 strands are anti-parallel to each other.**

**Observe the sugar-Phosphate backbone to understand**

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**Other terminologies- Complementary strands**



# Replication- Making copies of DNA

Simple steps

1. Helicases-  
Unwinds DNA
2. Polymerases-  
Creates  
Complementary  
strand

