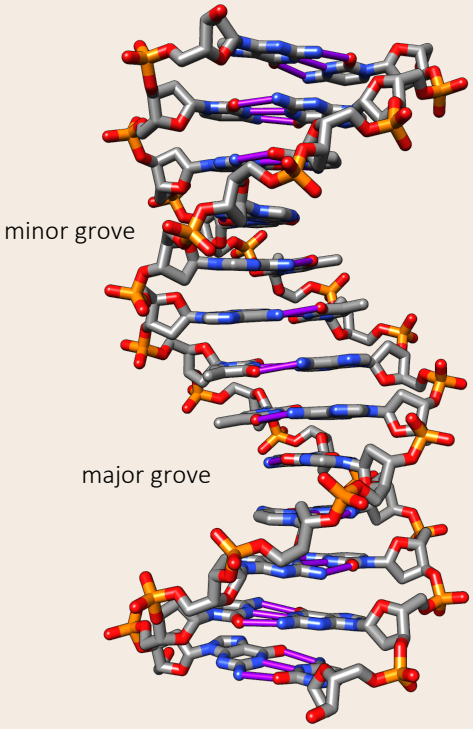
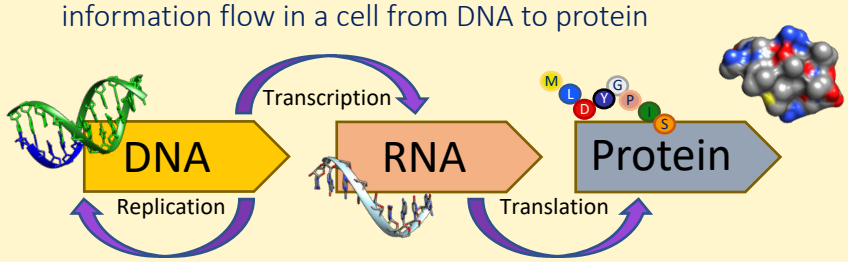
MOLECULE OF HEREDITY



DNA
Deoxyribonucleic Acid

- stores the genetic information of all bacteria, archaea, fungi, plants, animals, and some viruses
- serves as a cell's blueprint for production of proteins, regulatory molecules, and reproduction

CENTRAL DOGMA: describes the general pattern of information flow in a cell from DNA to protein



STRUCTURE

- **polymer** built of monomers (nucleotides) connected via phosphodiester bonds
- **nucleotides** differ in their bases (A, C, G, T)
- **double helix** with sugar-phosphate backbone on the outside and nitrogenous bases inside
- **hydrogen bonds** bind complementary nucleotides
- proteins bind to DNA within the **major and minor groves**

LOCATION

- in the **nucleus** of fungi, plant, and animal cells
- in **capsids** of DNA viruses
- as a **nucleoid** in bacteria
- organized into structures called **chromosomes**
- human cells have 46 linear chromosomes
- bacteria have usually a single circular chromosome
- also found in cellular organelles (mitochondria and plastids)

FUNCTION

- two strands complementary to each other allow for the process of replication
- is more stable then RNA
- **genes** are segments of DNA that code for proteins and regulatory molecules
- **human genome** consists of 3.2×10^9 bp of DNA, coding for ~25,000 proteins
- ***E. coli* bacterium** has a genome of 4.6×10^6 bp, coding for 3,200 genes

Mutations in DNA result in genetic difference and in some cases in disease[1]

- identical twins have the same DNA but differ in its usage/gene expression (**epigenetics**)
- human DNA is 99 % identical to chimpanzee; humans share about 40 genes with bacteria
- mutations in DNA result in a variety of genetic disorders: sickle cell anemia (hemoglobin S); hemophilia (*FVIII* factor); phenylketonuria (*PAH* gene); cystic fibrosis (CFTR gene), etc.
- some mutations have been associated with increased risk of breast cancer (*BRCA1* gene); Parkinson disease (*PINK1* gene); colon cancer (FAP or HPNCC gene), etc.

[1] National Human Genome Research Institute (https://www.genome.gov/); Model made in UCSF Chimera