

# Human Genetics

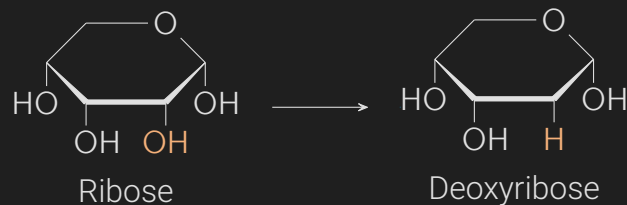
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# DNA Structure and Function

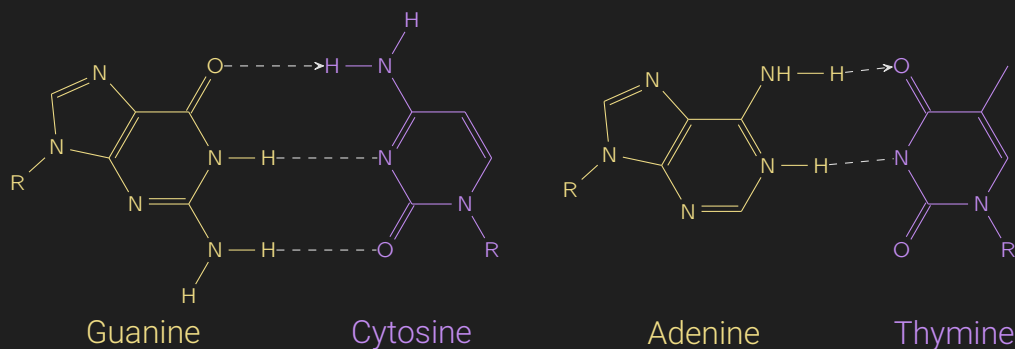
This chapter was mostly basic review material. The portion on DNA was more of a test of my recent changed document class settings. The majority of the chapter was omitted. I might add more review content later if I find necessary.

## Deoxyribonucleic Acid

- ▷ **Deoxyribonucleic Acid (DNA):** a double helix containing two polynucleotide chains that carries the genetic instructions for all known organisms and many viruses.
  - The bases are made of four bases:
    - The **purine** derivatives: **adenine (A)** and **guanine (G)**.
    - The **pyrimidine** derivatives: **thymine (T)** and **cytosine (C)**.
  - The backbone is made of **alternating deoxyribose** molecules (a ribose missing its 2' oxygen) connected to phosphodiester bonds from 5' → 3' positions—forming two **antiparallel** strands.



- ▷ Number of **adenines** = **thymines**. (A-T)
- ▷ Number of **guanines** = **cytosines**. (C-G)
  - Bonds between bases are **noncovalent** (no electron sharing, weak).
  - C—G pairs form three hydrogen bonds, while A—T forms two; making G—C slightly more stable.



# Genetic Variation

Much of this chapter was once again mostly review. However, the mini-section on nomenclature was new to me and seemed useful, so I included this. This chapter provided several hooks for related topics, so I may add more content from elsewhere in this chapter if I find my understanding on basic material lacking.

## Mutation Nomenclature

### ▷ Level of mutational change:

- **g** = Genomic
- **c** = Coding sequence
- **m** = Mitochondrial sequence
- **r** = RNA sequence
- **p** = Protein sequence
- **E+I** or **E-I** = Explained below

### ▷ Type of mutational change:

- **>** = Substitution in the DNA
- **\_** = A range of affected bases
- **del** = Deletion
- **dup** = Duplication
- **ins** = Insertion
- **inv** = Inversion

- ▷ **E+I** = The last nucleotide of preceding exon (E) for genomic mutations at the 5' (+) and number of nucleotides into the intron (I).
- ▷ **E-I** = The first nucleotide of the next exon (E) for mutations at the 3' end of an intron (-) and the number of nucleotides into the intron (I).














































## Nomenclature Examples

- **g.1346A>C**: Change of A to C at position 1346 in the genomic DNA sequence.
- **c.745delT**: Deletion of T at position 745 in the coding sequence.
- **g.1567\_1568delAT**: Deletion of AT at positions 1567–1568 in the genomic DNA sequence.
- **c.145+1T**: Change of splice donor (first position of intron after base 145 of preceding exon) to T
- **p.Arg54Gly**: Change of arginine at codon 54 to glycine.

# Patterns of Inheritance

Still, mostly basic review. Some fuzzier key terms were added in for quick reference, as well as a legend for pedigree analysis. Again, I will probably be revisiting this later.

## Pedigree Legend

	Male	Female	Sex unknown
Individual			
Affected individual			
Multiple individuals (number known)			
Multiple individuals (number unknown)			
Deceased individuals			
Stillbirth	 SB	 SB	 SB
Pregnancy			
Proband			
Consultand			
Spontaneous abortion	 Male	 Female	 ECT (ectopic pregnancy)
Affected spontaneous abortion	 Male	 Female	
Termination of pregnancy	 Male	 Female	
Affected termination of pregnancy	 Male	 Female	
Relationship no longer exists			
Consanguinity			
Monozygotic twins			
Dizygotic twins			
Adoption out			
Adoption in			

## Inheritance Review

- ▷ **Pseudodominant**: when a condition generated from an autosomal recessive trait that is common and compatible with reproduction.
  - A “false” dominance, due to higher frequencies of homozygous carriers of the recessive allele.
- ▷ **Penetrance**: the proportion of individuals carrying a particular variant that also express the trait.

- E.g., 60% penetrance of autosomal dominant allele means 60% of the population will express the trait to some degree.
- ▷ **Expressivity:** the degree of phenotypic expression, not to be confused with penetrance.
- ▷ **Allelic heterogeneity:** when different mutations at the same locus lead to the same or very similar phenotypes.
- ▷ **Mosaicism:** when two or more populations of cells with different genotypes in one individual who has developed from a fertilized egg.
  - Germline mosaicism occurs during gamete cell development, which means mutations can be passed on despite not being present in one generating the germline.
  - Somatic mosaicism occurs when mutation occurs in early development, usually expressing mild or restricted manifestations of the phenotype. Only affects children if also present in germline.
- ▷ **Trinucleotide repeat disorder:** a mutation in which repeats of three nucleotides increases until they cross a threshold above which they become unstable.