

# Human Genetics

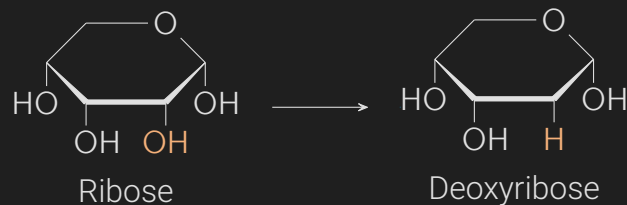
|                                   |          |
|-----------------------------------|----------|
| <b>DNA Structure and Function</b> | <b>2</b> |
| Deoxyribonucleic Acid             | 2        |
| <b>Genetic Variation</b>          | <b>3</b> |
| Mutation Nomenclature             | 3        |
| Nomenclature Examples.....        | 3        |
| <b>Patterns of Inheritance</b>    | <b>4</b> |
| Inheritance Review                | 4        |

# DNA Structure and Function

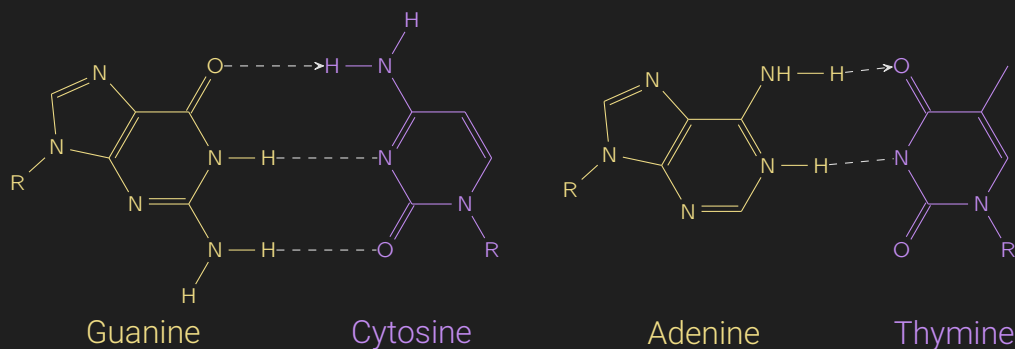
This chapter was mostly basic review material. The portion on DNA was more of a test of my recent changed document class settings. The majority of the chapter was omitted. I might add more review content later if I find necessary.

## 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                            |     |     |    |
| Pregnancy                             |     |     |    |
| Proband                               |     |     |    |
| Consultand                            |   |   |  |
| Spontaneous abortion                  |   |   |  |
|                                       | Male   | Female   | ECT (ectopic pregnancy)   |
| Affected spontaneous abortion         |   |   |  |
| 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.