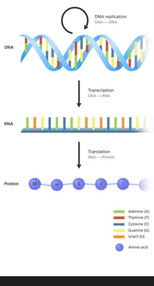
Central Dogma

Monday, June 9, 2025 10:40 AM

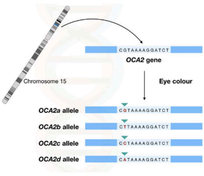
Central Dogma



Central Dogma in genetics is a theory that explains how genetic information flows. It states that this information flows in one direction: DNA replication –> Transcription (DNA to RNA) –< Translation (RNA to Protein)

Basics About DNA

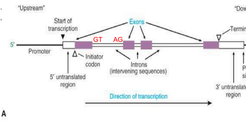
1. How many human chromosomes per cell?
2. What does 15q13.3 mean?
3. What is a gene?
4. How many human genes are there?
5. What is an allele?



Gene vs Allele: Key Genetic Concepts Simplified (geneticeducation.co.in)

Typical Gene Structure

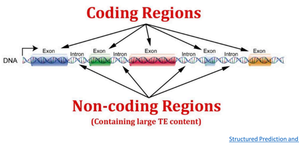
- Initiator codon AUG – methionine
- Type of variation on the level of single gene:
  - Single nucleotide substitution
    - Splice Site Variants
  - Insertion/Deletion (indel
  - Trinucleotide repeat



Nussbaum RL, McInnes RR, Willard HF. *Thompson and Thompson Genetics in Medicine*. Pg 17. (2007)

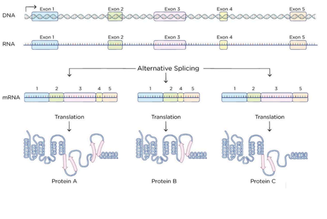
What Did We Learn from the Human Genome Project?

- 1.5 % of DNA is protein coding
  - Approximately 20,000 protein coding genes
  - 20,000 to 25,000 non-coding RNA genes
    - RNAs important for transcription, splicing, snoRNAs, miRNA



Structured Prediction and Probabilistic Graphical Models (ubc.ca)

mRNA Splicing



Alternative splicing - Wikipedia

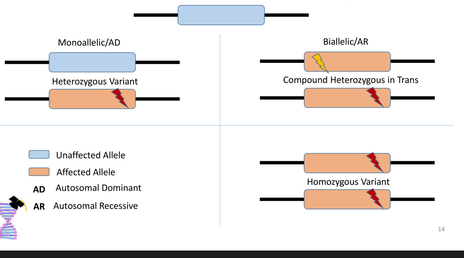
The Genetic Code is Degenerate

- Single nucleotide substitutions
  - Synonymous variant
    - Ex: DNA: TTT > TTC → Amino acids: Phe > Phe
  - Missense variant
    - Ex: DNA: TTT > TTA → Amino acids: Phe > Leu
  - Nonsense variant
    - Ex: DNA: TAC > TAA → Amino acids: Tyr > STOP
- INDELs
  - ATGCCAACCTATATTAGT
    - Met-Pro-Thr-Tyr-Ile-Ser
  - ATGCCAACTATATTAGT
    - Met-Pro-Thr-Ile-Leu

fire.biol.wwu.edu/trent/trent/primersequence.htm

Definitions

<u>Genotype</u> – alleles at a particular locus

<u>Phenotype</u> – observable physical characteristics

AA (homozygous)	Aa (heterozygous)	aa (homozygous)