Central Dogma

* Replication -> transcription -> translation
* DNA -> RNA [ Transcription] | RNA -> Protein [Translation]
* RNA -> DNA [Reverse transcription]

Replication:

* Biological process
* Creates copy of exact DNA
* Basis of interitance
* Daughter DNA from Parent DNA [aided by DNA polymerase] {called replication}
* (dNMP)­­n + dNTP -> (dNMP)n+1 + PPi
* Transfer of genetic information takes place
* Three types of replication patterns:
  + Semiconservative
  + Conservative
  + Dispersive
* Semiconservative
  + The complement of each strand is created
  + This leaves us with 2 DNA each with one old strand and one new strand
* Conservative replication
  + Here a completely new DNA helix is created from scratch
  + In this we are left with one OLD HELIX and one NEW HELIX
* Dispersive replication
  + In this, random parts of the DNA are conserved and random parts are generated
  + This leaves us with partly old and partly new DNA helixes
* Replication is semi-conservative
* It is bidirectional, i.e. It happens in both 3’-5’ and vice versa
* It is semicontinuous: The leading strand replicates continuously and the lagging strand replicates discontinuously
* The process of replication has High Fidelity, i.e. It the replicated pair is indistinguishable from the original pair

Meselson and Stahl experiment [1958]:

* E. coli was grown in the presence of 15N (heavy nitrogen isotope)
* This E. coli was then placed in 14N (light nitrogen isotope) with 3 samples one at 0 min one at 20 min and one at 30 min
* The cells are then broken open to extract DNA and this DNA is extracted in CsCl (Cesium Chloride) solution
* All the 3 samples are then CsCl density gradient centrifugation in performed (This measures density of the DNA. While centrifuging the CsCl solution forms a concentration gradient, i.e., Concentrated CsCl accumulates at the bottom with less concentrated CsCl at the top create a gradient. When DNA is included in this mixture, denser DNA forms a band lower down during centrifugation and lighter DNA forms a band higher up in the CsCl solution)
* After this, in the 3 samples 3 types of bands are observed. Heavy band (DNA with 15N), intermediate band (F1 gen with one strand 15N and one strand 14N) and a light band (F2 gen with more 14N than 15N
* This proves the hypothesis that each DNA strand is replicated semi conservatively, in which half of the parental DNA molecules is conserved in each new double helix paired with a newly synthesized complementary strand.

Bidirectional replication:

* Replication starts by unwinding Double stranded DNA at origin site
* Parent DNA and two newly formed DNA form a Y shape during replicaion this is called the Replication Fork
* This happens in eukaryotes

In prokaryotes the replication starts from origin and proceeds in 2 opposite directions. This is called \_\_\_\_ replication

Replication Enzymes and proteins:

* DNA Polymerase: Matches the correct nucleotides to their complementary nucleotide and then joins the adjacent nucleotides to each other
* Helicase: Unwinds the DNA at the start
* Primase: Starts polymerization by giving an DNA primer
* SSBP – Single standed binding protein keeps the DNA from rejoining before replication finishes
* Gyrase – It is a topoisomerase that relieves the torsional strain on the DNA molecule
* Ligase – Joins adjacent DNA strands
* Telomerase – Finishes off the ends of the DNA strands