The Mechanism of DNA Replication

- Many proteins assist in DNA replication
- DNA helicases unwind the scuble helic, the template strands are stabilized by other proteins
- Single-stranded DNA binding proteins make the template available
- RNA primase catalyzes the synthesis of short RNA primers, to which nucleotides are added.
- DNA polymerase III extends the strand in the 5'-to-3' direction
- DNA polymerase I degrades the RNA primer and replaces it with DNA
- DNA ligase joins the DNA fragments into a continuous daughter strand





Leading strand synthesis continues in a 5' to 3' direction.

Discontinuous synthesis produces 5' to 3' DNA segments called Okazaki fragments.



Polymerase activity of DNA polymerase I fills the gaps. Ligase forms bonds between sugar-phosphate backbone.

Transcription Overview



Translation

- Translation is the RNA-directed escence.uk ullet39e 46 of
- Translation in coives \bullet
 - mRNA
 - **Ribosomes Ribosomal RNA**
 - **Transfer RNA**
 - Genetic coding codons



The Genetic Code

- Codons: 3 base code for the production of a Opecific amino acid, sequence of three of the four different nucleotides
- Since there are 4 bases and 3 positions in each codon, there are 4 x 4 x 4 = 64 preside codons
- 64 codons but only 20 amino acids, therefore most have more than 1 codon
- 3 of the 64 codons are used as STOP signals; they are found at the end of every gene and mark the end of the protein
- One codon is used as a START signal: it is at the start of every protein
- Universal: in all living organisms

The Genetic Code

 A codon in messenger RNA is either translated into an amino acid or serves as a translational stan/stop signal

ovi	e)	N	ade	Secor	nd mR	NA base			
			Play			Α	G		
	U		Phe Leu	UCU UCC UCA	Ser	UAU UAC UAA Stop	UGU UGC UGA Stop	U C A	(
base (5′ end)	C	CUU CUC CUA CUG	Leu	CCU CCC CCA CCG	Pro	CAU CAC His CAA CAA GIn	CGU CGC CGA CGG	U C A G	base (3′ end
First mRNA	A	AUU AUC AUA AUG	lle Met or start	ACU ACC ACA ACG	Thr	AAU AAC AAA AAG Lys	AGU AGC Ser AGA AGG Arg	U C A G	Third mRNA
	G	GUU GUC GUA GUG	Val	GCU GCC GCA GCG	Ala	GAU GAC Asp GAA GAG Glu	GGU GGC GGA GGG	U C A G	-



(c) Schematic model with mRNA and tRNA. A tRNA fits into a binding site when its anticodon basepairs with an mRNA codon. The P site holds the tRNA attached to the growing polypeptide. The A site holds the tRNA carrying the next amino acid to be added to the polypeptide chain. Discharged tRNA leaves via the E site.

Mutagens

- Mutagens are chemical or physical gents that interact with DNA to cause mutations.
- Physical agents include high-energy radiation like X-rays and ultraviolet light
- Chemical mutagens fall into several categories.
 - Chemicals that are base analogues that may be substituted into DNA, but they pair incorrectly during DNA replication.
 - Interference with DNA replication by inserting into DNA and distorting the double helix.
 - Chemical changes in bases that change their pairing properties.
- Tests are often used as a preliminary screen of chemicals to identify those that may cause cancer
- Most carcinogens are mutagenic and most mutagens are carcinogenic.

Viral Mutagens

- Scientists have recognized a number of *tumor* viruses that cause cancer in various animals, including humans, 64
- About 15% of human cancers are caused by viral infections that disrupt normal control of cell division
- All tumor viruses transform cells into cancer cells through the integration of viral nucleic acid into host cell DNA.

Substitutions

- A base-pair substitution is the replacement of one queleotide and its partner with another pair of nucleotides of CO
 - Silent changes a codon but codes for the same amino acid
 - Missense substitutions that change foodon for one amino acid into a codon for a different amine acid
 - Sonse -subsources that change a codon for one amino acid into a stop codon

Wild type						
mRNA 5' AUGAAGUUUGGCUAA 3'						
Protein Met Lys Phe Gly Stop						
Amino end Carboxyl end						
Base-pair substitution						
No effect on amino acid sequence U instead of C						
A Ŭ G A A G Ŭ Ŭ Ŭ G G Ŭ Ŭ A A						
Met Lys Phe Gly Stop						
Missense A instead of G						
AUGAAGUUUAA						
Met Lys Phe Ser Stop						
Nonsense U instead of A						
- Cop						