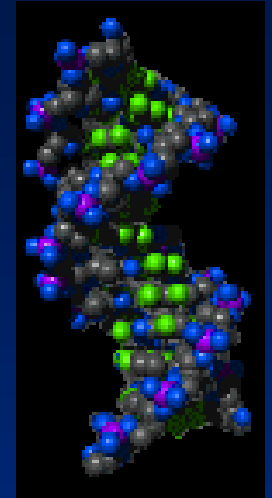


Le biotecnologie: principi di base



Ilaria Ciabatti

Dipartimento di Virologia e Biotecnologie

Progetto formativo aziendale

BIOTECNOLOGIE: PRINCIPI E CONCETTI DI BASE

Roma, 26-28 ottobre 2004

Roma, 22-24 novembre 2004

Firenze, 15-17 dicembre 2004



Cosa sono le biotecnologie



Procedimenti basati su processi biologici per l'ottenimento di beni e servizi

Cosa sono le biotecnologie

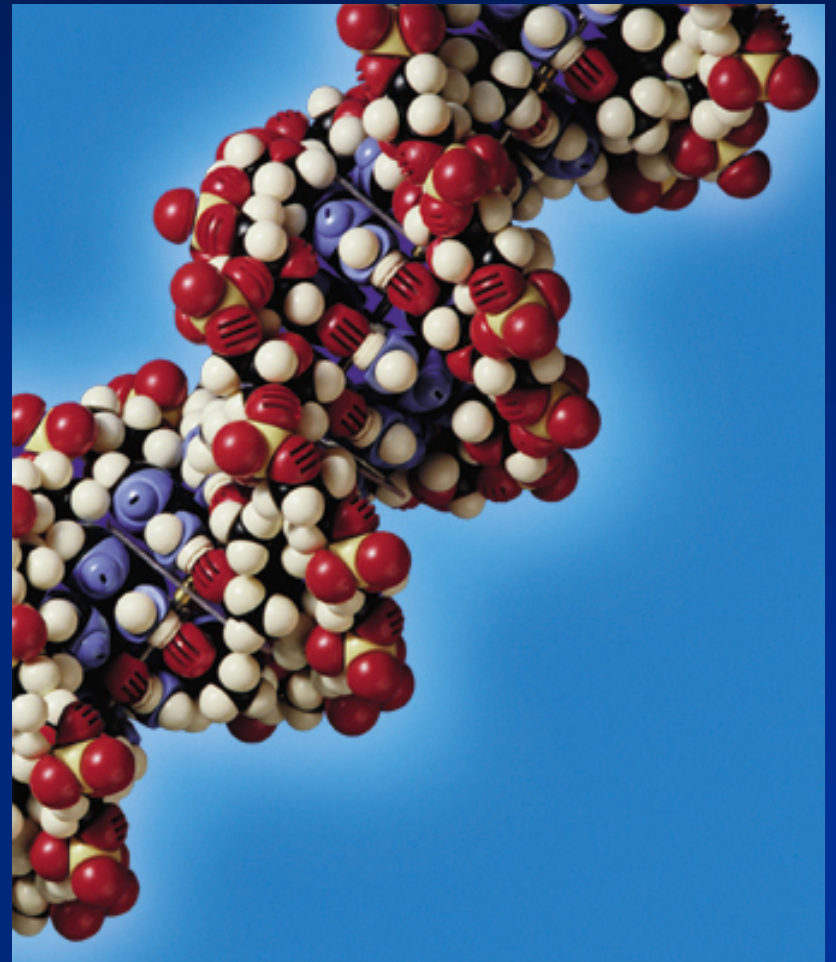
(protocollo di Cartagena sulla prevenzione dei rischi biotecnologici)

Biotecnologie moderne:

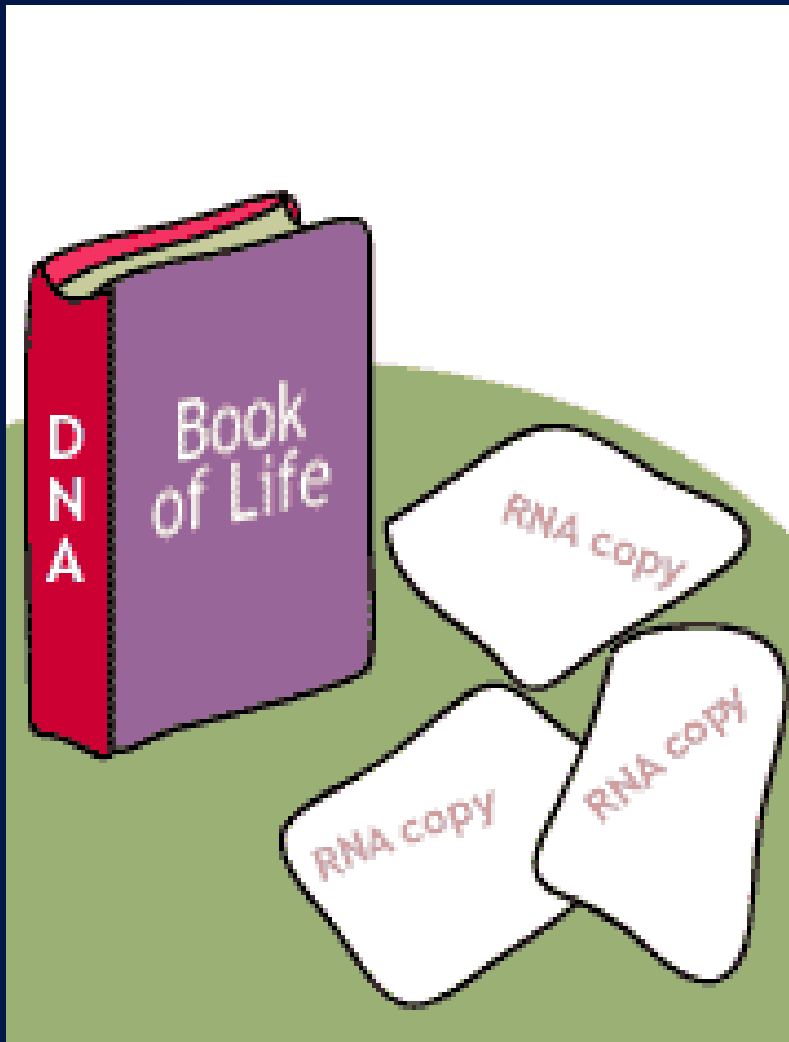
- tecniche in vitro dell'acido nucleico, compresa la ricombinazione del DNA e l'inoculazione diretta dell'acido nucleico in cellule o organuli
- fusione di cellule al di fuori della famiglia tassonomica, che superano le naturali barriere fisiologiche della riproduzione o della ricombinazione e che sono diverse dalle tecniche tradizionali utilizzate nell'allevamento e nella selezione

Settori coinvolti

- Terapeutico
- Diagnostico
- Agricolo
- Alimentare
- Ambientale
- Chimico
- Informatico

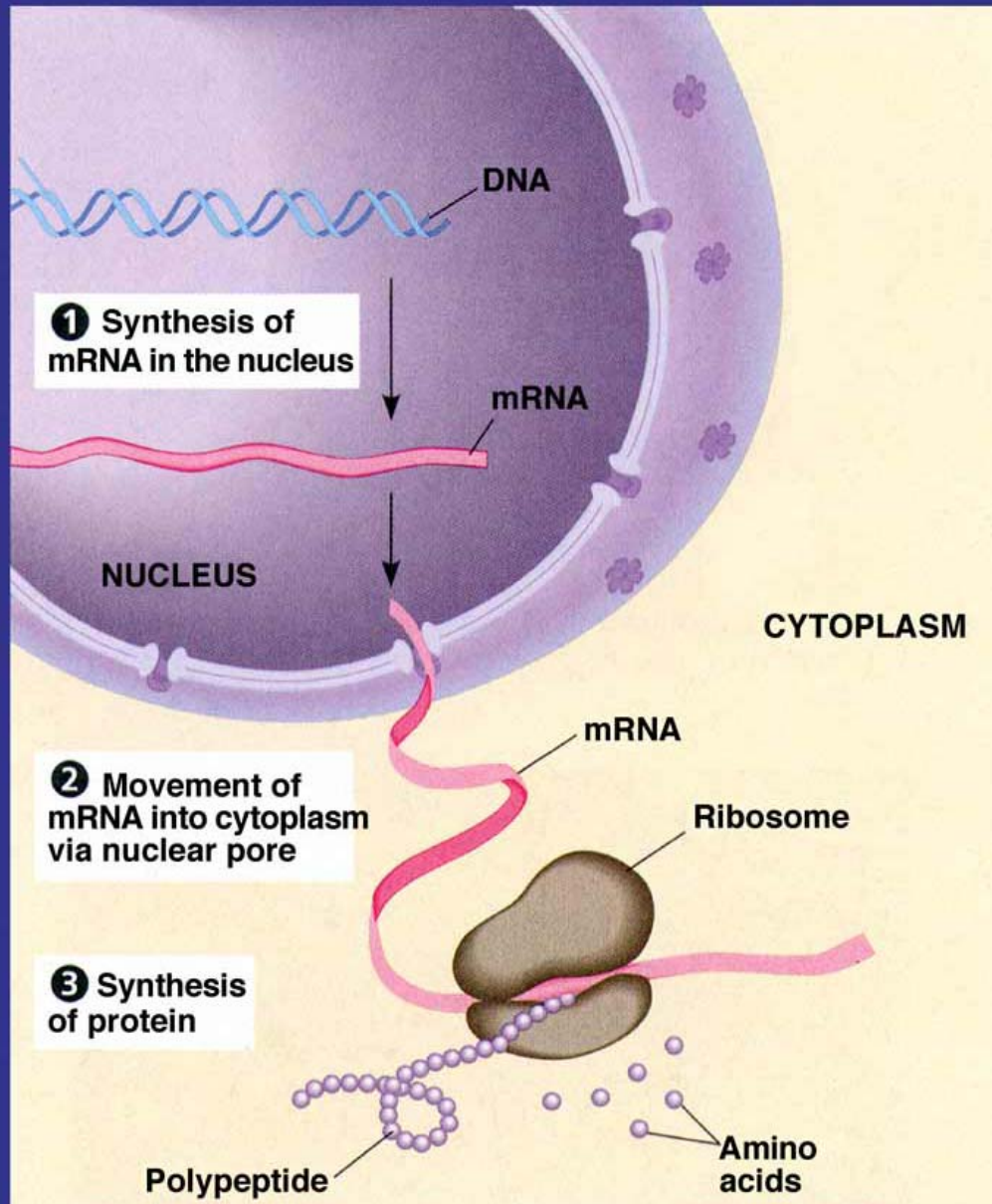


Le molecole della vita



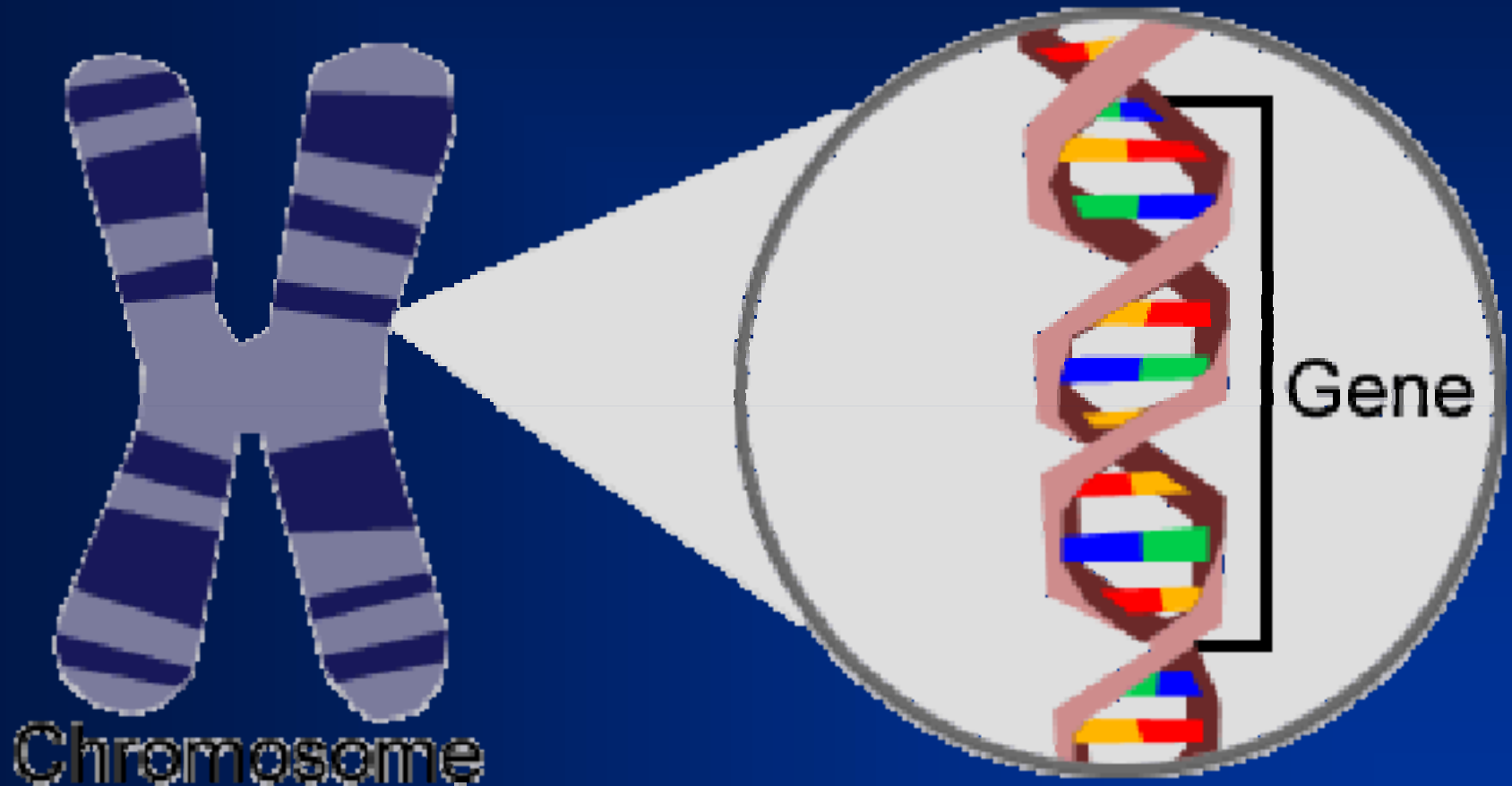
Proteine

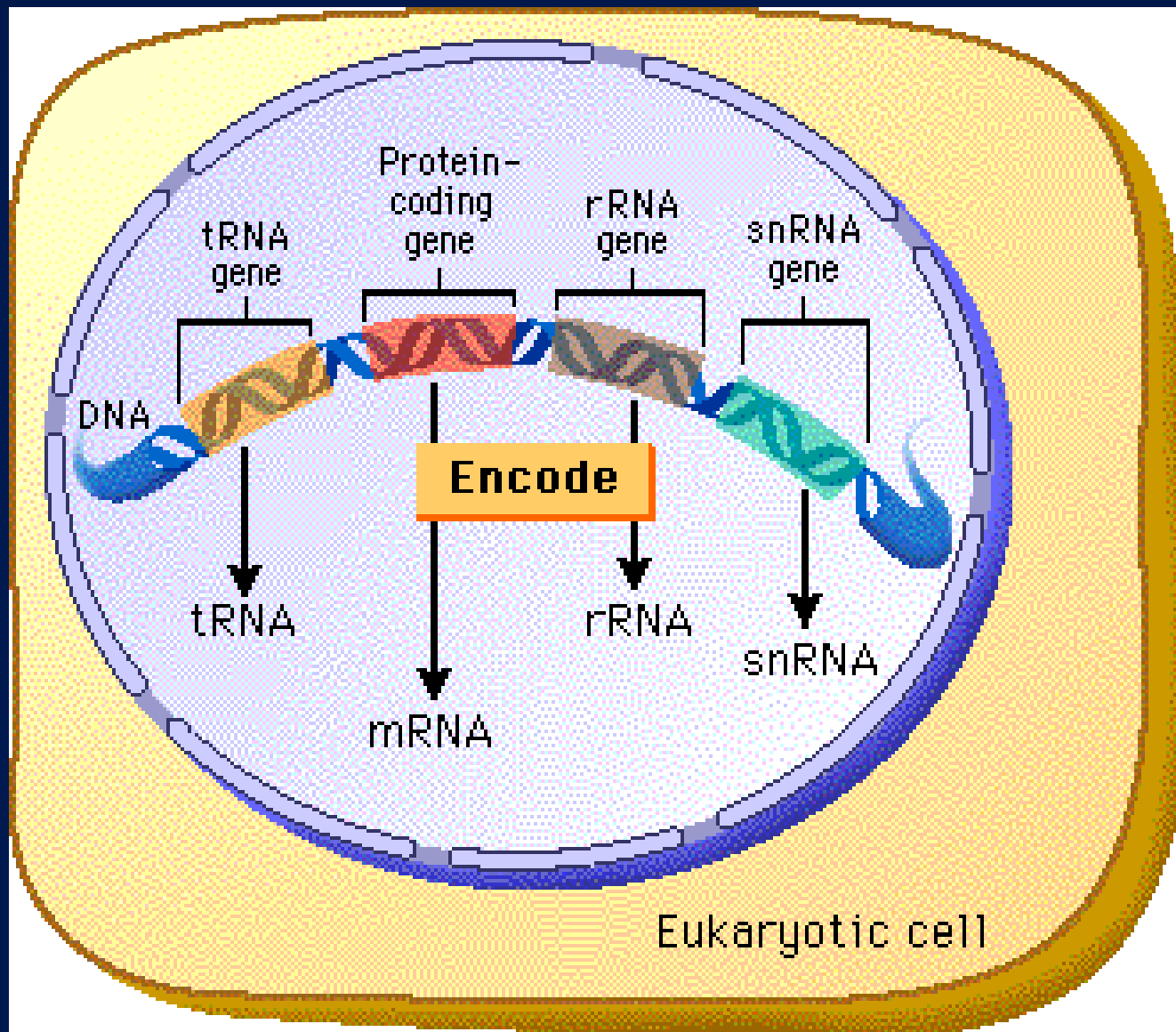
DNA → RNA → Protein:



II DNA

L'unità funzionale del DNA sono i geni

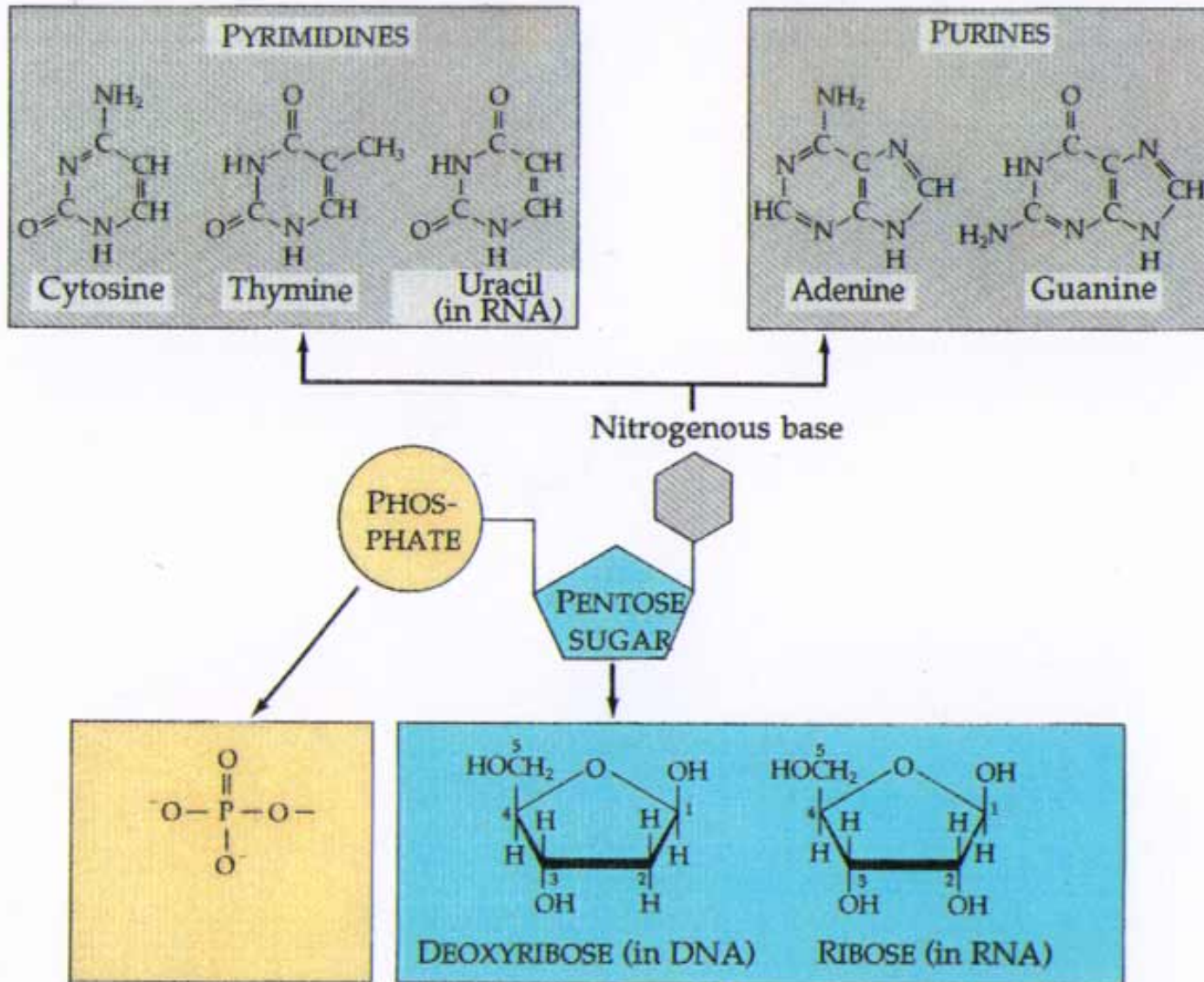




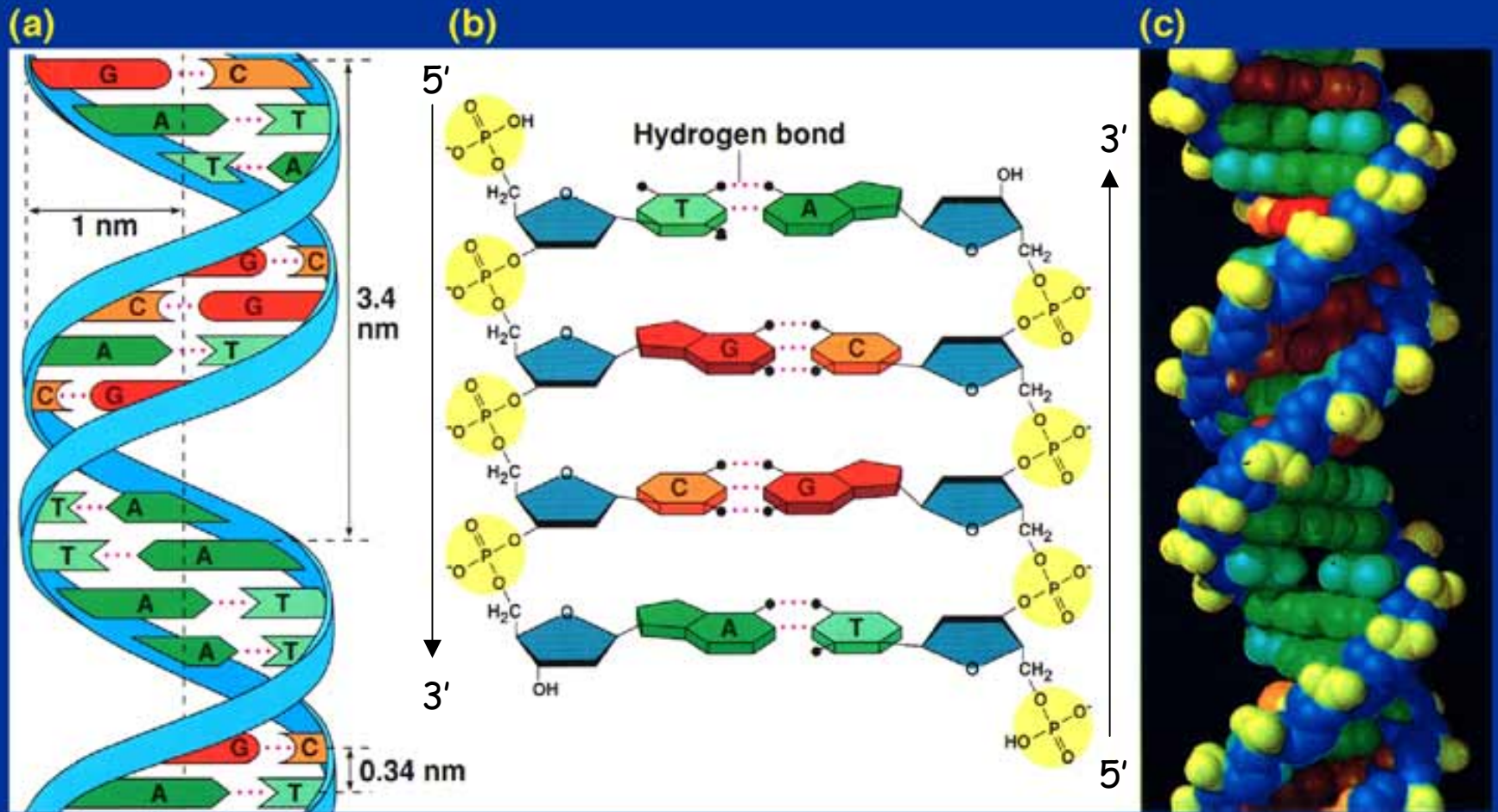
Quanto somigliano i loro geni ai nostri?

Un altro uomo	100%
Scimpanzè	98%
Topo	92%
Drosophila	44%
Lievito	26%
Piante	18%

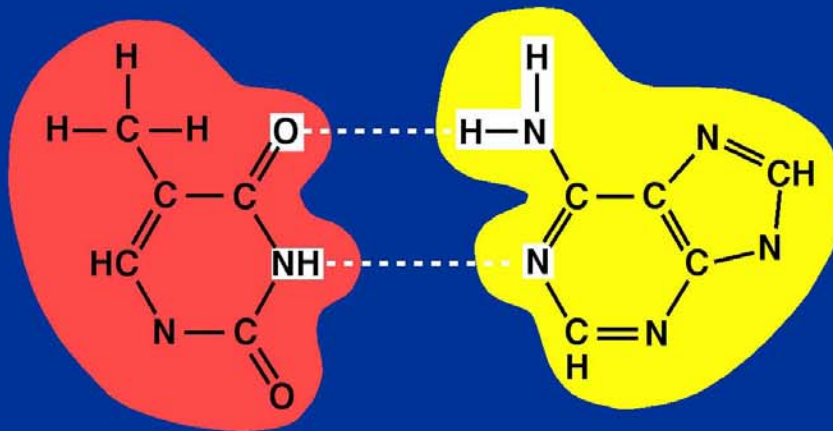
The Structure of a Nucleotide



La doppia elica del DNA

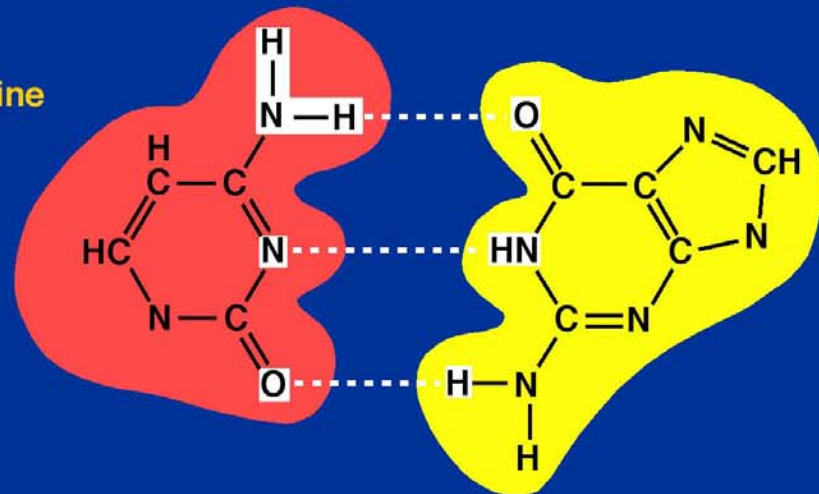


Gli accoppiamenti tra le basi azotate



Thymine

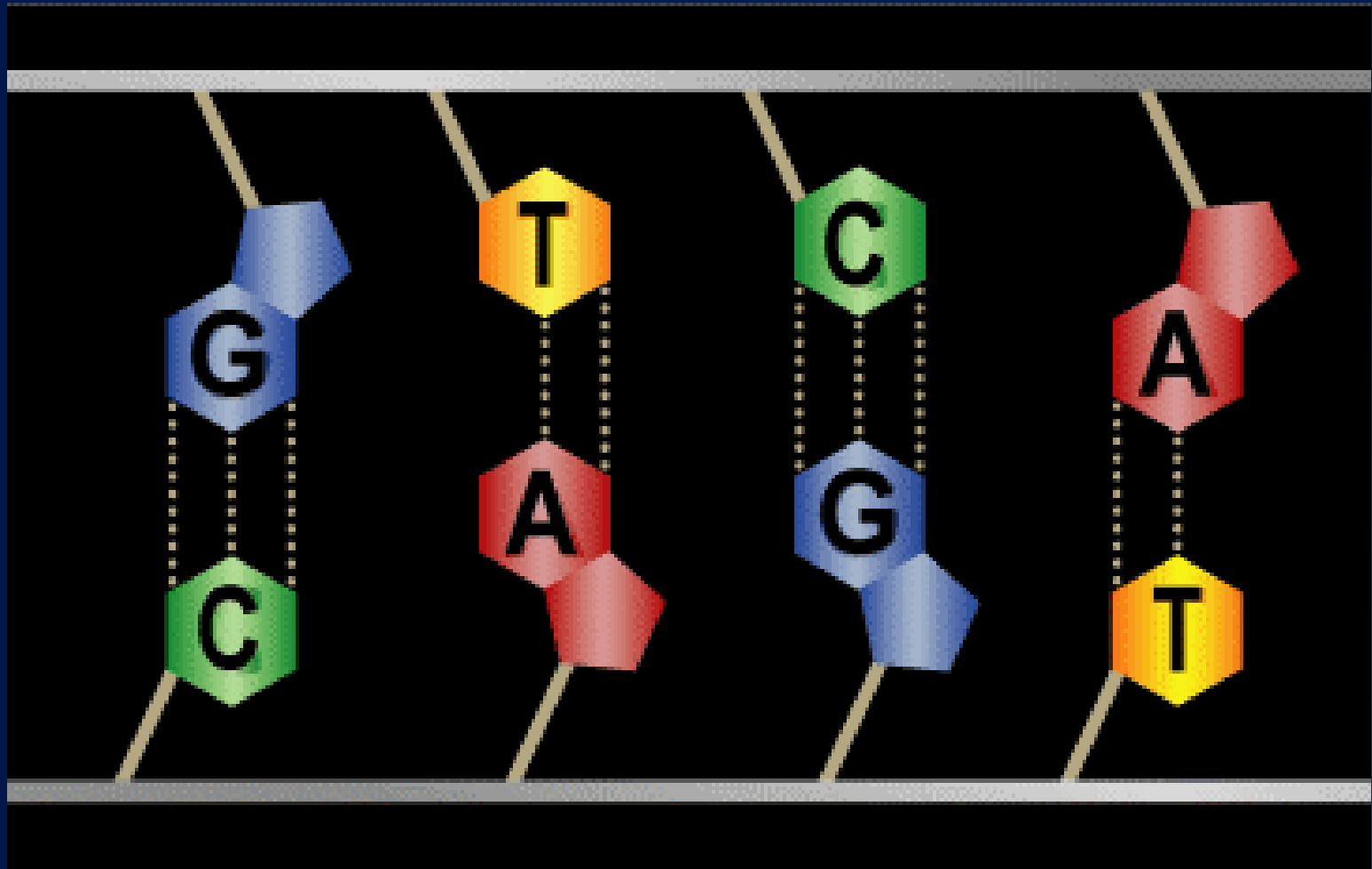
Adenine



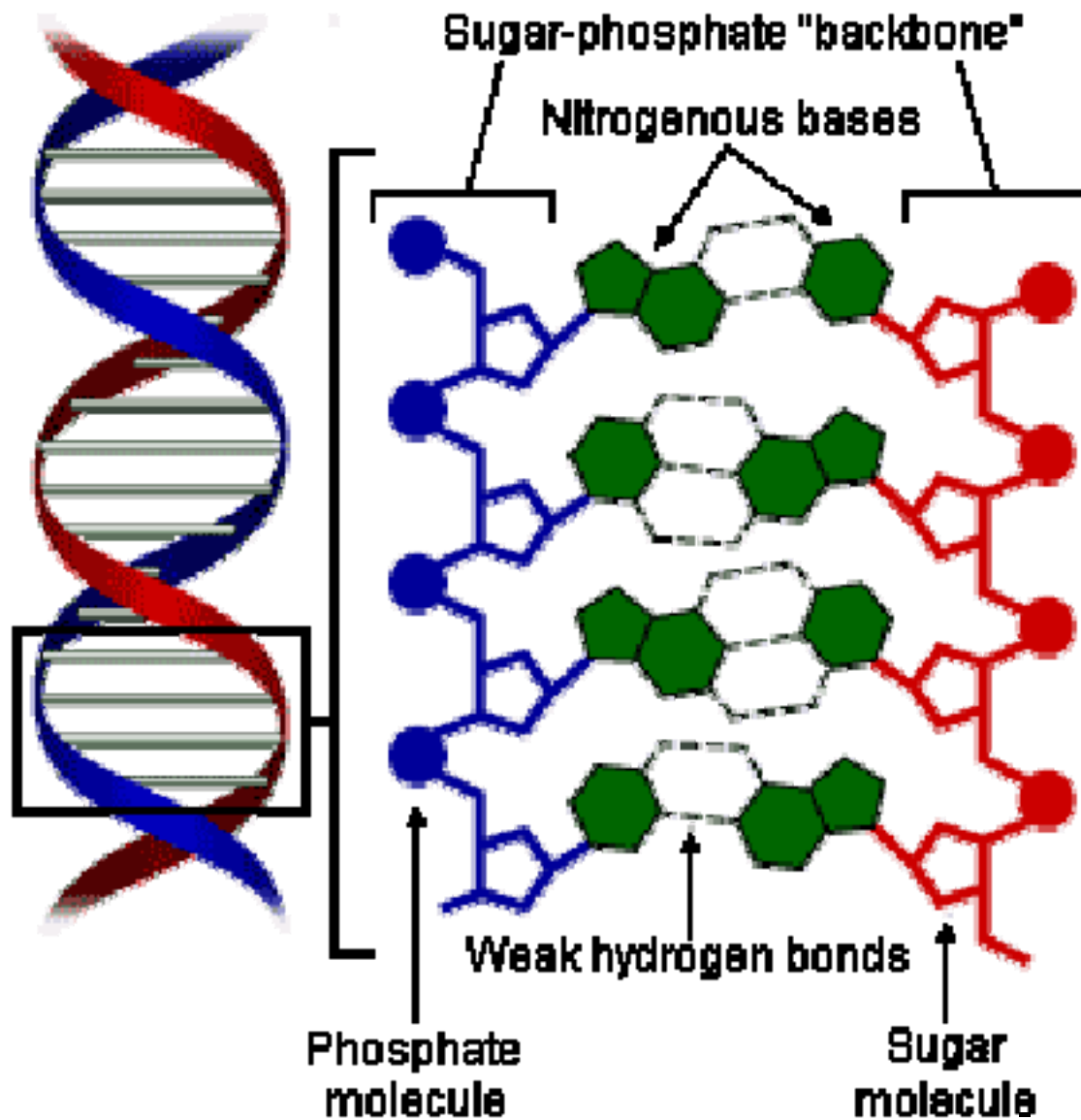
Cytosine

Guanine

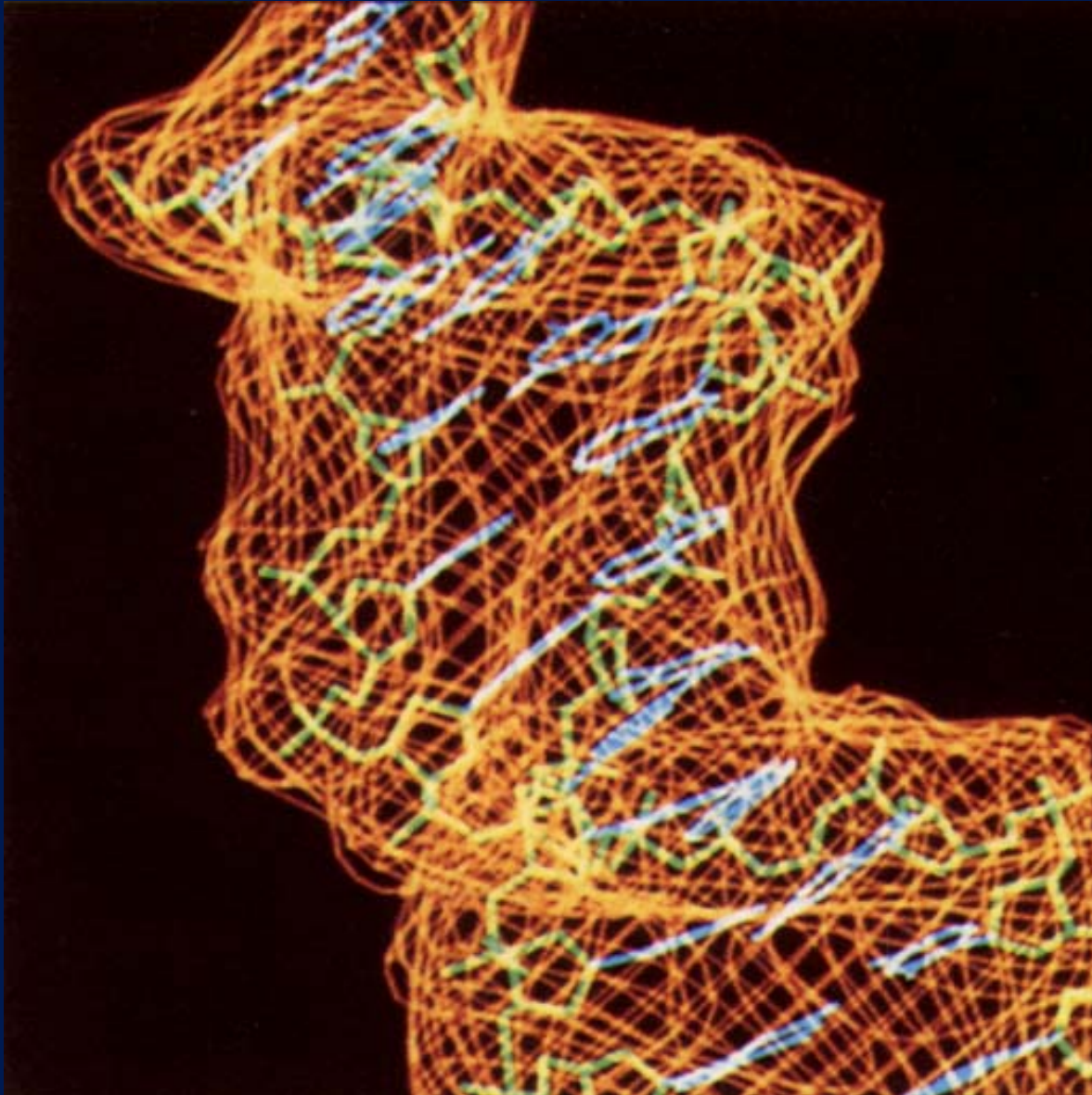
Gli accoppiamenti tra le basi azotate



La doppia elica del DNA



La doppia elica del DNA

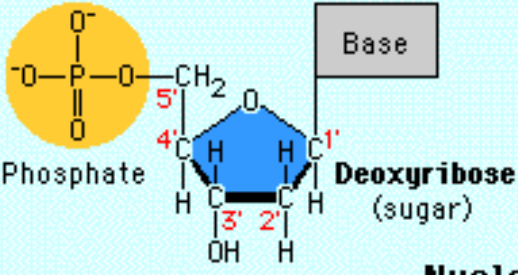
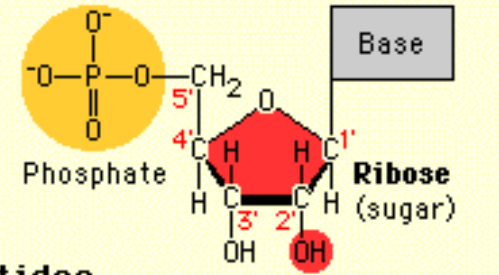
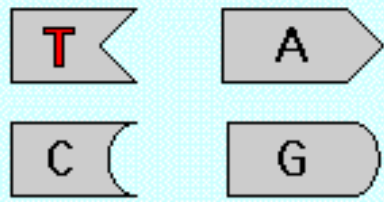
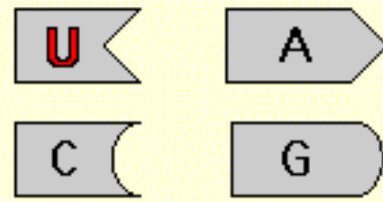
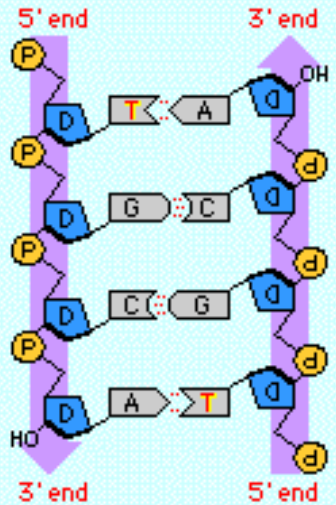
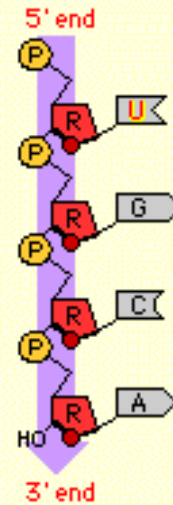


**JAMES WATSON AND FRANCIS CRICK WITH THEIR
MODEL OF DNA (THE DOUBLE HELIX) IN 1953**



L'RNA

DNA vs RNA

DNA	RNA
 Phosphate Base Deoxyribose (sugar)	 Phosphate Base Ribose (sugar)
Nucleotides	
Pyrimidines Purines  T A C G	Pyrimidines Purines  U A C G
Bases	
 5' end 3' end P D T A G C OH HO	 5' end 3' end P R U G C A HO
Polynucleotides	

Le proteine

Type of Protein

Function

Examples

Structural proteins

Support

COLLAGEN and ELASTIN: tendons and ligaments; KERATIN: hair, horns, feathers, quills.

Storage proteins

Storage of amino acids

OVALBUMIN: egg white; CASEIN: milk; plants store PROTEINS transport molecules across cell membranes.

Transport proteins

Transport of other substances

HEMOGLOBIN: iron-containing transports oxygen; OTHER PROTEINS transport molecules across cell membranes

Hormonal proteins

Cordination of bodily activities

INSULIN: a pancreas hormone regulates blood sugar.

Receptor proteins

Response of cell to chemical

RECEPTORS in nerve cell membranes to detect chemical signals

Contractile proteins

Movement

ACTIN and MYOSIN: movement of muscles. CONTRACTILE PROTEINS: undulations of cilia and flagella

Defensive proteins

Protection against disease

ANTIBODIES combat bacteria and viruses.

Enzymatic proteins

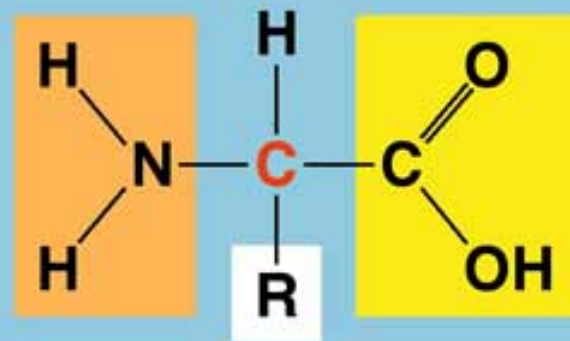
Acceleration of chemical reactions

DIGESTIVE ENZYMES hydrolyze the polymers in food.

THE PRIMARY STRUCTURE OF A PROTEIN



Amminoacido



Amino
group

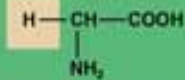
Carboxyl
group



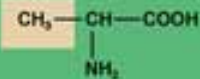
THE AMINO ACIDS COMMONLY FOUND IN PROTEINS

NONPOLAR

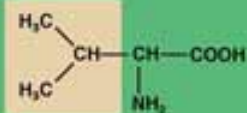
Glycine (Gly)



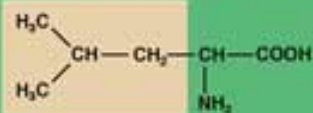
Alanine (Ala)



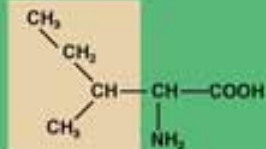
Valine (Val)



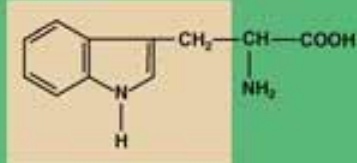
Leucine (Leu)



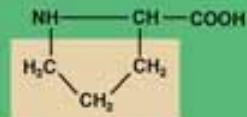
Isoleucine (Ile)



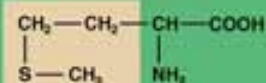
Tryptophan (Trp)



Proline (Pro)

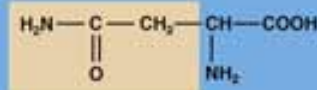


Methionine (Met)

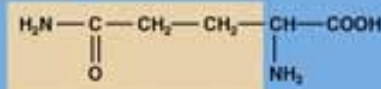


POLAR

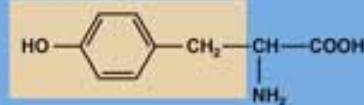
Asparagine (Asn)



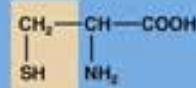
Glutamine (Gln)



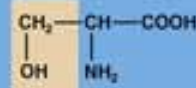
Tyrosine (Tyr)



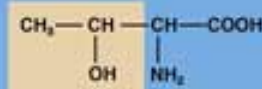
Cysteine (Cys)



Serine (Ser)



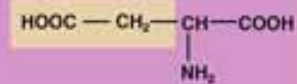
Threonine (Thr)



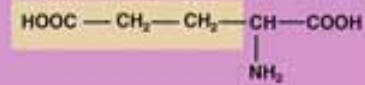
ELECTRICALLY CHARGED

Acidic

Aspartic acid (Asp)

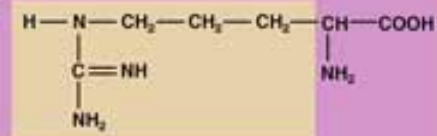


Glutamic acid (Glu)

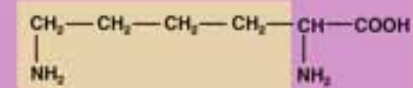


Basic

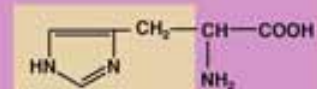
Arginine (Arg)



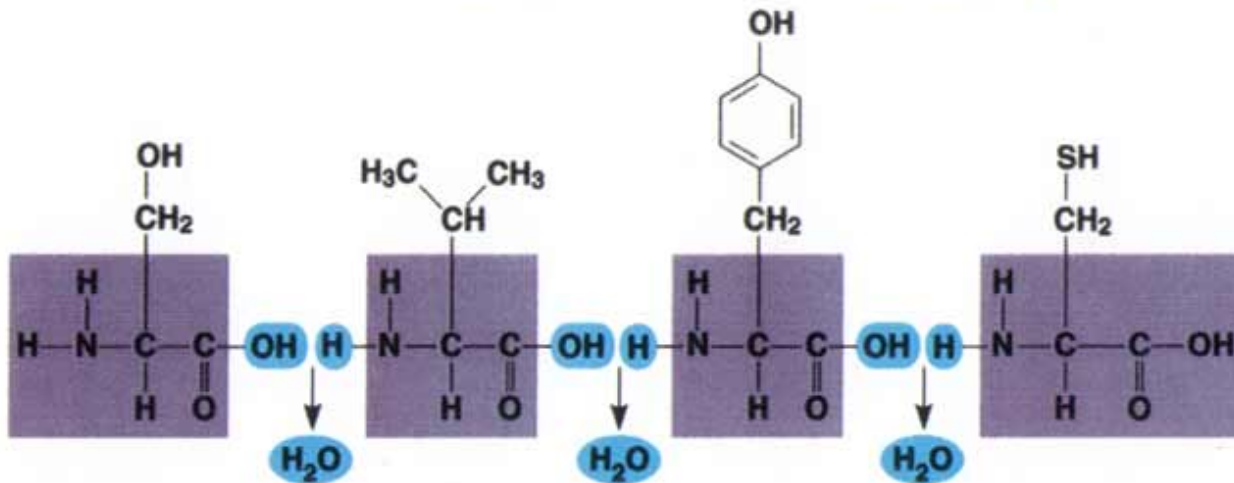
Lysine (Lys)



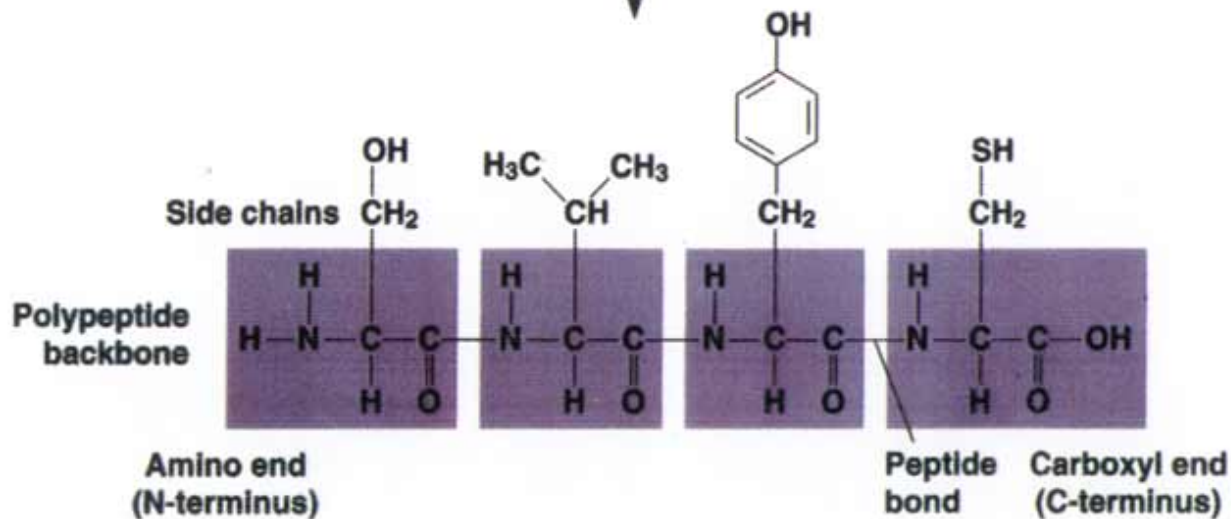
Histidine (His)



MAKING A POLYPEPTIDE CHAIN

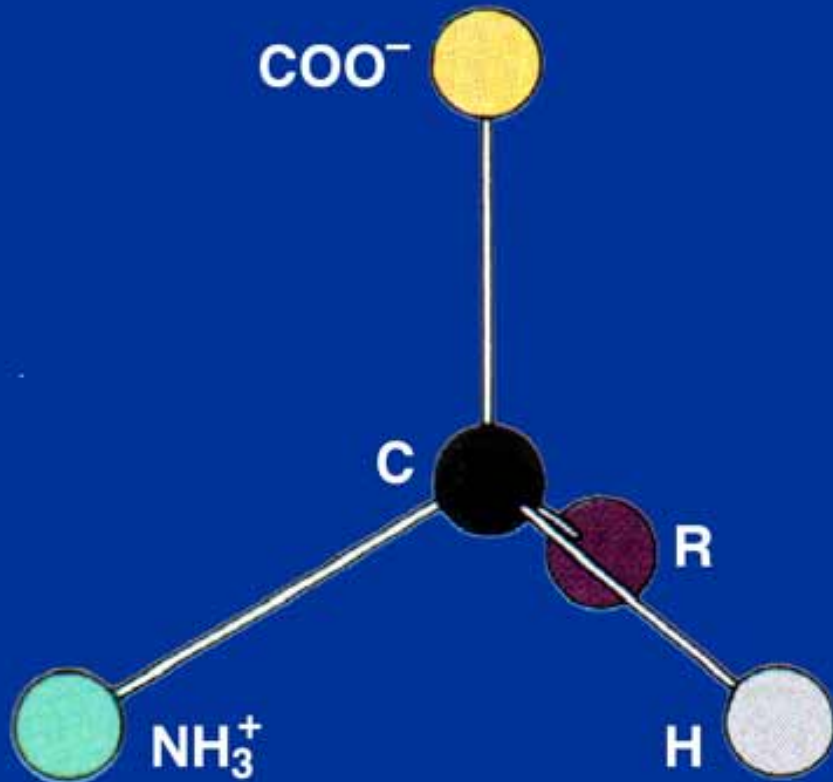


(a)

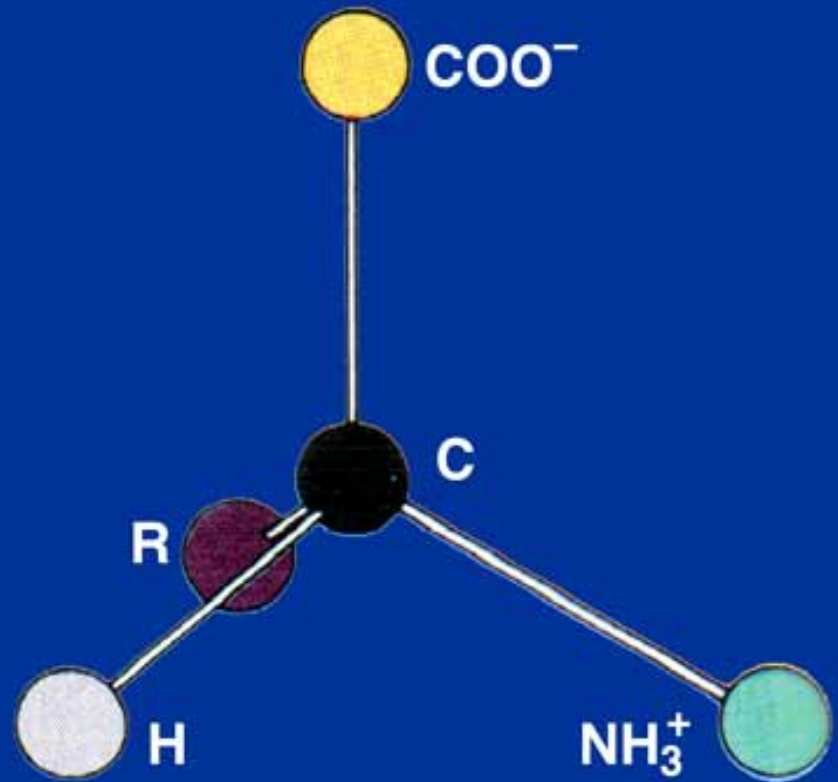


(b)

OPTICAL ISOMERS OF AMINO ACIDS



L-amino acid

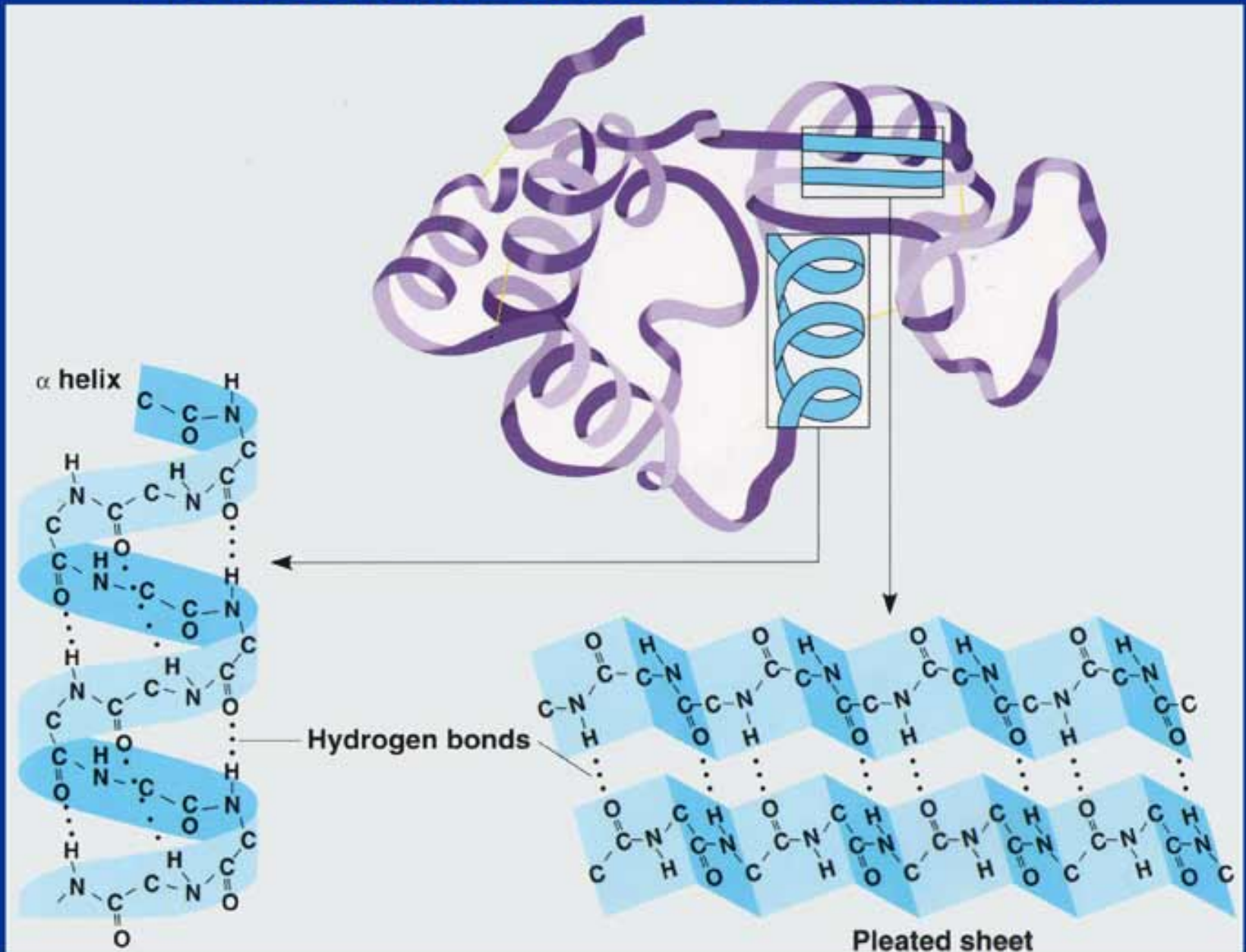


D-amino acid

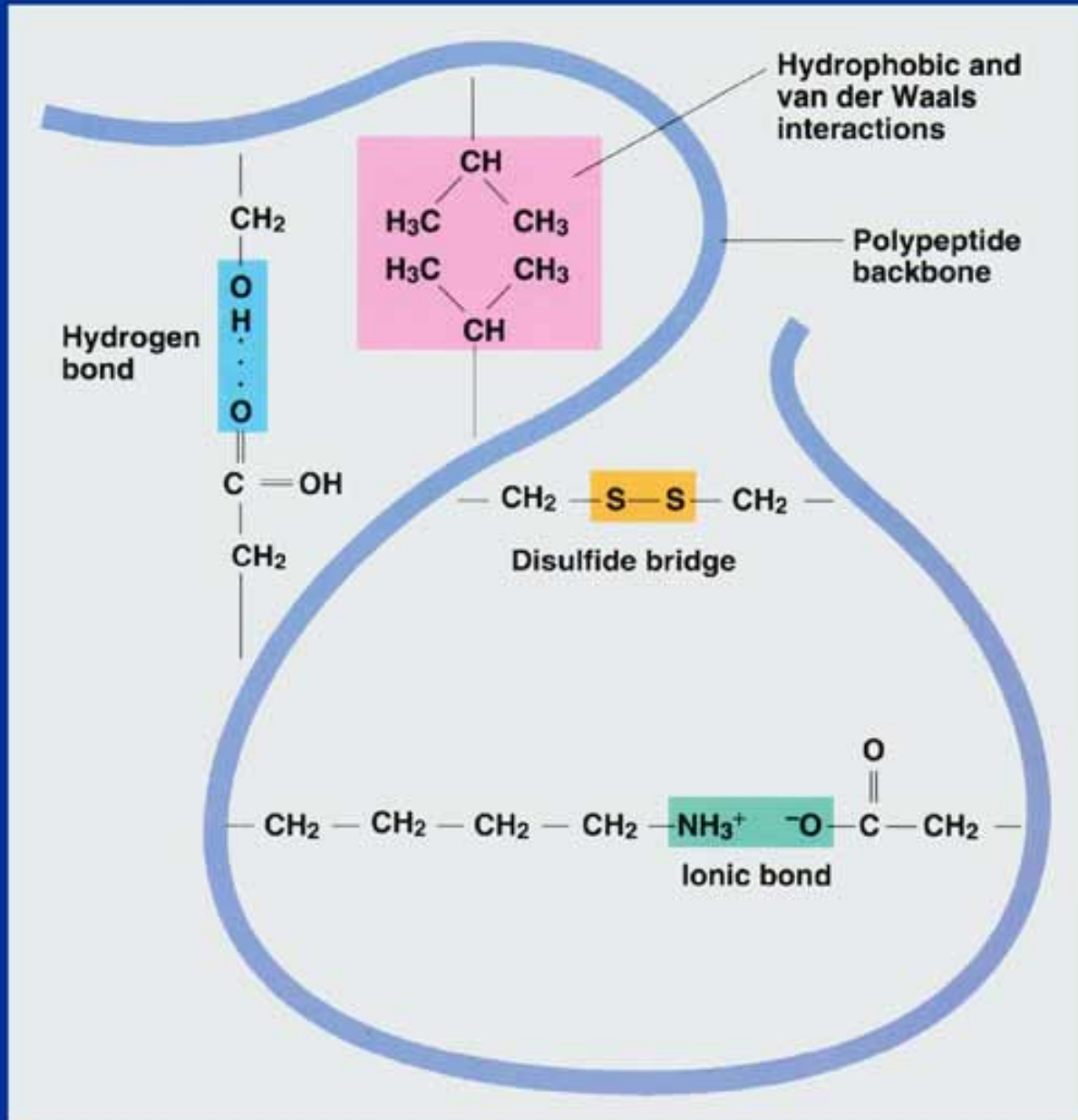
THE PRIMARY STRUCTURE OF A PROTEIN



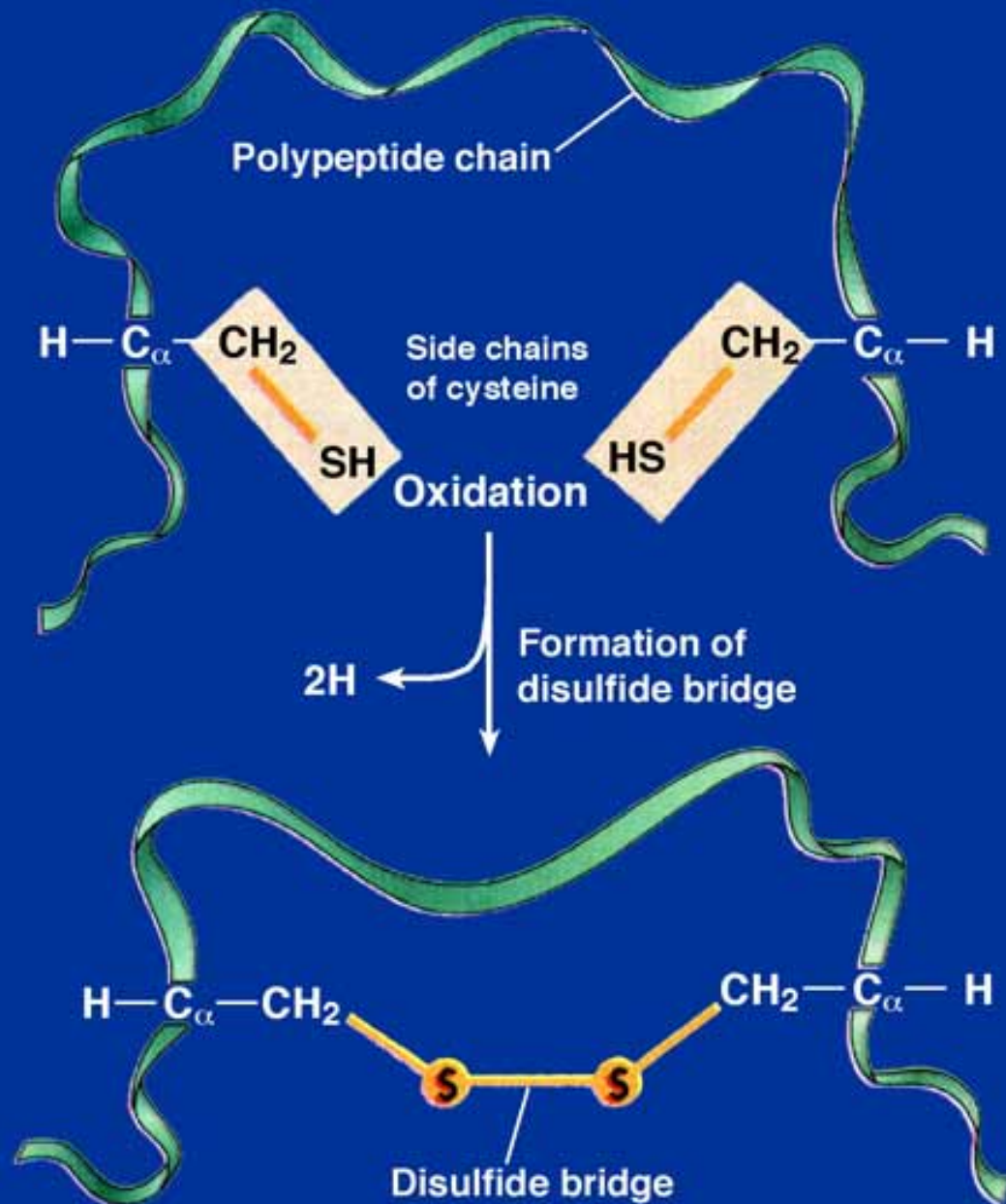
THE SECONDARY STRUCTURE OF A PROTEIN



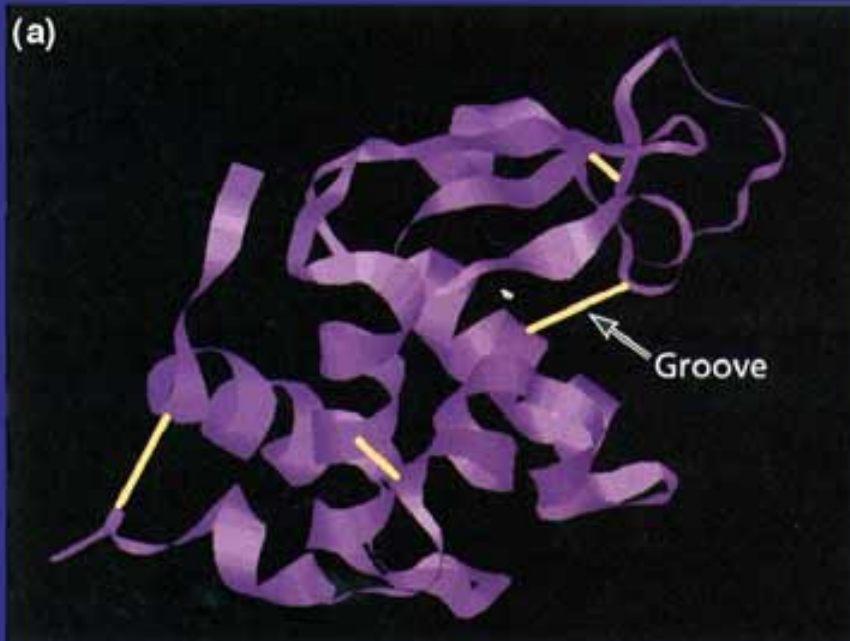
Examples of bonds contributing to the tertiary structure of a protein



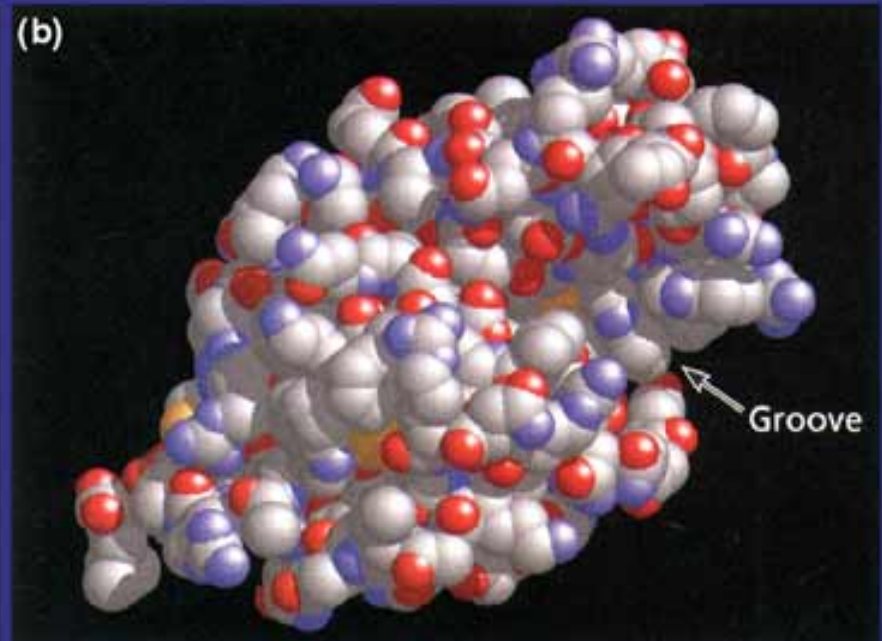
FORMATION OF A DISULFIDE BRIDGE



Conformation of a Protein, the Enzyme Lysozyme



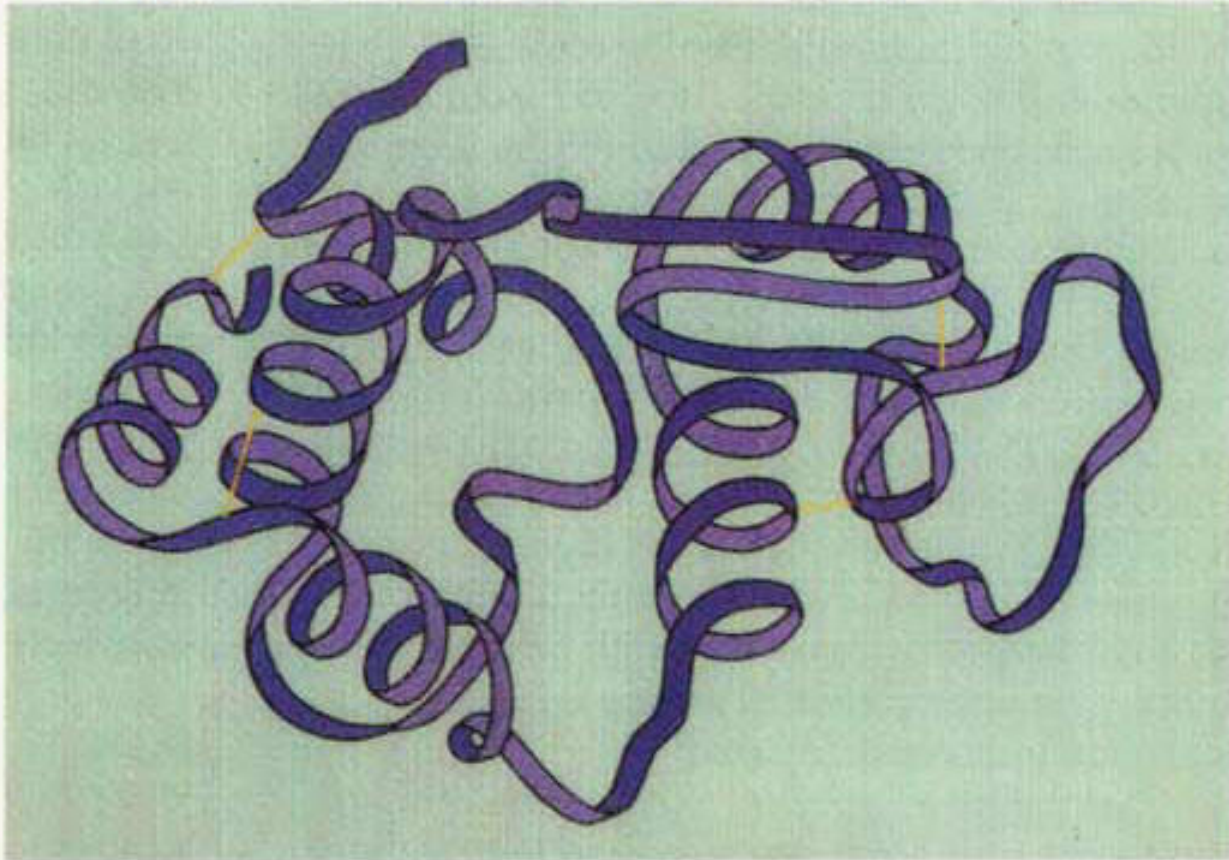
A ribbon model shows how the single polypeptide chain folds and coils to form the functional protein.



A space-filling model shows more clearly the globular shape seen in many proteins, as well as the specific conformation unique to lysozyme.



Native Confirmation of a Protein, then Disulfide Bonds Hold Shape

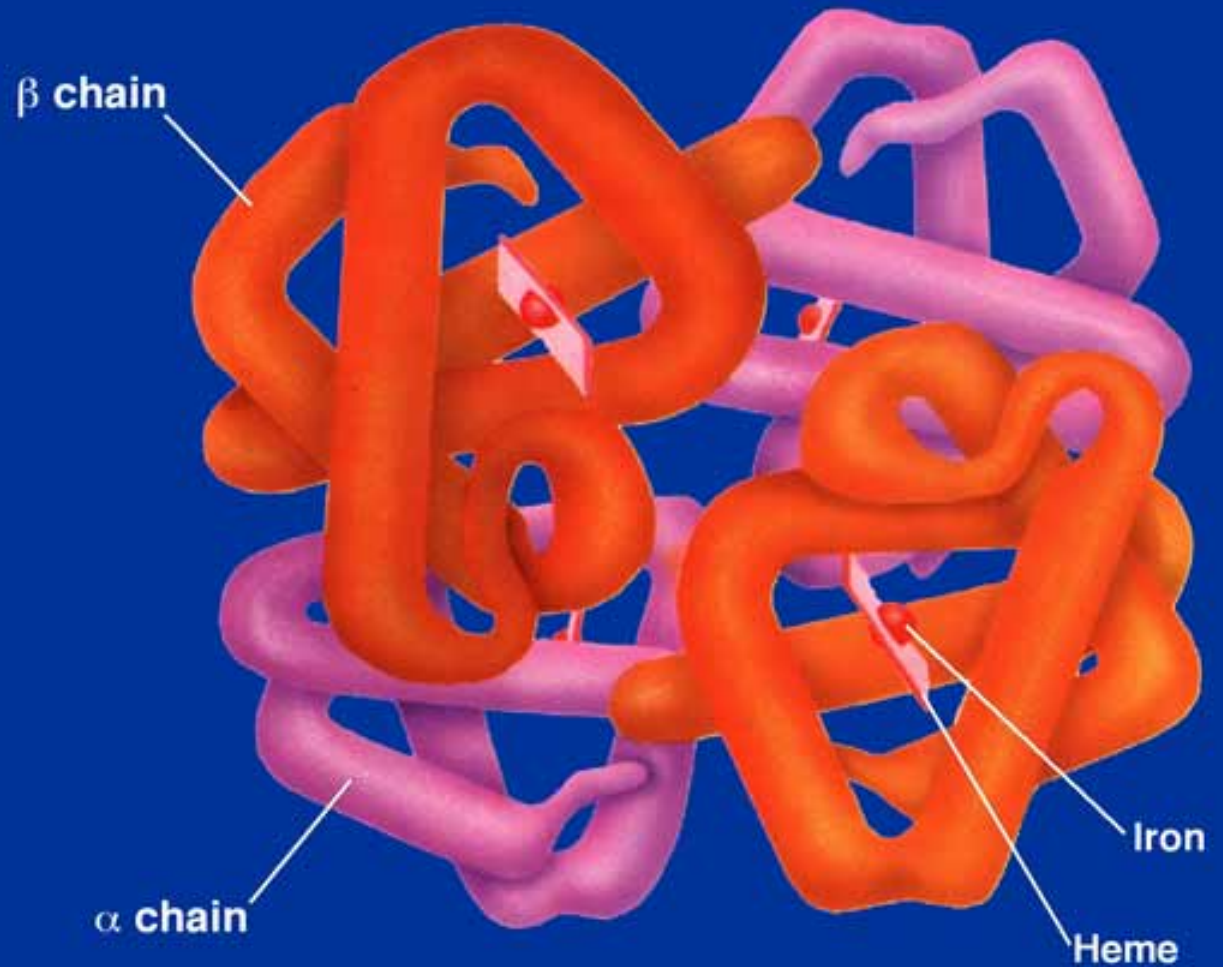


The polypeptide chain folds spontaneously into a specific shape.

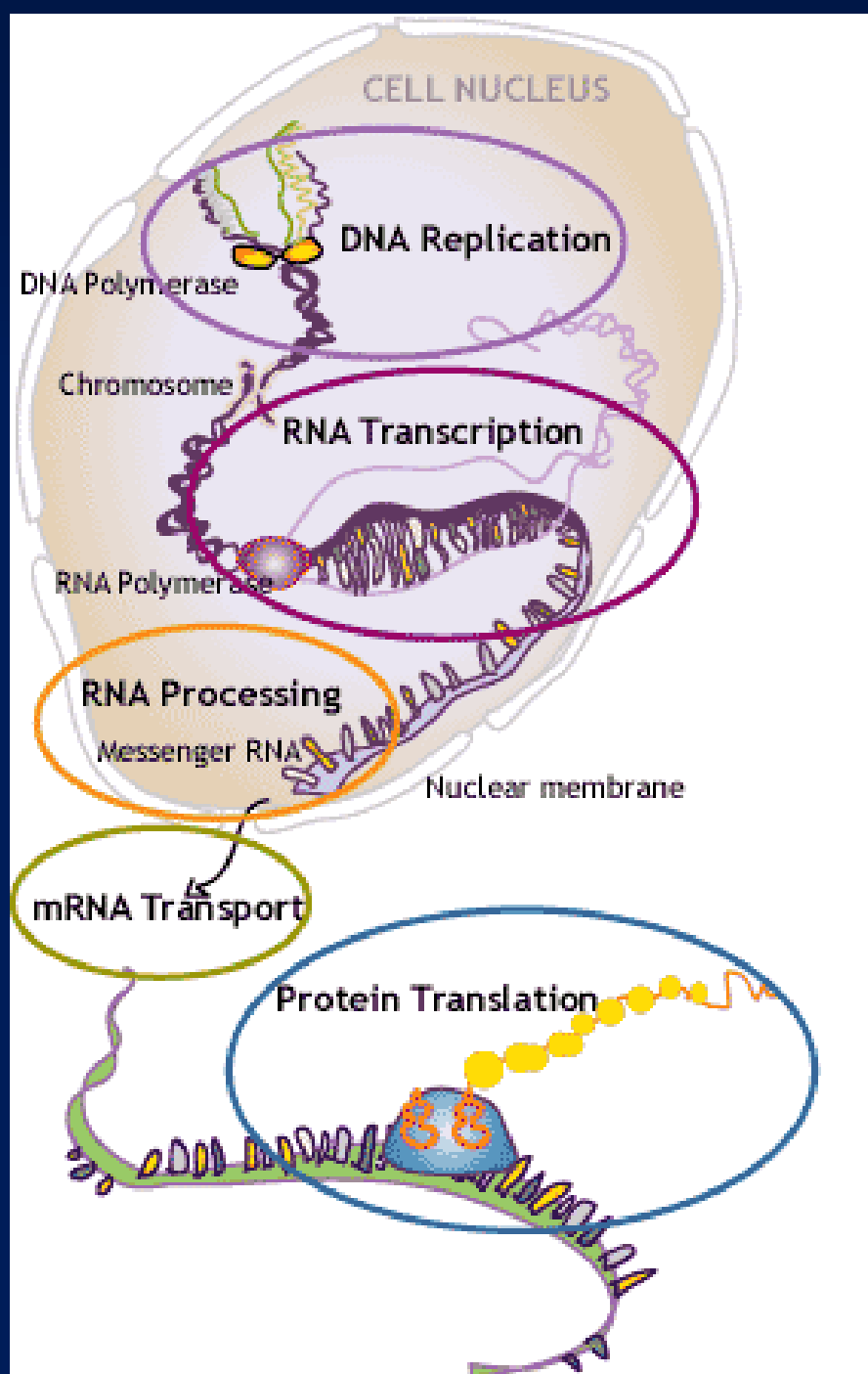
THE QUATERNARY STRUCTURE OF PROTEINS



(a) Collagen

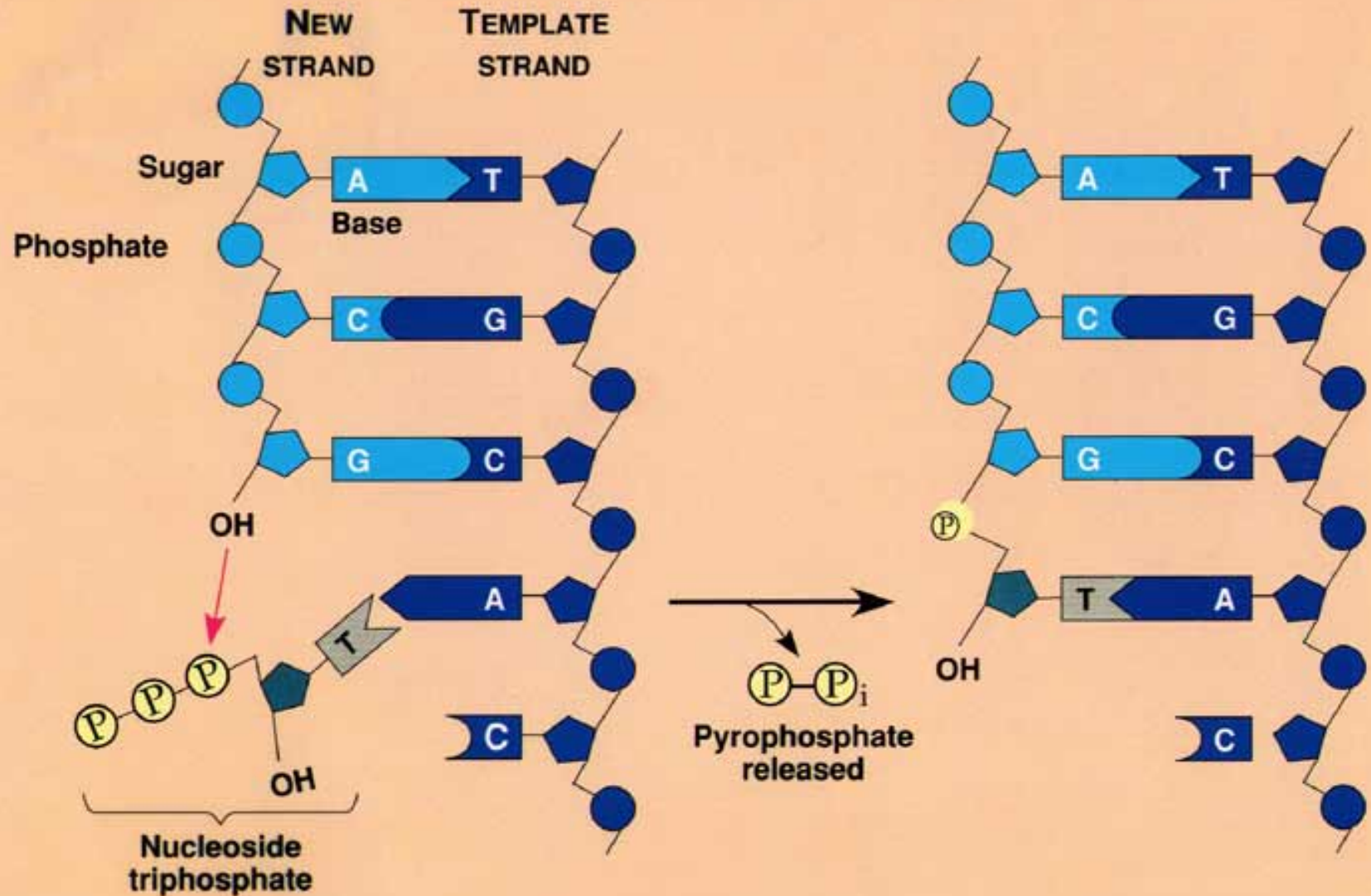


(b) Hemoglobin

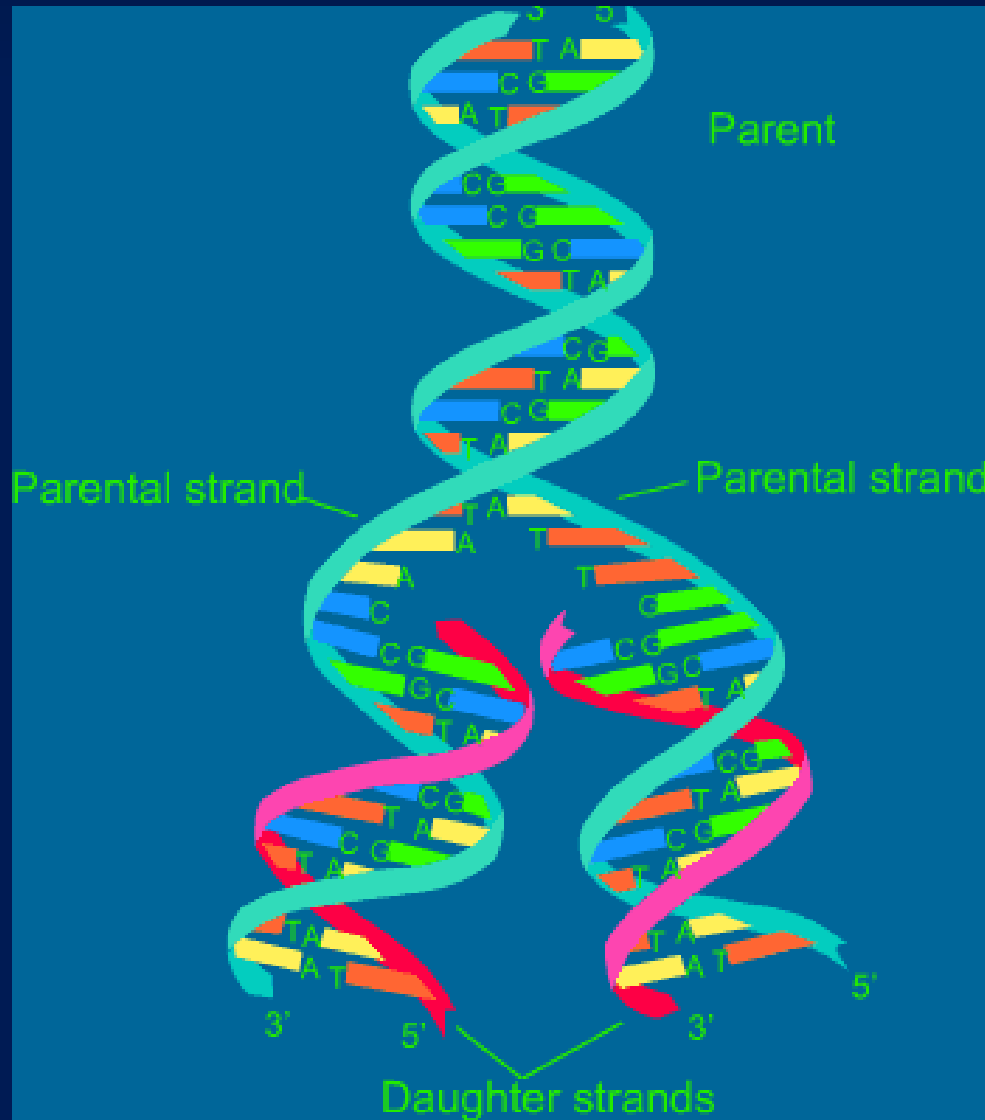


La replicazione del DNA

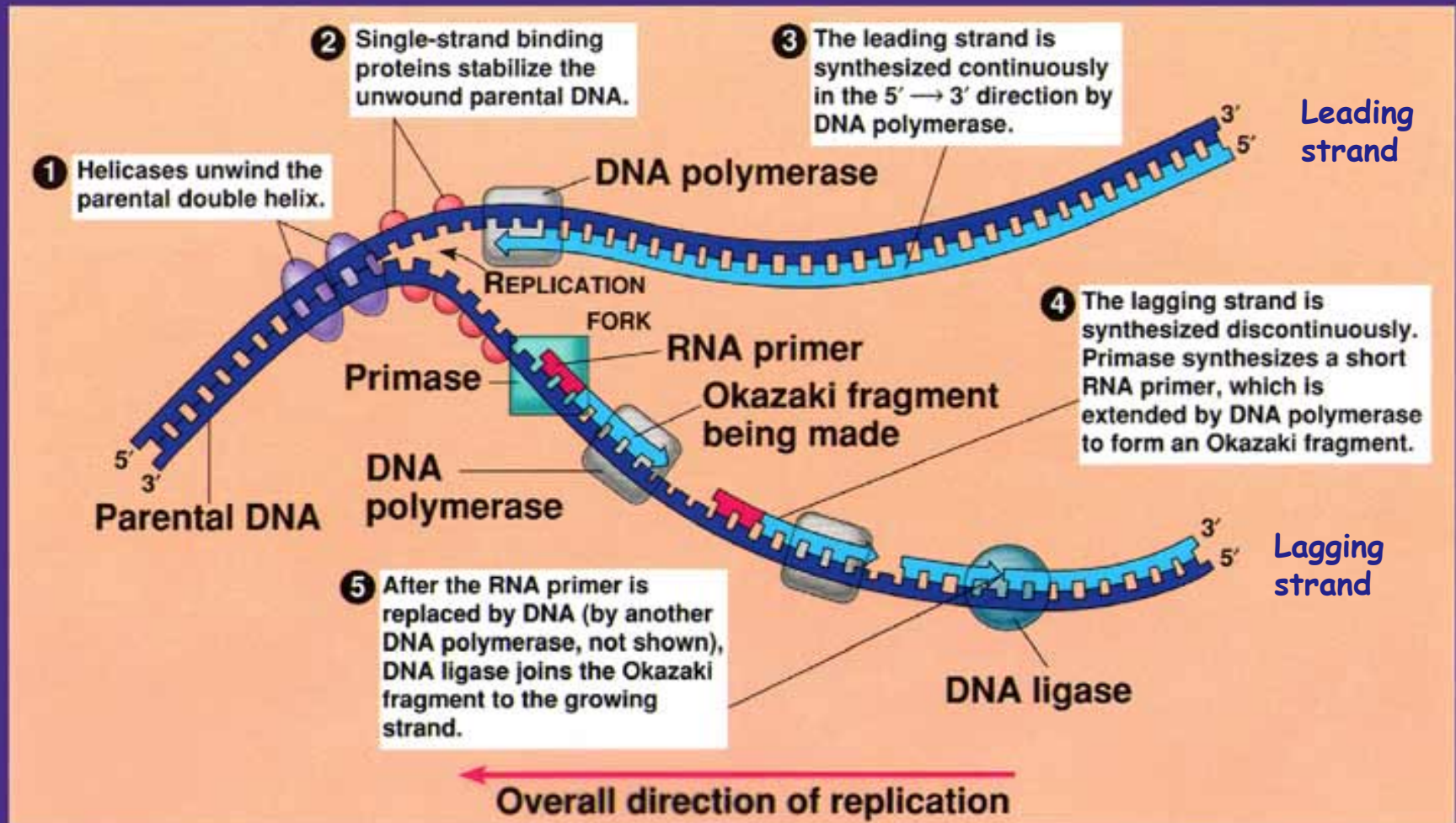
Incorporazione di un nucleotide in una catena di DNA



La replicazione del DNA è semiconservativa



A SUMMARY OF DNA REPLICATION



Trascrizione e
traduzione: dal
DNA alle proteine

Il codice genetico

1ª posizione (5' end)	2ª posizione				3ª posizione (3' end)
	U	C	A	G	
U	Phe F	Ser S	Tyr Y	Cys C	U
	Phe F	Ser S	Tyr Y	Cys C	C
	Leu L	Ser S	STOP	STOP	A
	Leu L	Ser S	STOP	Trp W	G
C	Leu L	Pro P	His H	Arg R	U
	Leu L	Pro P	His H	Arg R	C
	Leu L	Pro P	Gln Q	Arg R	A
	Leu L	Pro P	Gln Q	Arg R	G
A	Ile I	Thr T	Asn N	Ser S	U
	Ile I	Thr T	Asn N	Ser S	C
	Ile I	Thr T	Lys K	Arg R	A
	Met M	Thr T	Lys K	Arg R	G
G	Val V	Ala A	Asp D	Gly G	U
	Val V	Ala A	Asp D	Gly G	C
	Val V	Ala A	Glu E	Gly G	A
	Val V	Ala A	Glu E	Gly G	G

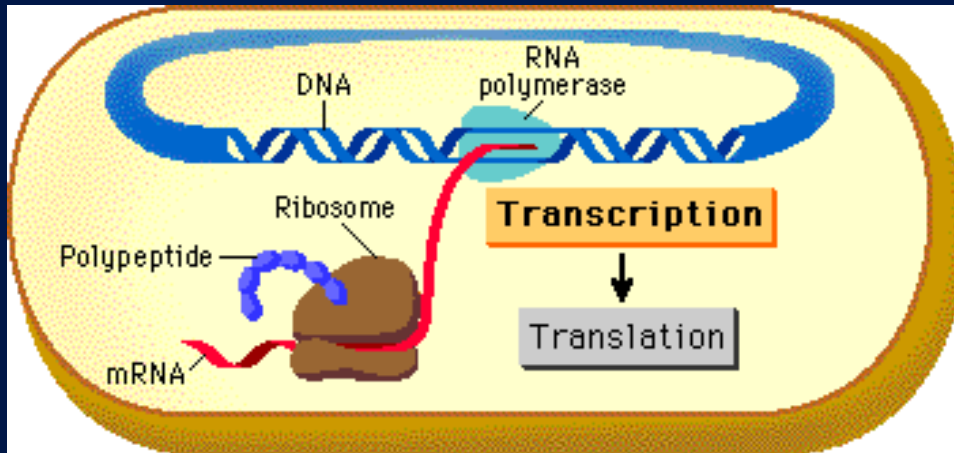
1 codone

2 codoni

3 codoni

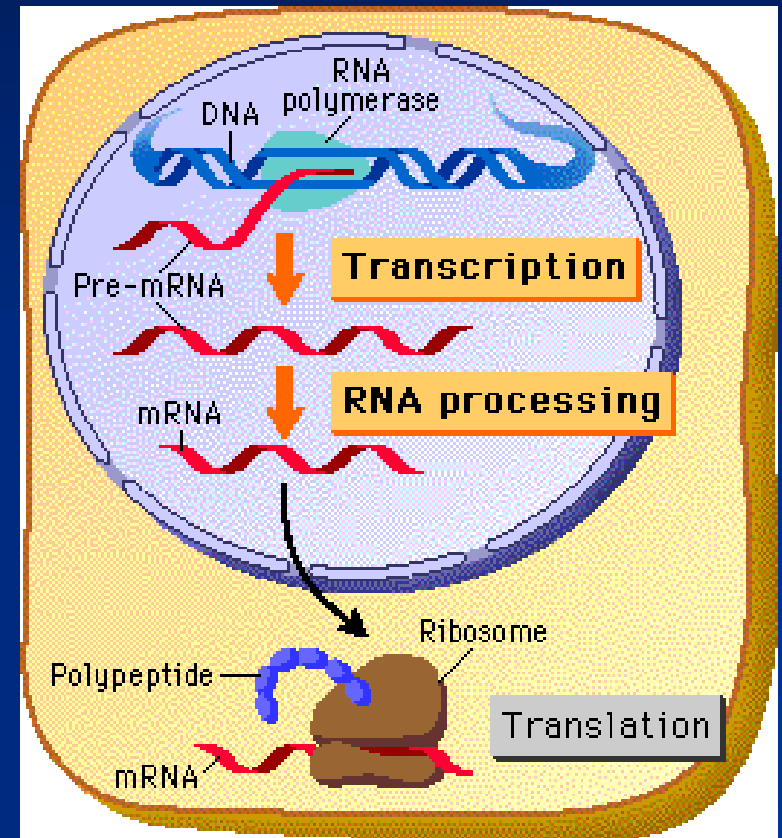
4 codoni

6 codoni



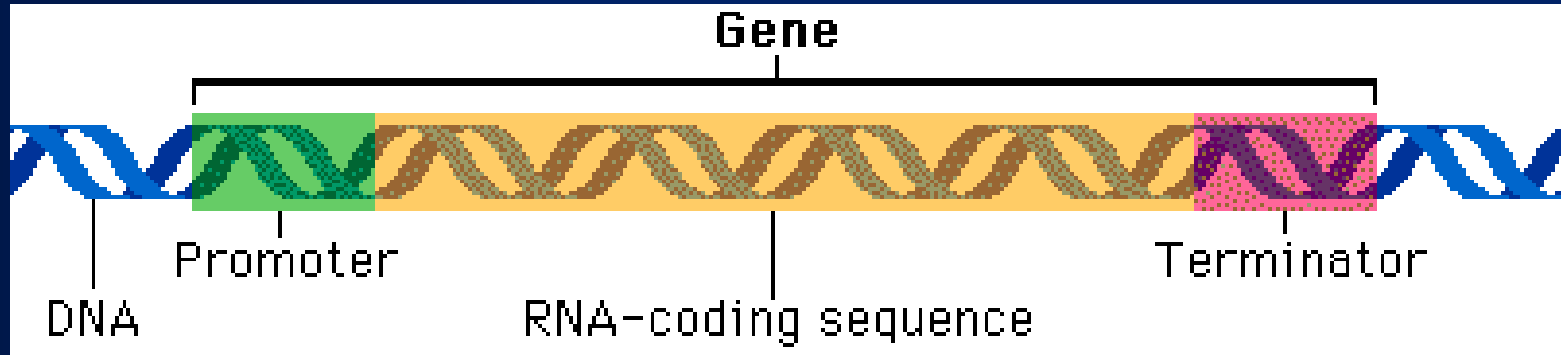
nei procarioti

negli eucarioti



La trascrizione

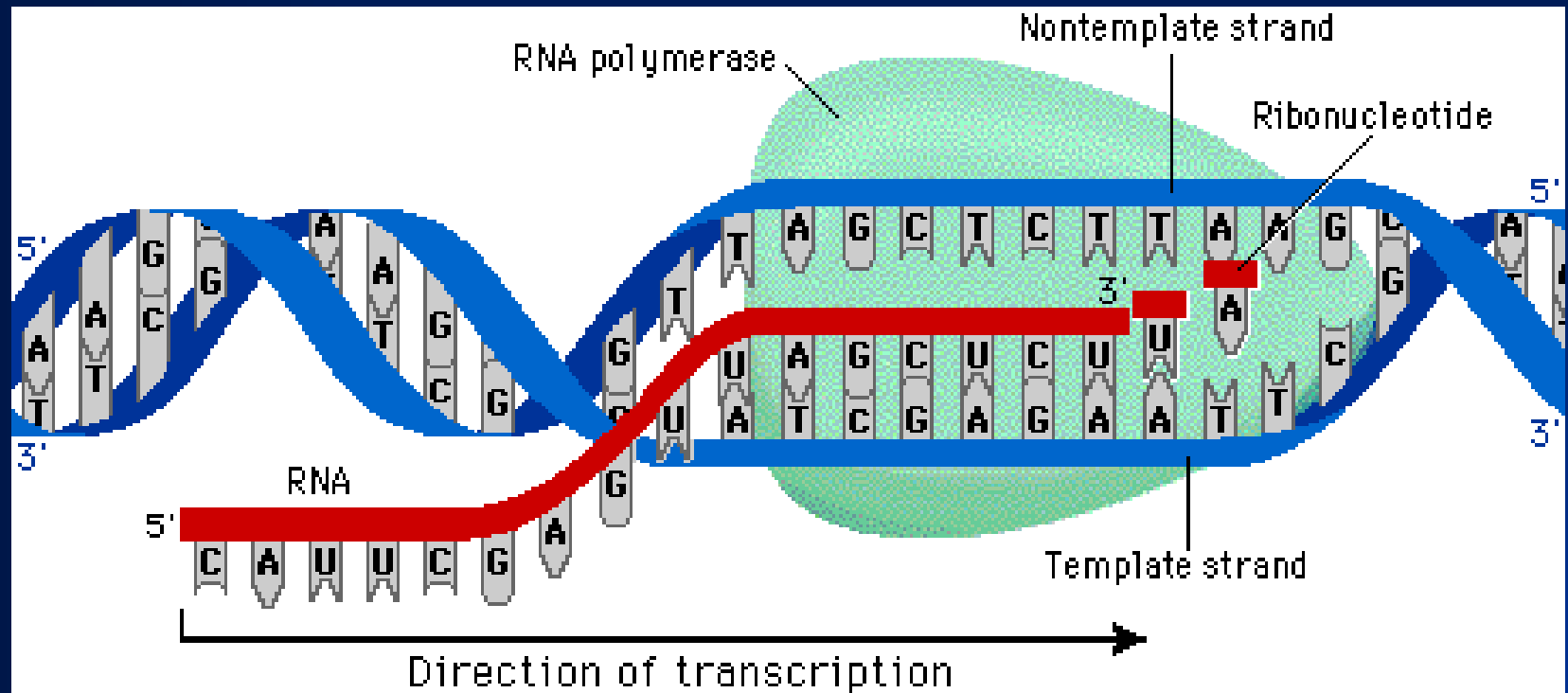
La struttura base di un gene



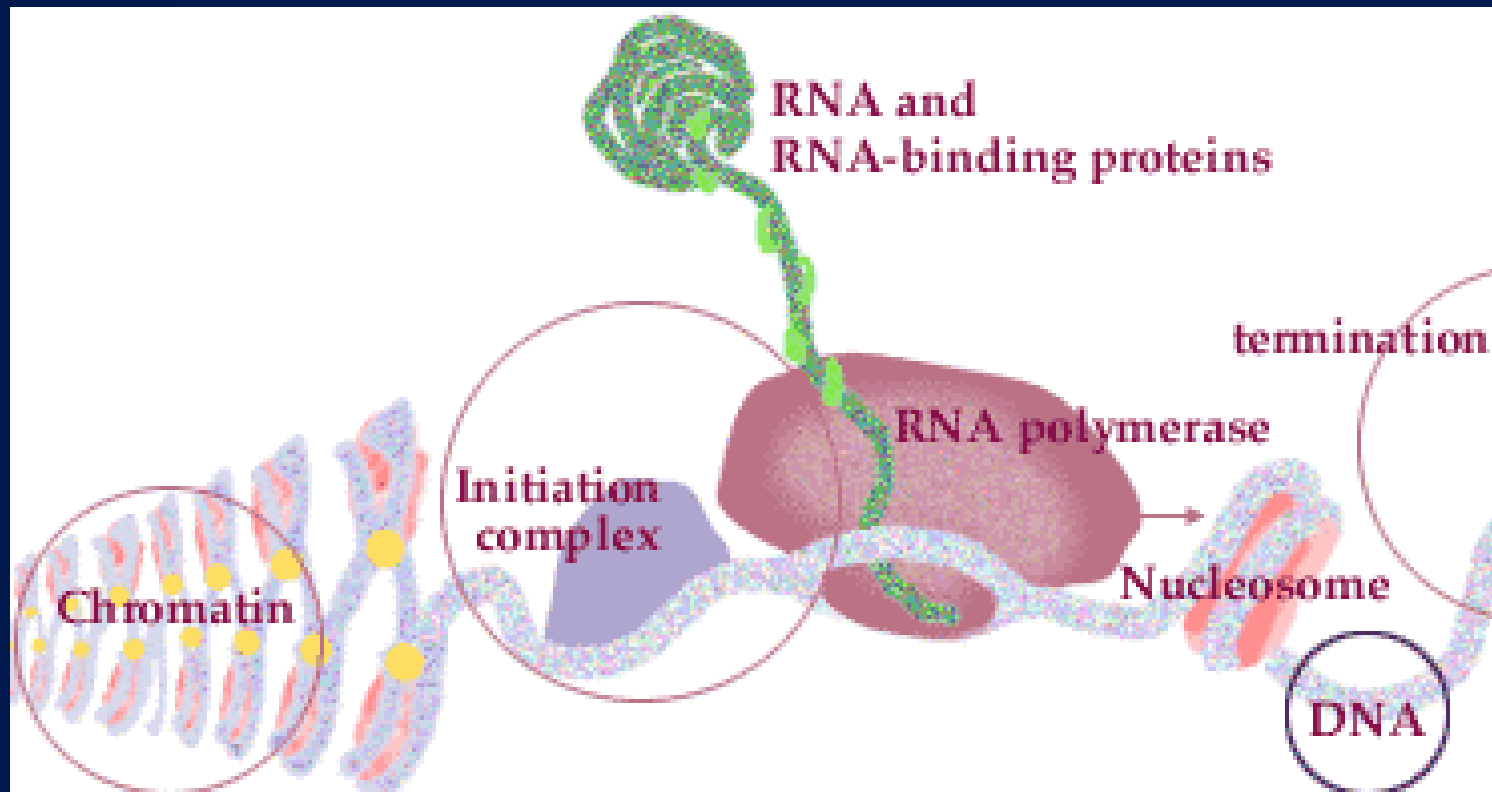
La trascrizione



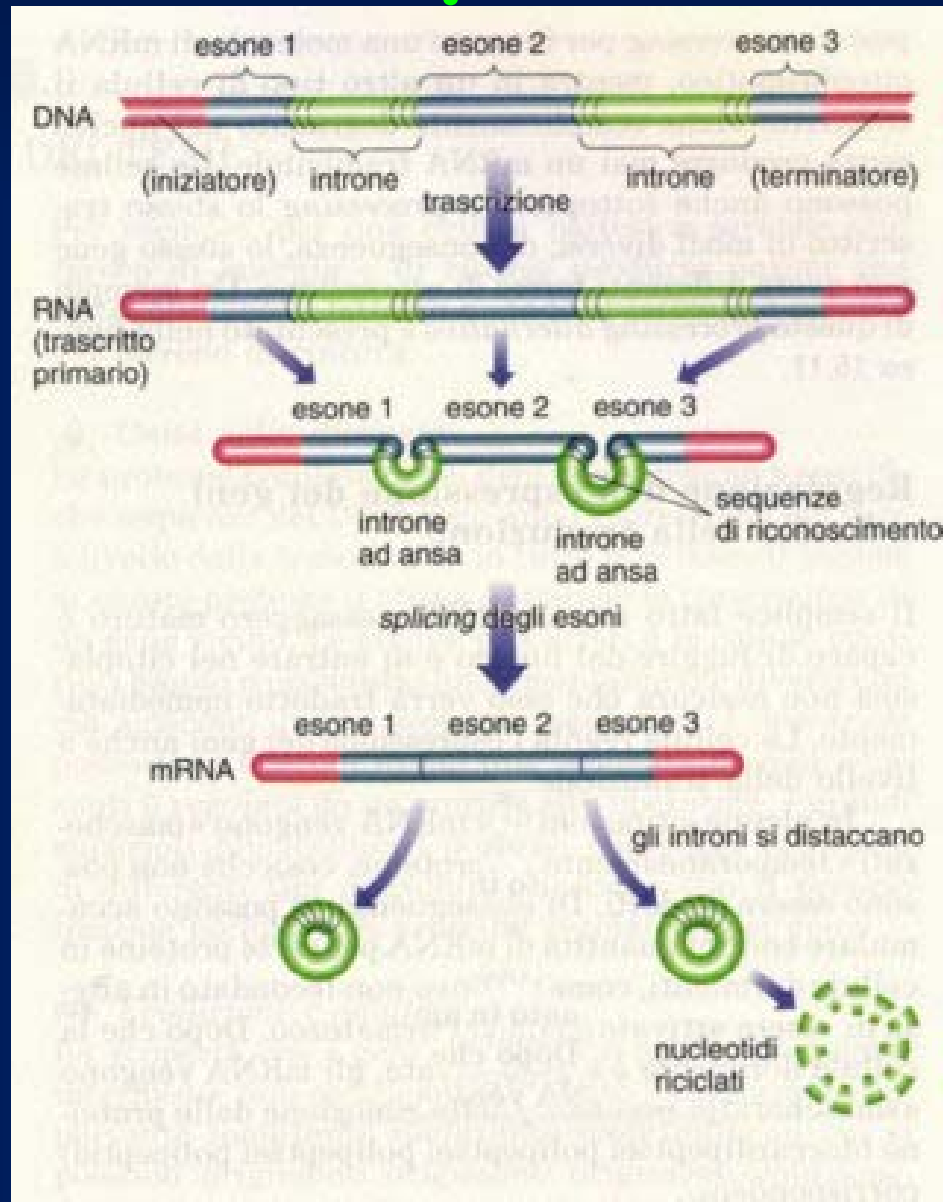
La trascrizione

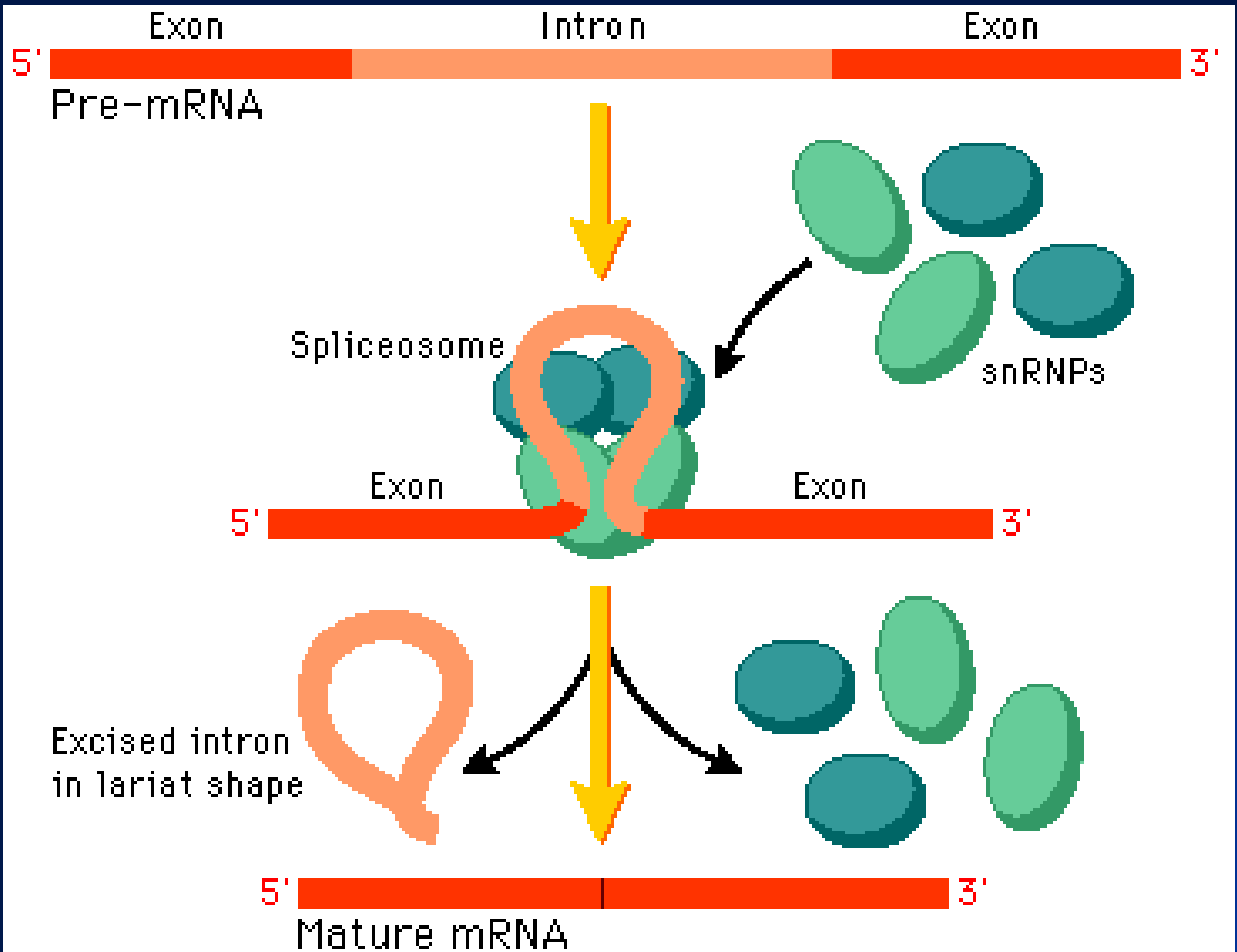


La trascrizione



Pre-mRNA processing





chain of amino acids →

Initiation

Elongation

Termination

mRNA →

codon ↑



tRNA

ribosome

stop
codon

CUC EAG AUG GUU

Leu
Gln
Met
Val

Gly
Arg
Val

GGA AGG GUU UAA

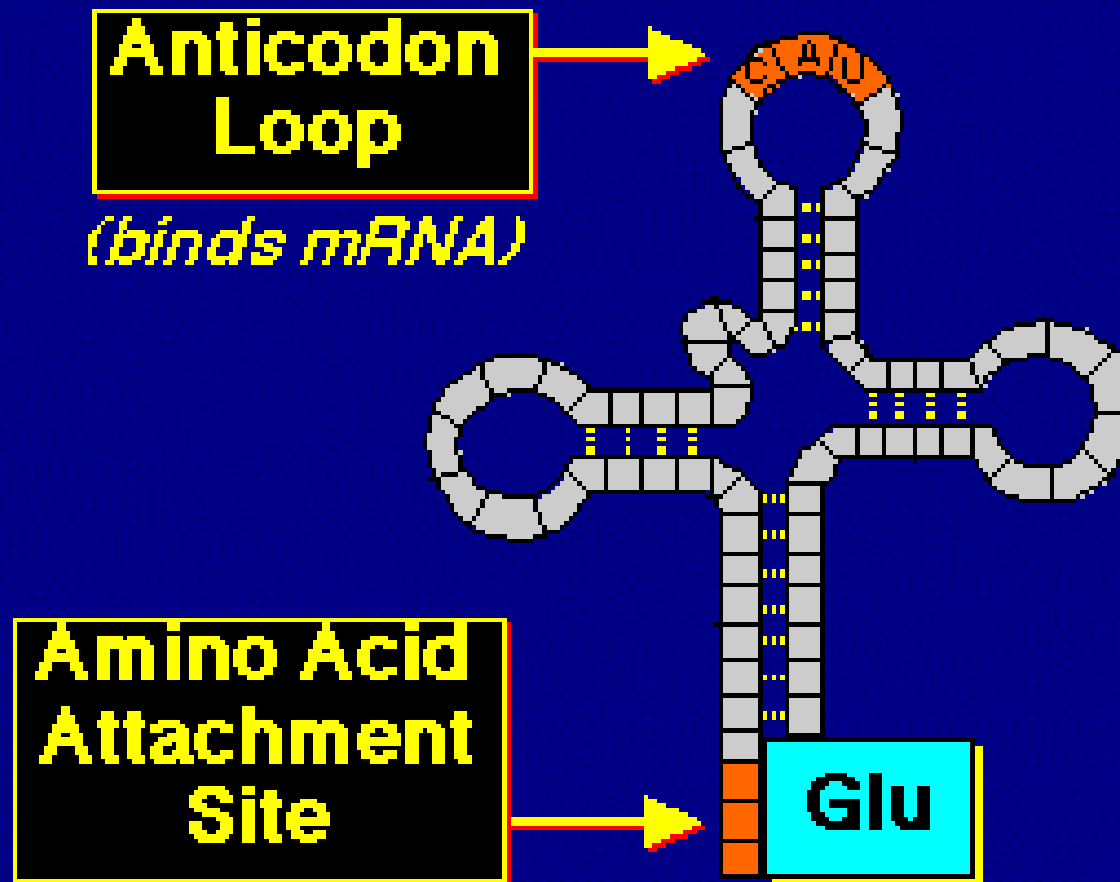
P A

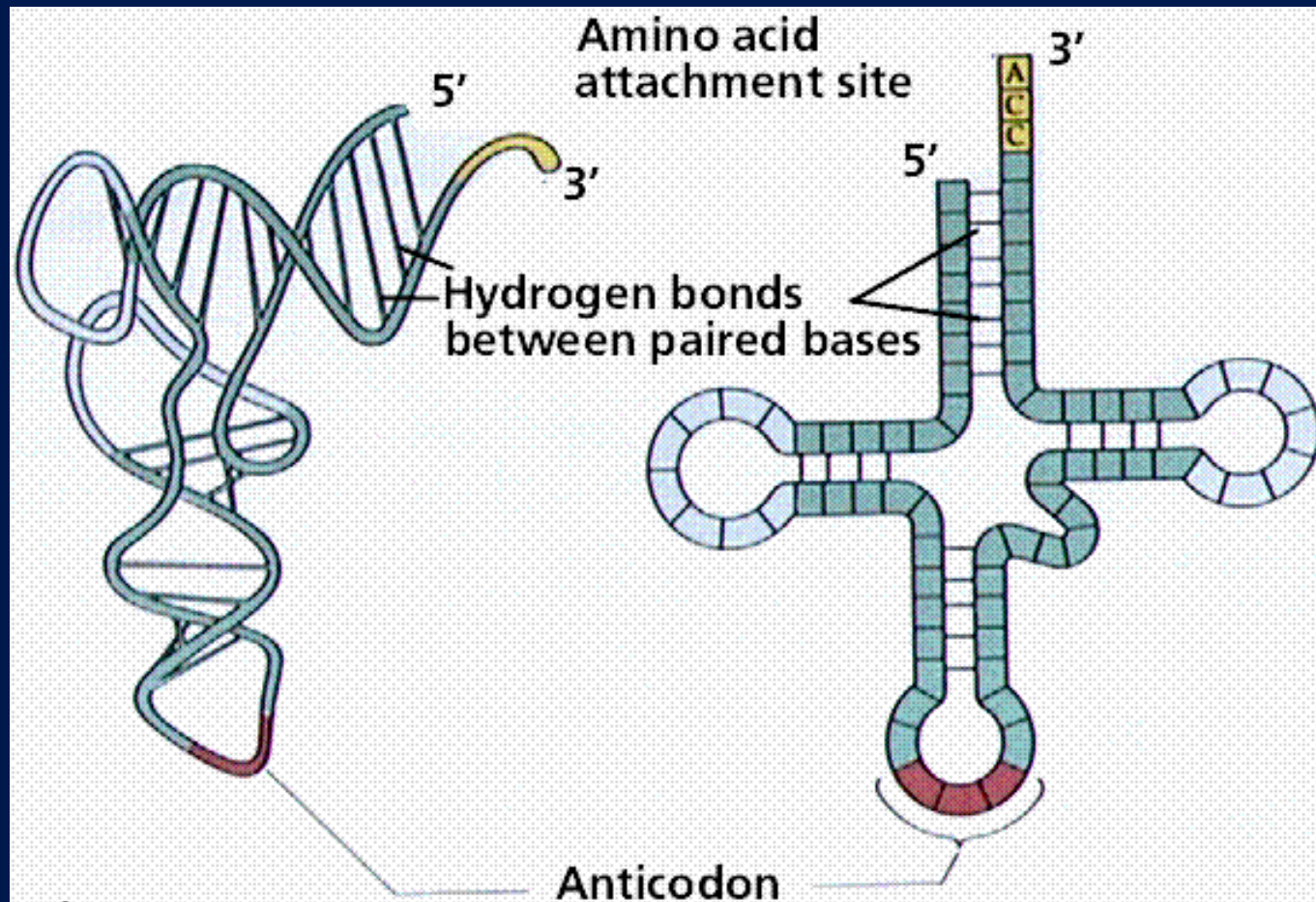
E CGA

P A

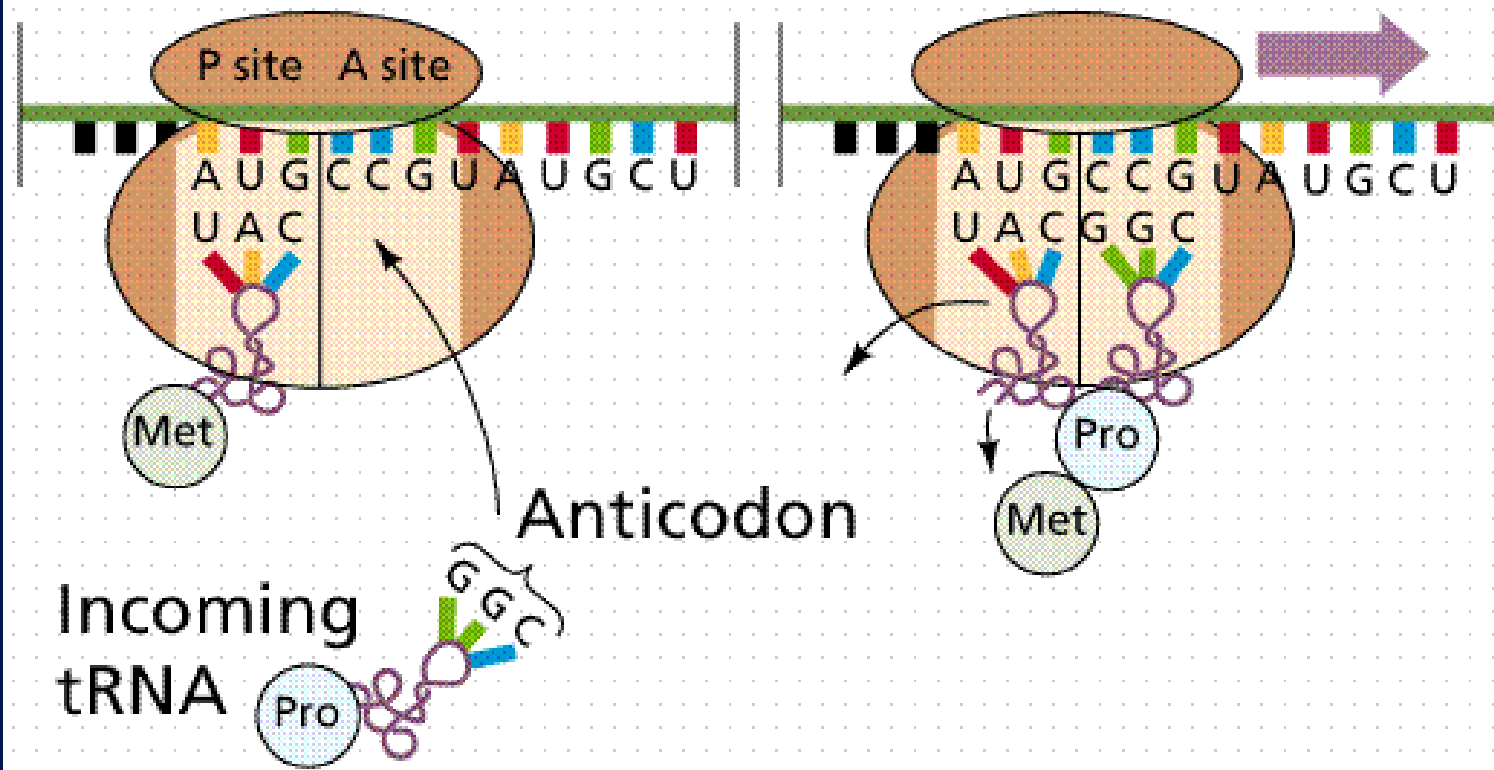
E CGA STOP

Transfer RNA (tRNA)

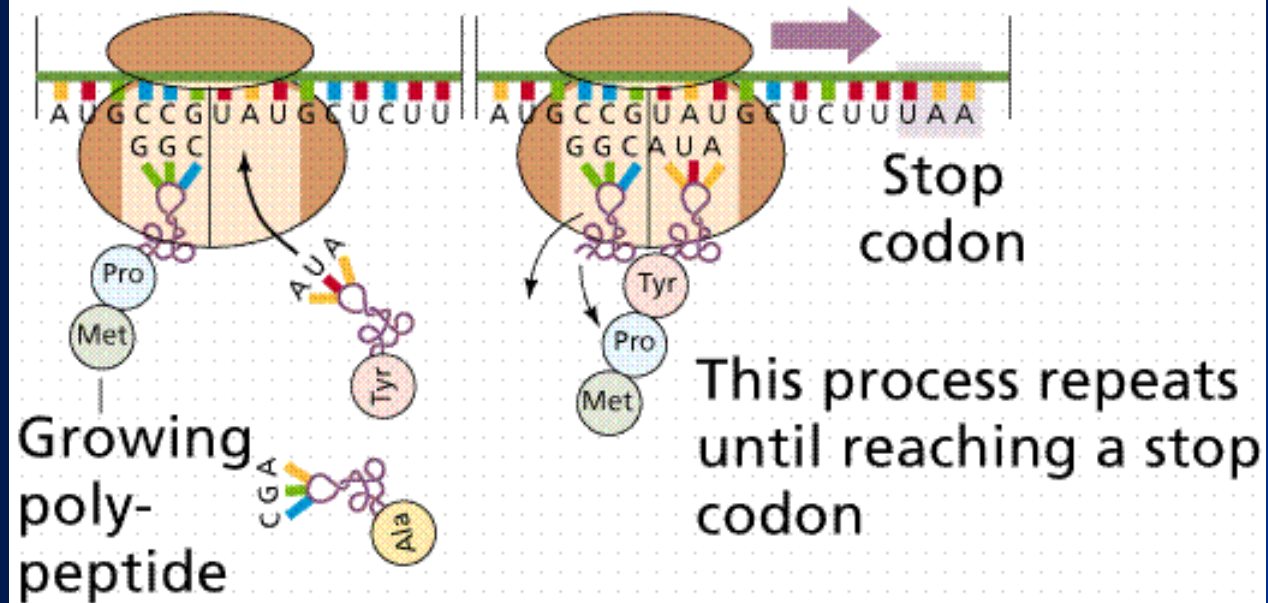




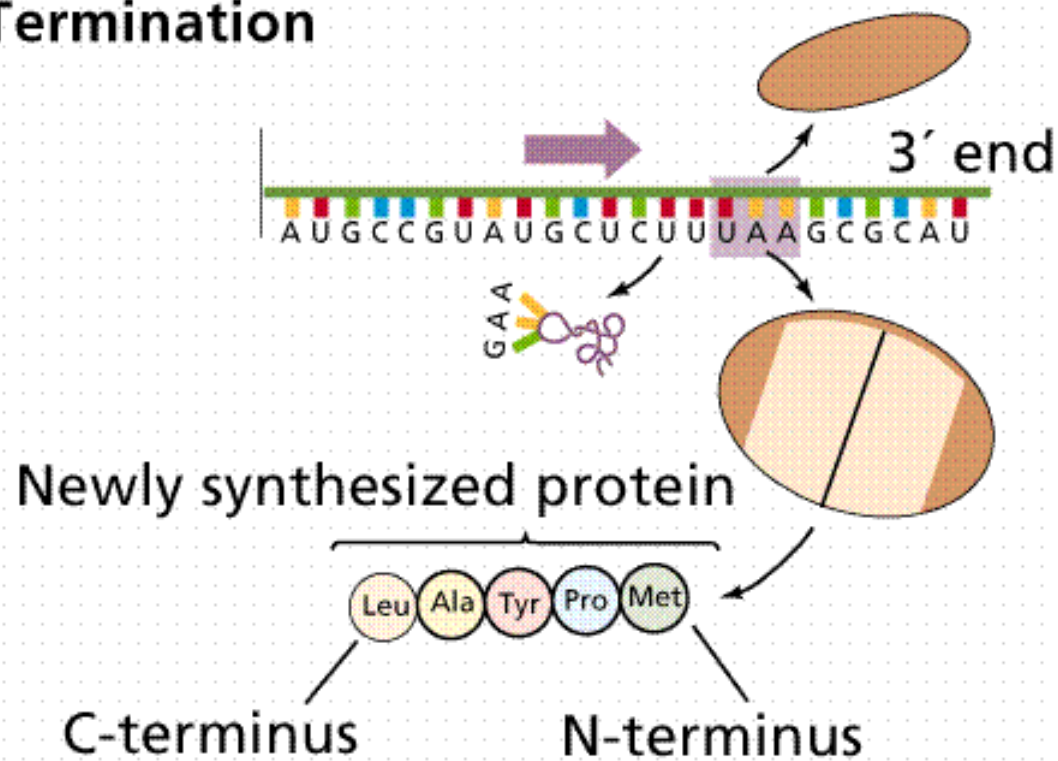
Elongation (translation)

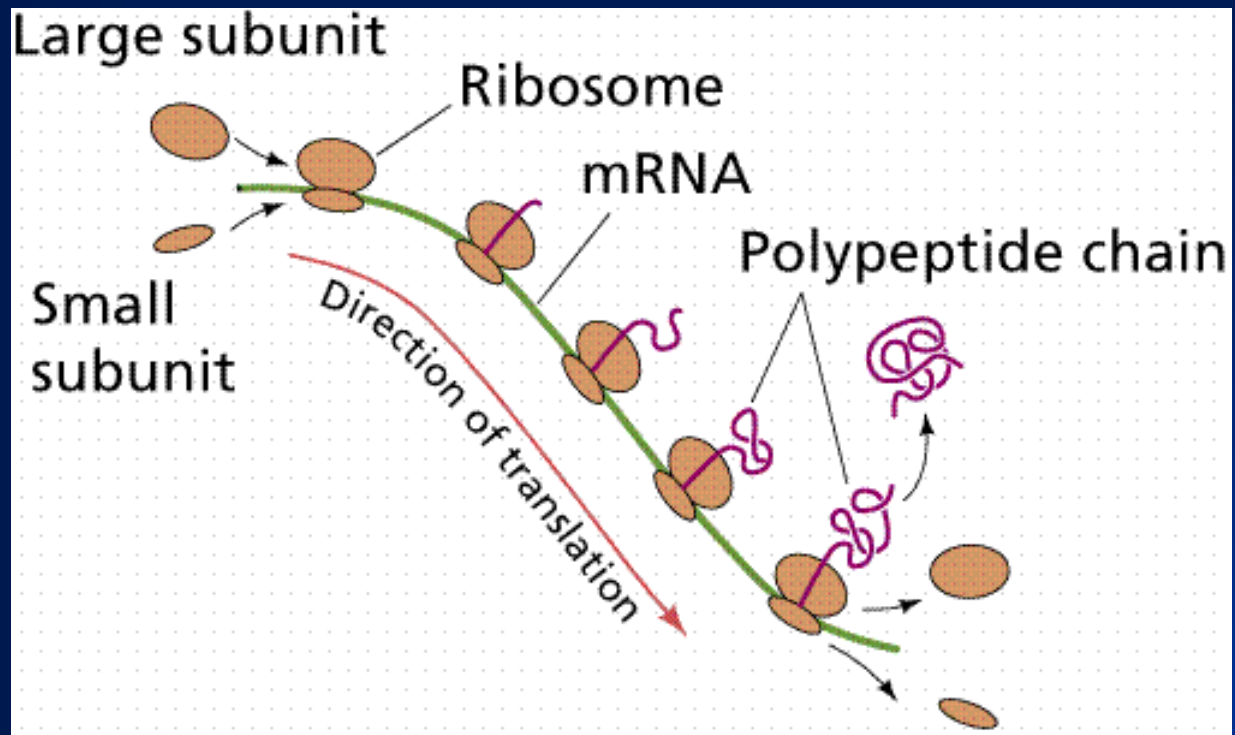


Elongation continues

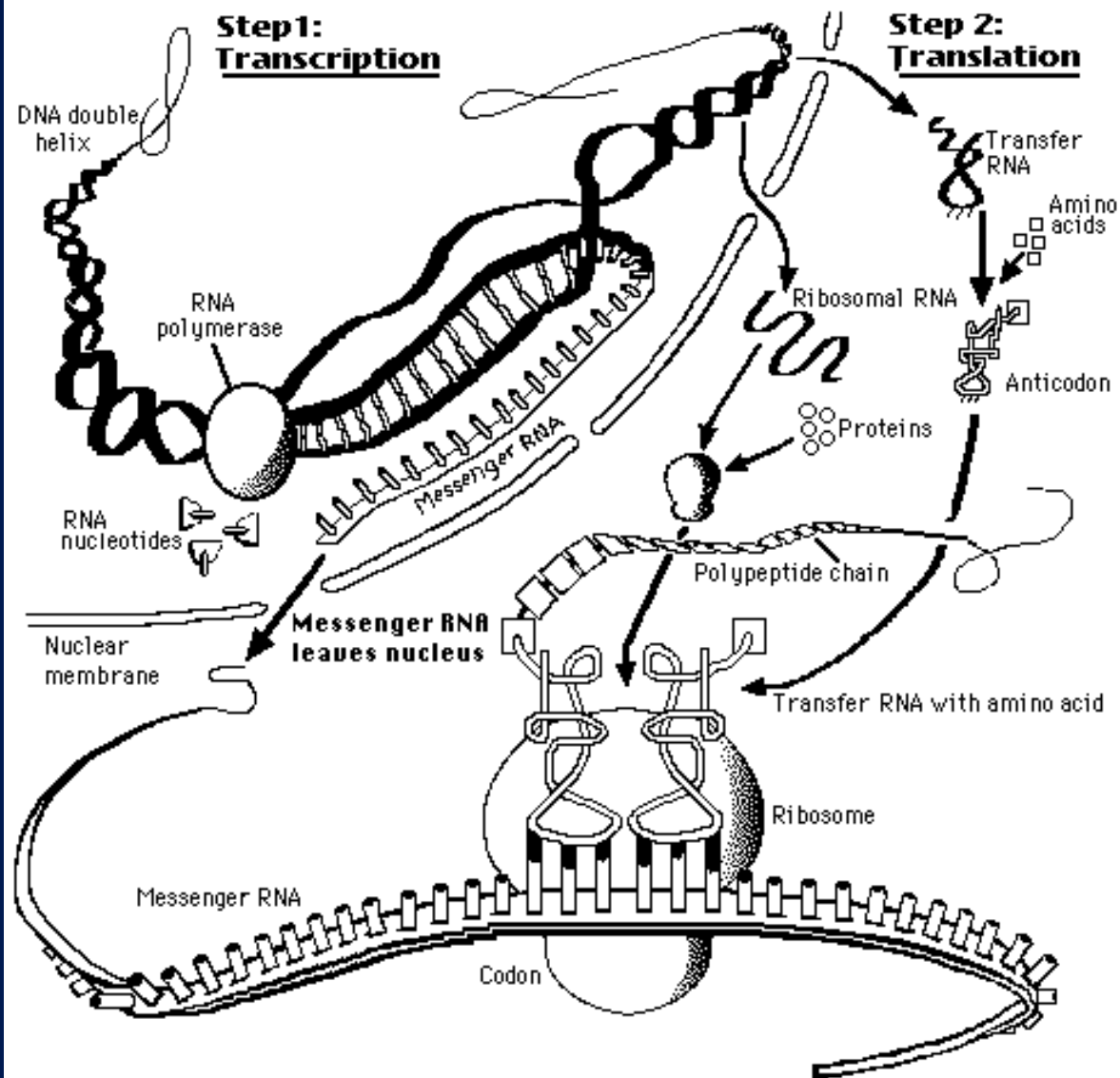


Termination



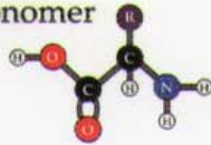


PROTEIN SYNTHESIS

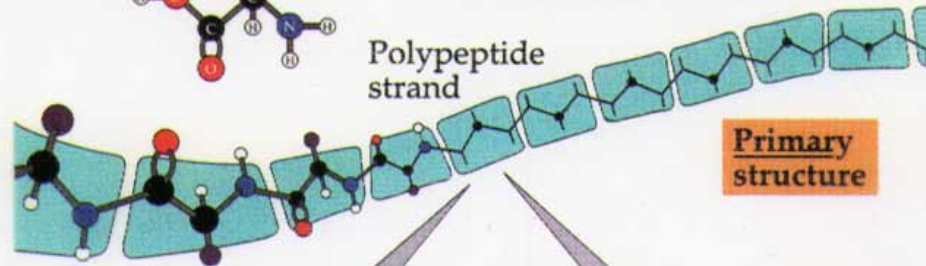


The Four Levels of Protein Structure

The amino acid monomer



R represents the side chain of the amino acid and is different on each of the 20 amino acids.



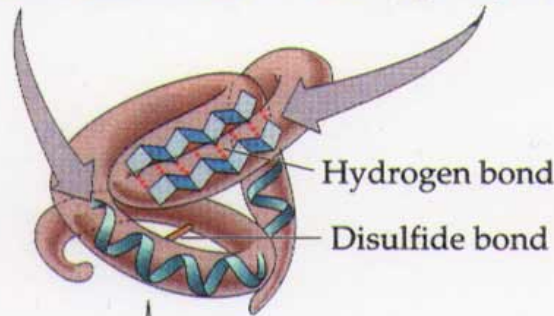
α Helix



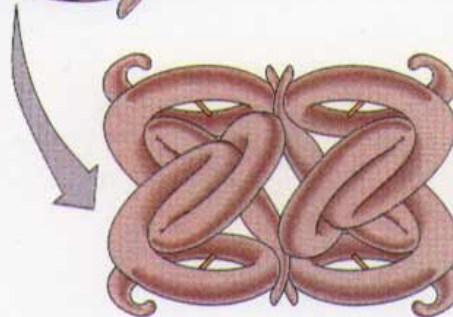
β -Pleated sheet



Secondary structure



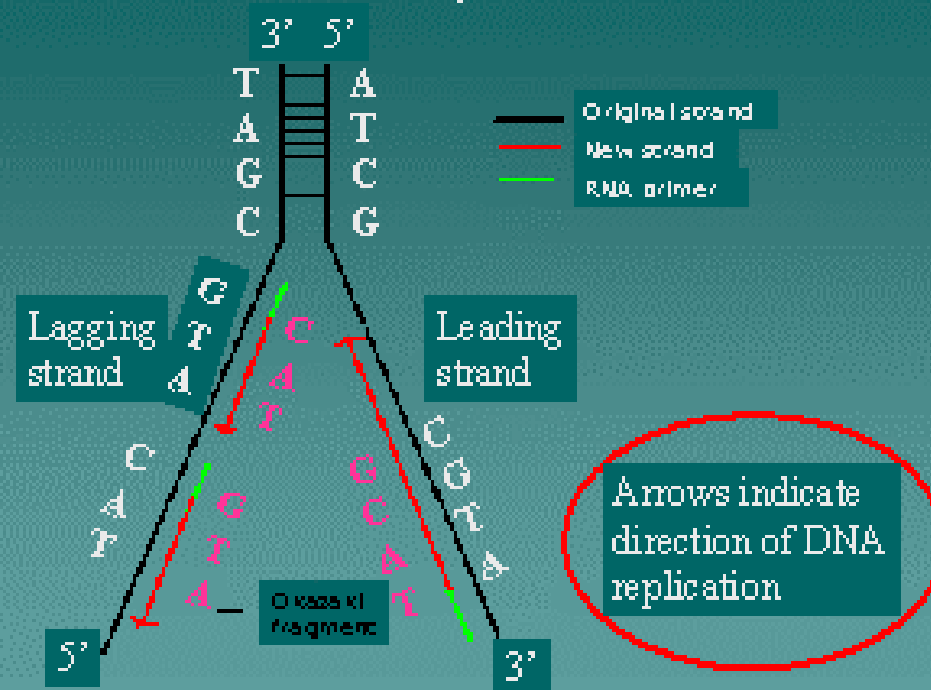
Tertiary structure



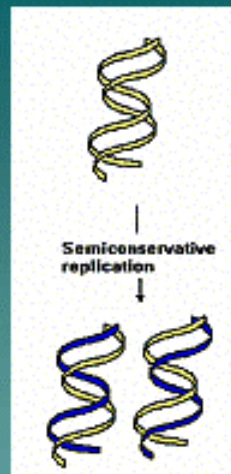
Quaternary structure



DNA Replication

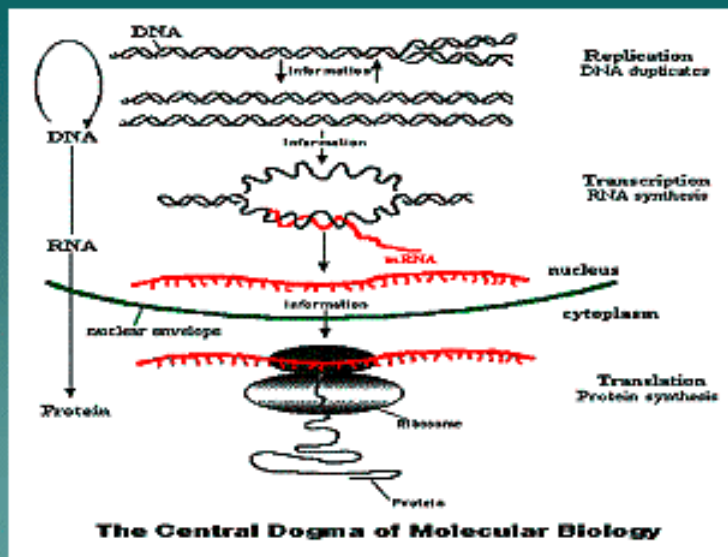


<http://www.ncc.gmu.edu/dna/repanim.htm>



The result of DNA replication is two double helices.

Each with a strand from the original DNA and a newly synthesized strand that is complementary & anti-parallel to the original.

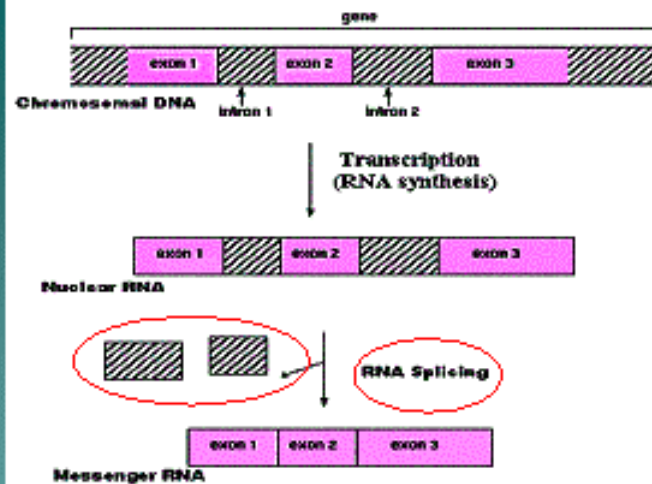


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Transcription

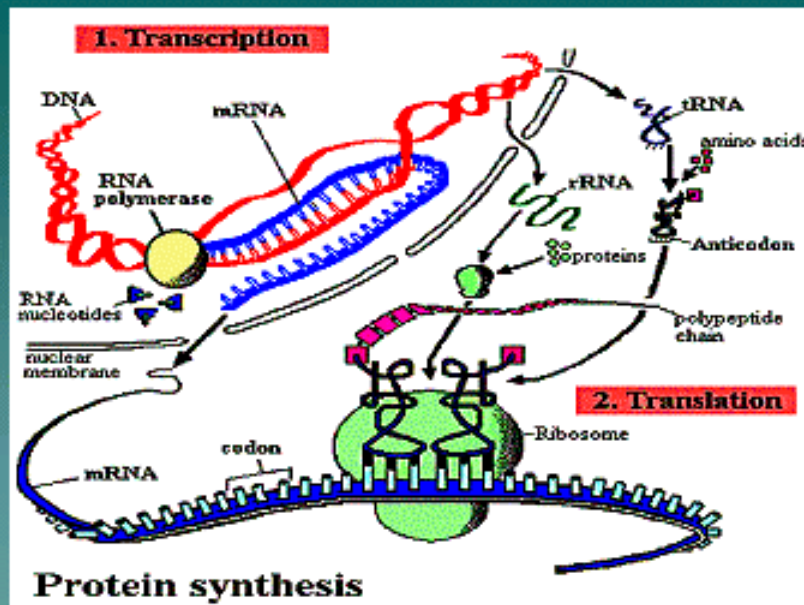


Figure used with permission
Of Joan Polancic ©2003

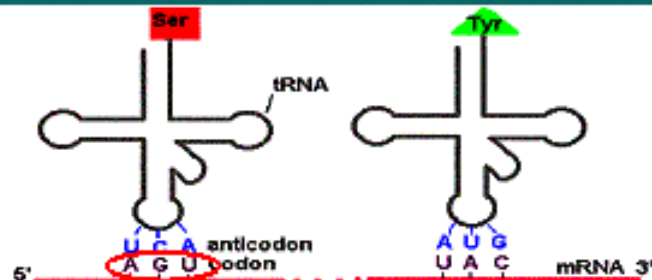


RNA synthesis and processing

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		2nd base in codon				
		U	C	A	G	
1st base in codon	U	Phe Phe Leu Leu	Ser Ser Ser Ser	Tyr Tyr STOP STOP	Cys Cys STOP Trp	U C A G
	C	Leu Leu Leu Leu	Pro Pro Pro Pro	His His Gln Gln	Arg Arg Arg Arg	U C A G
	A	Ile Ile Ile Met	Thr Thr Thr Thr	Asn Asn Lys Lys	Ser Ser Arg Arg	U C A G
	G	Val Val Val Val	Ala Ala Ala Ala	Asp Asp Glu Glu	Gly Gly Gly Gly	U C A G

The Genetic Code

Translation animation site: <http://www.ncc.gmu.edu/dna/ANIMPROT.htm>

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