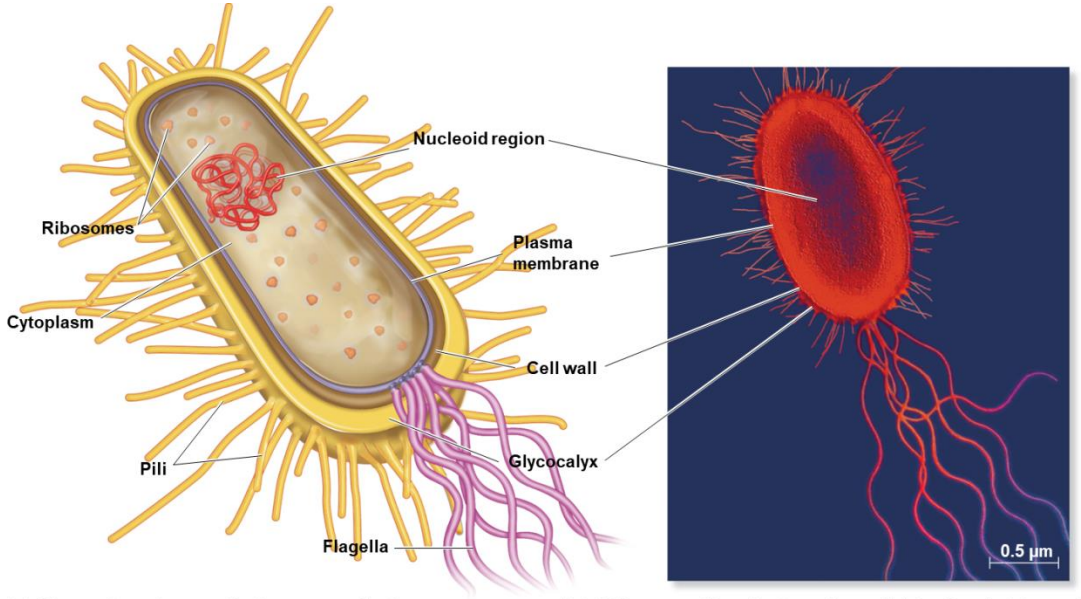
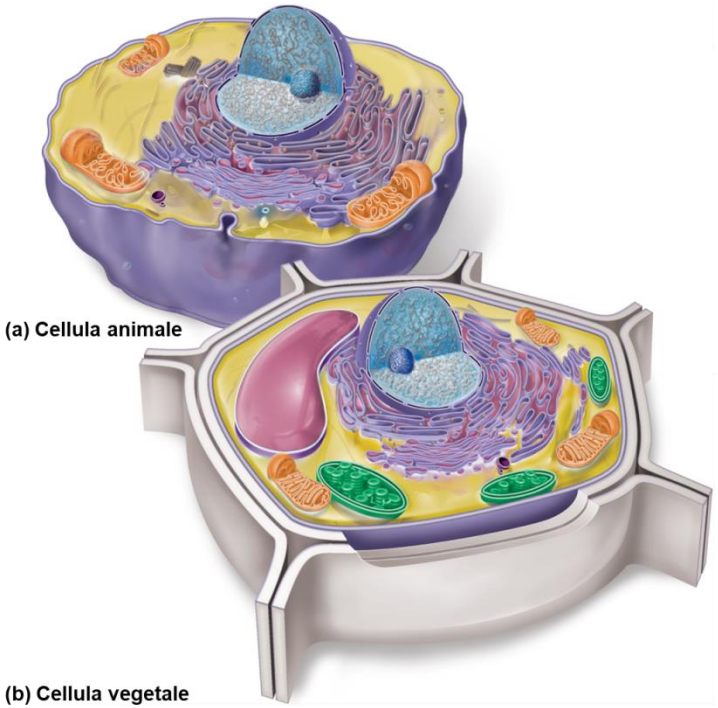
1. Differenze tra cellula PROCARIOTE e cellula EUCARIOTE



(a) Una classica cellula procariotica

(b) Micrografia elettronica di Escherichia coli



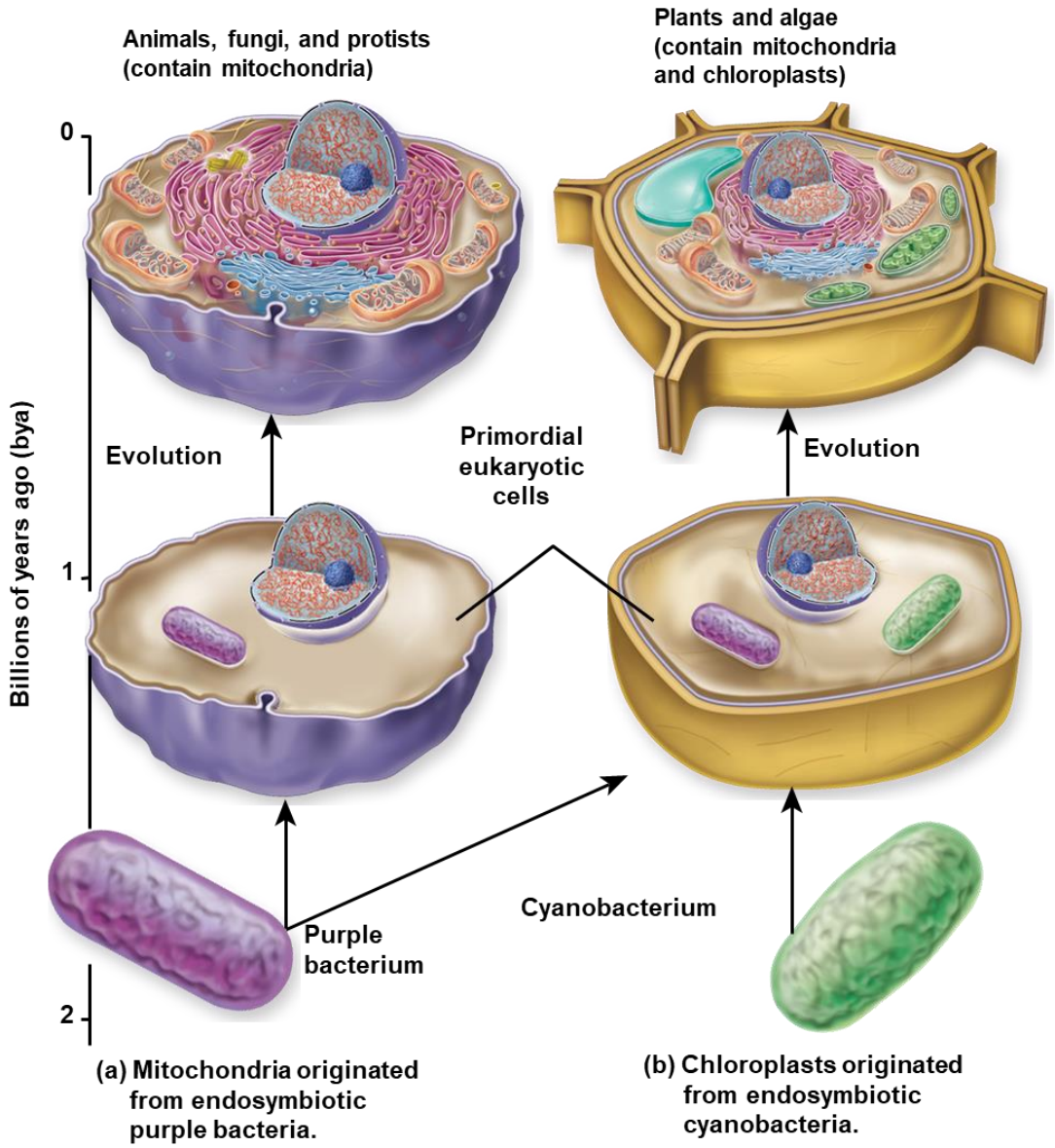
CELLULA PROCARIOTE

- E' provvista di PARETE
- Non ci sono organuli
- Esistono RIBOSOMI dispersi
- E' tipica di due gruppi di microorganismi: Batteri e Archaea

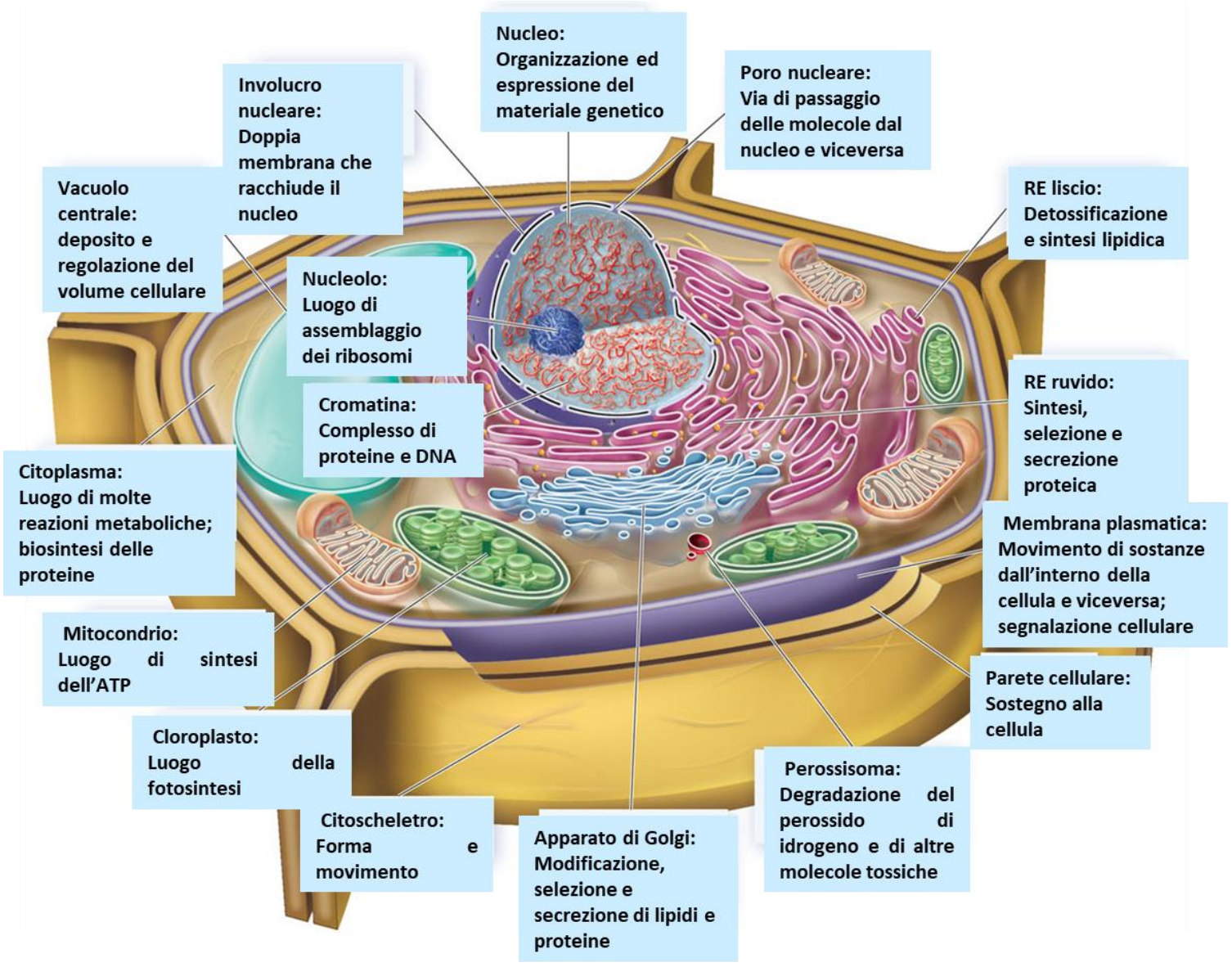
CELLULA EUCARIOTE

- La parete non è una struttura fondamentale (è presente in piante terrestri, alghe e funghi)
- Nucleo
- Mitocondri
- Tubuli
- Ribosomi ADDENSATI su un sistema di membrane (RER)

2. Origine endosimbiontica di MITOCONDRI e CLOROPLASTI



3. Caratteristiche generali delle cellule EUCARIOTICHE



4. I principali LEGAMI CHIMICI

Sono FORZE ATTRATTIVE che tengono UNITI ATOMI all'interno di molecole

Mappe-DSA
http://mappe-dsa.blogspot.it/

COME GLI ATOMI SI LEGANO TRA LORO?

LEGAME IONICO

CONDIZIONE → QUANDO ENTRANO IN CONTATTO UN **ATOMO CHE TENDE A PERDERE ELETTRONI** E UNO CHE **TENDE AD ACQUISTARNE**

SI FORMANO **2 IONI**

- **IONE POSITIVO**
- **IONE NEGATIVO**

TRA QUESTI DUE SI GENERA UNA **FORZA ELETTROSTATICA**

QUESTA FORZA **TIENE SALDAMENTE UNITI I DUE IONI**

E PRENDE IL NOME DI

LEGAME IONICO

IL COMPOSTO CHE SI FORMA

SI CHIAMA **COMPOSTO IONICO**

LEGAME COVALENTE

CONDIZIONE → SI STABILISCE TRA ATOMI CHE **METTONO IN COMUNE ALCUNI ELETTRONI**

GLI ATOMI PERCIO'

CONDIVIDONO GLI ELETTRONI FINCHE' ENTRAMBI **HANNO 8 ELETTRONI ESTERNI** (tranne nel caso dell' idrogeno che ne ha 2)

GLI ELETTRONI CONDIVISI

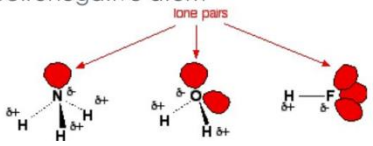
APPARTENGONO AD ENTRAMBI GLI ATOMI QUINDI C'E' UNA **CONDIVISIONE TOTALE**

IL LEGAME COVALENTE SI RAPPRESENTA

CON UN **TRATTINO** es. H-H (coppia di elettroni legame)

Definition Hydrogen Bond

- A **hydrogen bond** is an electromagnetic attraction - not a true bond!
- Hydrogen must be directly bonded to a small atom with high EN (N, O, F)
- Can form with another molecule (intermolecular) or another part of the same molecule (intramolecular).
- The hydrogen has a partial δ+ charge and the oxygen has a partial δ- charge from being covalently bonded to an electronegative atom



5. Il pH

Definizione di neutralità, acidità e basicità

La definizione **di neutralità, acidità** o **basicità** nell'acqua è riferita alle differenze tra **$[H^+]$ e $[OH^-]$**; il concetto è valido per **qualsiasi soluzione acquosa**; in particolare:

$[H^+] = [OH^-]$ soluzione **neutra**

$[H^+] > [OH^-]$ soluzione **acida**

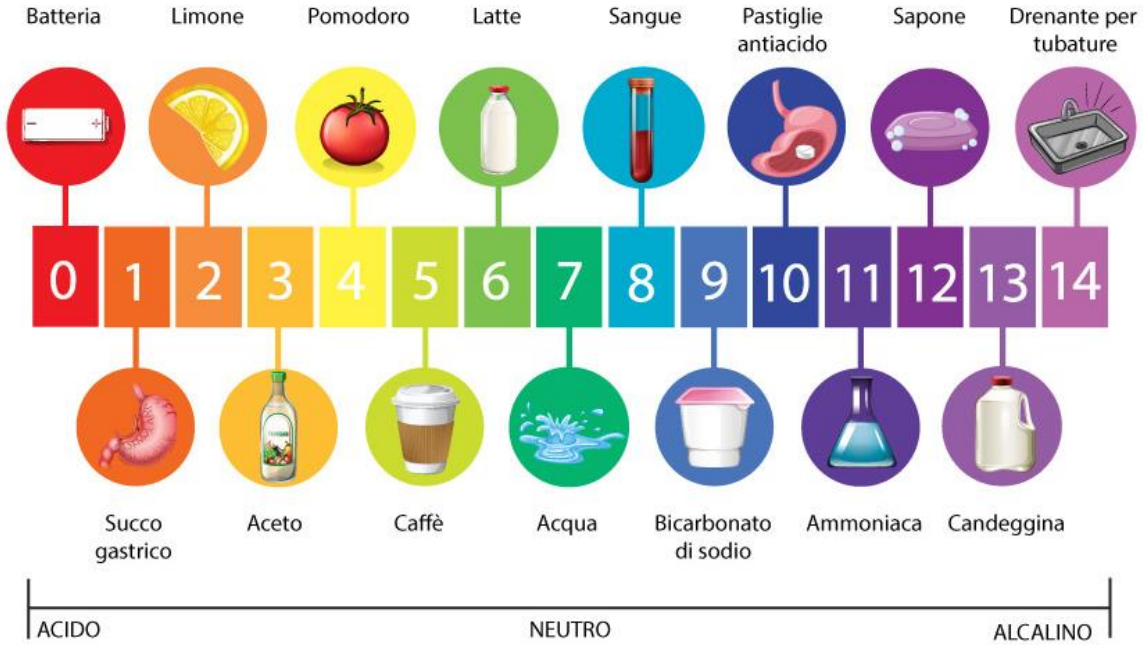
$[H^+] < [OH^-]$ soluzione **basica**

Se poi la **temperatura** è di **25°C** risulta che:

soluzione **neutra;** **$[H^+] = 1{,}0 \cdot 10^{-7}$ M: pH = 7**

soluzione **acida;** **$[H^+] > 1{,}0 \cdot 10^{-7}$ M: pH < 7**

soluzione **basica;** **$[H^+] < 1{,}0 \cdot 10^{-7}$ M: pH > 7**



6. La sintesi delle macromolecole biologiche

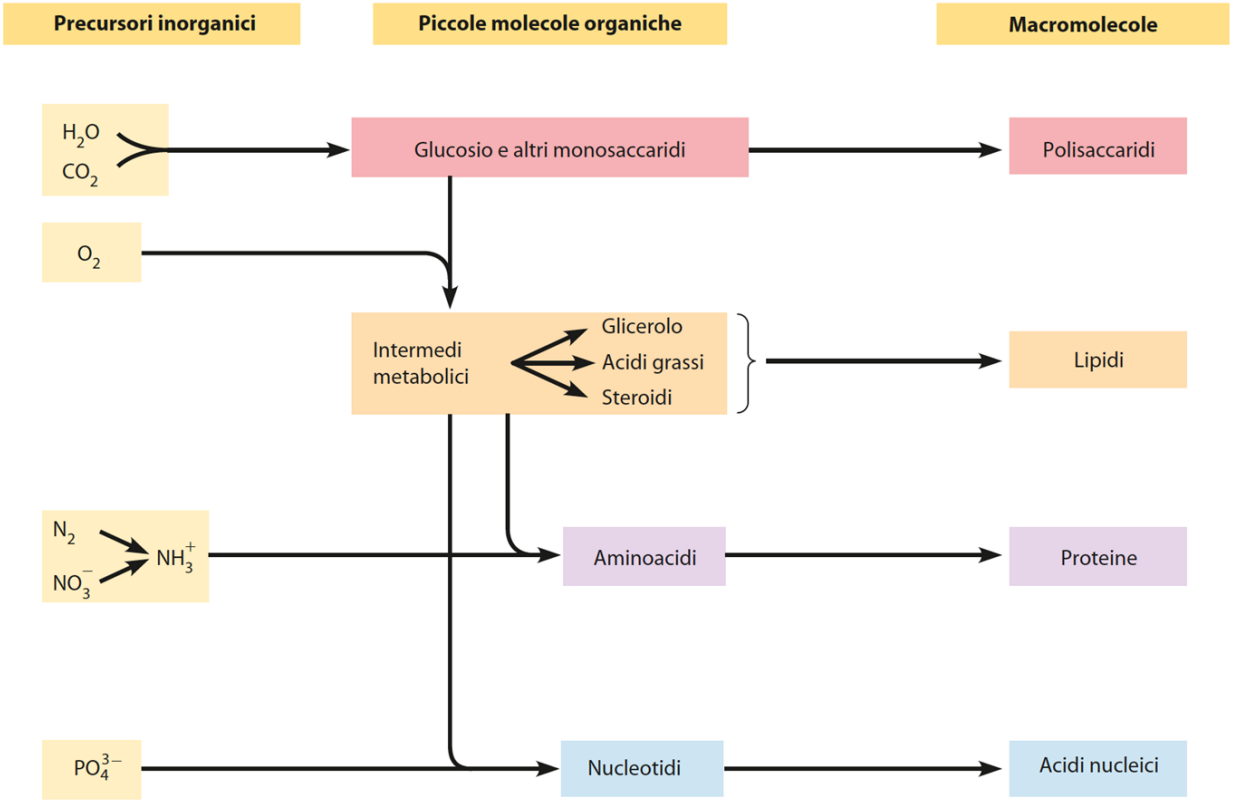
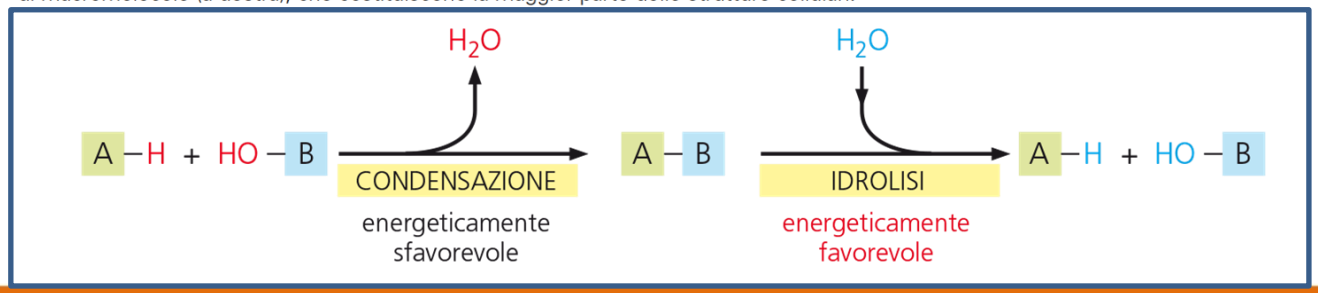
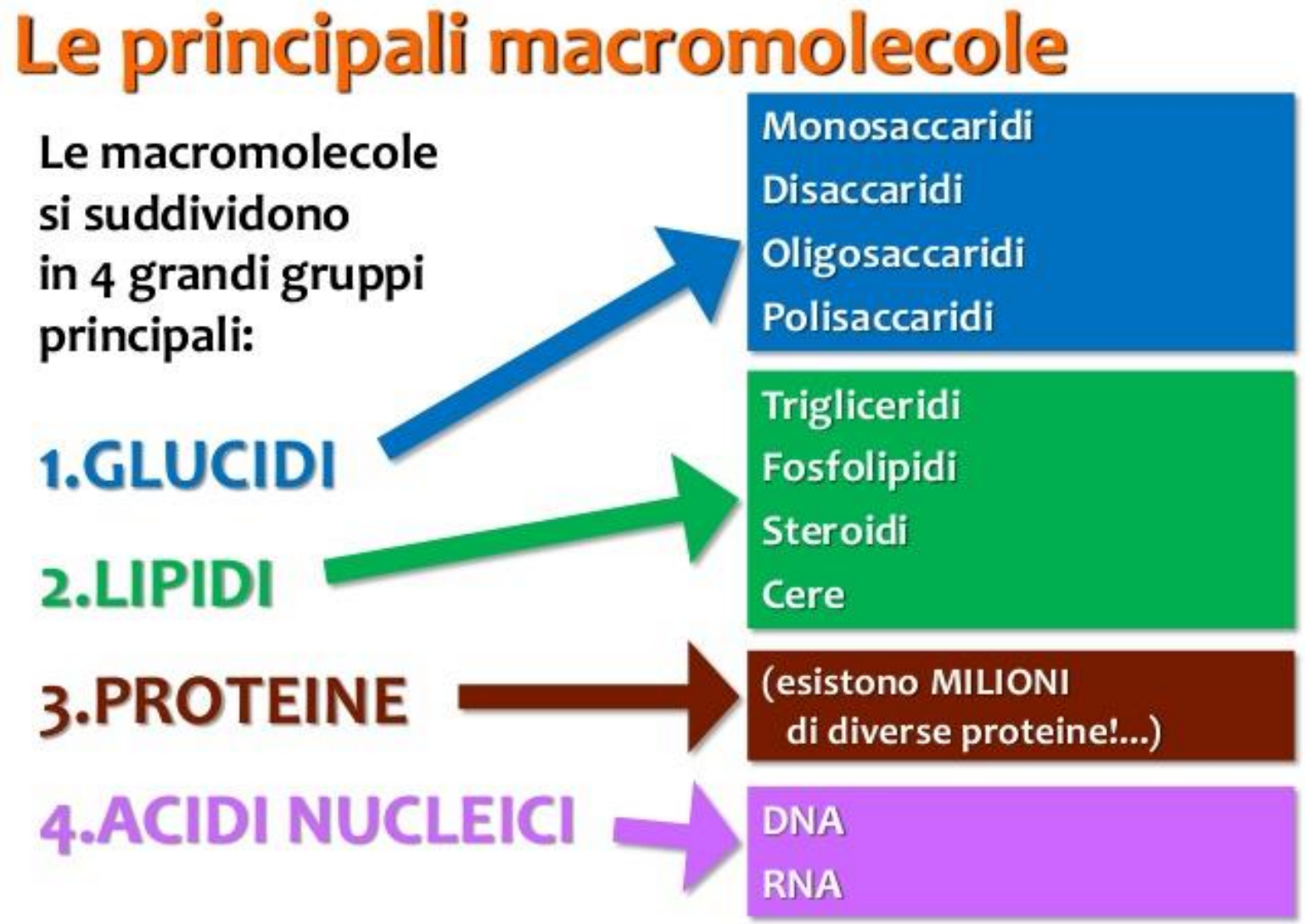


FIGURA 2.15 Sintesi delle macromolecole biologiche. Semplici precursori inorganici (a sinistra) reagiscono formando piccole molecole organiche (al centro), che sono i monomeri utilizzati nelle sintesi di macromolecole (a destra), che costituiscono la maggior parte delle strutture cellulari.



7. Le principali macromolecole

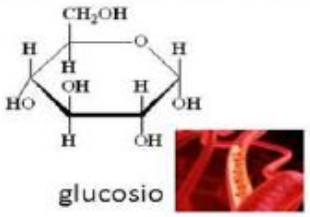


CARBOIDRATI

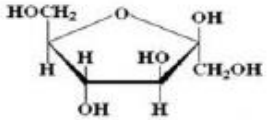
I carboidrati, detti anche glucidi (dal greco "glucos" = dolce) sono sostanze formate da carbonio ed acqua. Hanno forma molecolare $C_n(H_2O)_n$ e sono contenuti principalmente negli alimenti di origine vegetale. Sono la classe di composti organici più abbondante.

I CARBOIDRATI O ZUCCHERI

Tre tipi di atomi:
C H O
(carbonio, idrogeno, ossigeno)

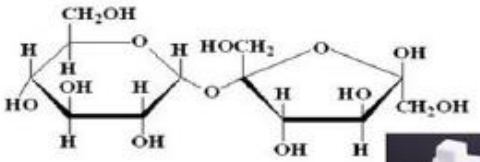


glucosio



fruttosio

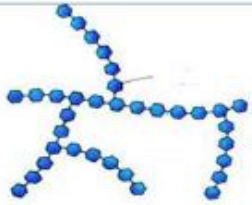
MONOSACCARIDI



saccarosio

DISACCARIDE

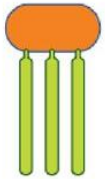
POLISACCARIDE



Amido
e cellulosa

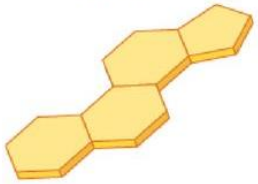
9. I Lipidi: trigliceridi, fosfolipidi e steroidi

TRIGLICERIDI



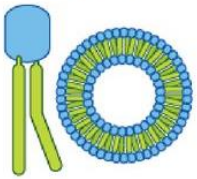
FUNZIONE
Accumulo di energia a lungo termine e isolamento termico.

STEROIDI

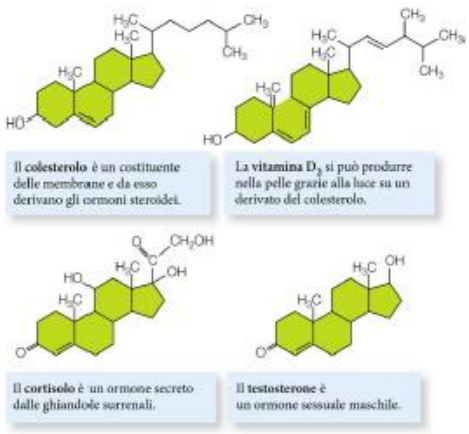


FUNZIONE
Regolano la crescita e lo sviluppo.

FOSFOLIPIDI

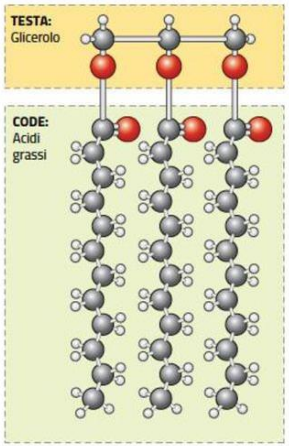


FUNZIONE
Formano le membrane cellulari.



Steroidi

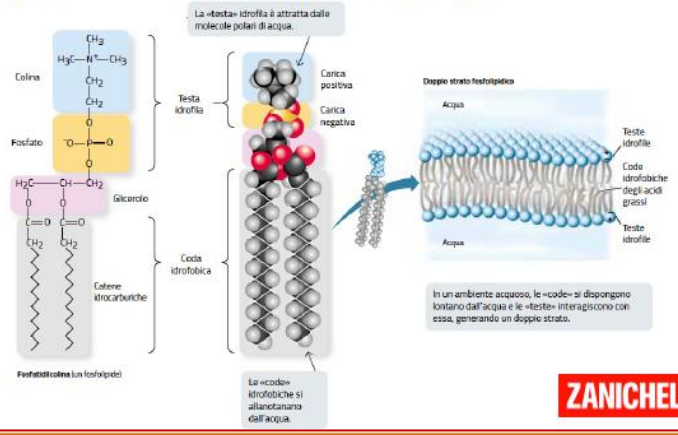
I **lipidi** sono insolubili in acqua e oleosi al tatto perché sono molecole apolari. Hanno dimensioni, composizione e funzioni molto varie, ma tutti sono composti prevalentemente da carbonio e idrogeno.



I **trigliceridi** contengono una molecola di glicerolo unita per condensazione a tre acidi grassi saturi (solo legami singoli C-C) o insaturi (uno o più legami doppi C=C).

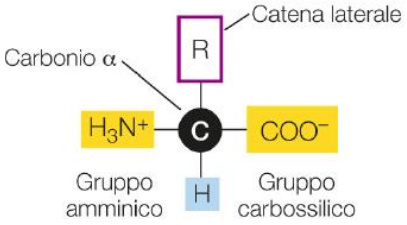
Sono ottime riserve energetiche a lungo termine e isolanti termici.

I **fosfolipidi** possiedono un'estremità idrofila e due lunghe code idrofobiche; formano un doppio strato che costituisce le membrane cellulari.



10. Le proteine

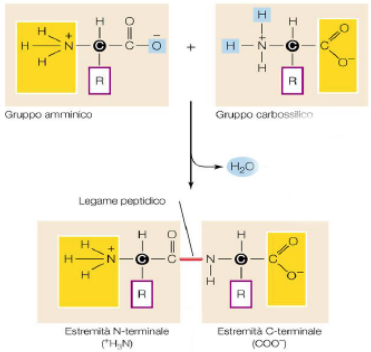
Gli amminoacidi



- **gruppo amminico (NH_3^+)**
- **gruppo carbossilico (COO^-)**
- **catena laterale**
- **atomo di idrogeno**

Le strutture proteiche…..

La sequenza di amminoacidi nella catena polipeptidica costituisce la **struttura primaria** di una proteina.



I gruppi funzionali di due amminoacidi reagiscono tra loro dando origine a un legame peptidico.

L'ossatura di una catena polipeptidica è formata dalla successione regolare di –N–C–C–N–.

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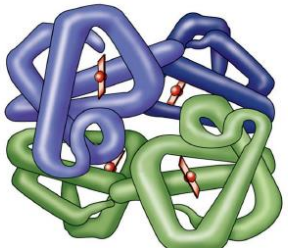
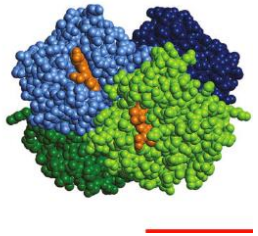
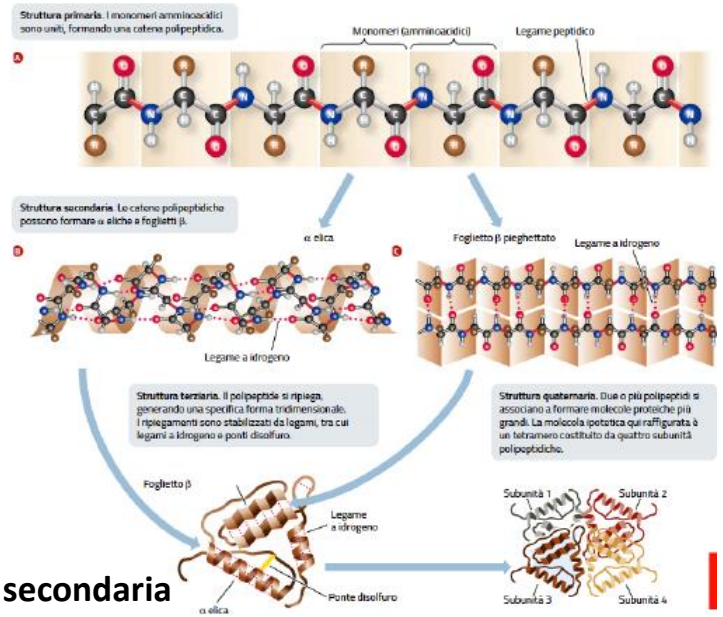
La **struttura quaternaria** è il risultato del modo in cui le subunità polipeptidiche si legano insieme e interagiscono fra loro.





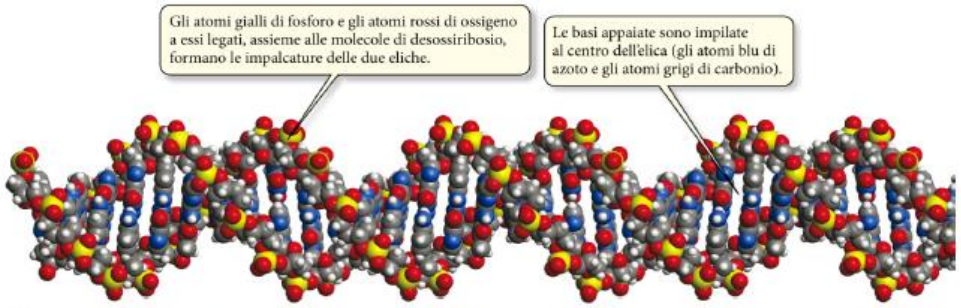
La **struttura terziaria** produce una macromolecola con una precisa forma tridimensionale, la cui superficie esterna presenta gruppi funzionali capaci di svolgere particolari reazioni chimiche con altre molecole specifiche.

I responsabili della struttura terziaria sono le interazioni tra i gruppi R.



Struttura secondaria

11. Gli acidi nucleici

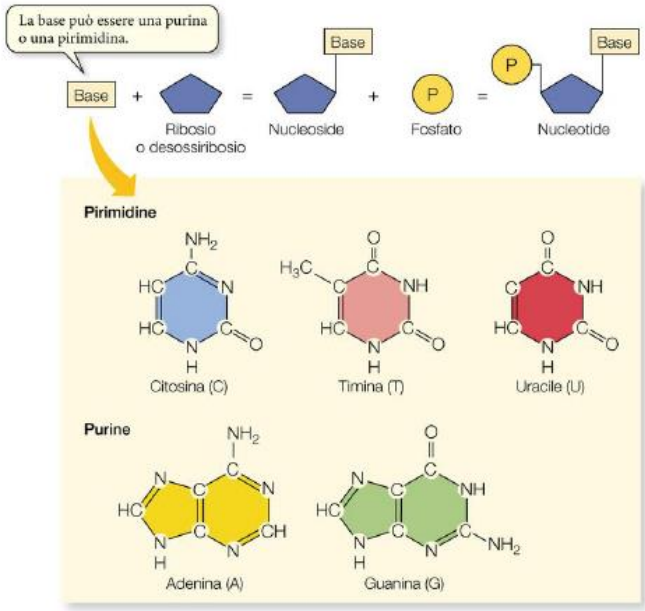


Gli acidi nucleici sono polimeri formati da **nucleotidi**.

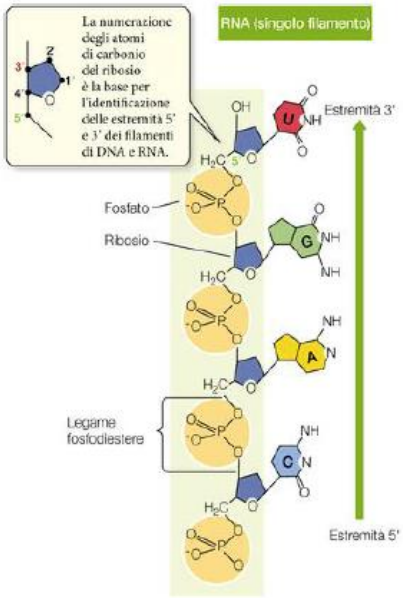
Esistono due tipi di acidi nucleici: il **DNA** e l'**RNA**.

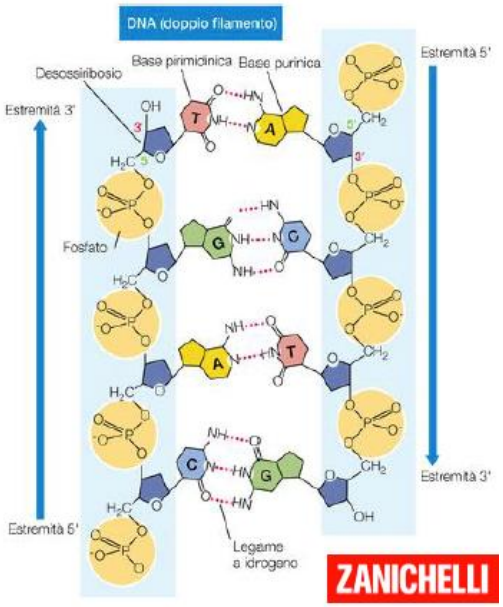
L'informazione genetica contenuta nel DNA risiede nella sequenza dei nucleotidi che costituiscono la doppia elica.

I monomeri: le basi azotate



I polimeri: DNA e RNA





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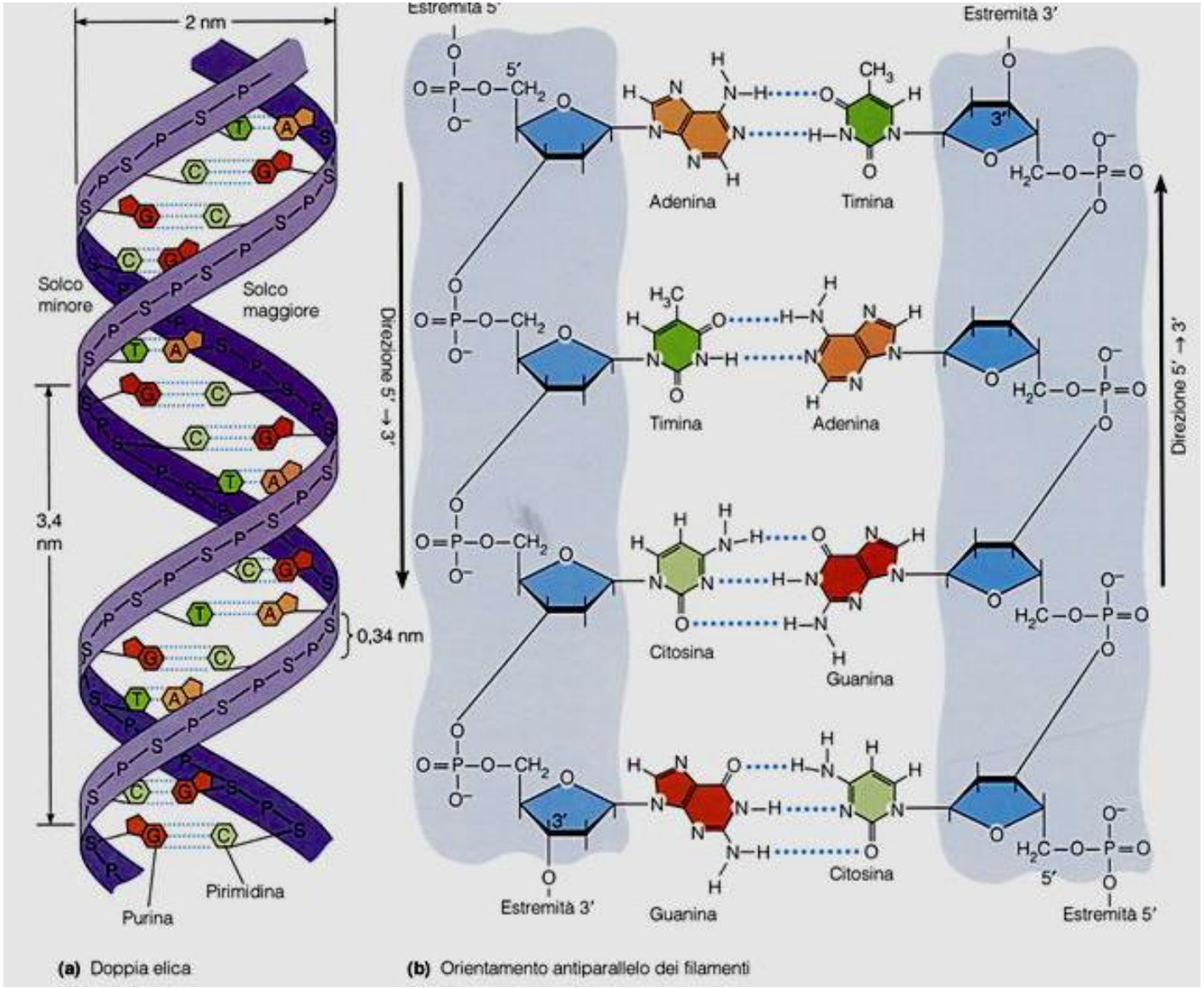
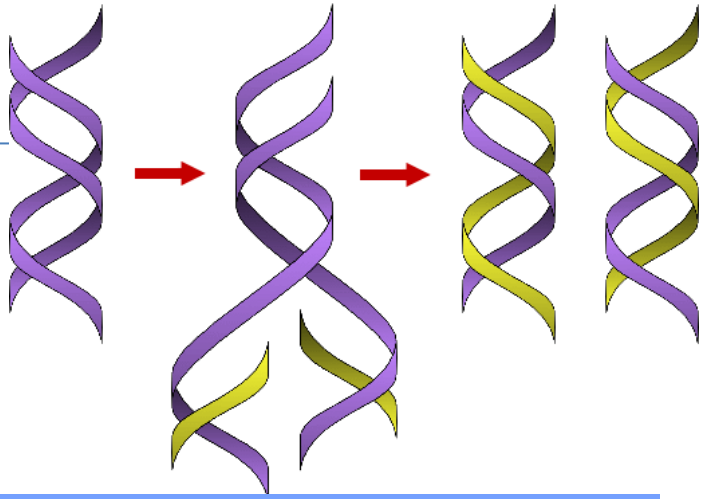
12. La doppia elica del DNA

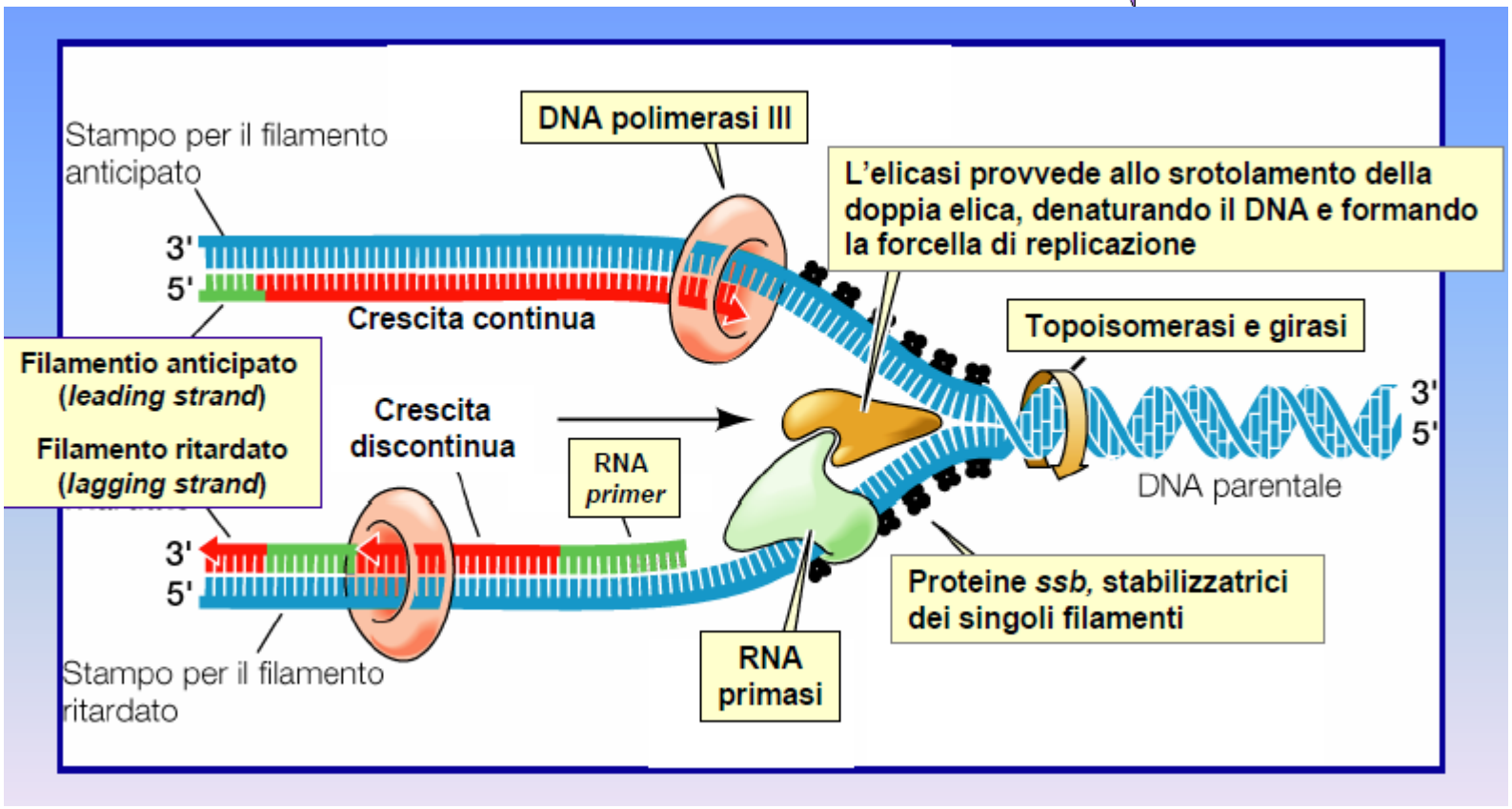


Prima Regola di Chargaff:
Considerando la coppia di filamenti
Numero A = Numero T
Numero C = Numero G
Validità: Sempre
Motivo: Accoppiamanto selettivo delle basi della doppia elica

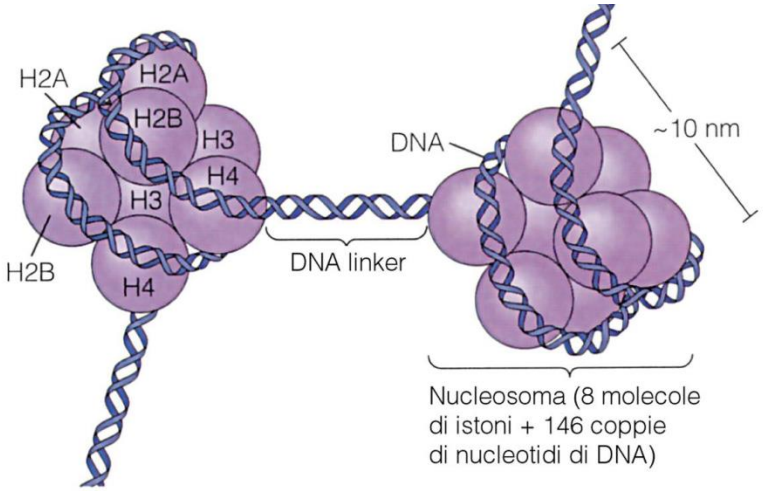
13. La duplicazione del DNA

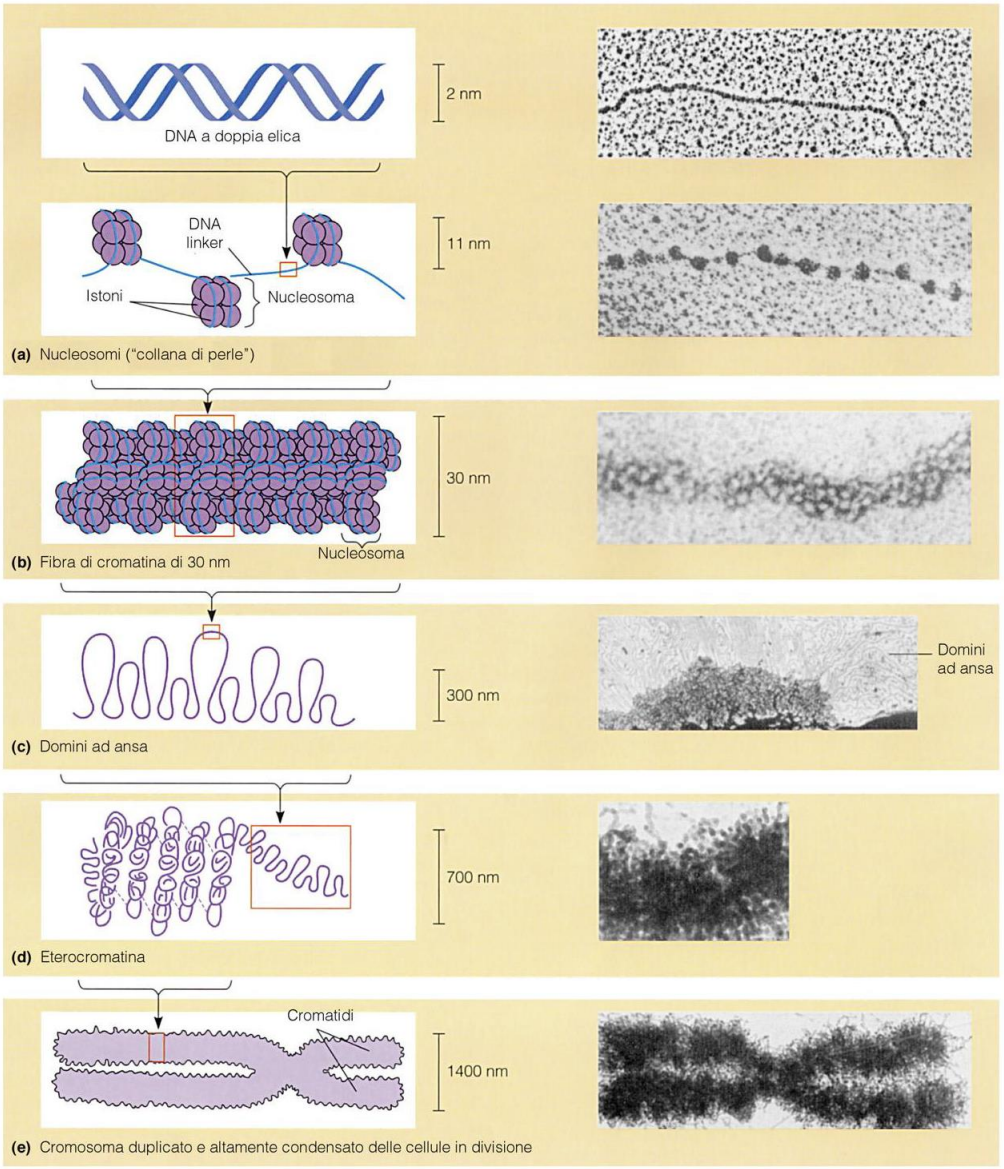


DUPLICAZONE SEMICONSERVATIVA



14. La compattazione del DNA





15. Genes

- I geni contengono le **informazioni necessarie per generare un organismo** e per consentirne un'interazione favorevole con il suo ambiente
- I **geni codificano per polipeptidi**
- Le attività di **proteine determinano la struttura e la funzione** delle cellule

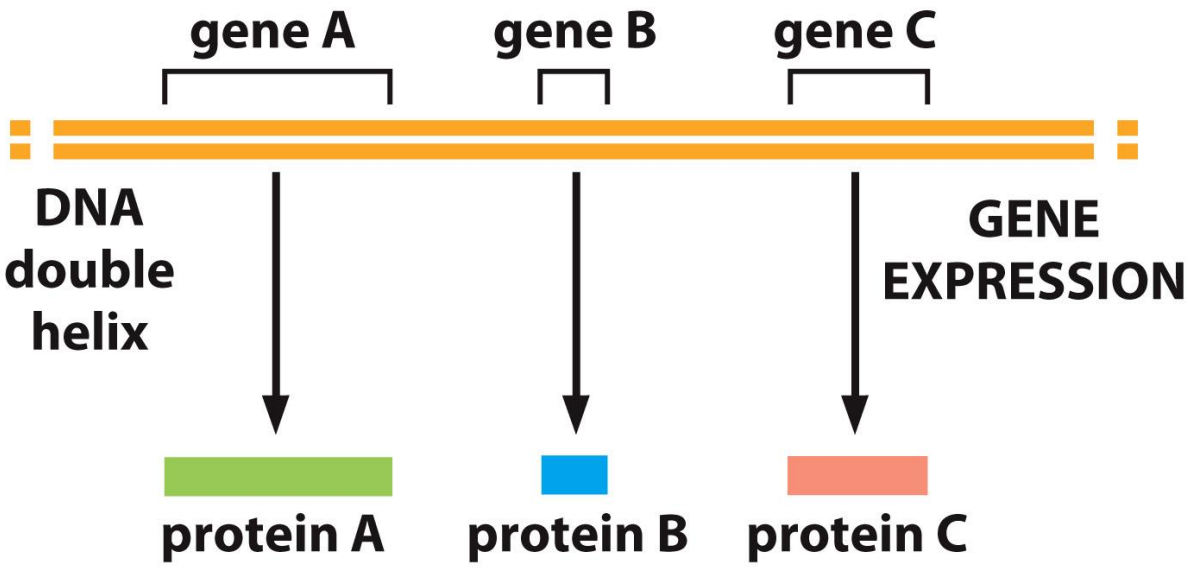


Figure 4-7 Molecular Biology of the Cell 6e (© Garland Science 2015)

16. The code of Life

DNA

RNA

Proteins

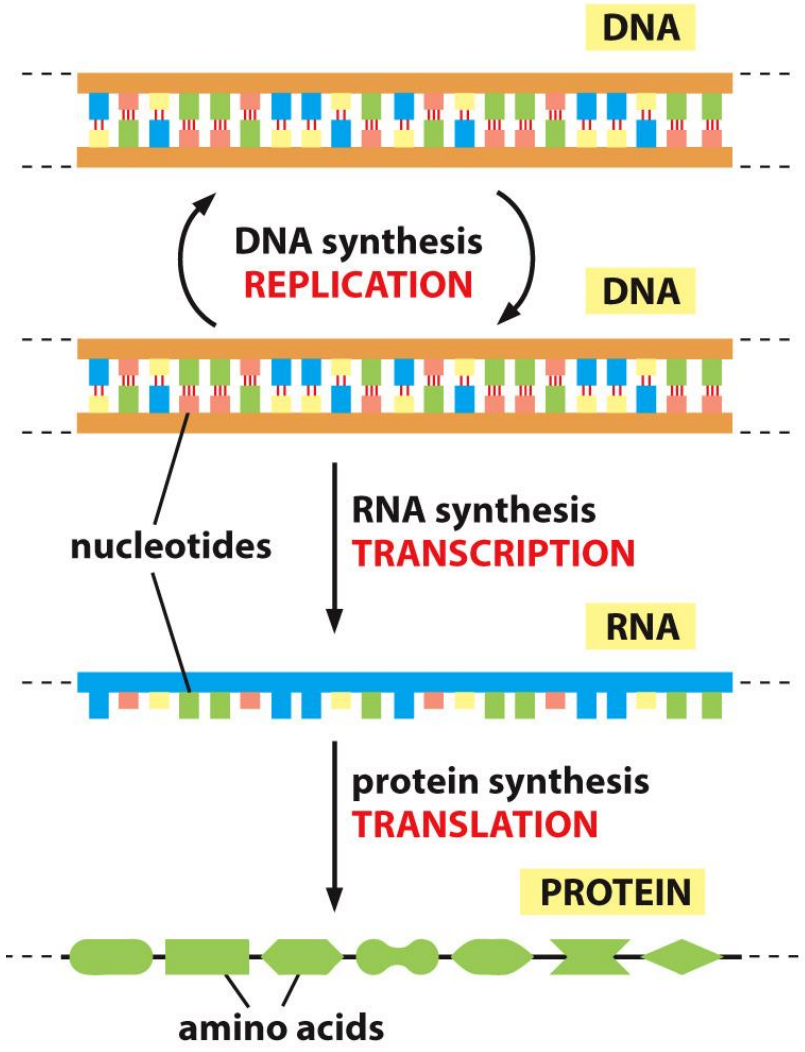
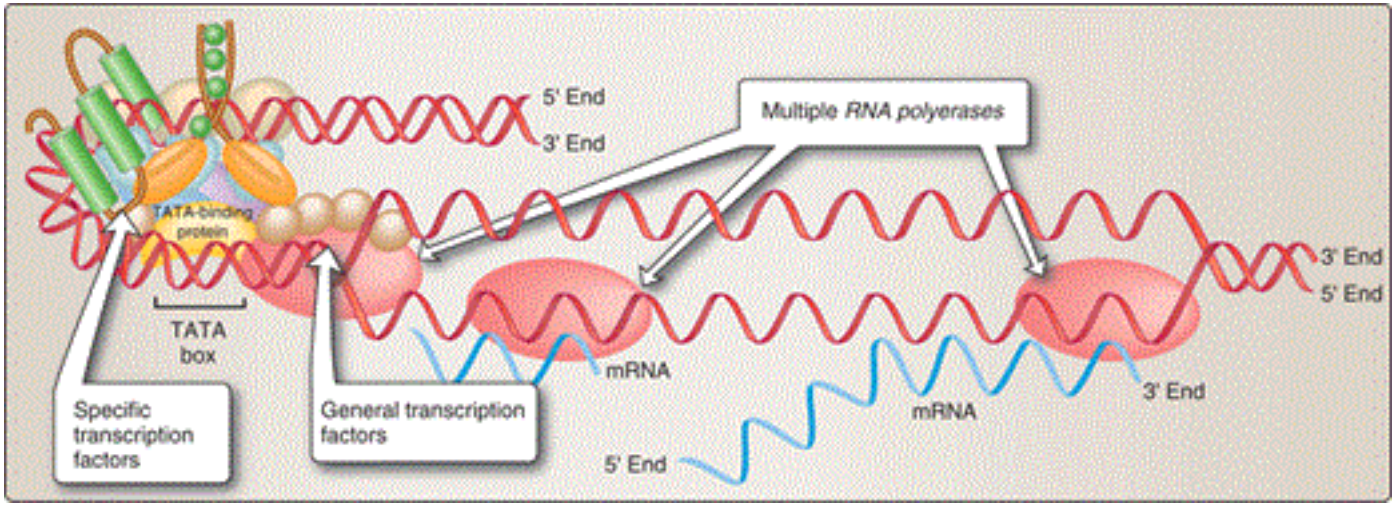


Figure 1-4 Molecular Biology of the Cell 6e (© Garland Science 2015)

17. Transcription

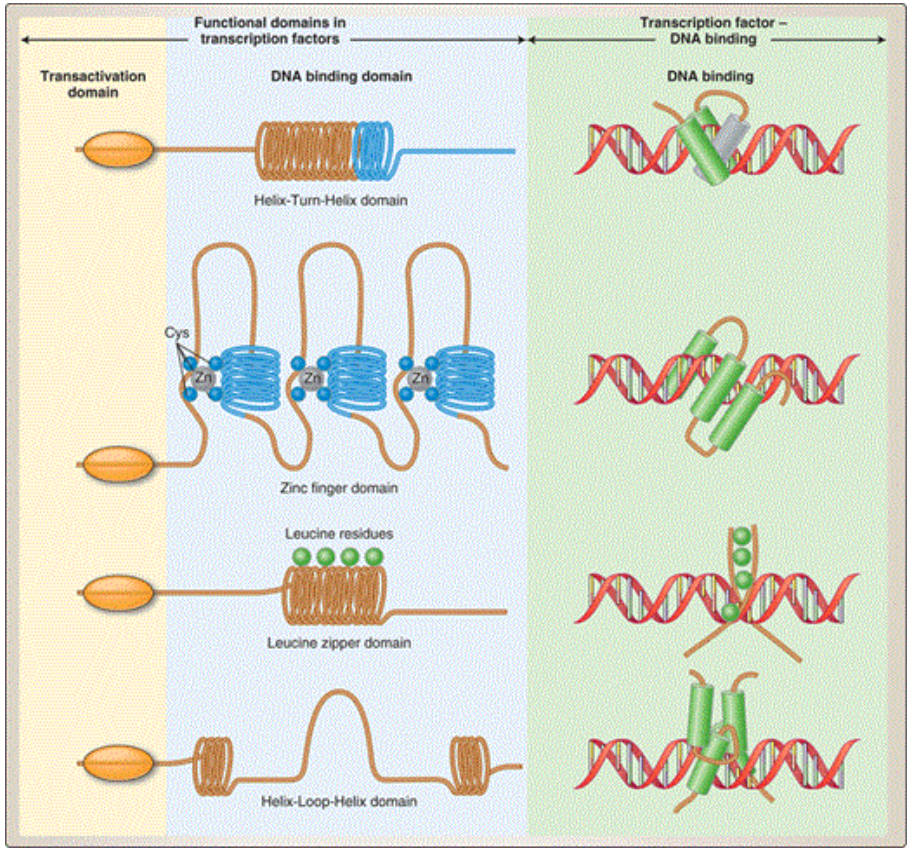
- **RNA Polymerase II** catalyzes the synthesis of mRNA at a fixed rate of **~ 30-40 nucleotides per second**.
- The **rate of synthesis (transcription) is constant**, and the **number of polymerases** that simultaneously synthesize RNA from a given gene determine the absolute transcription rate.
- Specific **transcription factors modulate the number of RNA polymerase** molecules actively synthesizing RNA



18. Transcription factors

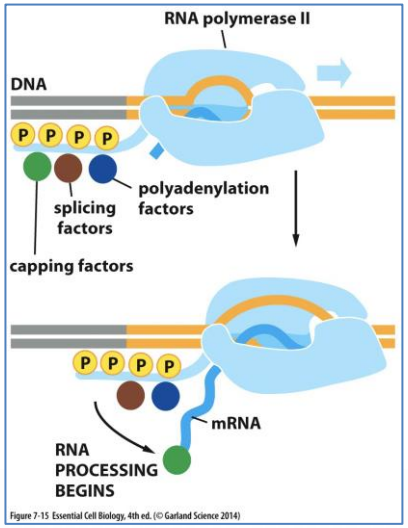
- **Transcription factors** are proteins that have a modular design consisting of at least **two distinct domains**:
  - **DNA-binding** domain consists of the structural motif that recognizes specific DNA sequences (DNA binding)
  - **Transcription-activating domain** contacts the transcriptional machinery and accelerates the rate of transcription initiation by accelerating the assembly of the general transcription factors at the promoter site (transcription activating)

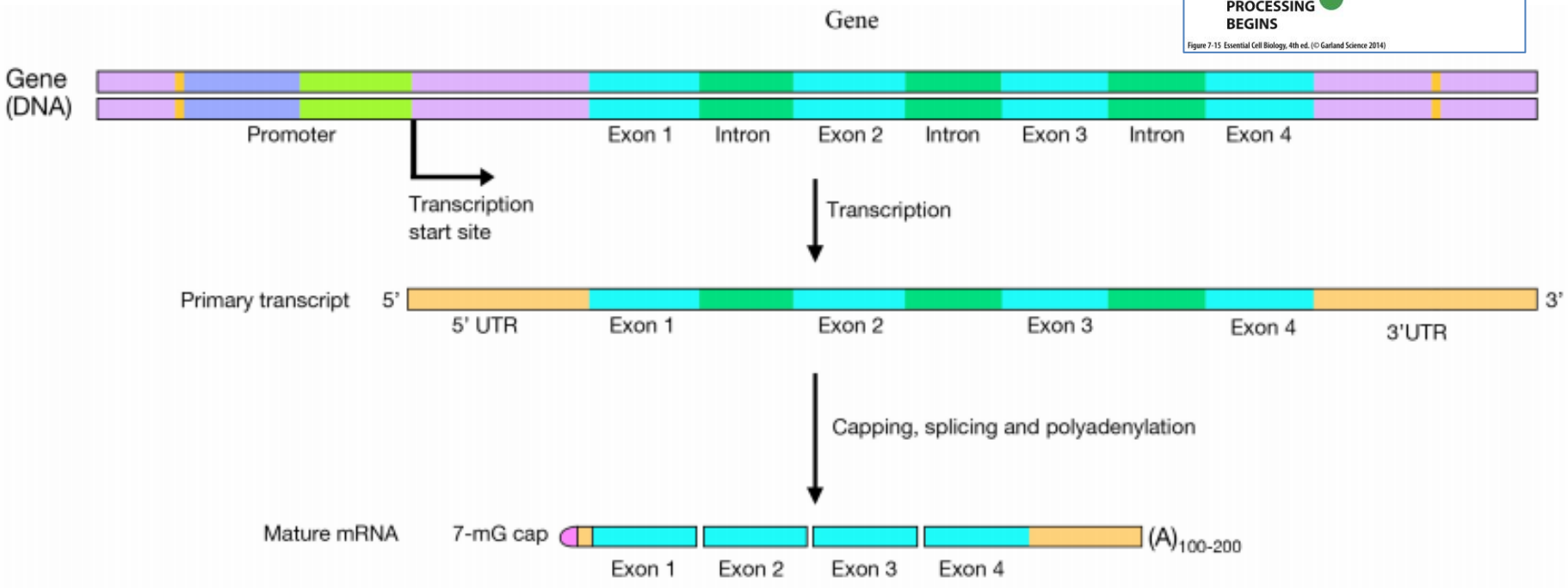
Different types of DNA-binding domains



19. mRNA maturation

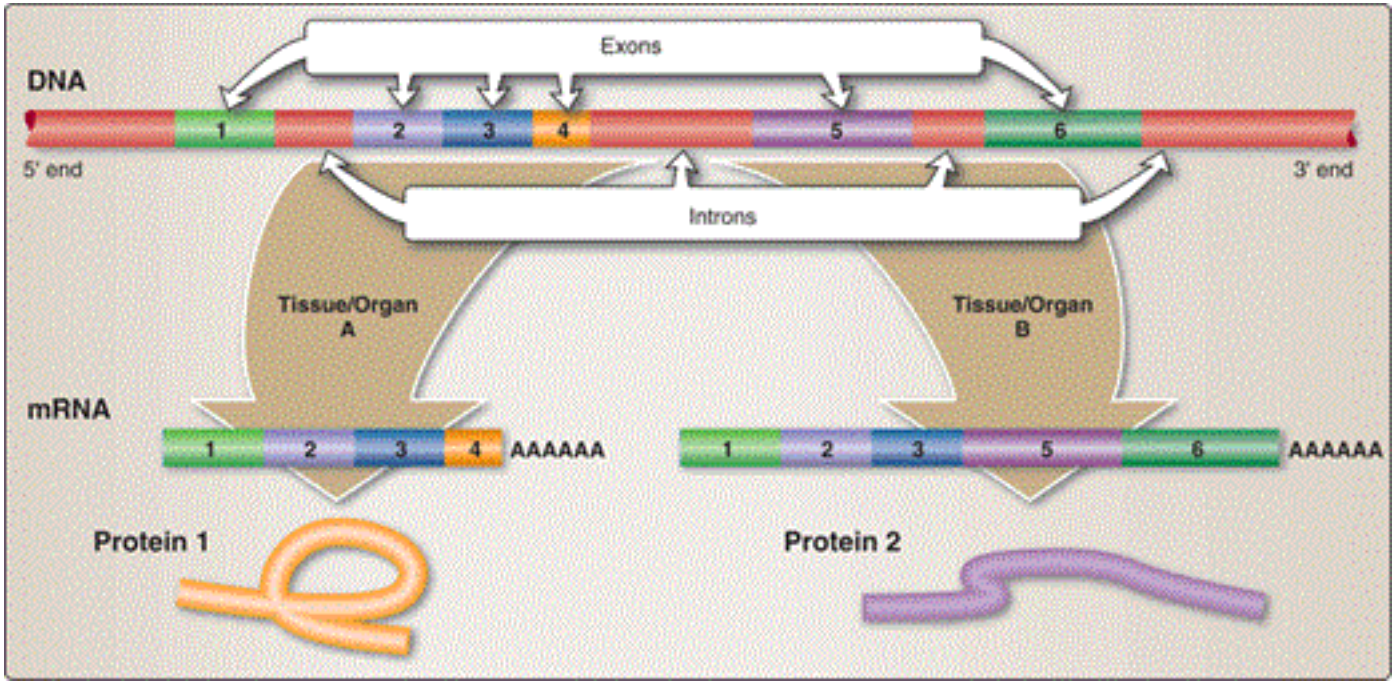
- Gene transcription produces an **RNA that is larger** than the **mRNA found in the cytoplasm for translation**. This larger RNA is called the **primary transcript** and contains segments of transcribed introns
- The primary transcript is matured **through splicing, 5' capping** (metylguonosine) **and 3'polyadenilation**



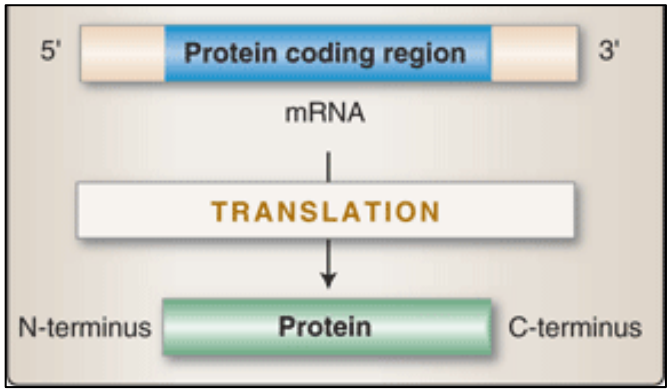


20. Alternative splicing = different proteins

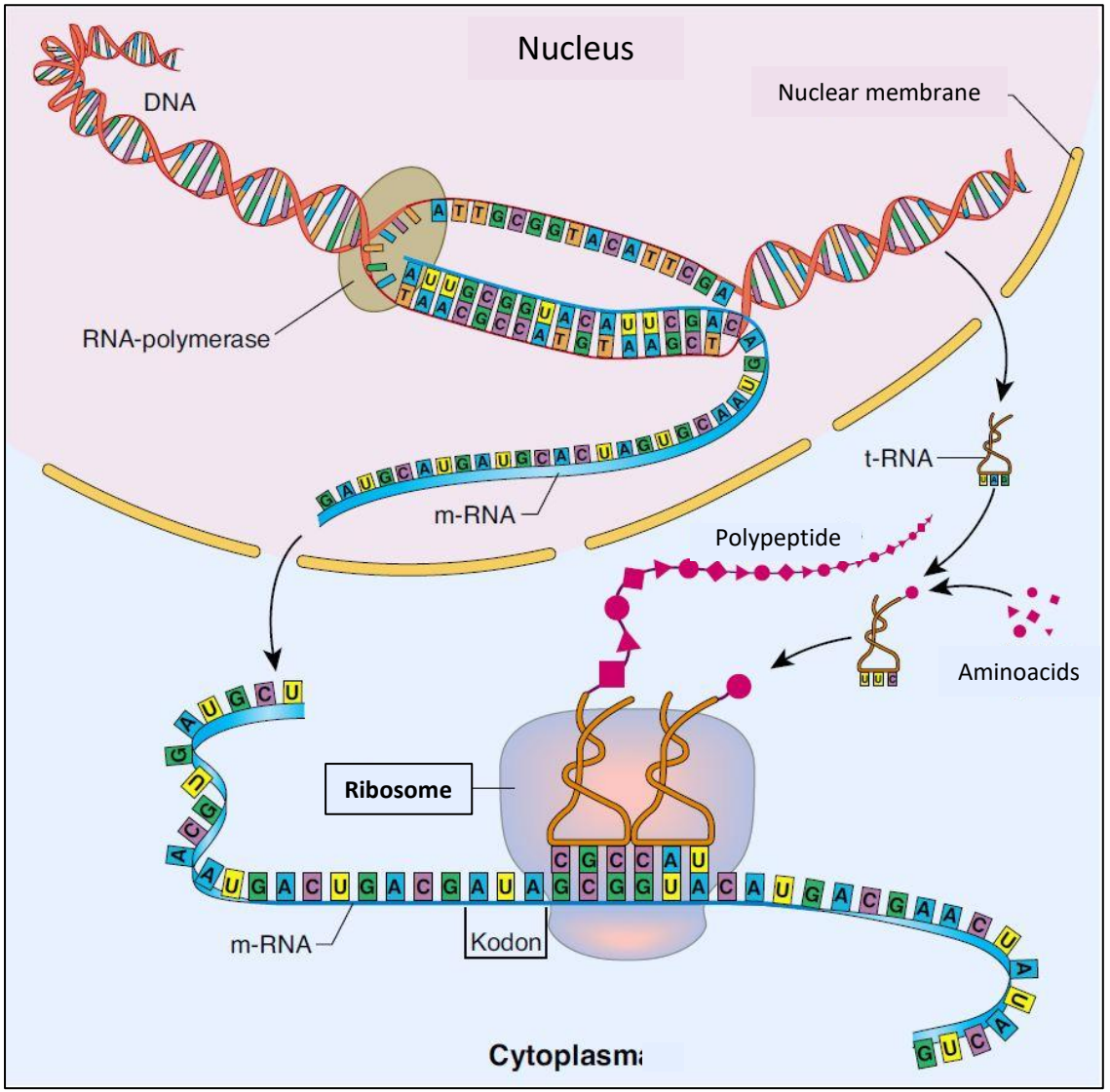
- **Alternative splicing** can give rise to **different proteins from the same gene**.
- In **most cases**, the **splicing patterns are regulated** by the cell so that different forms of the protein are produced at **different times** and in **different tissues**



21. Translation

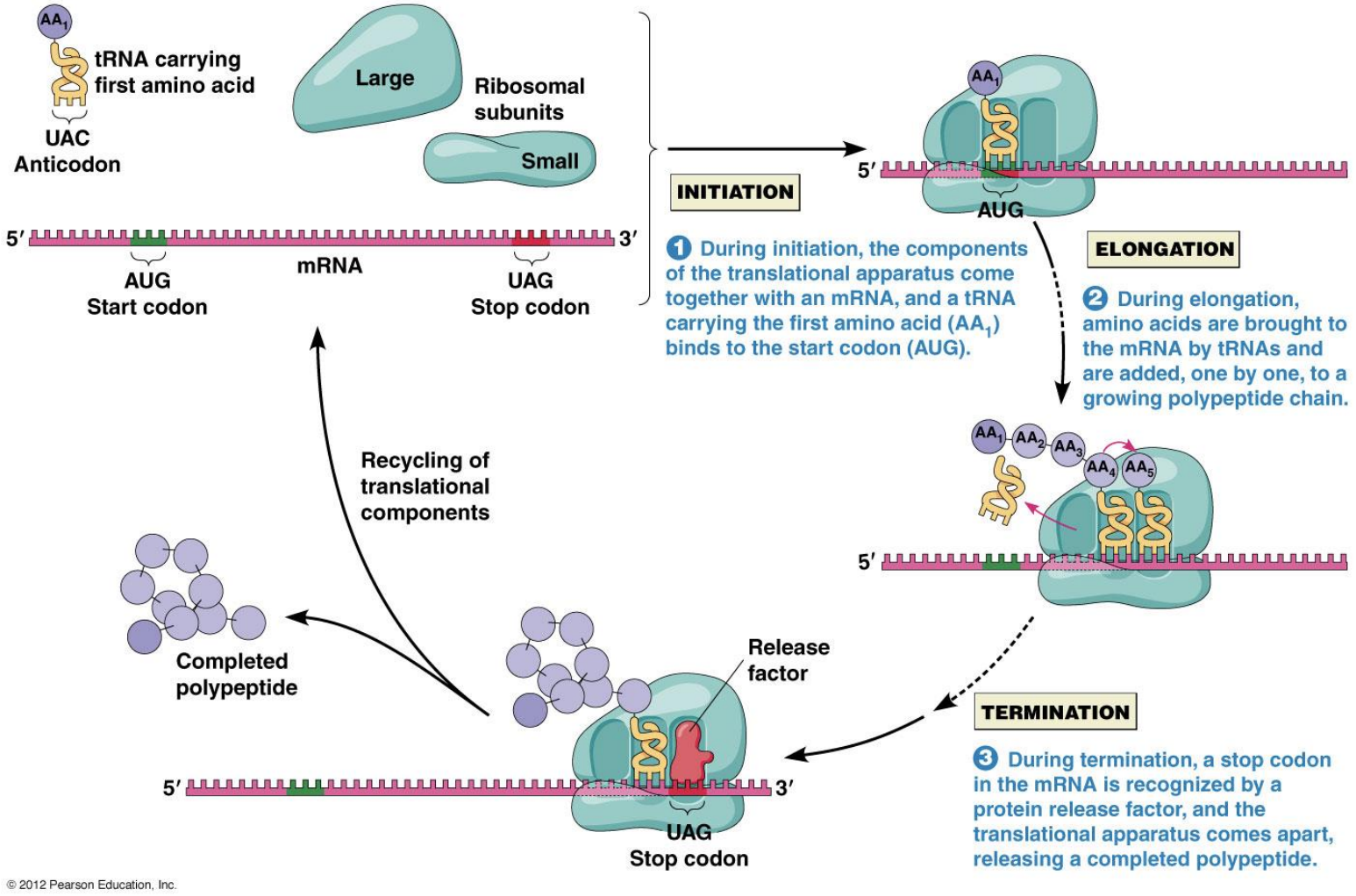


- A **large number of components** are required for the synthesis of a protein:
- **amino acids**
- **mRNA** to be translated
- transfer RNA (**tRNA**)
- functional **ribosomes**
- **energy sources**
- **Enzymes and protein factors** needed for **initiation, elongation, and termination** of the polypeptide chain.

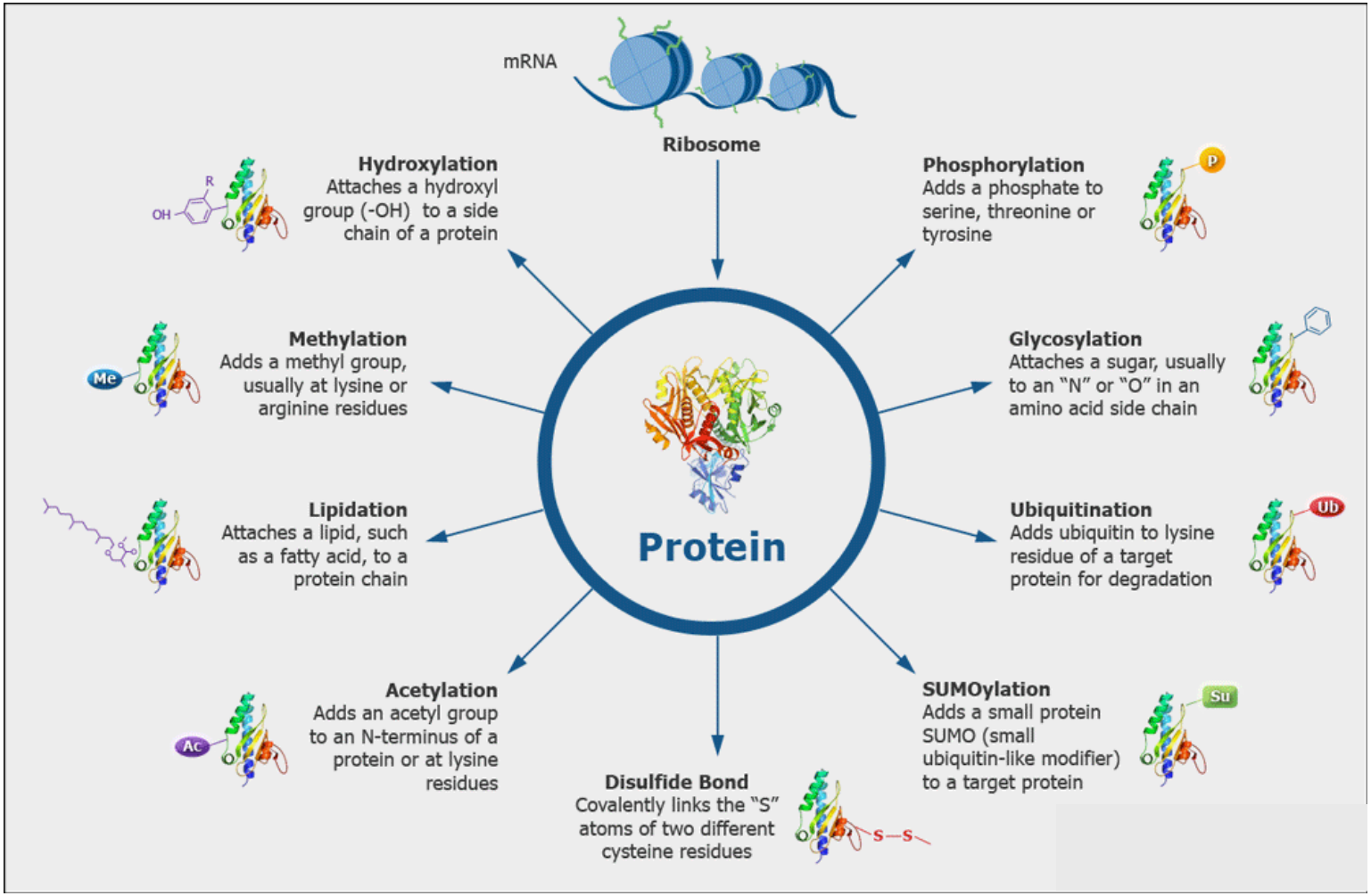


22. Phases of Translation

- • Translation is divided into three phases: initiation (1), elongation (2), and termination (3)



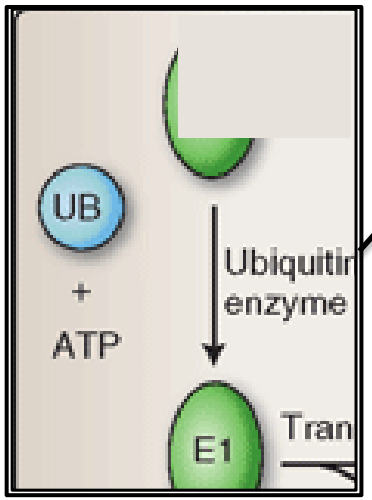
23. Modulation of protein function: post-translational modifications

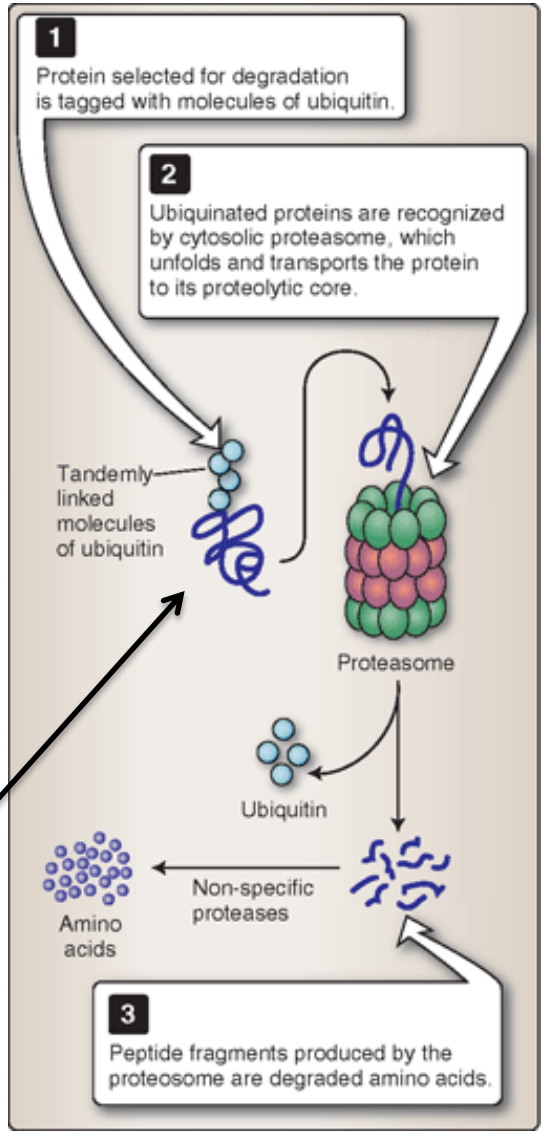


24. Protein degradation

- **Proteosome:** The 26S proteosome is a large complex (made up of **about 60 protein** subunits) and resembles a **large cylinder**. It contains a **central core (20S**) and a **19S regulatory particle** at either end:
  - 19S particle contains **several ATPases** and other enzymes and is important for recognition and binding of polyubiquitinated proteins, removal of ubiquitin, unfolding the protein substrate, and **translocation into the central core**.
  - Proteins are then **hydrolyzed within** the **central core** into **smaller peptides**, which are **further degraded by cytosolic peptidases**.

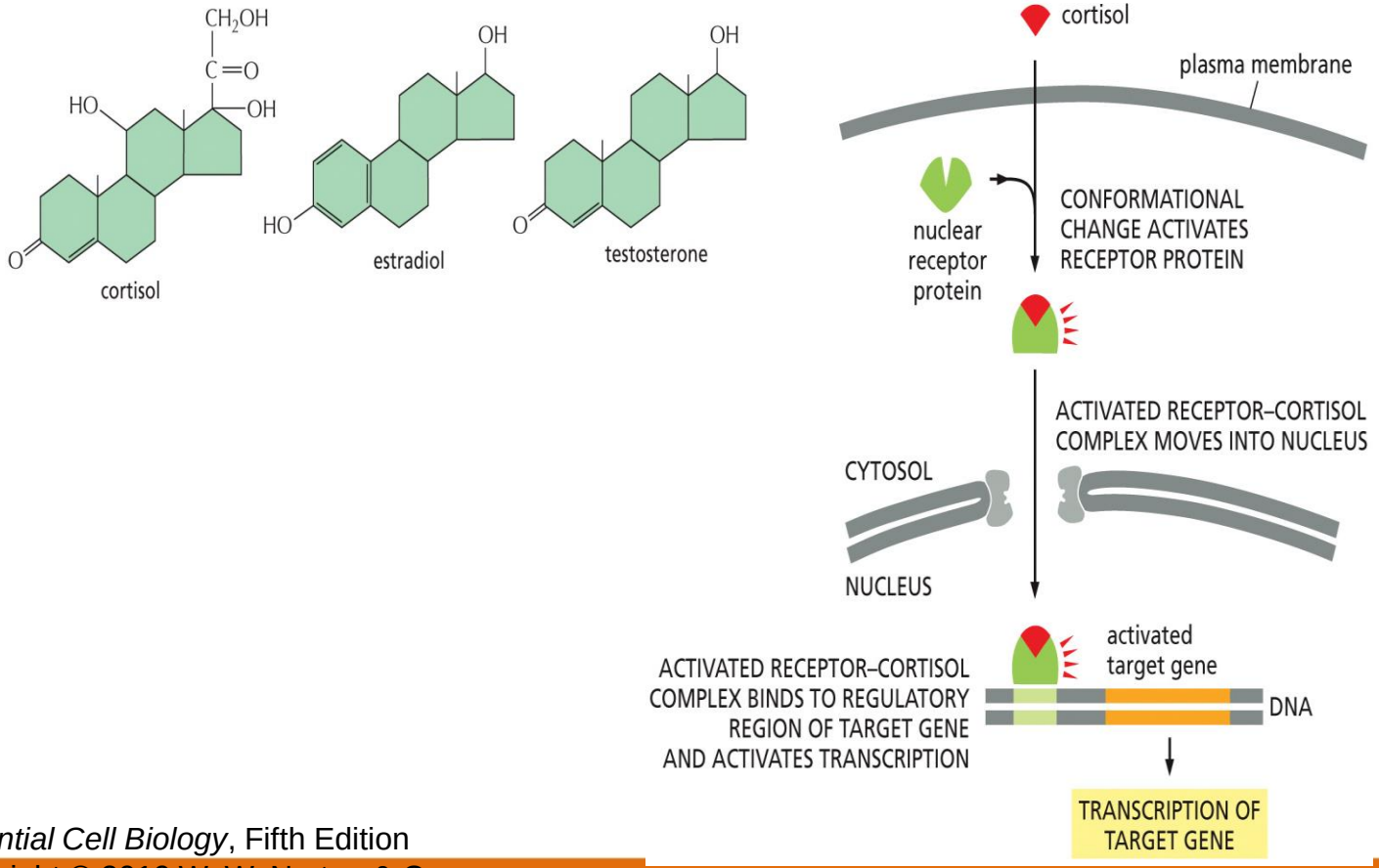
- The ATP-dependent pathway involves the protein **ubiquitin**, a highly conserved **protein containing 76 amino acids** which, as the name suggests, is ubiquitous in the eukaryotic kingdom. Proteins destined for destruction are **tagged by multiple covalent attachment** of ubiquitin (**→polyubiquitination**) through the enzimatic action of highly specific enzymes.





33. Intracellular RECEPTORS

- Some Extracellular Signal Molecules Cross the Plasma Membrane and Bind to Intracellular Receptors



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