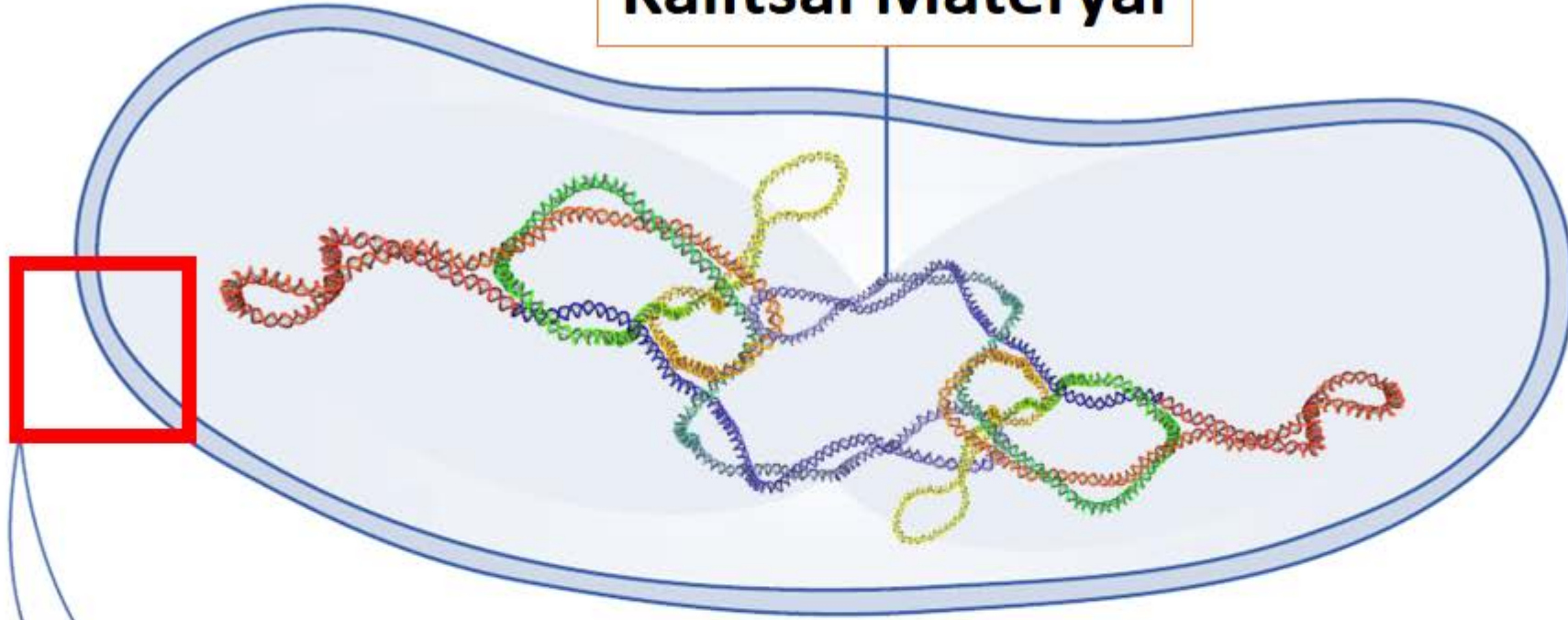


Kalitsal Materyal

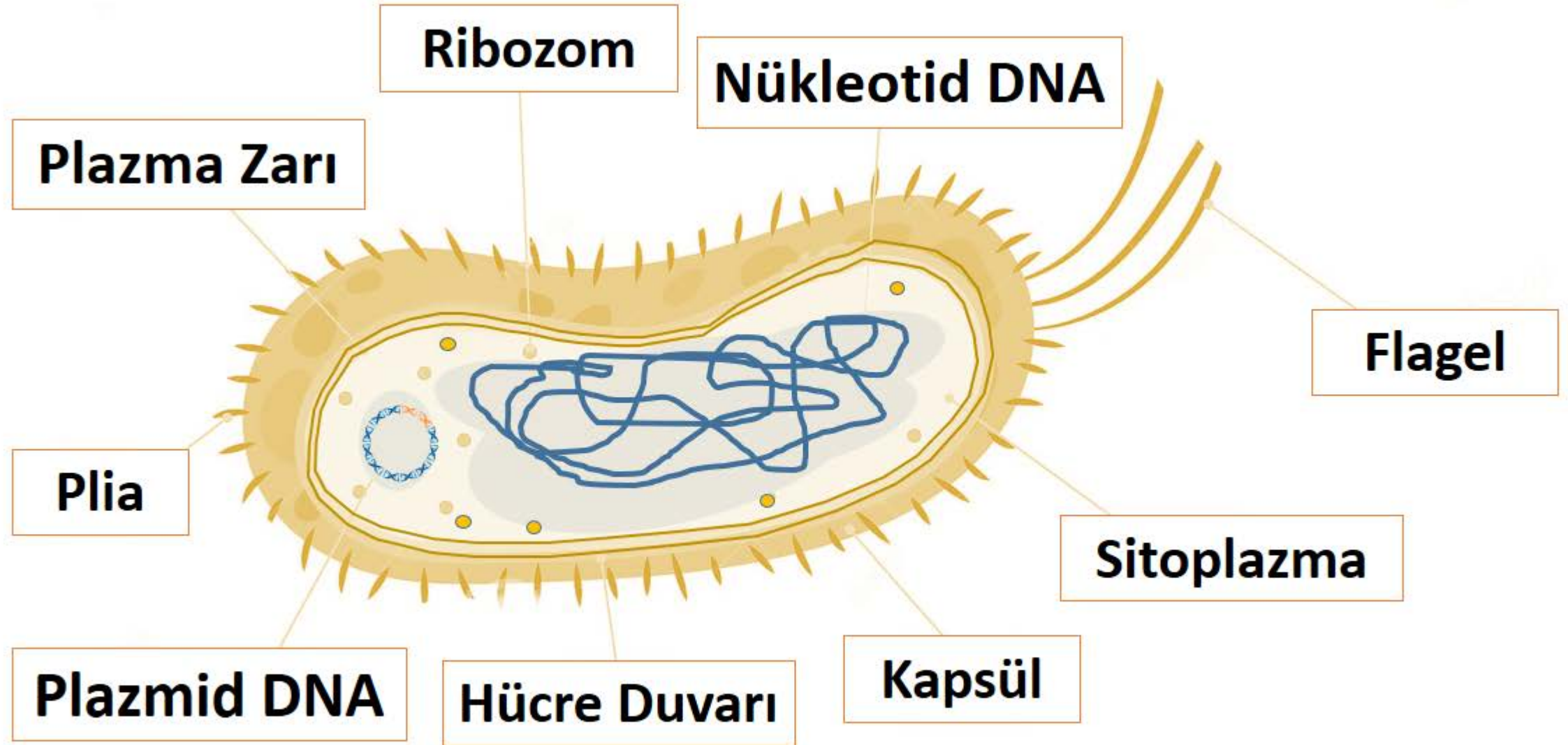


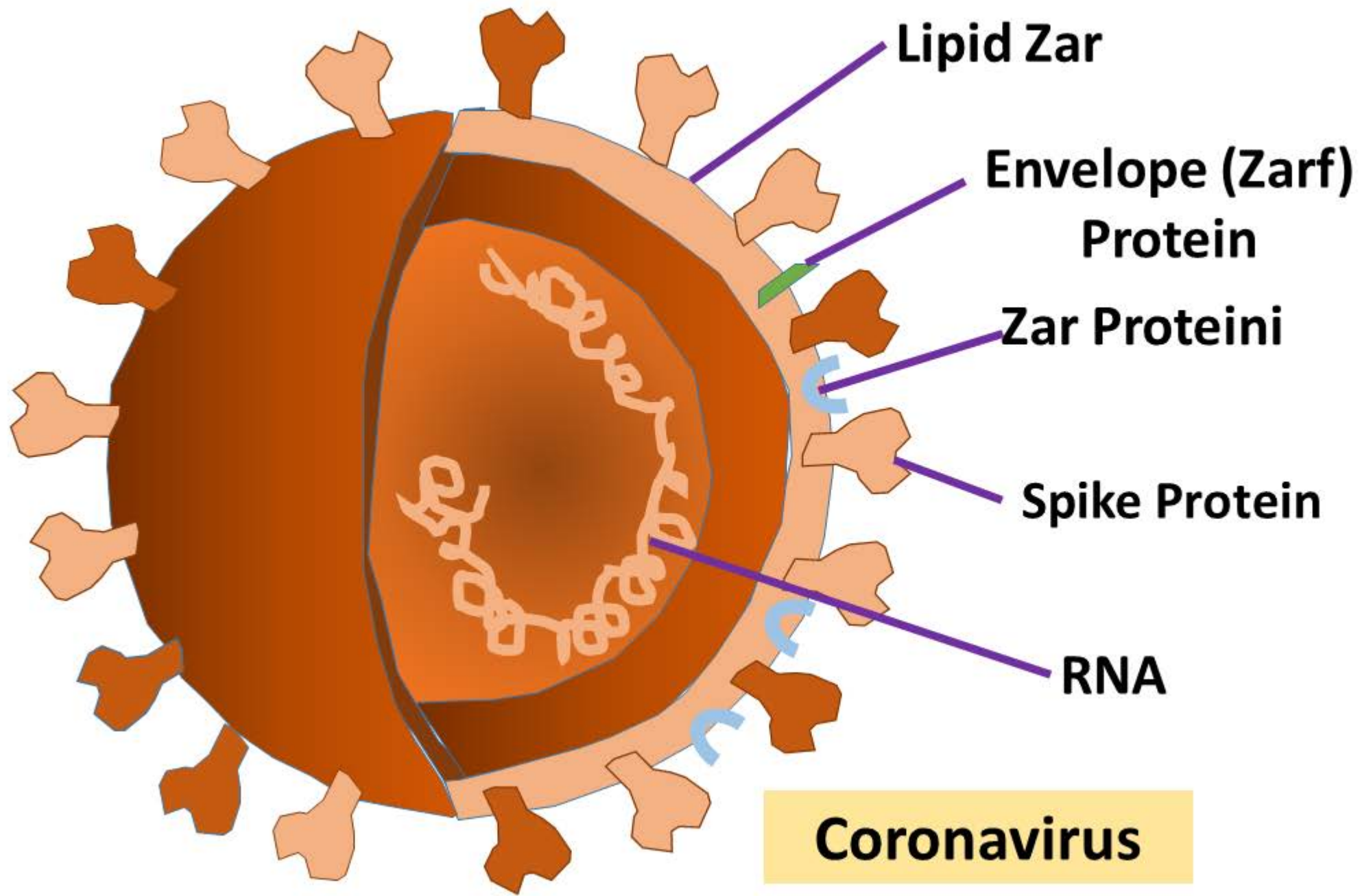
İç hücre zarı

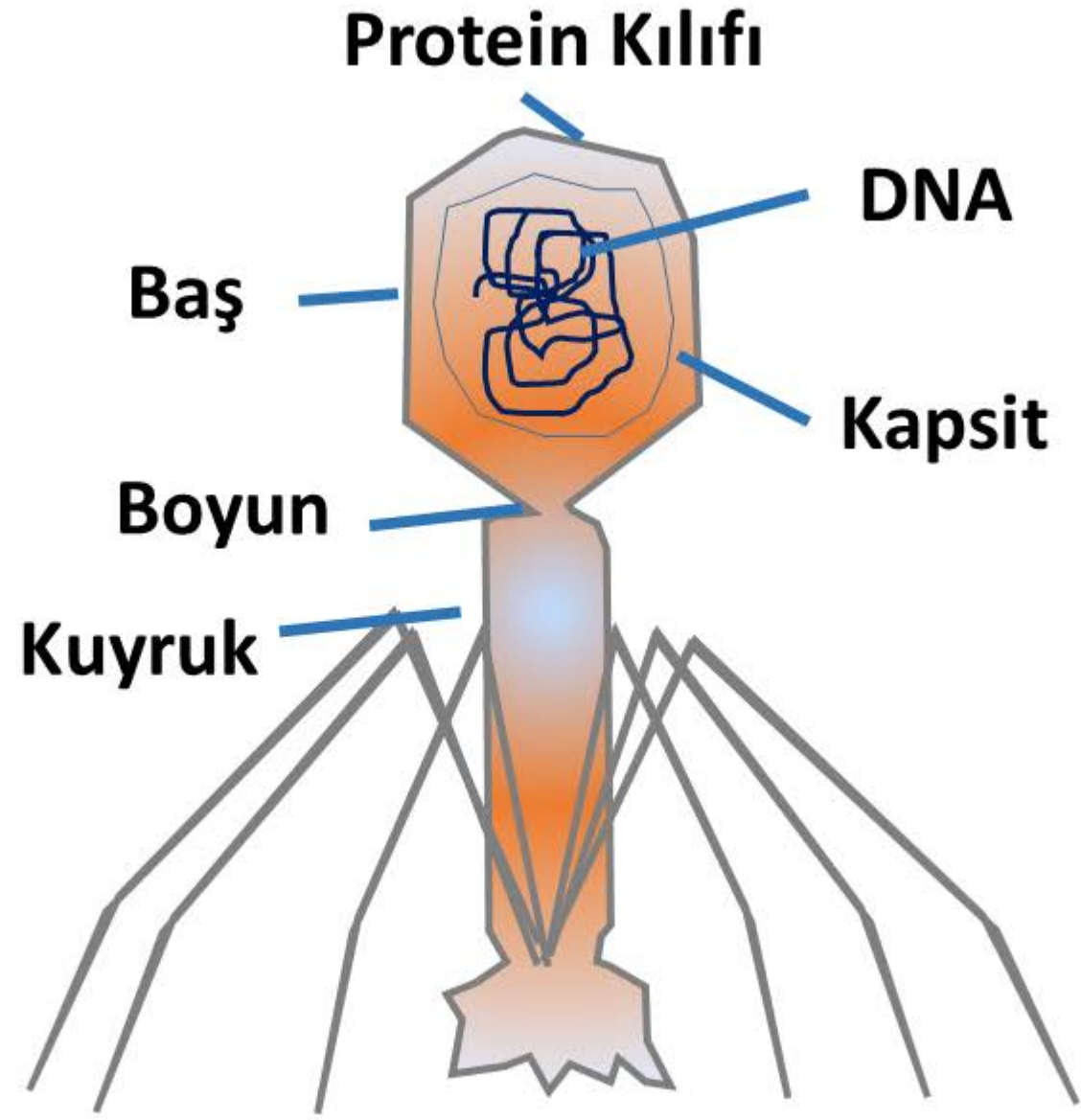
Hücre duvarı

Hücre zarı arası boşluk

Dış hücre zarı







T4 Bakteriyofaj

Granüllü
Endoplazmik
Retikulum

Çekirdek Zarı

Hücre Zarı

Golgi

Çekirdek

Mitokondri

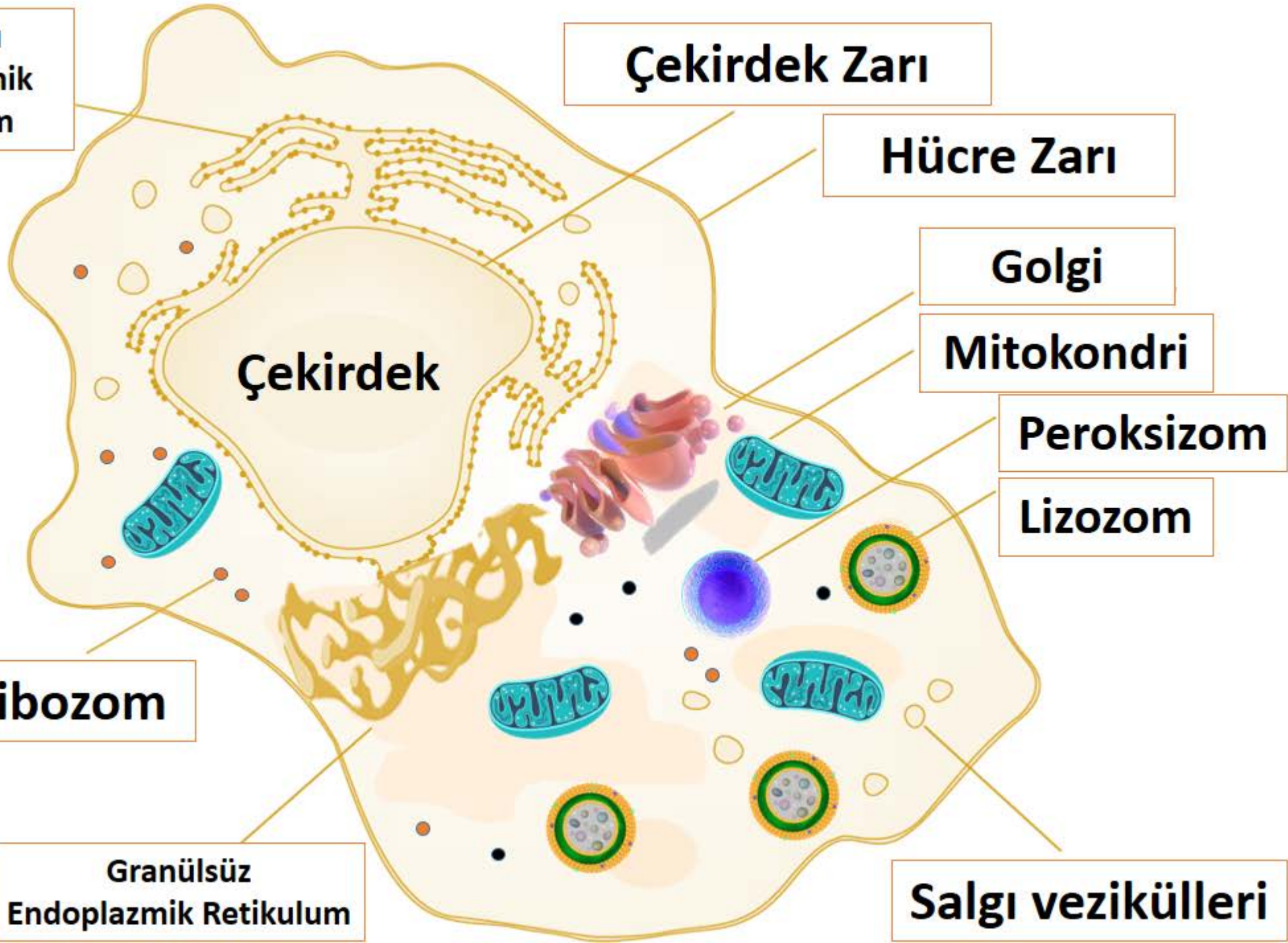
Peroksizom

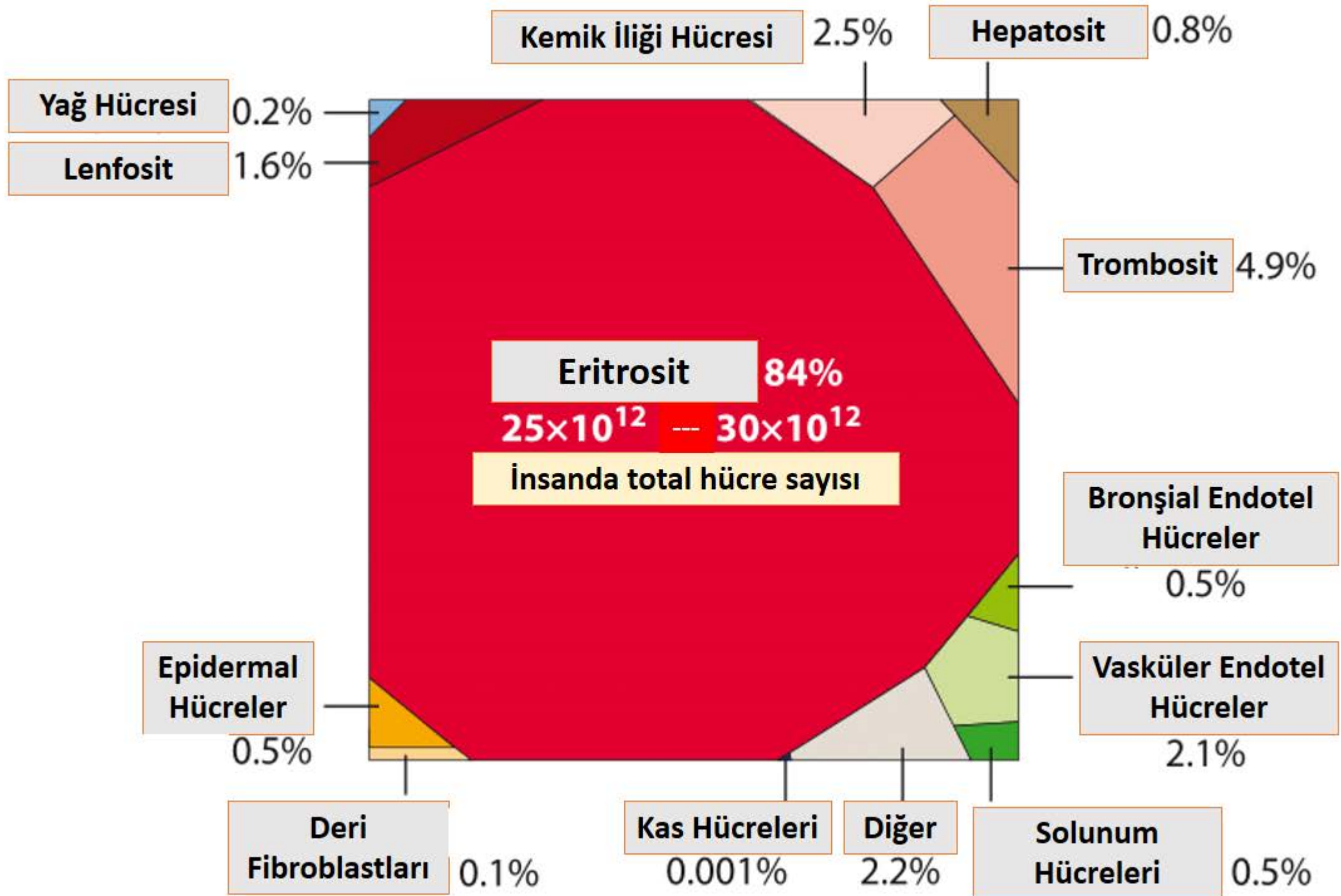
Lizozom

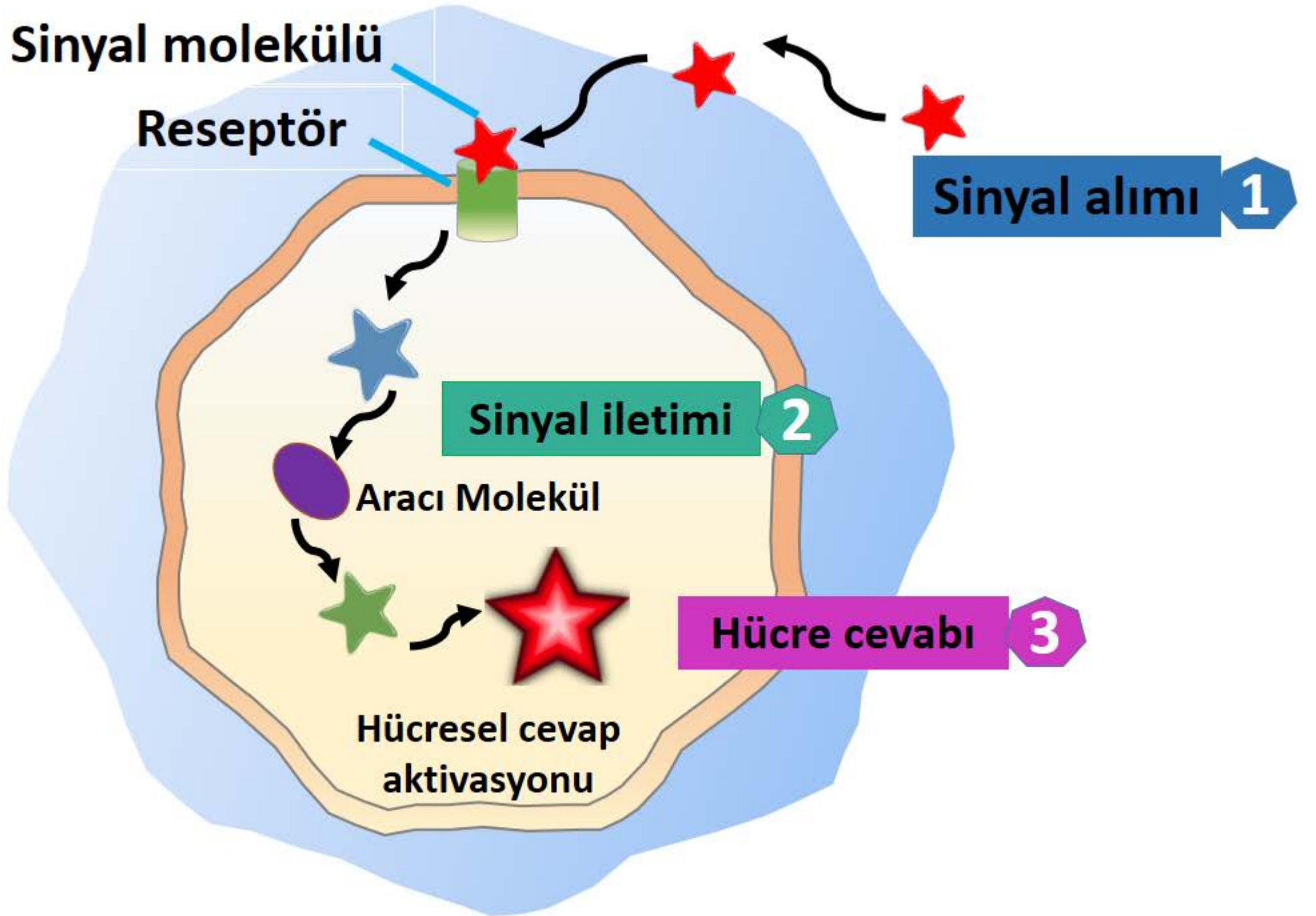
Ribozom

Granülsüz
Endoplazmik Retikulum

Salgı vezikülleri

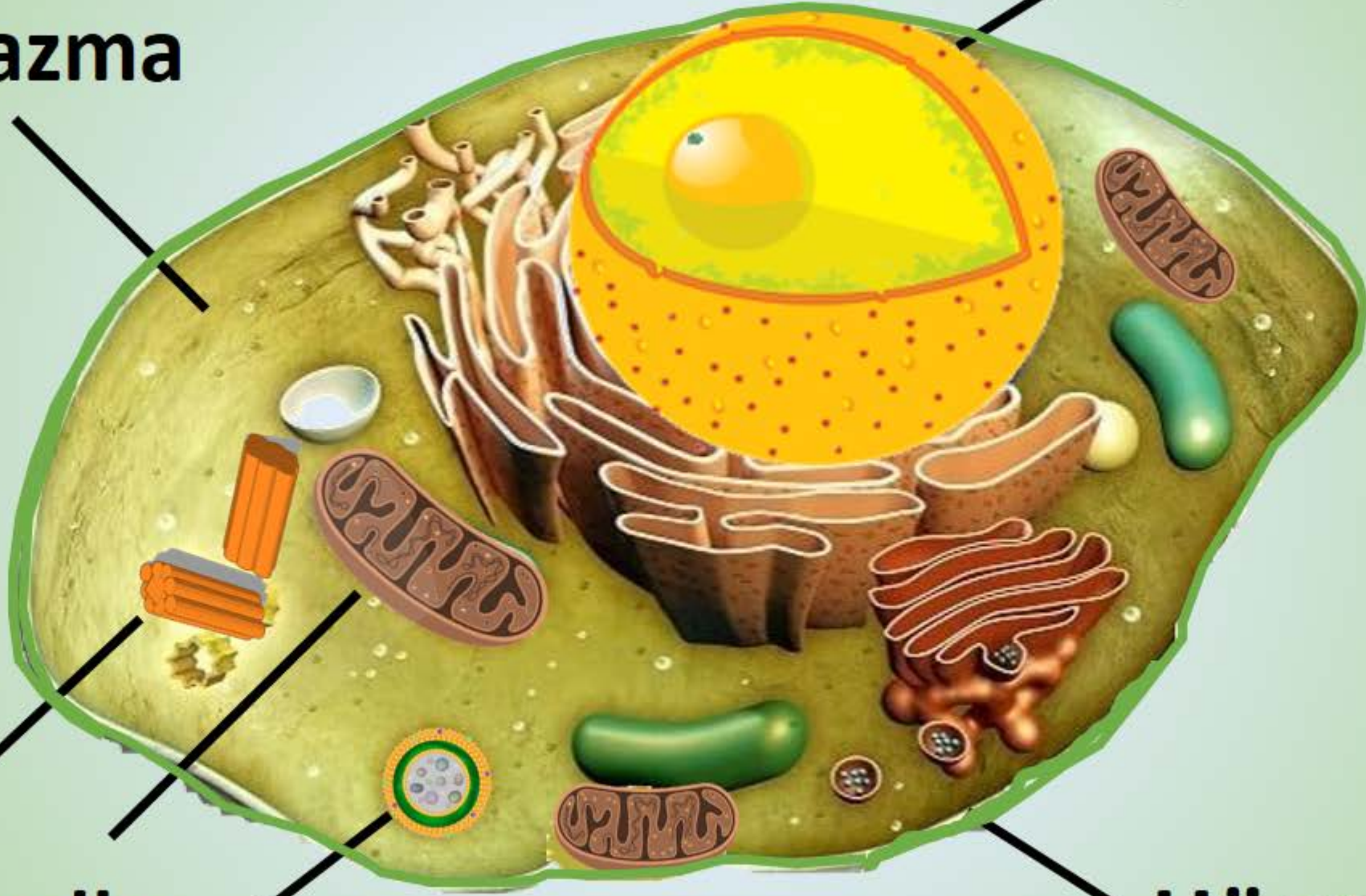






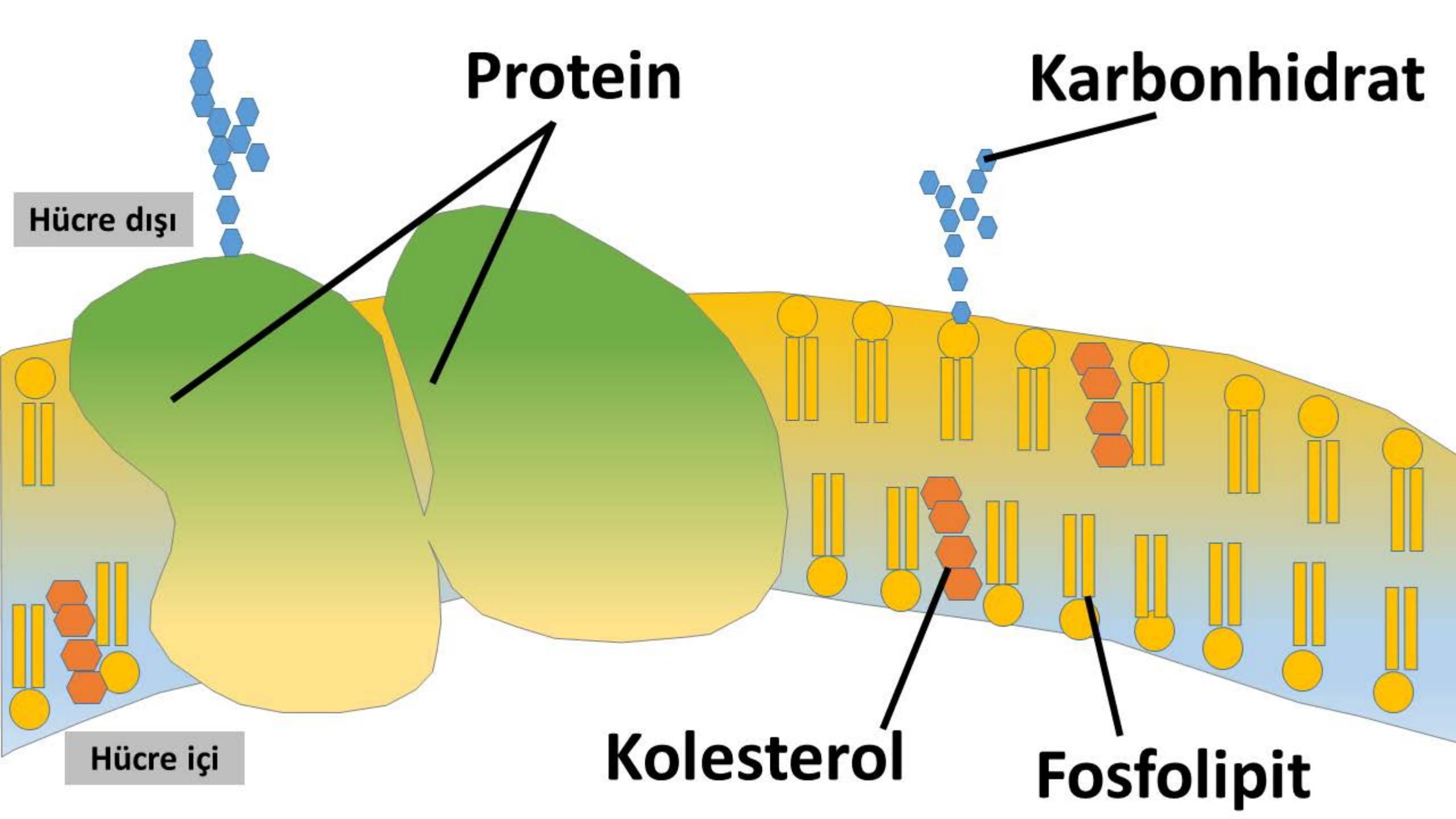
Sitoplazma

Çekirdek



Organelles

Hücre Zarı



Hücre dışı

Protein

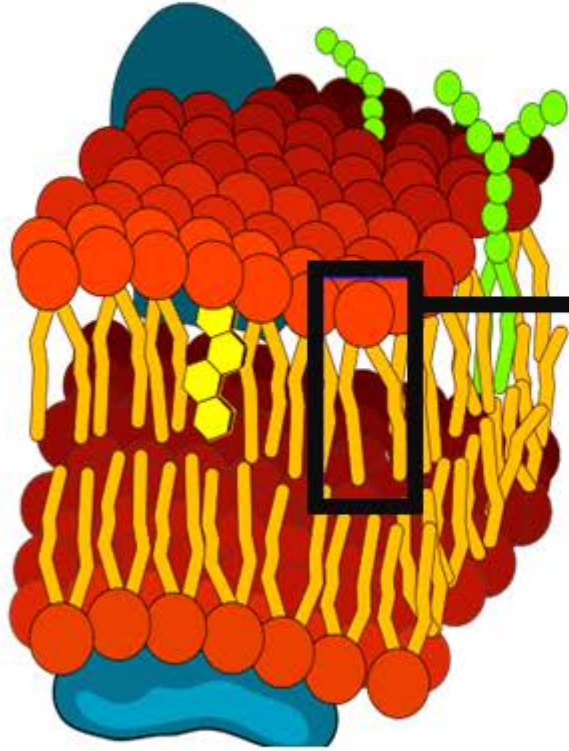
Karbonhidrat

Hücre içi

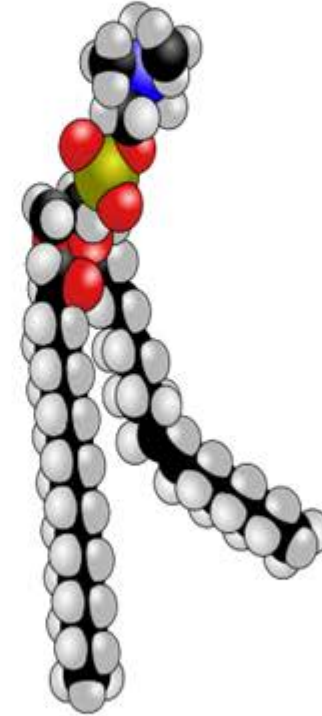
Kolesterol

Fosfolipit

Fosfolipit çift tabaka



Fosfolipit



Hidrofilik baş

Hidrofobik
kuyruk

Lipid Salları bölgesi

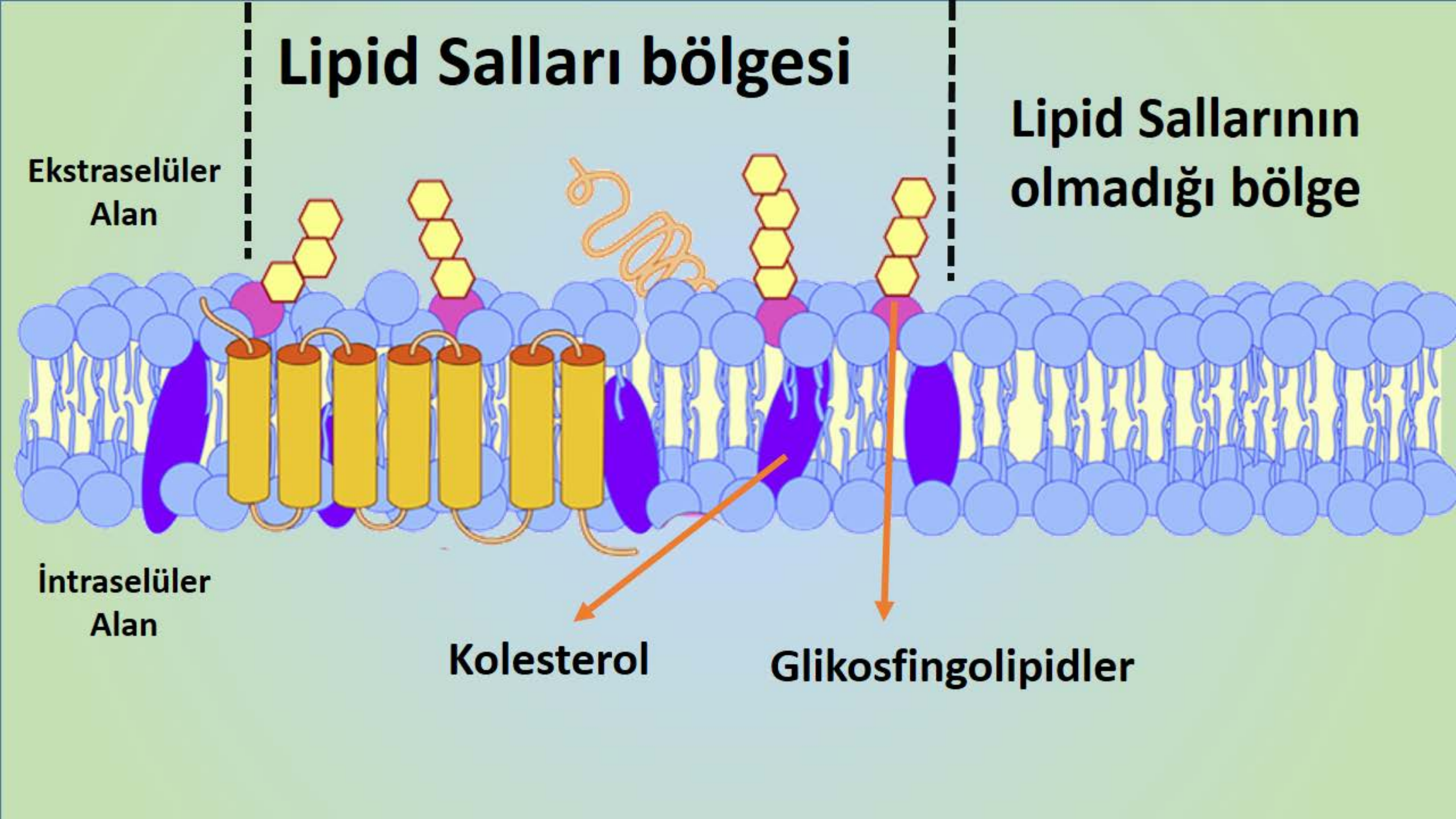
Lipid Sallarının
olmadığı bölge

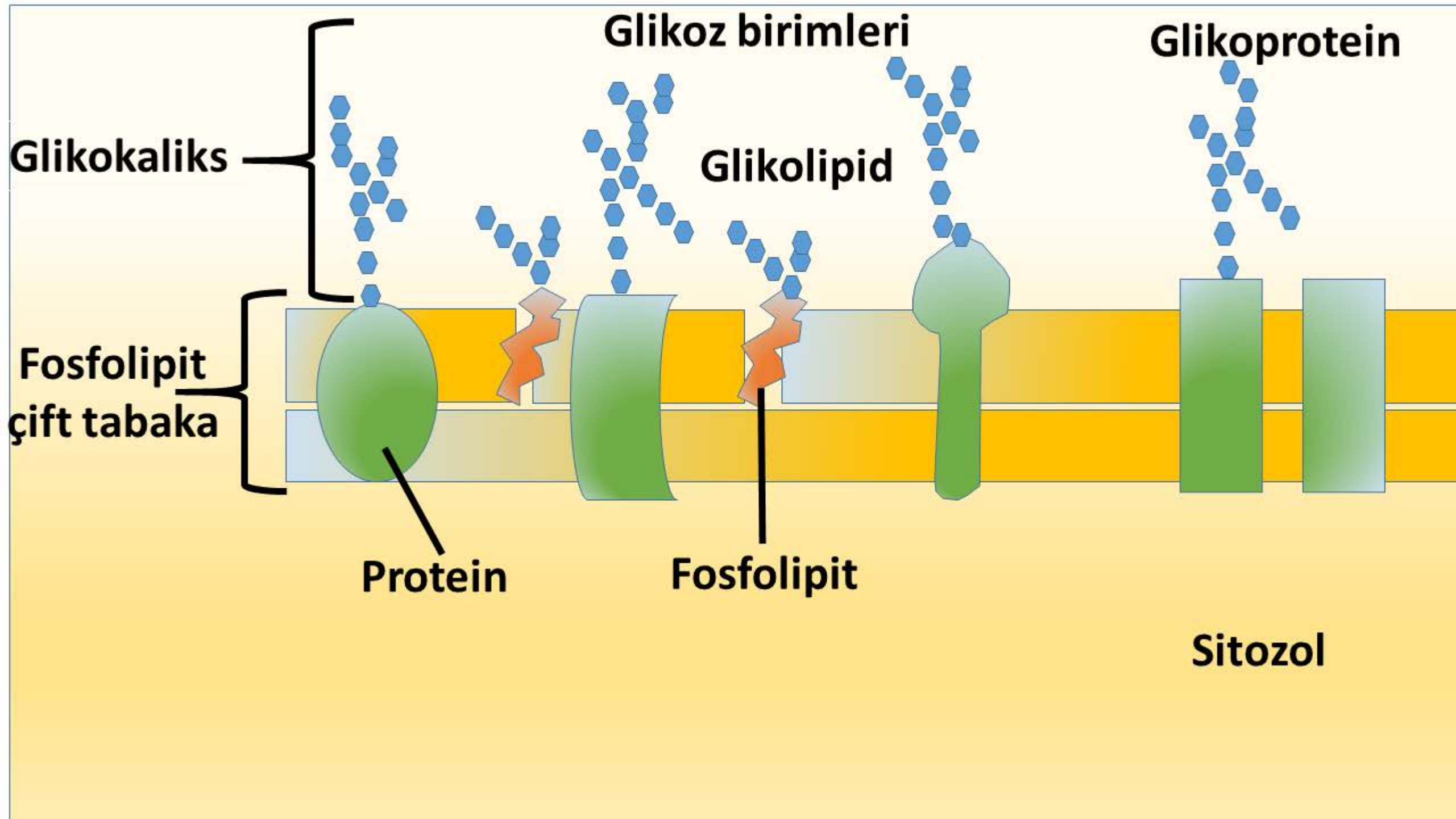
Ekstraselüler
Alan

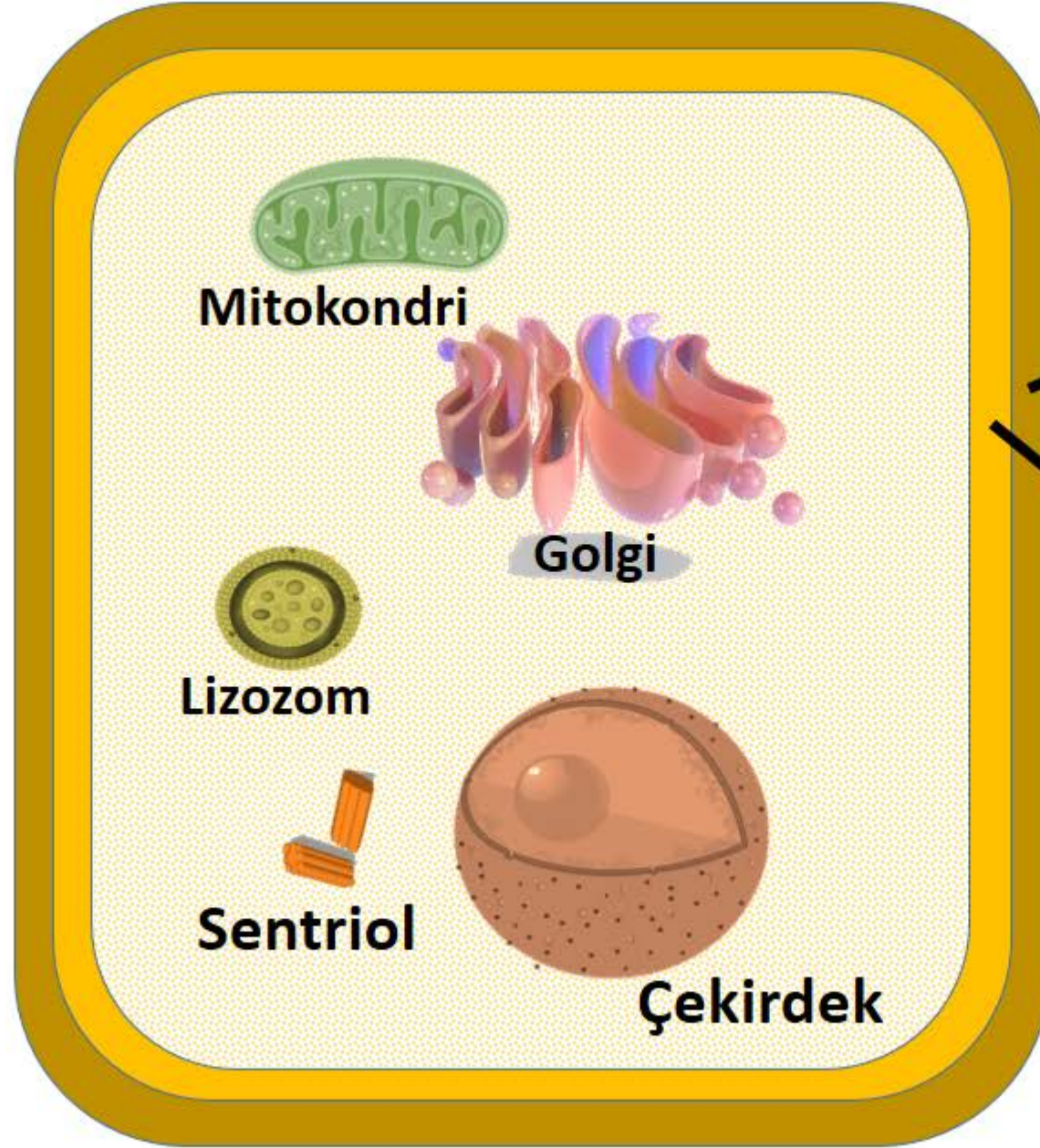
İntraselüler
Alan

Kolesterol

Glikosfingolipidler







Mitokondri

Golgi

Lizozom

Sentriol

Çekirdek

Eksoplazmik Yüz

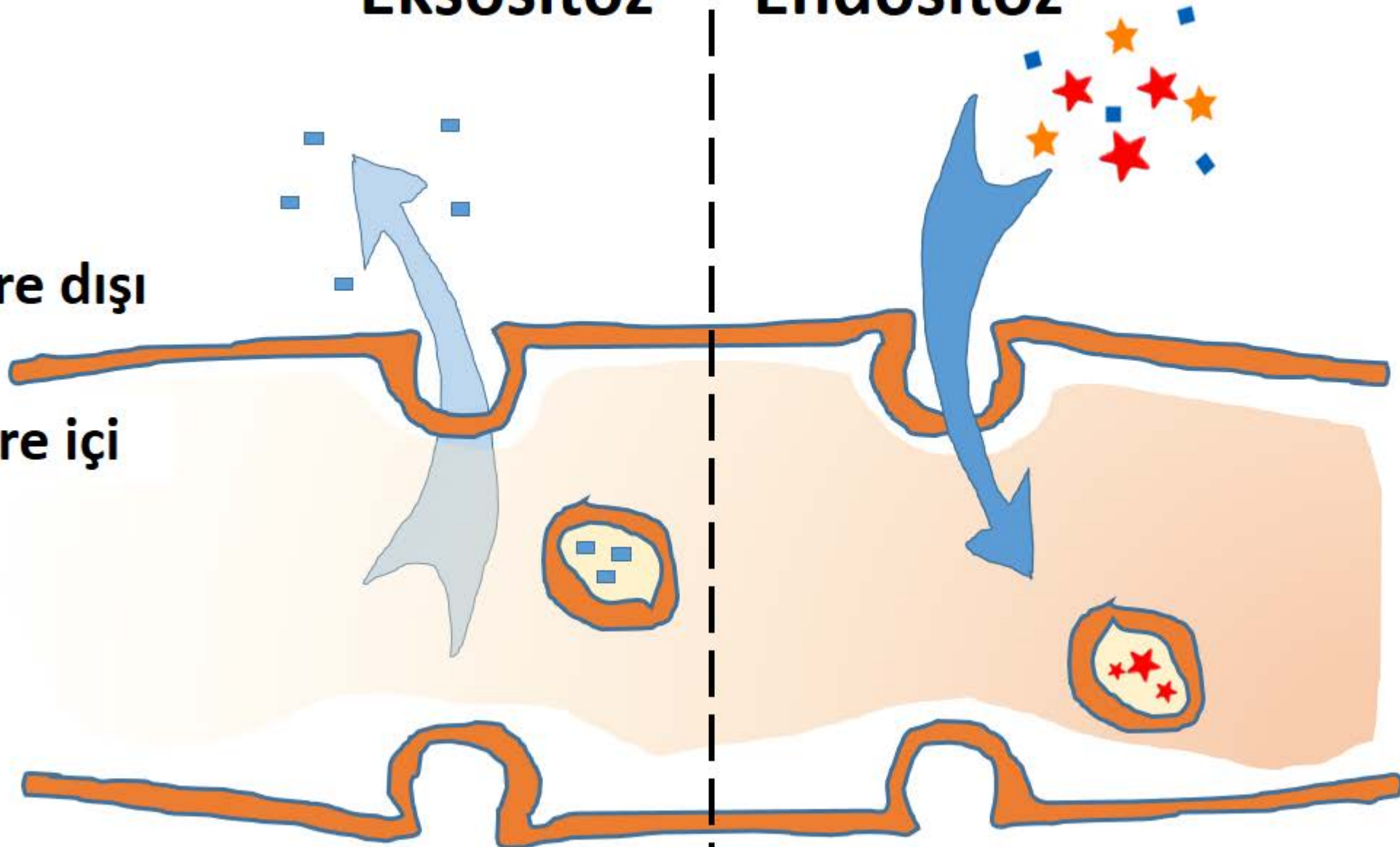
Sitozolik Yüz

Eksositoz

Endositoz

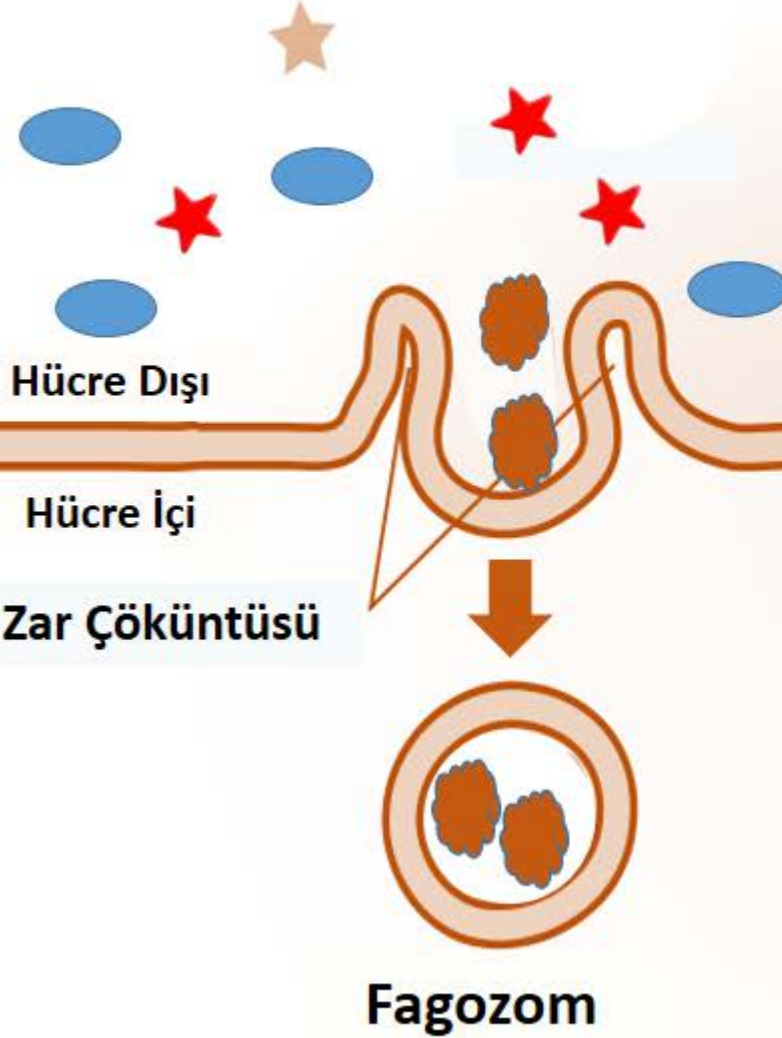
Hücre dışı

Hücre içi

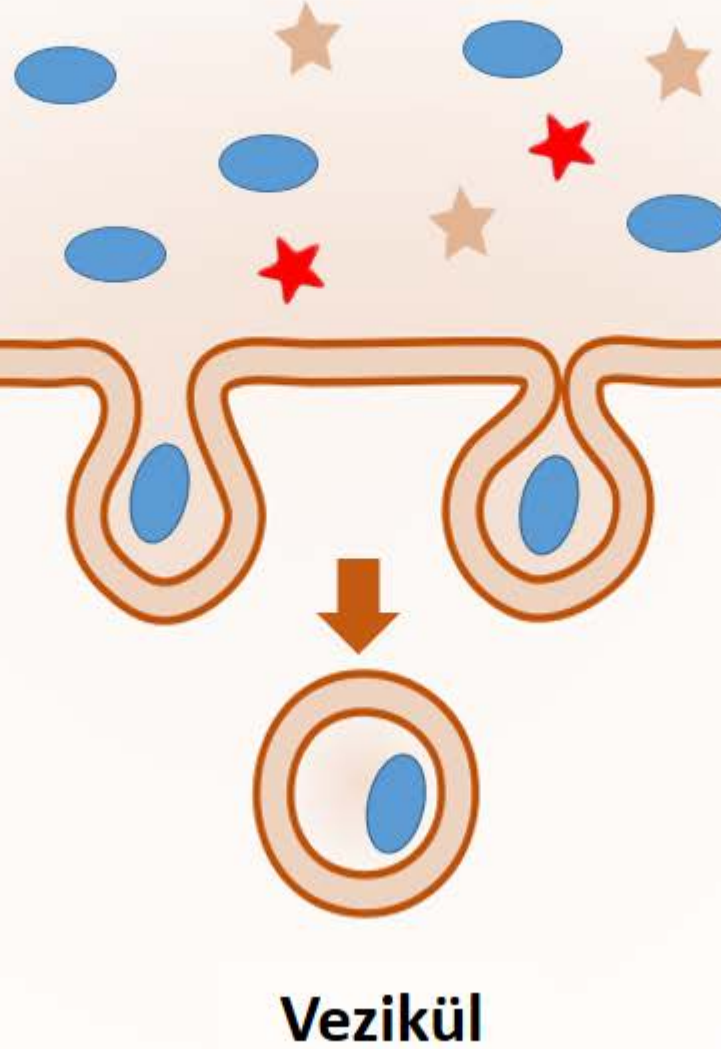


ENDOSİTOZ

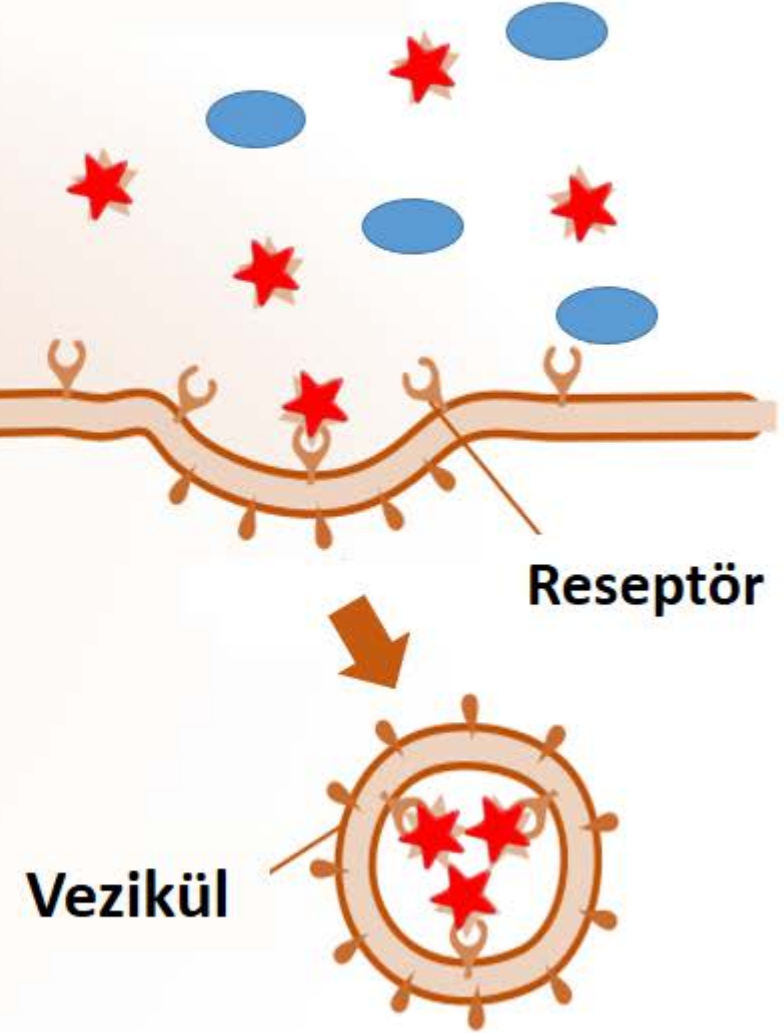
Fagositoz

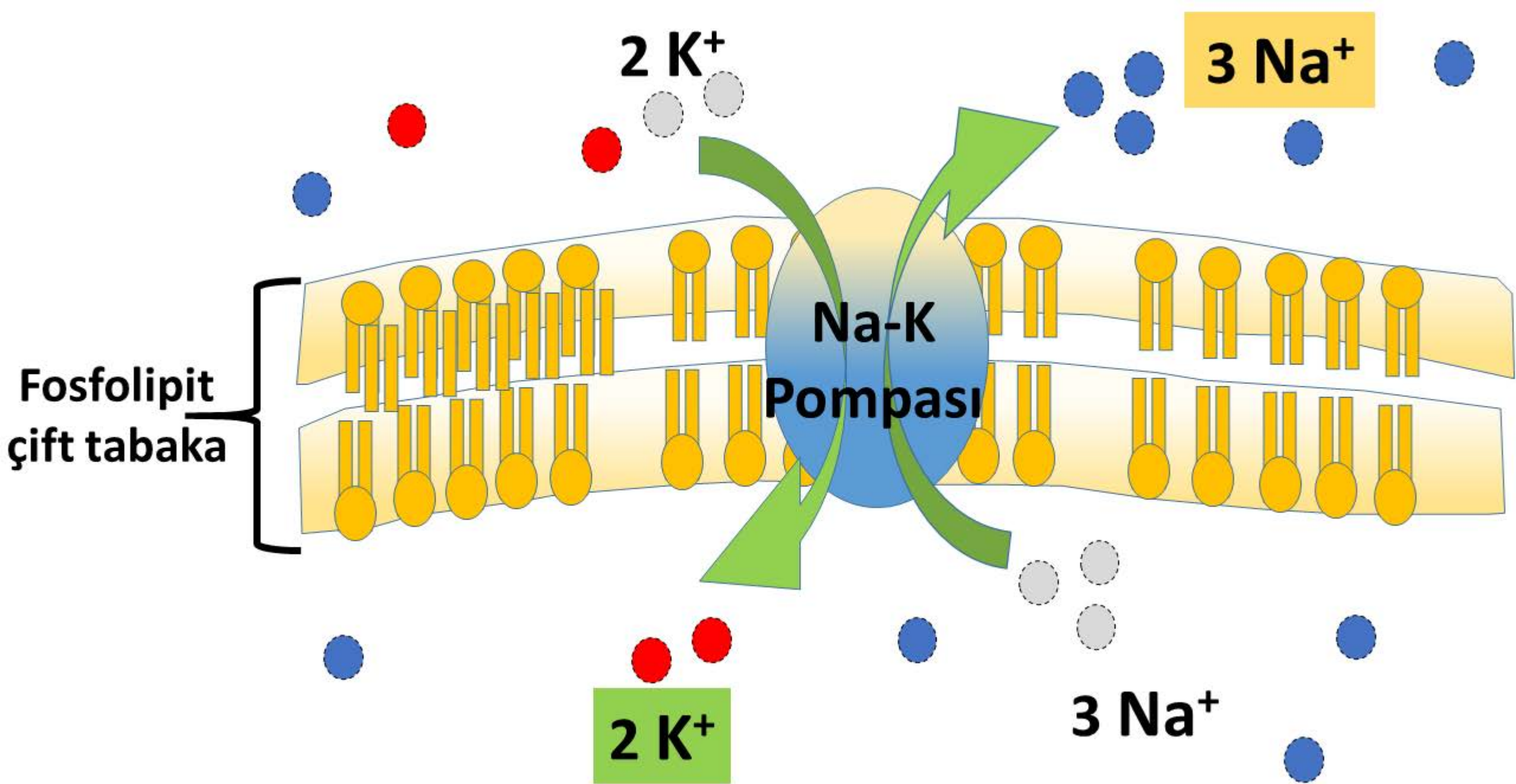


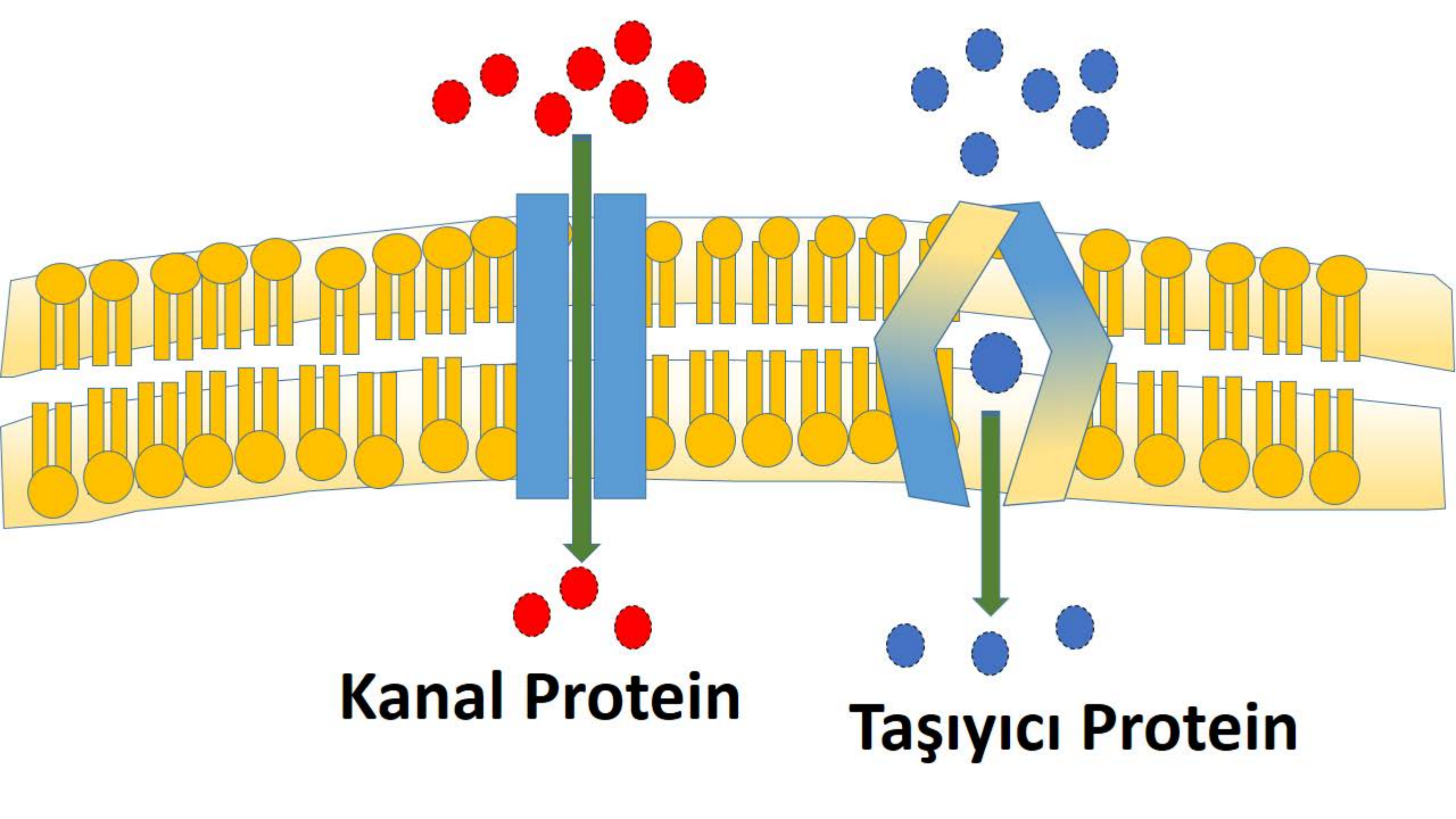
Pinositoz



Reseptör Aracılı Pinositoz



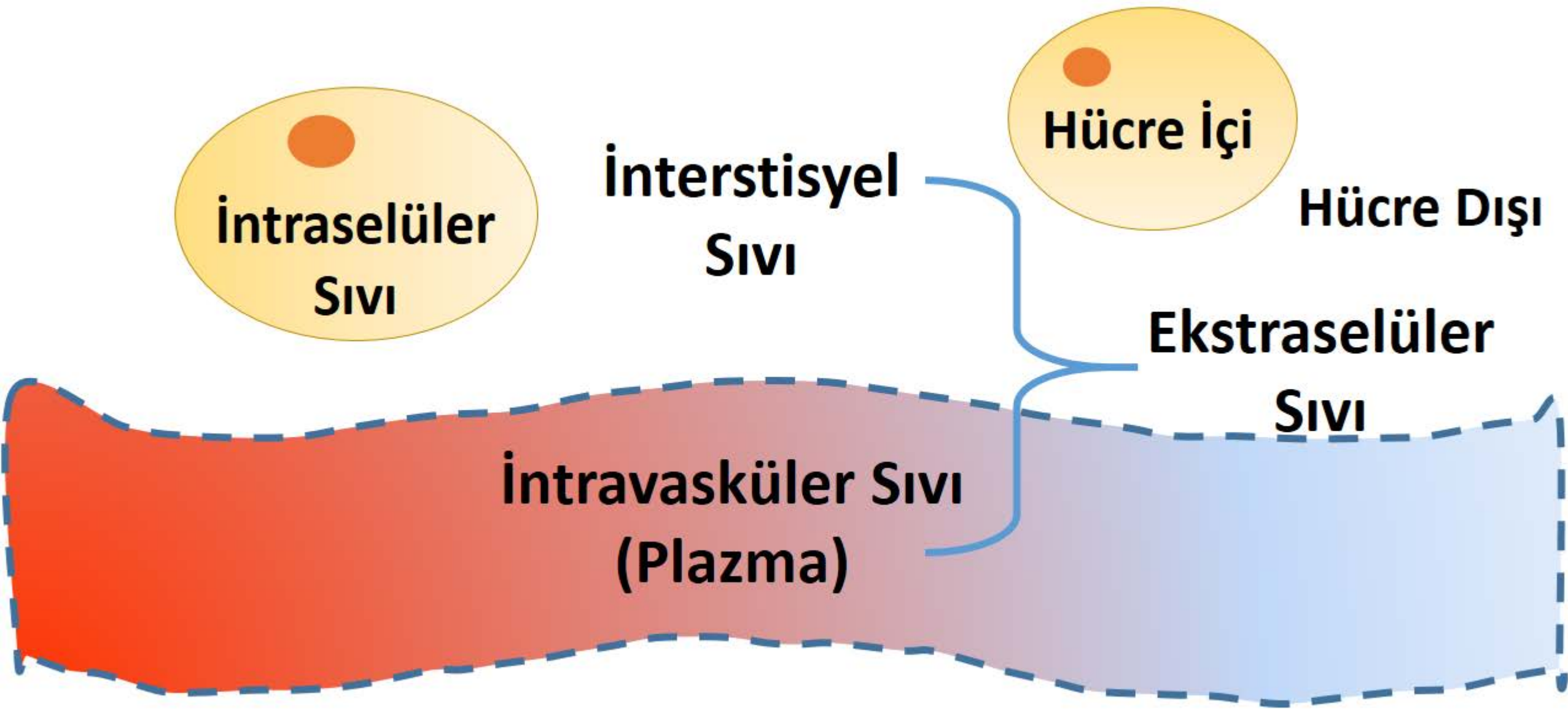




Kanal Protein

Taşıyıcı Protein





Sitozol-Sitoplazma-Proto plazma-Hücre

Proto plazma

Plazma Membrani

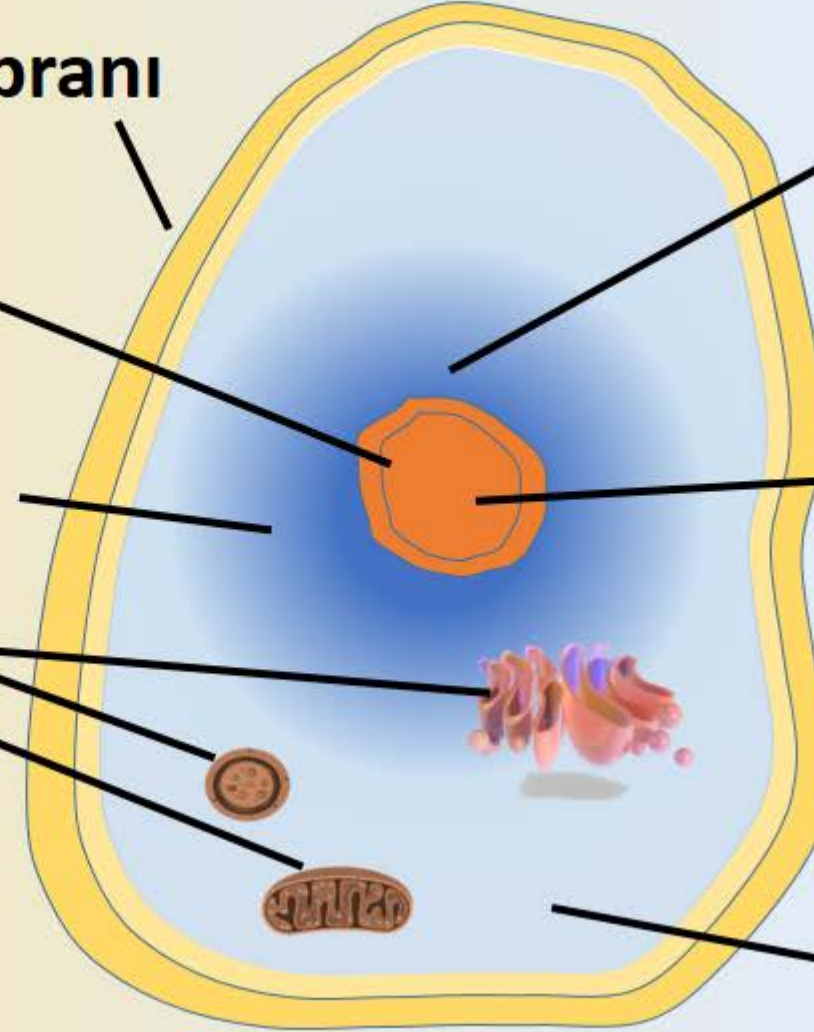
Endoplazma

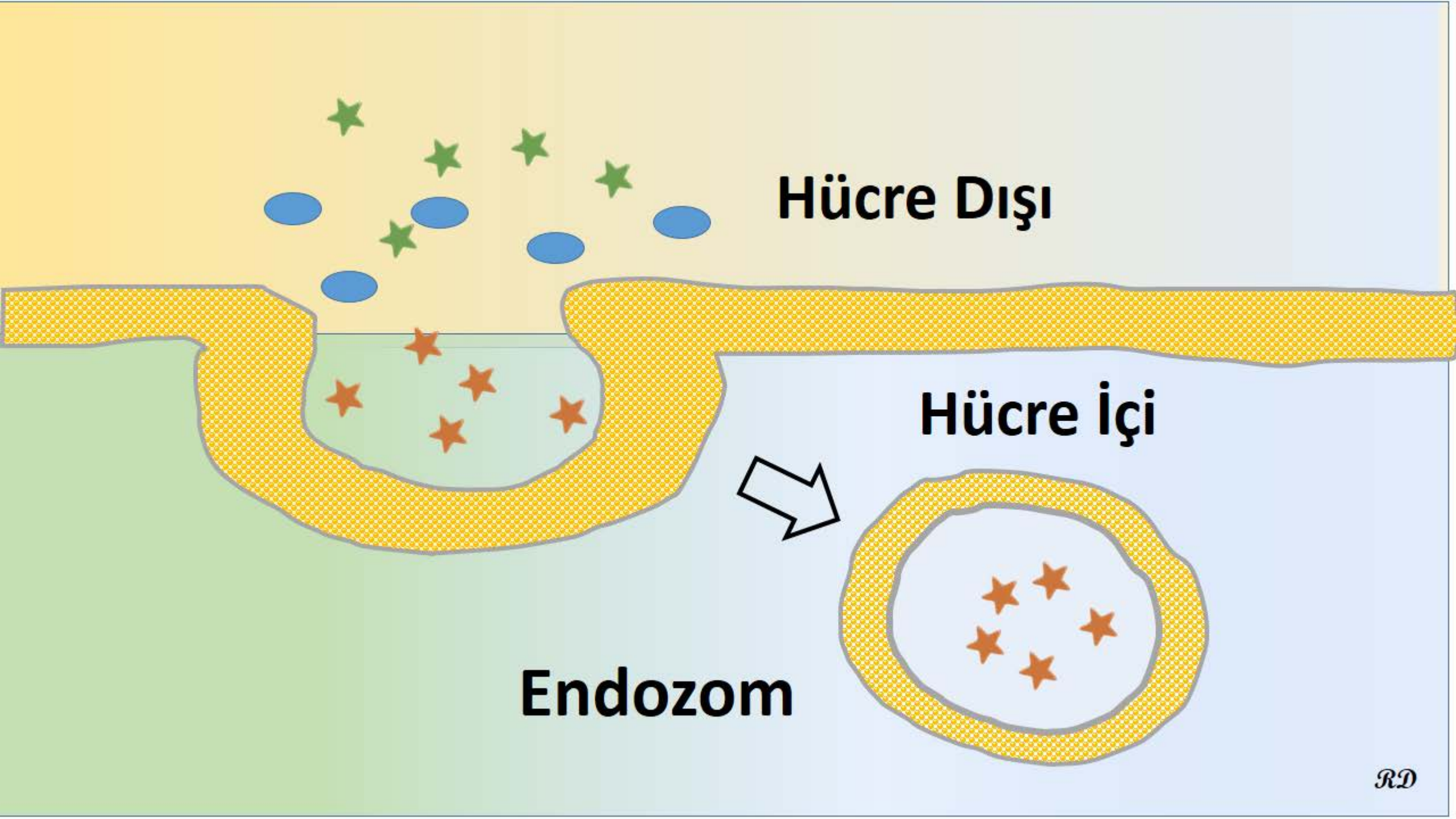
Nukleus

Sitoplazma
(Sitozol ve
Organelleler)

Nukleoplazma

Ektoplazma

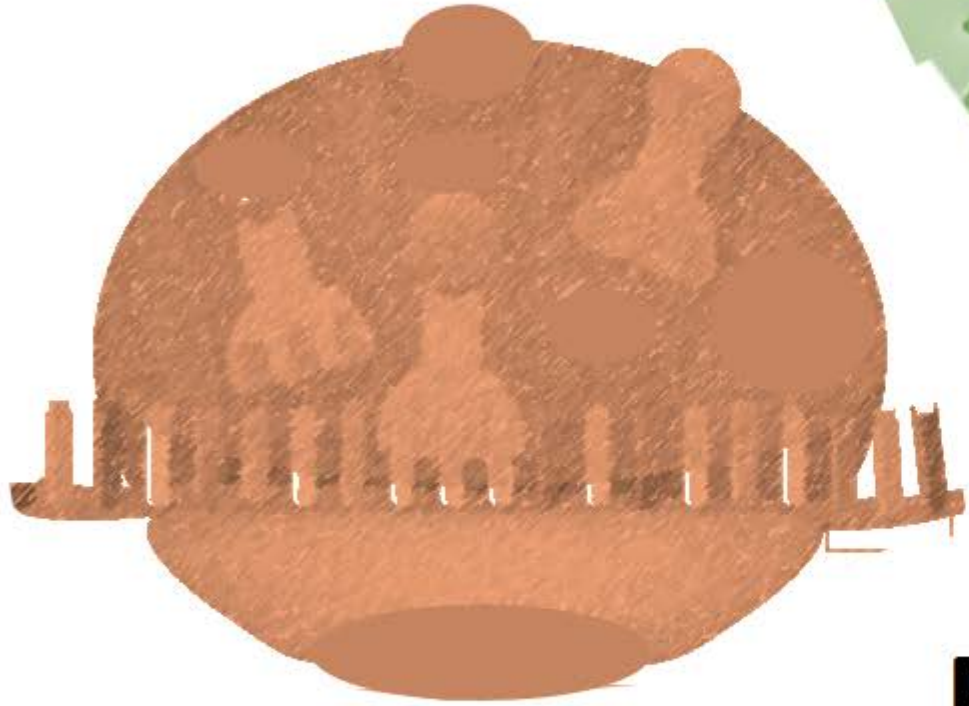




Hücre Dışı

Hücre İçi

Endozom



Ribozom



**Endoplazmik
Retikulum**



Golgi

Granüllü

Nukleus

ER

Ribozom

Plazma Membrani

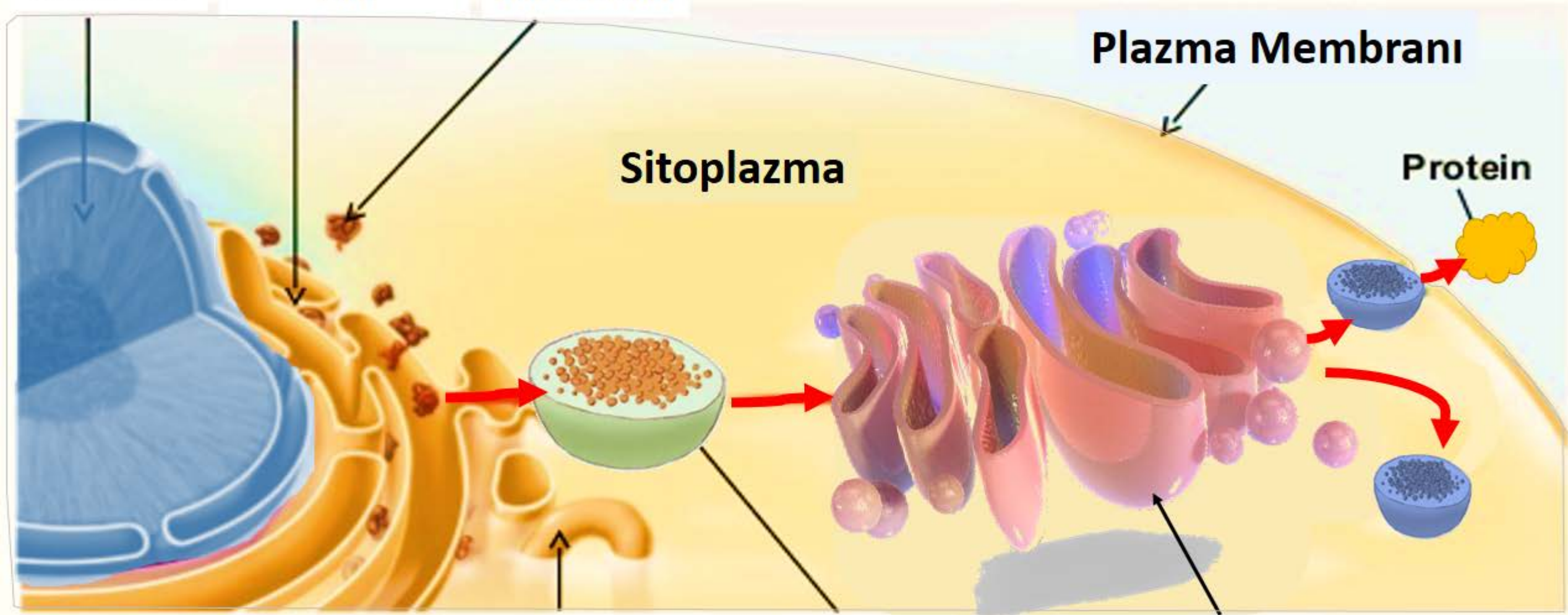
Sitoplazma

Protein

**Granülsüz
ER**

Vezikül

**Golgi
Kompleksi**

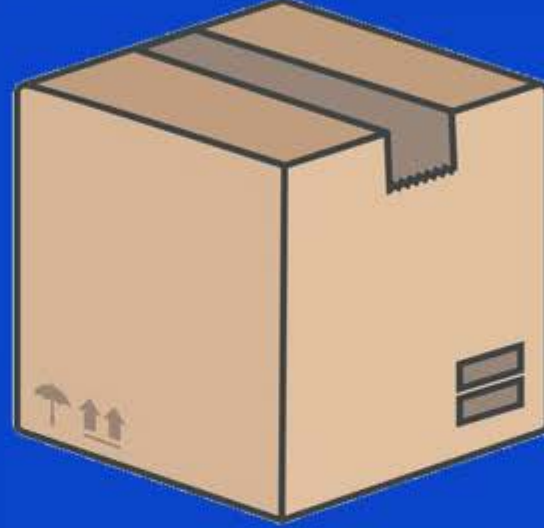


Ribozom

**Endoplazmik
Retikulum**

**Golgi
Kompleksi**

**Golgi
Vezikülleri**

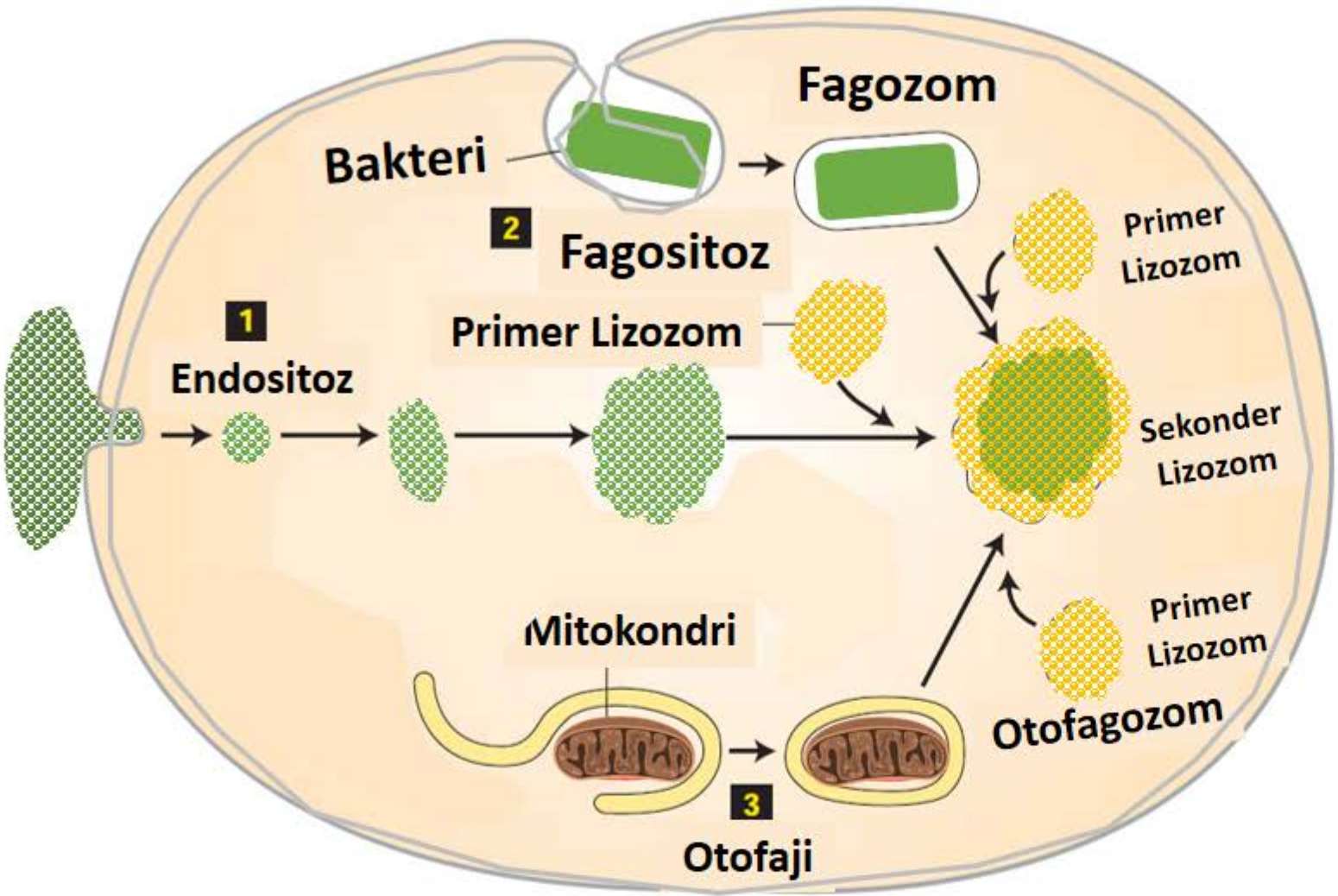


**Protein
yapımı**

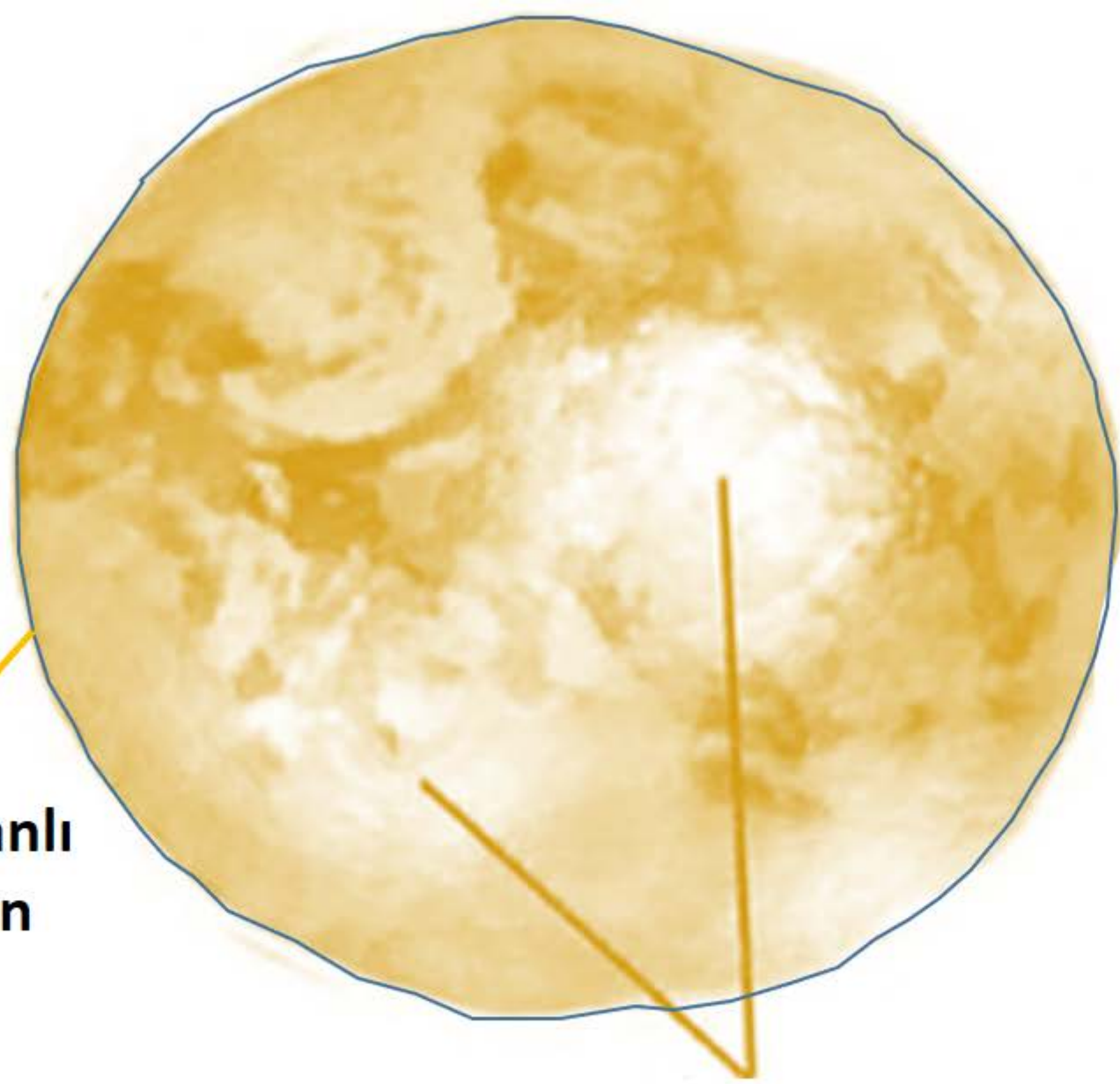
**Protein
katlanması
ve modifiye**

**Protein
ayrıştırılması
ve paketlenme**

**Hedef
bölgelere
transfer**



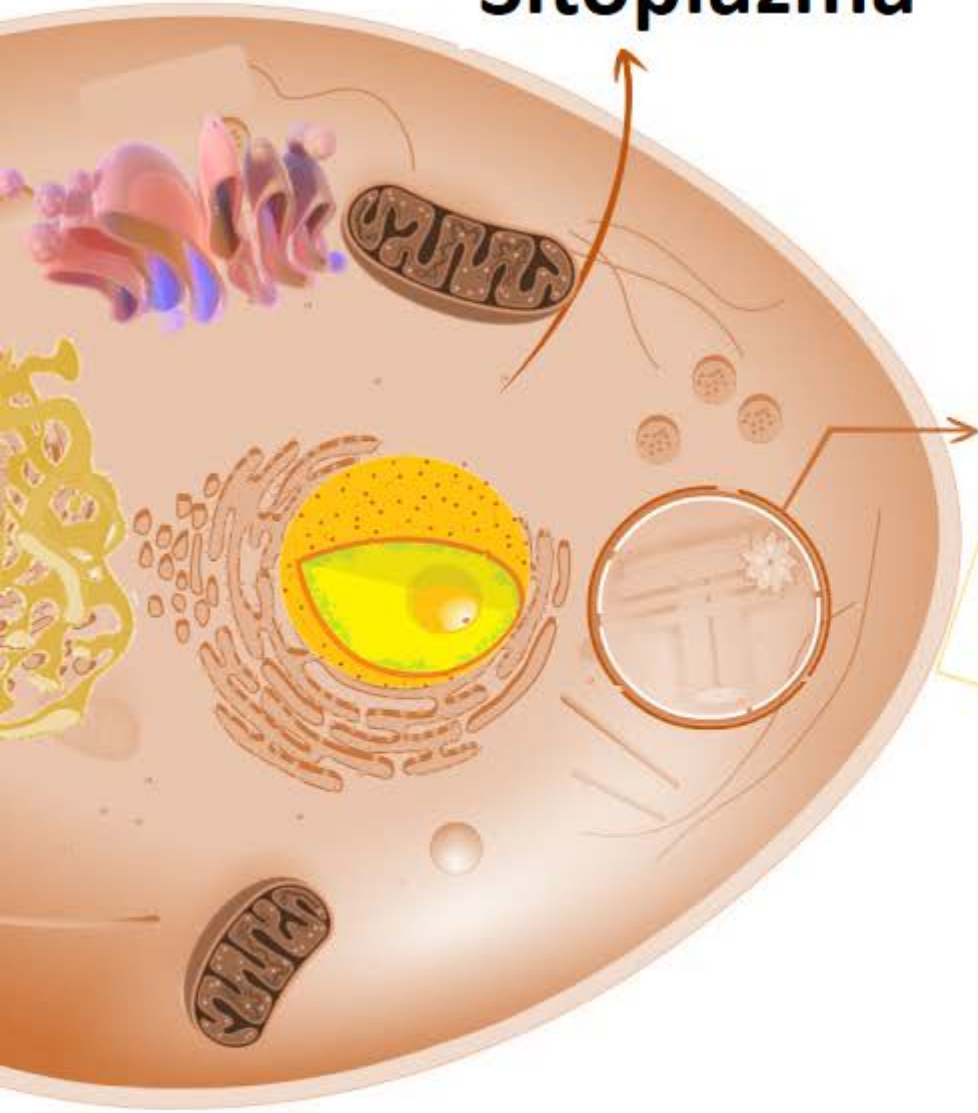
**Tek katmanlı
membran**



**Ürat oksidaz
kristal koru**

Sitoplazma

Sentrozom Matriksi



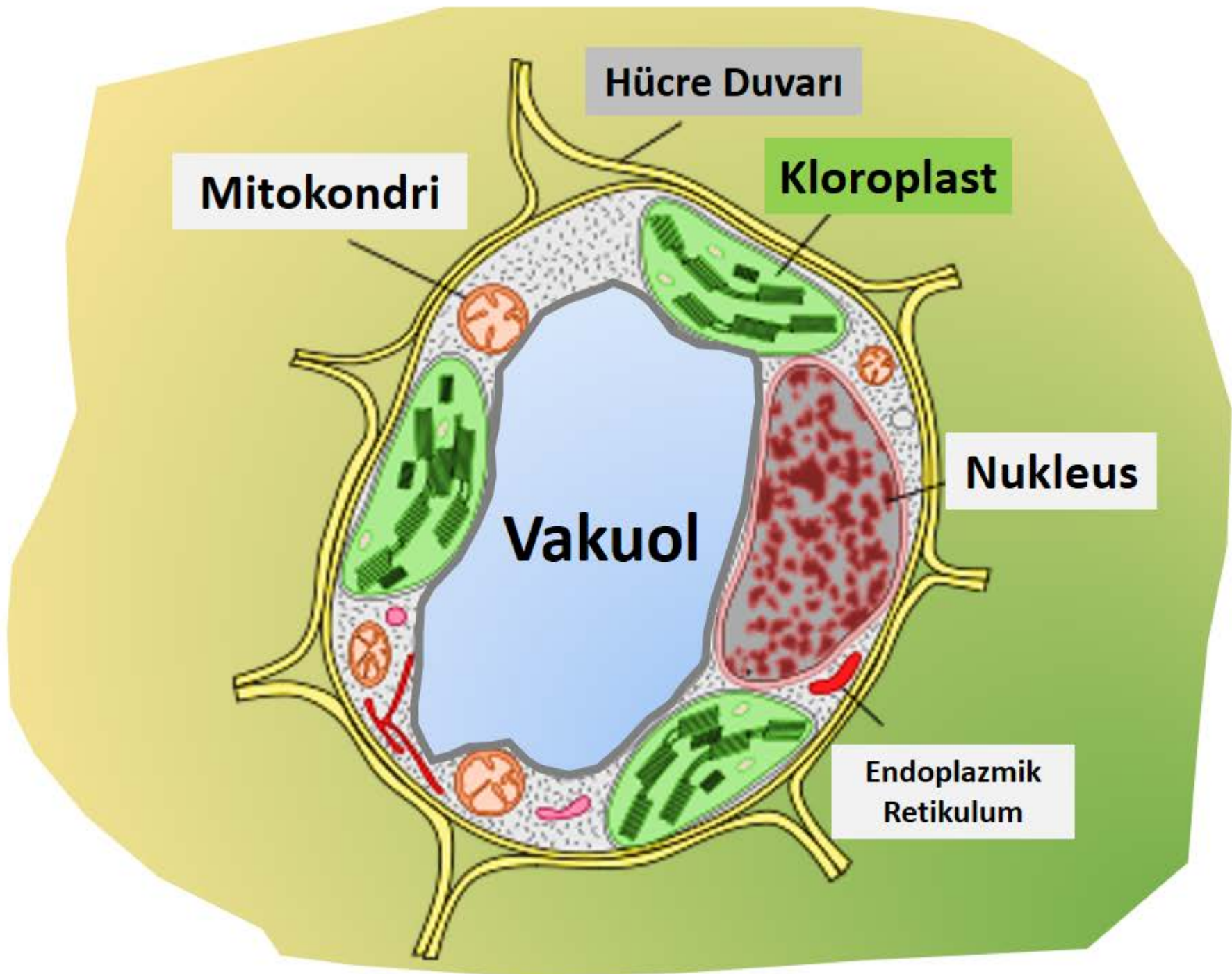
Sentrozom

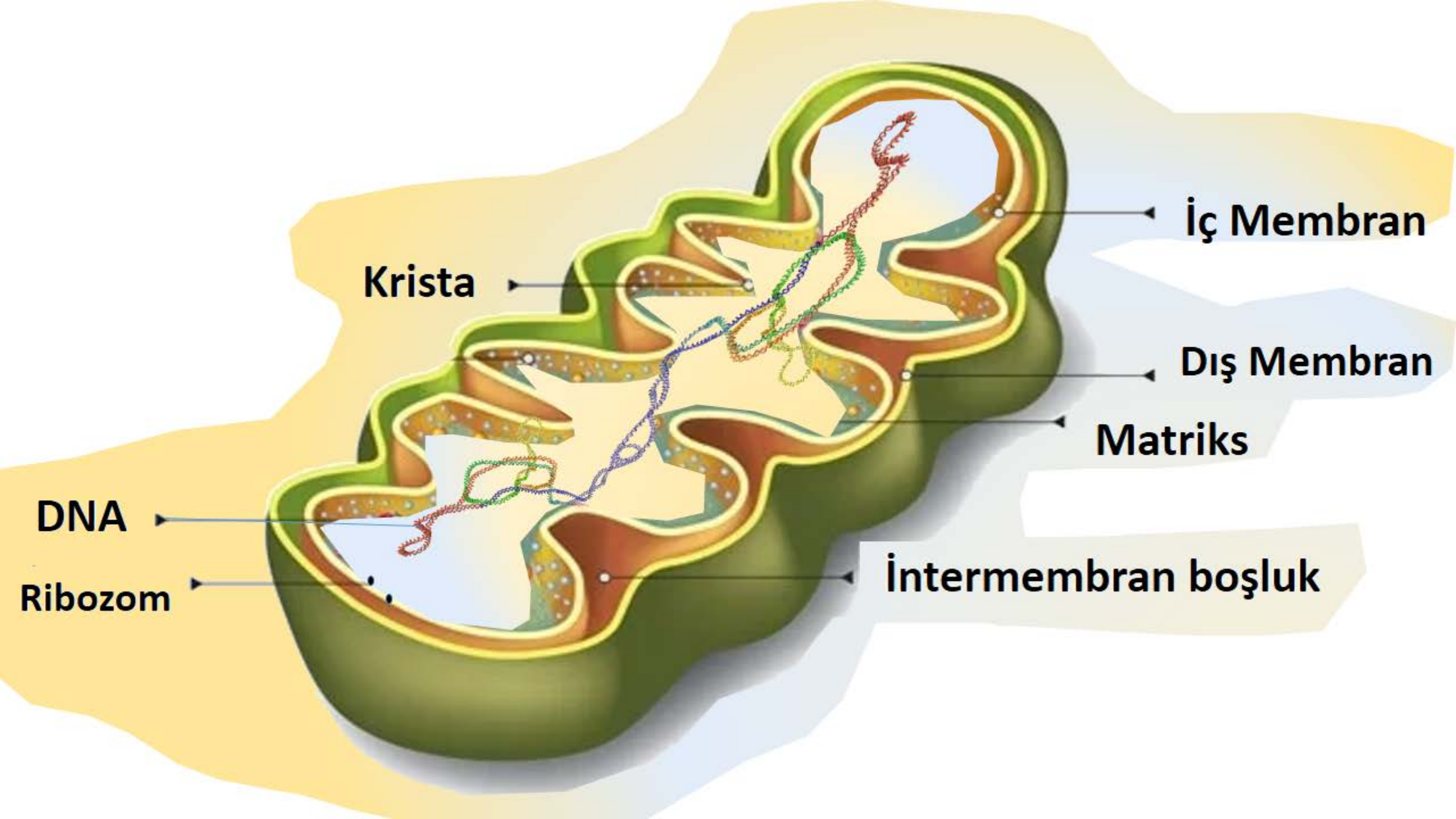


2 Sentriol



Kısa Silindirik yapı





Krista

İç Membran

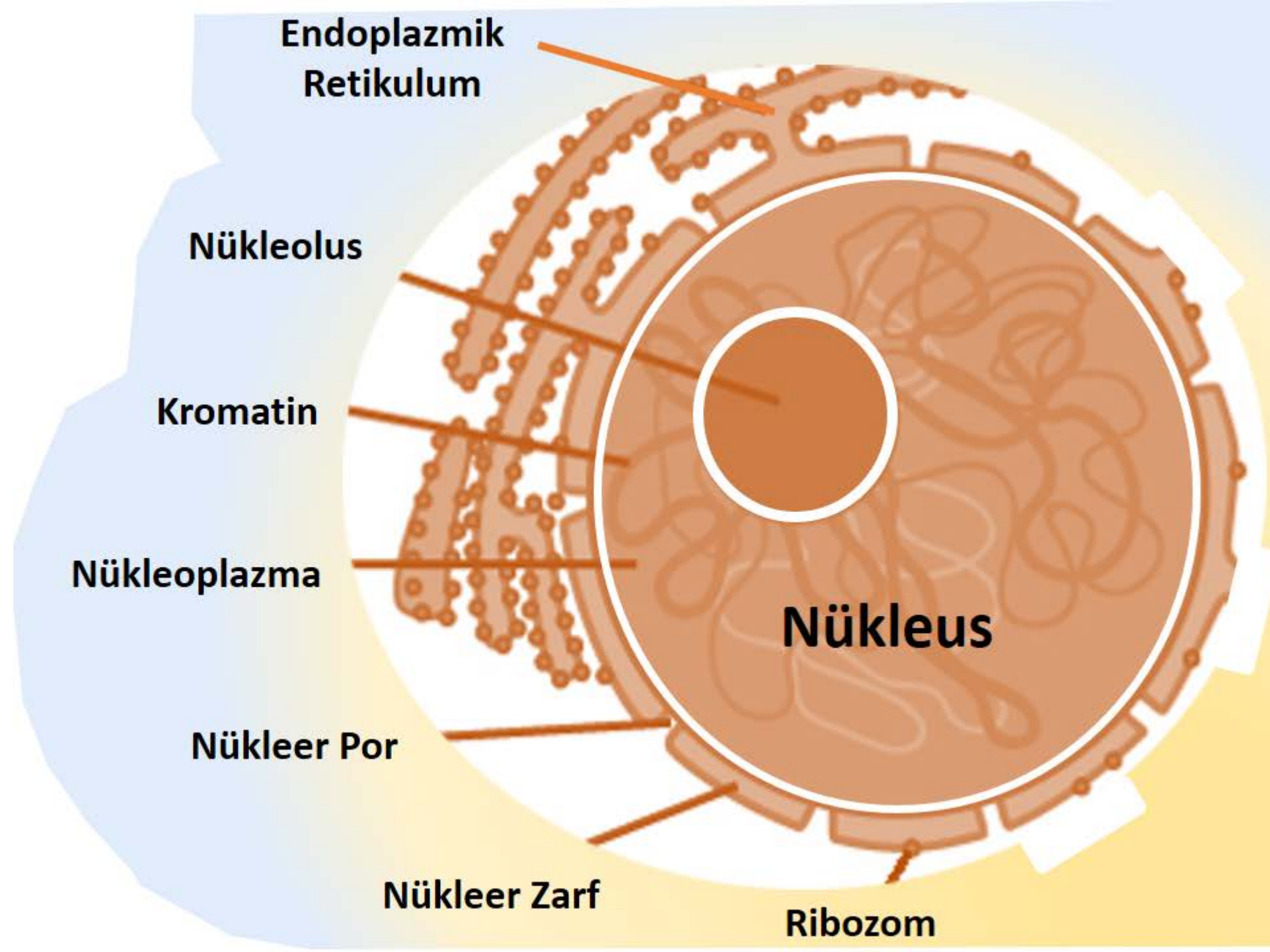
Dış Membran

Matriks

DNA

Ribozom

İntermembran boşluk



Endoplasmik
Retikulum

Nukleolus

Kromatin

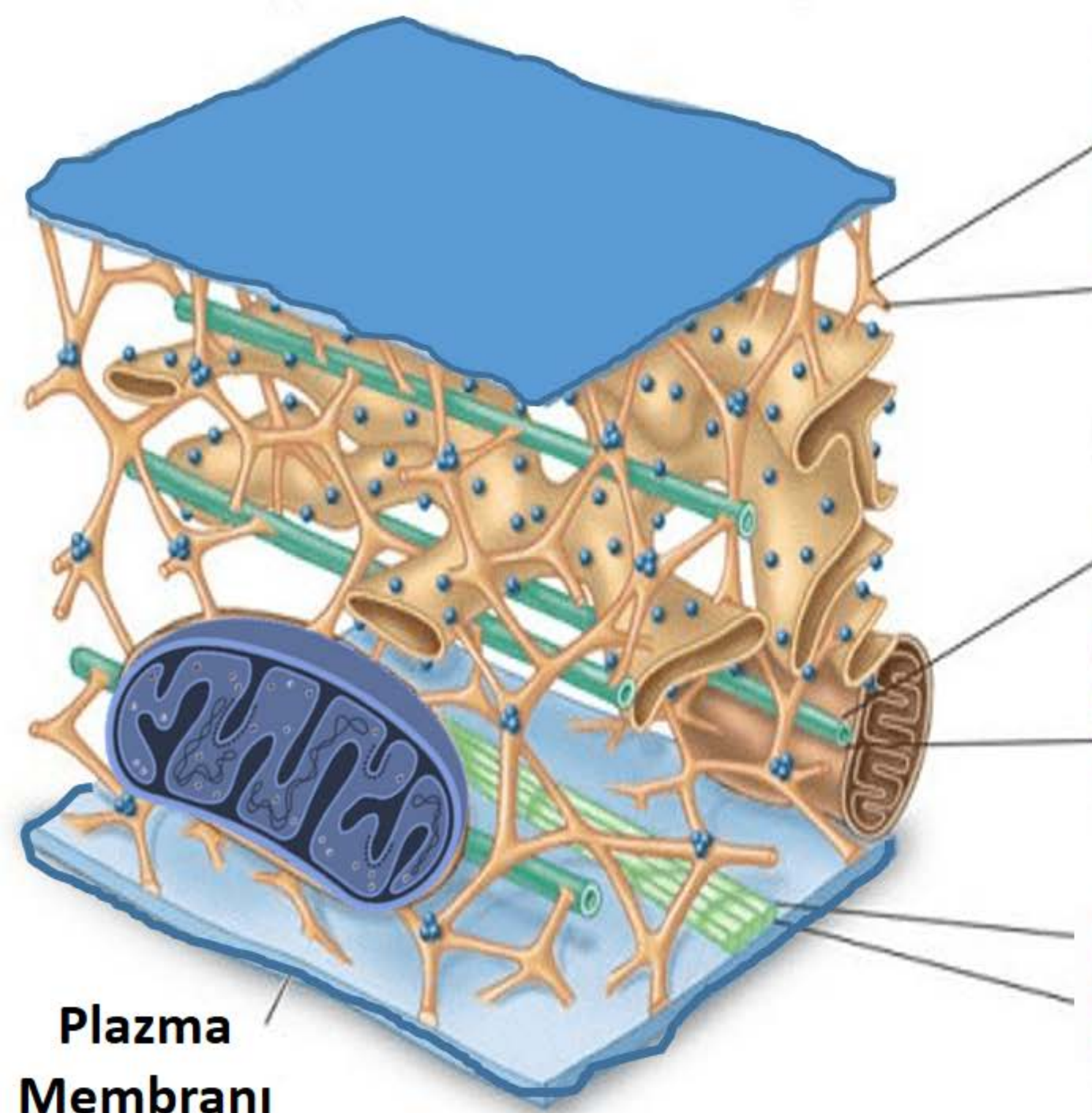
Nukleoplasma

Nukleer Por

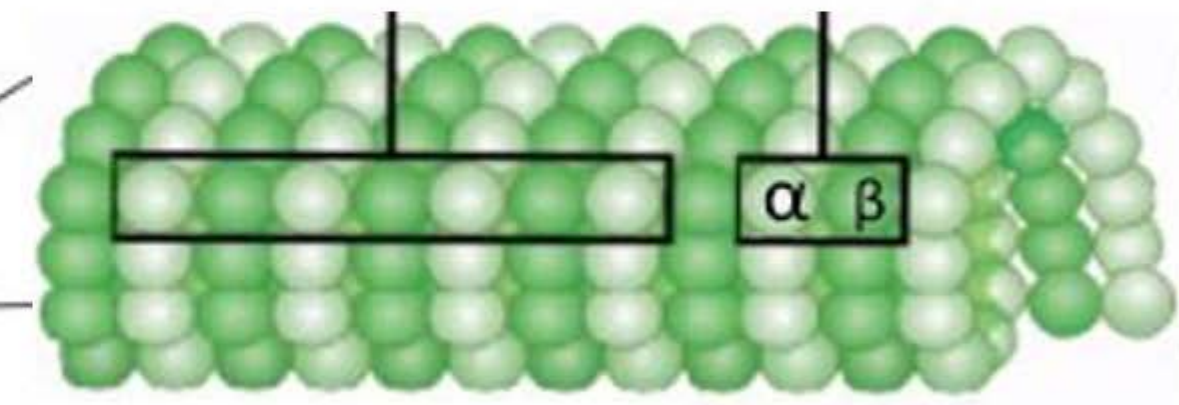
Nukleer Zarf

Nukleus

Ribozom



Ara Filamentler

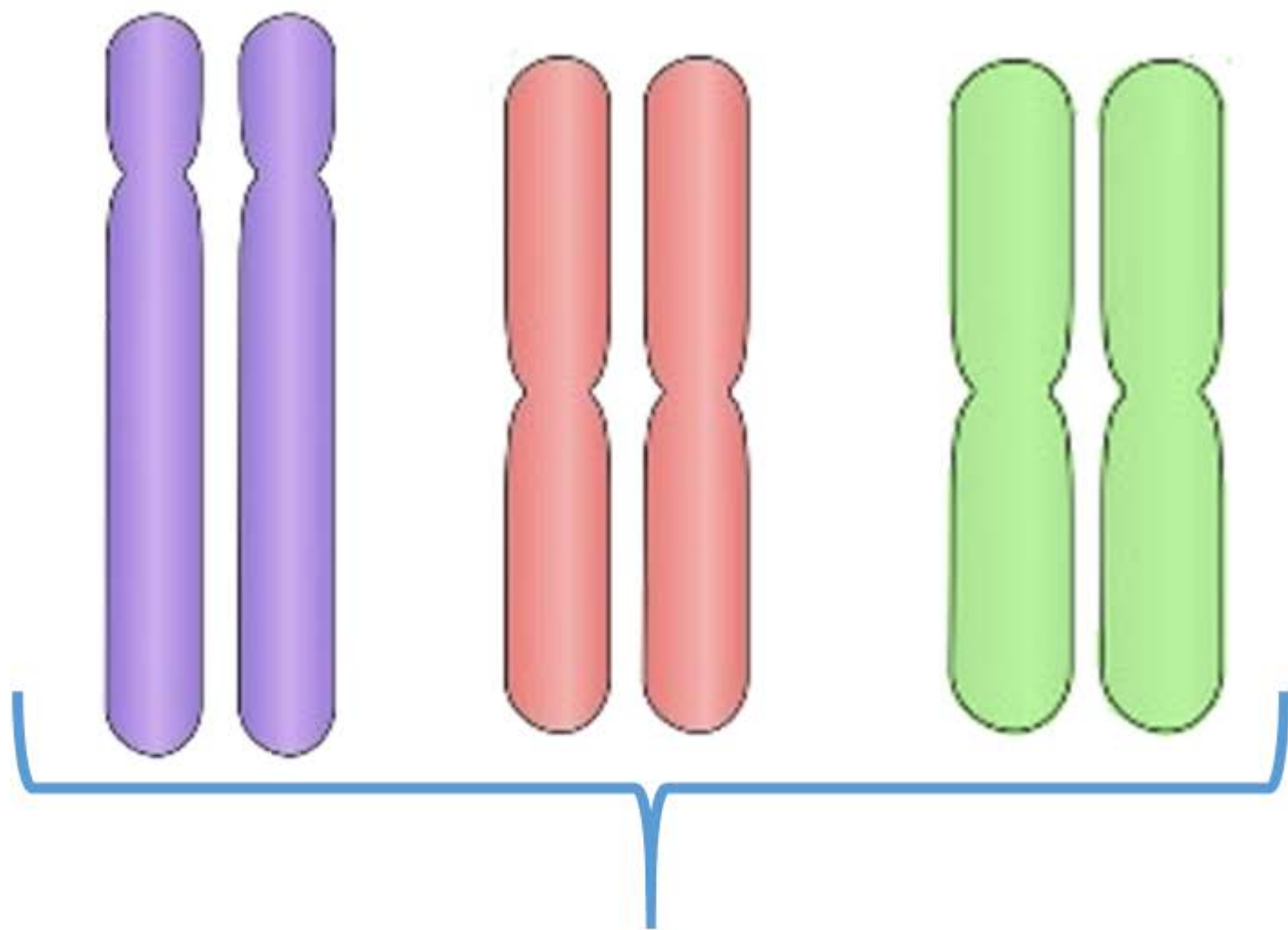


Mikrotübüller

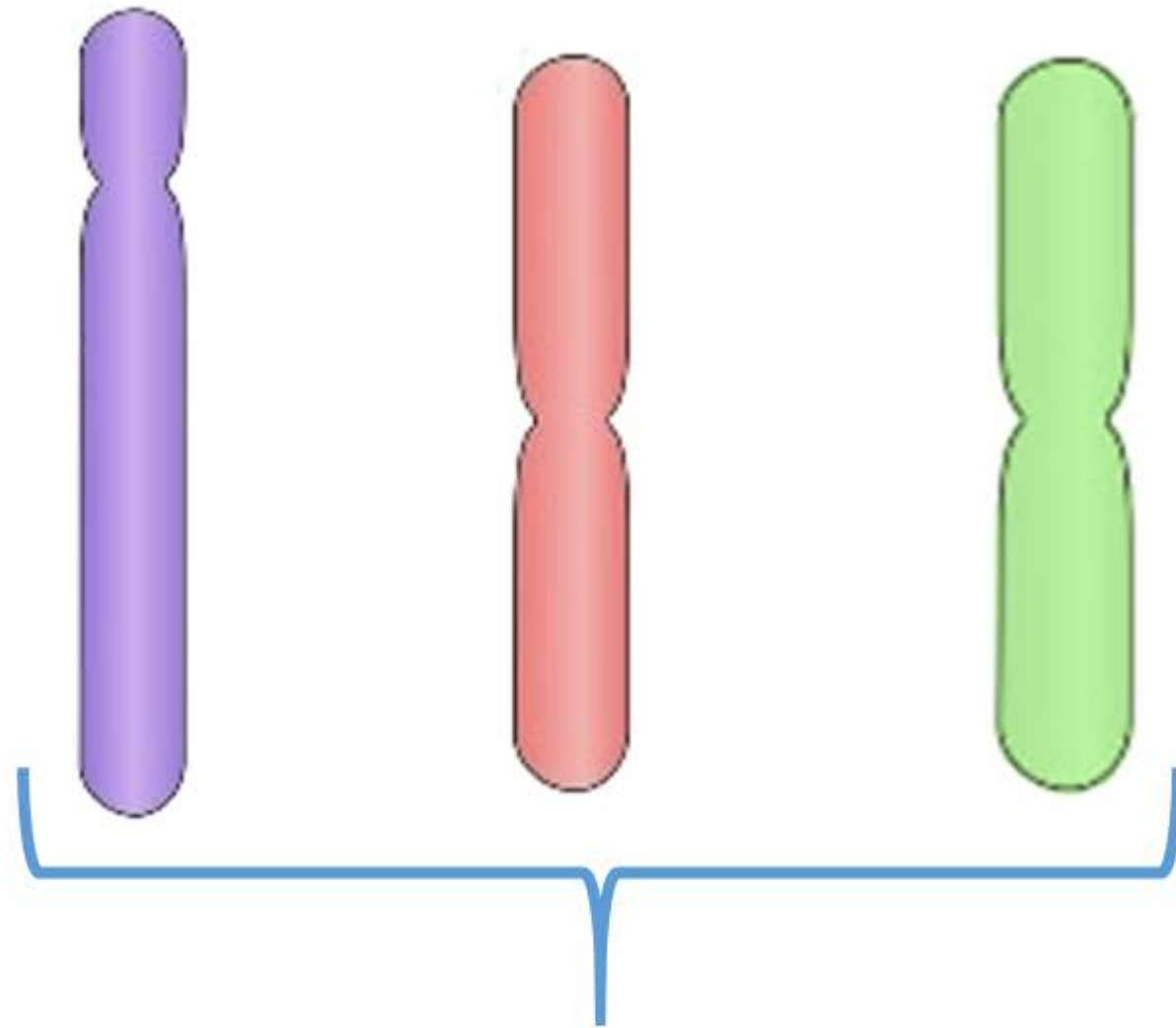


Mikrofilamentler

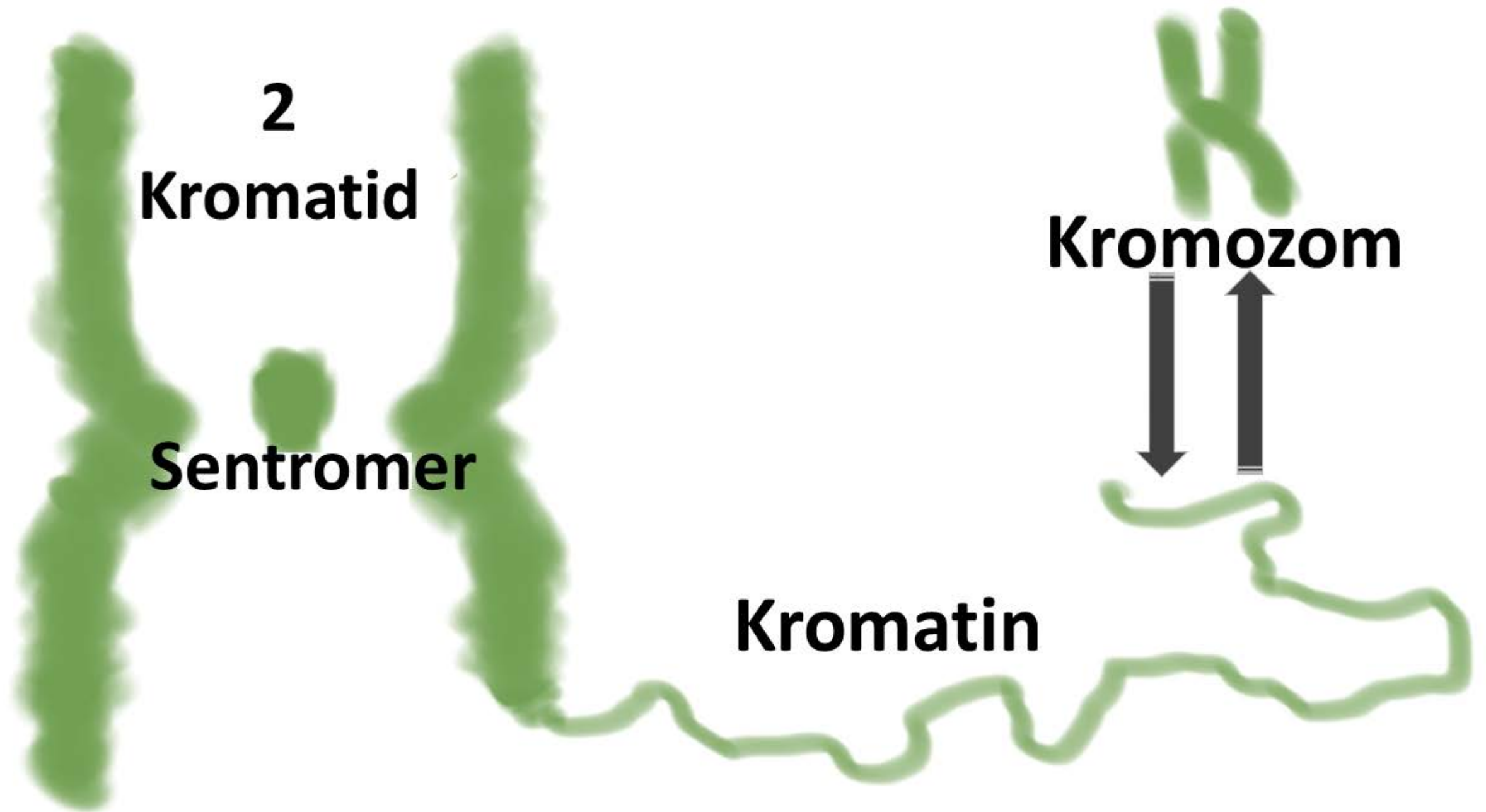
Plazma Membranı

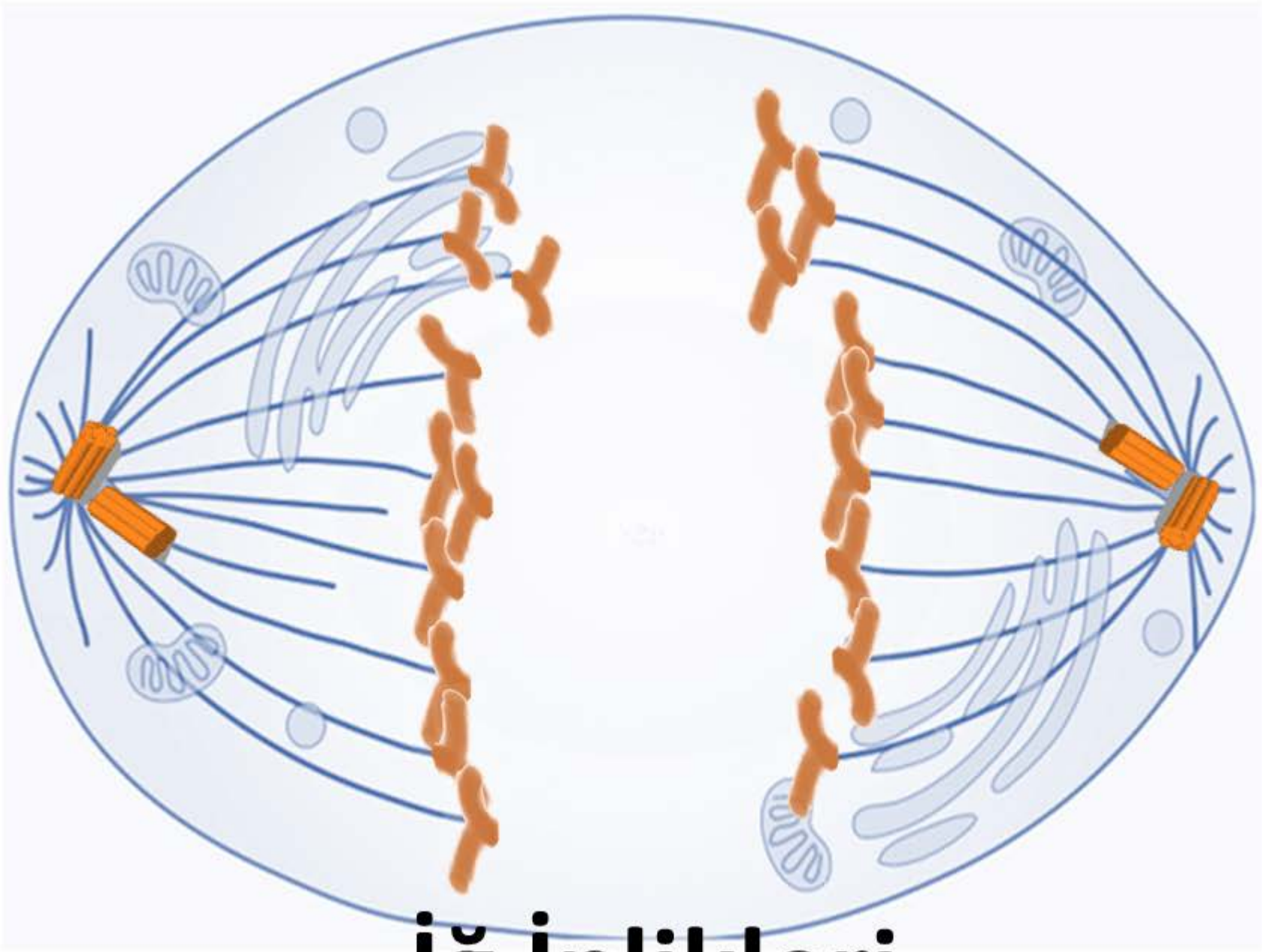


Diploid hücre

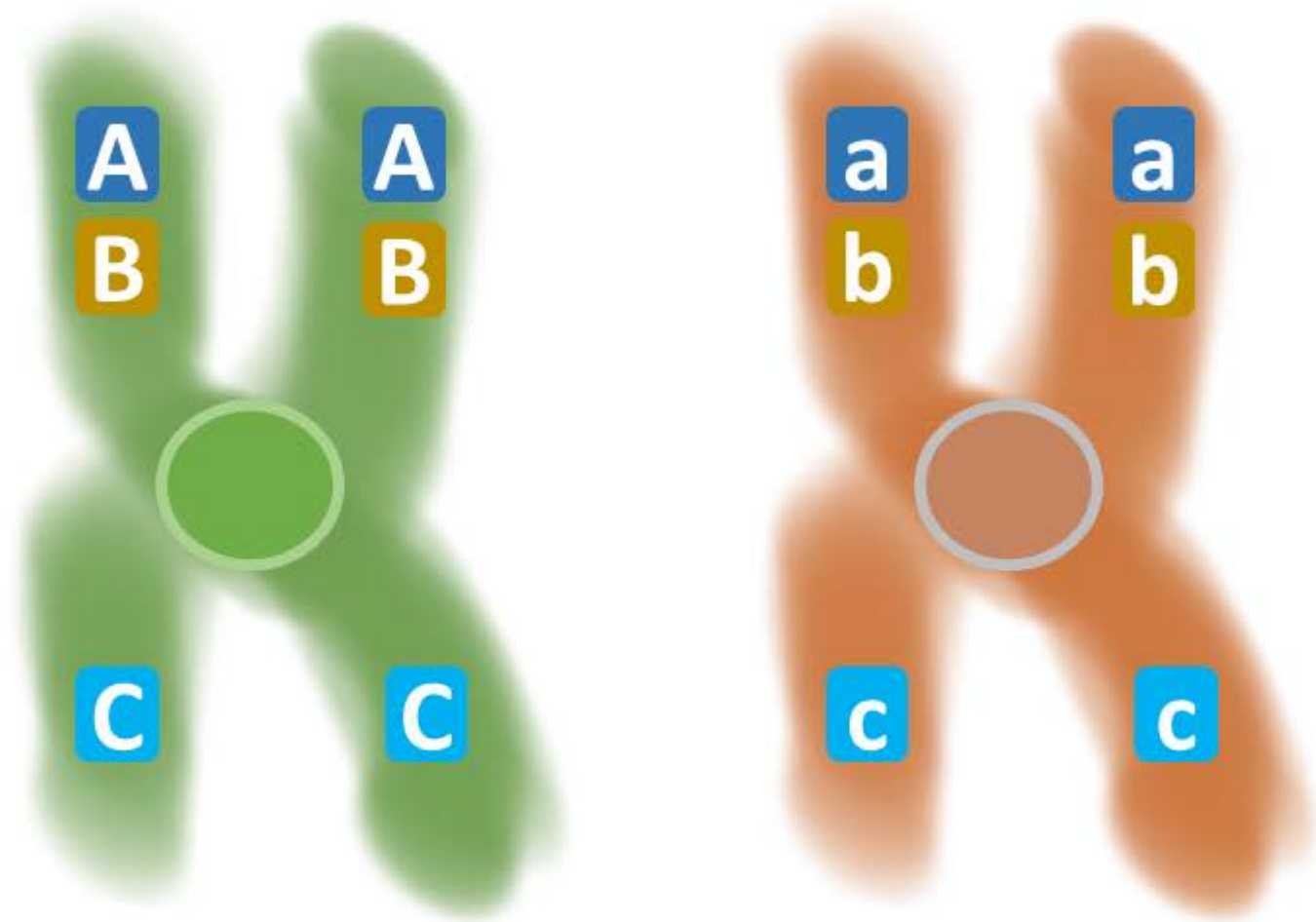


Haploid hücre





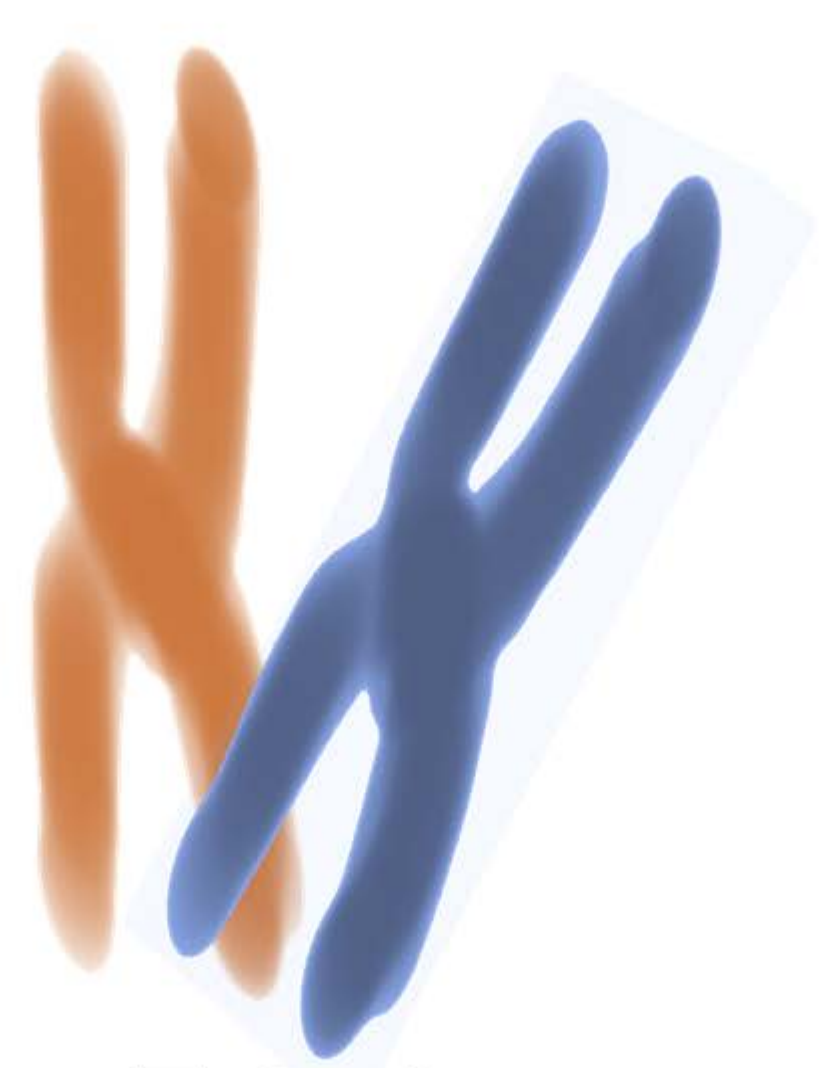
İğ iplikleri



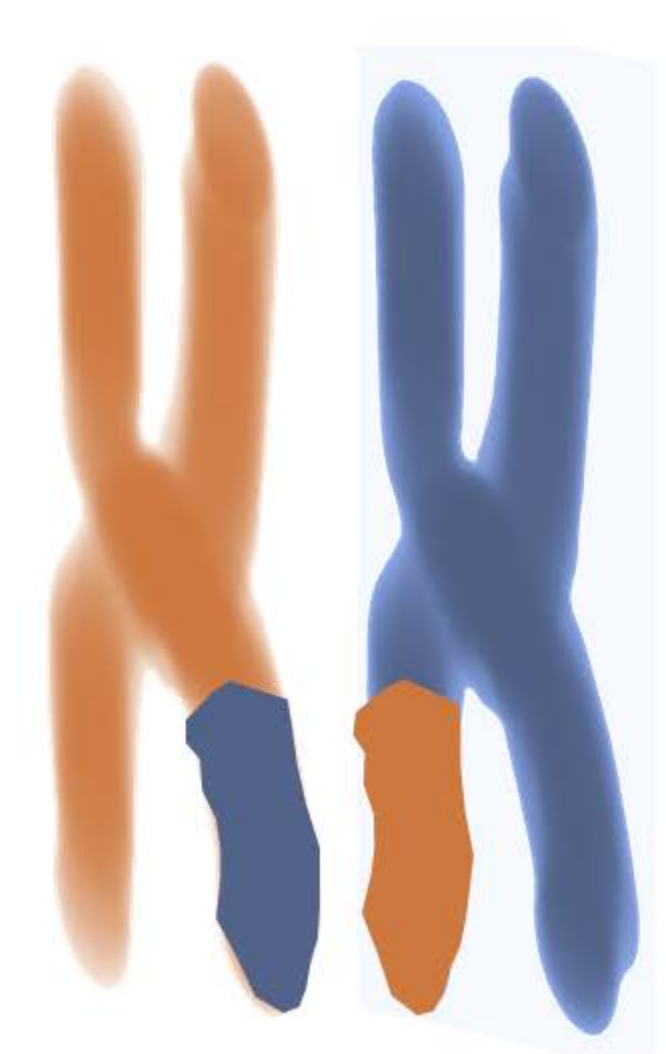
Homolog Kromozomlar



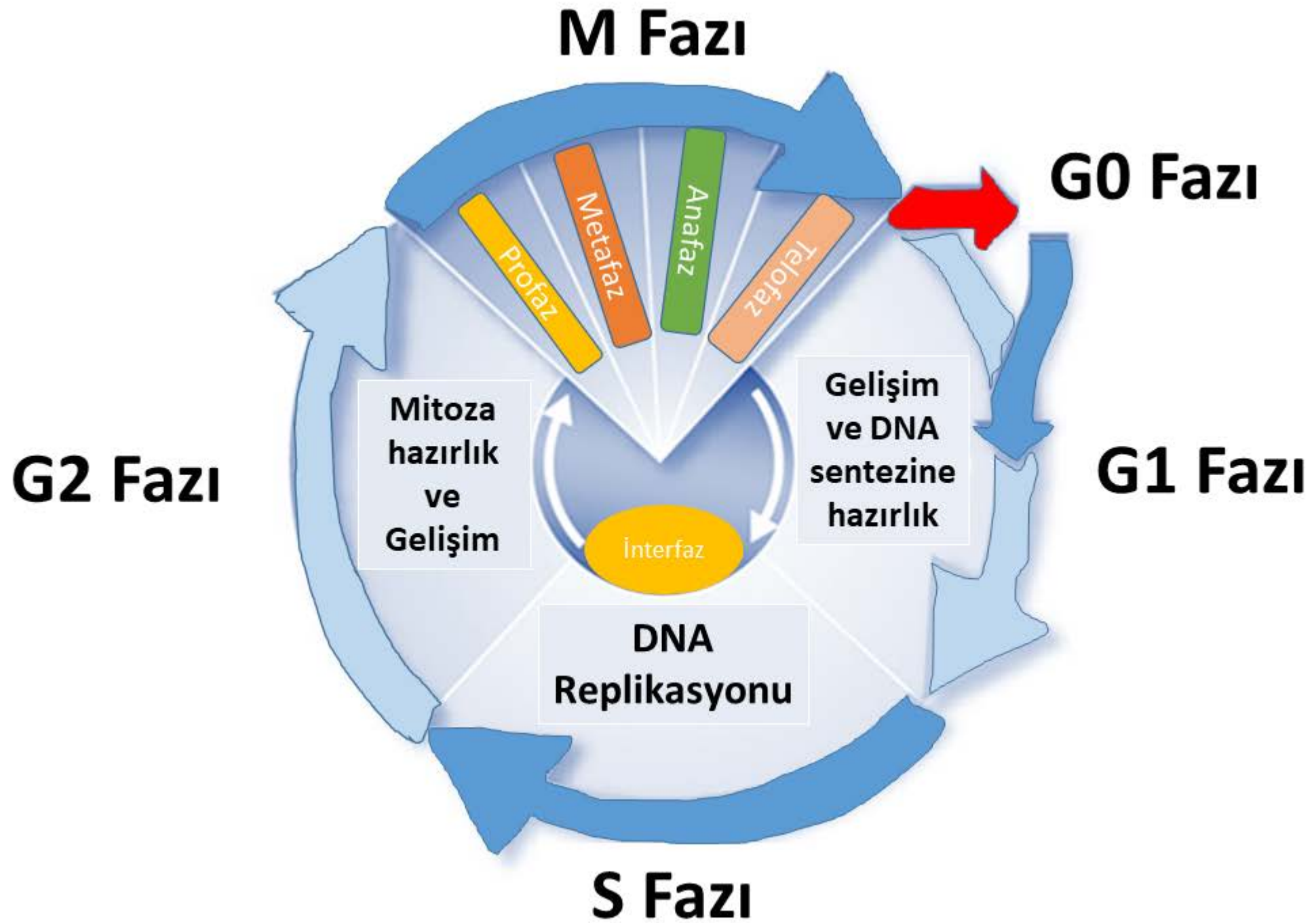
Sinaps

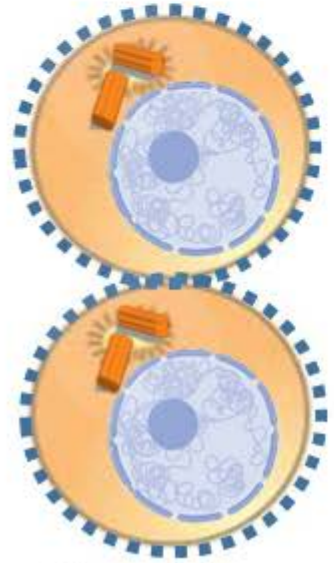
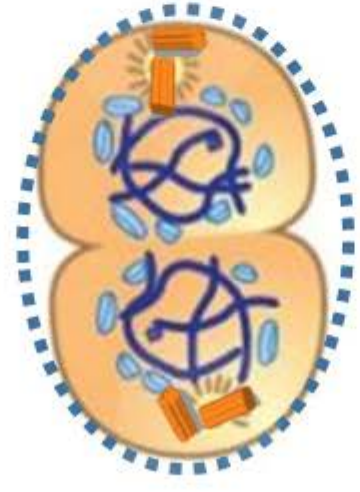
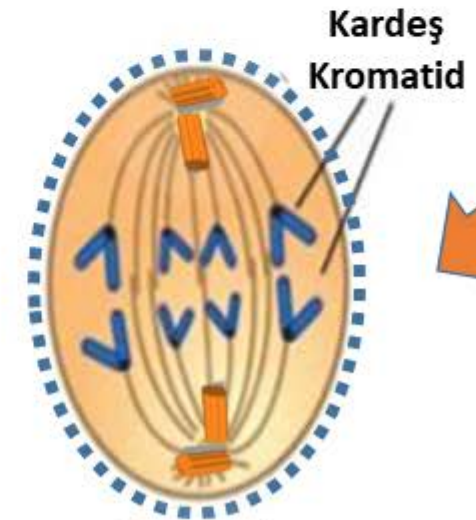
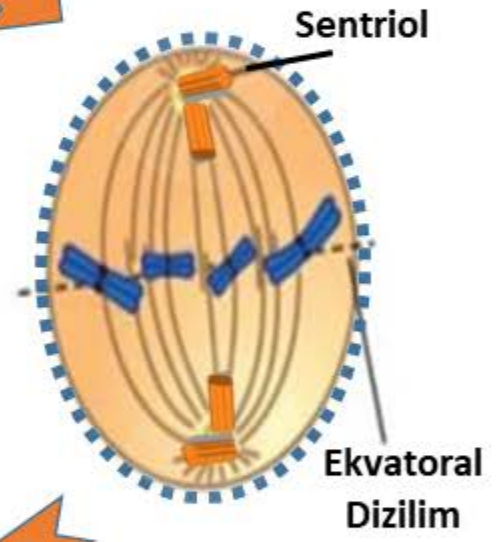
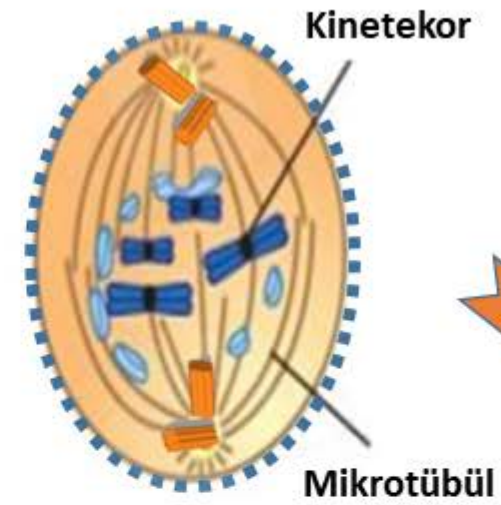
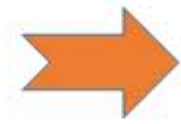
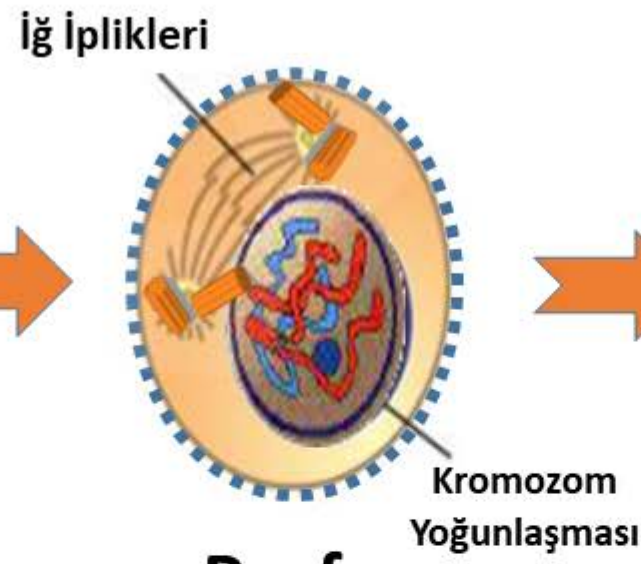
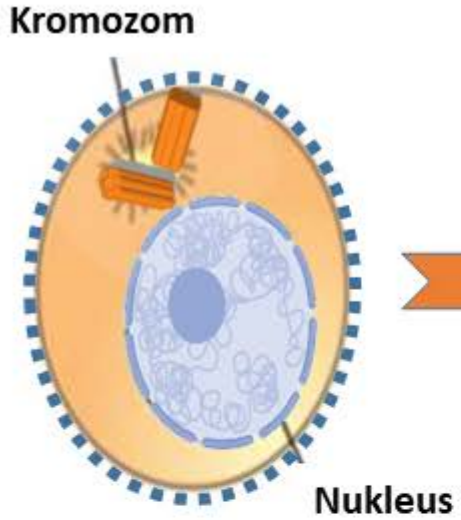


Tetrat



Krosingover





Sitokinez

Telofaz

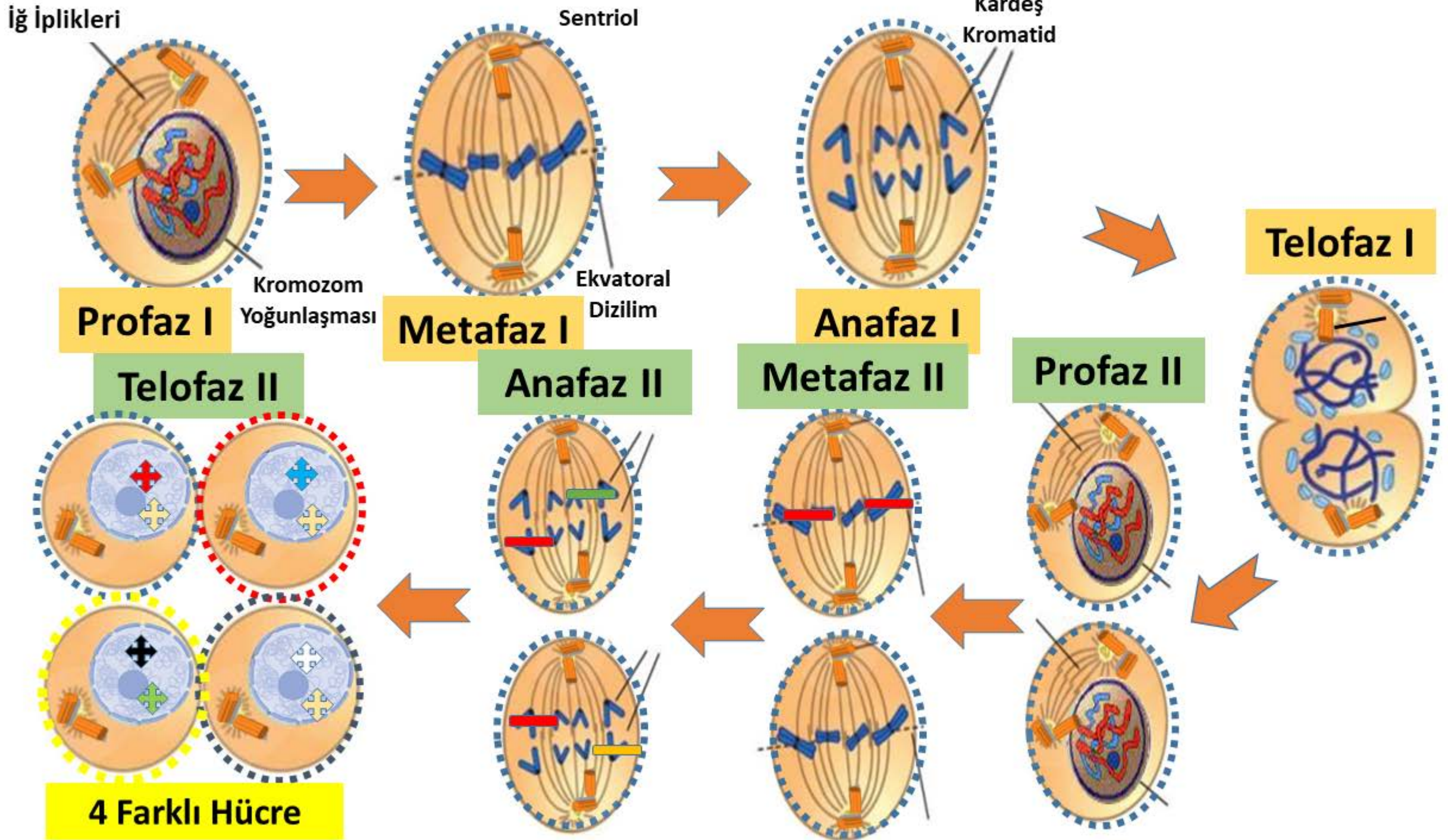
Anafaz

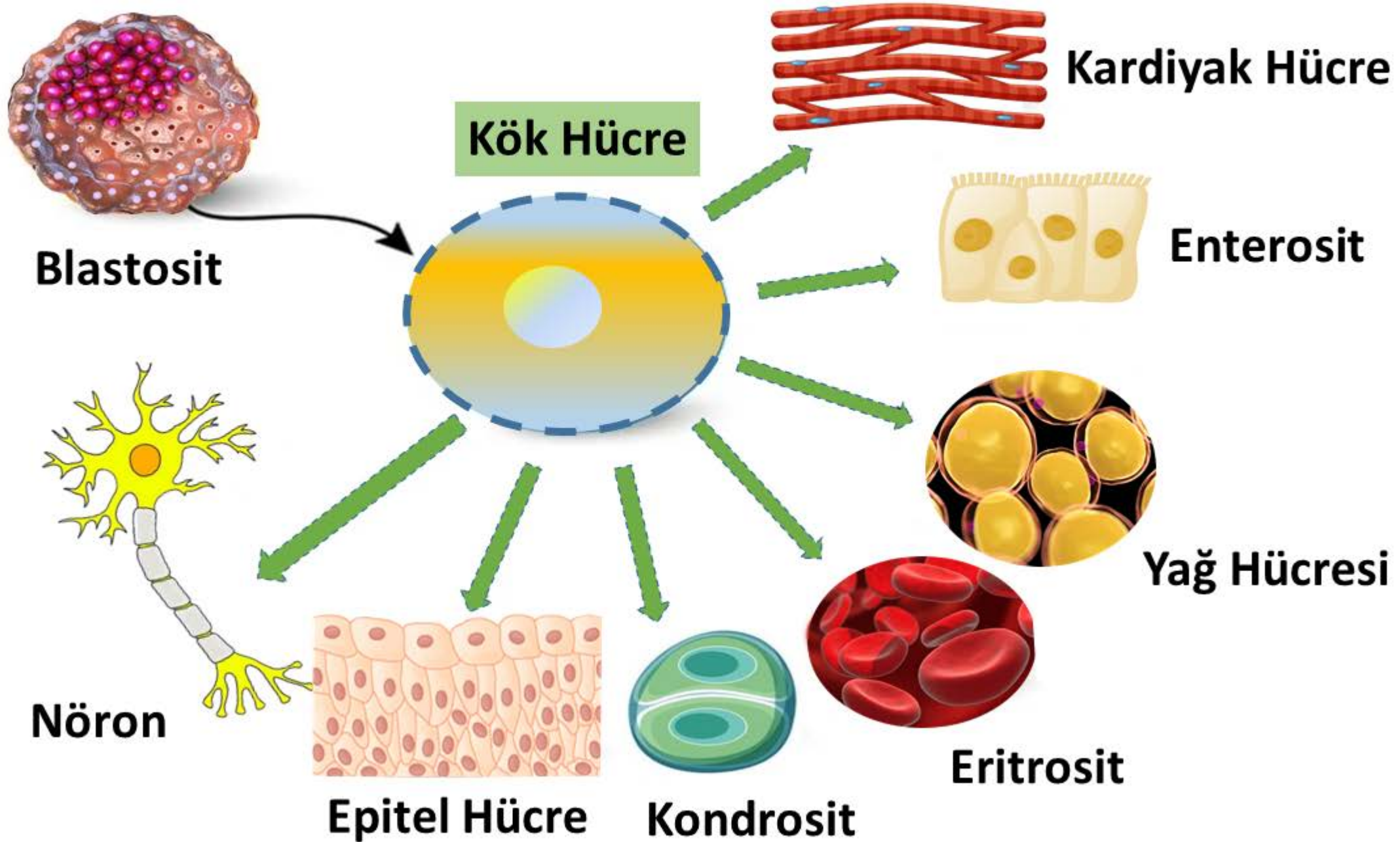
Metafaz

Prometafaz

Profaz

İnterfaz



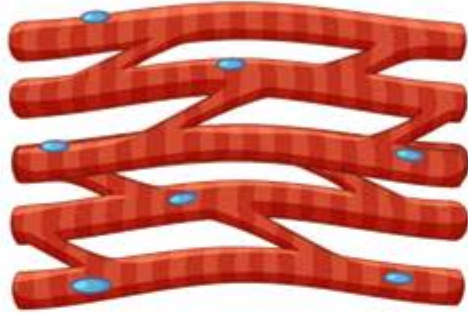


Hücre



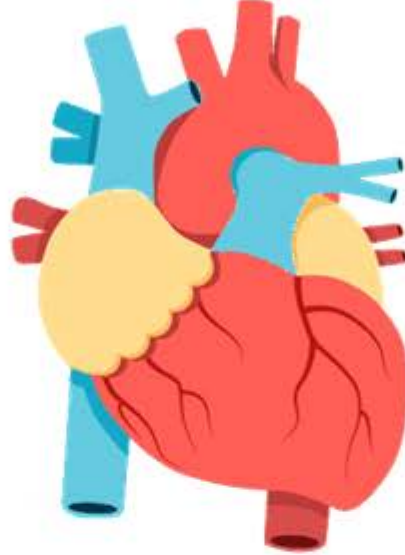
**Kardiyak
Hücre**

Doku



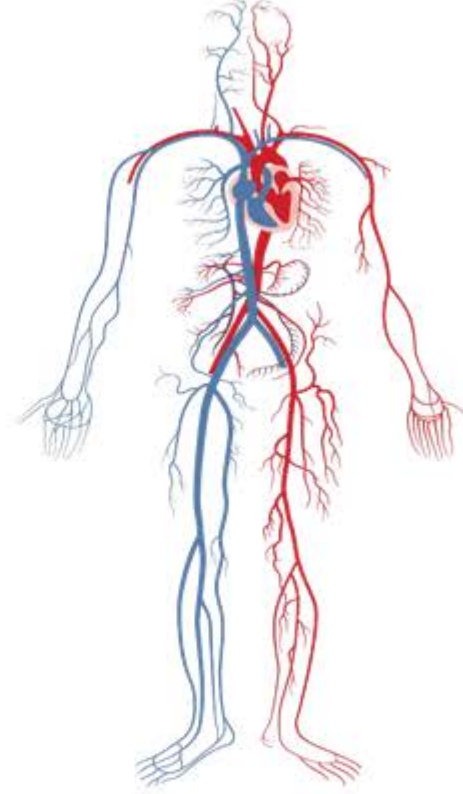
**Kardiyak
Doku**

Organ

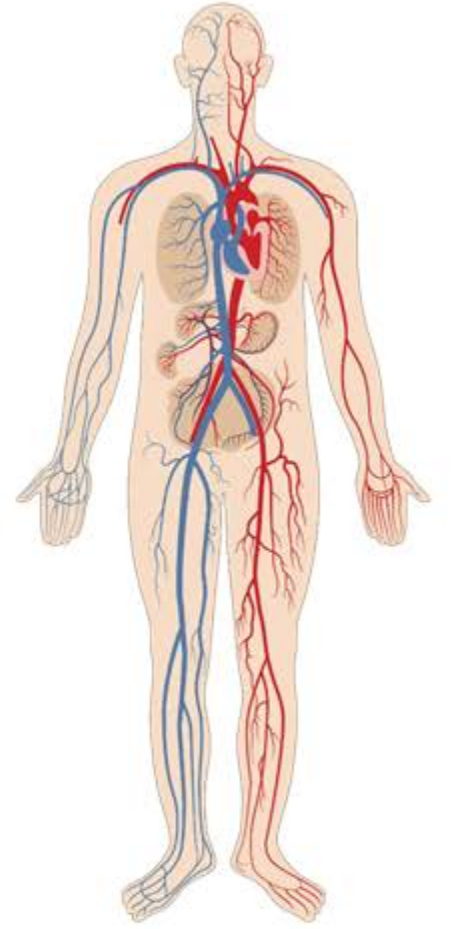


Kalp

Sistem



**Dolaşım
Sistemi**



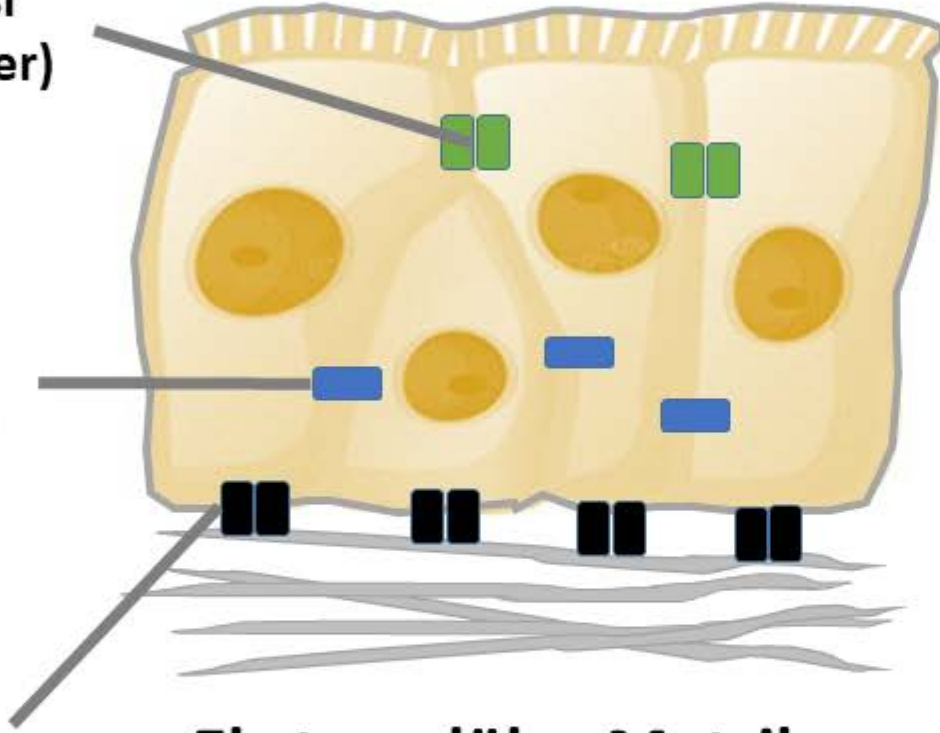
Organizma

Hücre-Hücre
Yapışması
(Kadherinler)

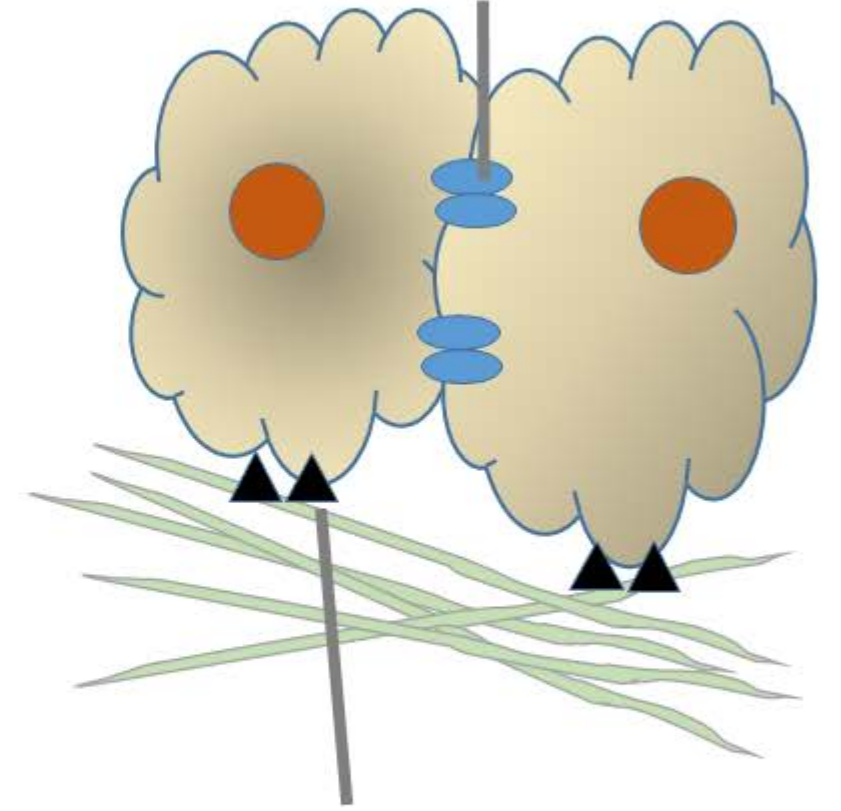
Gap
Junctions

Hemidesmozomlar
(İntegrinler)

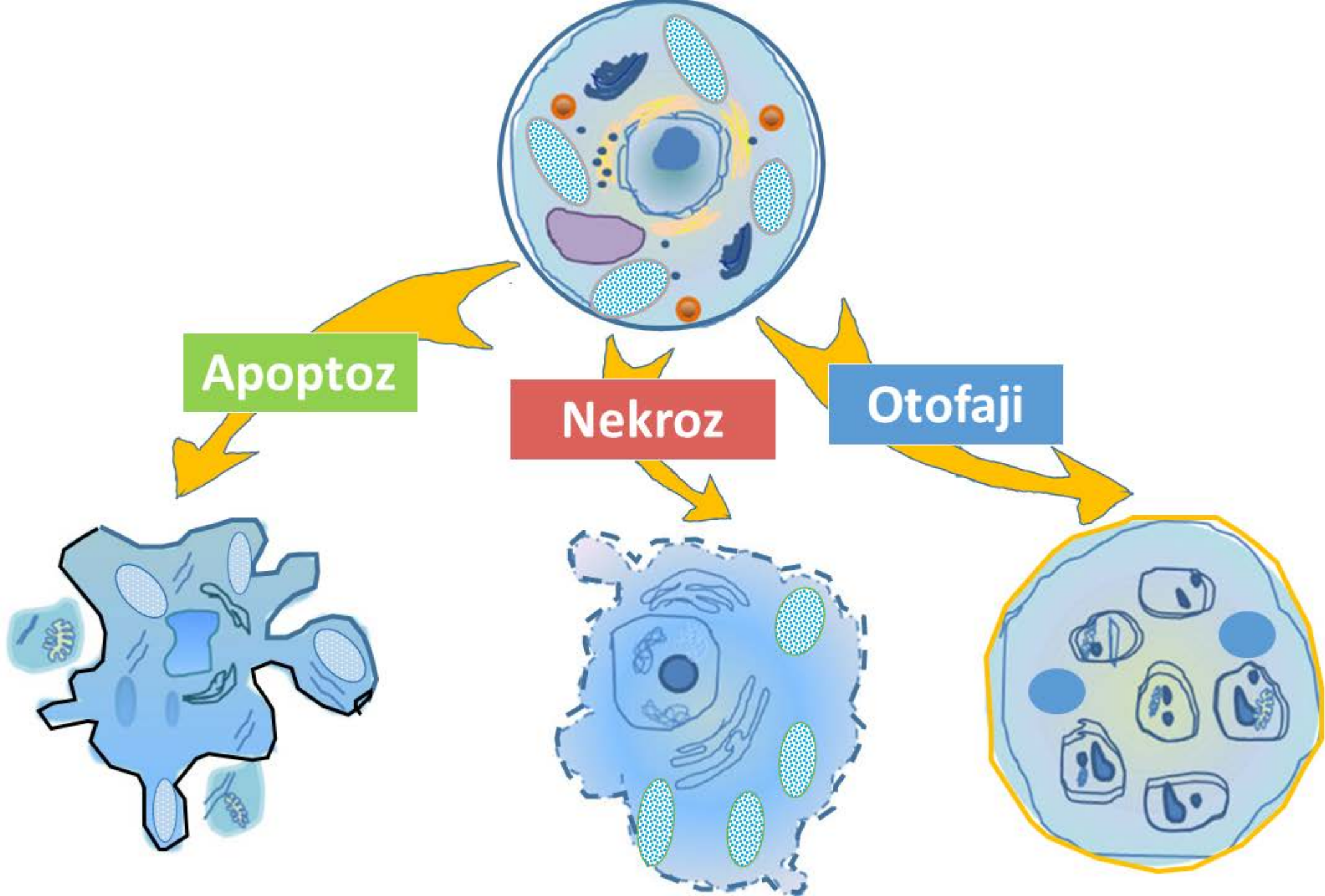
Ekstraselüler Matriks
(Laminin, Kollajen)

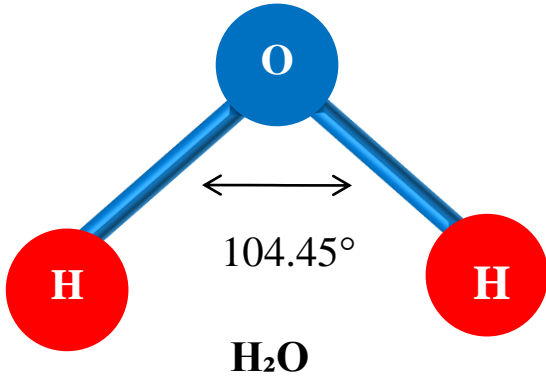


Hücre-Hücre Yapışması
(Kadherinler)



Hücre-Matriks Yapışması
(İntegrinler)





**Molekül
Formülü**

H₂

O₂

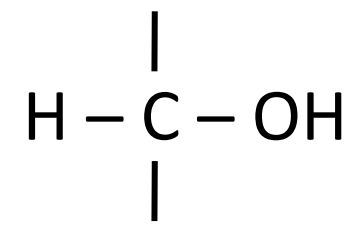
H₂O

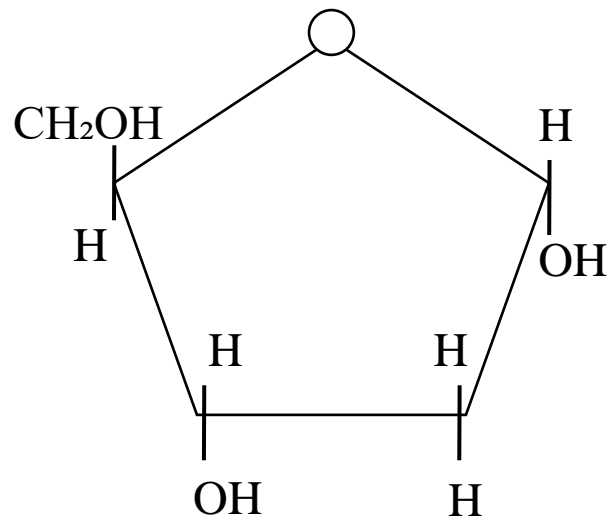
**Yapı
Formülü**

H-H

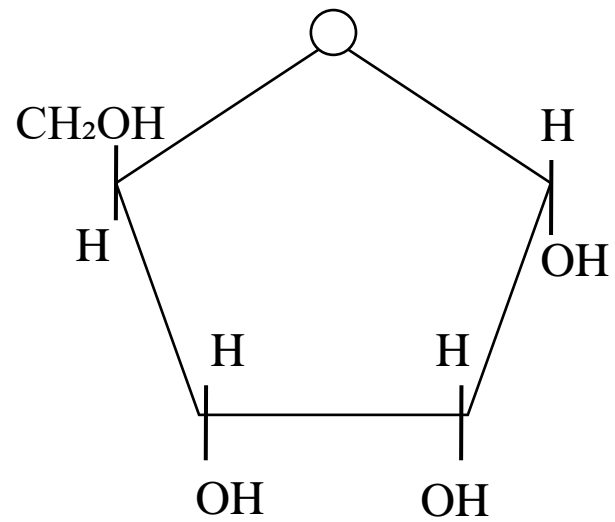
O=O

$\begin{array}{c} \text{O} \\ \diagdown \quad \diagup \\ \text{H} \quad \text{H} \end{array}$

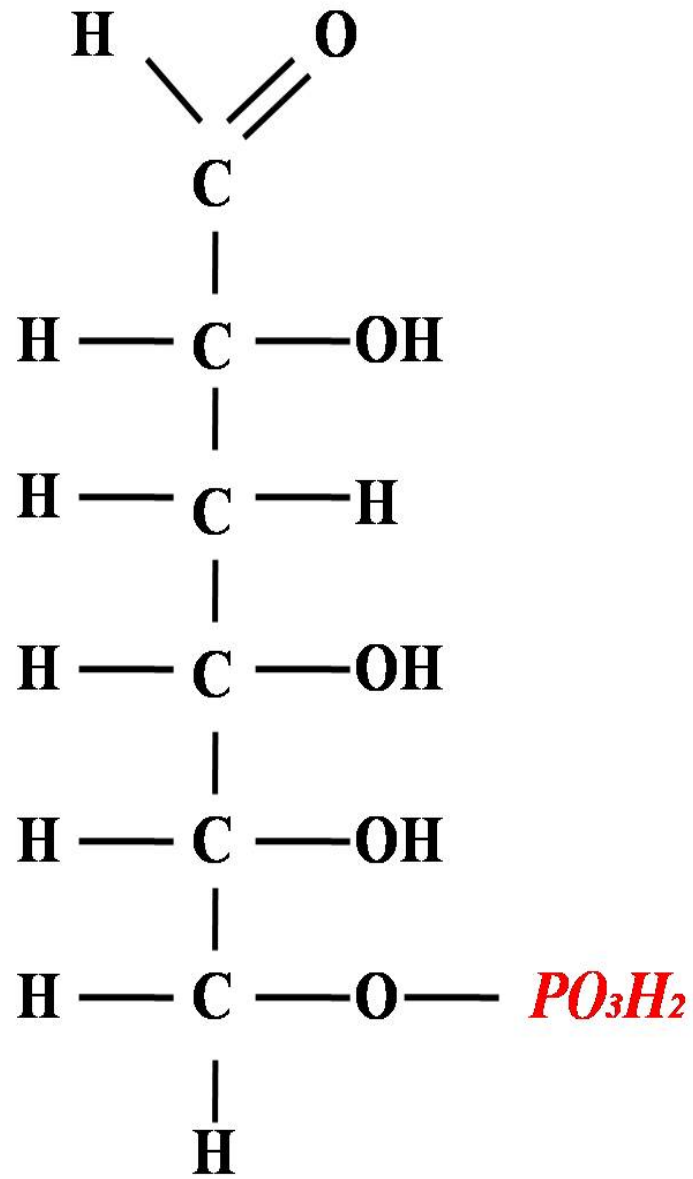




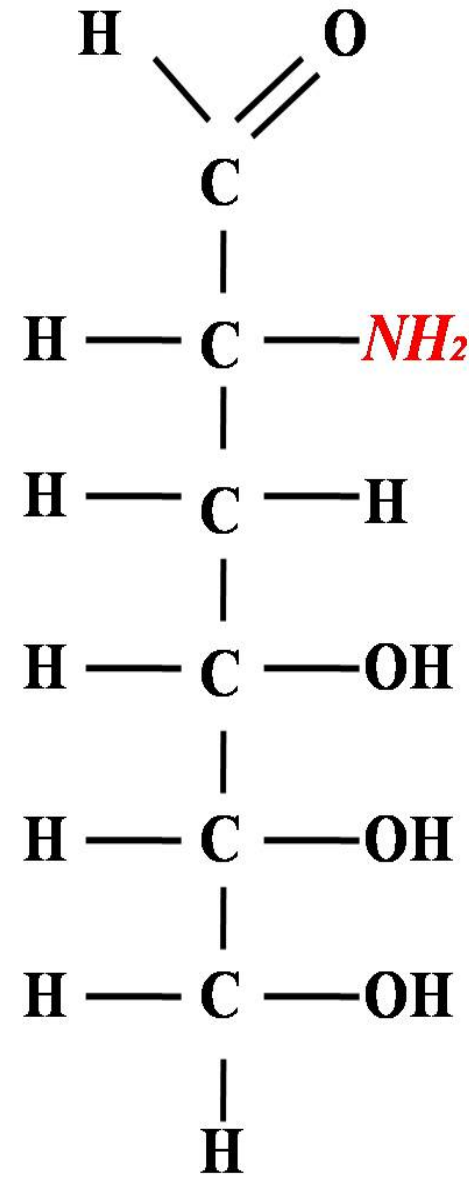
Deoksiriboz



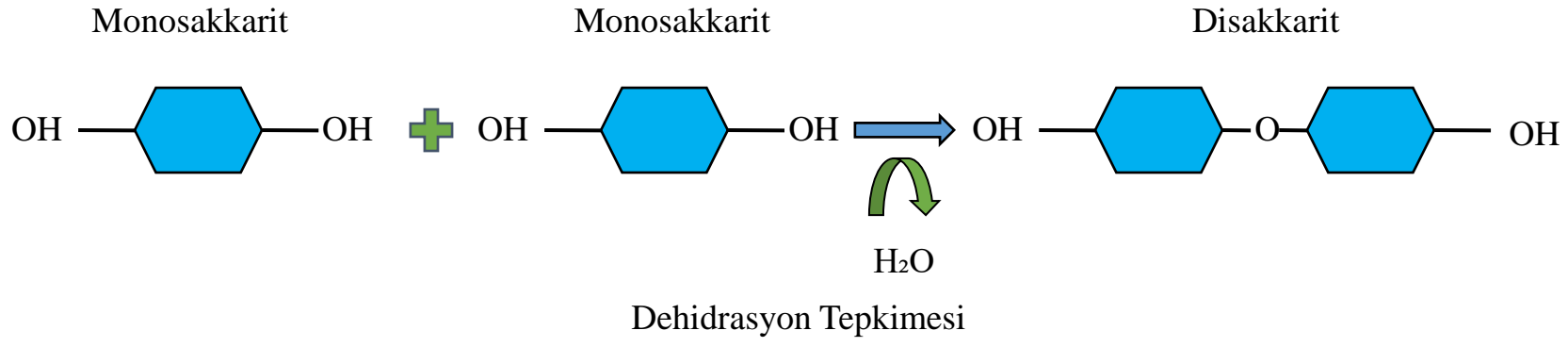
Riboz



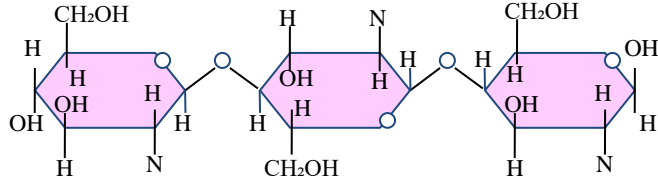
Glukoz-6-fosfat



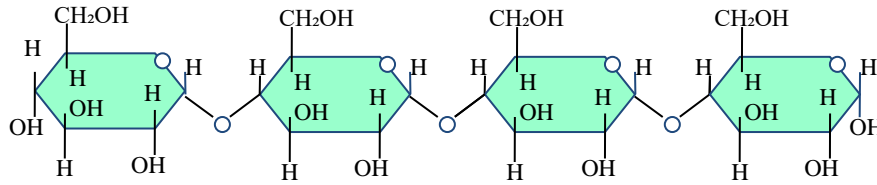
Glukozamin



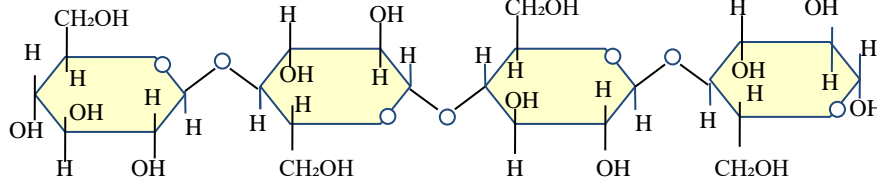
KİTİN



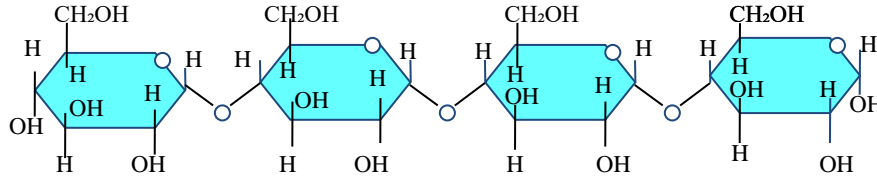
GLİKOJEN

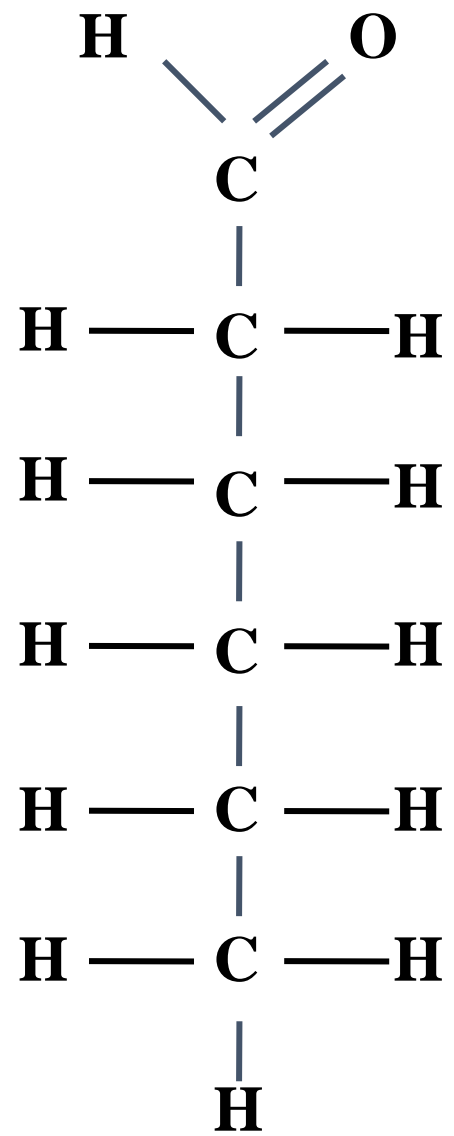


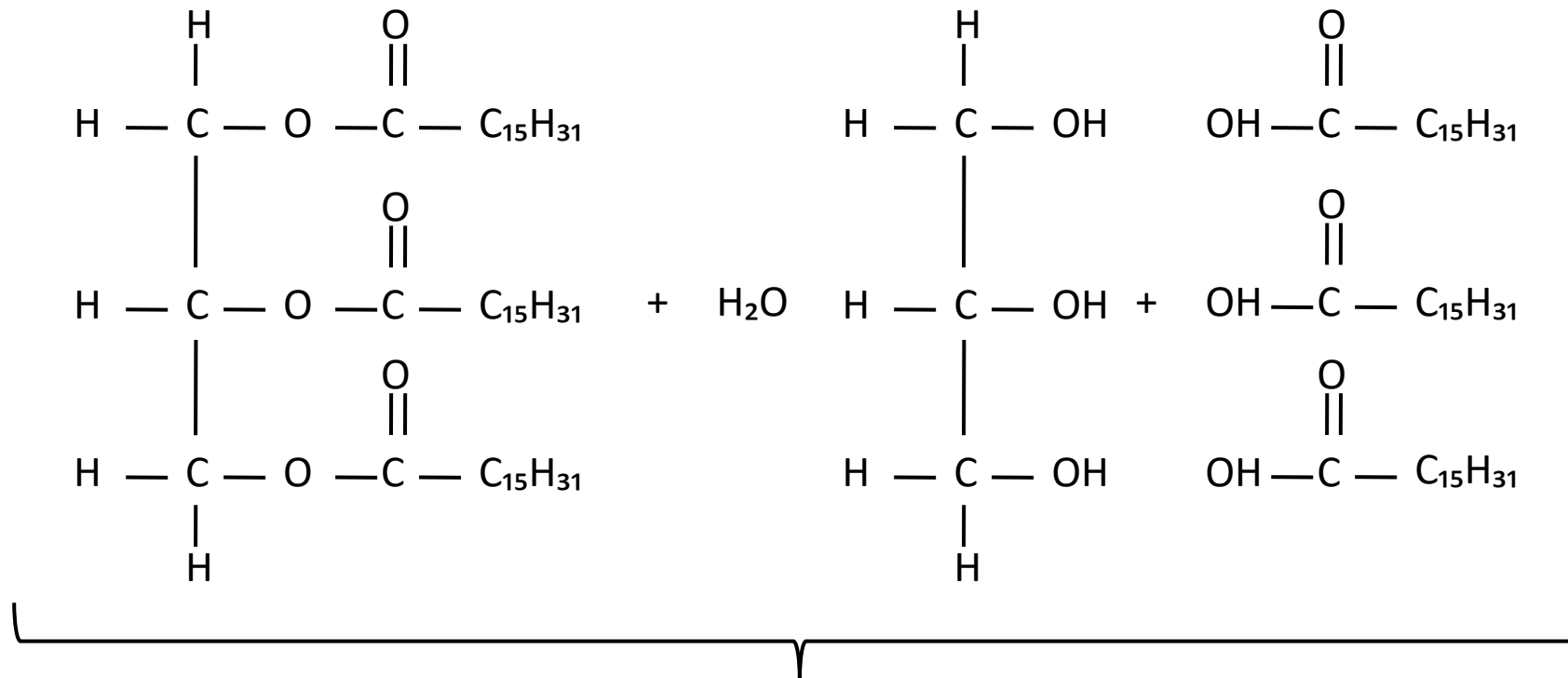
SELÜLOZ



NIŞASTA



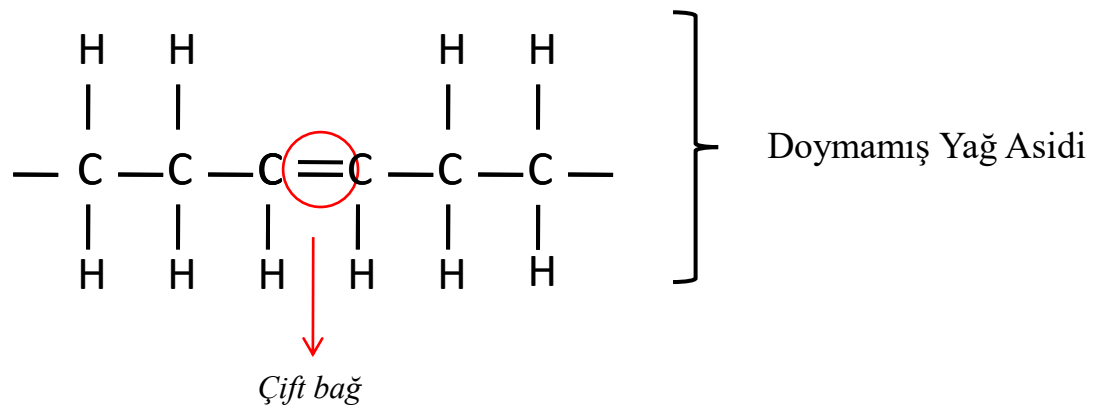
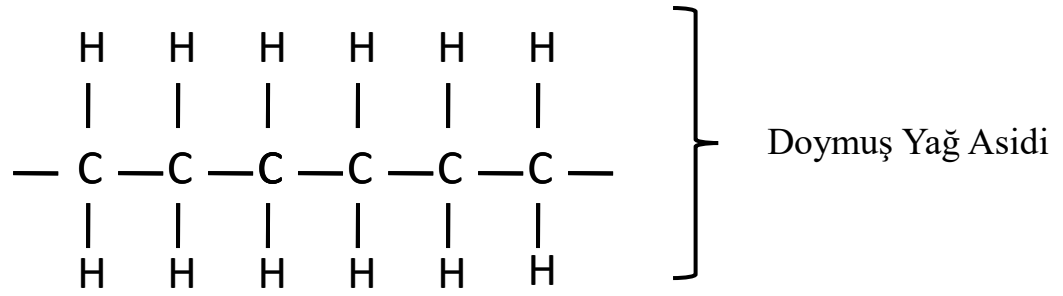


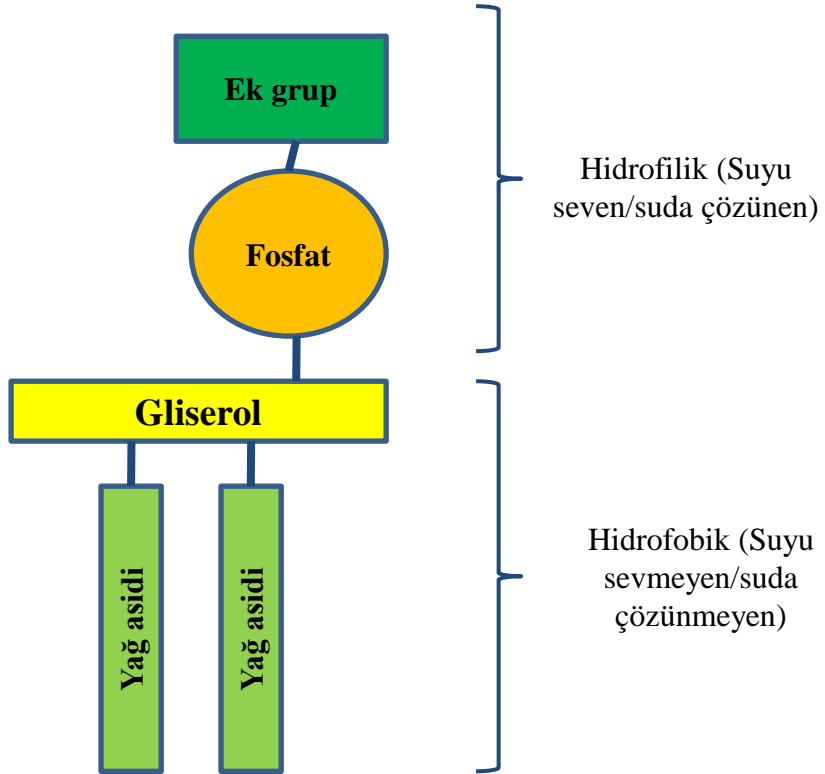


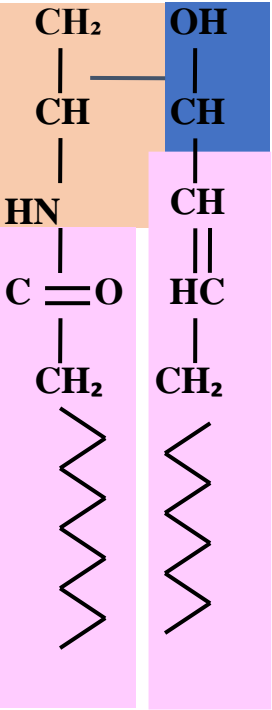
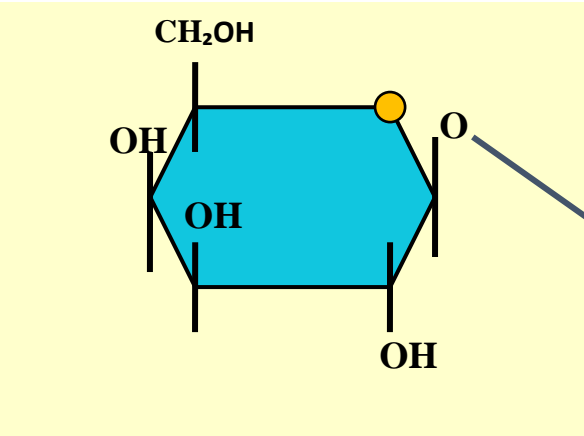
1 Yağ + 3H₂O

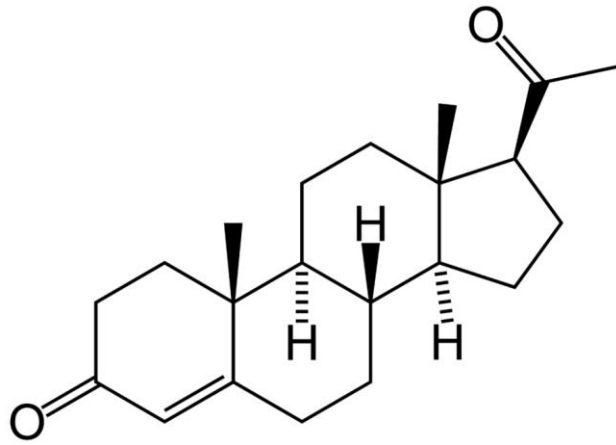


1 Gliserol + 3 Yağ Asiti

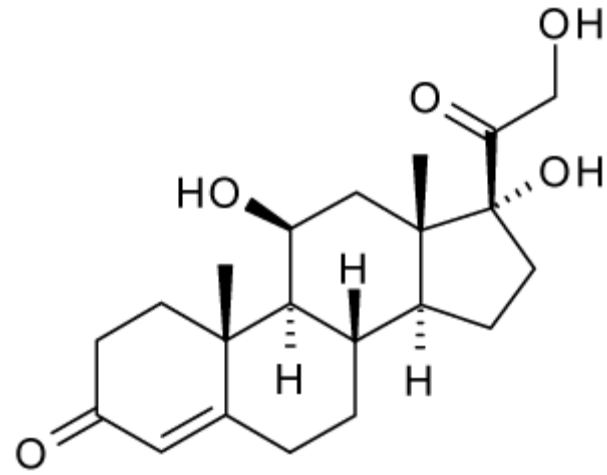




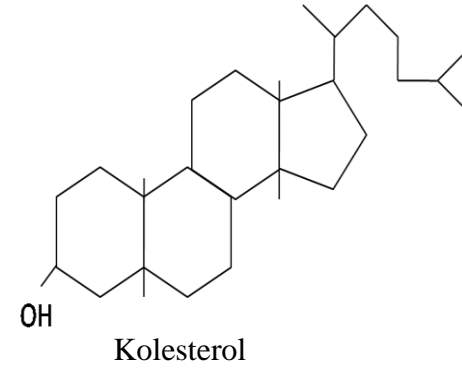
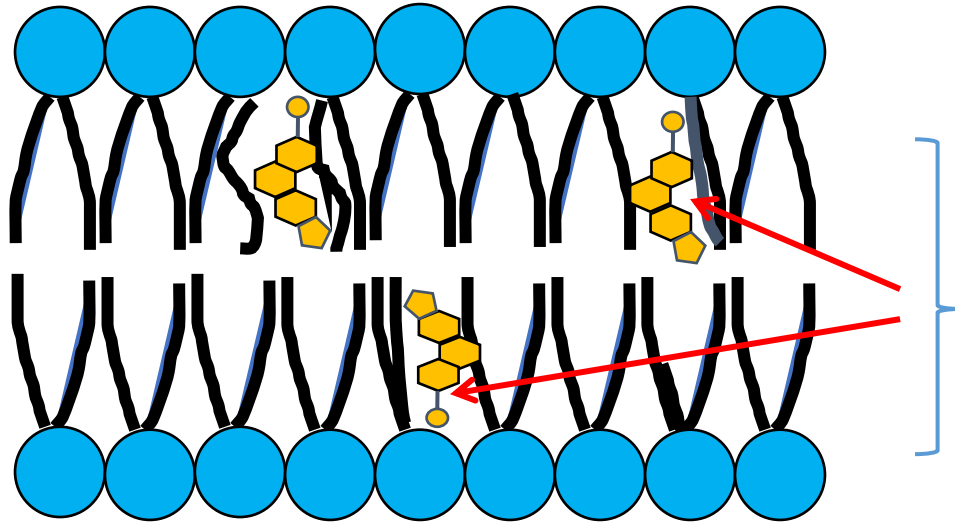




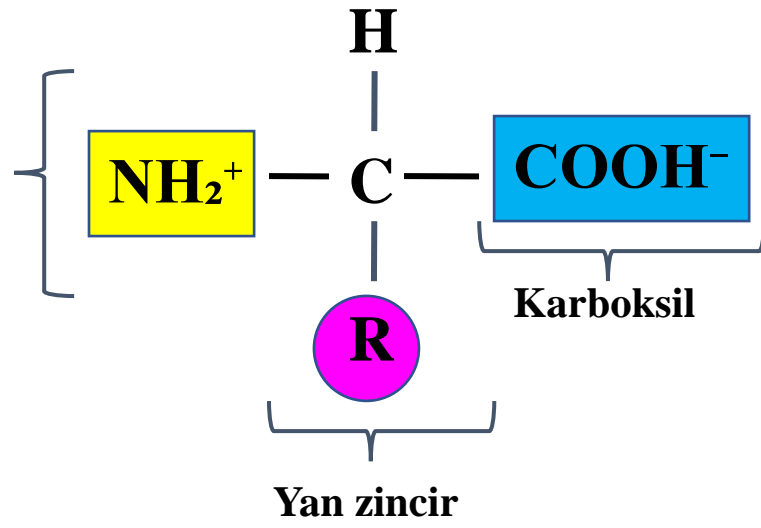
Progesteron

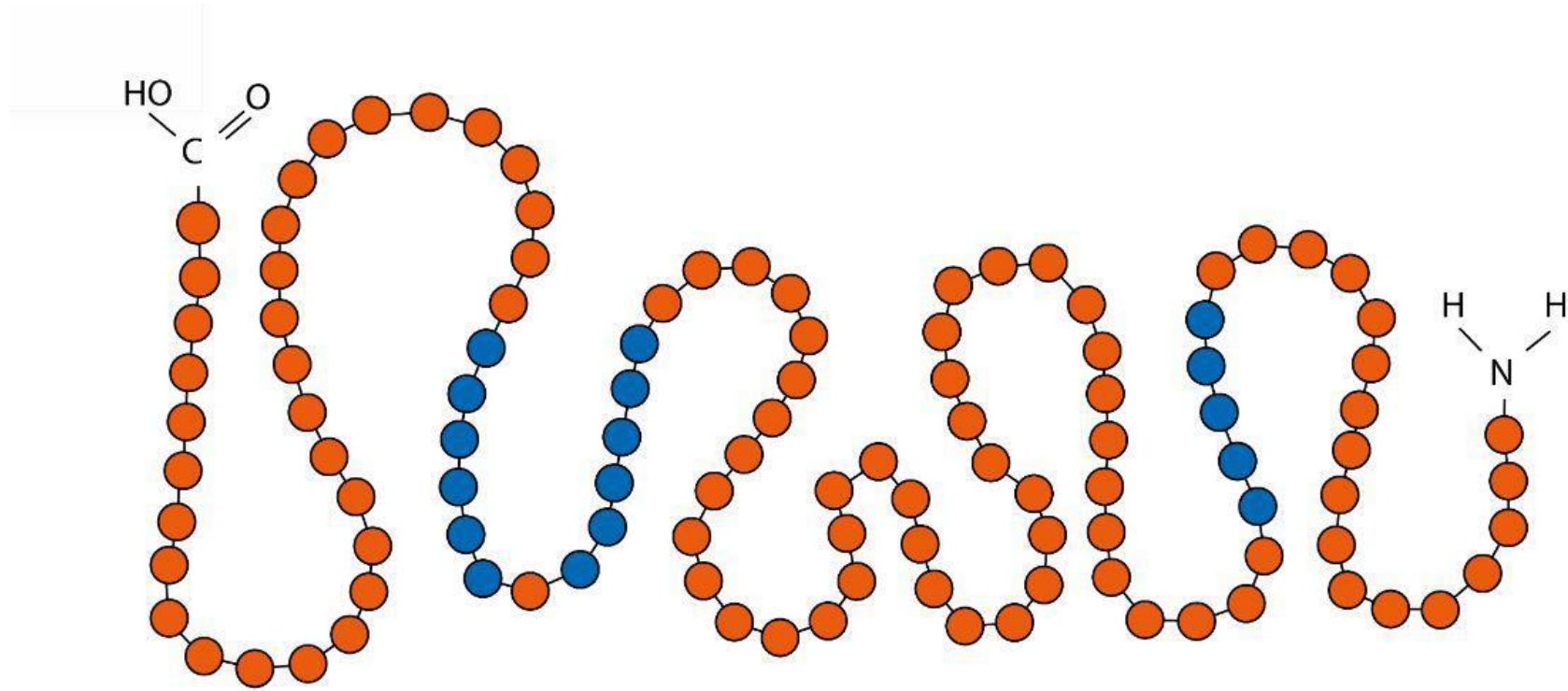


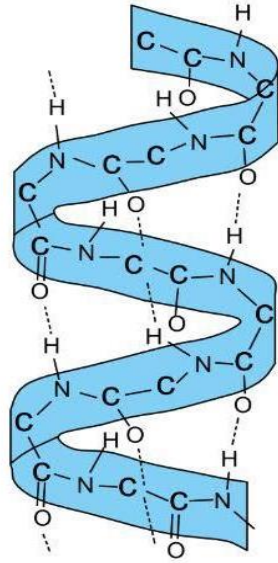
Kortizol



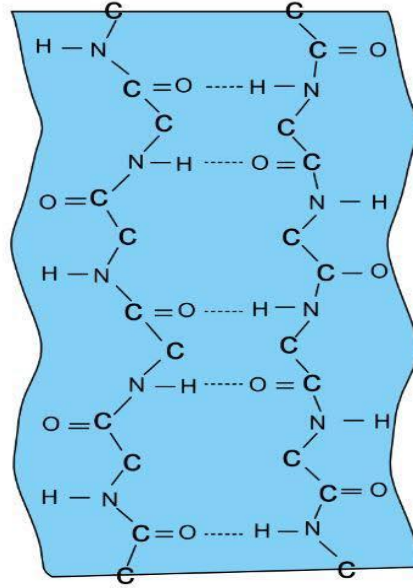
Amino





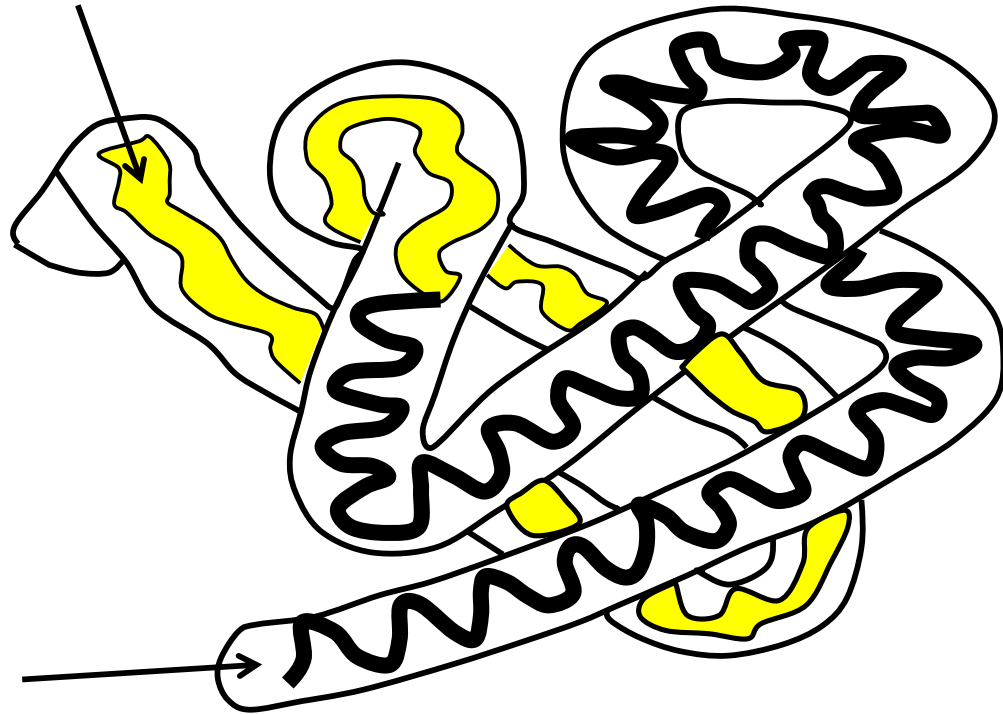


α helix

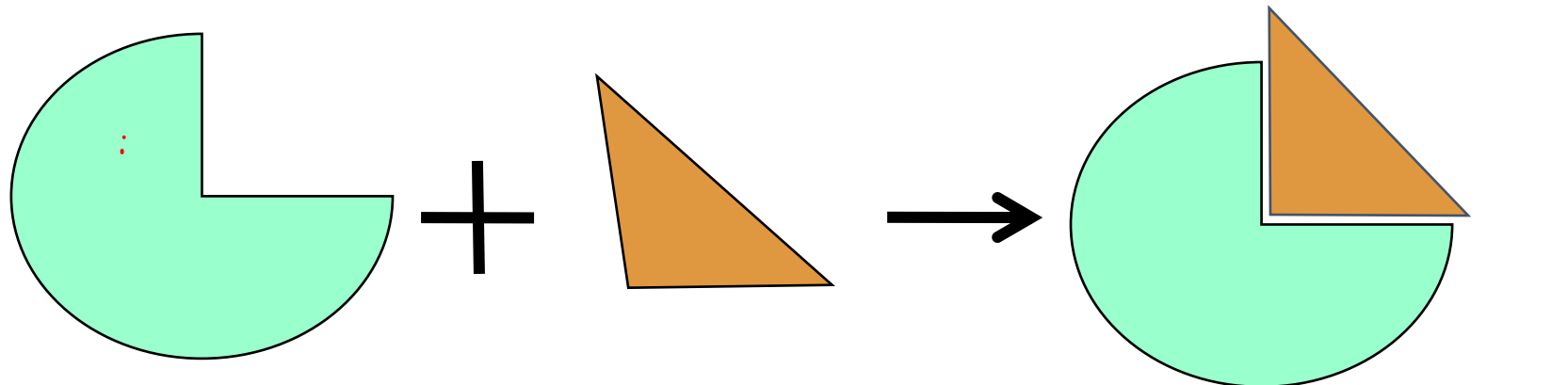
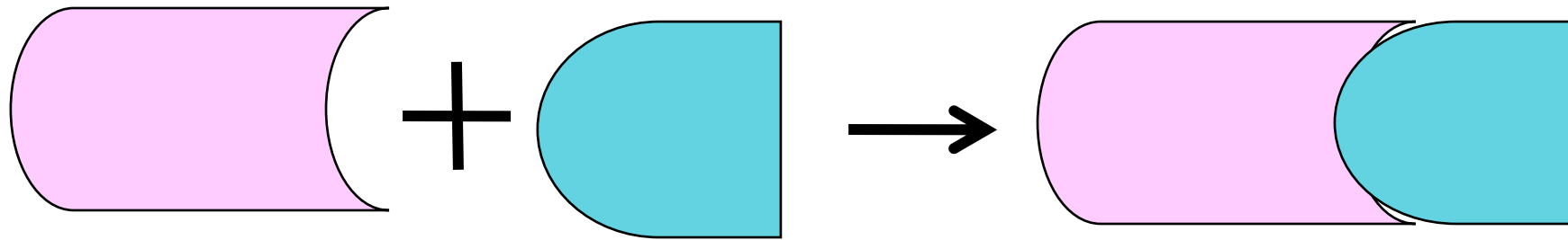


β - Tabaka Yapı

β Tabaka



α heliks



Enzim



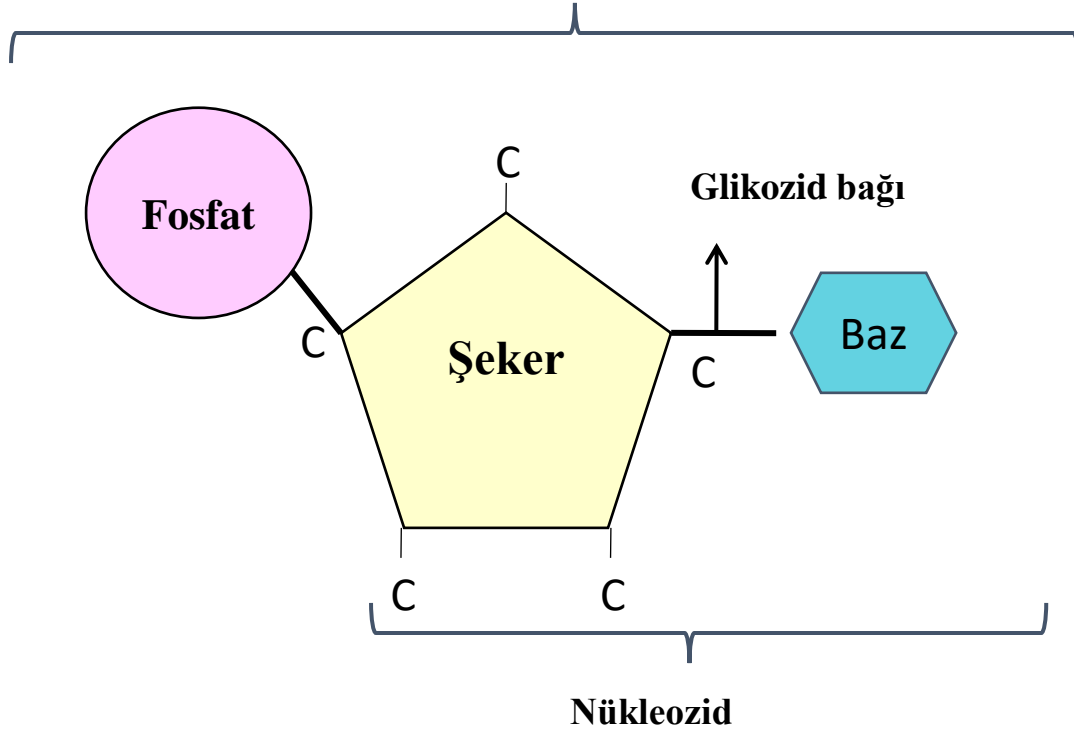
Substrat



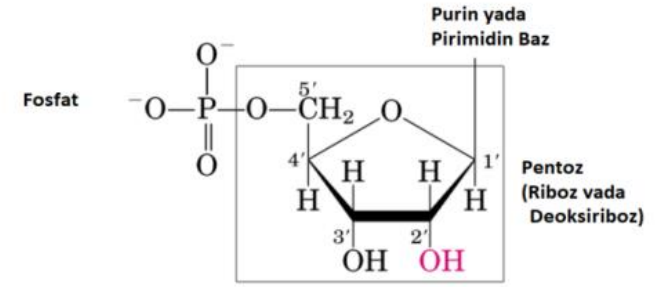
Enzim- Substrat Kompleksi

.

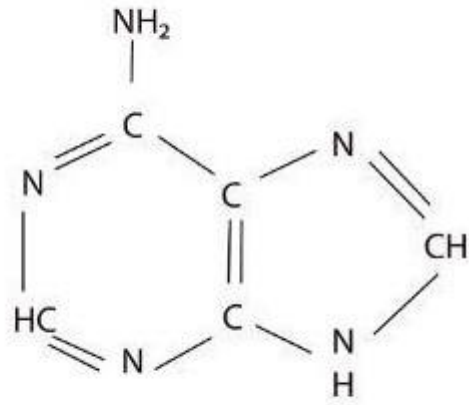
Nükleotid



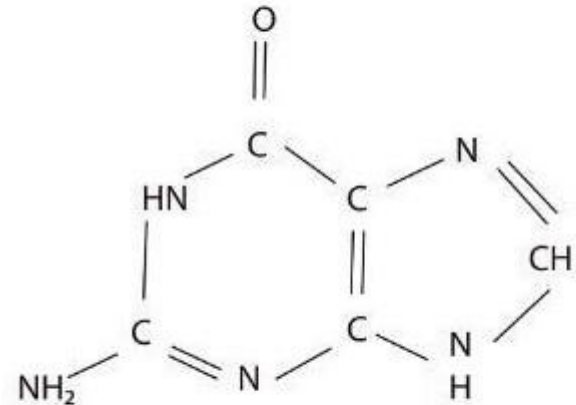
Nükleotid



PÜRİNLER

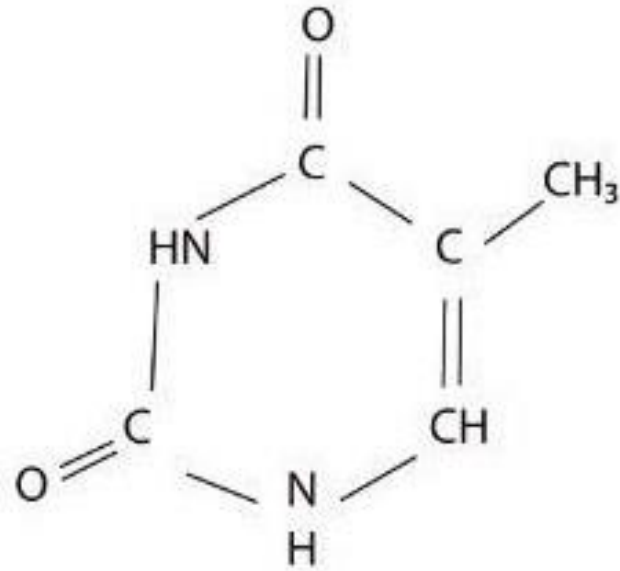


Adenin

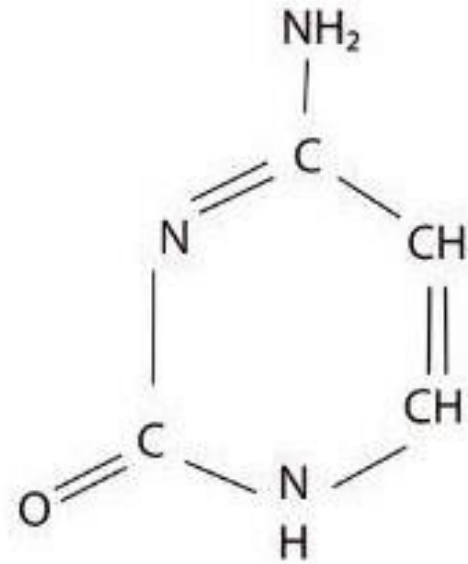


Guanin

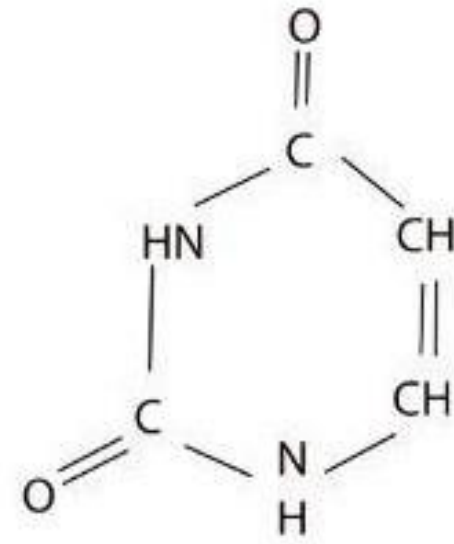
PİRİMİDİNLER



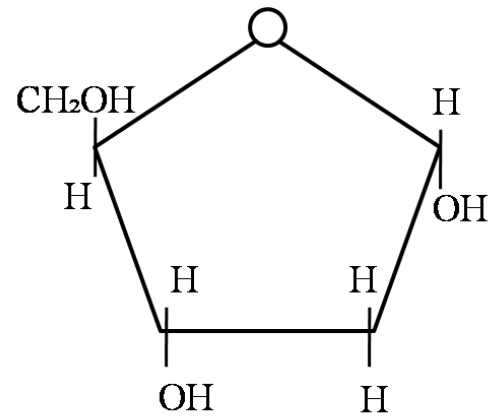
Timin
(sadece DNA'da)



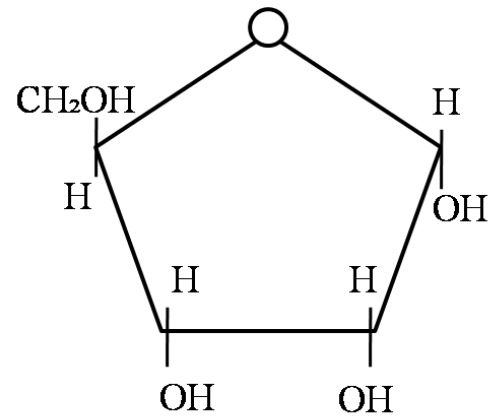
Sitozin



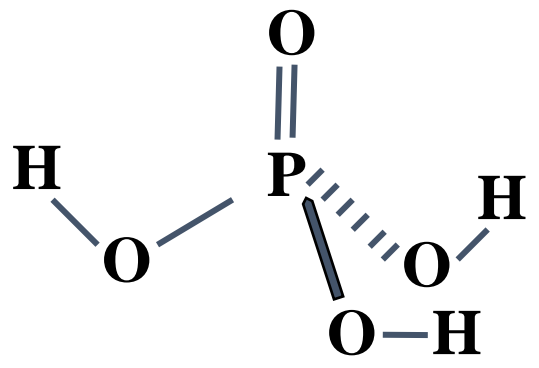
Urasil
(sadece RNA'da)



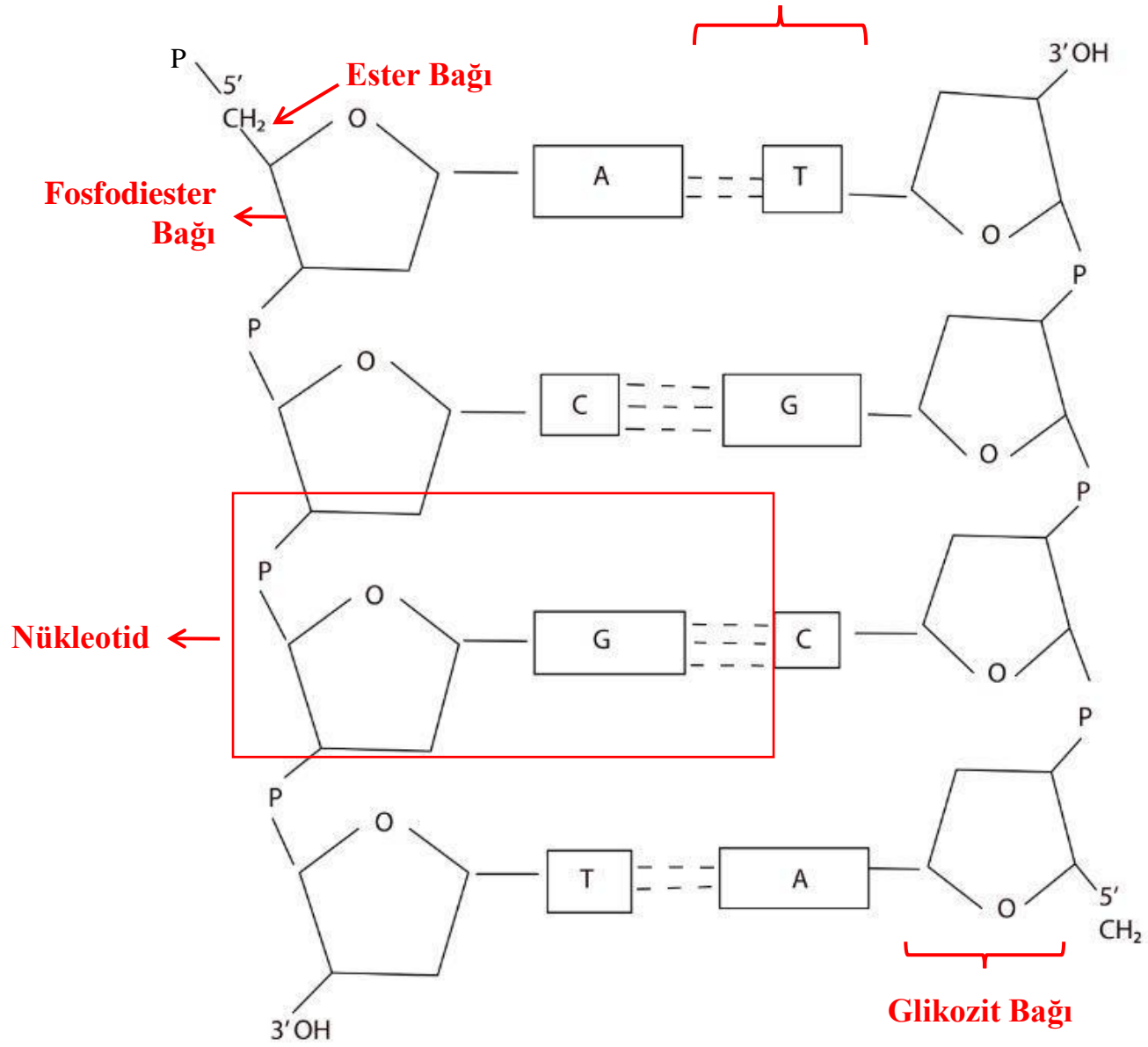
Deoksiriboz

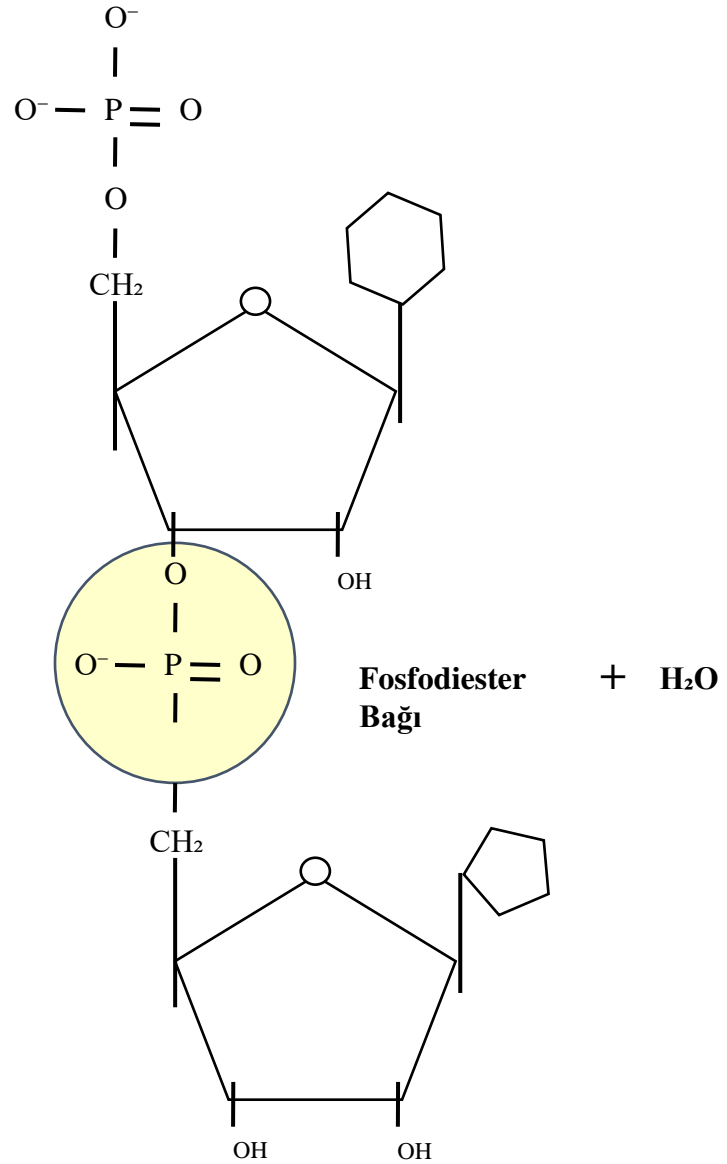


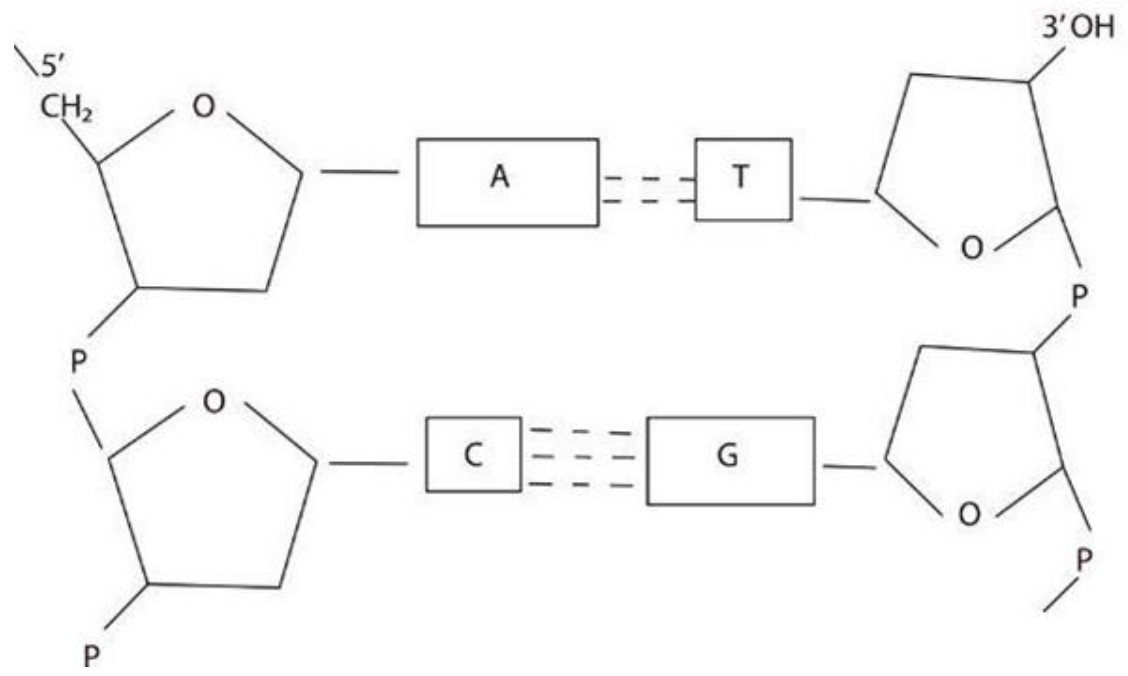
Riboz

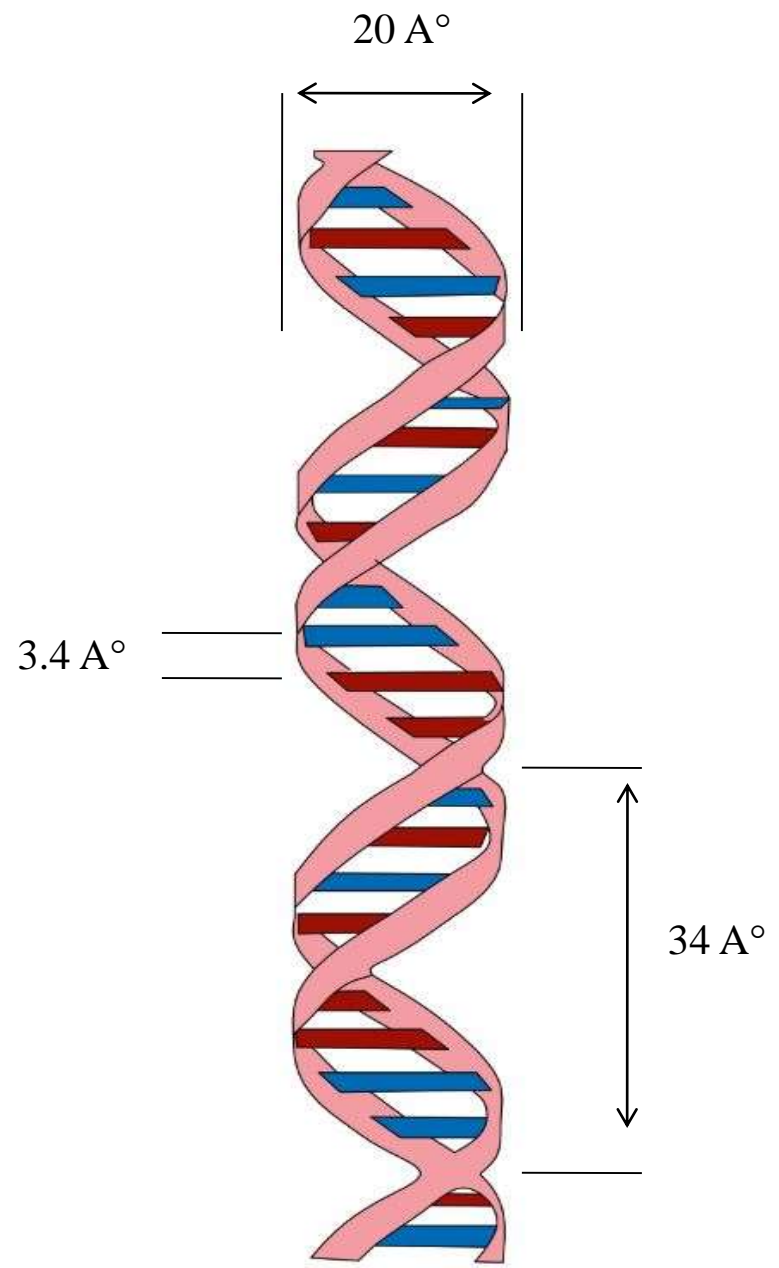


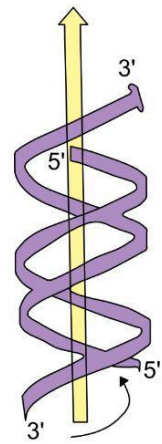
Zayıf Hidrojen Bağları



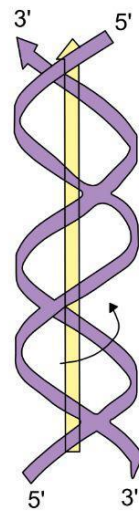




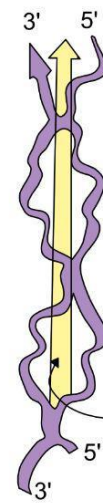




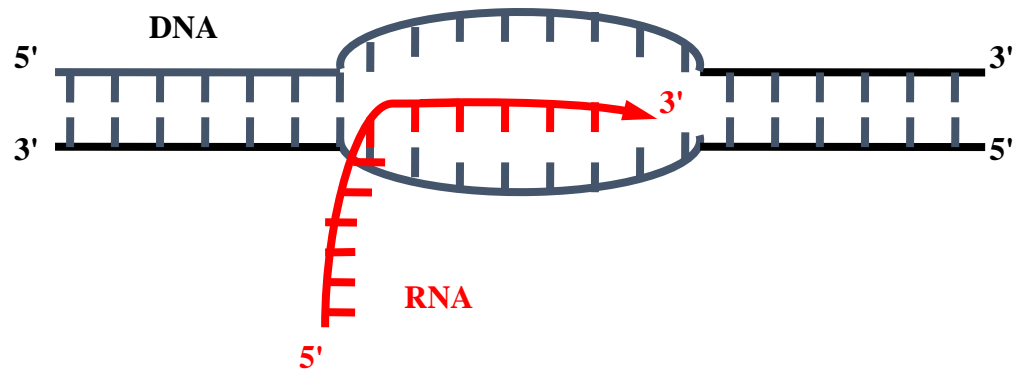
A-DNA

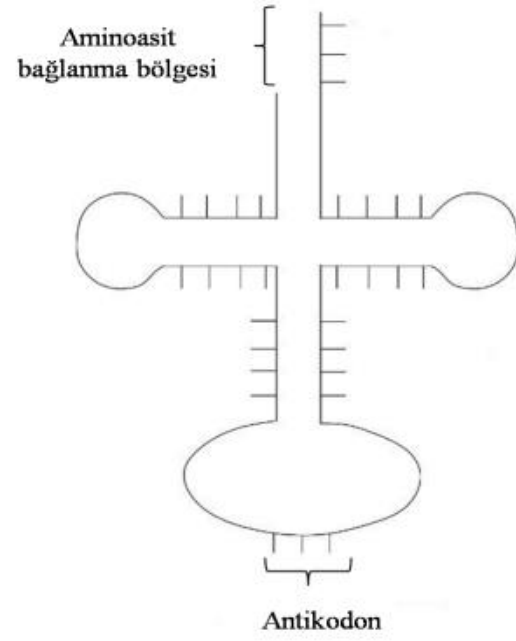


B-DNA

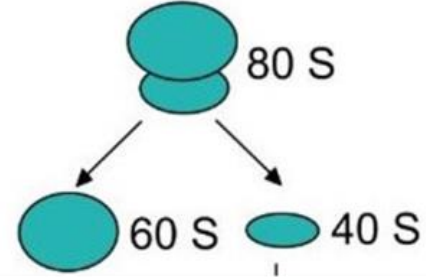


Z-DNA

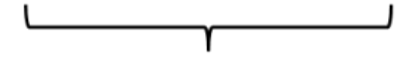




Ribozom



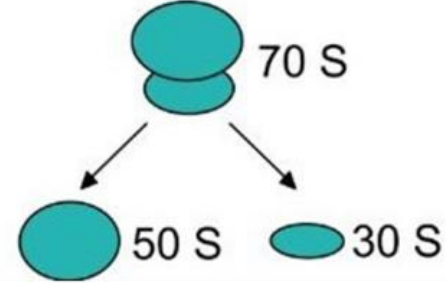
Alt üniteler



5.8 S, 18S, 28 S ve 5S rRNA

Ökaryotik Hücre

Ribozom

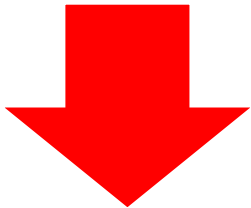


Alt üniteler



23S, 16S ve 5S rRNA

Prokaryotik Hücre

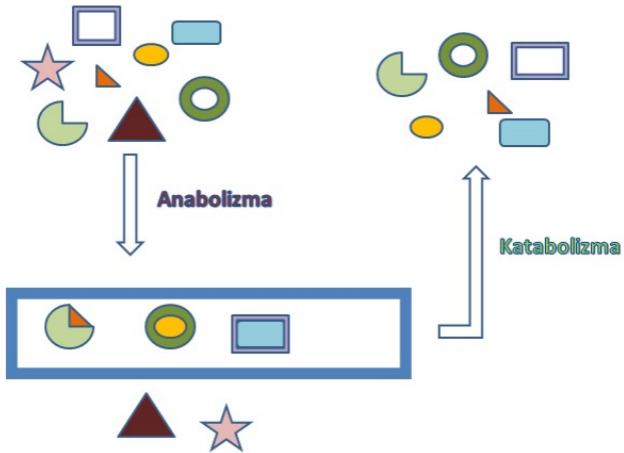


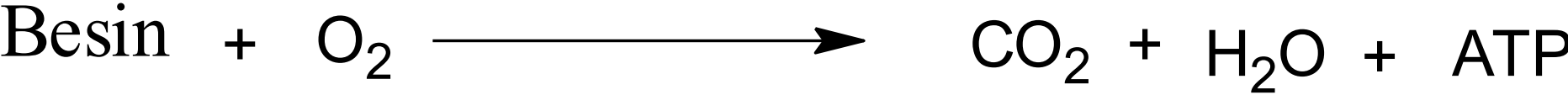
Anabolizma

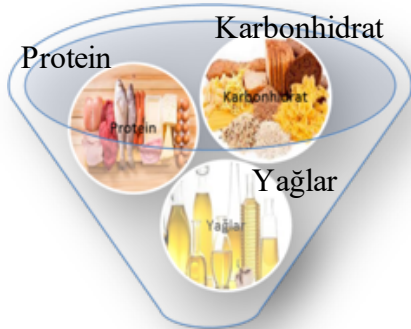


Katabolizma









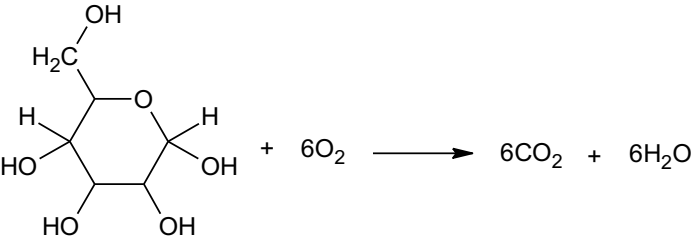
Katabolizma

Amino asit

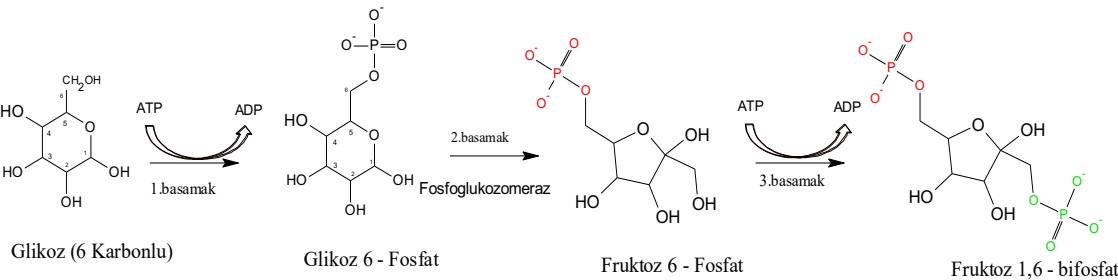


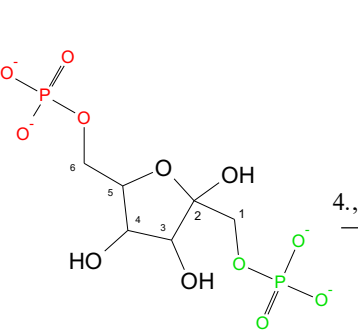
Yağ asidi

Monosakkarit



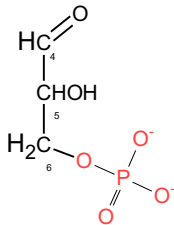
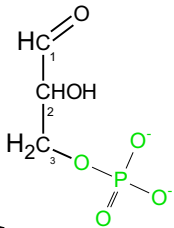
Glukoz ($\text{C}_6\text{H}_{12}\text{O}_6$)



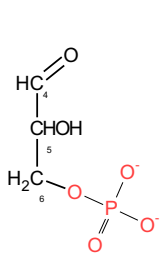


Fruktoz 1,6 - bifosfat

4., 5. basamak

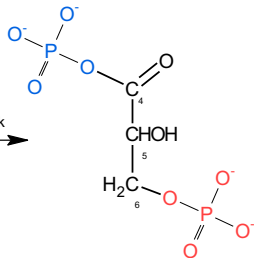


2 adet gliseraldehit-3-fosfat



gliseraldehit-3-fosfat

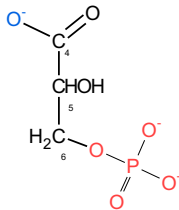
6. basamak



1,3-bifosfolgliserat

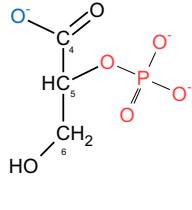
7. basamak

1. ATP üretimi



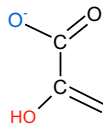
3-fosfolgliserat

8. basamak



9. basamak

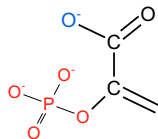
-H₂O



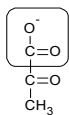
piruvat

10. basamak

2. ATP üretimi



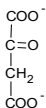
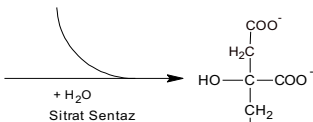
fosfoenolpiruvat



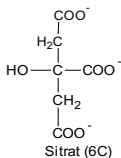
Pirüvat (3C)



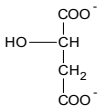
Asetil Co - A (2C)



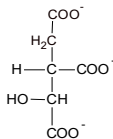
Oksaloasetat (4C)



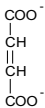
Sitrat (6C)



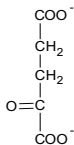
Malat (4C)



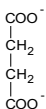
izositrat (6C)



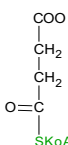
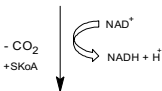
Fumarat (4C)



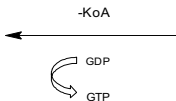
alfa - ketoglutarat (5C)

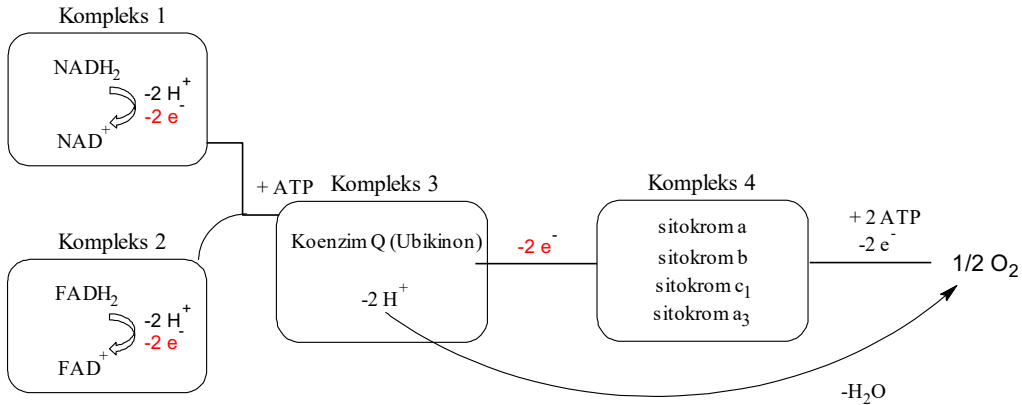


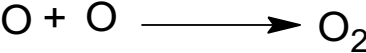
Süksinat (4C)



Süksinil KoA (4C)

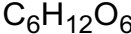








Su

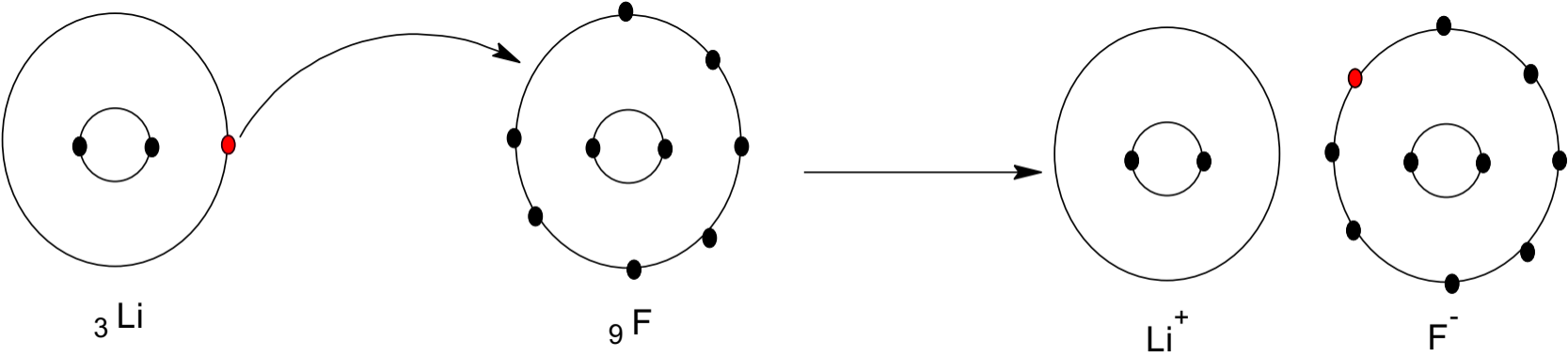


Glikoz

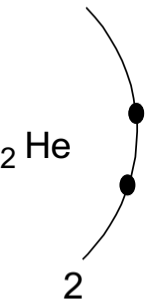


Yumusak

Sert

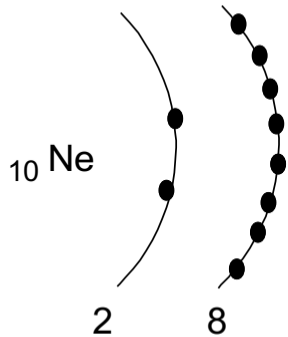


Dublet

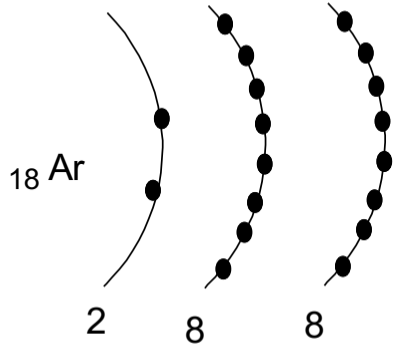


Kararlı

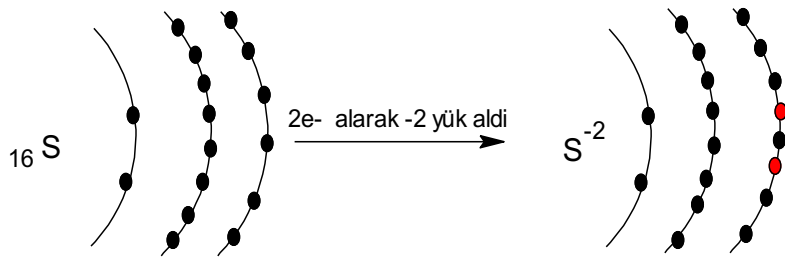
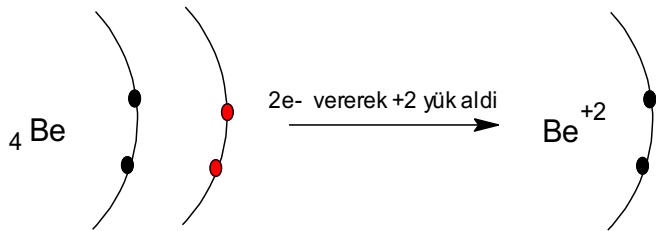
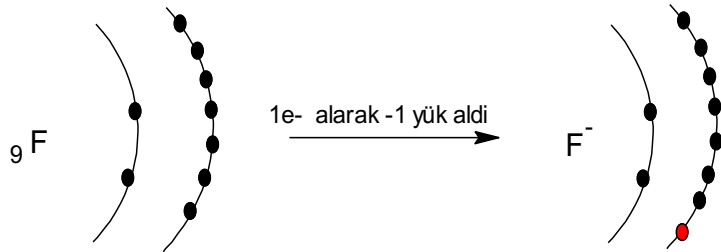
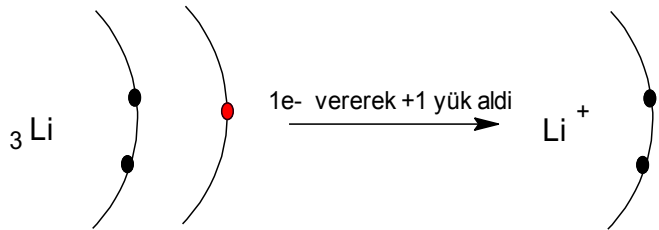
Oktet

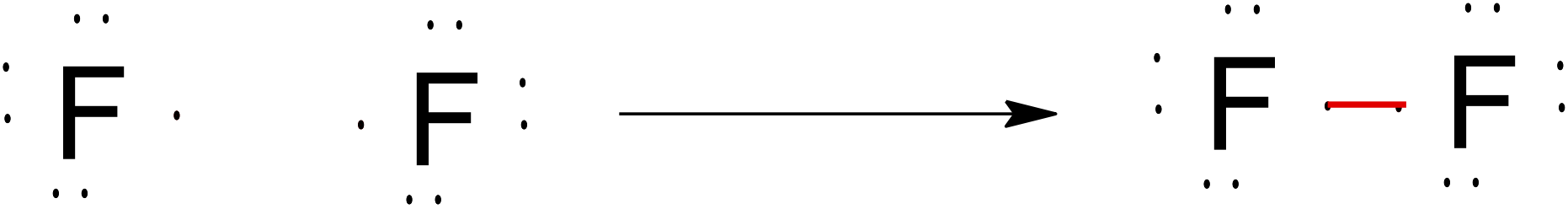


Kararlı



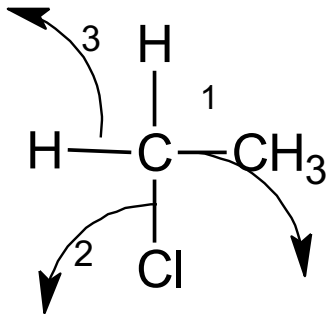
Kararlı







polar kovalent bag

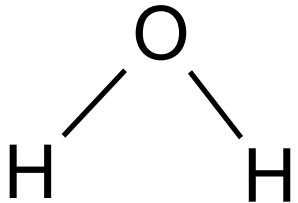


polar kovalent bag

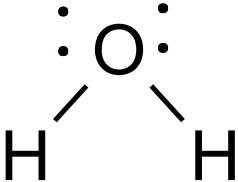
apolar kovalent bag



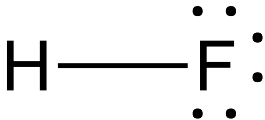
Sime trik



Asimetrik

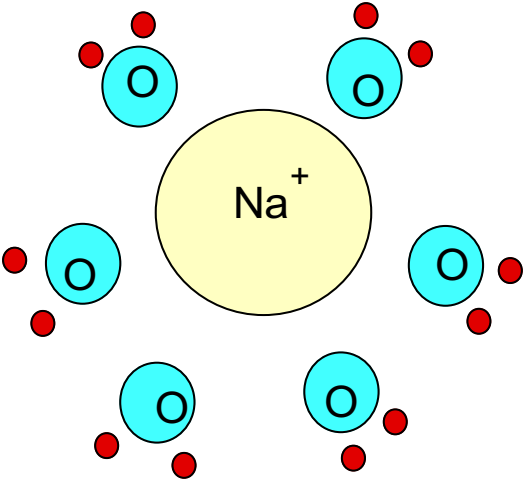


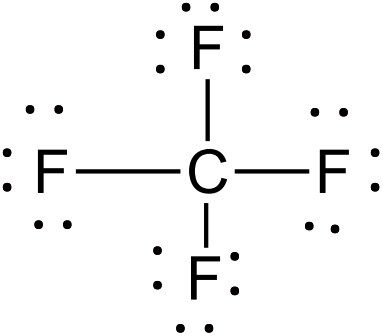
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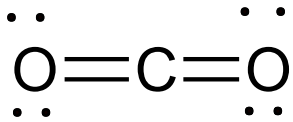
Polar

Polar

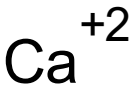




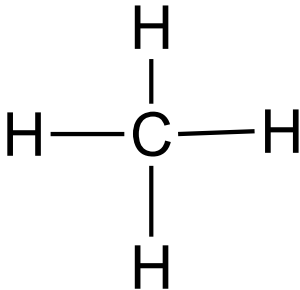
Apolar



Apolar

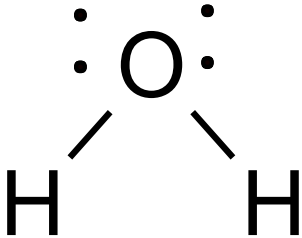


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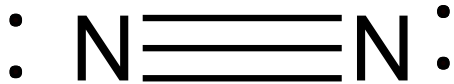


Iyon

Apolar

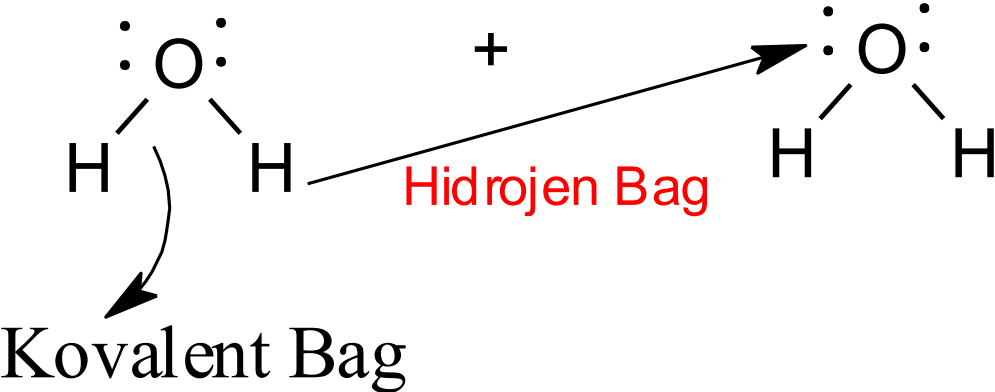


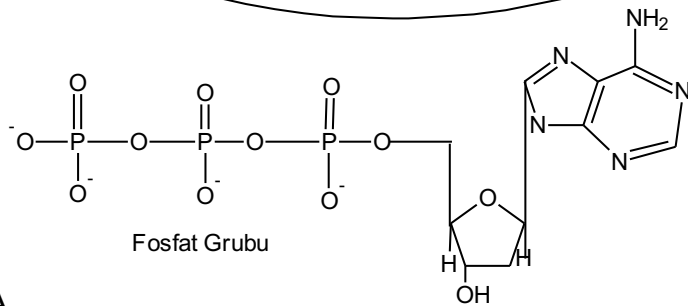
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Polar

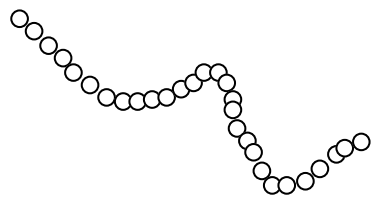
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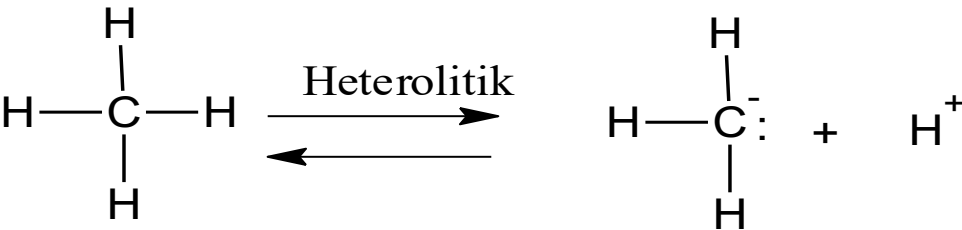
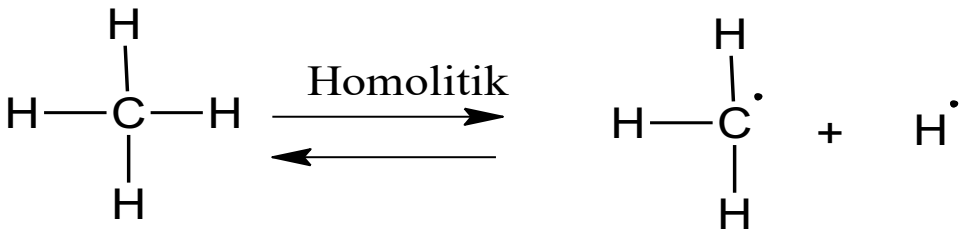
H₂O polar

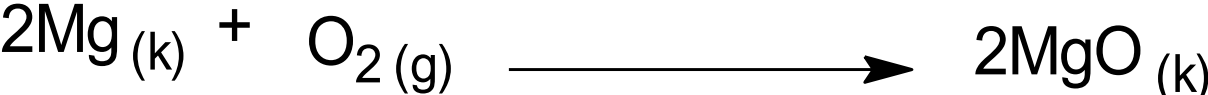
DNA

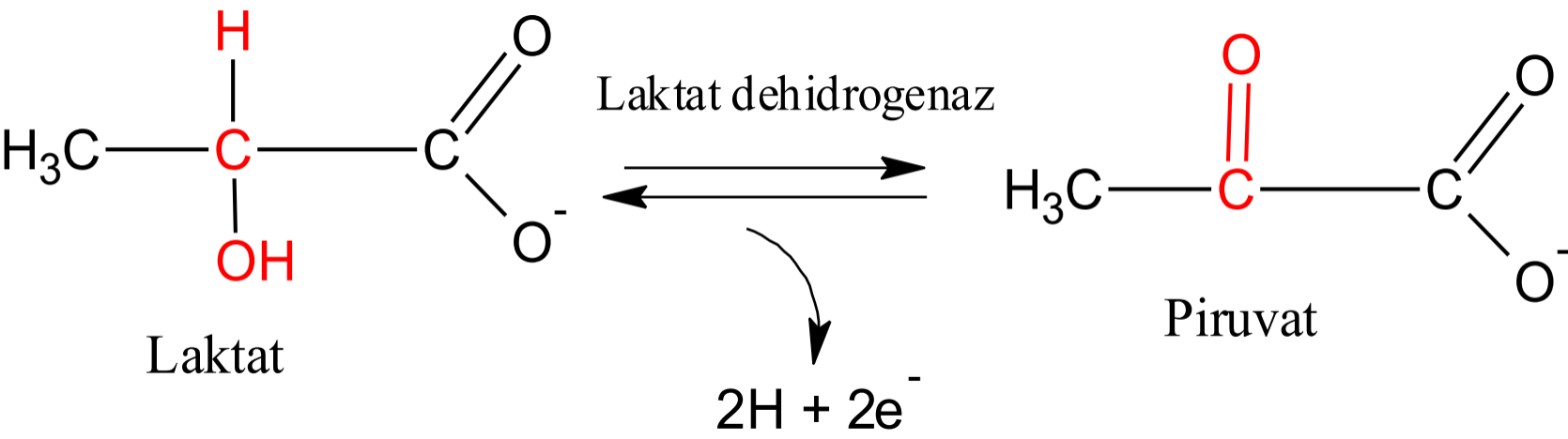


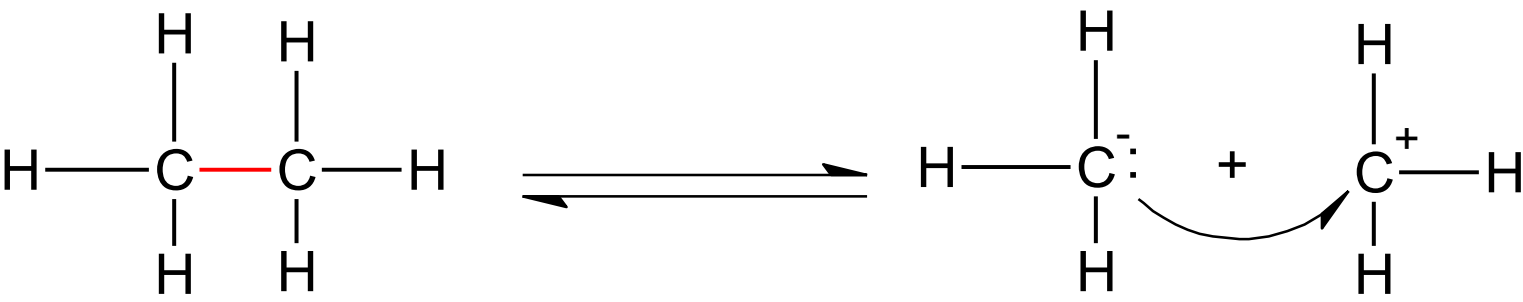
Fenol Apolar

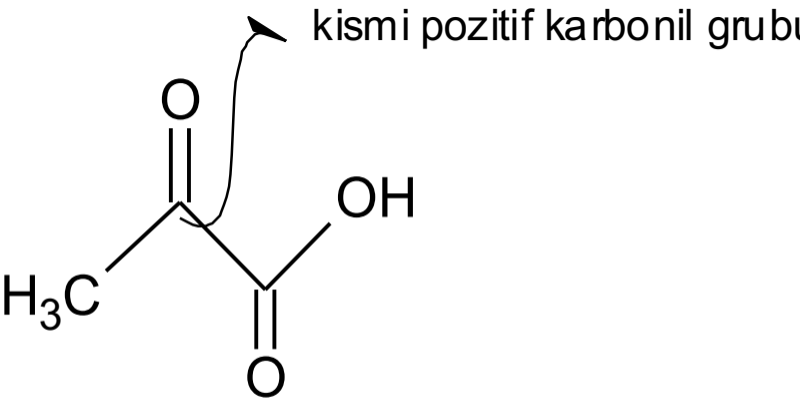
Protein



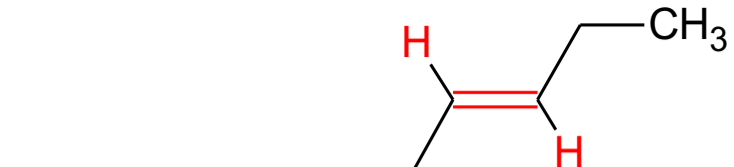




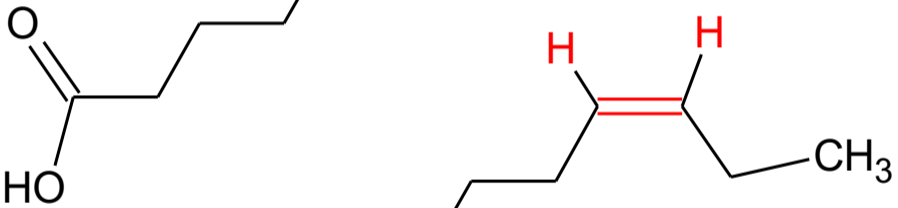




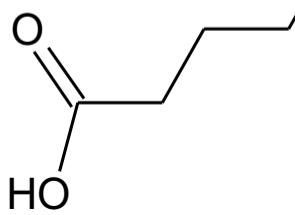
alfa-keto asit

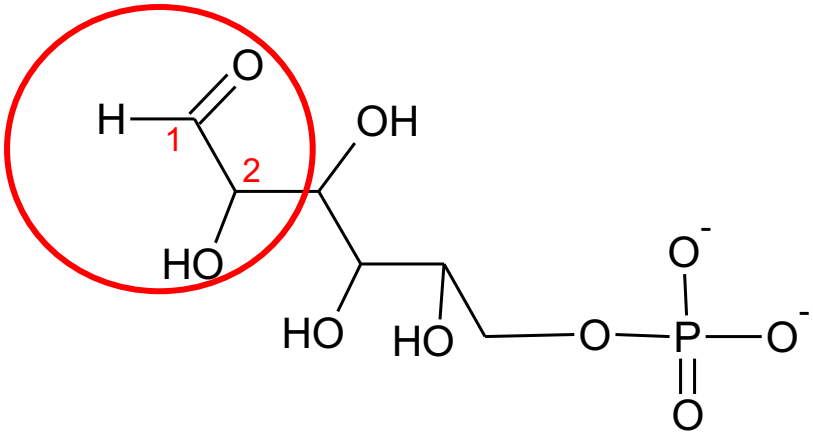


trans yağ asidi

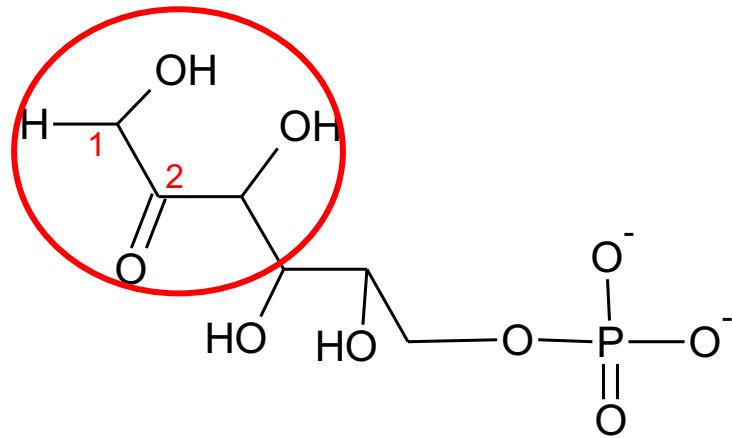
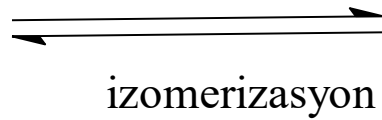


cis yağ asidi

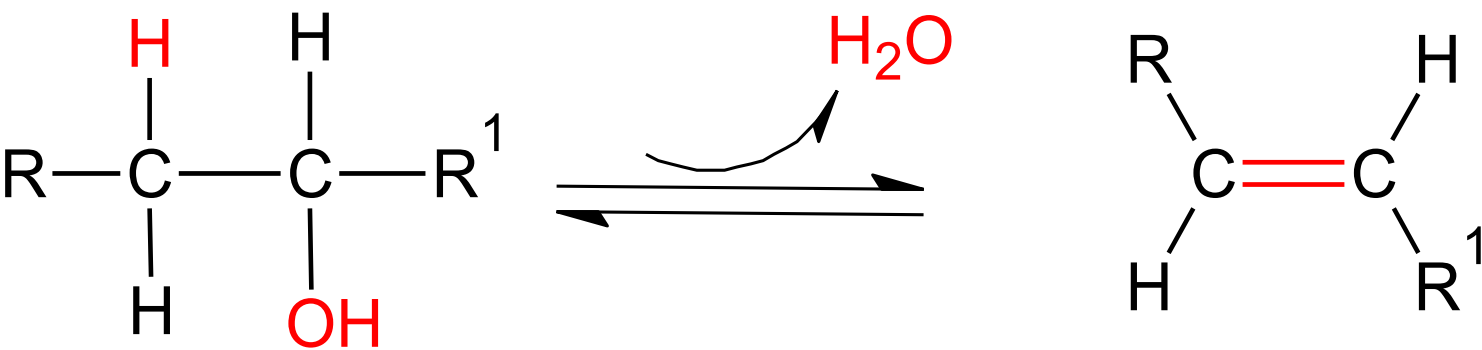


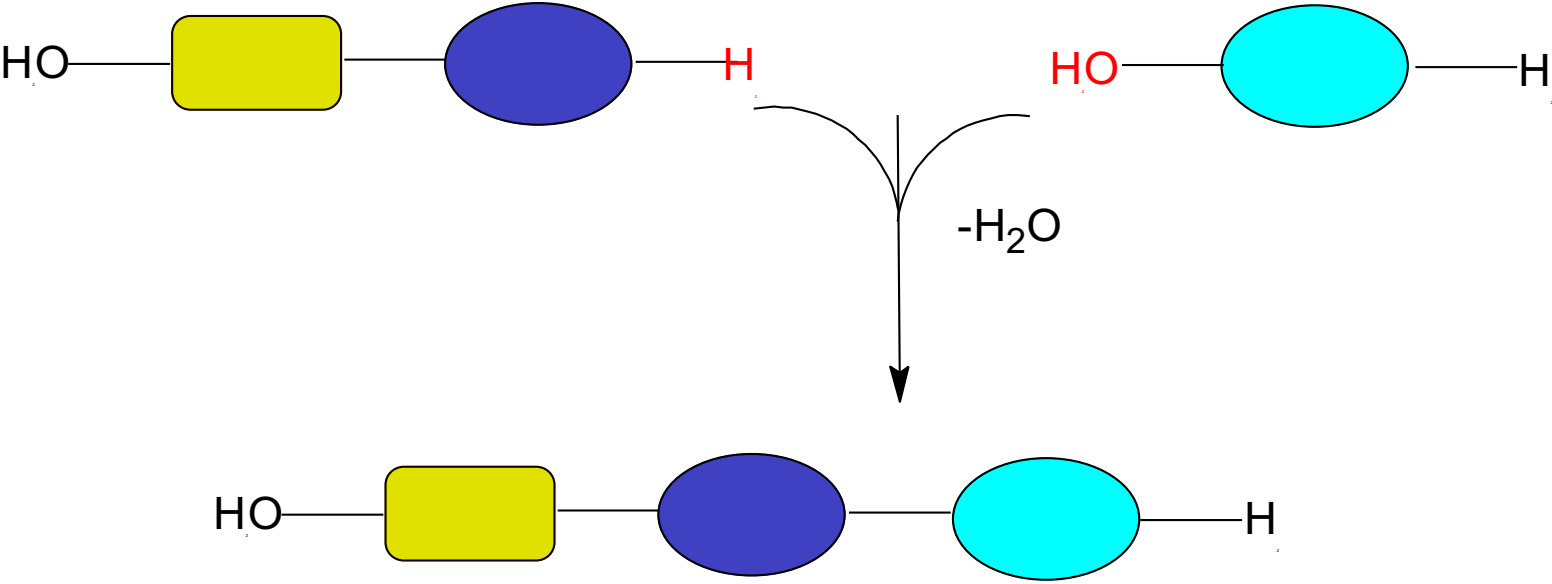


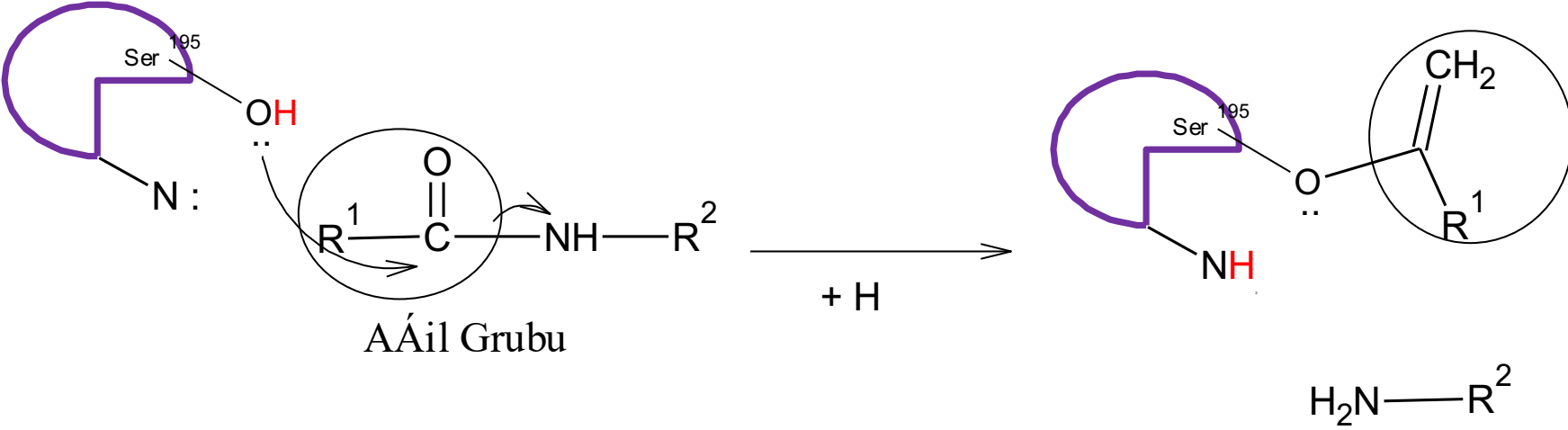
Glukoz 6 - fosfat

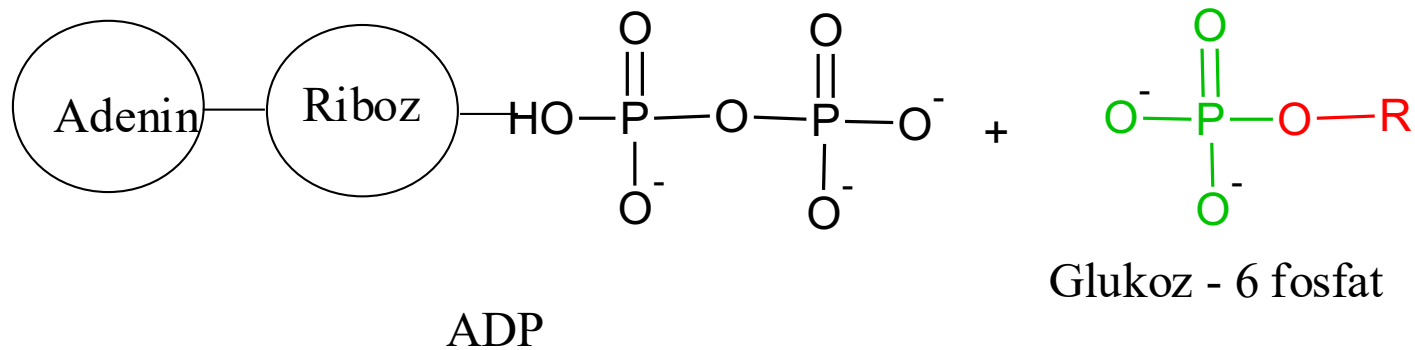
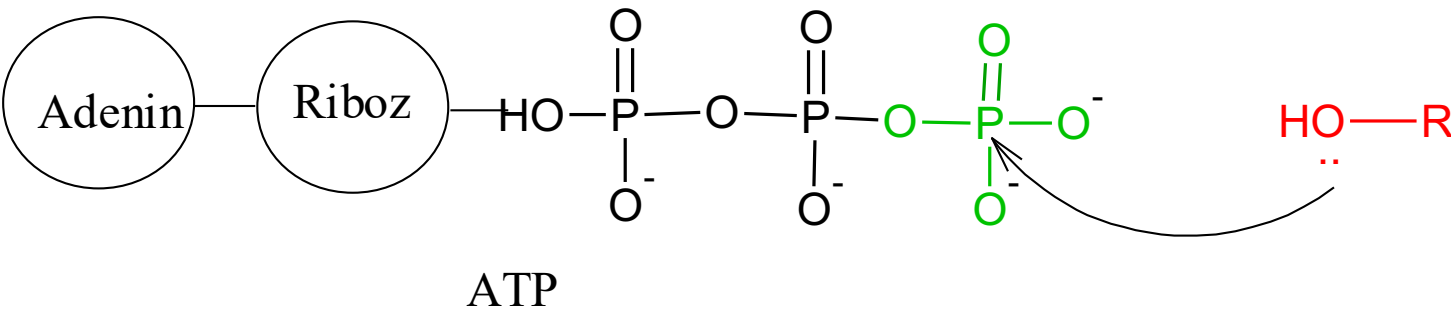


Fruktoz 6 - fosfat



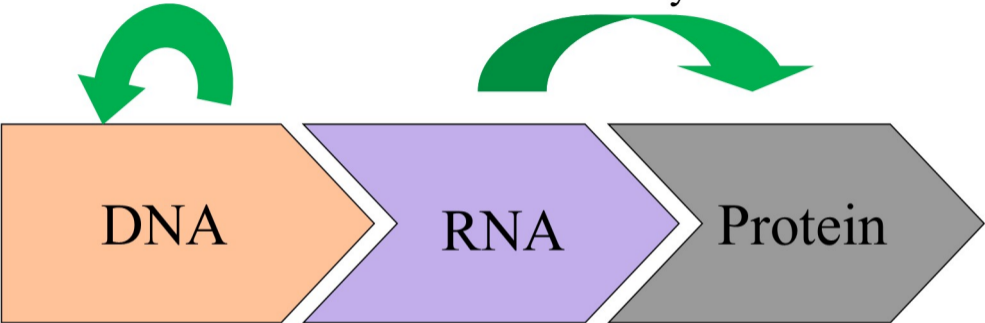






Replikasyon

Translasyon

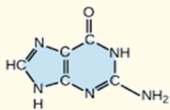


DNA

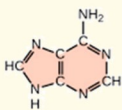
RNA

Protein

Transkripsiyon

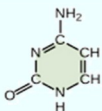


Guanin

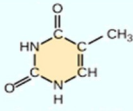


Adenin

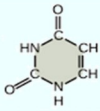
Pürinler



Sitozin

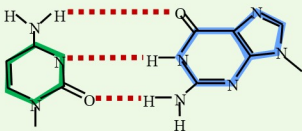


Timin



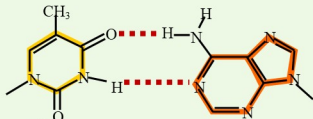
Urasil

Pirimidinler



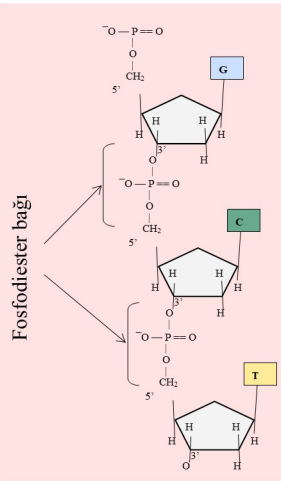
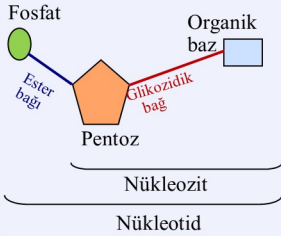
Sitozin

Guanin

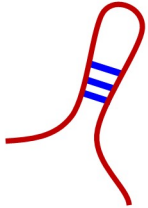


Timin

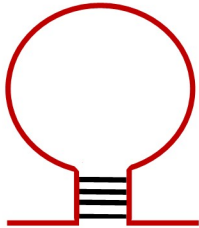
Adenin



Sekonder yapı

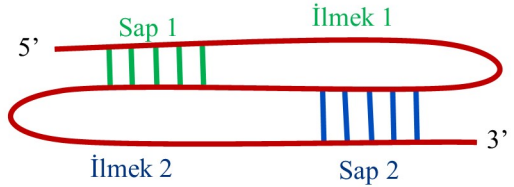


Saç tokası



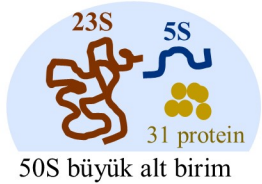
Sap-ilmek

Tersiyer yapı

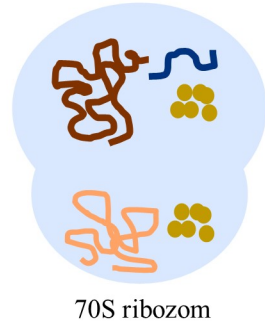


Yalancı düğüm

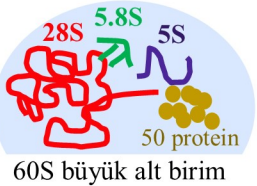
Prokaryotik ribozom



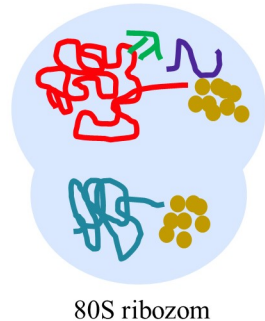
+

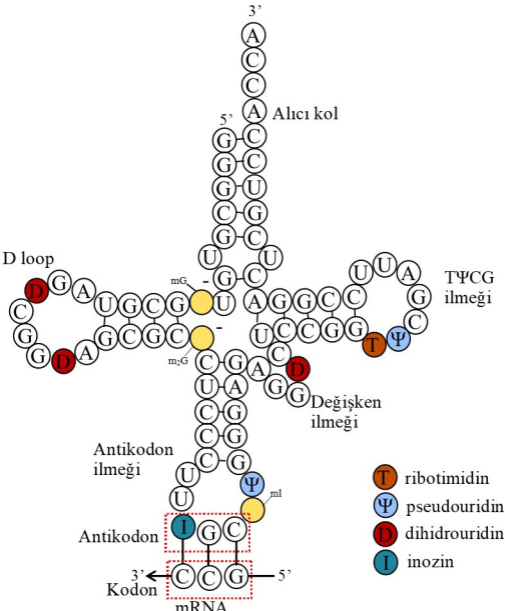


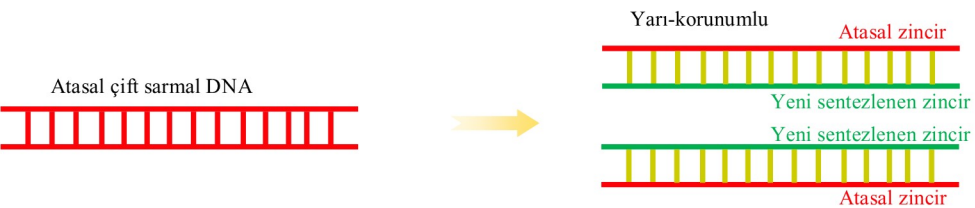
Ökaryotik ribozom

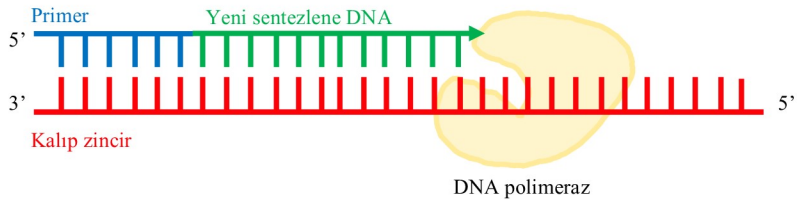
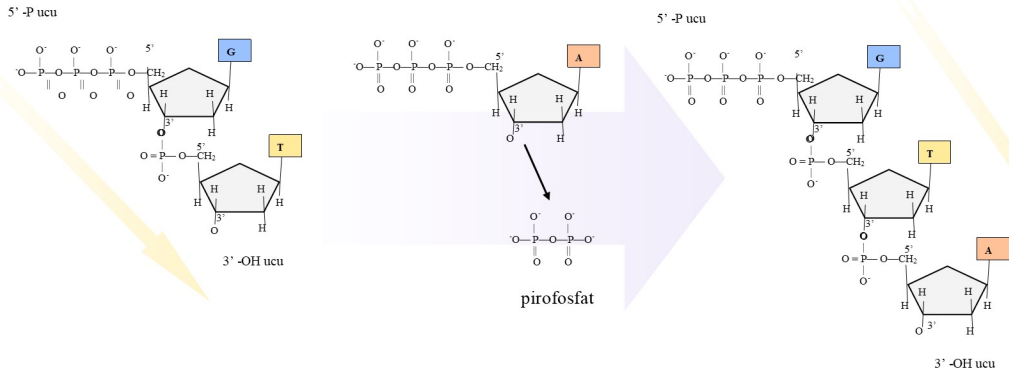


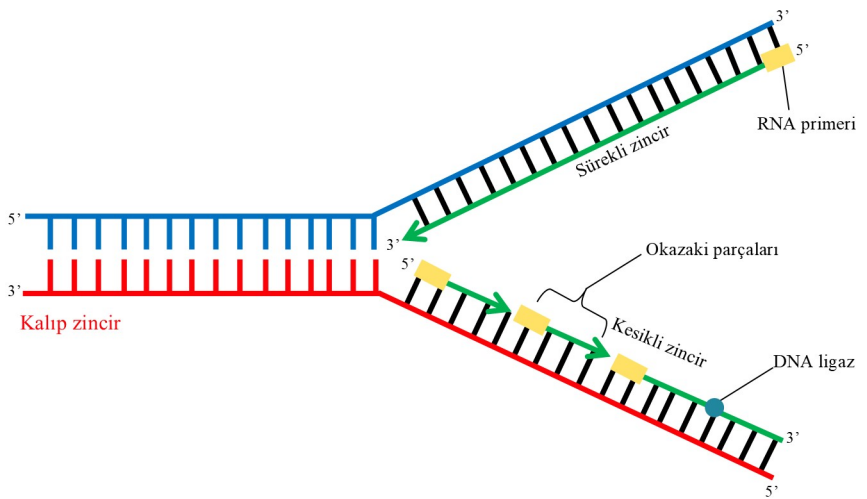
+



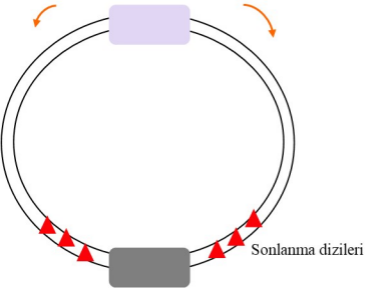




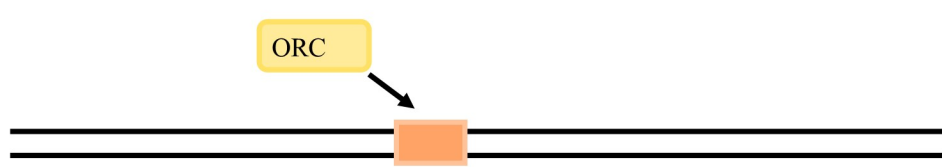
A**B**



Replikasyon
başlama orijini

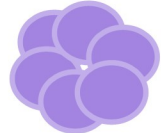


Replikasyon
sonlanma bölgesi



Replikasyon başlama orijini

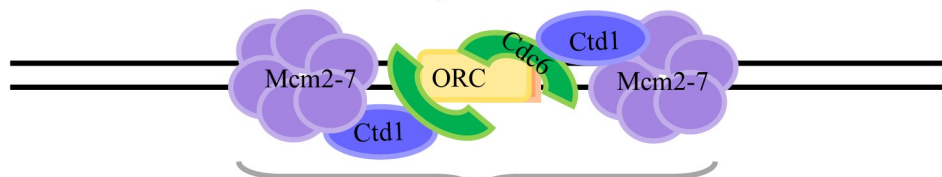
Mcm2-7



Cdc6



Ctd1

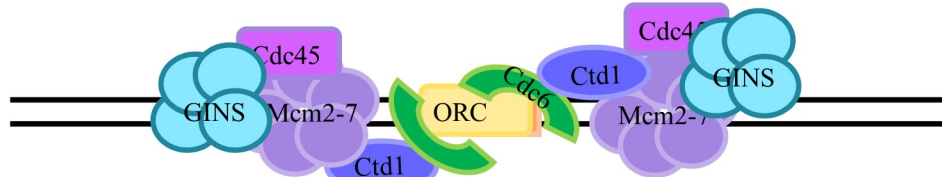


Pre-RC

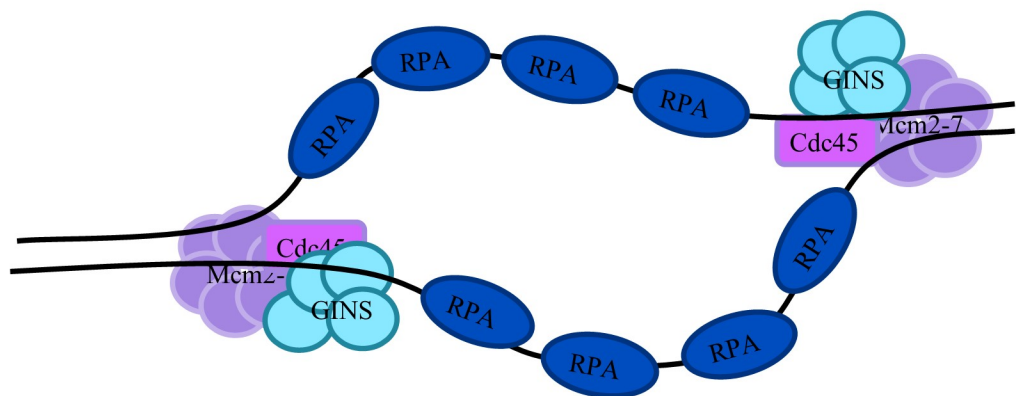
DDK aktivitesi

Cdc45

CDK aktivitesi

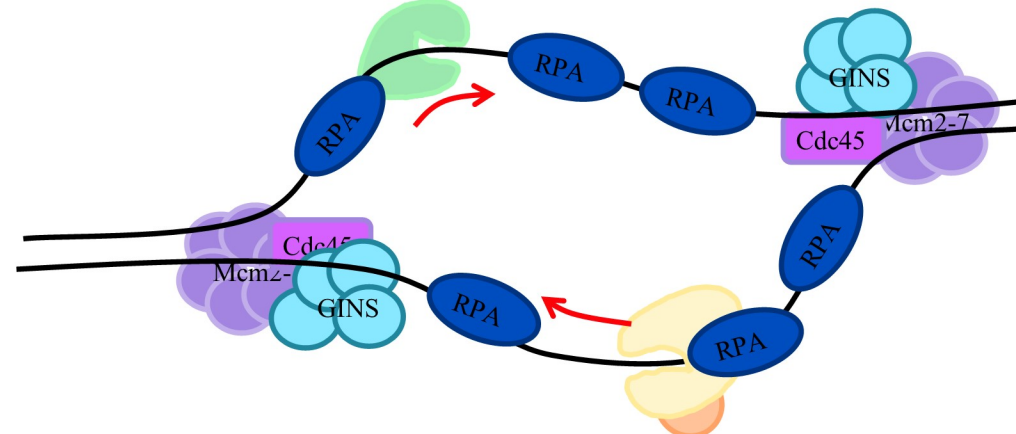
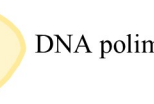


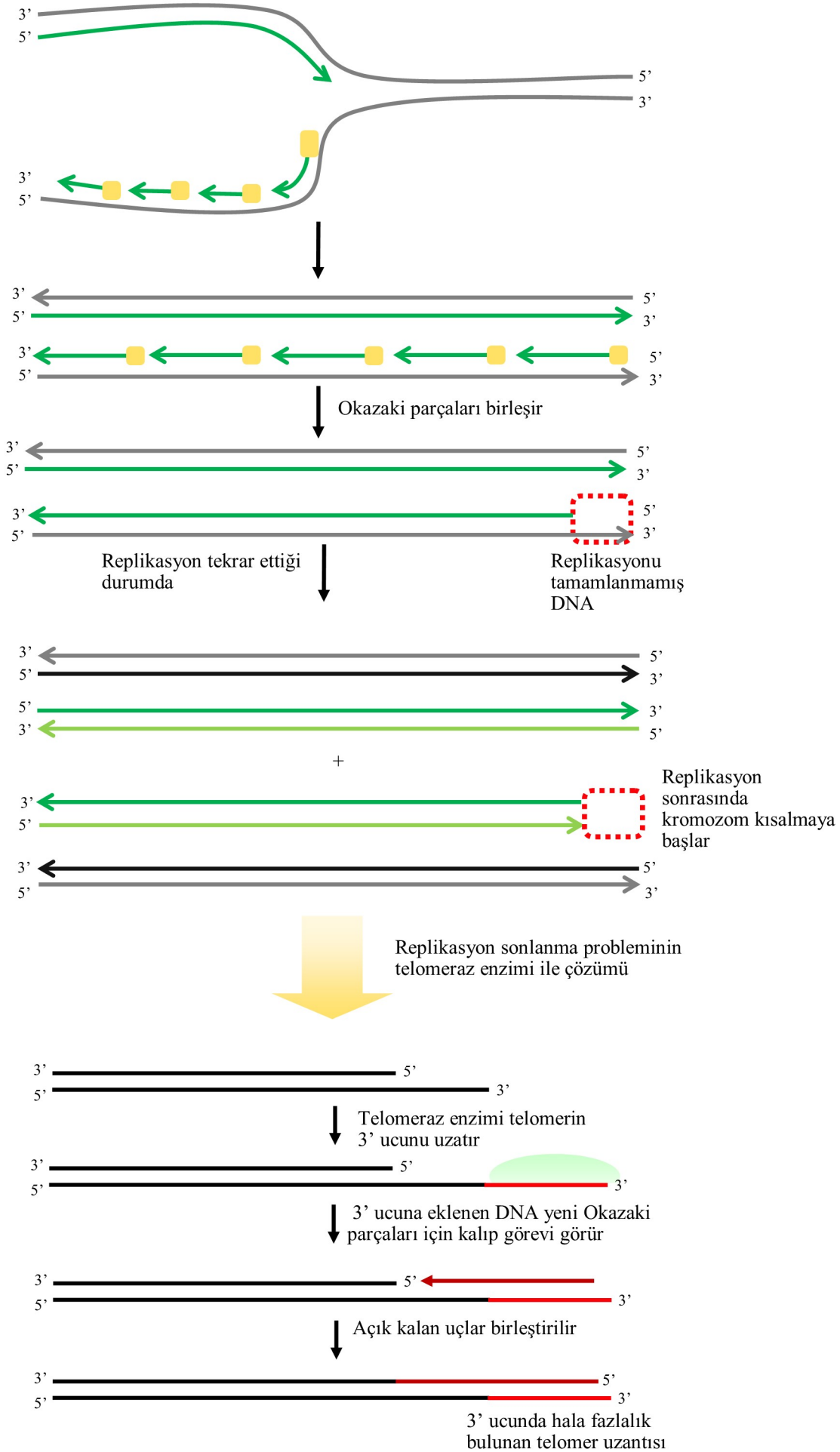
Mcm10

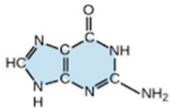


DNA polimeraz ε

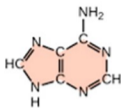
DNA polimeraz α/primaz



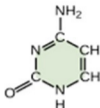




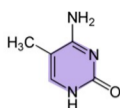
Guanin



Adenin

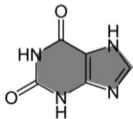


Sitozin

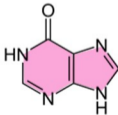


5-metilsitozin

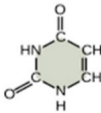
Deaminasyon



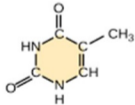
Ksantin



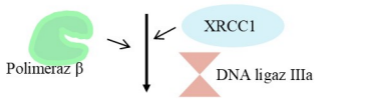
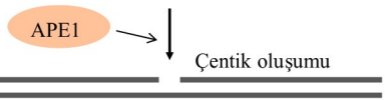
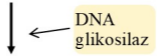
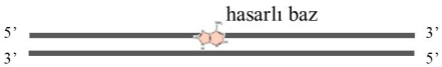
Hipoksantin



Urasil

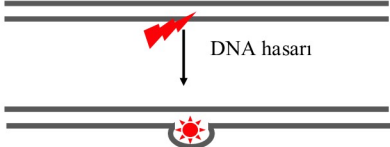


Timin



Onarılmış DNA

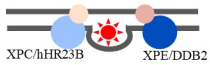
Detailed description: The final state shows the DNA double helix fully repaired (Onarılmış DNA).



DNA hasarı

Global genom NER

Transkripsiyona bağlı NER



XPC/hHR23B

XPE/DDB2

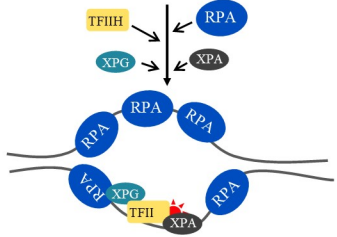


CSB

XPG

RNA polimeraz

hata tanınır



TFIIH

RPA

XPG

XPA

RPA

RPA

RPA

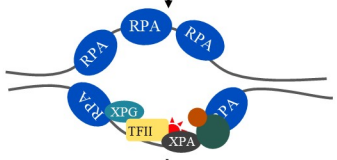
RPA

XPG

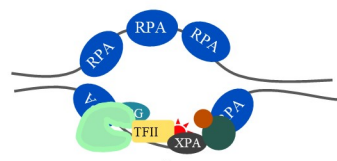
TFII

XPA

XPF/ERCC1



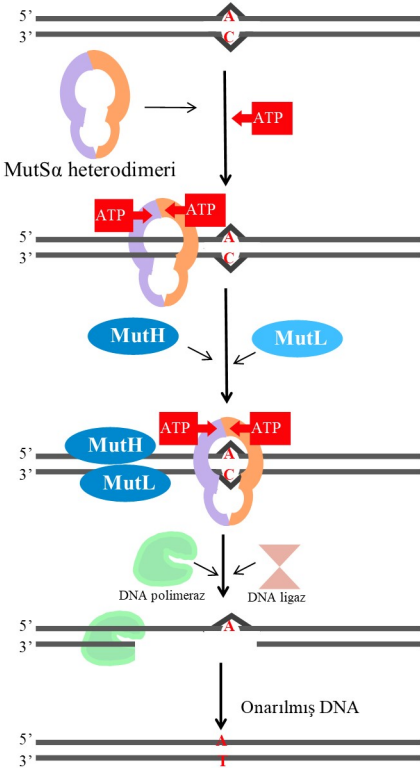
DNA polimeraz

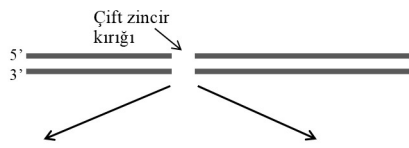


DNA ligaz



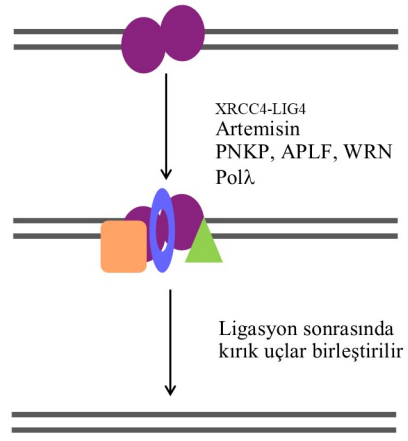
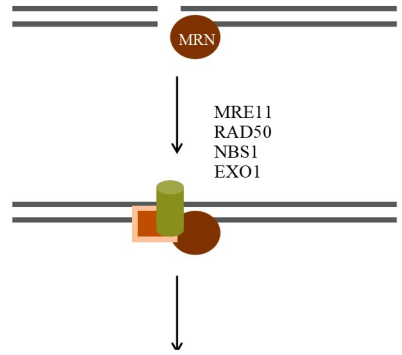
Onarılmış DNA



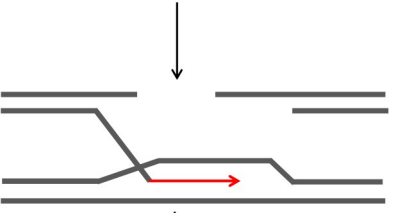


Homolog rekombinasyon

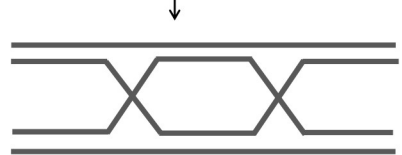
Homolog olmayan uç birleştirme



homolog donör



Holliday bağlantısı



Ligasyon sonrasında kırık uçlar birleştirilir

promoter

RNA polimeraz

RNA polimeraz promoter bölgesini tanır ve transkripsiyon başlar

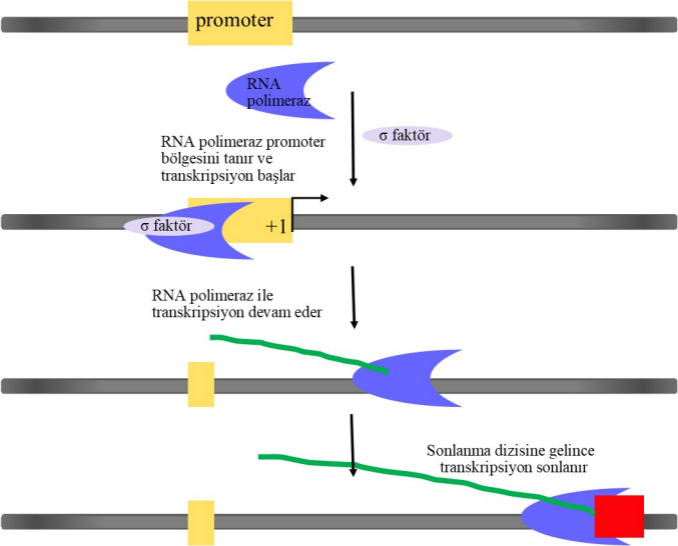
σ faktör

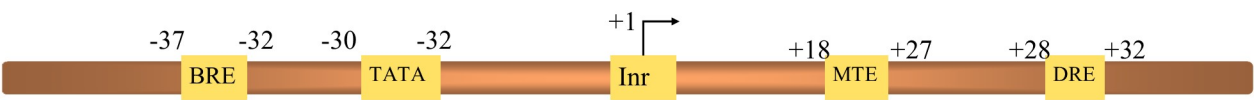
σ faktör

+1

RNA polimeraz ile transkripsiyon devam eder

Sonlanma dizisine gelince transkripsiyon sonlanır





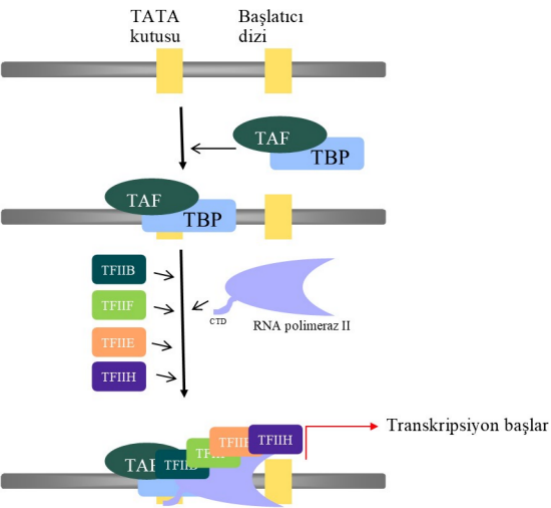
TFIIB tanıma
elemanı

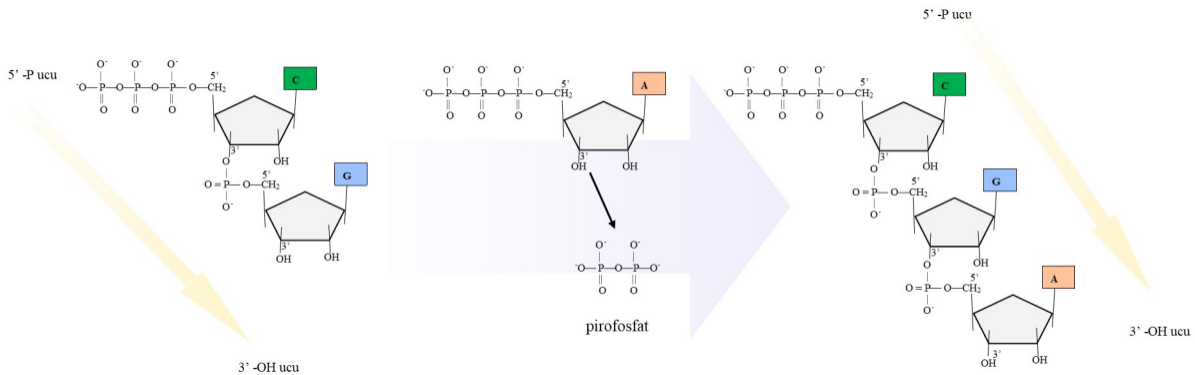
5'-TATAWAAR-3'
TATA kutusu

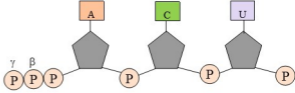
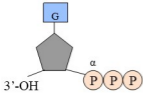
5'-YCANTYY-3'
Başlatıcı dizi

Motif on
elemanı

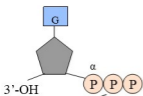
Akış aşağı
promoter element



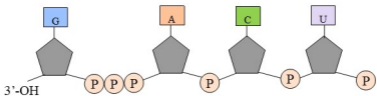




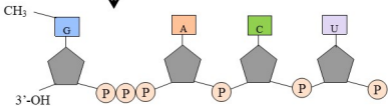
RNA trifosfataz



Guanililtransferaz



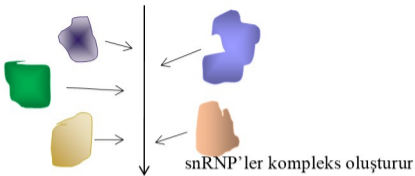
Metiltransferaz



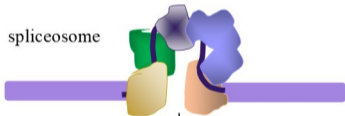
Ekzon 1

İntron 1

Ekzon 2



spliceosome

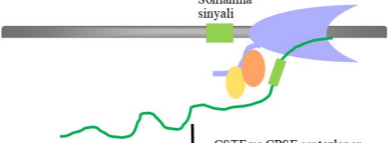


İntron çıkartılıp
ekzonlar birleştirilir

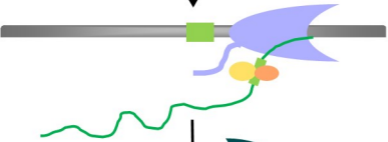
Ekzon 1

Ekzon 2

Sonlanma sinyali



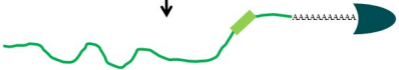
CSTF ve CPSF sentezlenen sonlanma sinyal dizisinin olduğu bölgeye bağlanır



Poli-A polimeraz



3' Poli-A kuyruğu sentezlenir



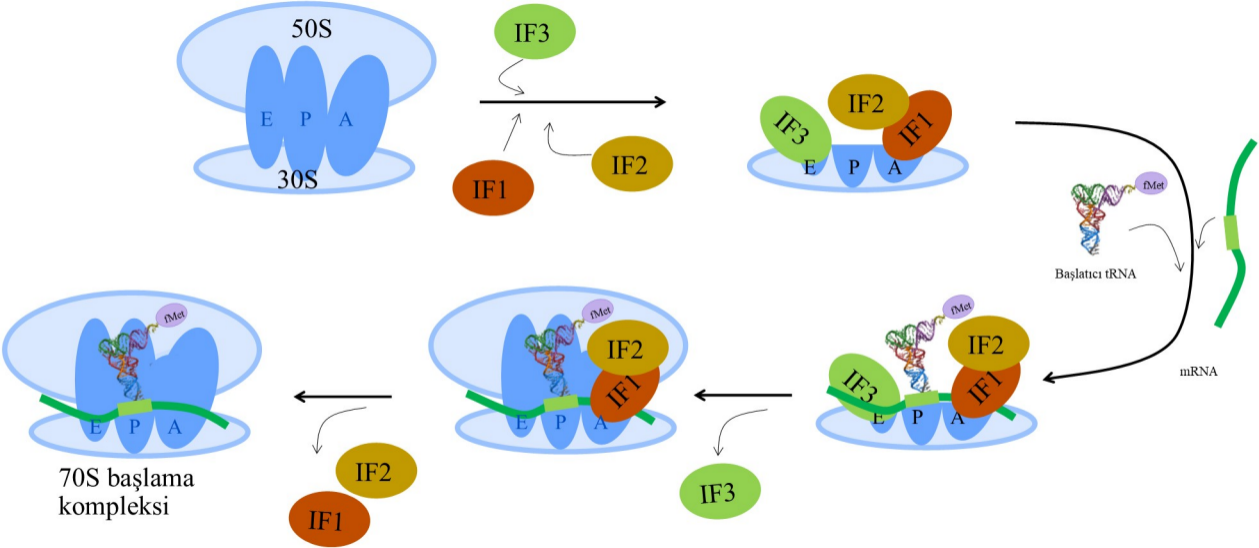
Ribozomun küçük alt biriminin
bağlanma bölgesi

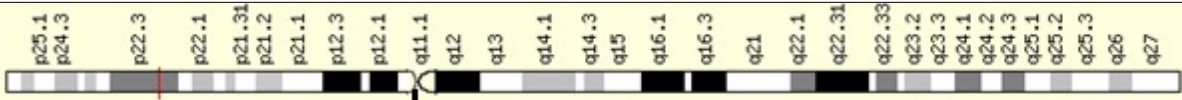


Shine-Dalgarno dizilimi

8-10 nt

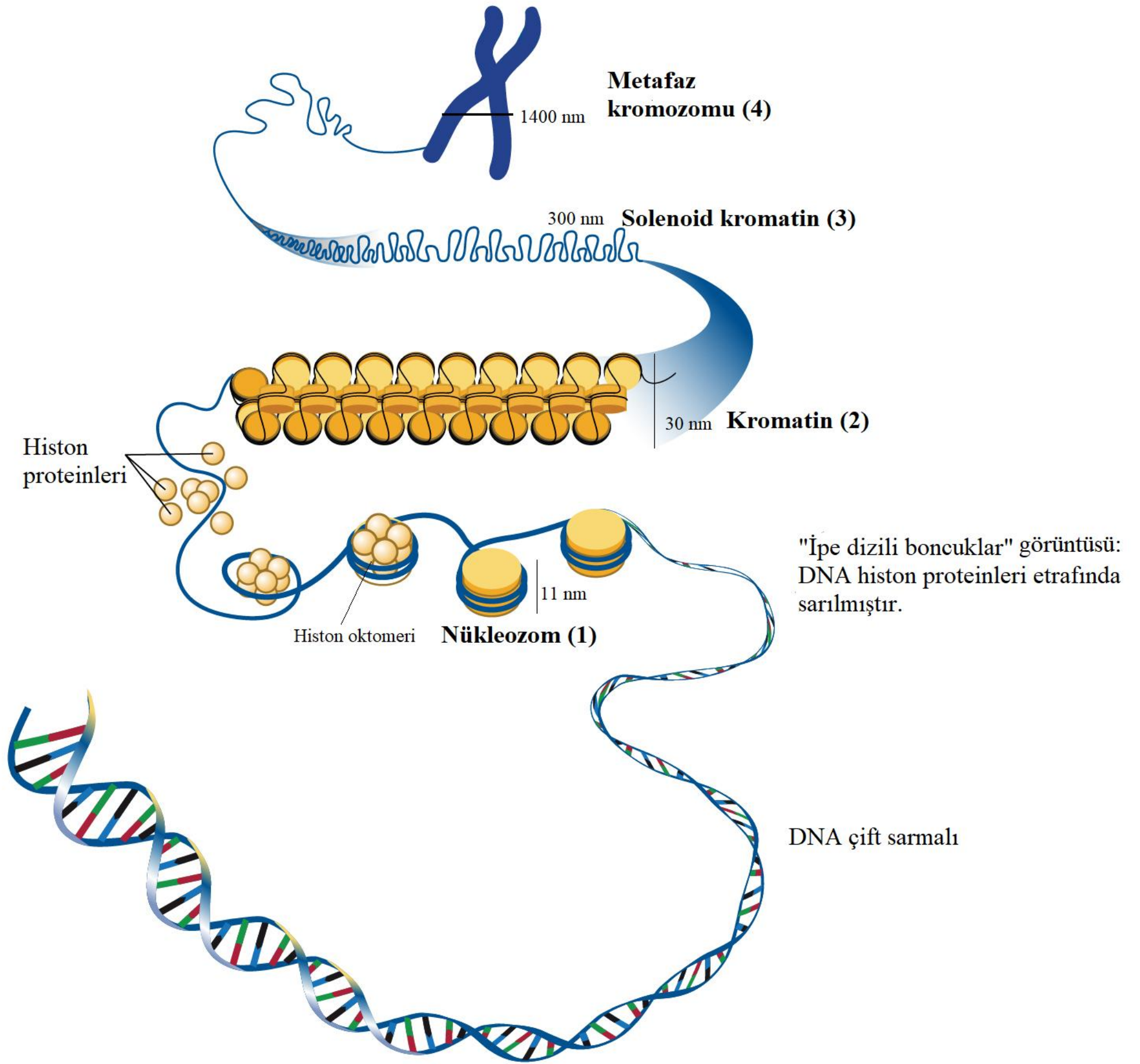
AUG
Başlama kodonu



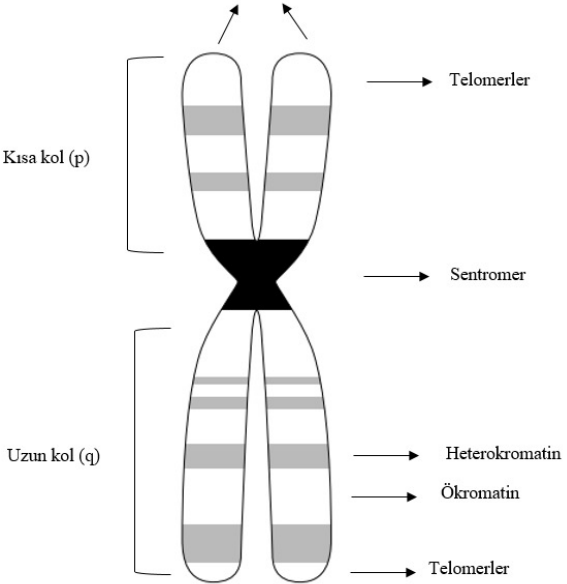


Sentromer

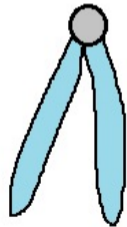
6. kromozom



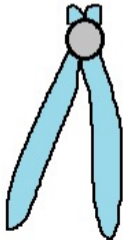
Kardeş kromatidler



Sentromer
↓



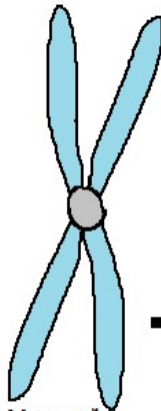
Telosentrik



Akrosentrik



Submetasentrik



Metasentrik

→ Kısa kol (p kolu)

→ Uzun kol (q kolu)



1



2



3



4



5



6



7



8



9



10



11



12



13



14



15



16



17



18



19



20



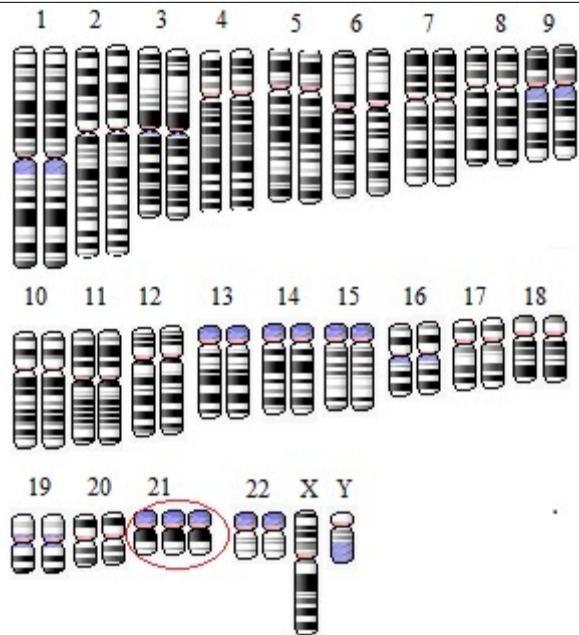
21

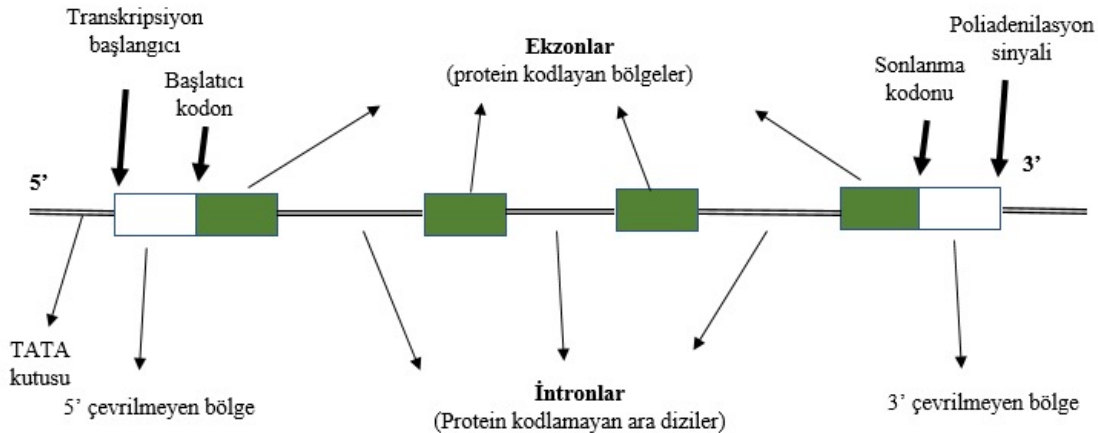


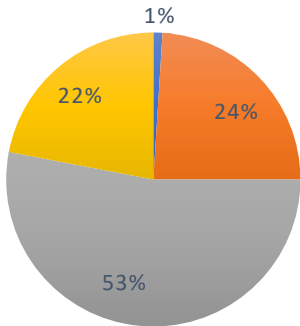
22



X/Y







■ Ekzonlar ■ İtronlar ■ Tekrar Dizileri ■ Diğer genler arası DNA

**İnsan
Genomu
(3200 Mb)**

**Genler ve Gen ile
İlişkili Diziler
(1200 Mb)**

**Genlerarası DNA
Dizileri
(2000 Mb)**

**Protein
Kodlayan
Bölgeler
(Ekzonlar)
(48 Mb)**

**Gen
Düzenleyici
Diziler**

**Gen ile İlişkili
Diziler
(1152 Mb)**

**Ardışık Tekrarlı
Diziler
(600 Mb)**

**Serpiştirilmiş
Tekrarlı Diziler
(1400 Mb)**

**Promotor
Diziler (Öncü
Diziler)**

**İntronlar,
UTR'ler**

**Kodlamayan
Fonksiyonel
RNA'lar**

Yalancı Genler

Minisatellitler

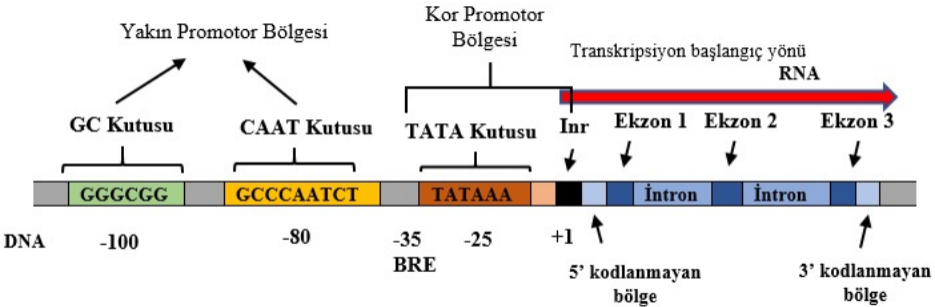
Mikrosatellitler

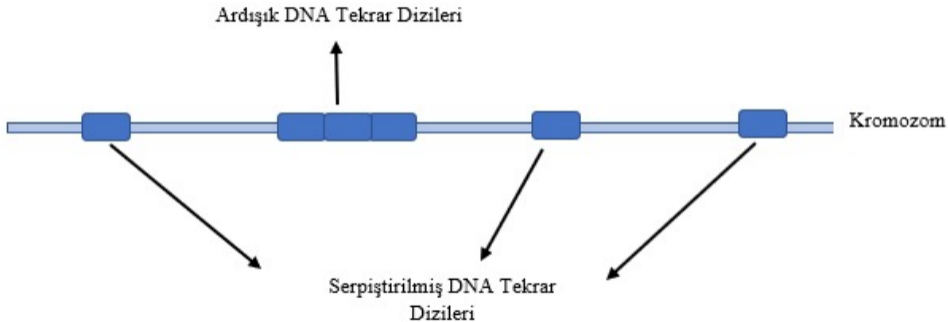
SINE

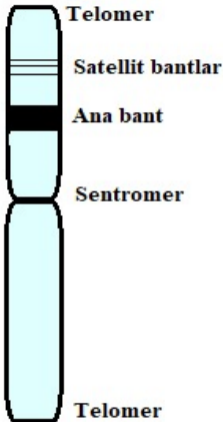
LINE

LTR'ler

**DNA
Transpozonlar**

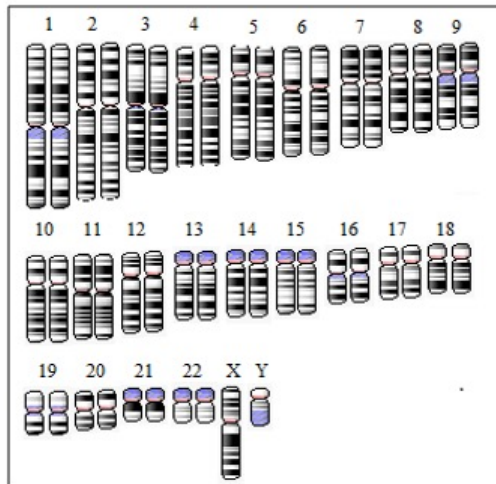




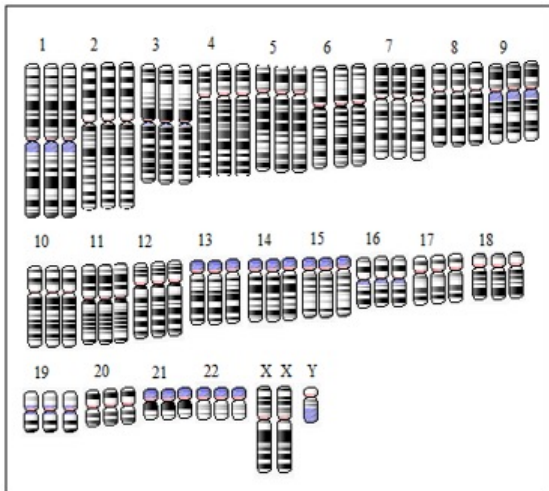


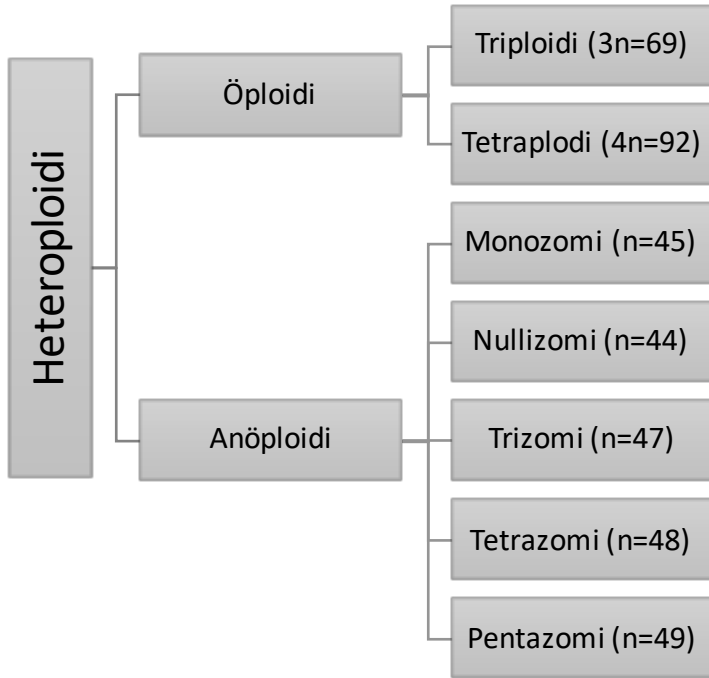
Kromozom

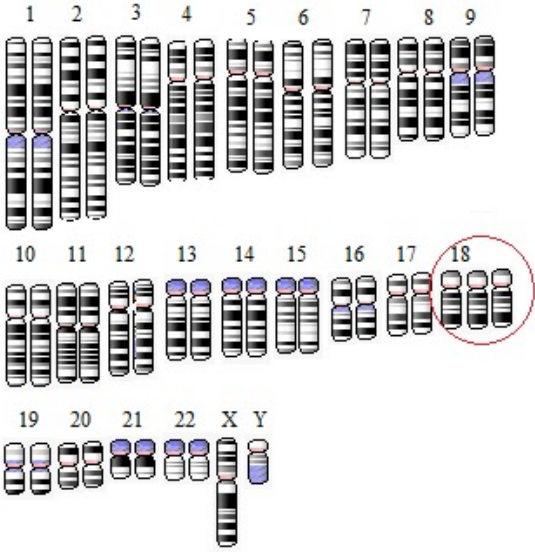
(a)

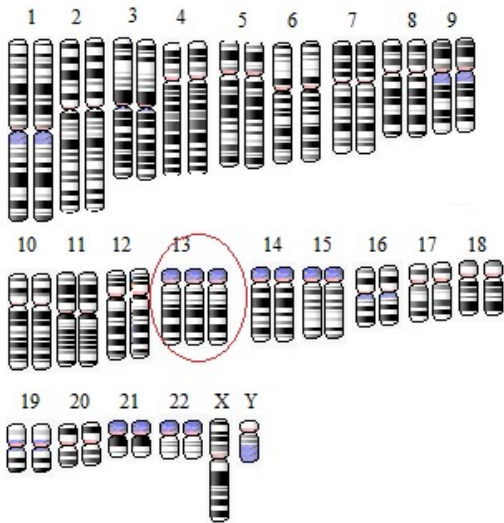


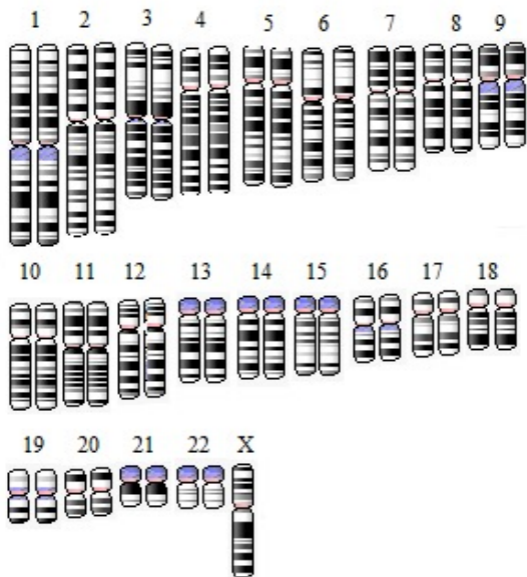
(b)

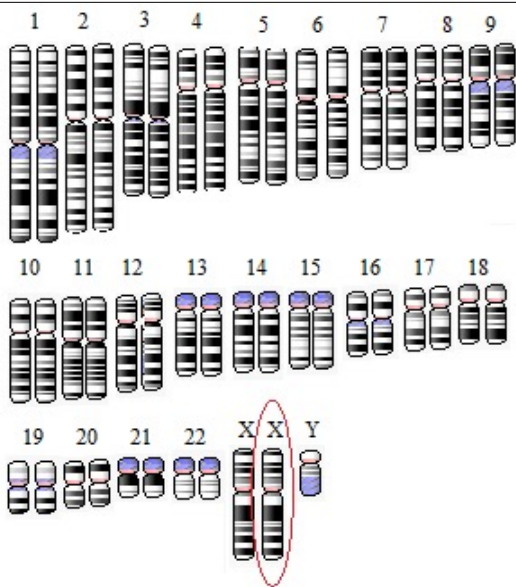


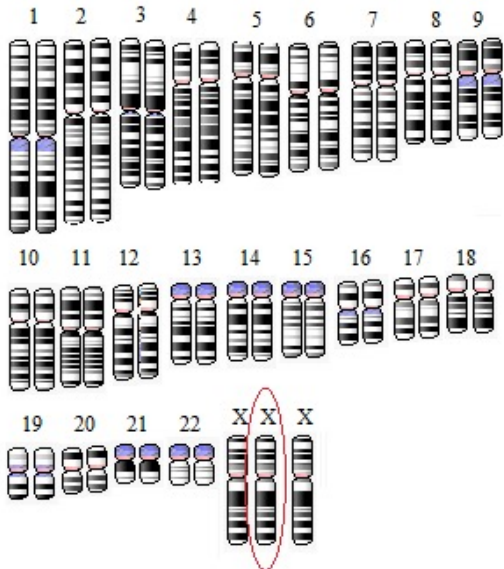












Kromozom 1



Kromozom 2



Dengeli resiprokal
translokasyon



Kromozom 1

Kromozom 2



Dengesiz robert sonian translokasyon



Kaybolan parça



Delesyon



Kopan parça



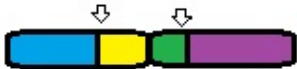
Kopan parça



Delesyon

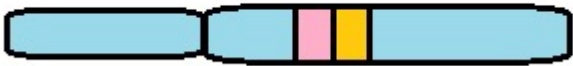


Paracentrik



Perisentrik





Duplikasyon olan
kromozom bölgesi





Kromozom 1



Kromozom 1' den kırılan
parça kromozom 2' ye
yerleşir



Kromozom 2



Halka kromozom



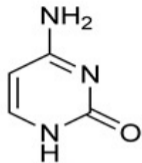
Parçalar



Sentromerde
meydana gelen
kırılma

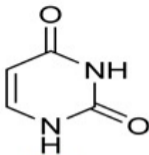


Uzun kol
duplikasyonu

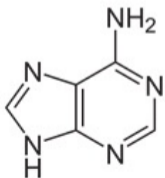


sitozin

Deaminasyon

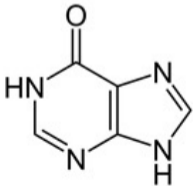


urasil



adenin

Deaminasyon



hipoksantin

Hatalı baz oluşumu

DNA
TCA
AGT

Mutasyon yok

DNA
TCA
AGT

mRNA
UCA

Protein
Ser

Normal protein
üretilir.

Yanlış anlamlı mutasyon

DNA
TTA
AAT

mRNA
UUA

Protein
Leu

Yeni kodon farklı bir aminoasit
şifreler; aminoasit dizisinde bir
değişim söz konusudur.

Anlamsız mutasyon

DNA
TAA
ATT

mRNA
UAA

Dur
kodonu

Protein

Yeni kodon bir dur
kodonudur ve translasyon
erken sonlanır.

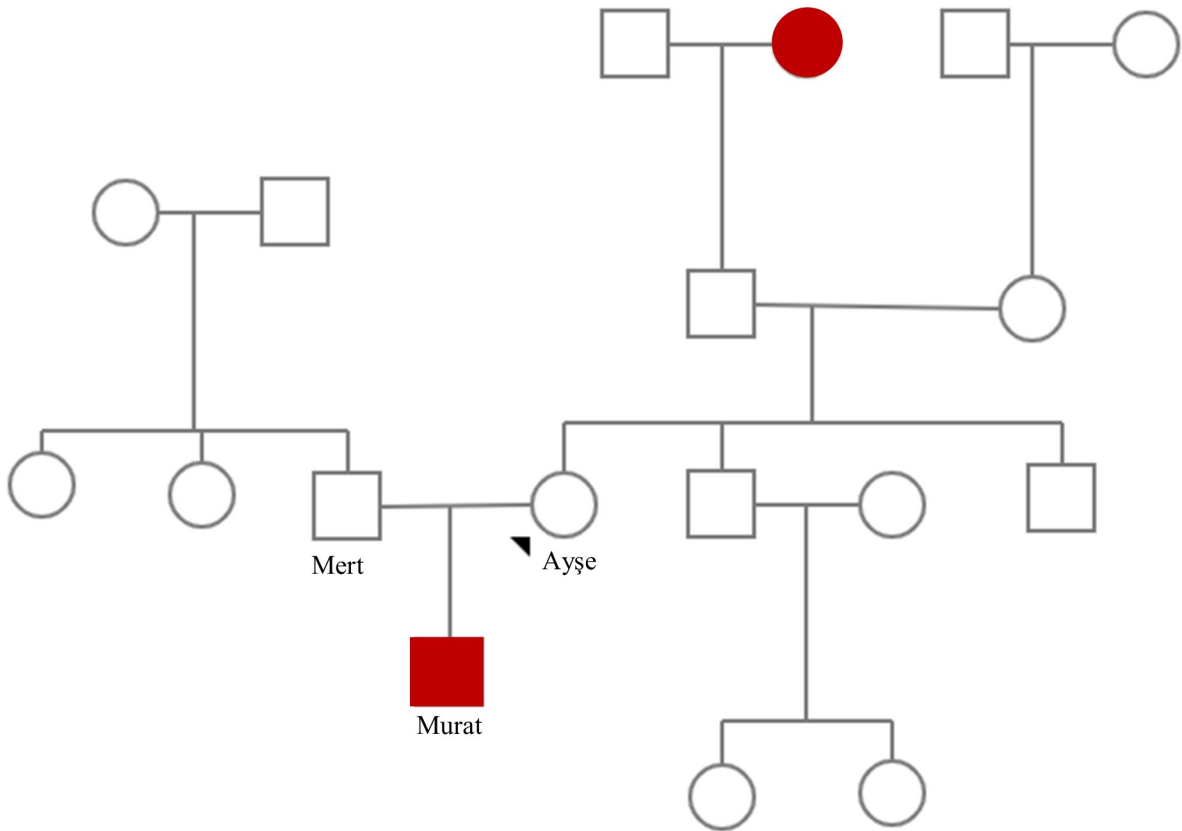
Sessiz mutasyon

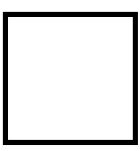
DNA
TCG
AGC

mRNA
UCG

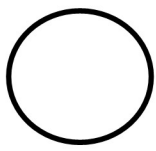
Protein
Ser

Yeni kodon aynı aminoasiti
sentezler; aminoasit dizisinde
bir değişiklik yoktur.

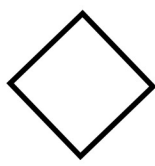




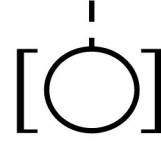
Erkek



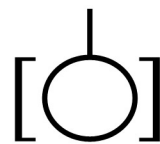
Dişi



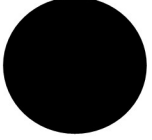
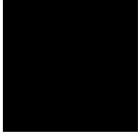
Belirtilmemiş cinsiyet



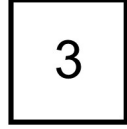
Aile içinden evlat
edinilmiş birey



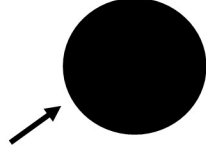
Aile dışından evlat
edinilmiş birey



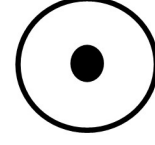
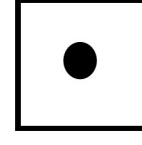
Etkilenmiş birey



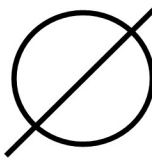
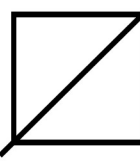
Gösterilen cinsiyetteki
çocuk sayısı



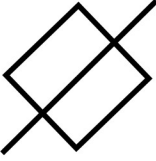
Proband



Zorunlu taşıyıcı
(hastalığı göstermez)



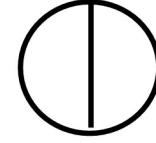
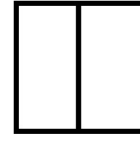
Ölü birey



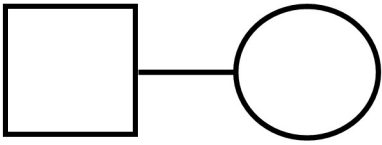
Ölü doğum



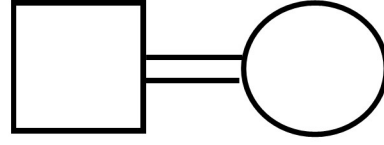
Düşük



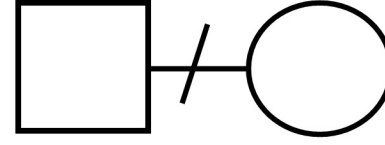
Penetran olmayan taşıyıcı
(hastalığı gösterebilir)



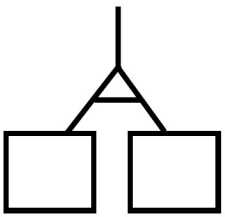
Evli



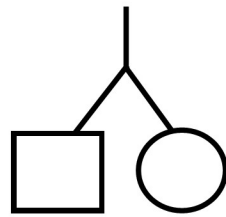
Akrabalık



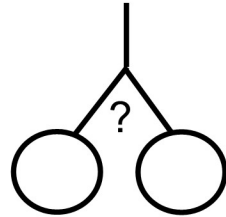
Boşanmış



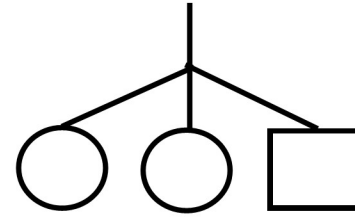
Monozygotik



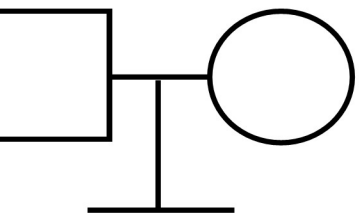
Dizigotik



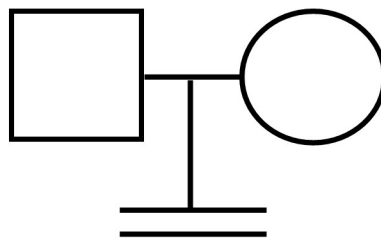
Zigositesi bilinmeyen



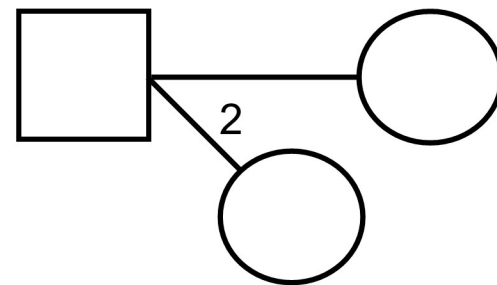
Trizigotik



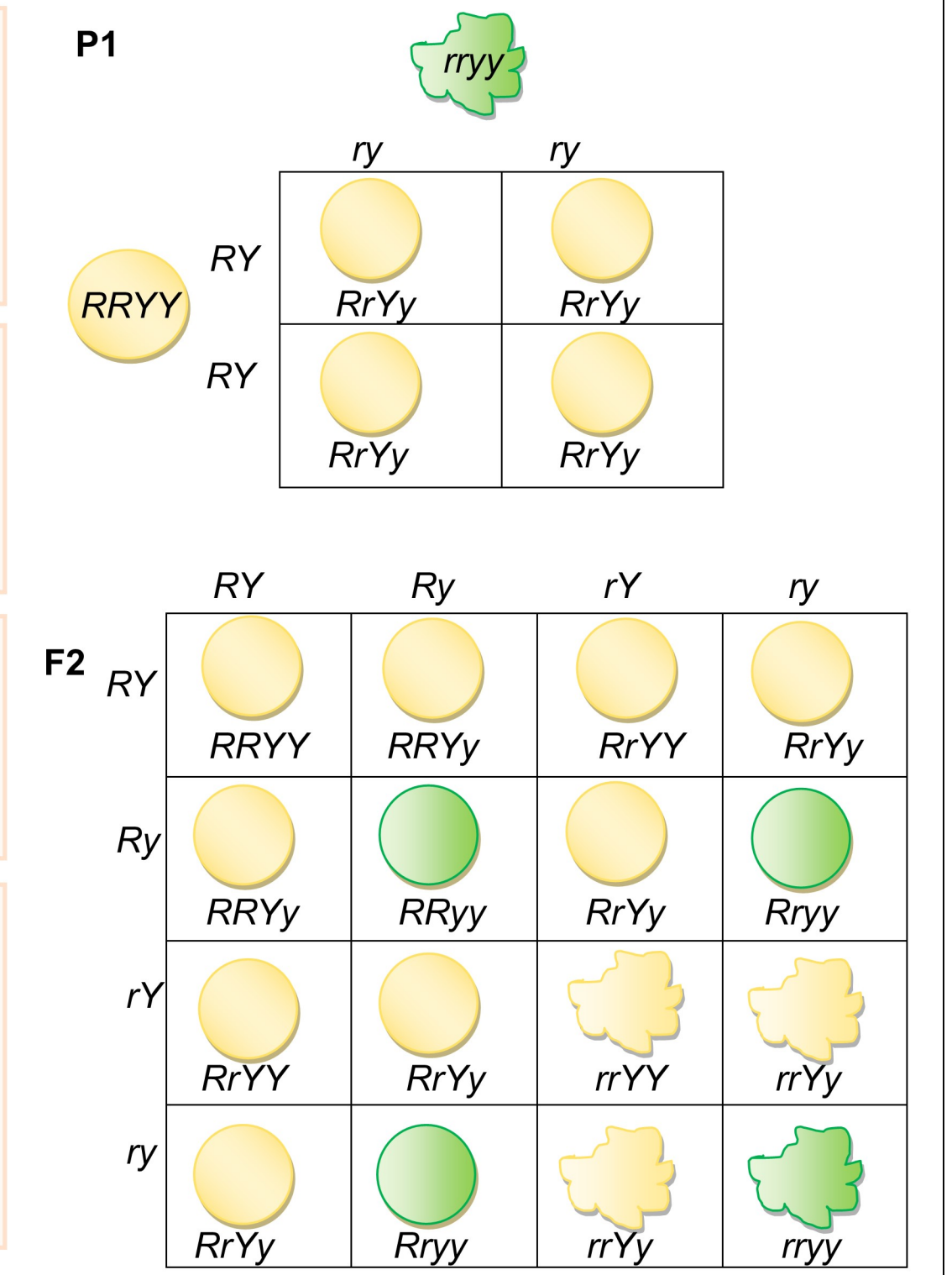
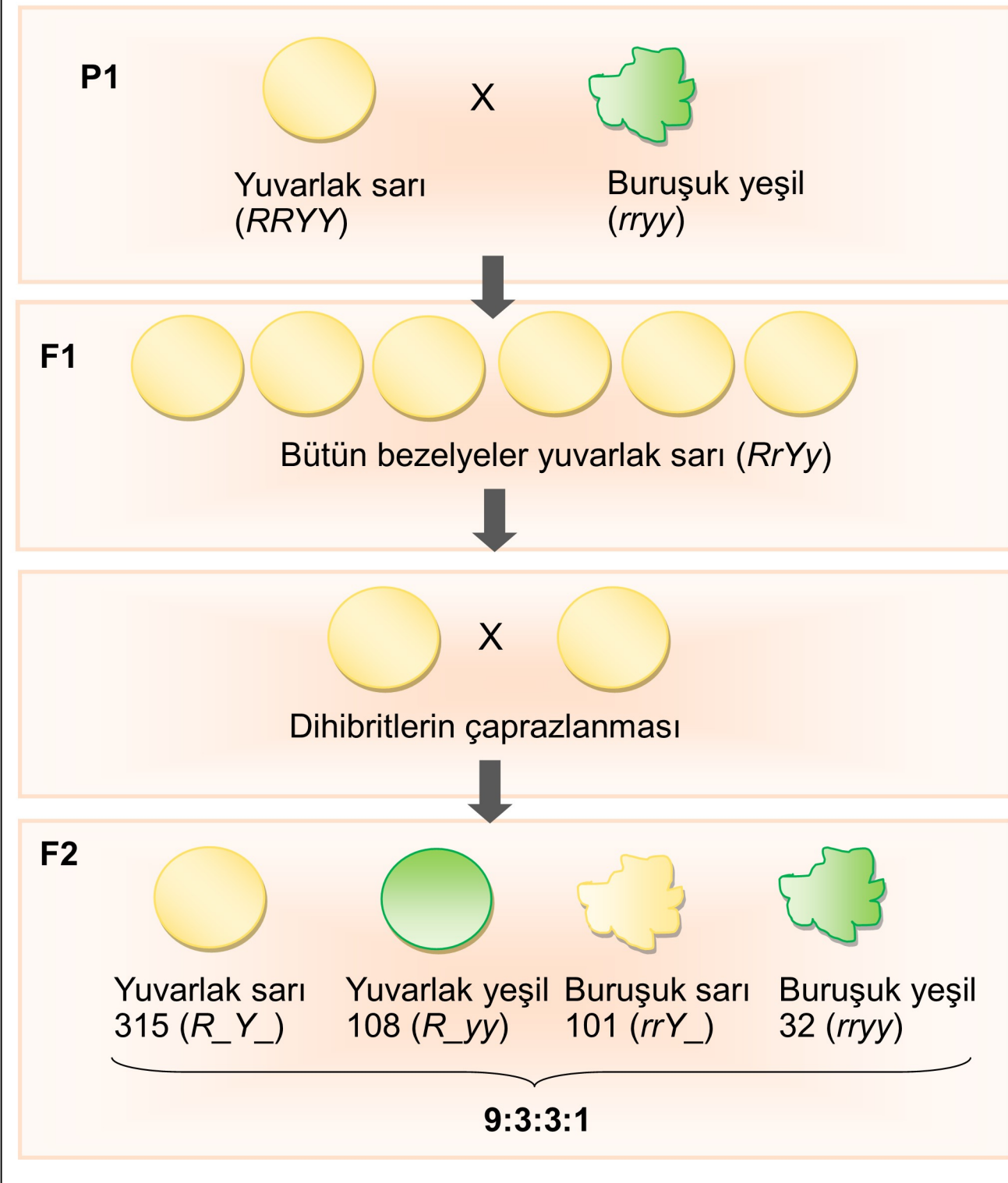
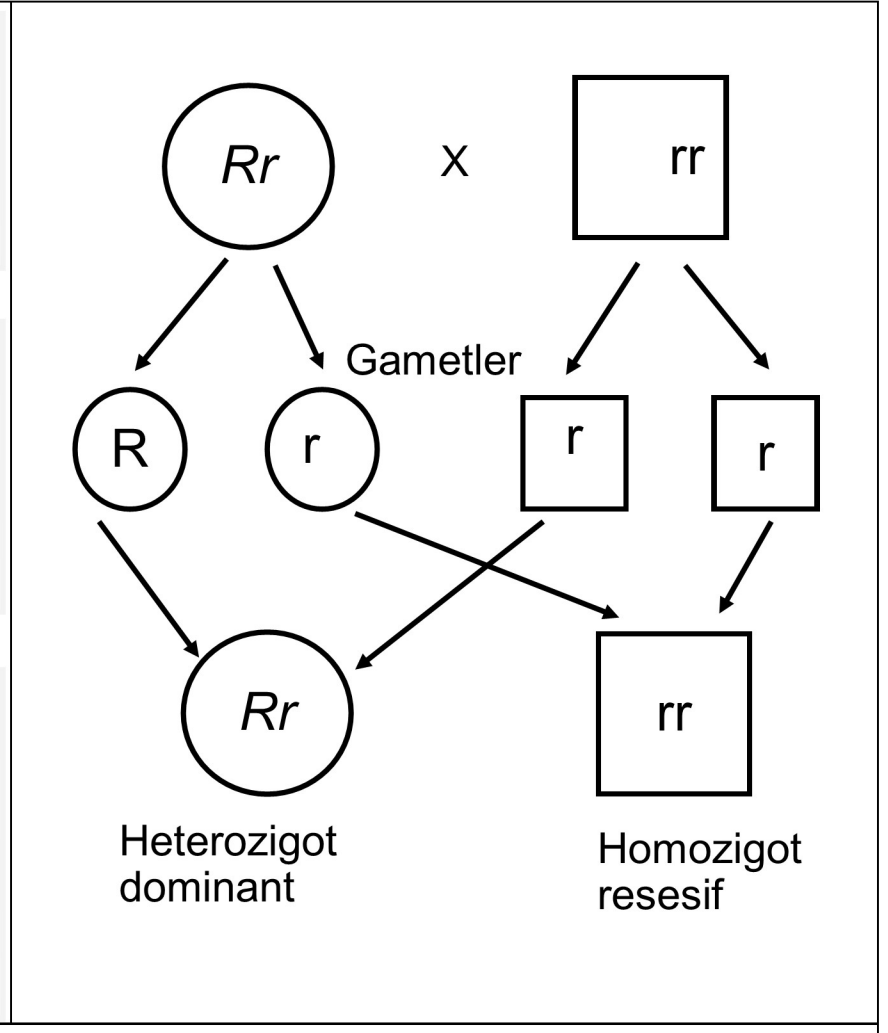
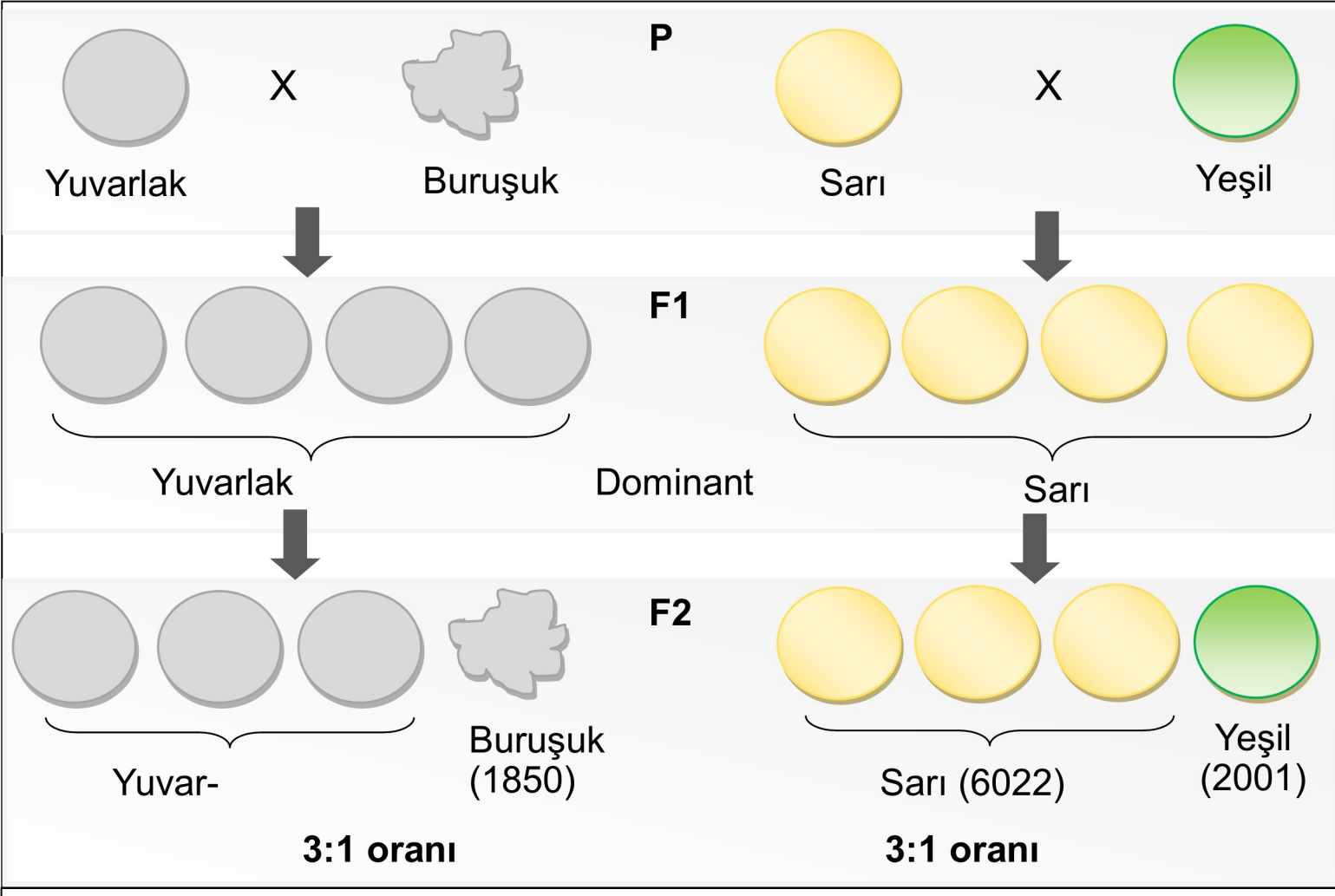
Çocuk yok
(isteğe bağlı veya
sebebi bilinmeyen)



Kısırlık
(sebebi belirtilmelidir)



Birden fazla
evlilik



I



II



III



IV



V



I



II

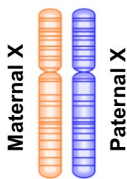


III



IV

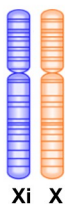
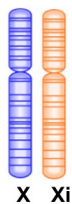


A

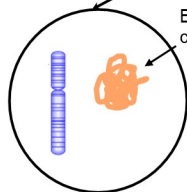
veya



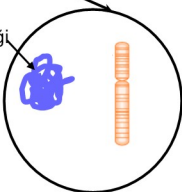
X inaktivasyonu



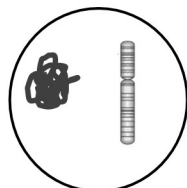
Barr cisimciği



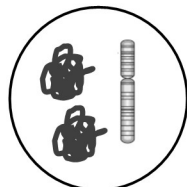
Paternal allel eksprese olur



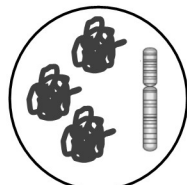
Maternal allel eksprese olur

B

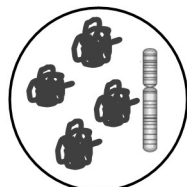
46,XX



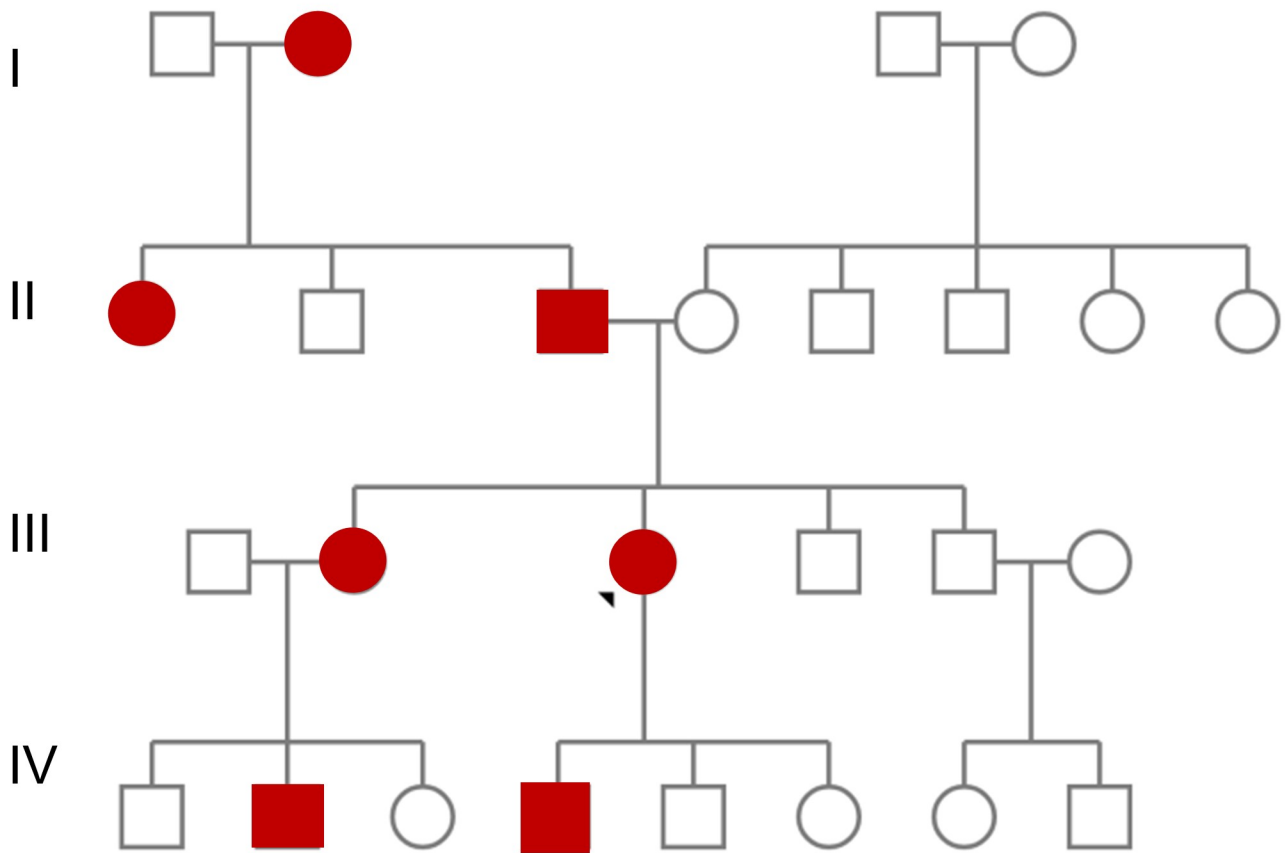
47,XXX

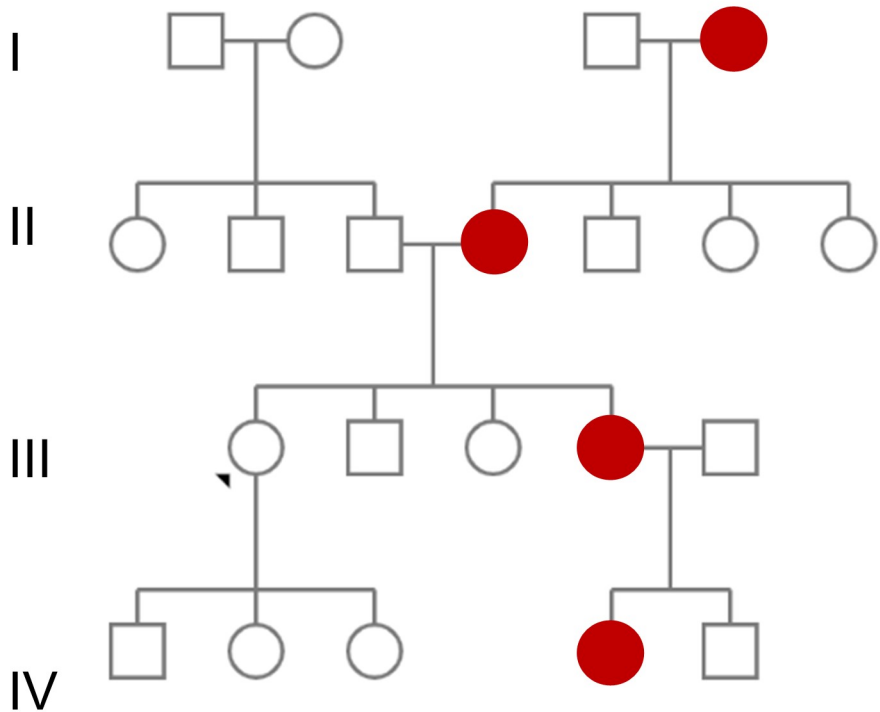


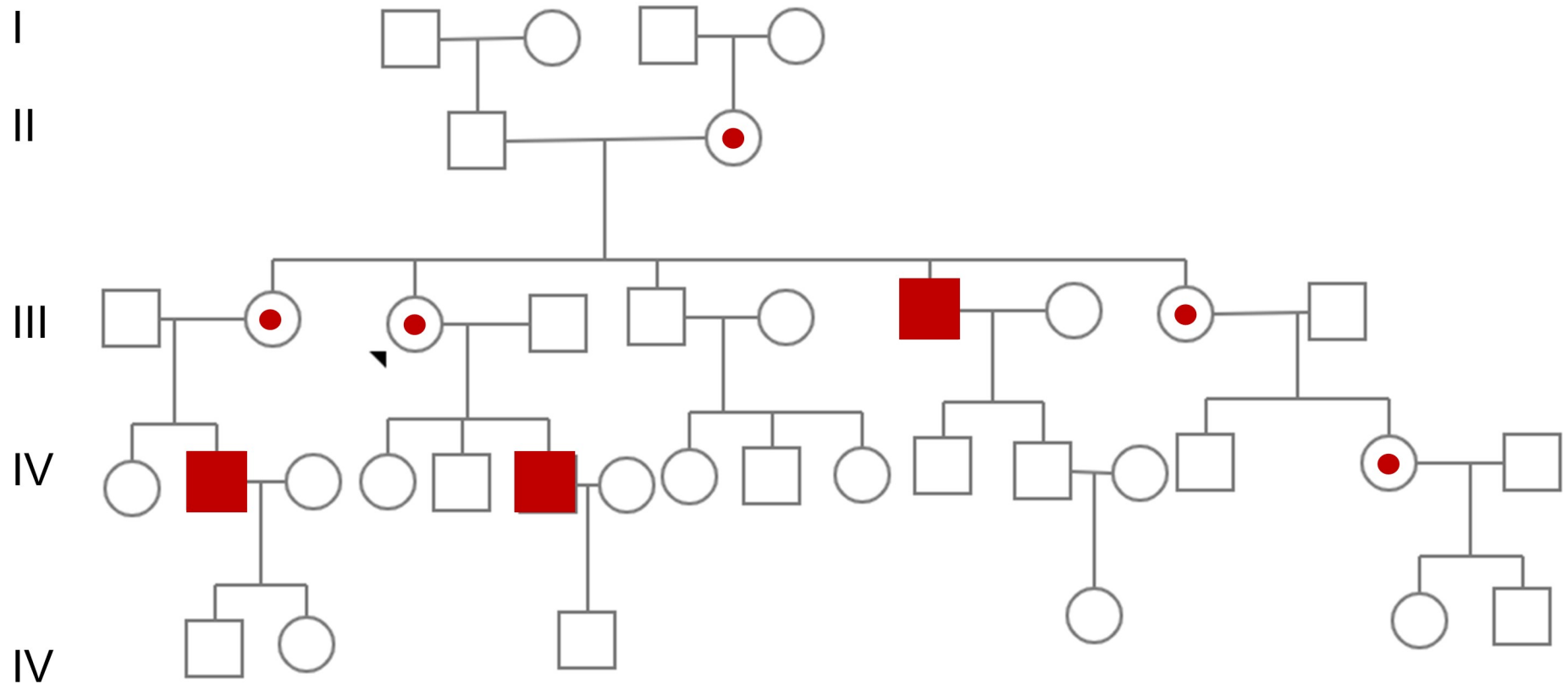
48,XXXX

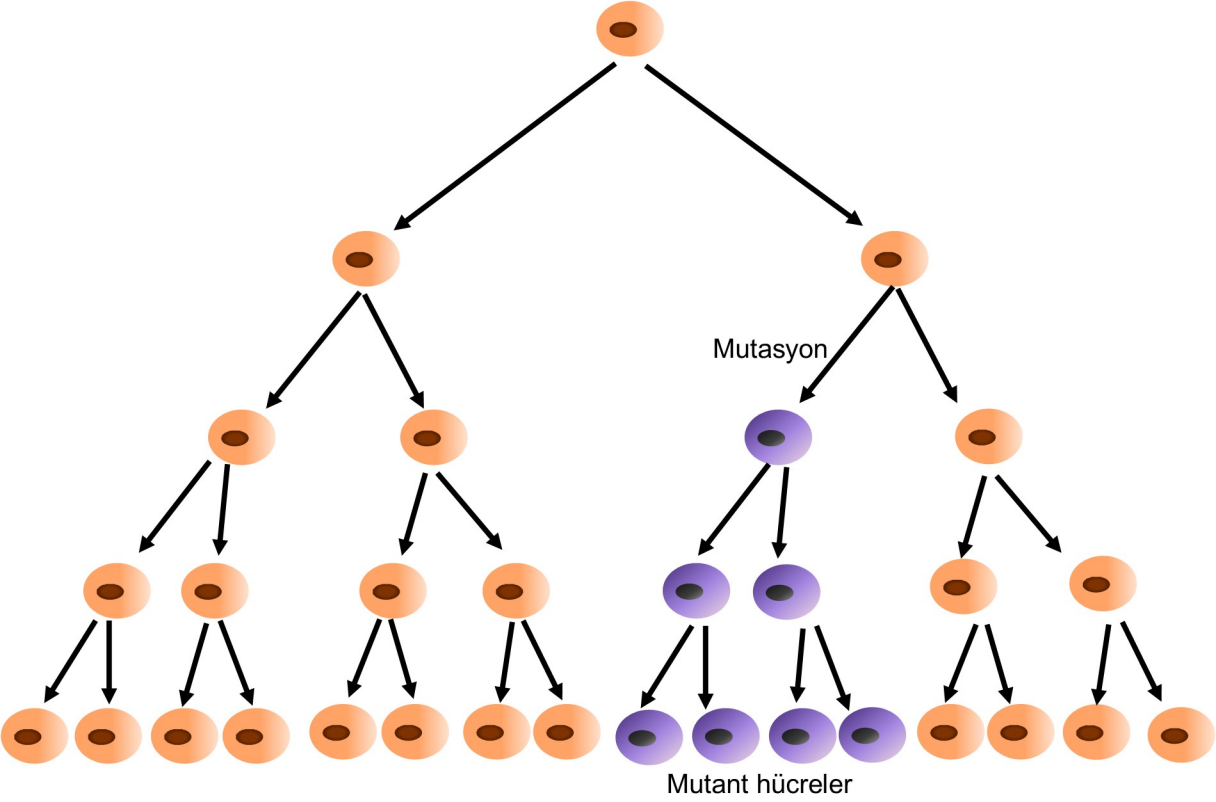


49,XXXXX



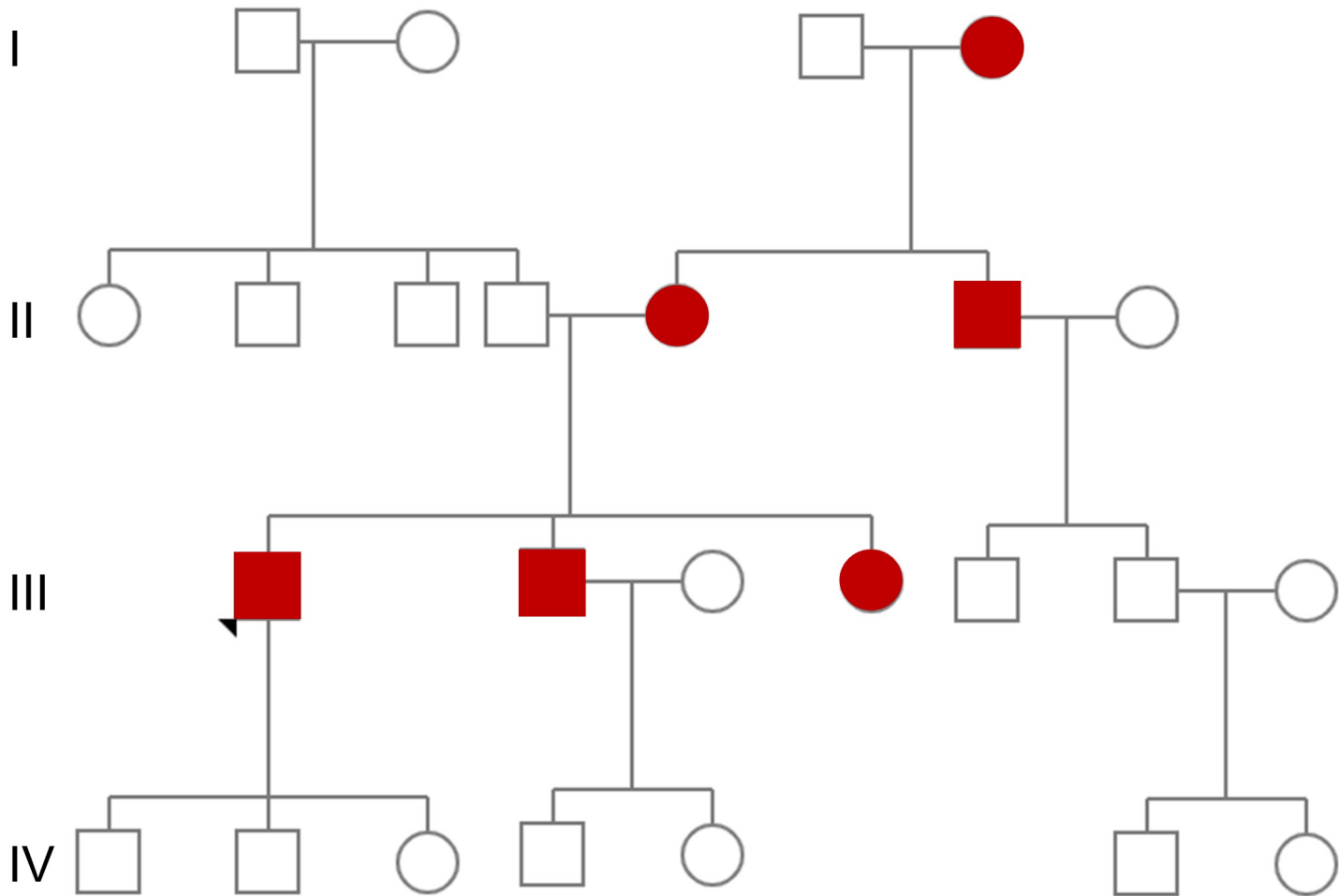


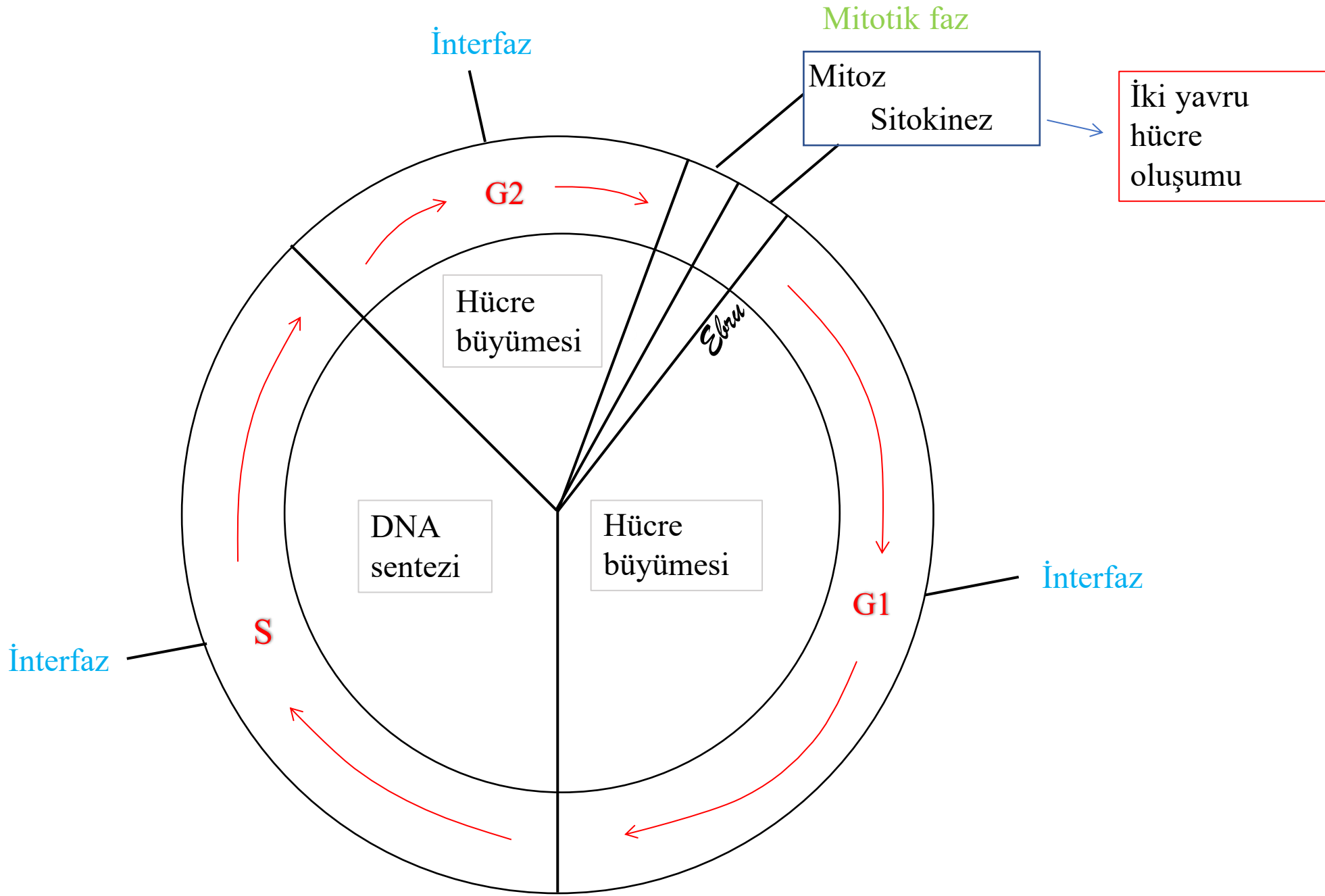


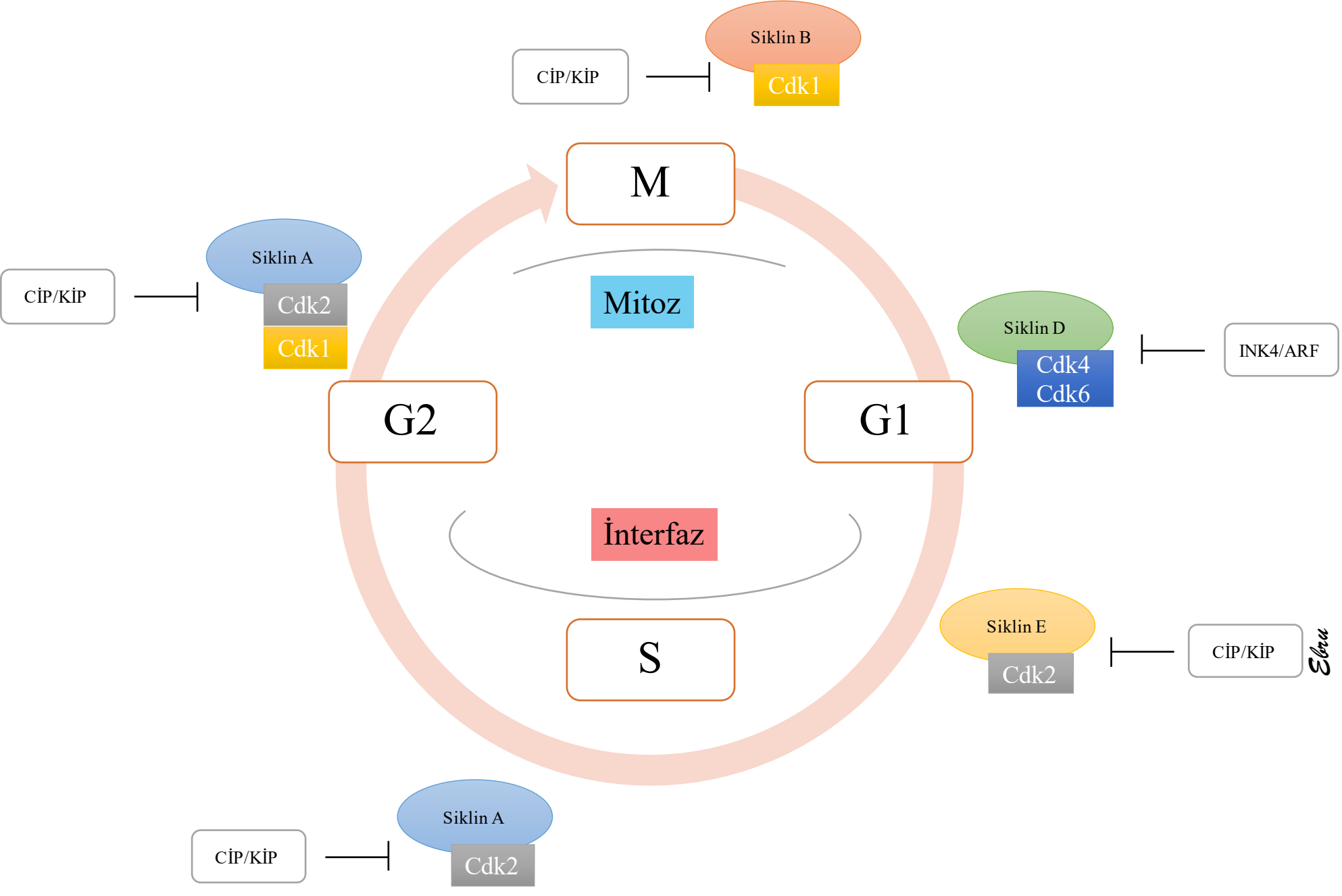


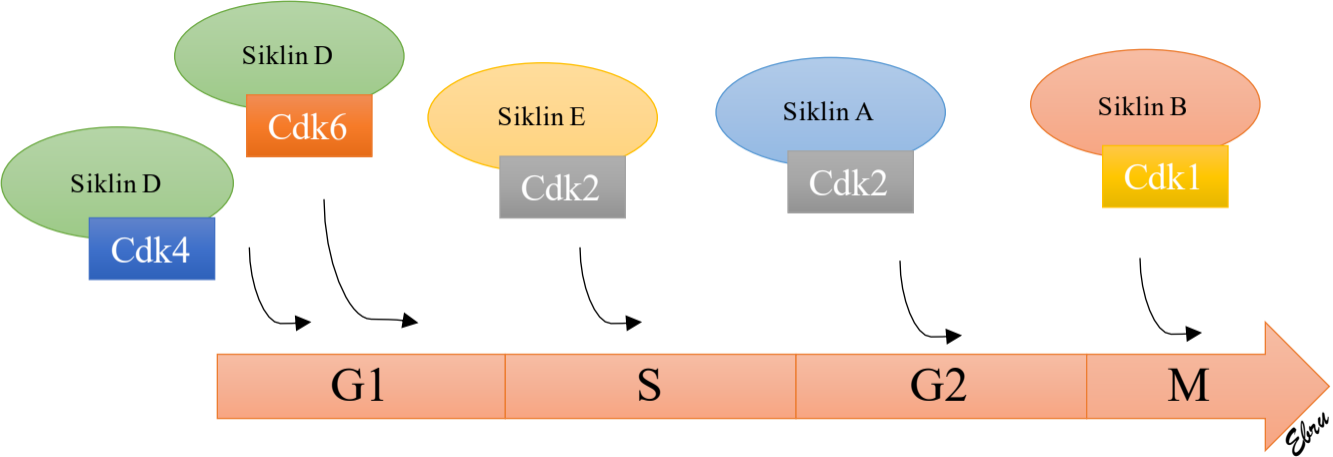
Mutasyon

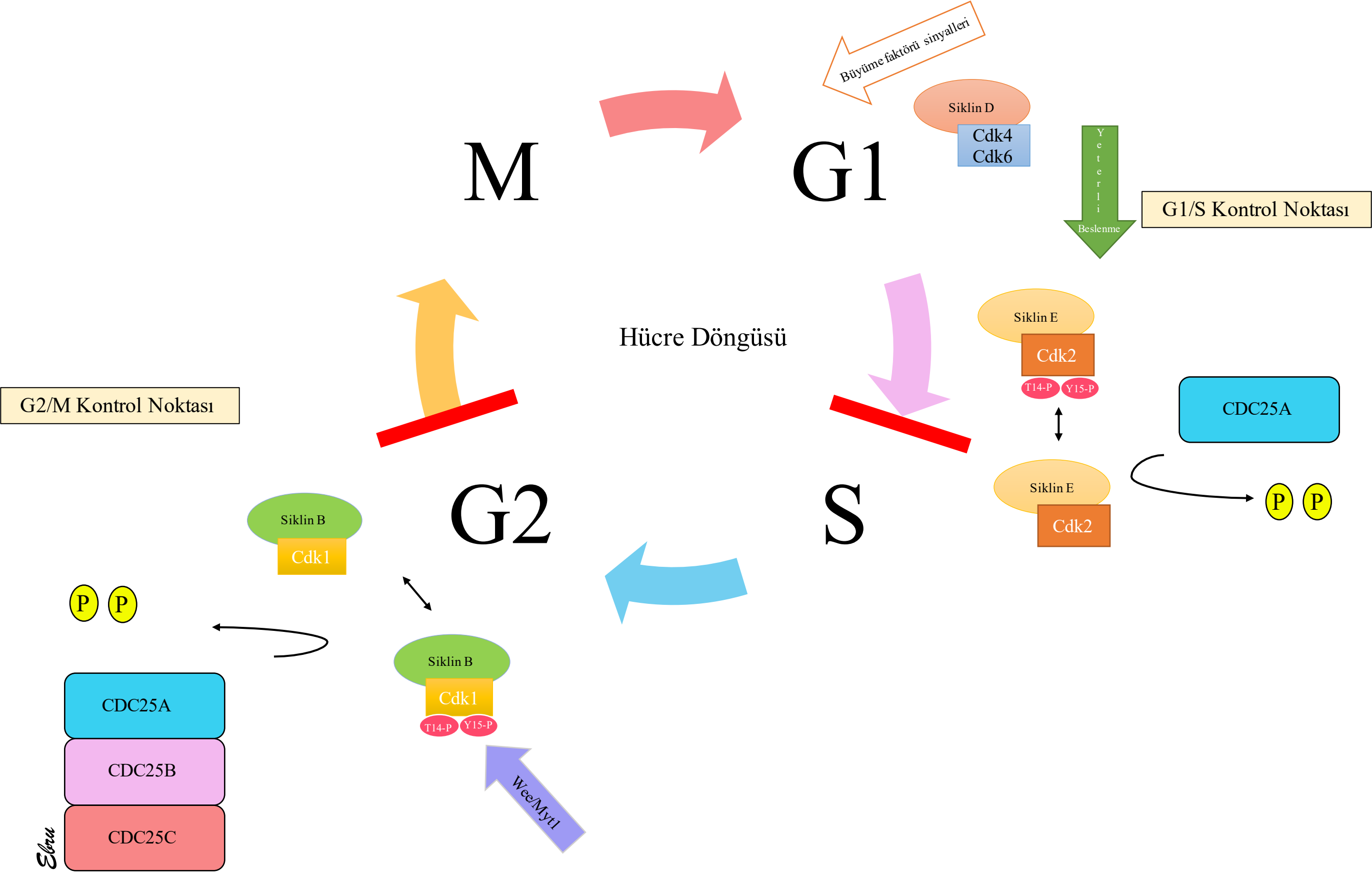
Mutant hücreler

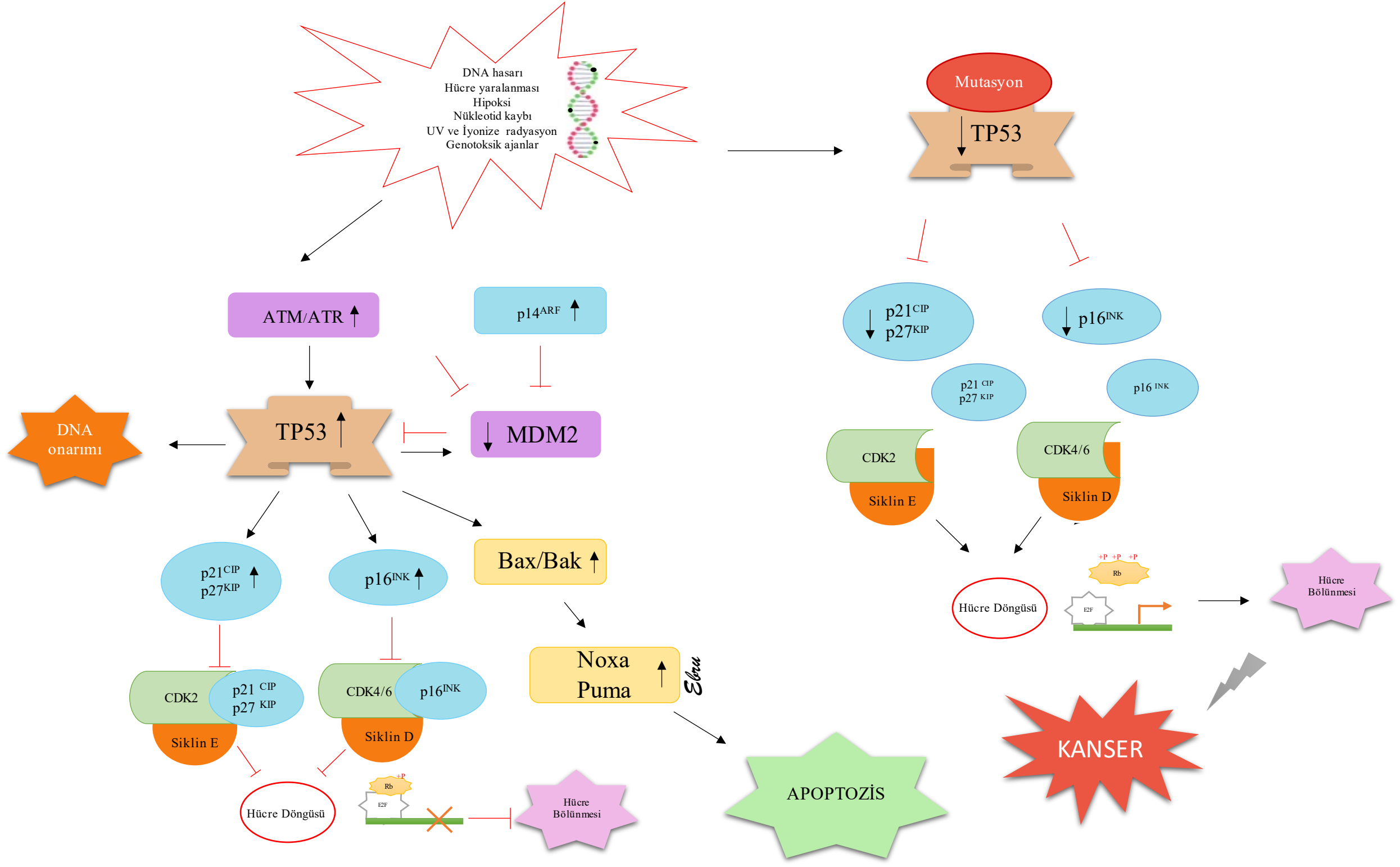










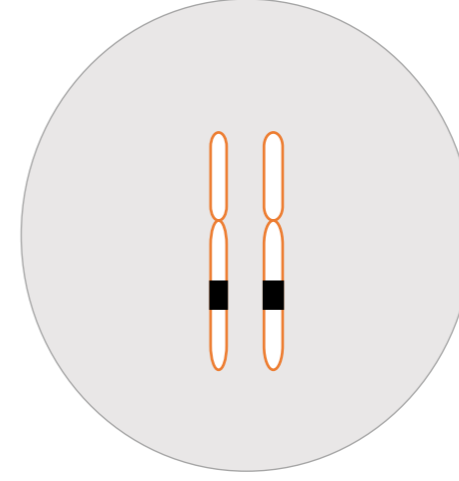
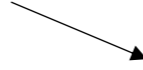
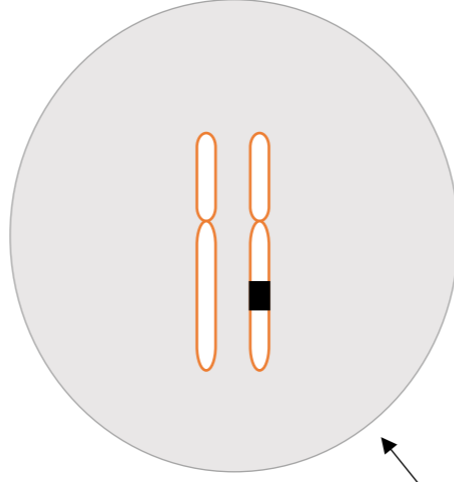
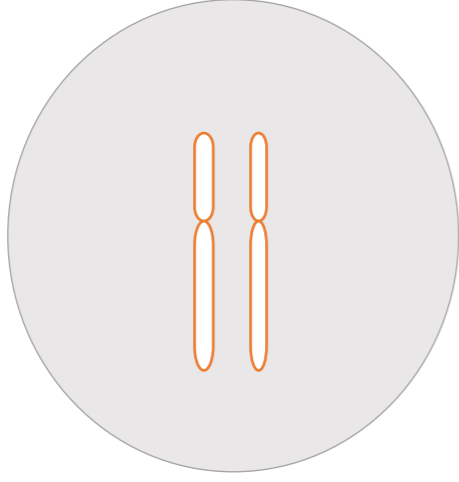


Normal Hücre

Tek vuruş

Çift vuruş

Kalıtsal olmayan

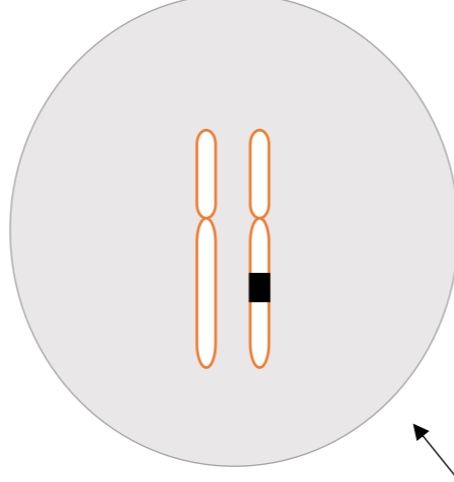
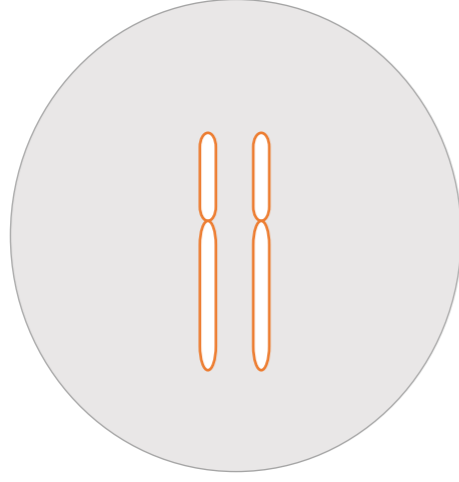


Mutant Rb geni

İki alelde Rb geni mutasyonu

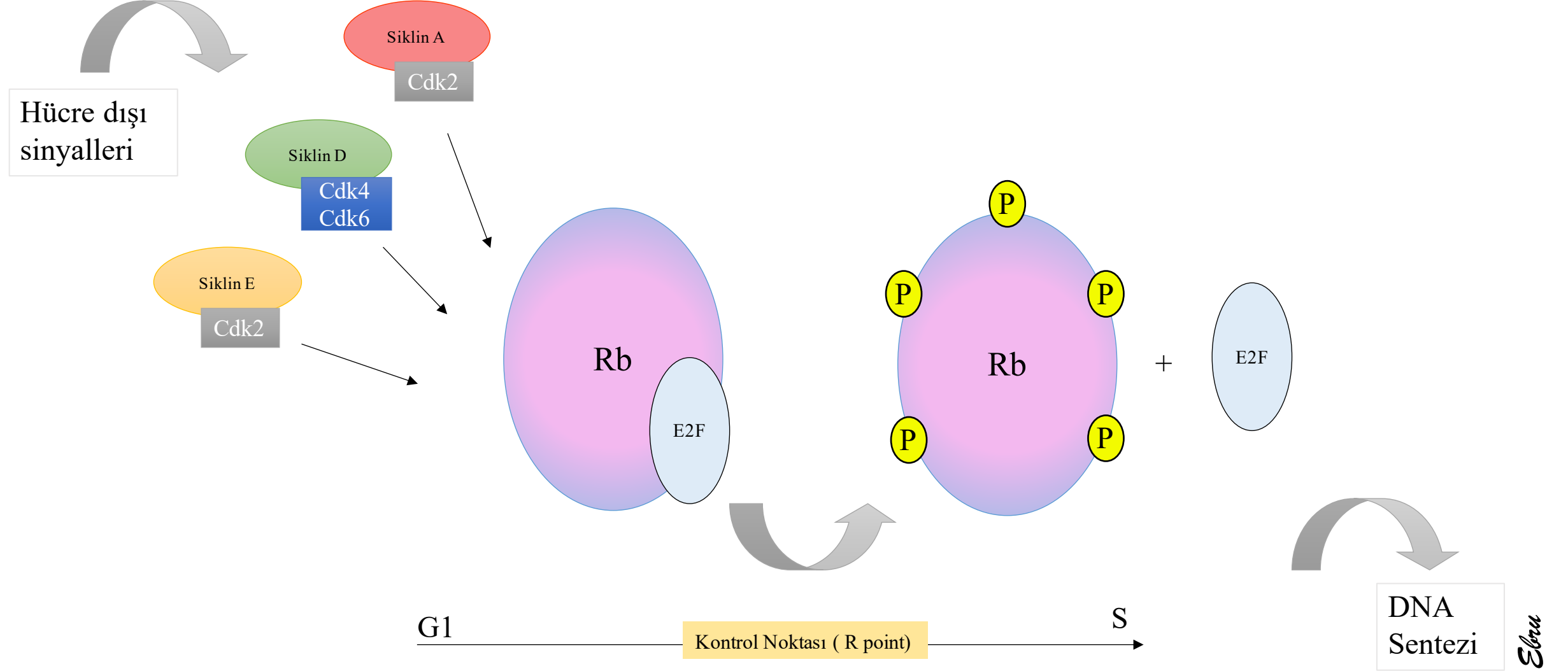
Tümör baskılayıcı genin fonksiyon kaybı

Kalıtsal



Mutant Rb geni

Ebru



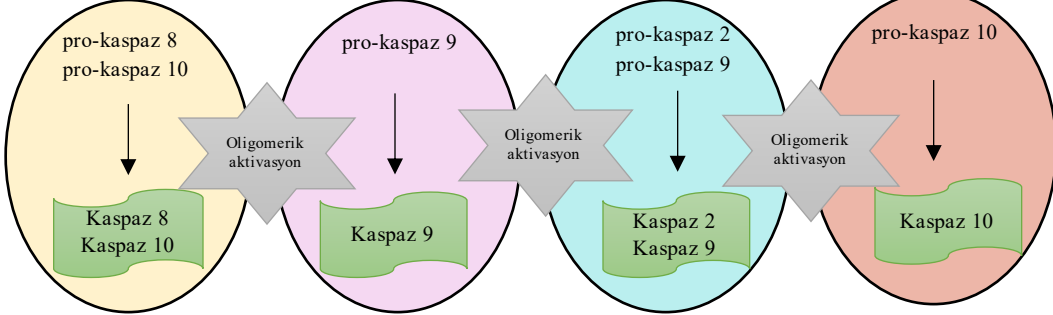
Ölüm reseptör yolu
(extrinsic pathway)

Mitochondriyal yolak
(intrinsic pathway)

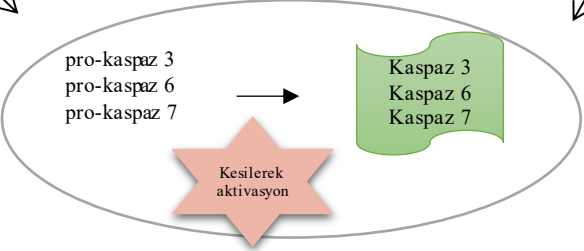
Stres kaynaklı yolak
(ER pathway)

Sitotoksik T lenfositler aracılı apoptozis
(Perforin/Granzyme pathway)

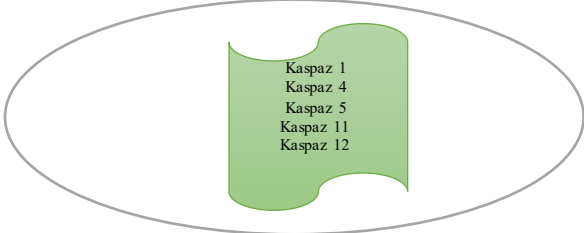
Başlatıcı Kaspazlar



Yürütücü Kaspazlar



İnflamatuar Kaspazlar



Anti-apoptotik çok alanlı üyeleri

Bcl-2, Bcl-xL, Bcl-W,
Mcl-1, A1 ve Bcl-B



Pro-apoptotik çok alanlı üyeleri

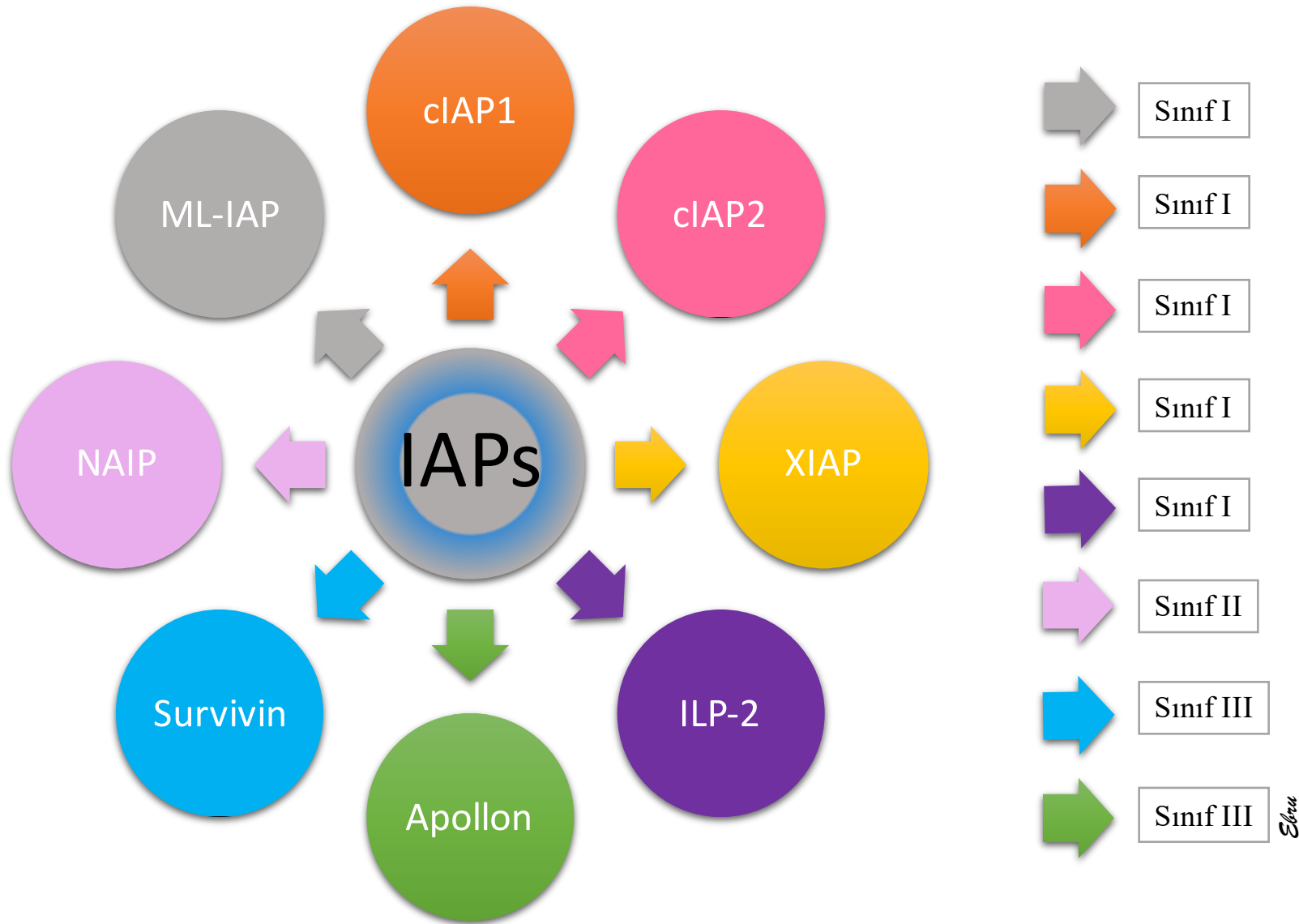
Bax, Bak ve Bok

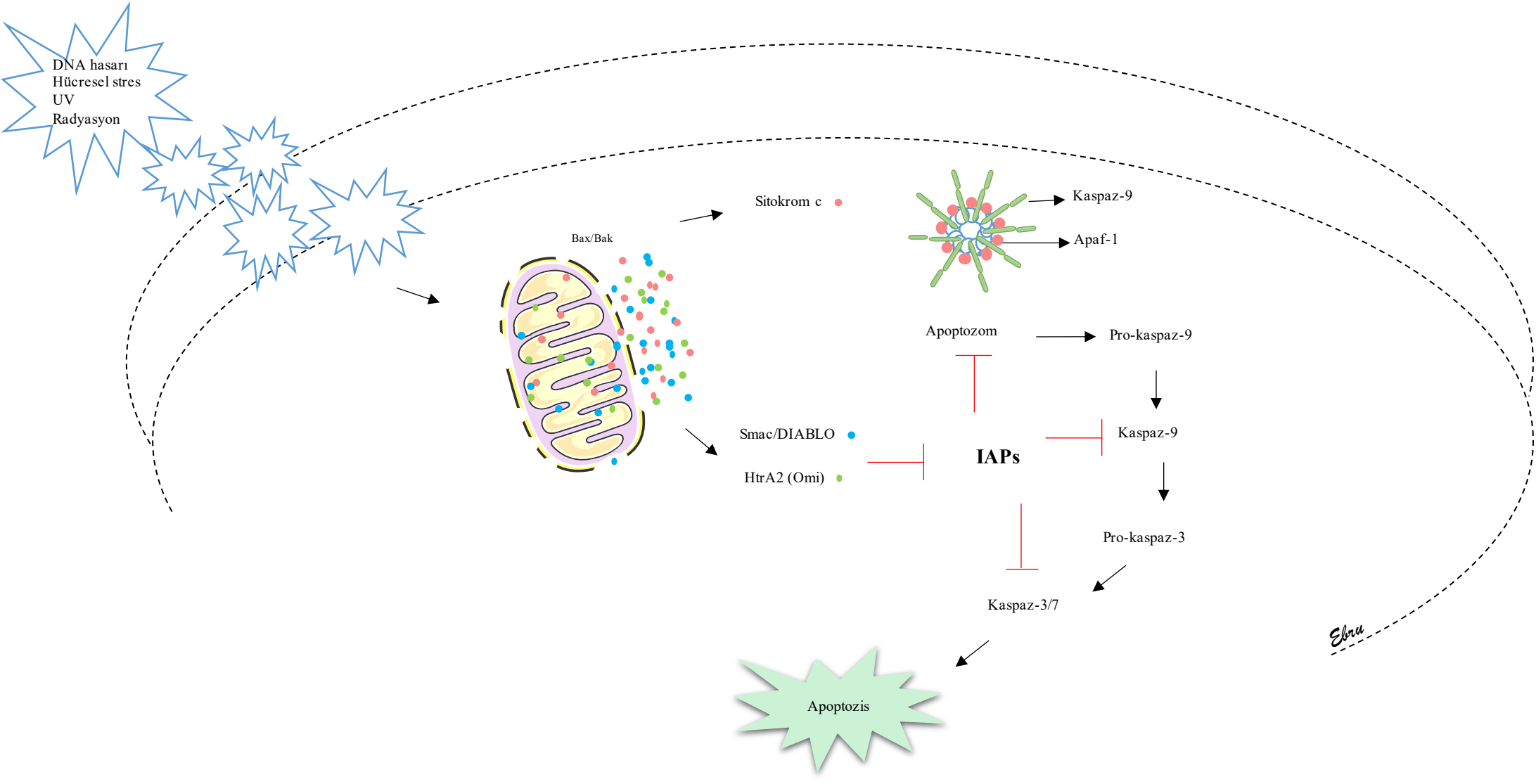


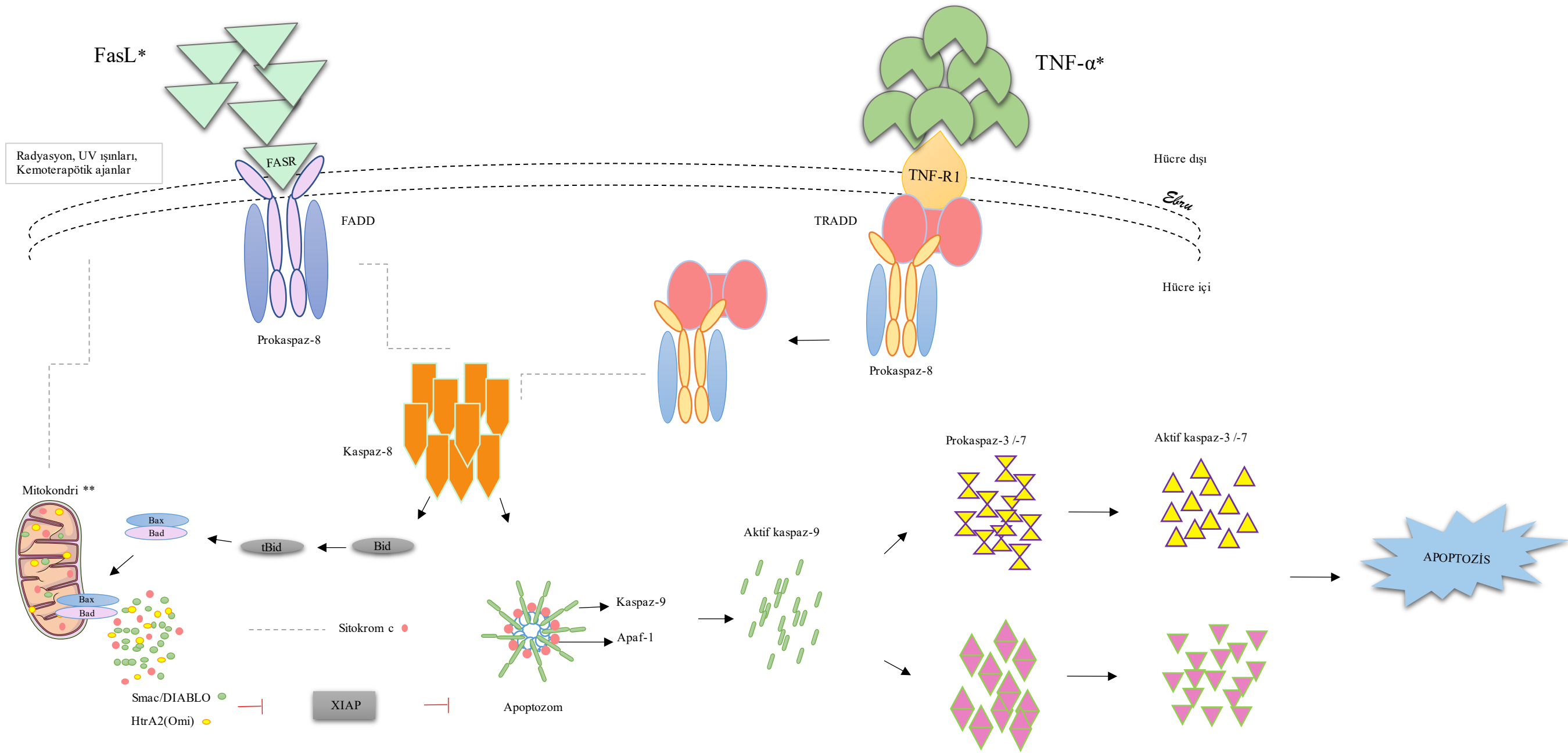
Pro-apoptotik sadece BH3 alanlı üyeleri

Bid, Bim, Bad, Puma ve Noxa





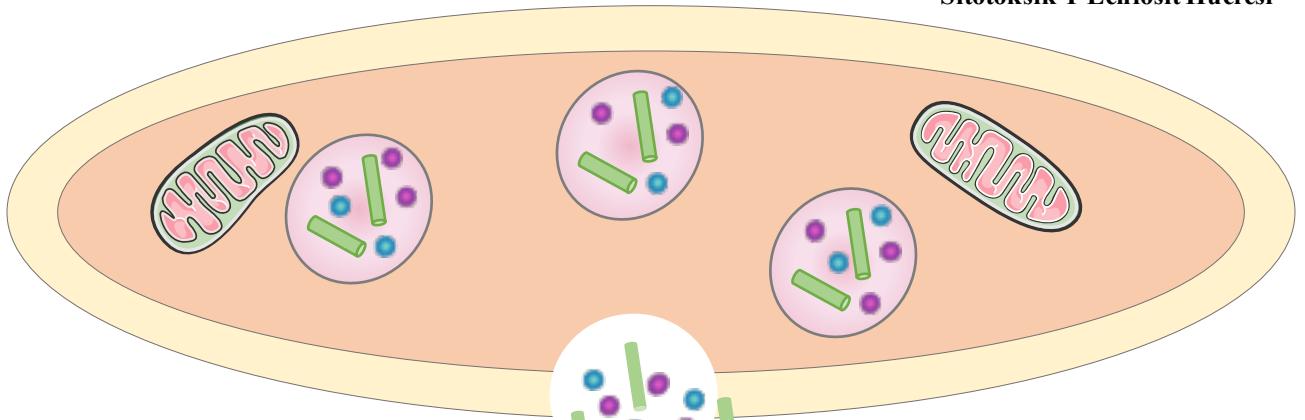




*Ölüm Reseptörü Yolu (Dış yolak)

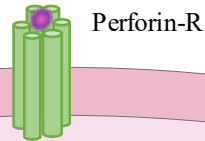
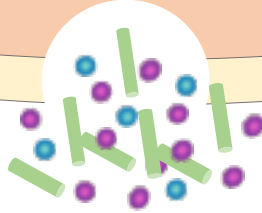
** Mitokondriyal Yolak (İç yolak)

Sitotoksik T Lenfosit Hücresi



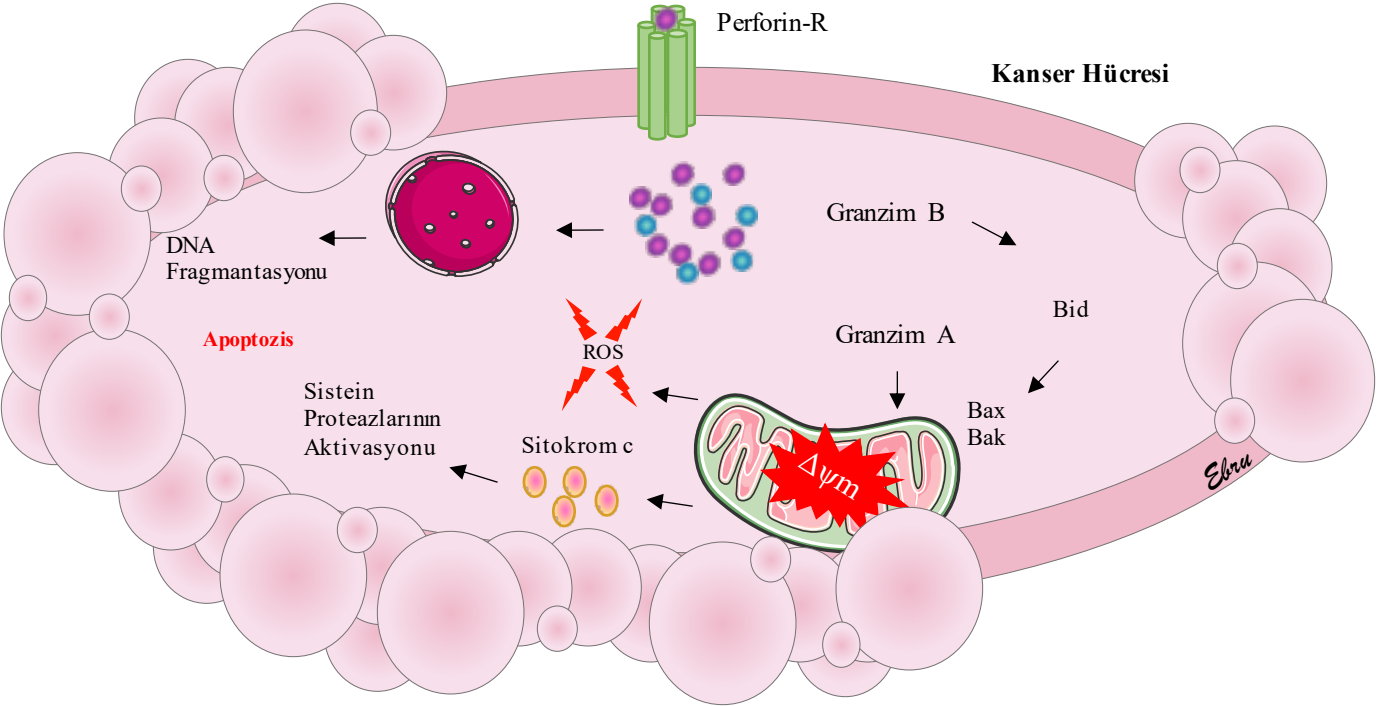
Granzim A
Granzim B

Perforin



Perforin-R

Kanser Hücresi



DNA
Fragmantasyonu

Apoptozis

Sistein
Proteazlarının
Aktivasyonu

Sitokrom c

ROS

Granzim B

Bid

Granzim A

Bax
Bak

Ebru