

# FOSFORILAZIONE OSSIDATIVA

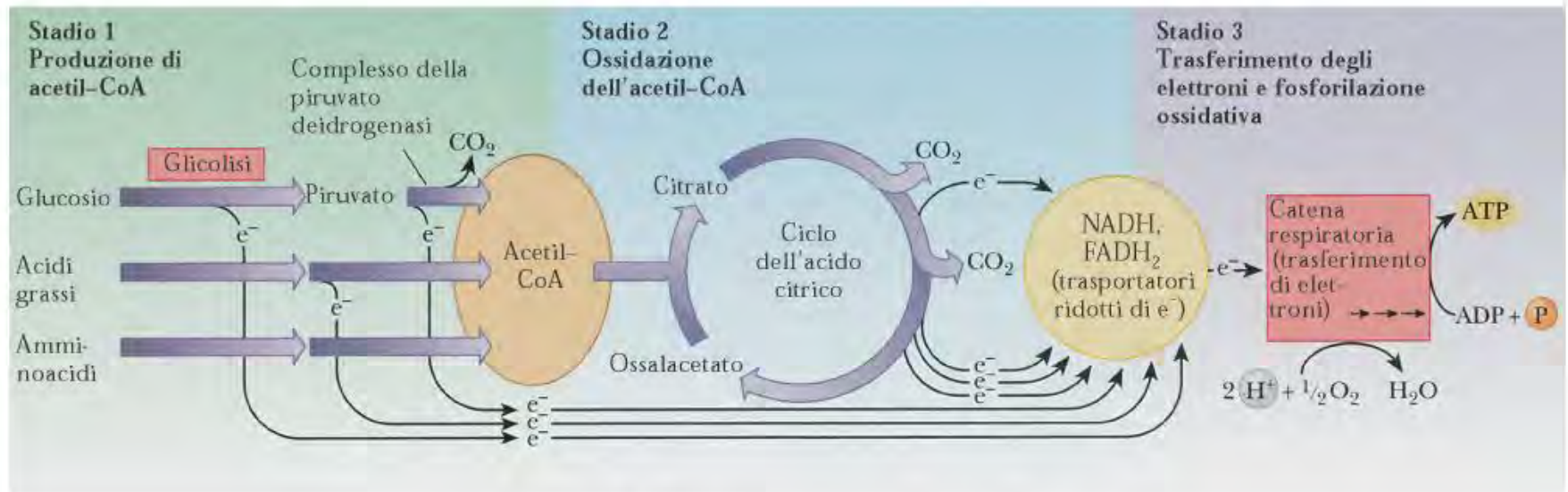
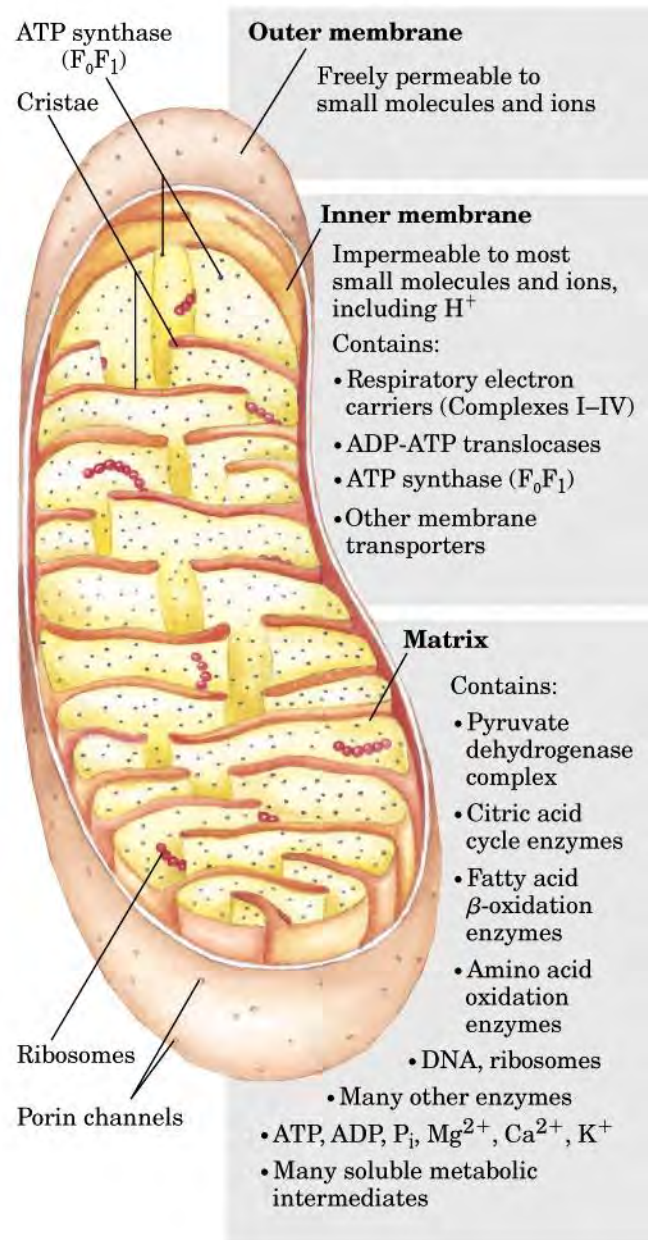
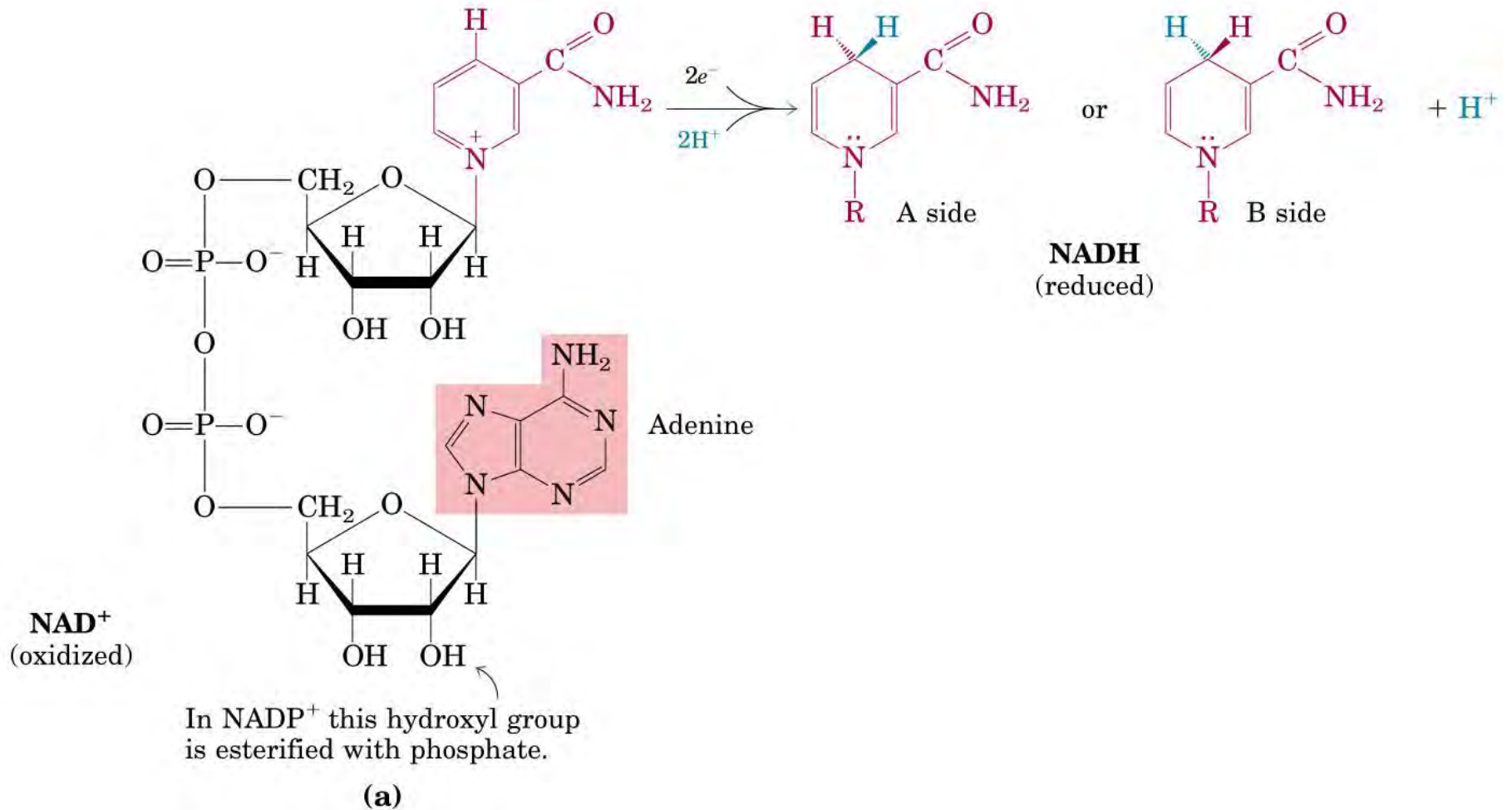


FIGURA 16.1

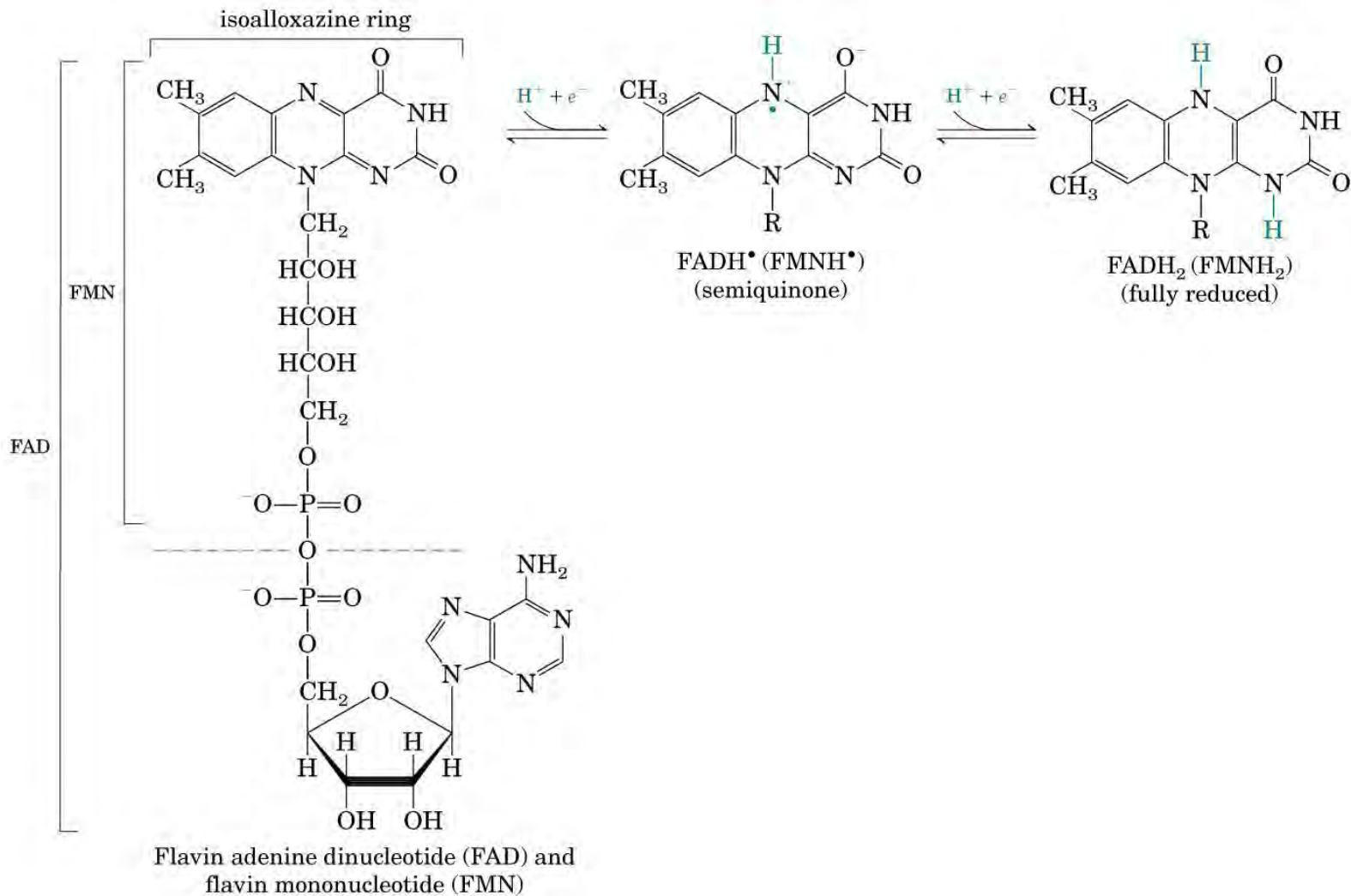
Il ciclo dell'acido citrico ha un ruolo centrale nel catabolismo. Gli amminoacidi, gli acidi grassi e il glucosio possono produrre tutti acetil-CoA nello stadio 1 del catabolismo. Nello stadio 2, l'acetil-CoA entra nel ciclo dell'acido citrico. Gli stadi 1 e 2 producono trasportatori di elettroni ridotti (qui mostrati come  $e^-$ ). Nello stadio 3, gli elettroni entrano nella catena di trasporto degli elettroni, che produce ATP.



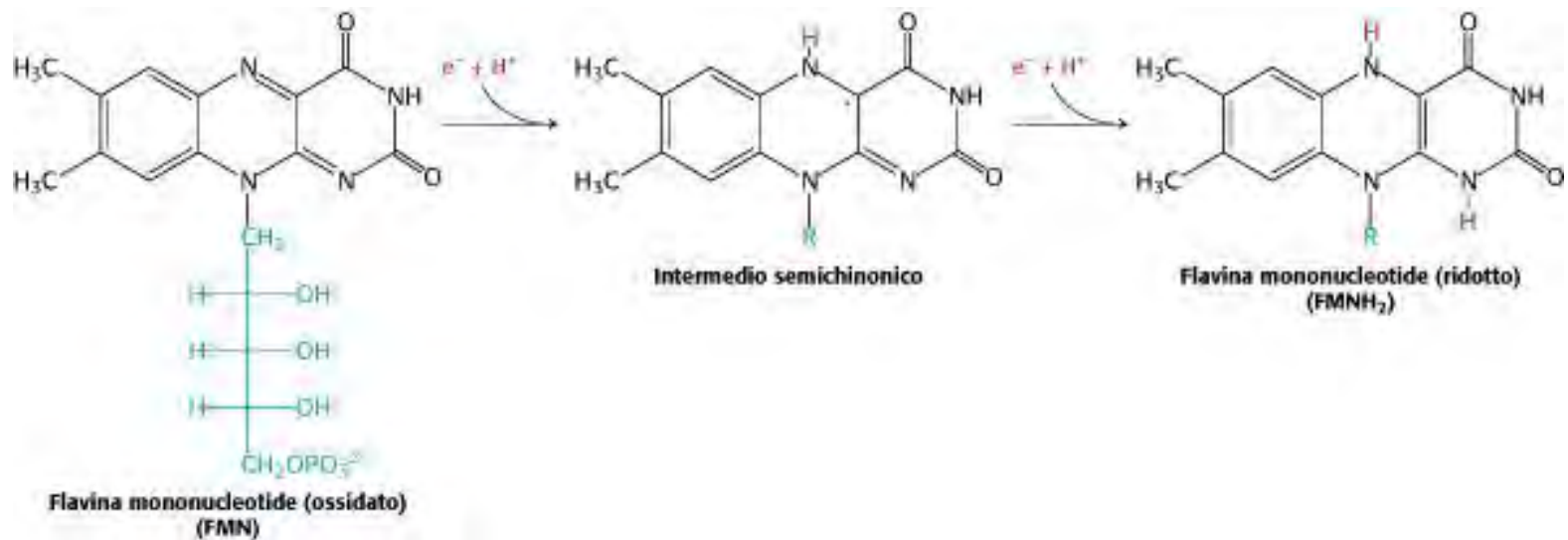
# I trasportatori di elettroni: il NAD<sup>+</sup>



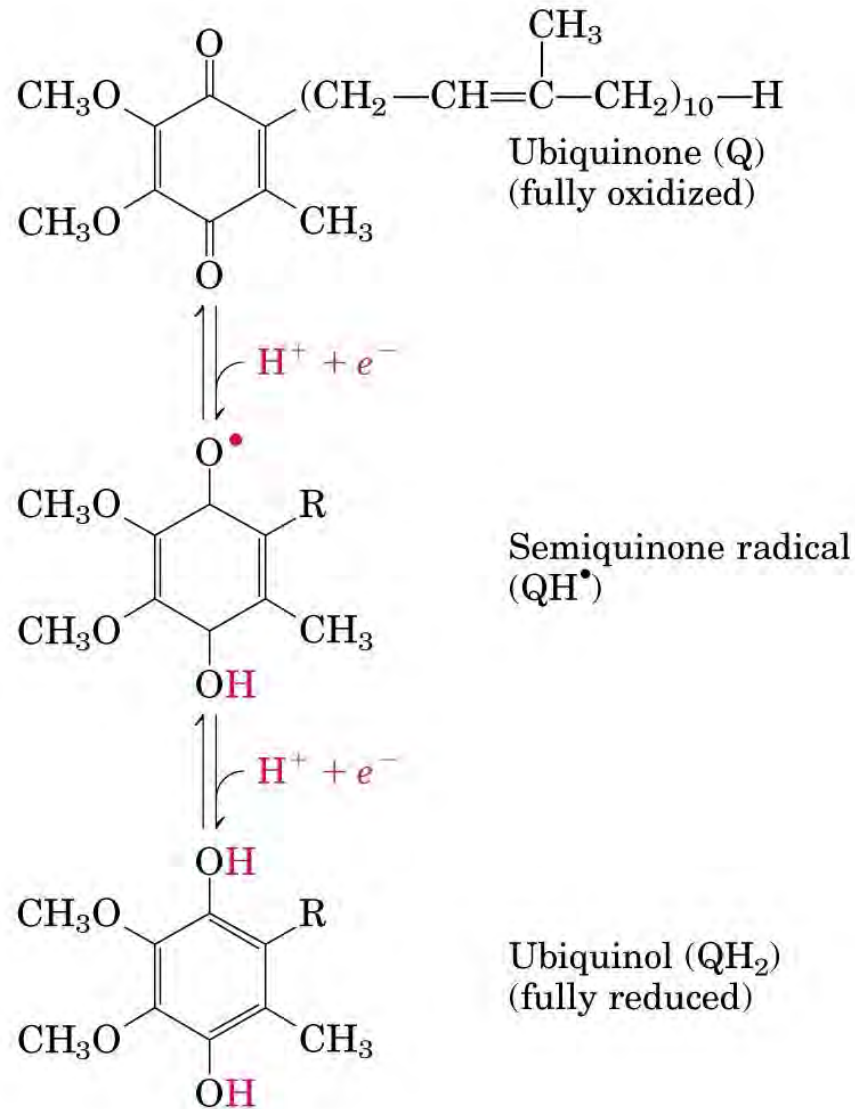
# I trasportatori di elettroni: il FAD e il FMN



# I trasportatori di elettroni: il FMN

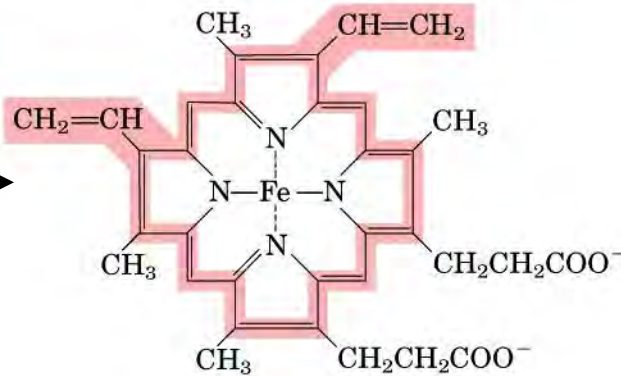


# I trasportatori di elettroni: l'ubichinone

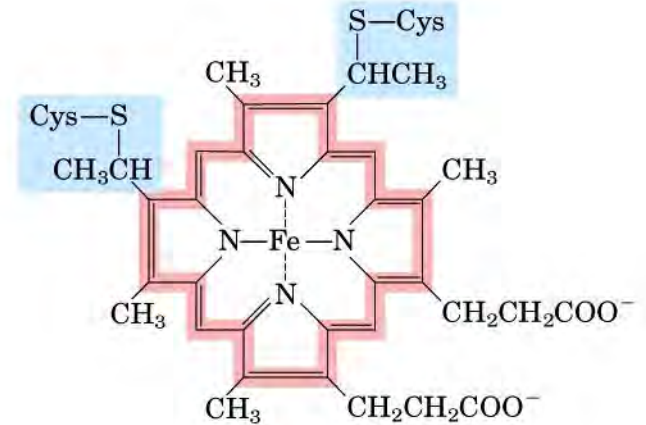


# I trasportatori di elettroni: i citocromi

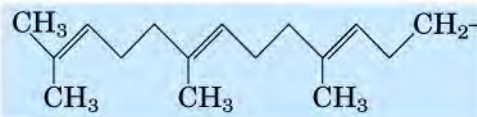
Cyt b



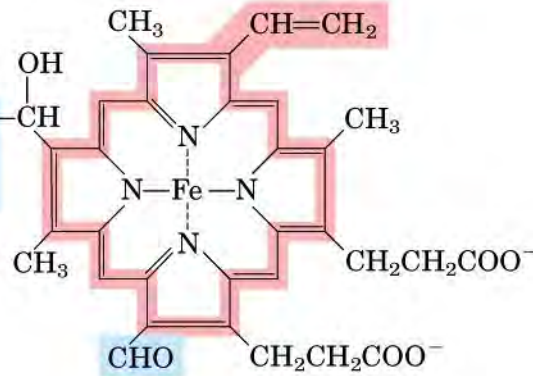
Iron protoporphyrin IX  
(in *b*-type cytochromes)



Heme C  
(in *c*-type cytochromes)



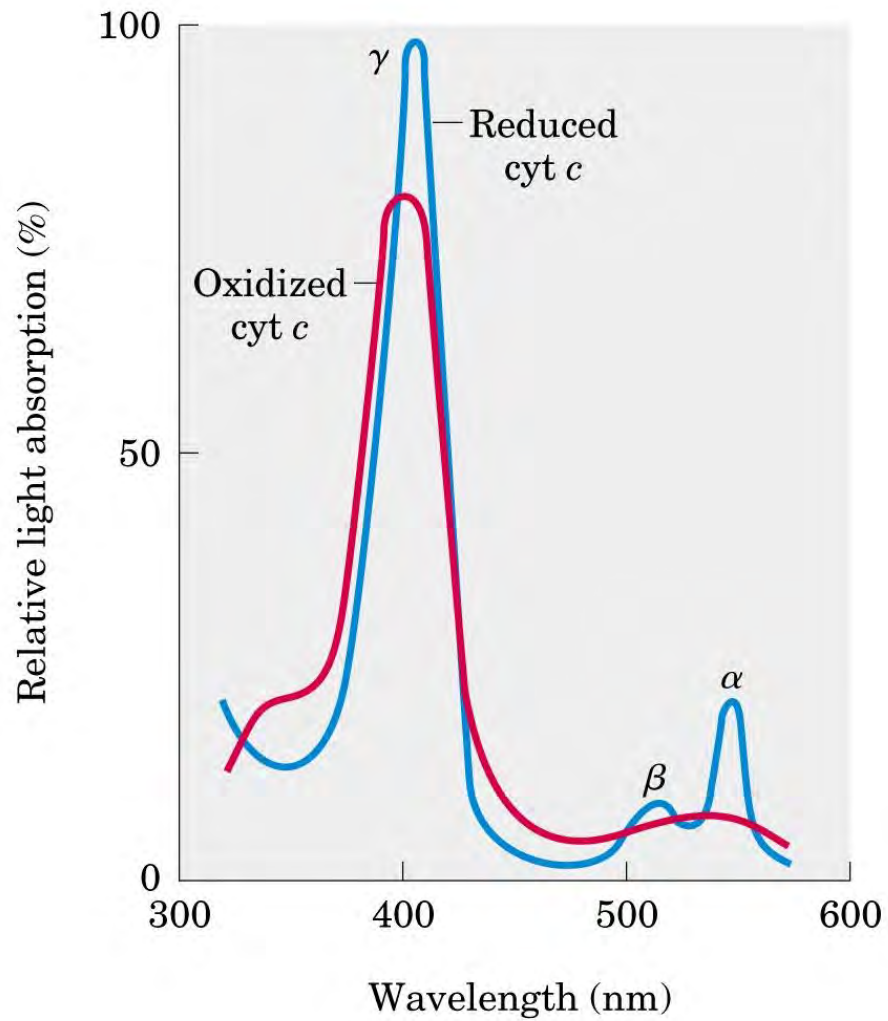
Cyt a



Heme A  
(in *a*-type cytochromes)

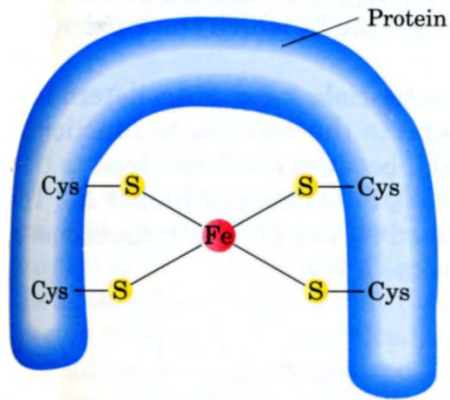
Cyt c

## I trasportatori di elettroni: i citocromi

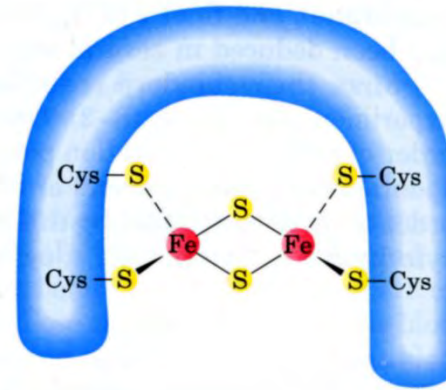




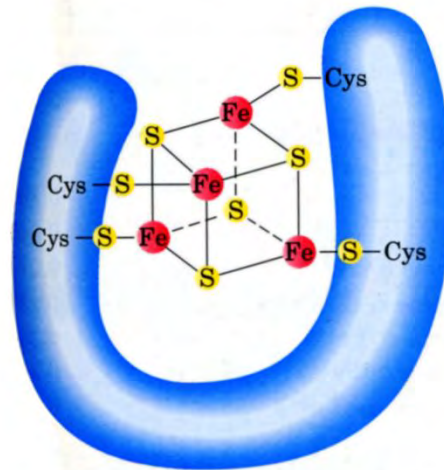
# I trasportatori di elettroni: i centri Fe-S



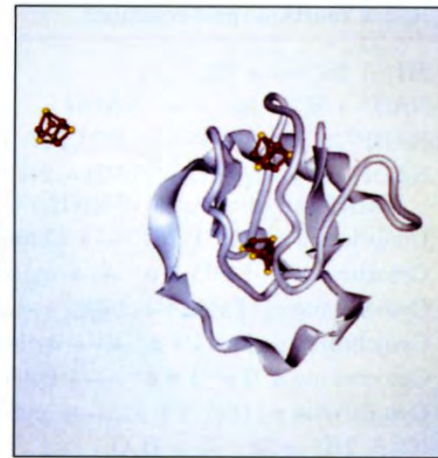
(a)



(b)



(c)



(d)

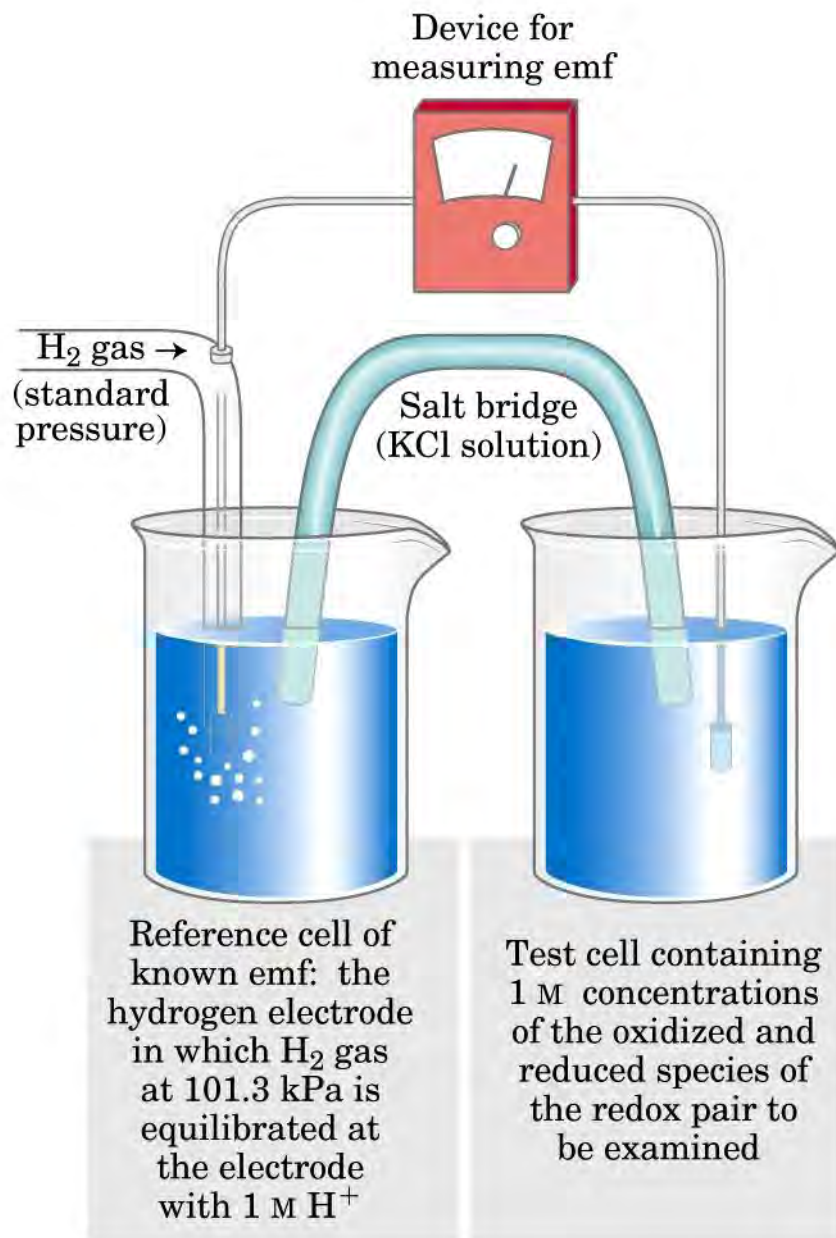
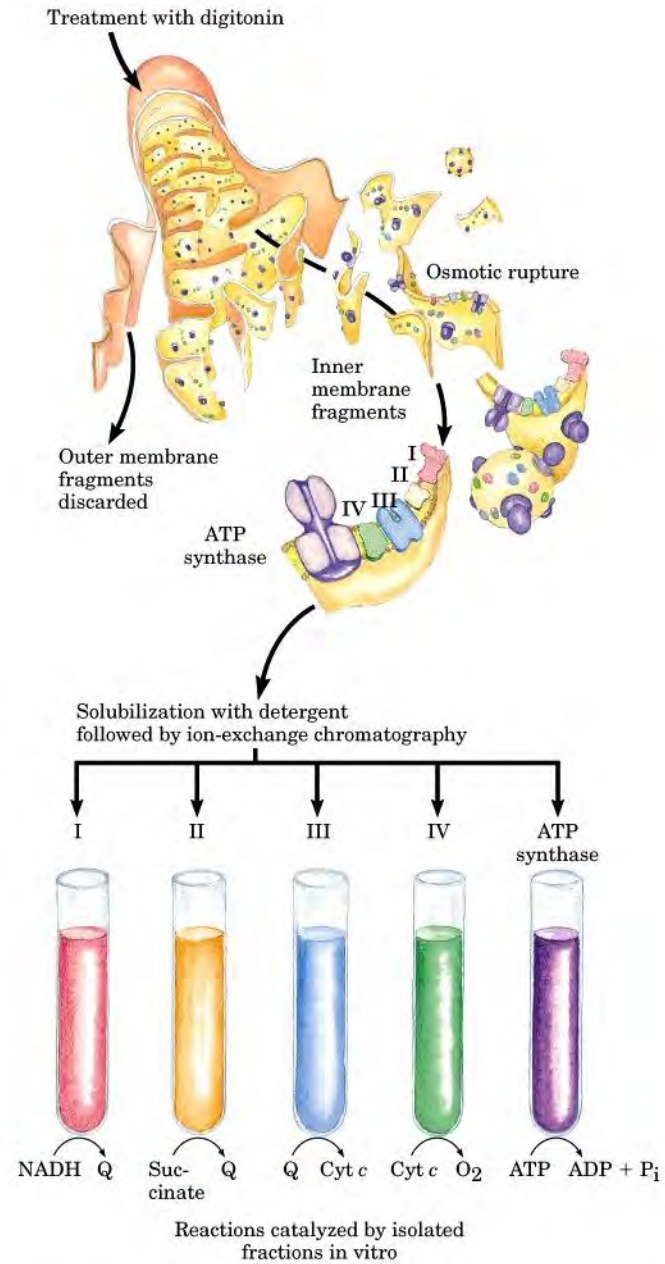


table 19-2

**Standard Reduction Potentials of Respiratory Chain and Related Electron Carriers**

Redox reaction (half-reaction)	$E'^{\circ}$ (V)
$2\text{H}^{+} + 2e^{-} \longrightarrow \text{H}_2$	-0.414
$\text{NAD}^{+} + \text{H}^{+} + 2e^{-} \longrightarrow \text{NADH}$	-0.320
$\text{NADP}^{+} + \text{H}^{+} + 2e^{-} \longrightarrow \text{NADPH}$	-0.324
$\text{NADH dehydrogenase (FMN)} + 2\text{H}^{+} + 2e^{-} \longrightarrow \text{NADH dehydrogenase (FMNH}_2\text{)}$	-0.30
$\text{Ubiquinone} + 2\text{H}^{+} + 2e^{-} \longrightarrow \text{ubiquinol}$	0.045
$\text{Cytochrome } b \text{ (Fe}^{3+}\text{)} + e^{-} \longrightarrow \text{cytochrome } b \text{ (Fe}^{2+}\text{)}$	0.077
$\text{Cytochrome } c_1 \text{ (Fe}^{3+}\text{)} + e^{-} \longrightarrow \text{cytochrome } c_1 \text{ (Fe}^{2+}\text{)}$	0.22
$\text{Cytochrome } c \text{ (Fe}^{3+}\text{)} + e^{-} \longrightarrow \text{cytochrome } c \text{ (Fe}^{2+}\text{)}$	0.254
$\text{Cytochrome } a \text{ (Fe}^{3+}\text{)} + e^{-} \longrightarrow \text{cytochrome } a \text{ (Fe}^{2+}\text{)}$	0.29
$\text{Cytochrome } a_3 \text{ (Fe}^{3+}\text{)} + e^{-} \longrightarrow \text{cytochrome } a_3 \text{ (Fe}^{2+}\text{)}$	0.55
$\frac{1}{2}\text{O}_2 + 2\text{H}^{+} + 2e^{-} \longrightarrow \text{H}_2\text{O}$	0.816



**table 19–3**

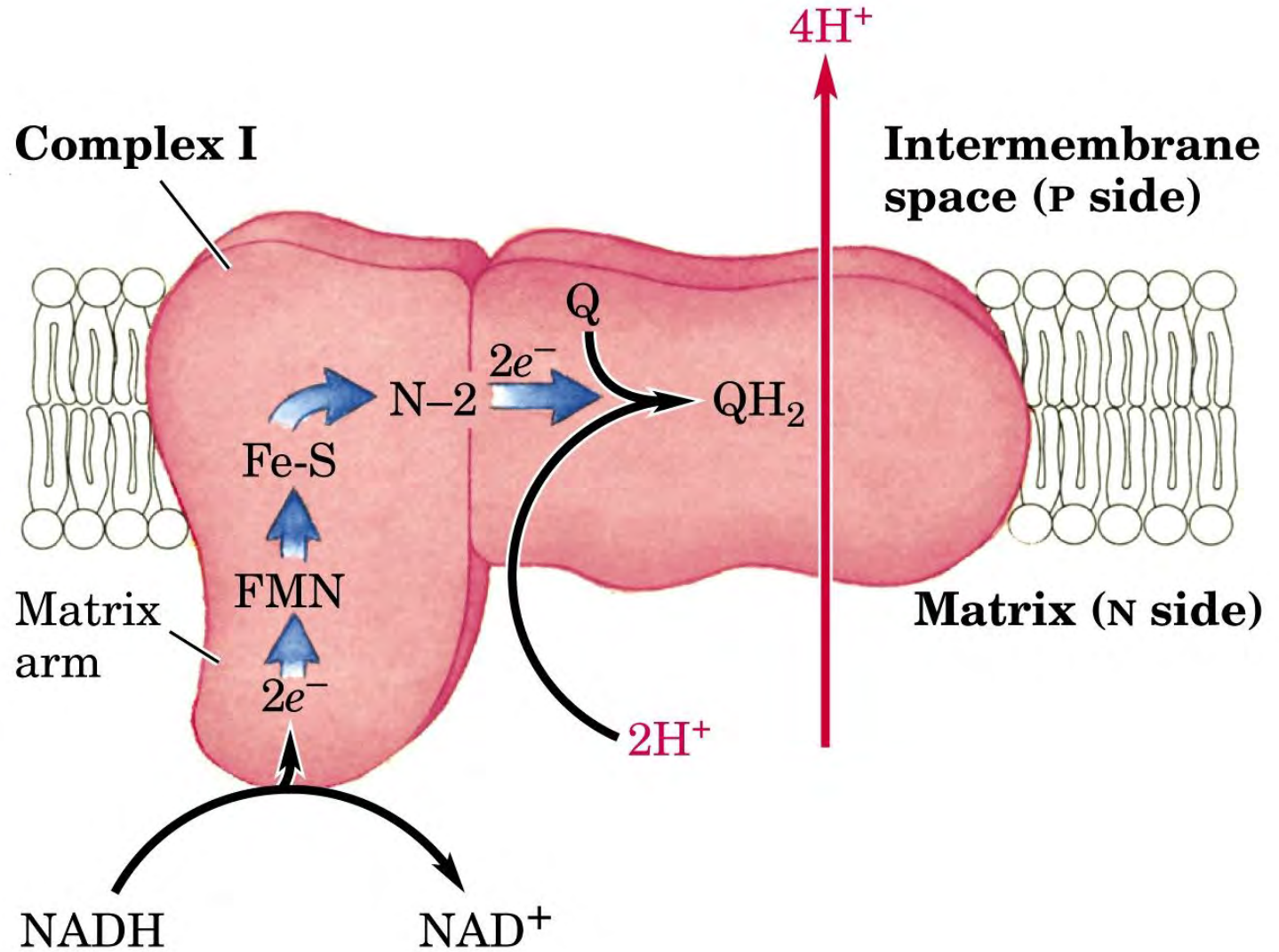
## Protein Components of the Mitochondrial Electron-Transfer Chain

Enzyme complex	Mass (kDa)	Number of subunits*	Prosthetic group(s)
I NADH dehydrogenase	850	42 (14)	FMN, Fe-S
II Succinate dehydrogenase	140	5	FAD, Fe-S
III Ubiquinone: cytochrome <i>c</i> oxidoreductase	250	11	Hemes, Fe-S
Cytochrome <i>c</i> <sup>†</sup>	13	1	Heme
IV Cytochrome oxidase	160	13 (3–4)	Hemes; Cu <sub>A</sub> , Cu <sub>B</sub>

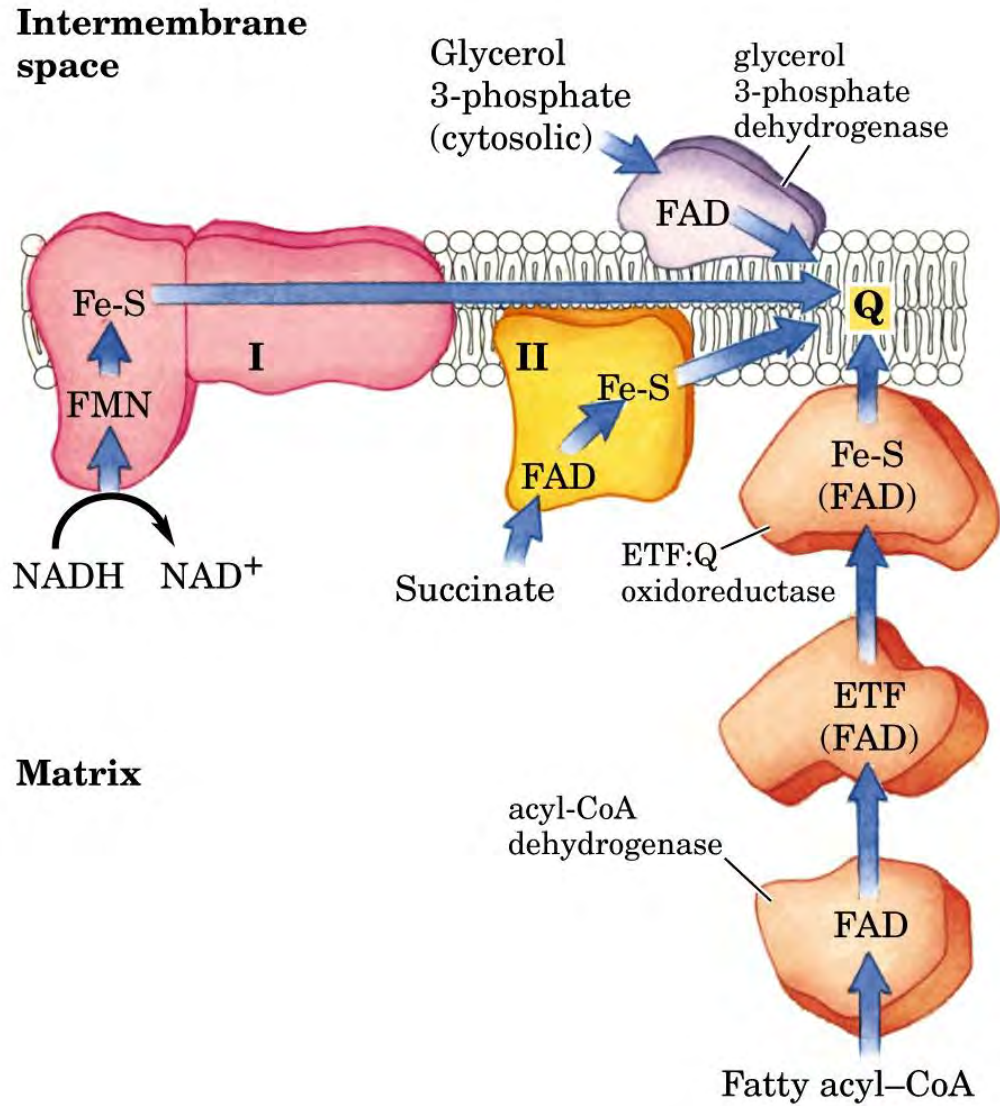
\*Numbers of subunits in the bacterial equivalents in parentheses.

<sup>†</sup>Cytochrome *c* is not part of an enzyme complex; it moves between Complexes III and IV as a freely soluble protein.

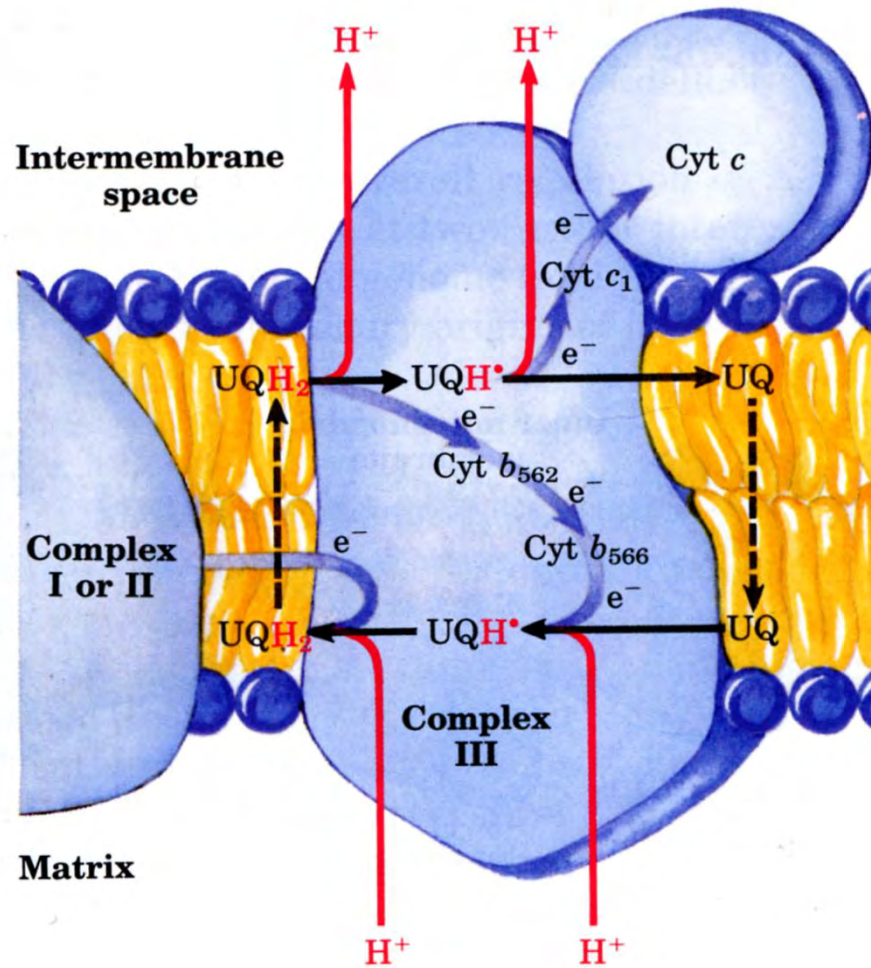
# IL COMPLESSO I: NADH deidrogenasi



# IL COMPLESSO II: succinato deidrogenasi

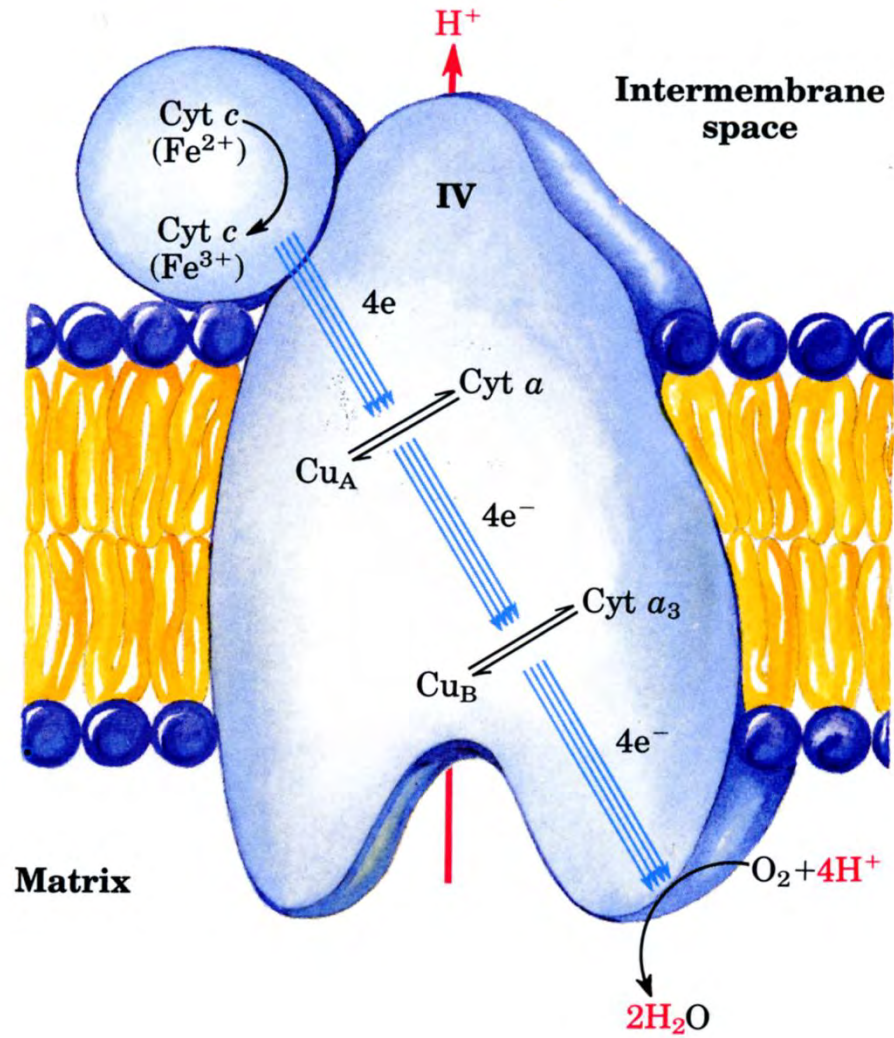


# IL COMPLESSO III: ubiquinone-citocromo c ossidoreduttasi

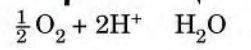
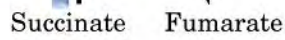
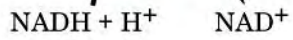
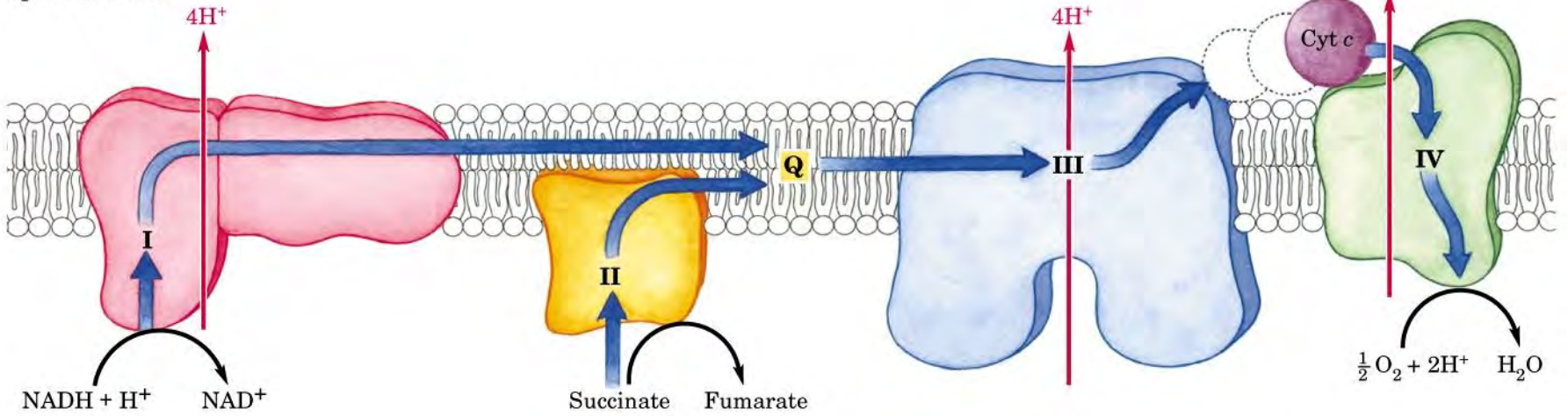




# IL COMPLESSO IV: citocromo ossidasi



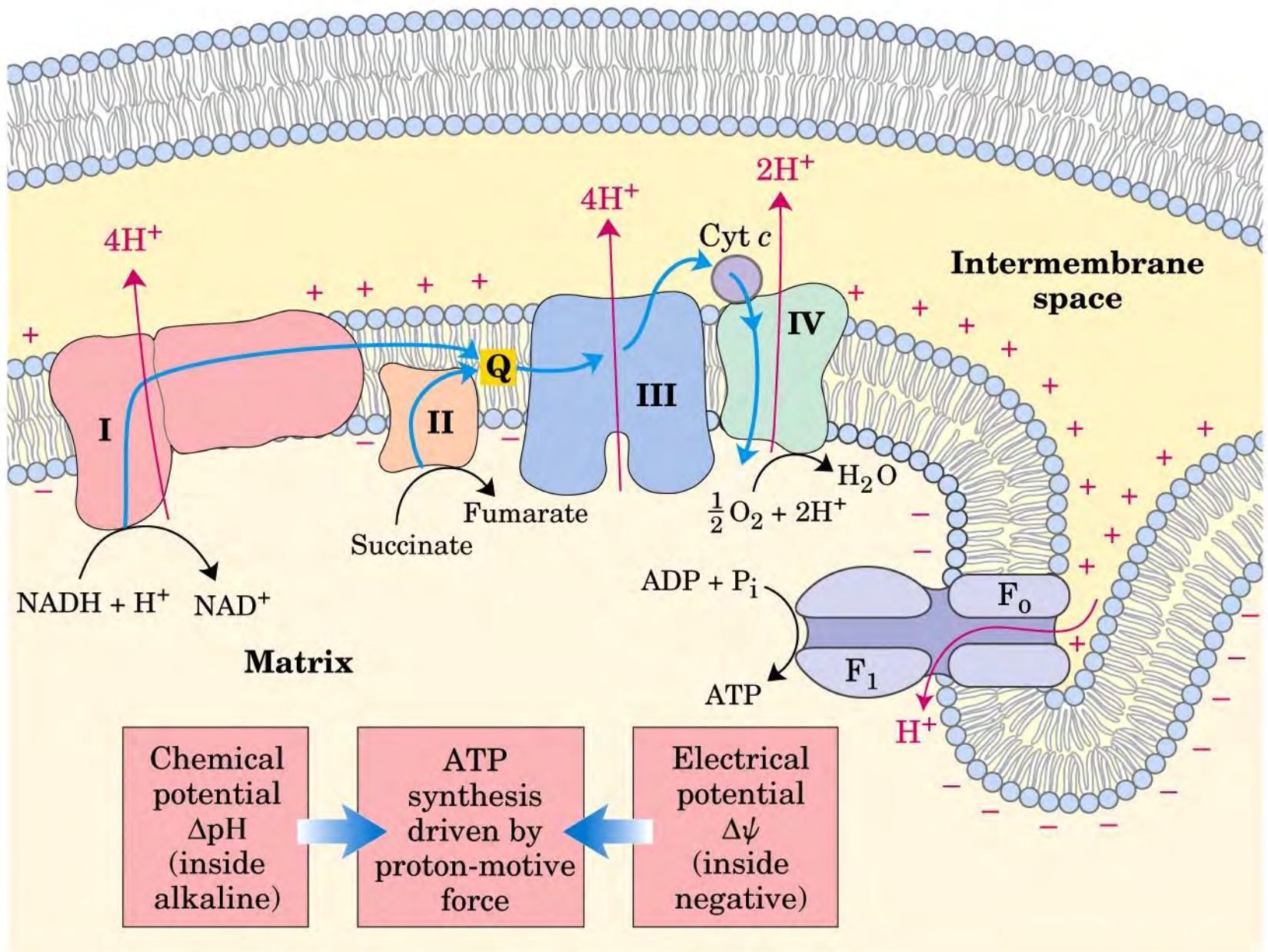
Intermembrane space (P side)

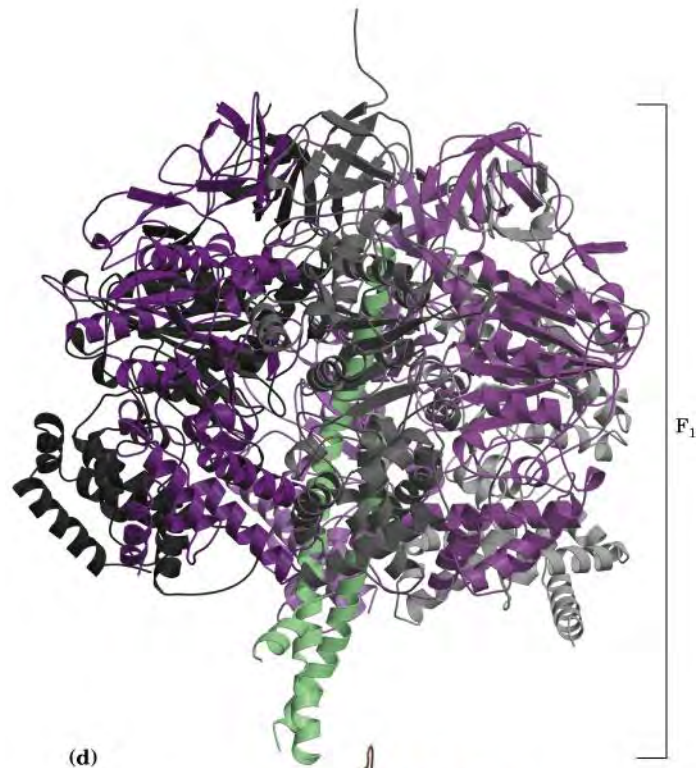


Matrix (N side)

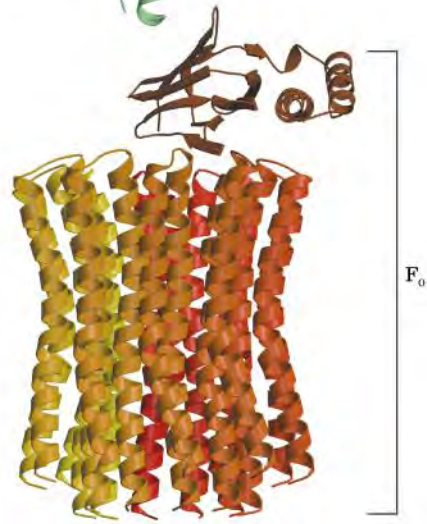
**NADH + H<sup>+</sup>**

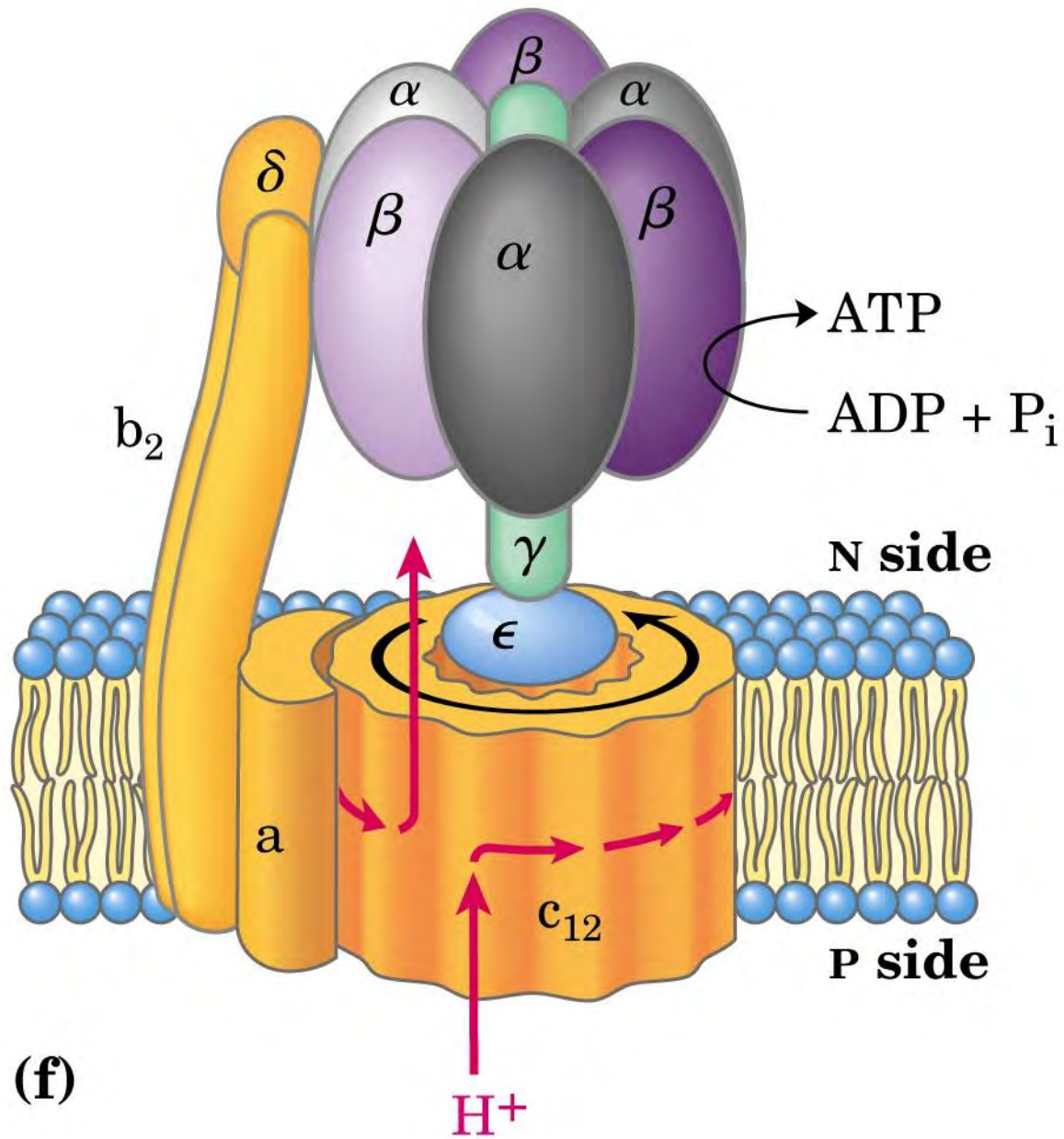
**FADH<sub>2</sub>**



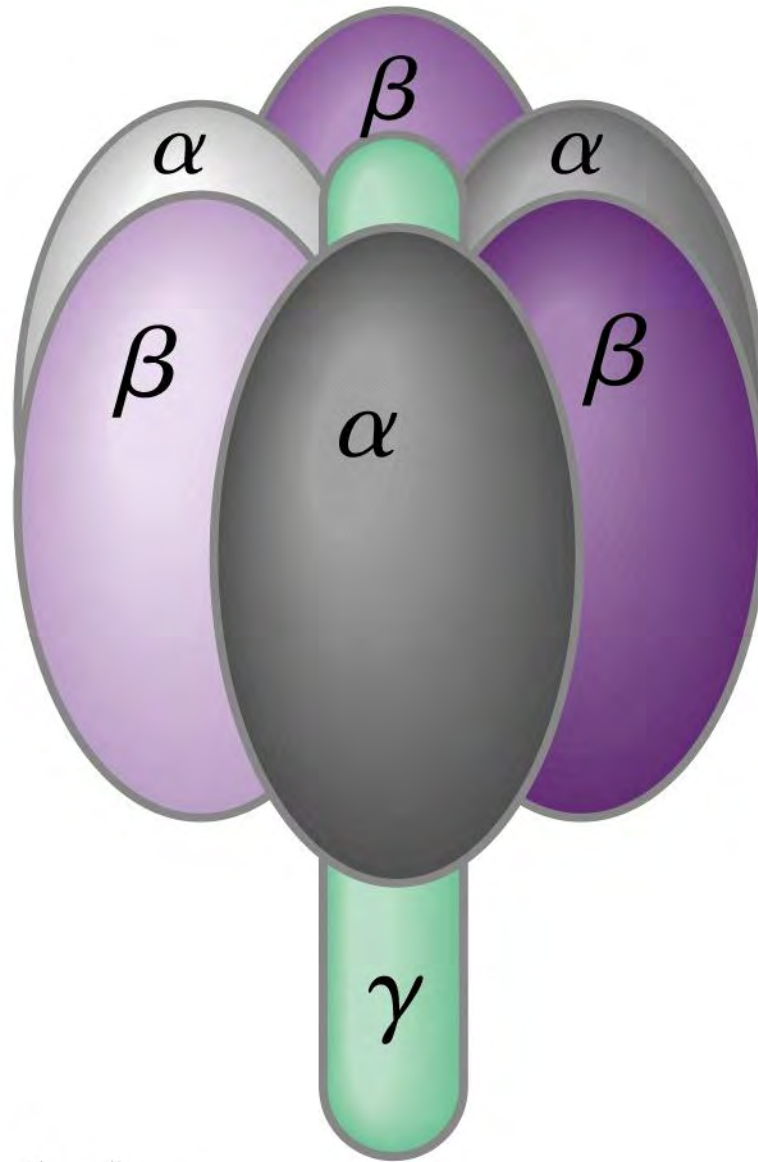


(d)

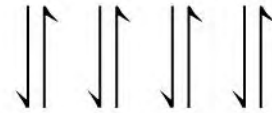
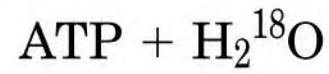




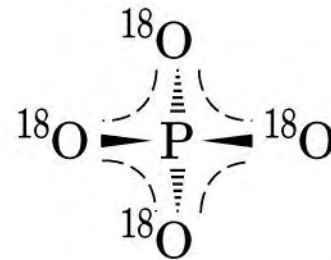
(f)



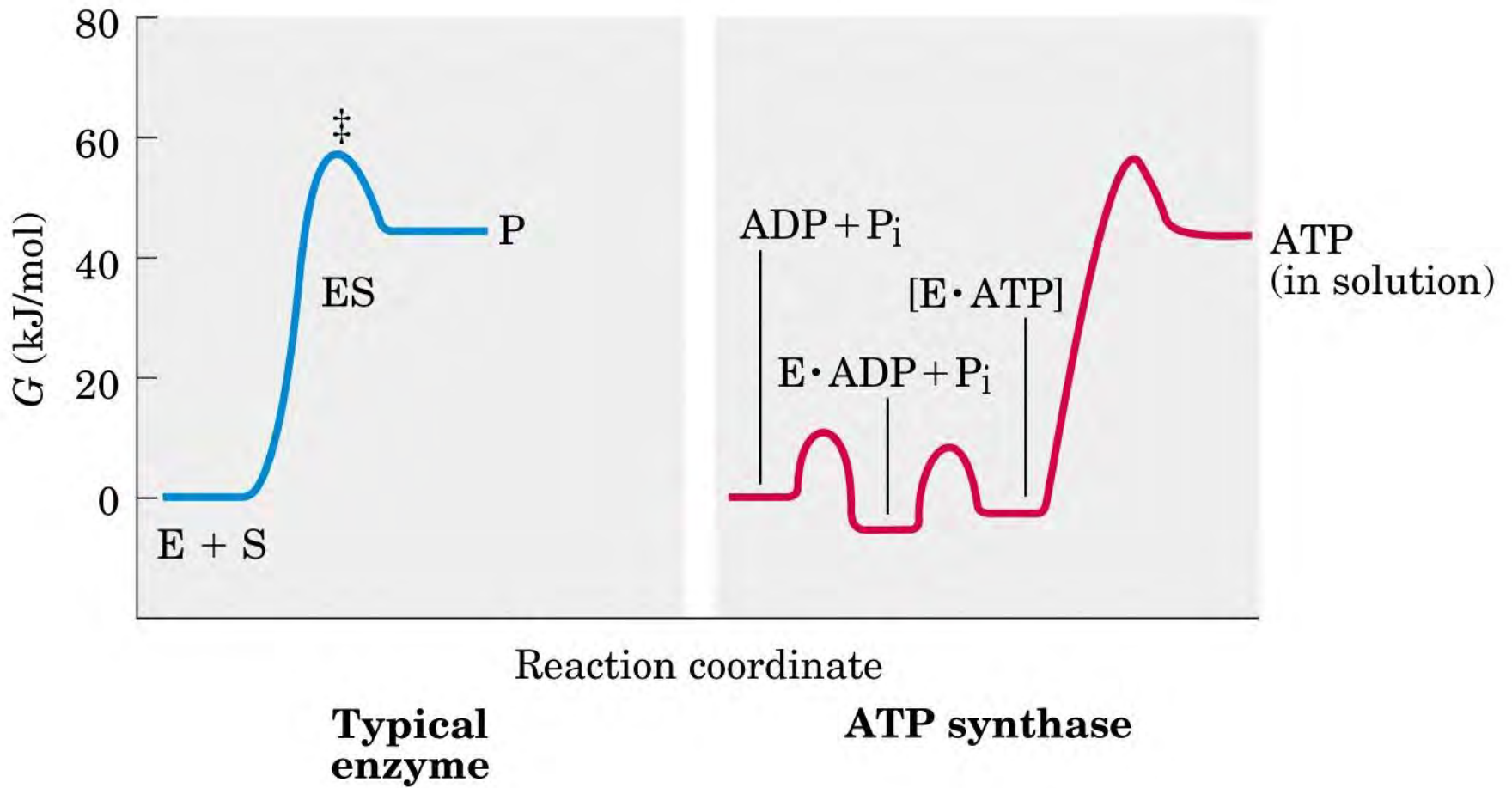
**(a)**



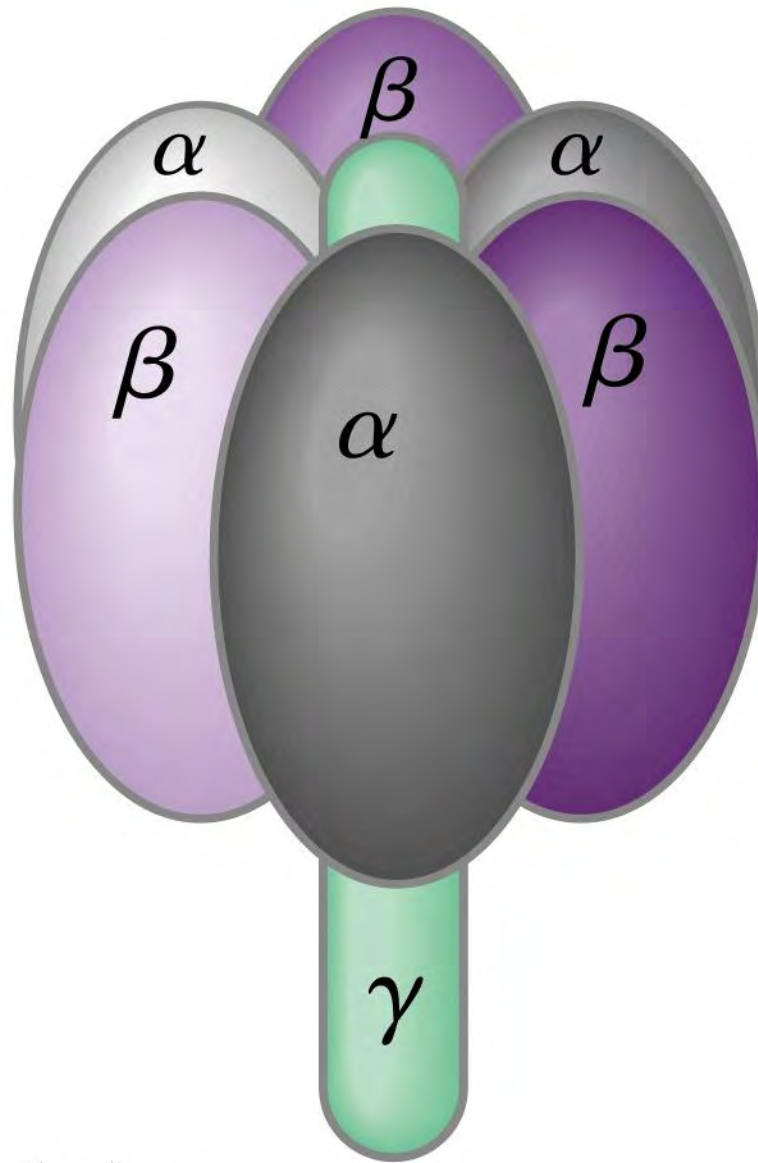
+



**Enzyme**  
**(F<sub>1</sub>)**

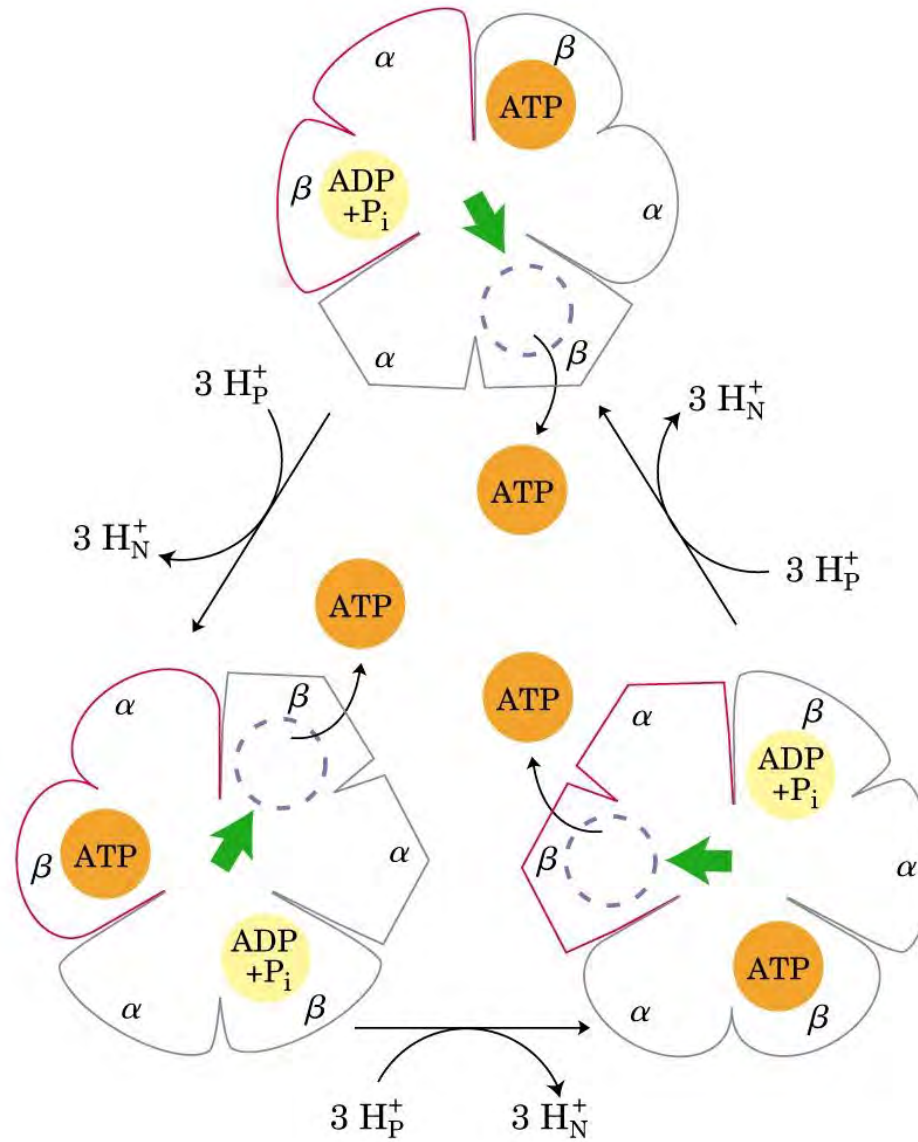




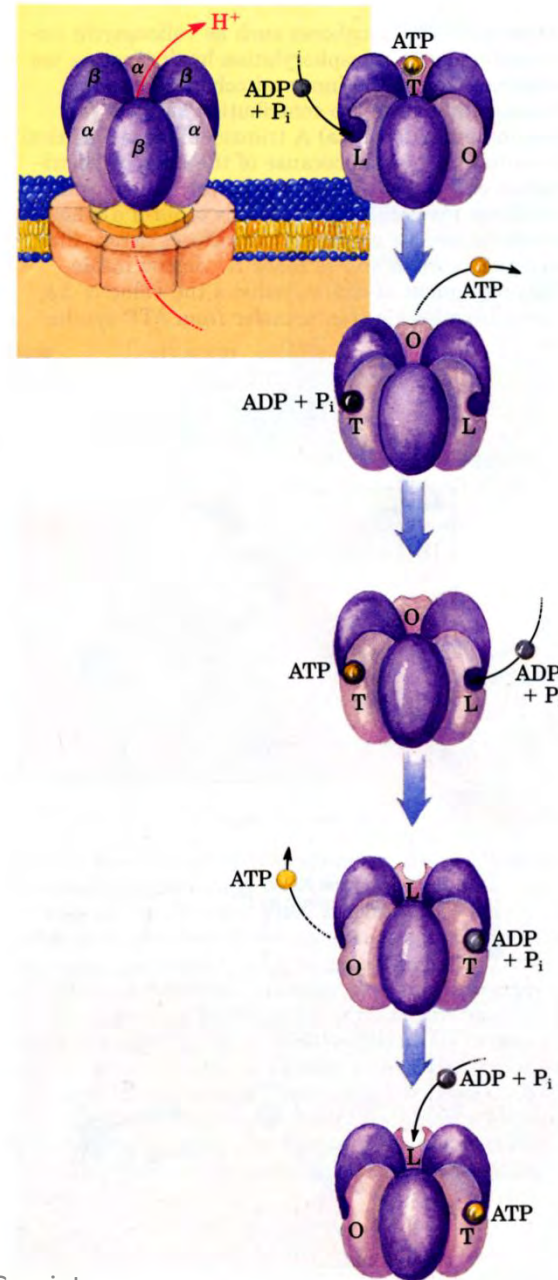


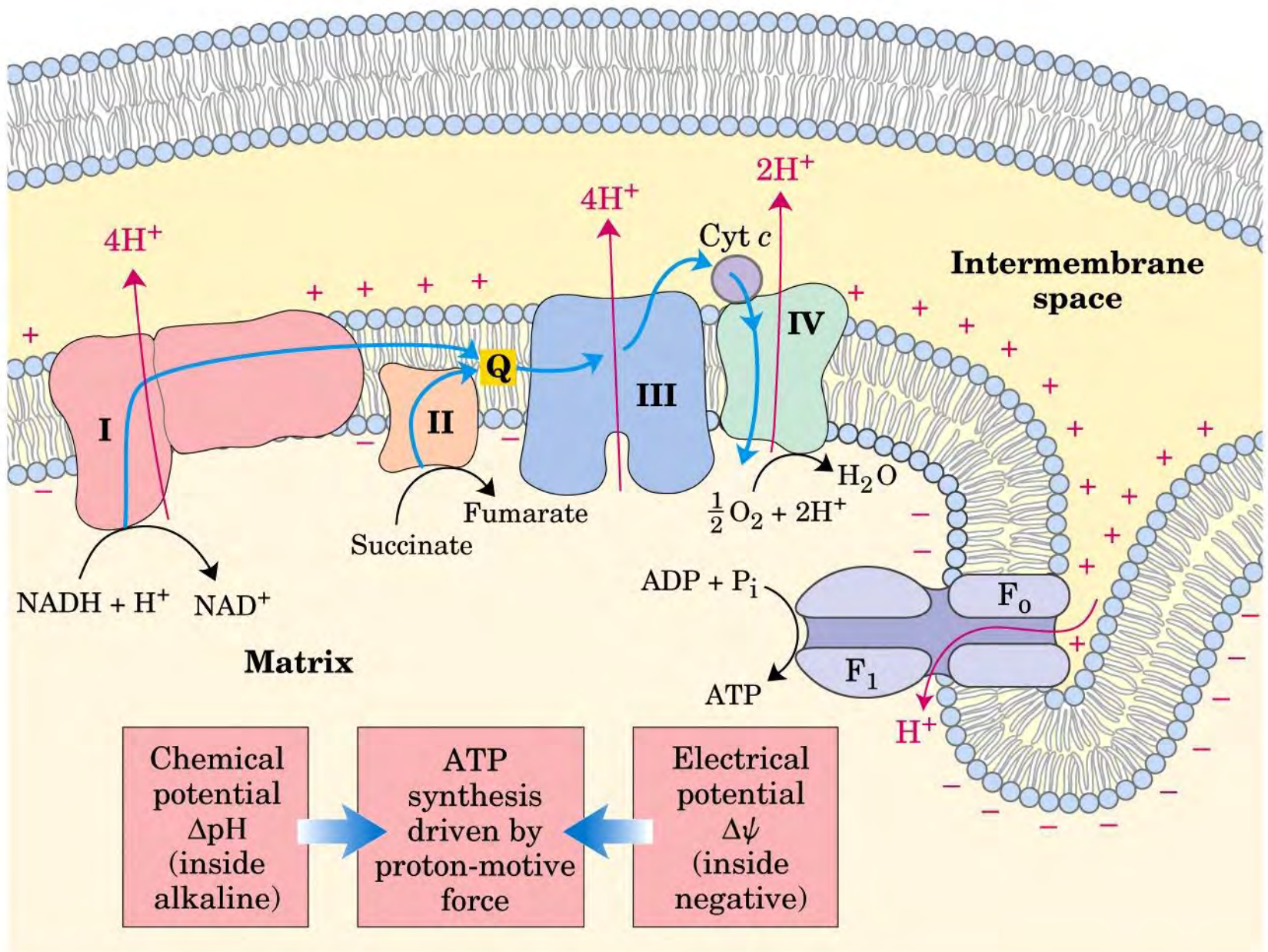
**(a)**

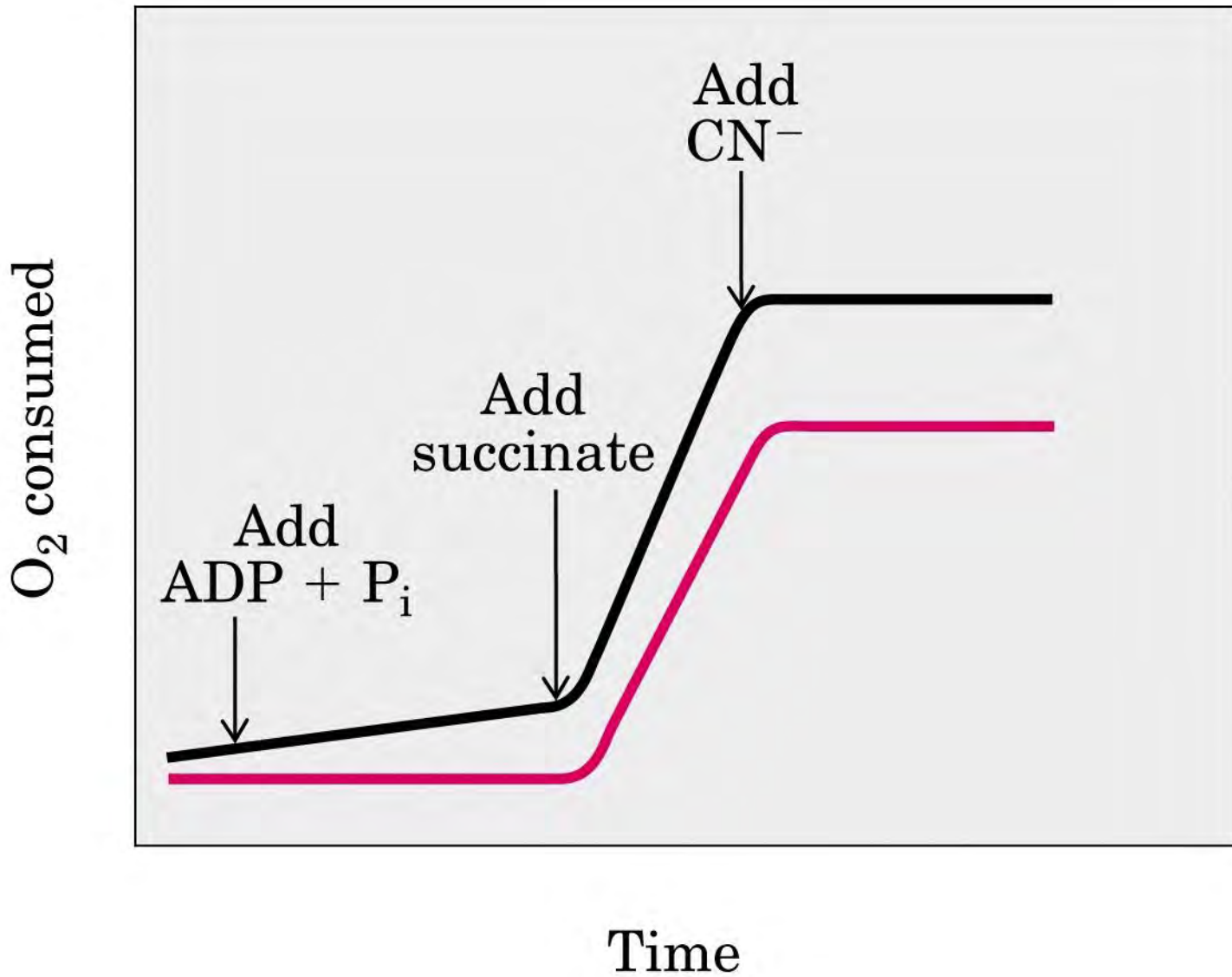
# MODELLO PER LA SINTESI DI ATP



# MODELLO PER LA SINTESI DI ATP

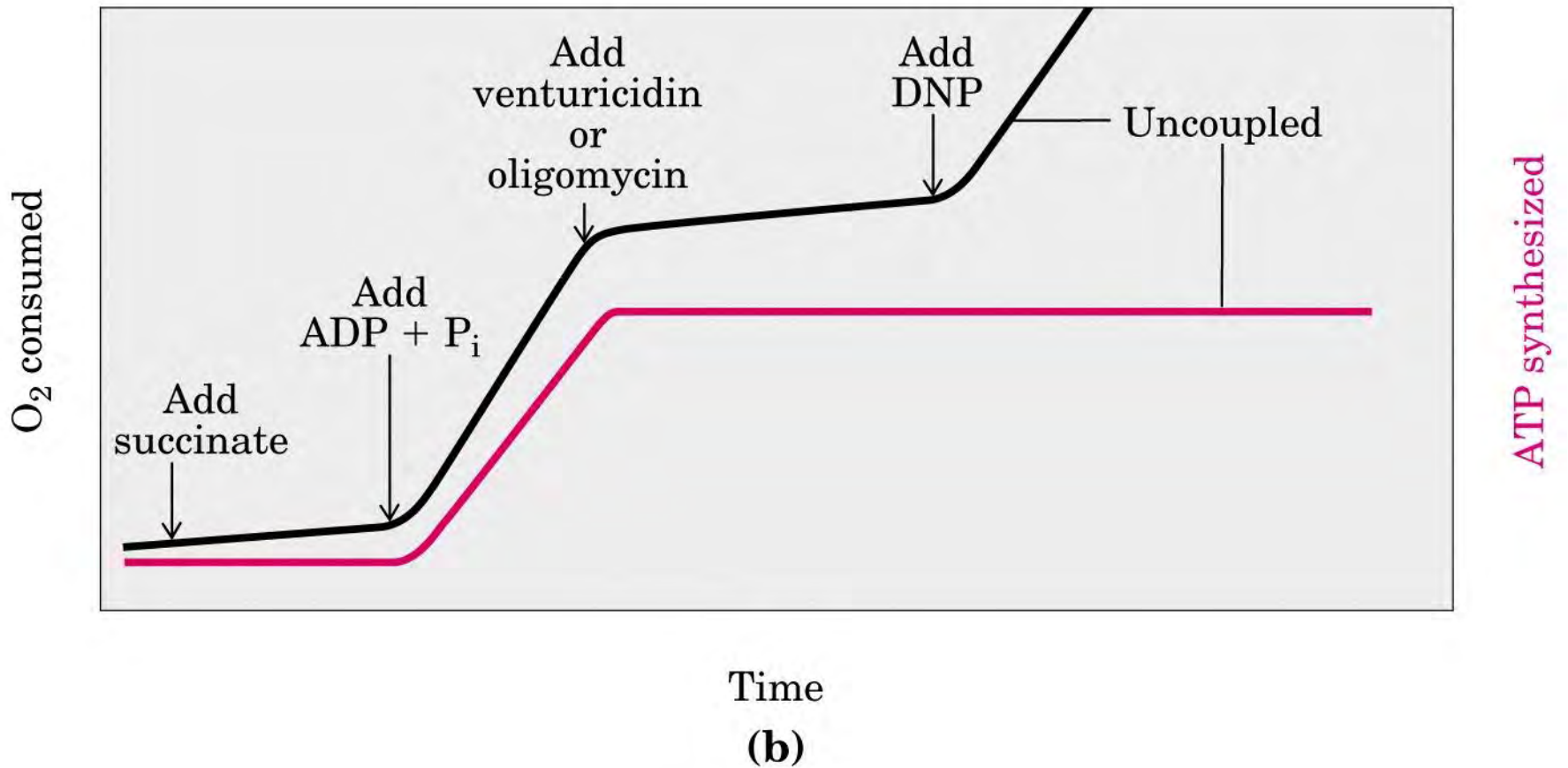


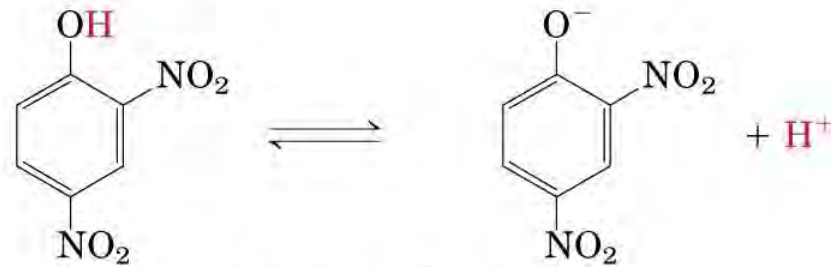




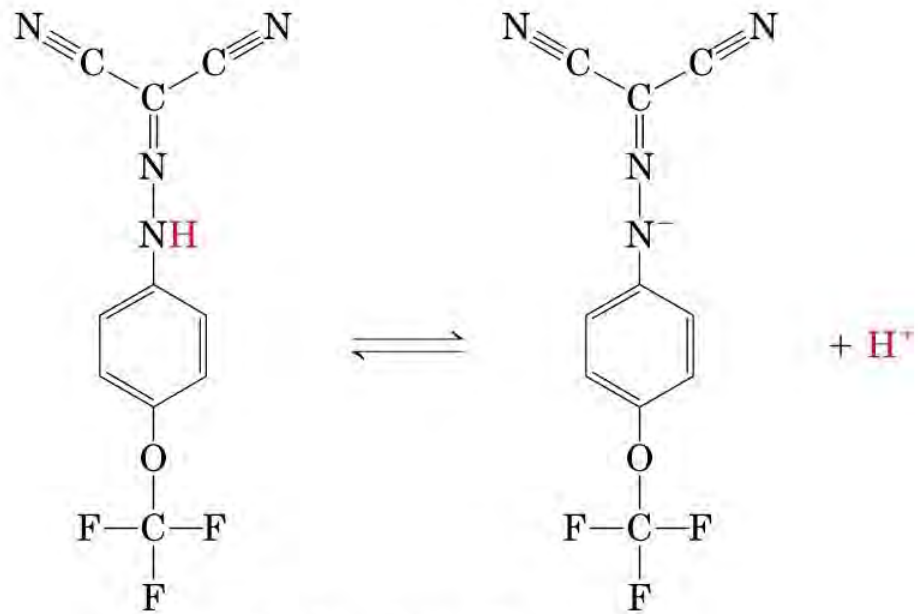
ATP synthesized

Time  
(a)

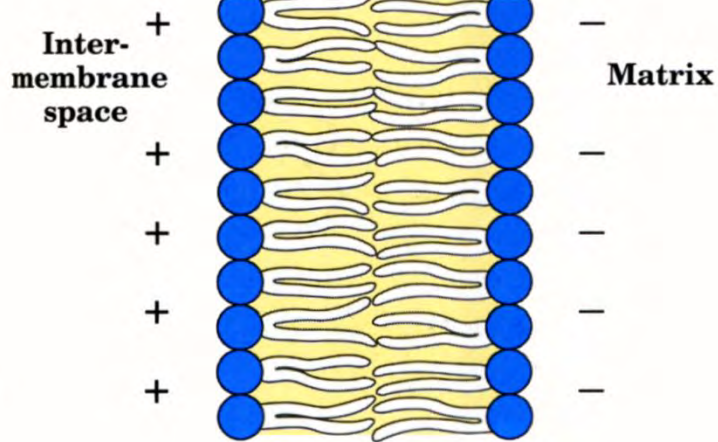




2,4-Dinitrophenol  
(DNP)



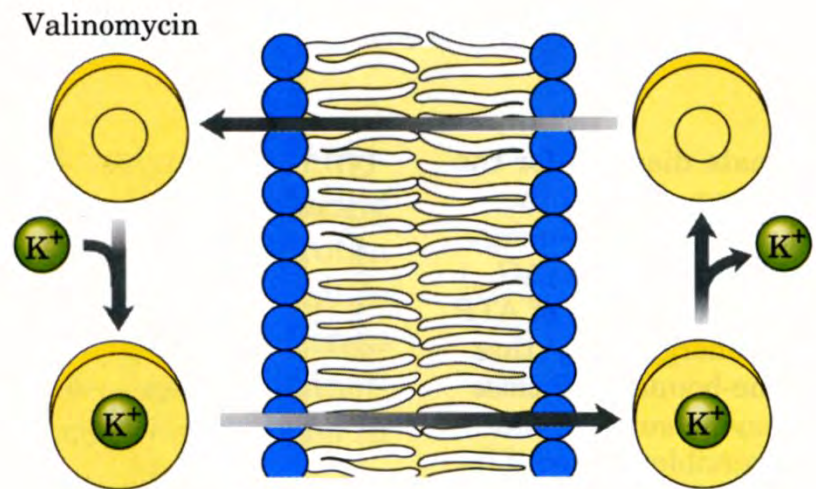
Carbonylcyanide-*p*-  
trifluoromethoxyphenylhydrazone  
(FCCP)



$$\Delta\psi > 0$$

Electron transfer coupled  
to ATP synthesis

(a)



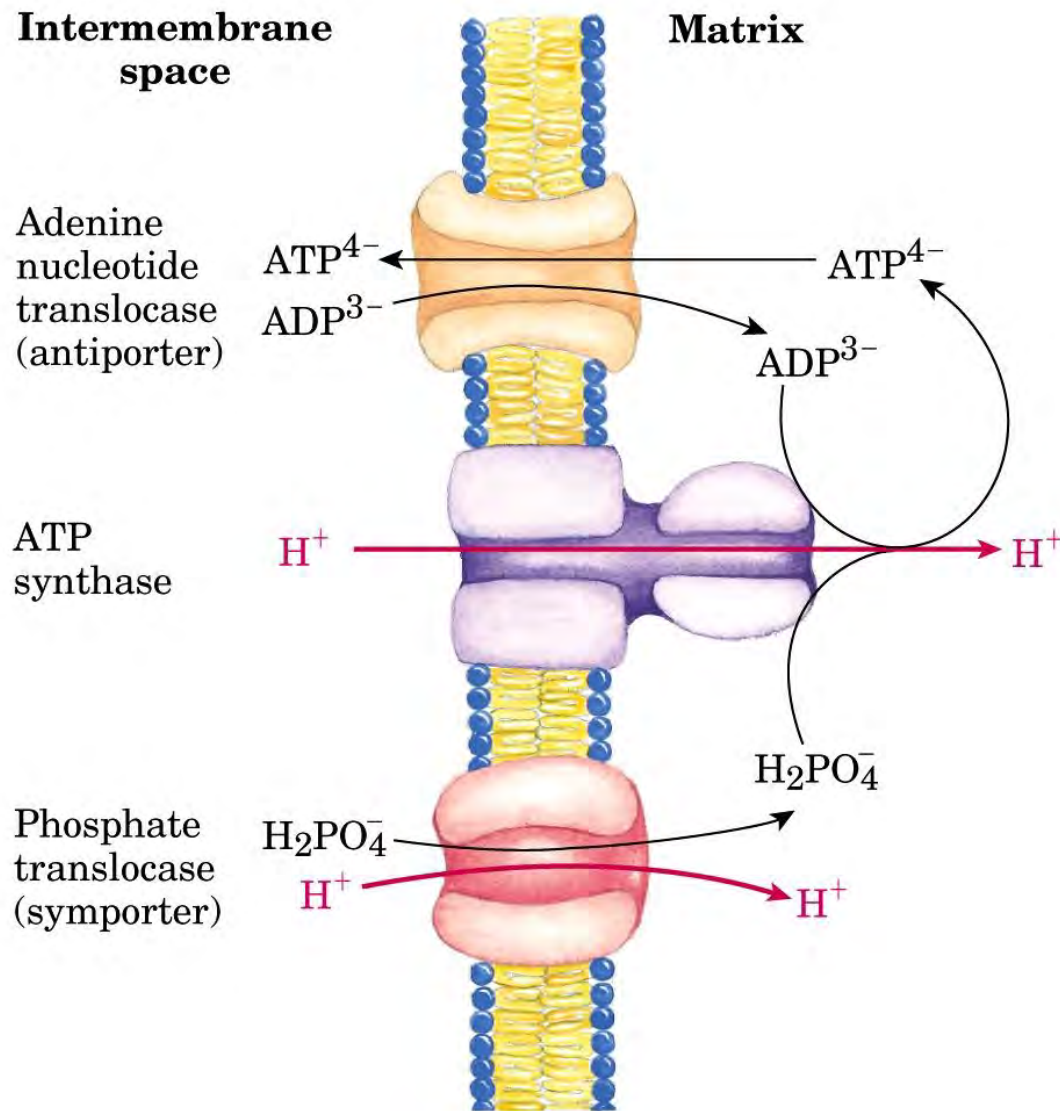
$$\Delta\psi \equiv 0$$

Electron transfer uncoupled  
from ATP synthesis

(b)



# TRASLOCASI DEI NUCLEOTIDI ADENINICI E DEL FOSFATO



# GENERAZIONE DI CALORE MEDIANTE DISACOPPIAMENTO MITOCONDRIALE: LA TERMOGENINA

