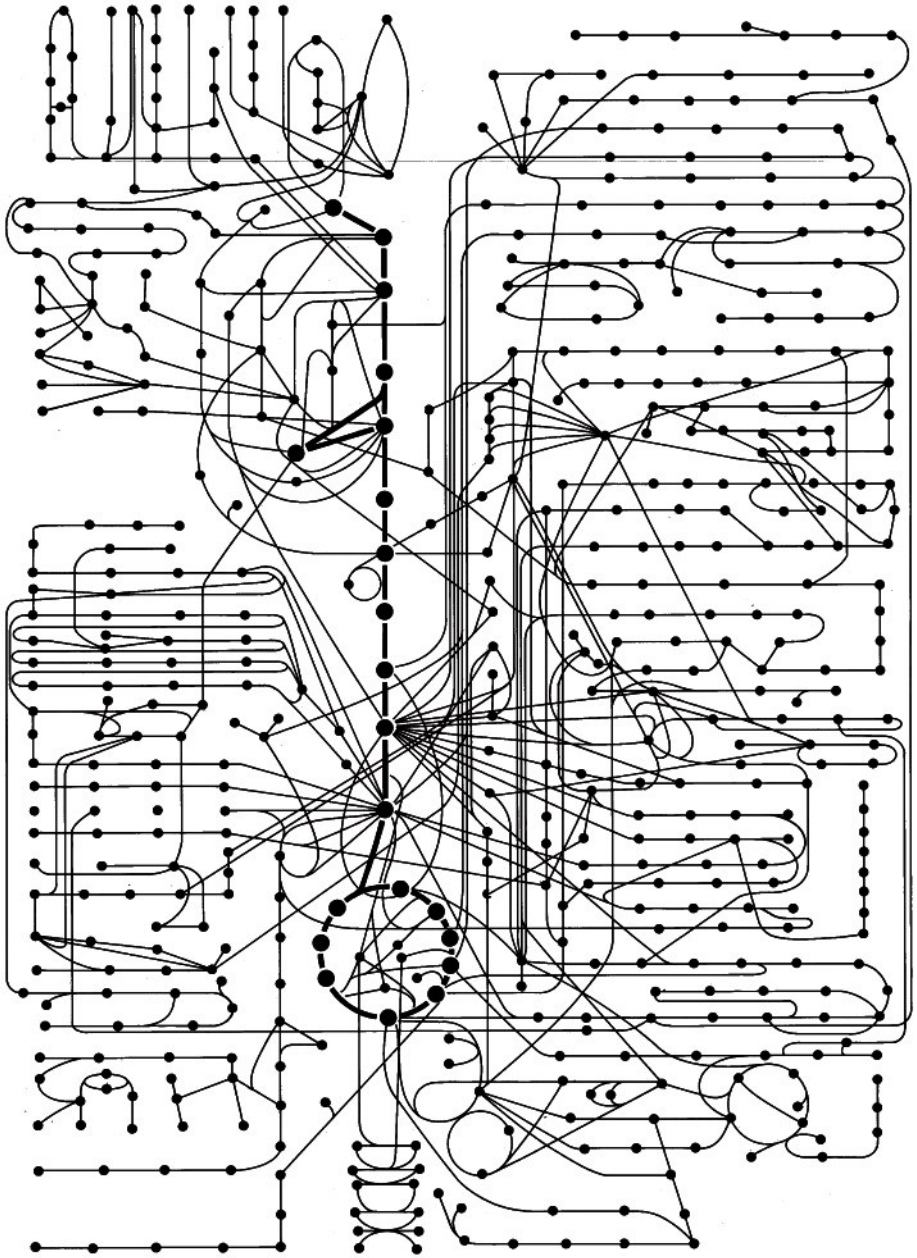
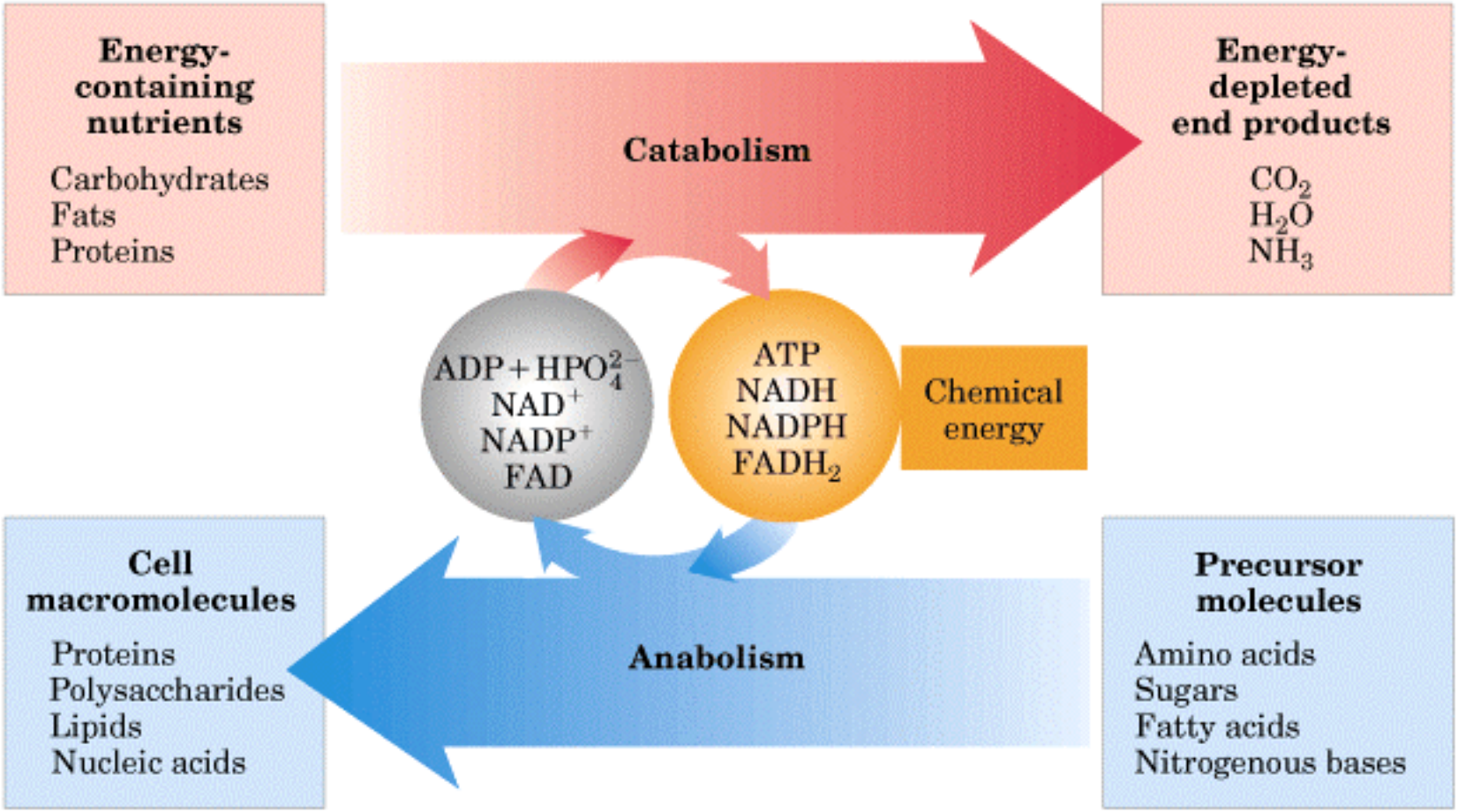
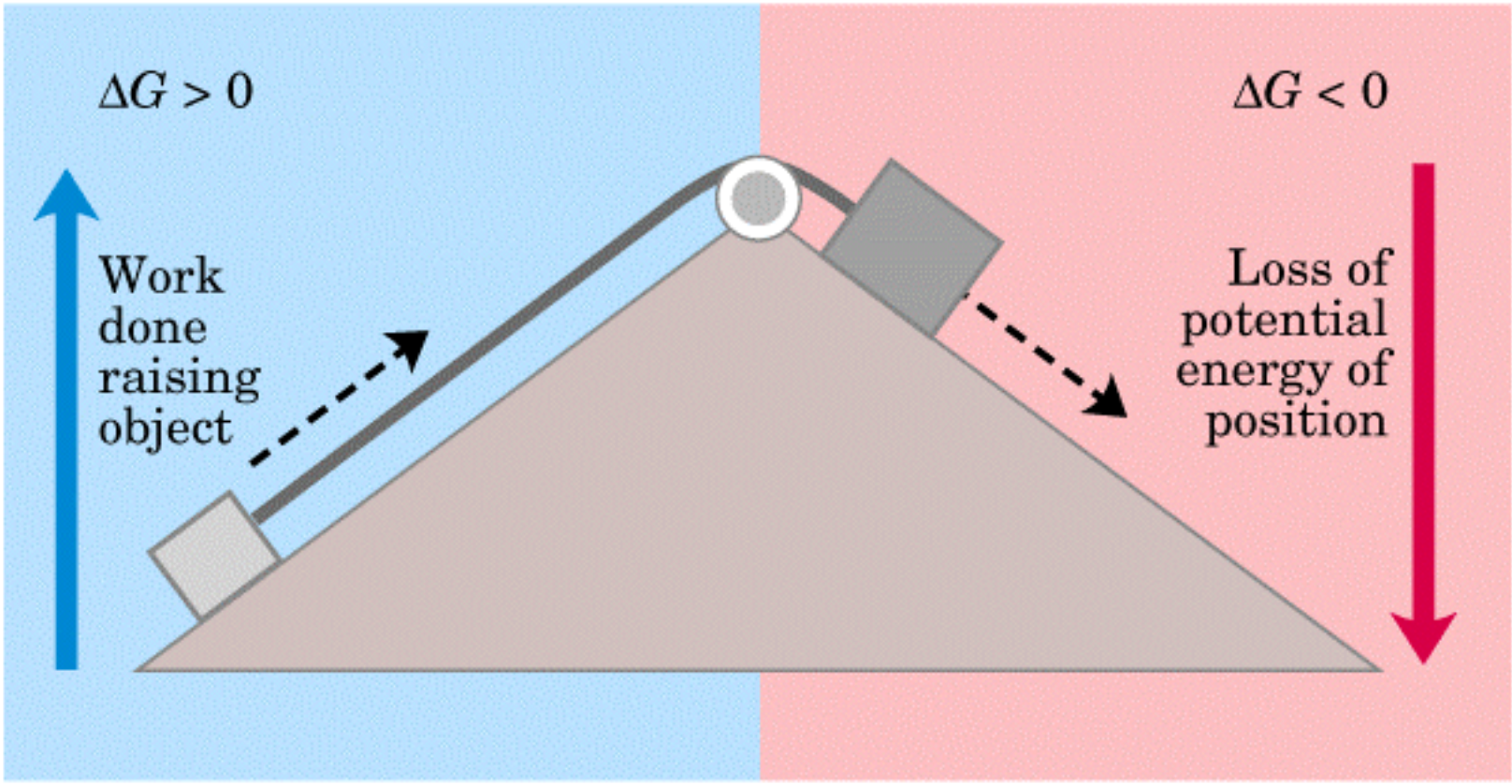


Figure 2-35 *Molecular Biology of the Cell* (© Garland Science 2008)


Energy-containing nutrients
Carbohydrates
Fats
Proteins
Catabolism
Energy-depleted end products
CO_2
H_2O
NH_3
$ADP + HPO_4^{2-}$
NAD^+
$NADP^+$
FAD
ATP
NADH
NADPH
$FADH_2$
Chemical energy
Cell macromolecules
Proteins
Polysaccharides
Lipids
Nucleic acids
Anabolism
Precursor molecules
Amino acids
Sugars
Fatty acids
Nitrogenous bases

(a) Mechanical example



$$\Delta G'^{\circ} = -RT \ln K'_{\mathrm{eq}}$$

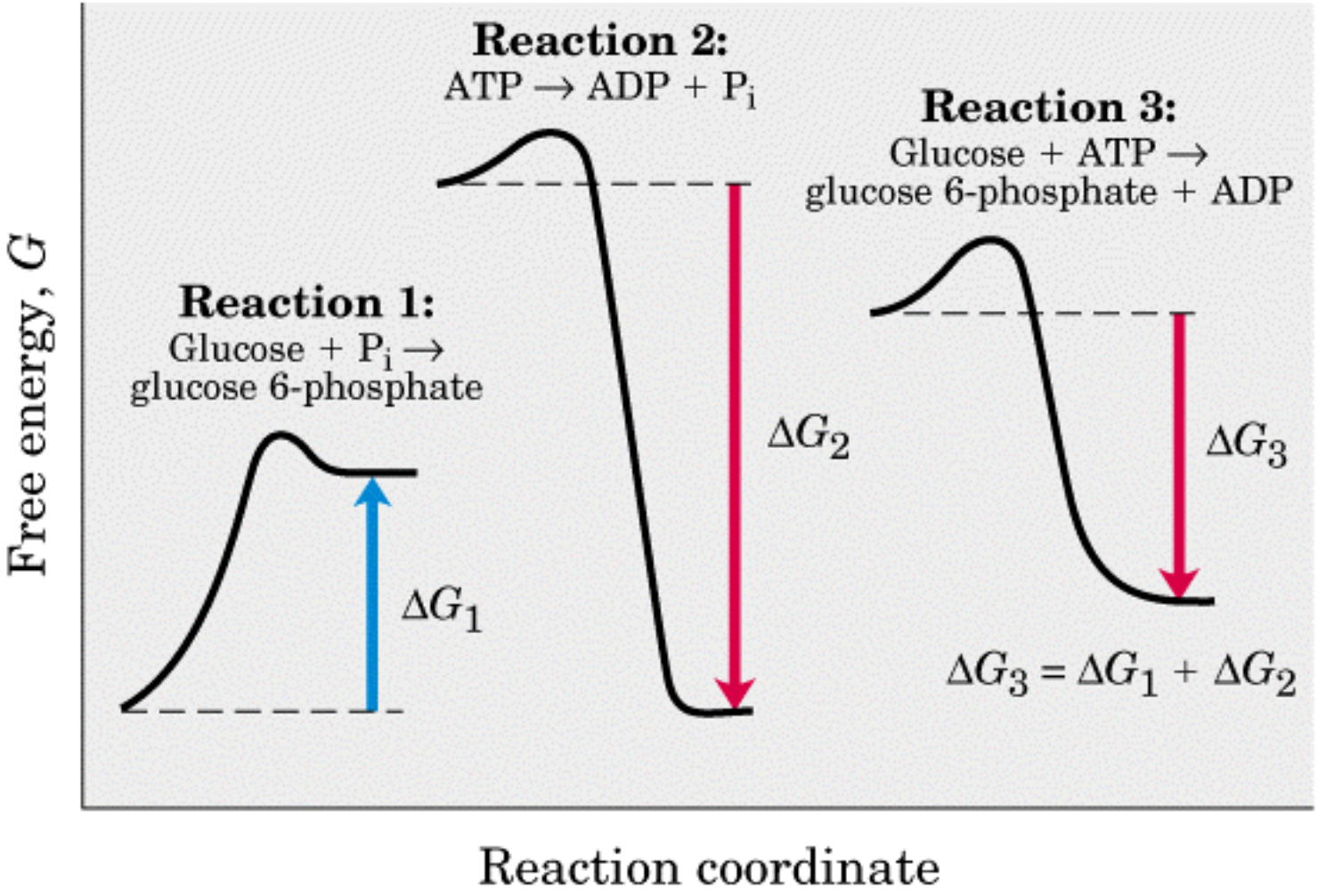
table 14–3

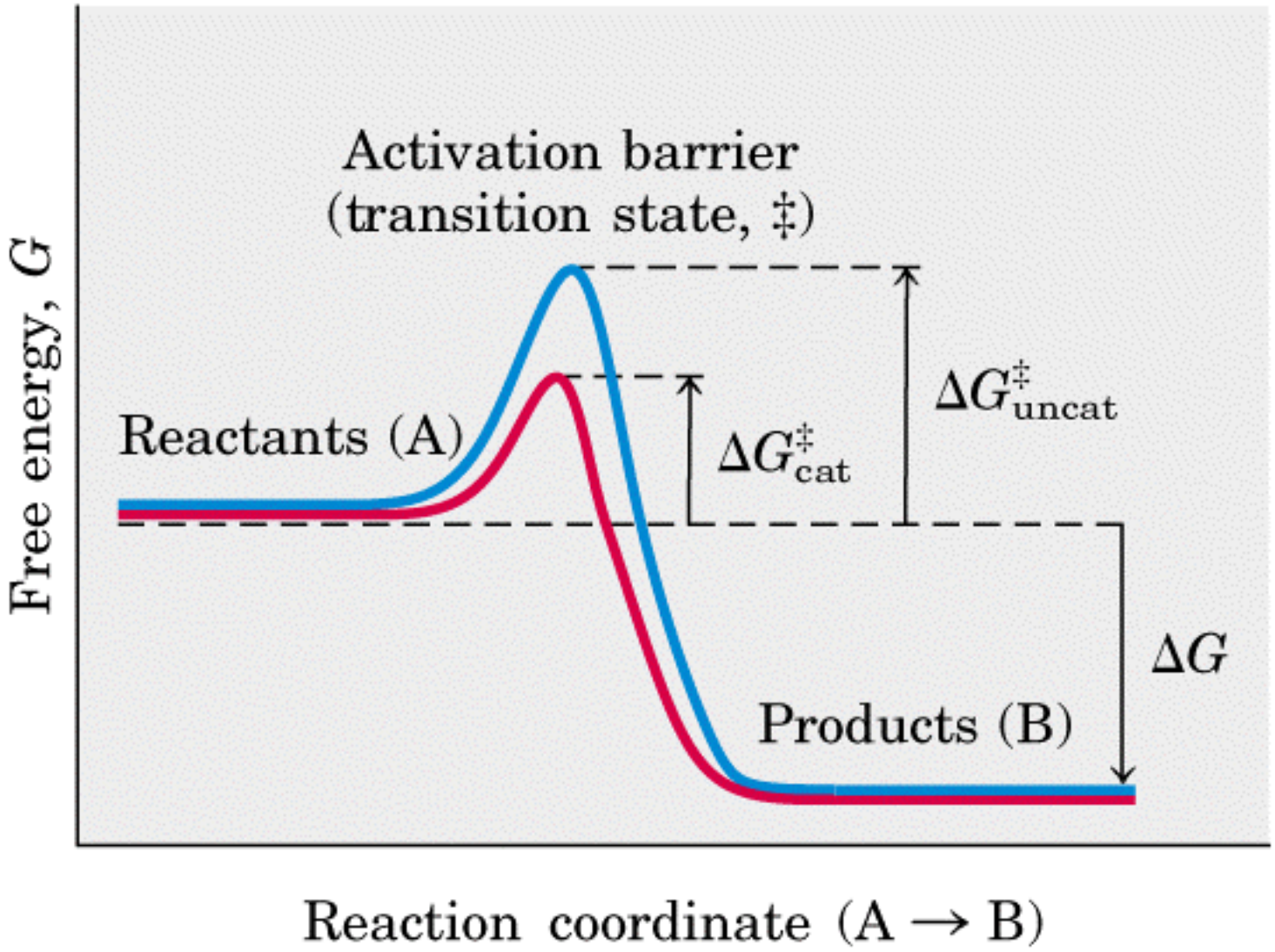
Relationships among K'_{eq}, $\Delta G'^{\circ}$, and the Direction of Chemical Reactions under Standard Conditions

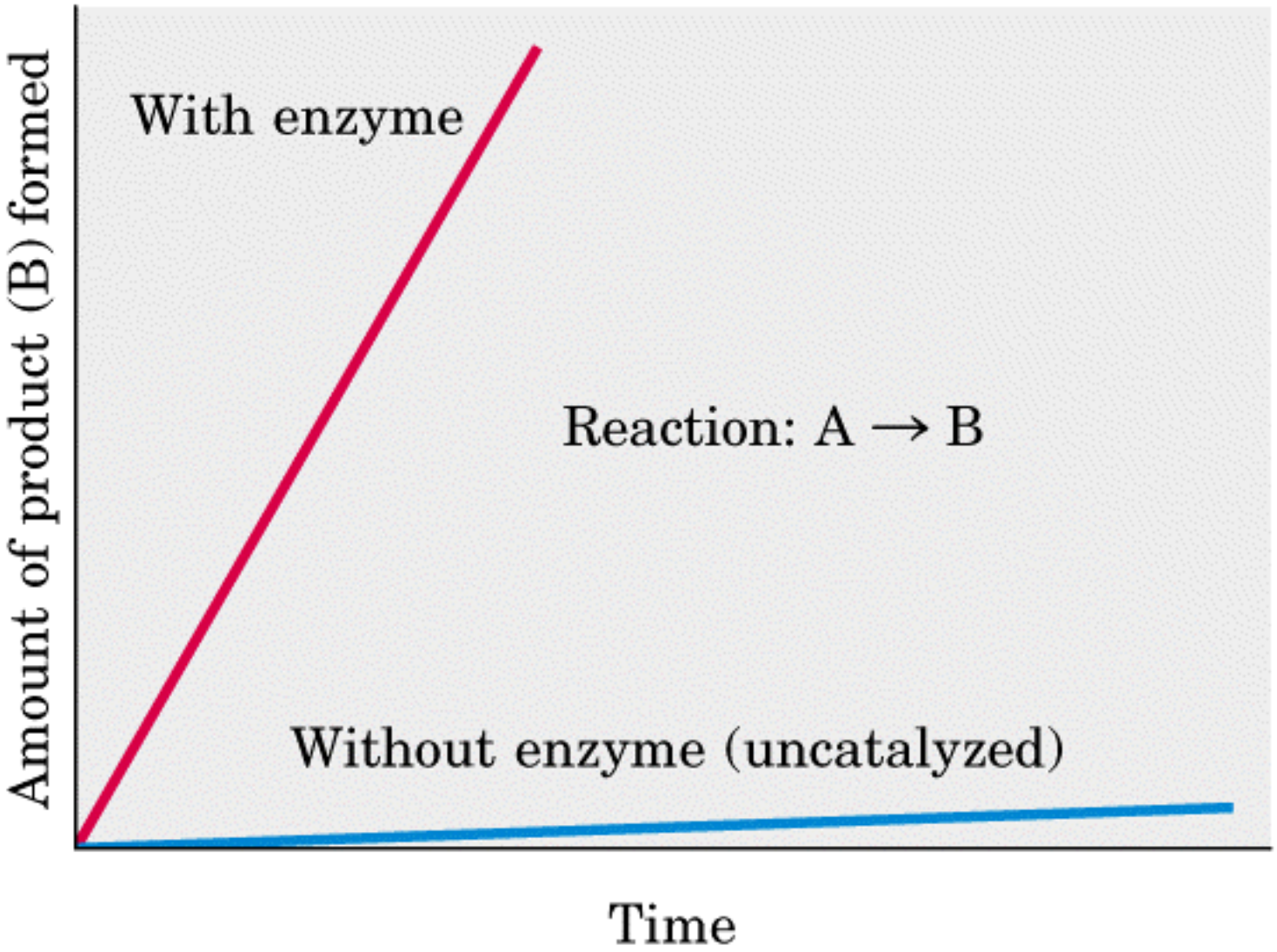
When K'_{eq} is	$\Delta G'^{\circ}$ is	Starting with 1 M components the reaction
>1.0	Negative	Proceeds forward
1.0	Zero	Is at equilibrium
<1.0	Positive	Proceeds in reverse

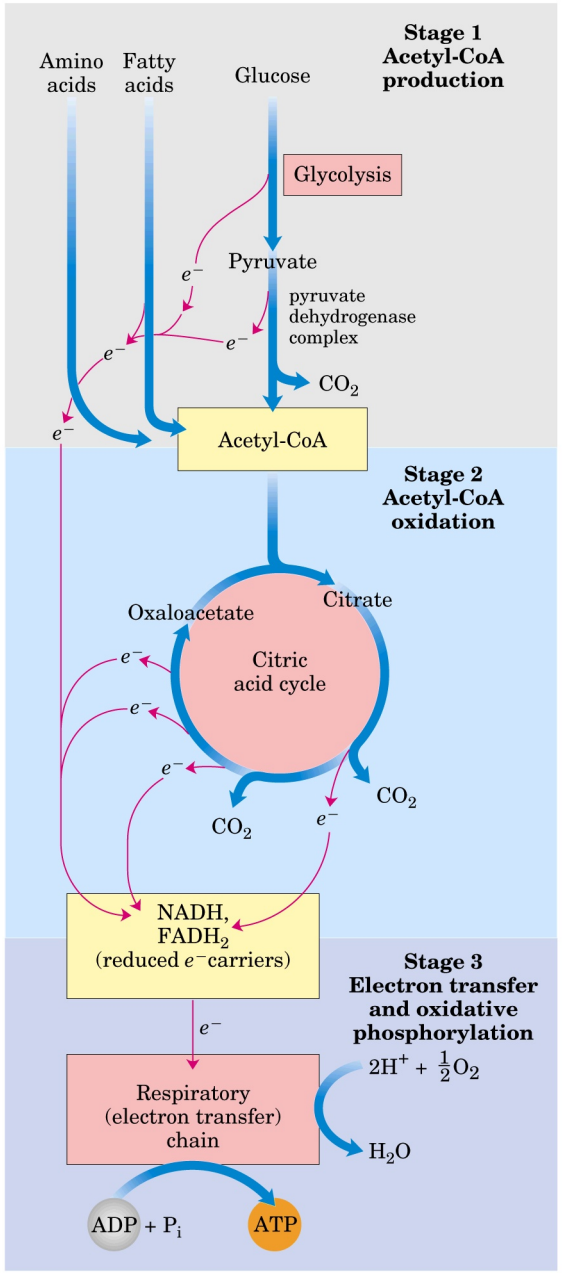
(1)	A	$\longrightarrow$	B	$\Delta G_1'^{\circ}$		
(2)	B	$\longrightarrow$	C	$\Delta G_2'^{\circ}$		
Sum:	A	$\longrightarrow$	C	$\Delta G_1'^{\circ}$	+	$\Delta G_2'^{\circ}$

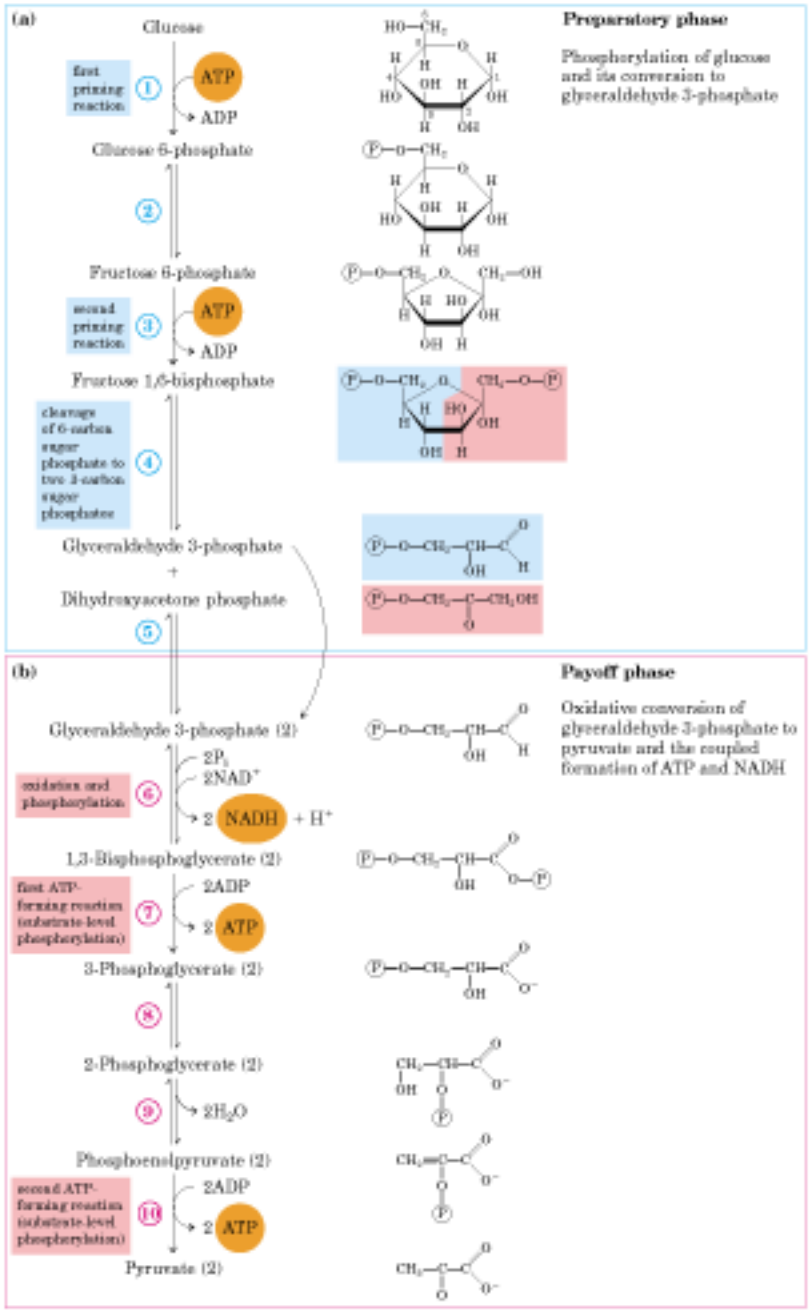
(b) Chemical example

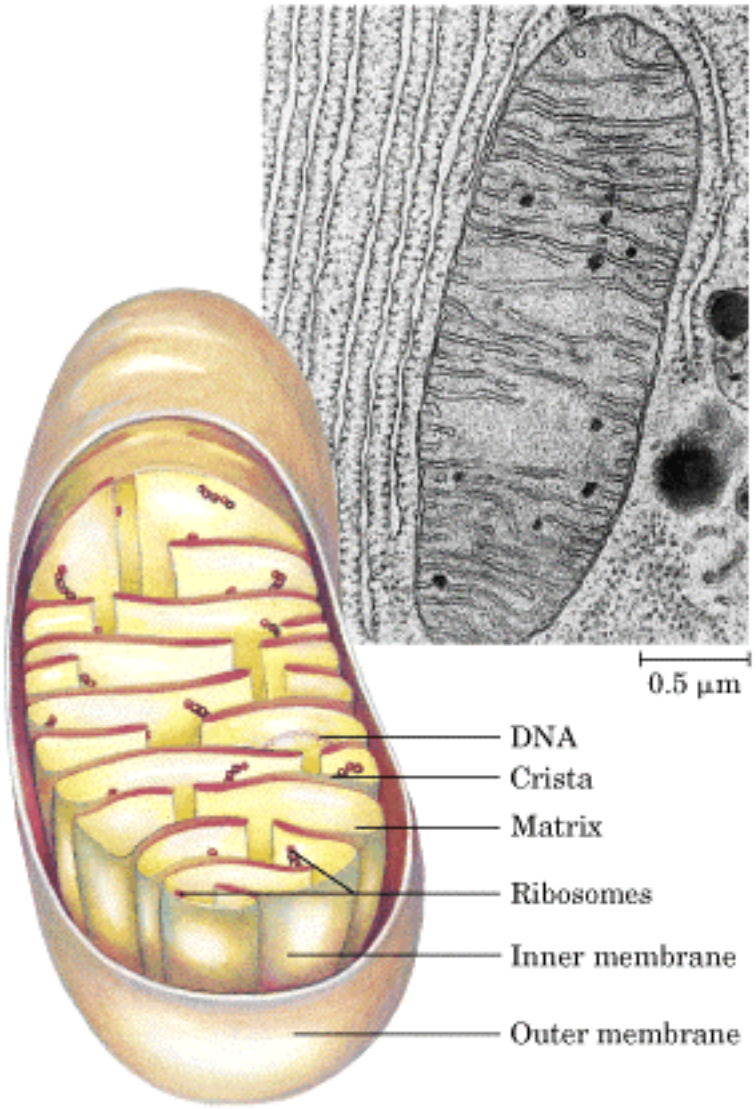


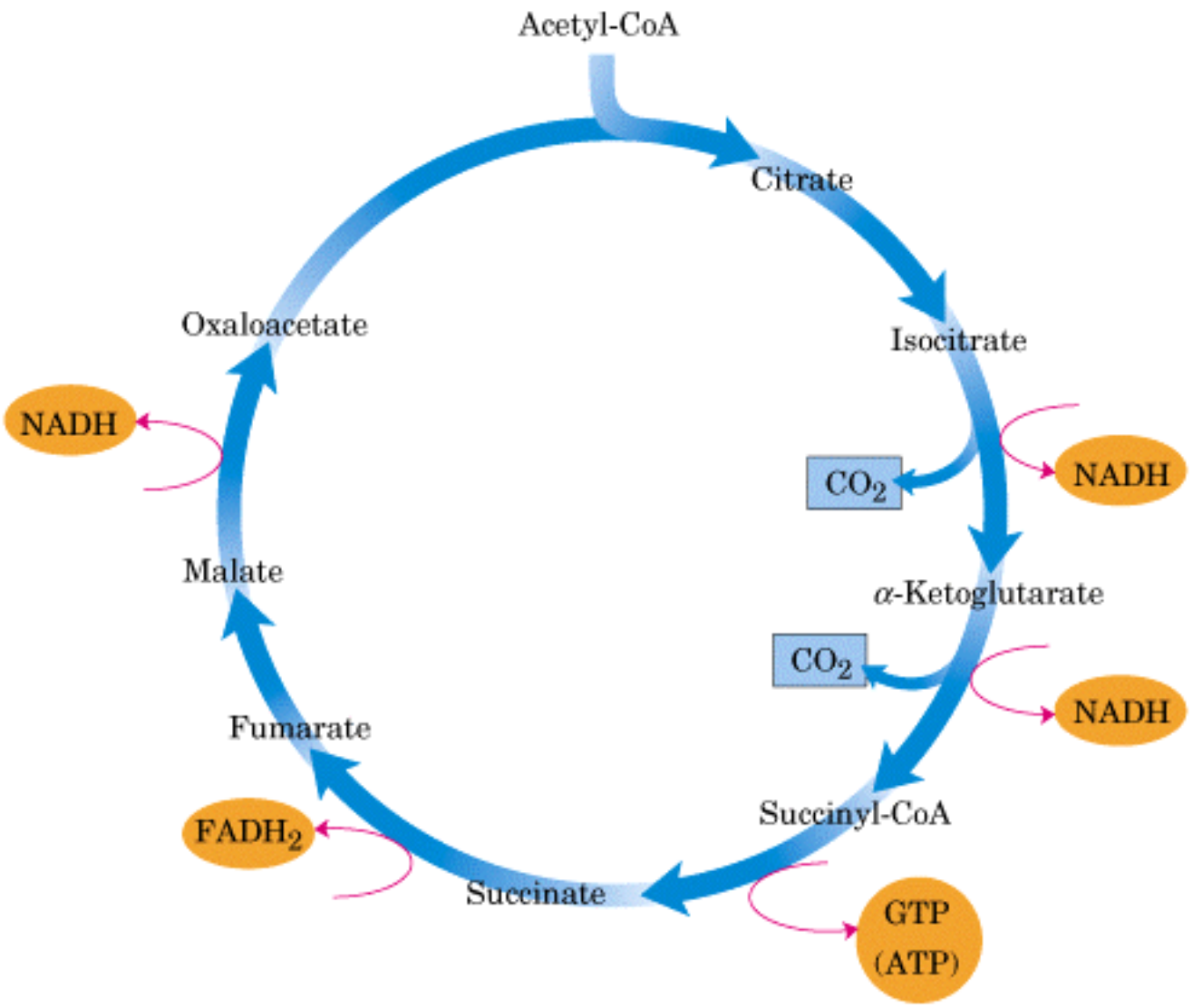

Activation barrier
(transition state, ‡)
Reactants (A)
$\Delta G^{\ddagger}_{cat}$
$\Delta G^{\ddagger}_{uncat}$
ΔG
Products (B)
Free energy, G
Reaction coordinate (A → B)


With enzyme
Reaction: A → B
Without enzyme (uncatalyzed)
Amount of product (B) formed
Time


Stage 1
Acetyl-CoA
production
Amino
acids
Fatty
acids
Glucose
Glycolysis
Pyruvate
pyruvate
dehydrogenase
complex
e^-
CO_2
Acetyl-CoA
Stage 2
Acetyl-CoA
oxidation
Oxaloacetate
Citrate
Citric
acid cycle
CO_2
CO_2
NADH,
$FADH_2$
(reduced e^-carriers)
Stage 3
Electron transfer
and oxidative
phosphorylation
$2H^+ + \frac{1}{2}O_2$
Respiratory
(electron transfer)
chain
H_2O
ADP + P_i
ATP


(a)
Glucose
first priming reaction
1
ATP
ADP
Glucose 6-phosphate
2
Fructose 6-phosphate
second priming reaction
3
ATP
ADP
Fructose 1,6-bisphosphate
cleavage of 6-carbon sugar phosphate to two 3-carbon sugar phosphates
4
Glyceraldehyde 3-phosphate
+
Dihydroxyacetone phosphate
5
Preparatory phase
Phosphorylation of glucose and its conversion to glyceraldehyde 3-phosphate
(b)
Glyceraldehyde 3-phosphate (2)
oxidation and phosphorylation
6
2 P_i
2 NAD^+
2 NADH + H^+
1,3-Bisphosphoglycerate (2)
first ATP-forming reaction (substrate-level phosphorylation)
7
2 ADP
2 ATP
3-Phosphoglycerate (2)
8
2-Phosphoglycerate (2)
9
2 H_2O
Phosphoenolpyruvate (2)
second ATP-forming reaction (substrate-level phosphorylation)
10
2 ADP
2 ATP
Pyruvate (2)
Payoff phase
Oxidative conversion of glyceraldehyde 3-phosphate to pyruvate and the coupled formation of ATP and NADH


0.5 μm
DNA
Crista
Matrix
Ribosomes
Inner membrane
Outer membrane


Acetyl-CoA
Citrate
Isocitrate
NADH
CO_2
α-Ketoglutarate
CO_2
NADH
Succinyl-CoA
GTP
(ATP)
Succinate
$FADH_2$
Fumarate
Malate
NADH
Oxaloacetate

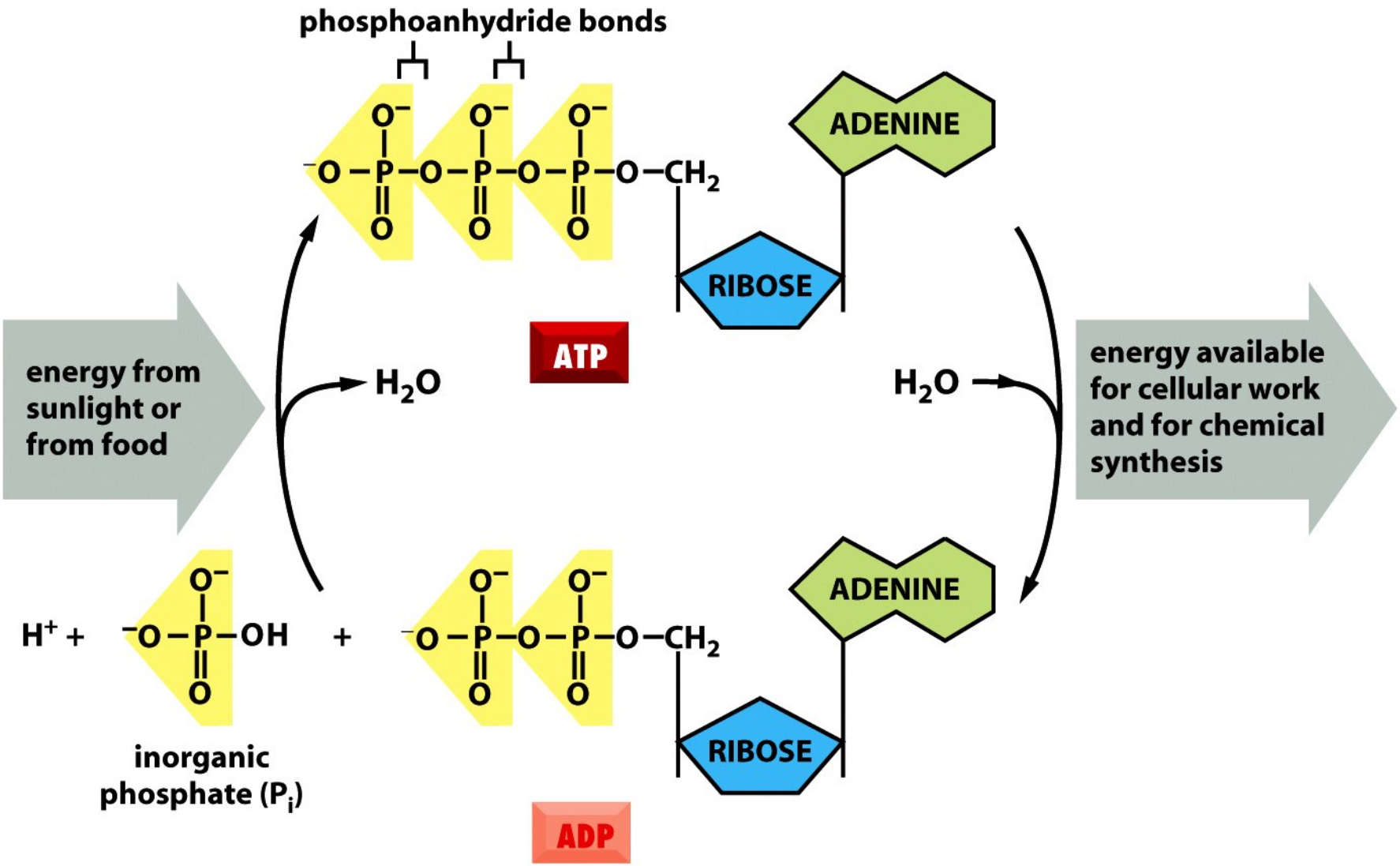
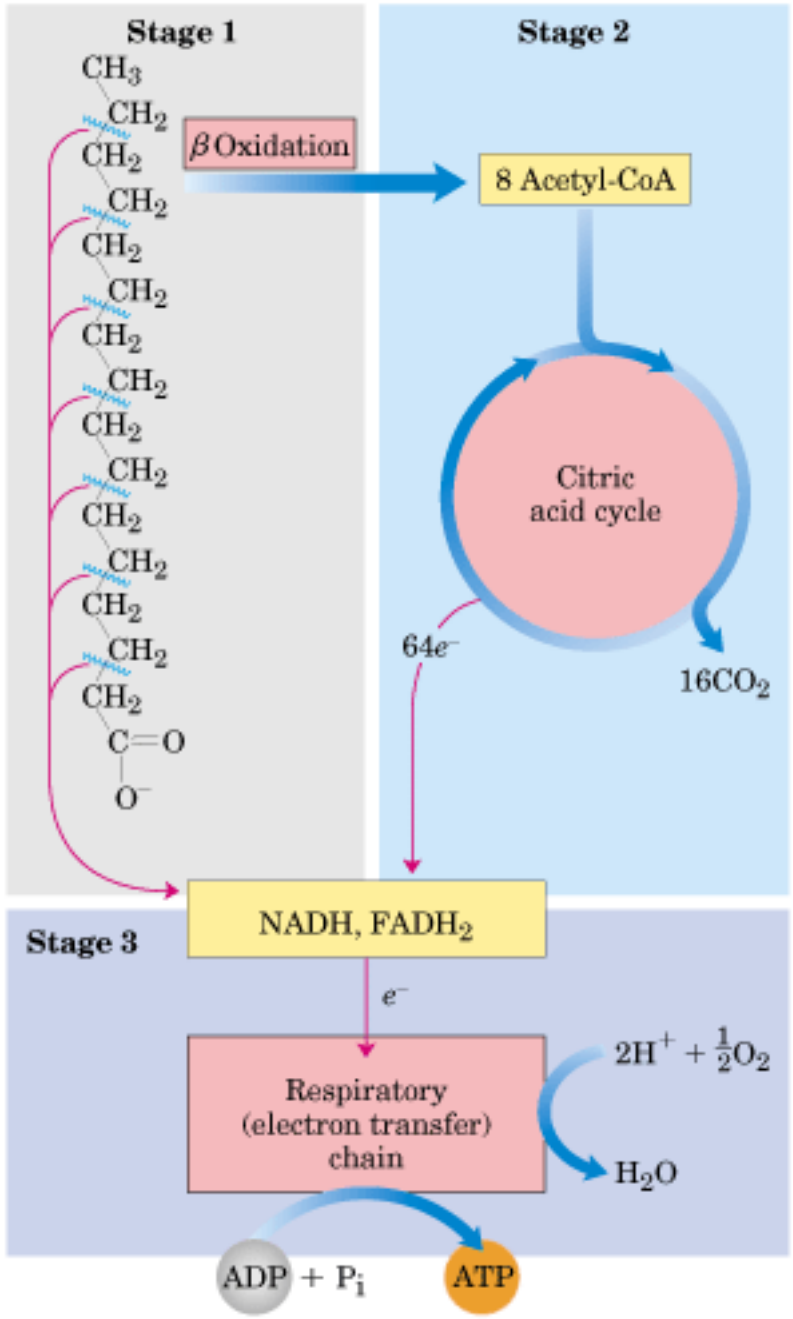
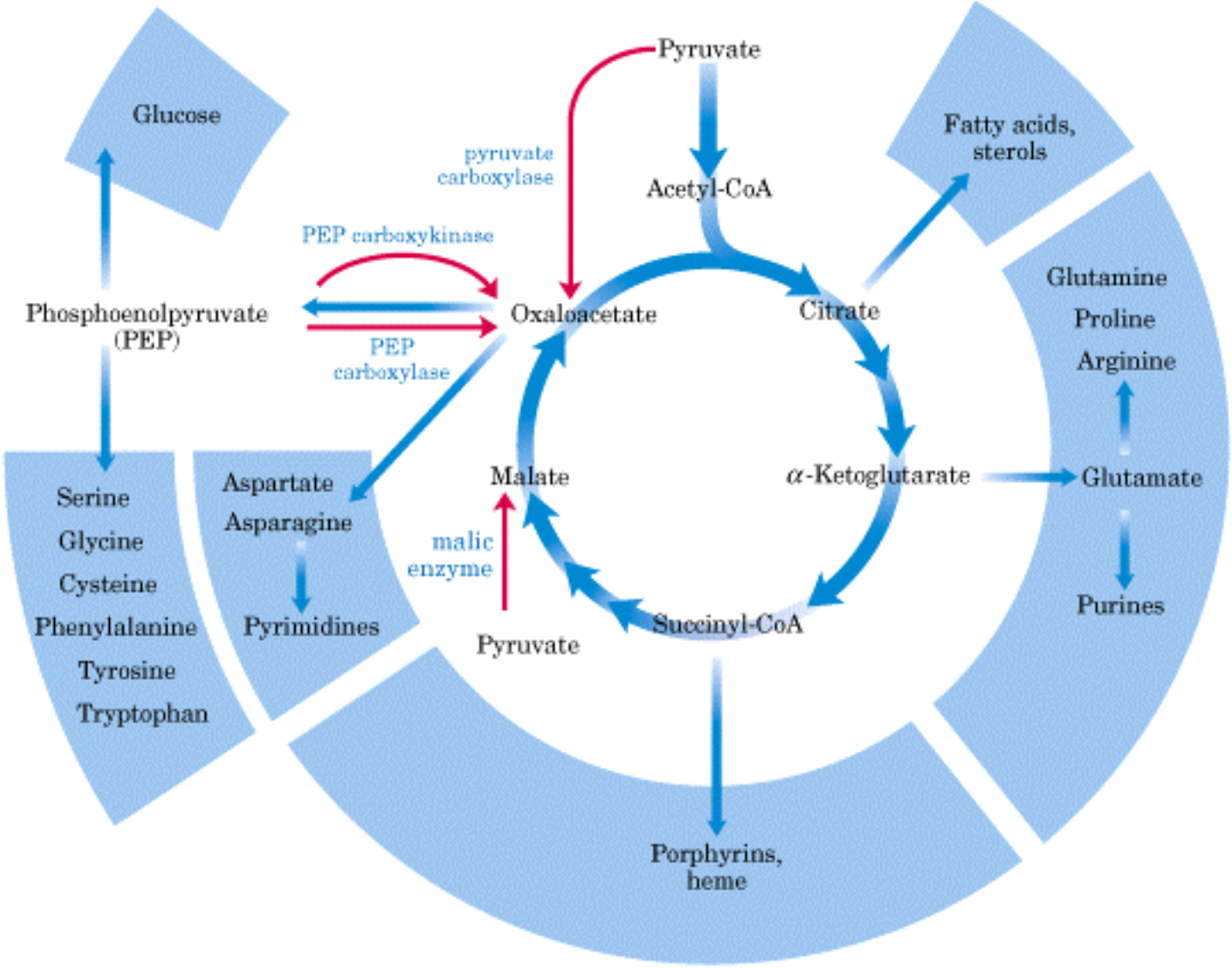
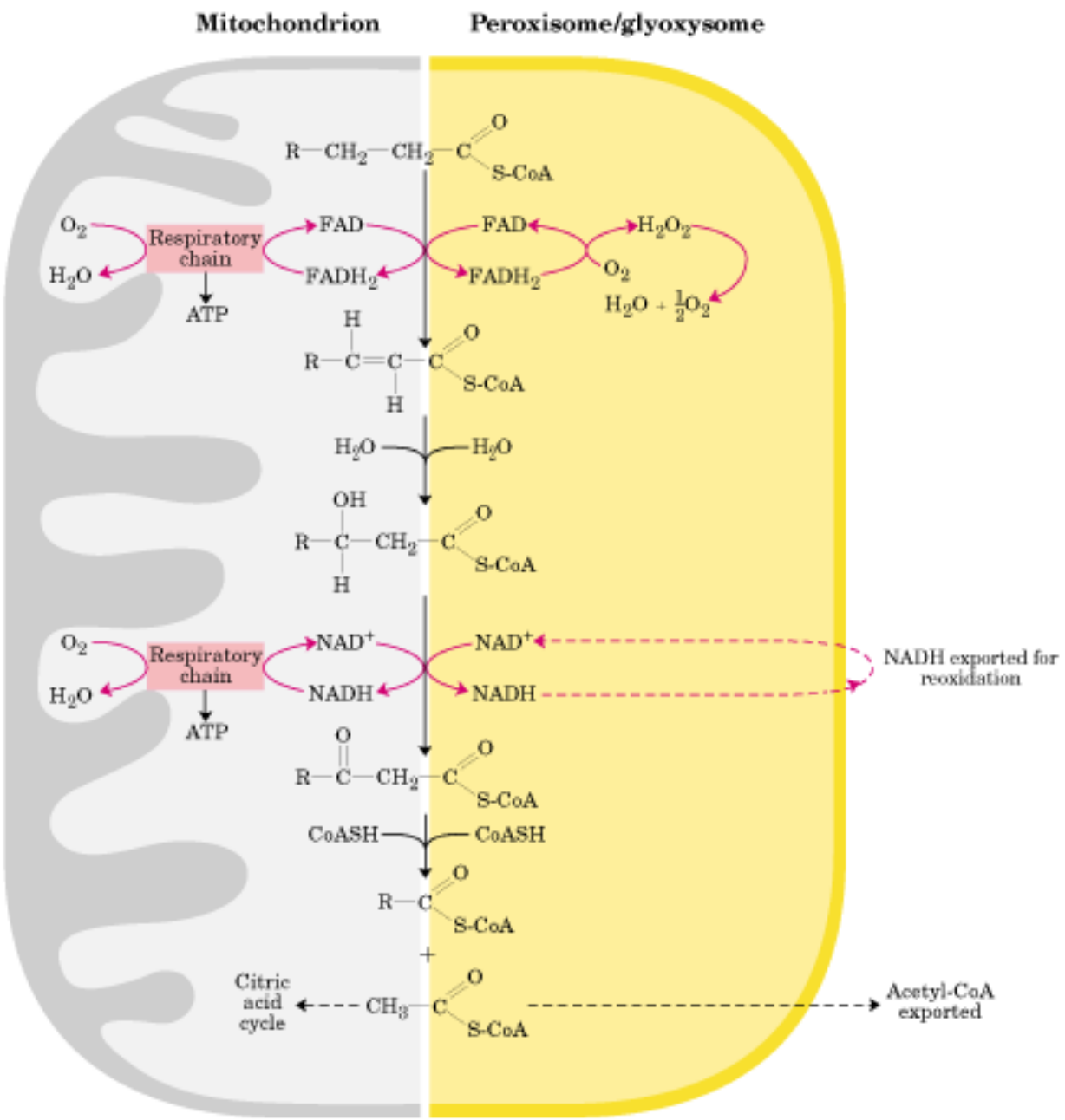


Figure 2-27 *Molecular Biology of the Cell* (© Garland Science 2008)


Stage 1
Stage 2
CH3
CH2
CH2
CH2
CH2
CH2
CH2
CH2
CH2
CH2
CH2
CH2
CH2
C=O
O−
β Oxidation
8 Acetyl-CoA
Citric acid cycle
64e−
16CO2
NADH, FADH2
Stage 3
e−
Respiratory (electron transfer) chain
2H+ + ½O2
H2O
ADP + Pi
ATP


Glucose
Pyruvate
pyruvate carboxylase
Acetyl-CoA
Fatty acids, sterols
PEP carboxykinase
Phosphoenolpyruvate (PEP)
Oxaloacetate
Citrate
PEP carboxylase
Glutamine
Proline
Arginine
Serine
Glycine
Cysteine
Phenylalanine
Tyrosine
Tryptophan
Aspartate
Asparagine
Malate
α-Ketoglutarate
Glutamate
malic enzyme
Pyrimidines
Pyruvate
Succinyl-CoA
Purines
Porphyrins, heme


Mitochondrion
Peroxisome/glyoxysome
R—CH2—CH2—C(=O)—S-CoA
O2
H2O
Respiratory chain
ATP
FAD
FADH2
FAD
FADH2
H2O2
O2
H2O + ½O2
H
R—C=C—C(=O)—S-CoA
H
H2O
H2O
OH
R—C—CH2—C(=O)—S-CoA
H
O2
H2O
Respiratory chain
ATP
NAD+
NADH
NAD+
NADH
NADH exported for reoxidation
O
R—C—CH2—C(=O)—S-CoA
CoASH
CoASH
R—C(=O)—S-CoA
+
Citric acid cycle
CH3—C(=O)—S-CoA
Acetyl-CoA exported

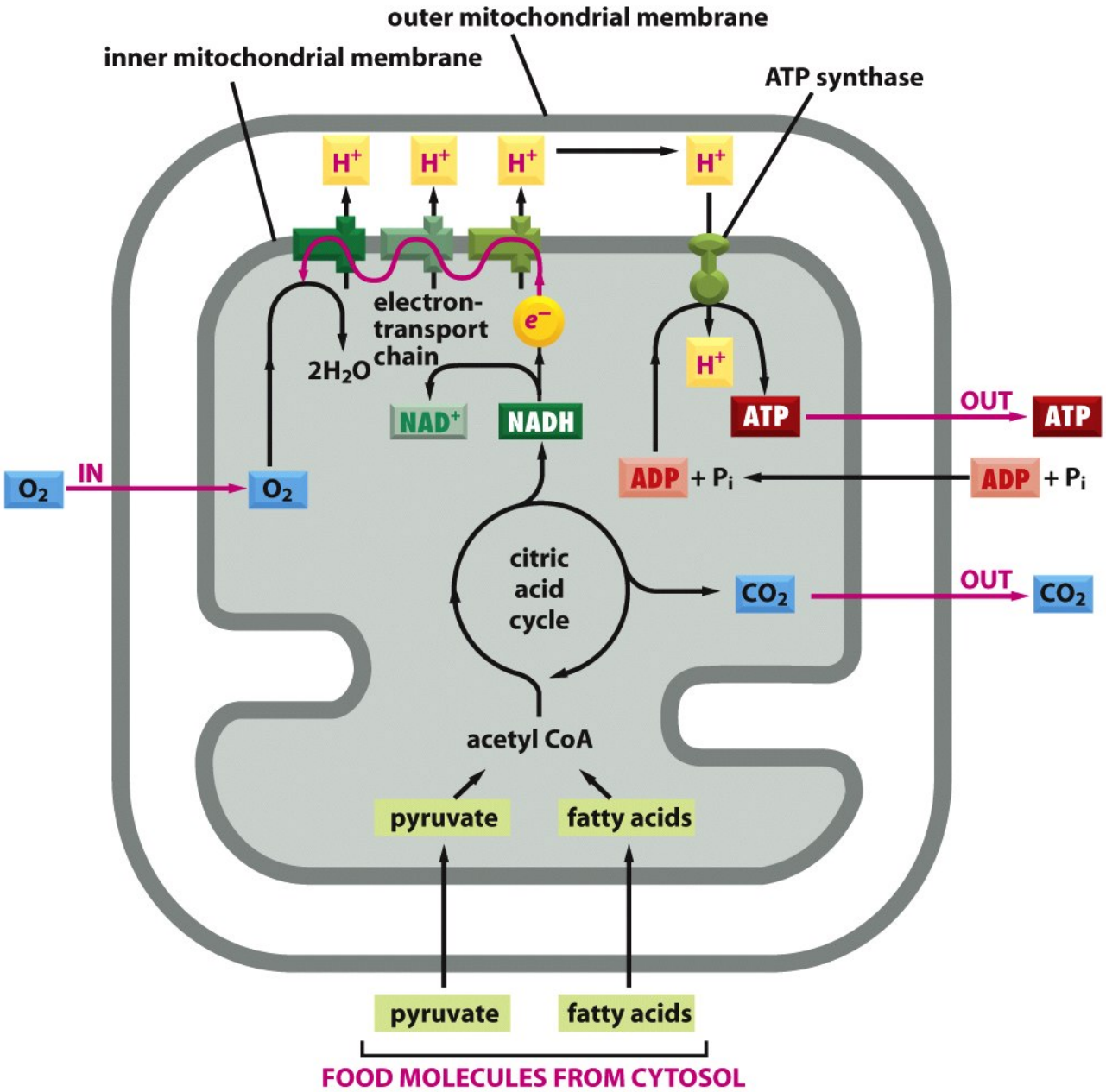
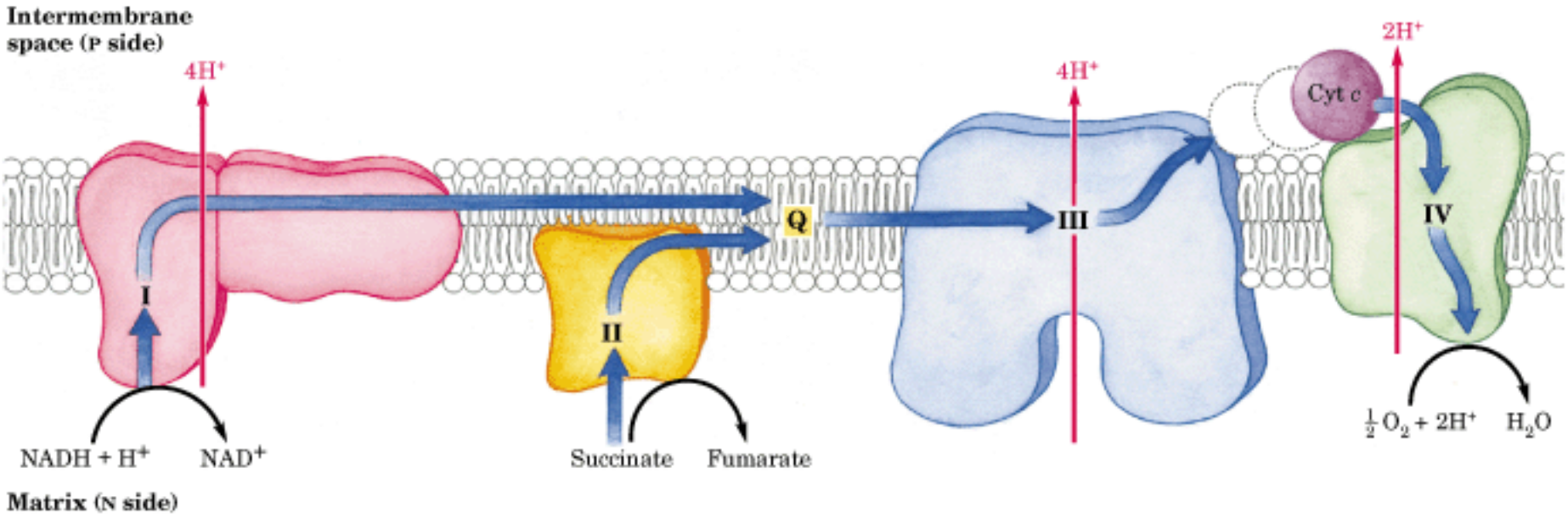


Figure 14-10 *Molecular Biology of the Cell* (© Garland Science 2008)


Intermembrane space (P side)
4H+
4H+
2H+
Cyt c
Q
I
II
III
IV
NADH + H+
NAD+
Succinate
Fumarate
½ O2 + 2H+
H2O
Matrix (N side)

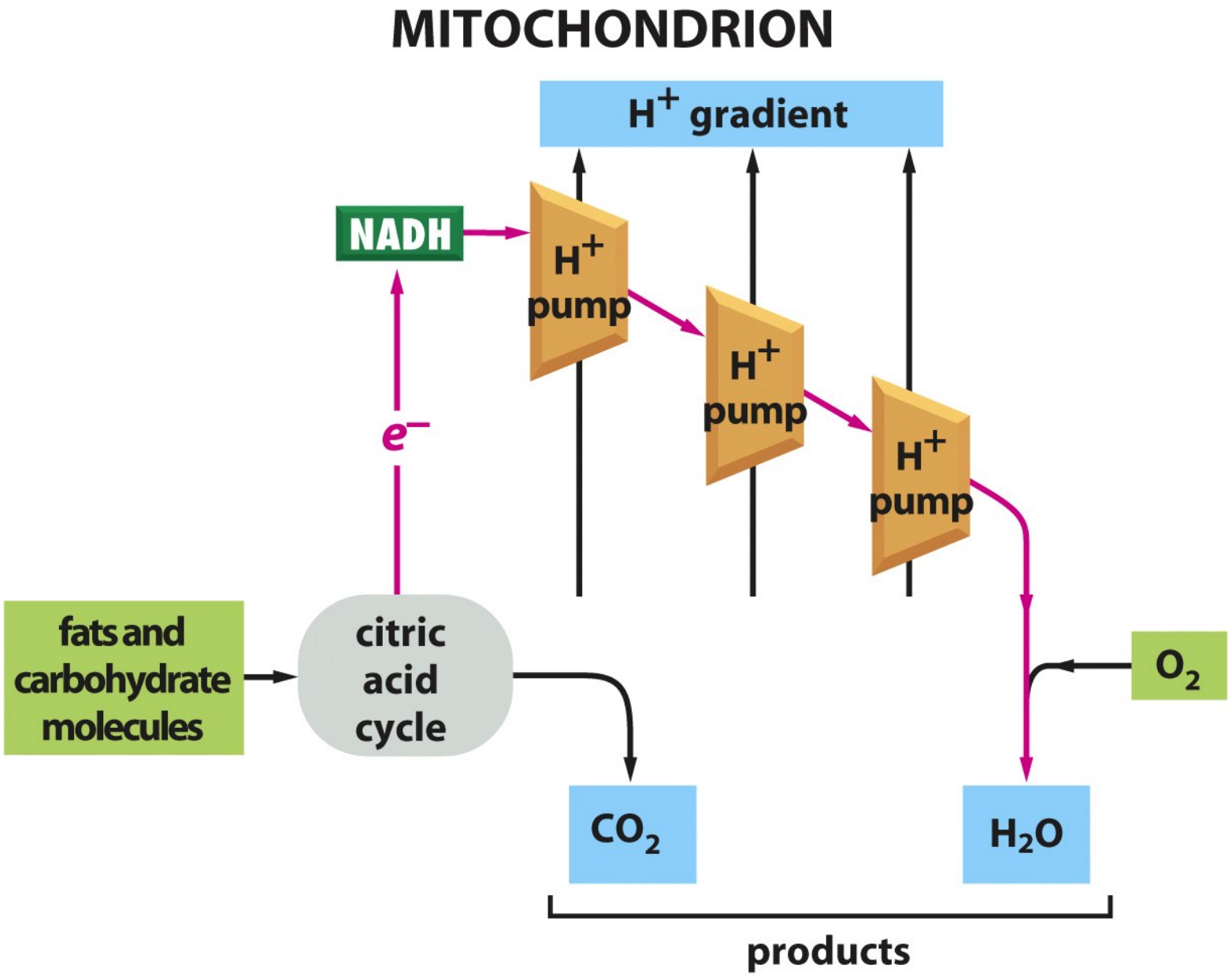


Figure 14-3a *Molecular Biology of the Cell* (© Garland Science 2008)

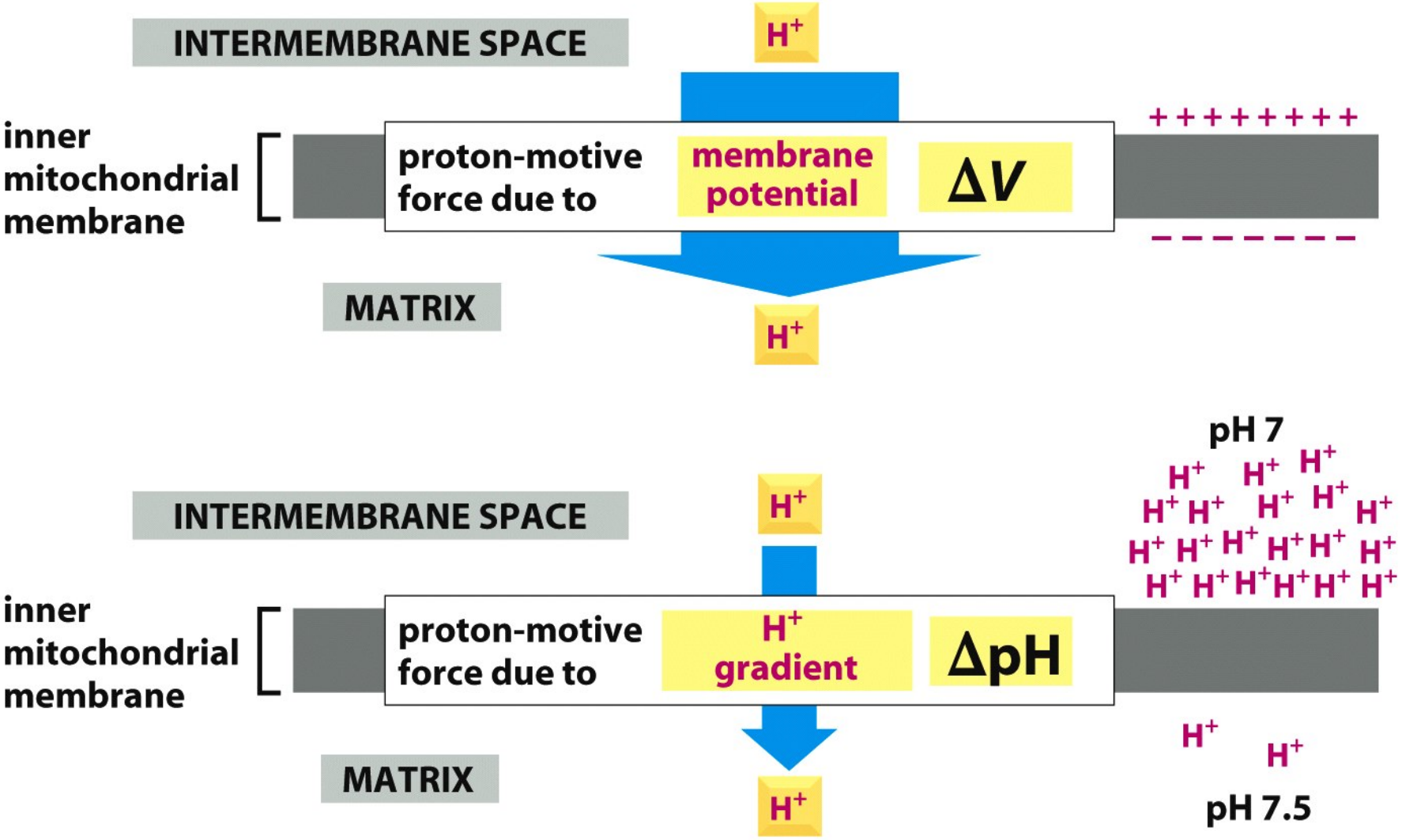


Figure 14-13 *Molecular Biology of the Cell* (© Garland Science 2008)

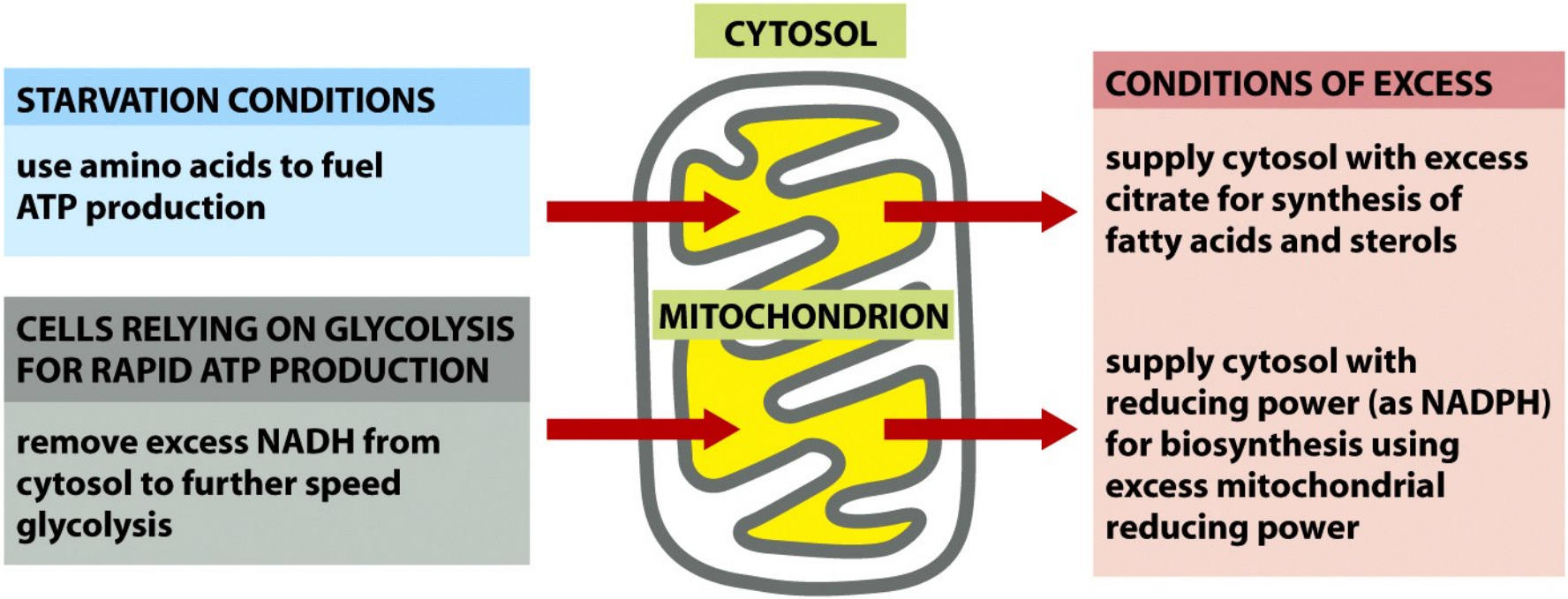
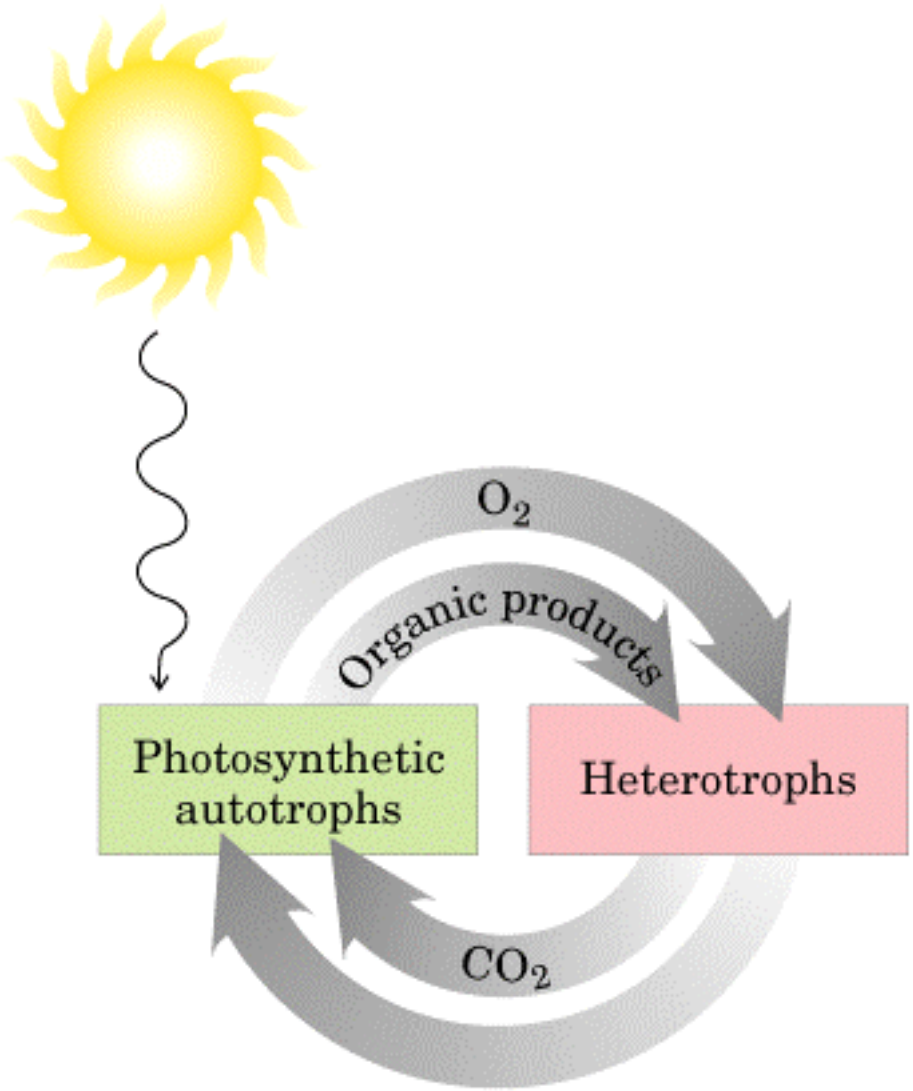


Figure 14-32 *Molecular Biology of the Cell* (© Garland Science 2008)


O_2
Organic products
Photosynthetic autotrophs
Heterotrophs
CO_2

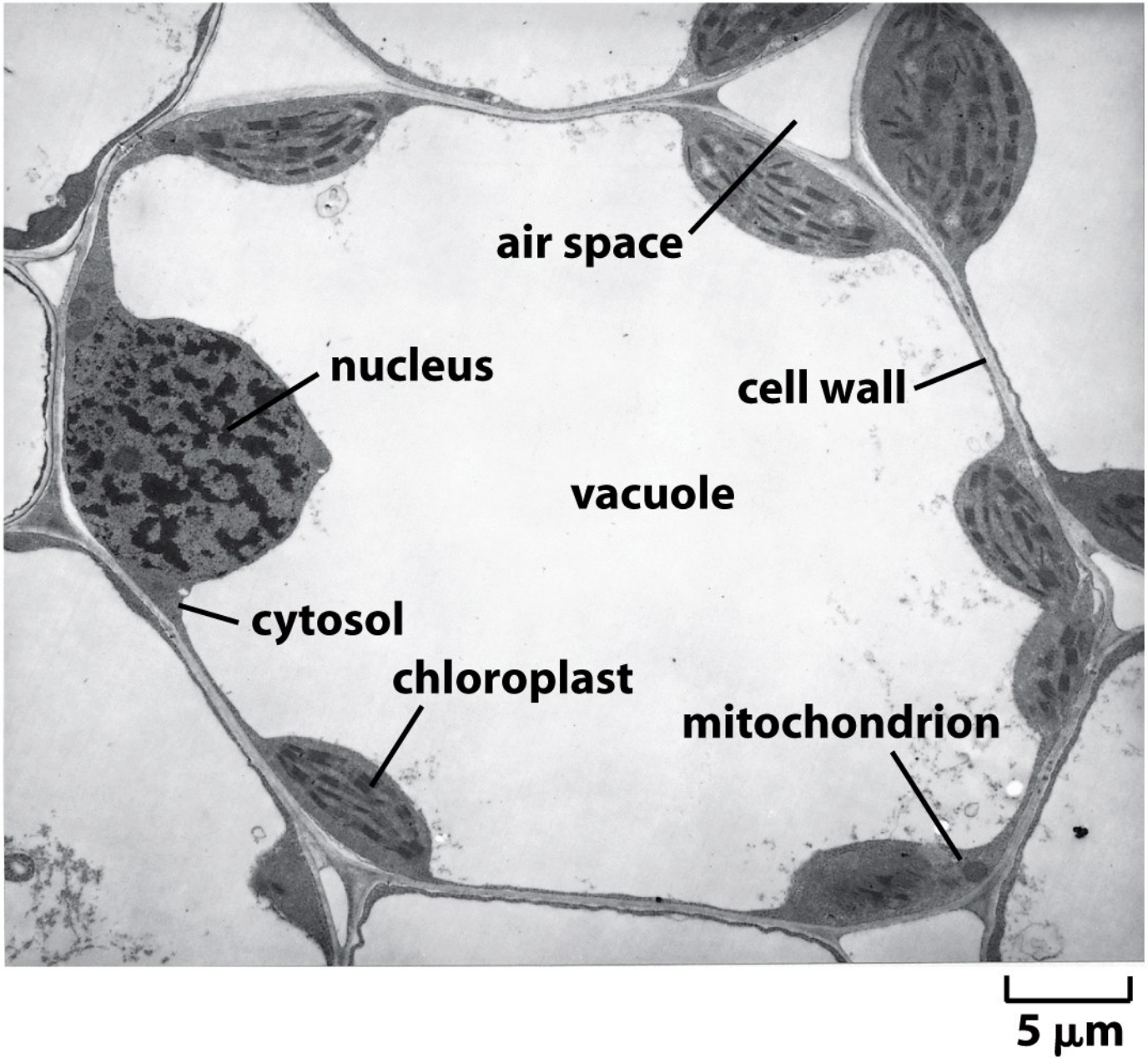


Figure 14-35a *Molecular Biology of the Cell* (© Garland Science 2008)

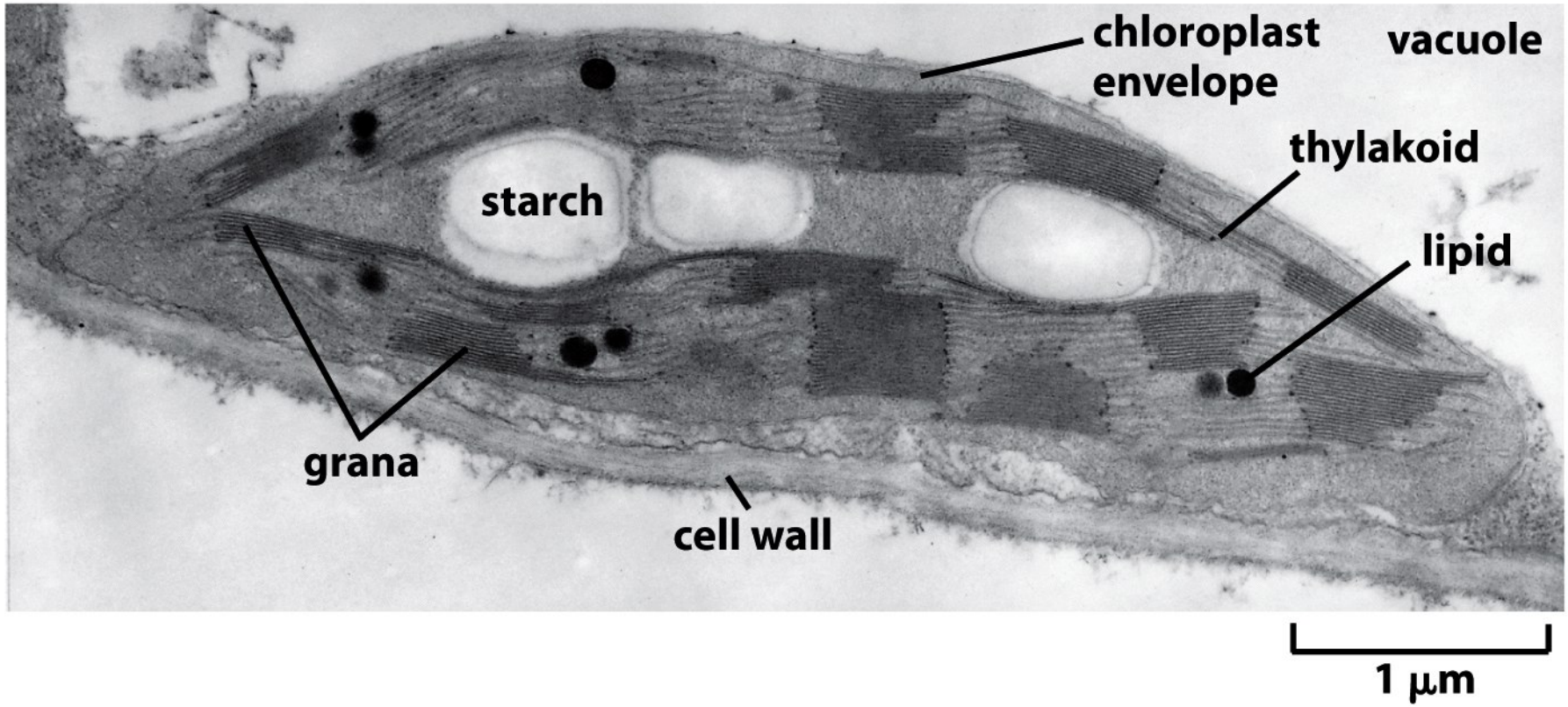


Figure 14-35b *Molecular Biology of the Cell* (© Garland Science 2008)

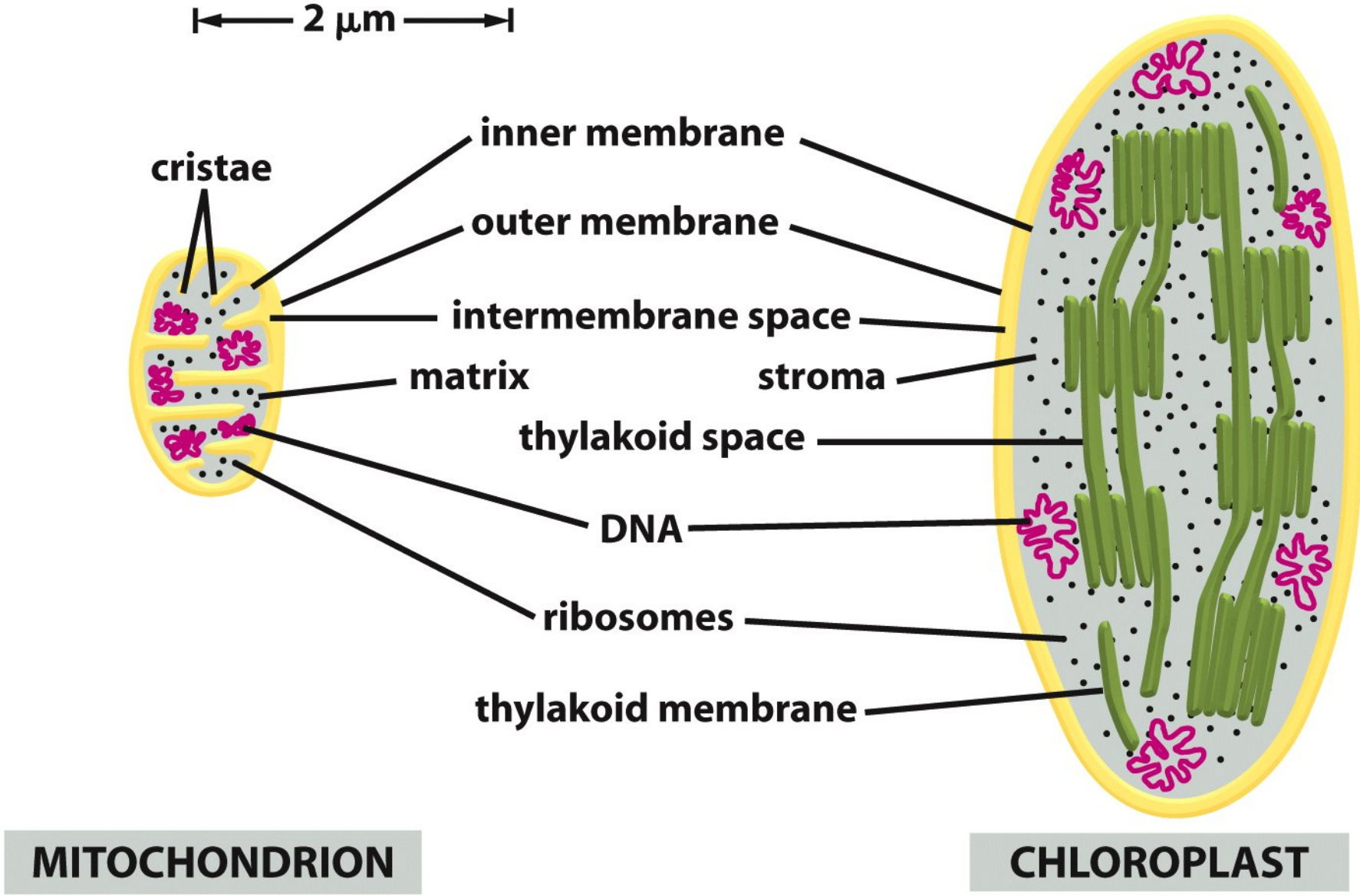


Figure 14-37 *Molecular Biology of the Cell* (© Garland Science 2008)

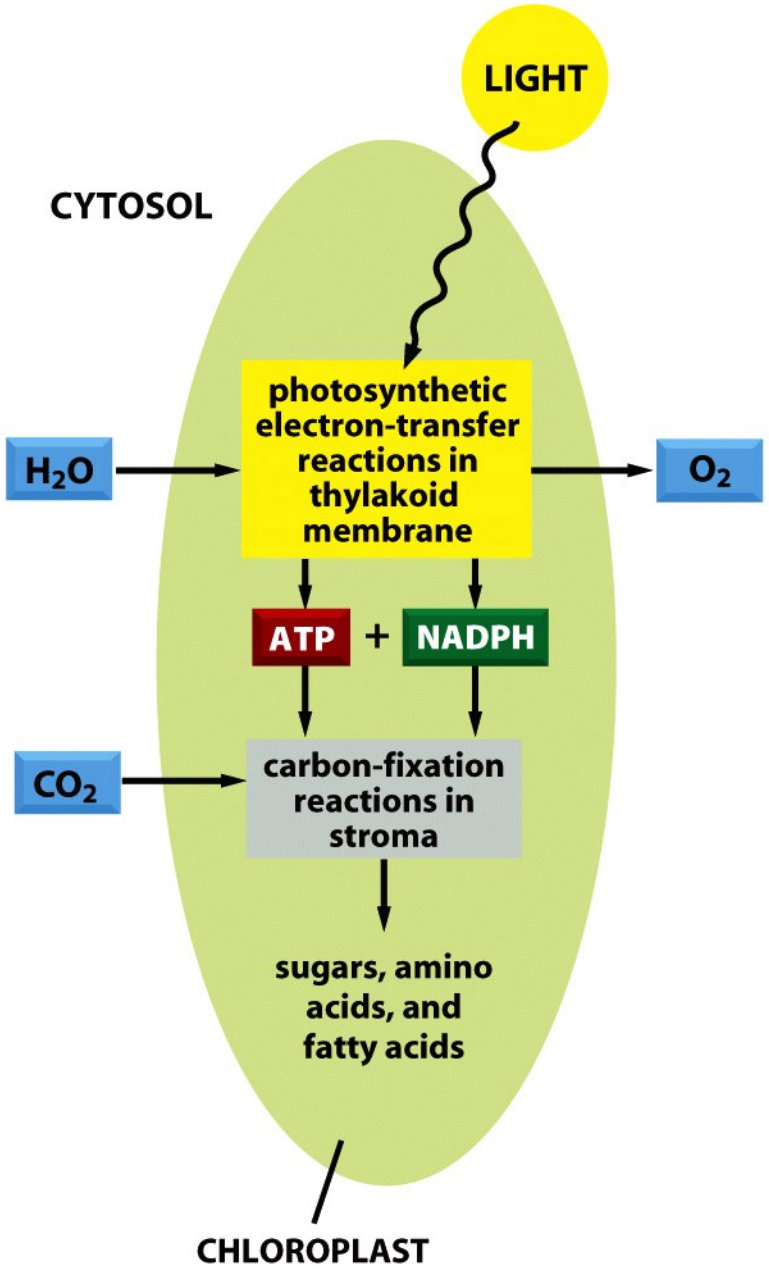


Figure 14-38 *Molecular Biology of the Cell* (© Garland Science 2008)

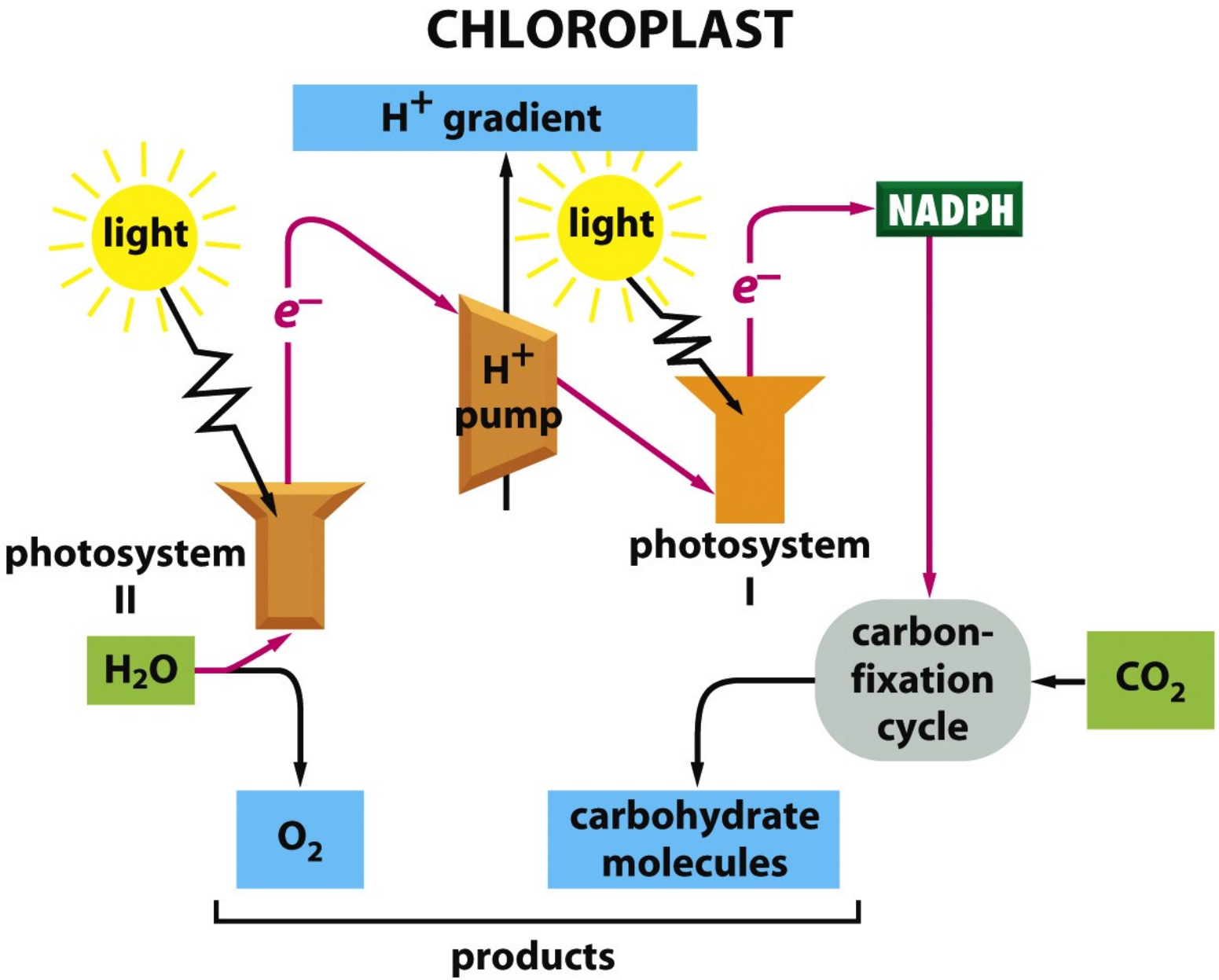


Figure 14-3b *Molecular Biology of the Cell* (© Garland Science 2008)

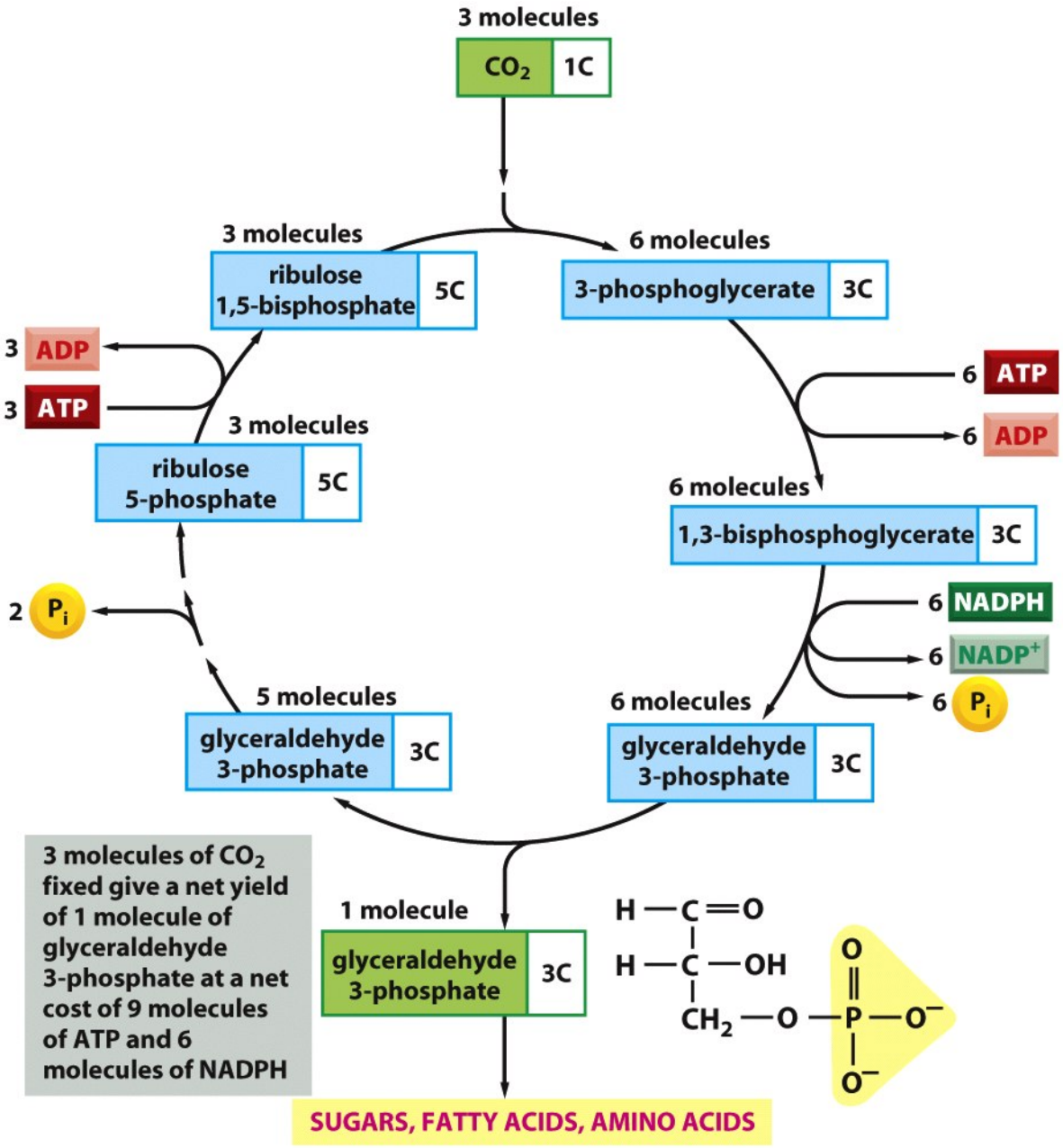


Figure 14-40 *Molecular Biology of the Cell* (© Garland Science 2008)

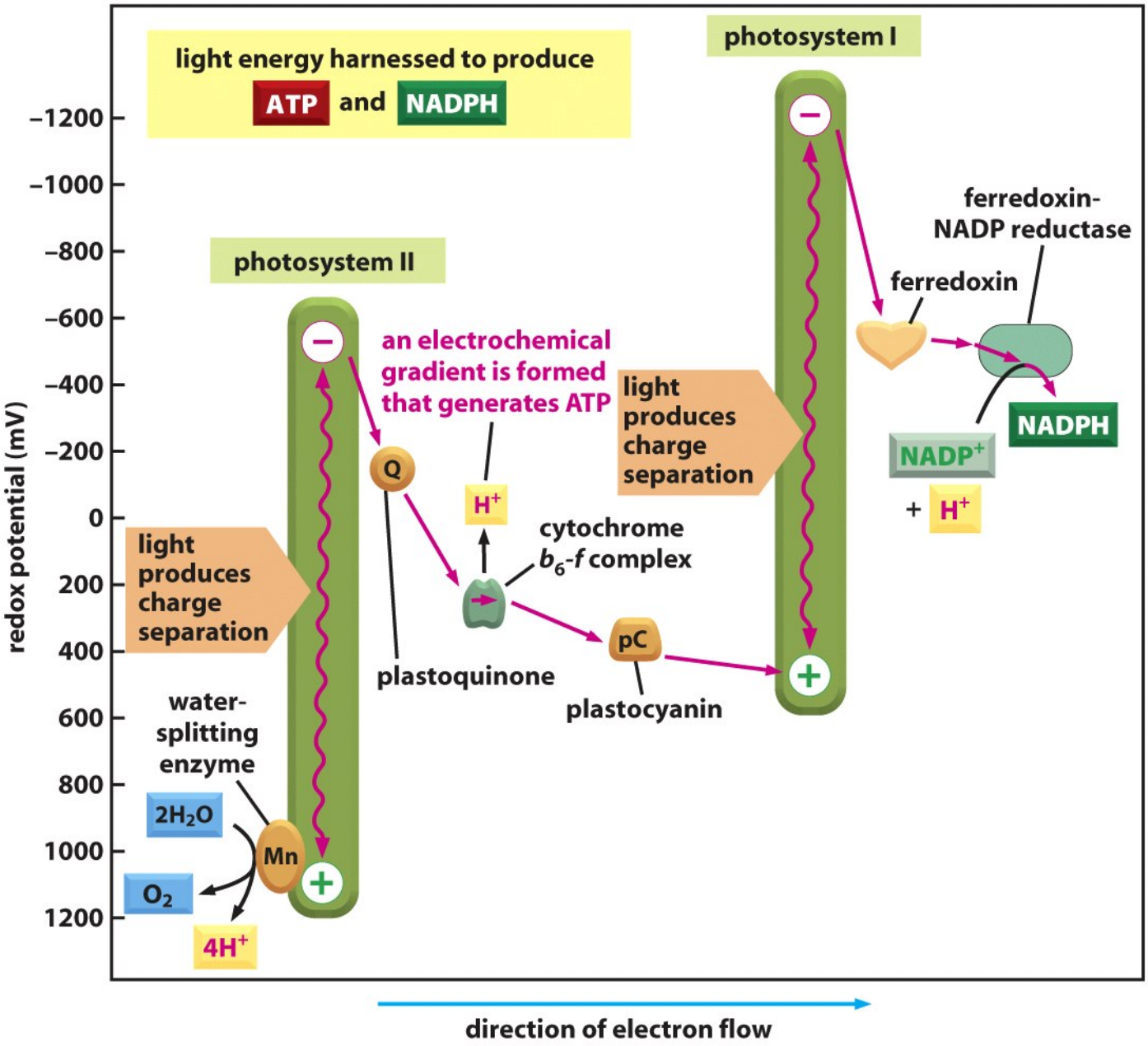


Figure 14-49 *Molecular Biology of the Cell* (© Garland Science 2008)

INSTRUCCIONES:

-Repase la clase
-Lea los siguientes artículos de wikipedia en inglés:
Lynn Margulis; Krebs cycle; Peter D. Mitchell; Calvin cycle; RuBisCO; Linus Pauling.
-Defina y explique:
Temperatura absoluta; energía libre de Gibbs (potencial químico); metabolismo; enlace covalente; catálisis (estado de transición; energía de activación); glicólisis; beta-oxidación de ácidos grasos; respiración celular; hipótesis quimiosmótica; fosforilación oxidativa; hipótesis endosimbionte; mitocondria; cloroplasto; fotosíntesis.
-Compare mediante una tabla, señalando diferencias y similitudes:
Respiración celular v/s Fotosíntesis; beta-oxidación mitocondrial v/s beta-oxidación peroxisomal; fase clara y fase oscura de la fotosíntesis.
-Dibuje, señalando partes y procesos: una molécula de ATP; una molécula de NADH; un diagrama de la respiración celular; un diagrama de la fotosíntesis.
-Persista y organícese, la prueba se acerca a pasos agigantados.