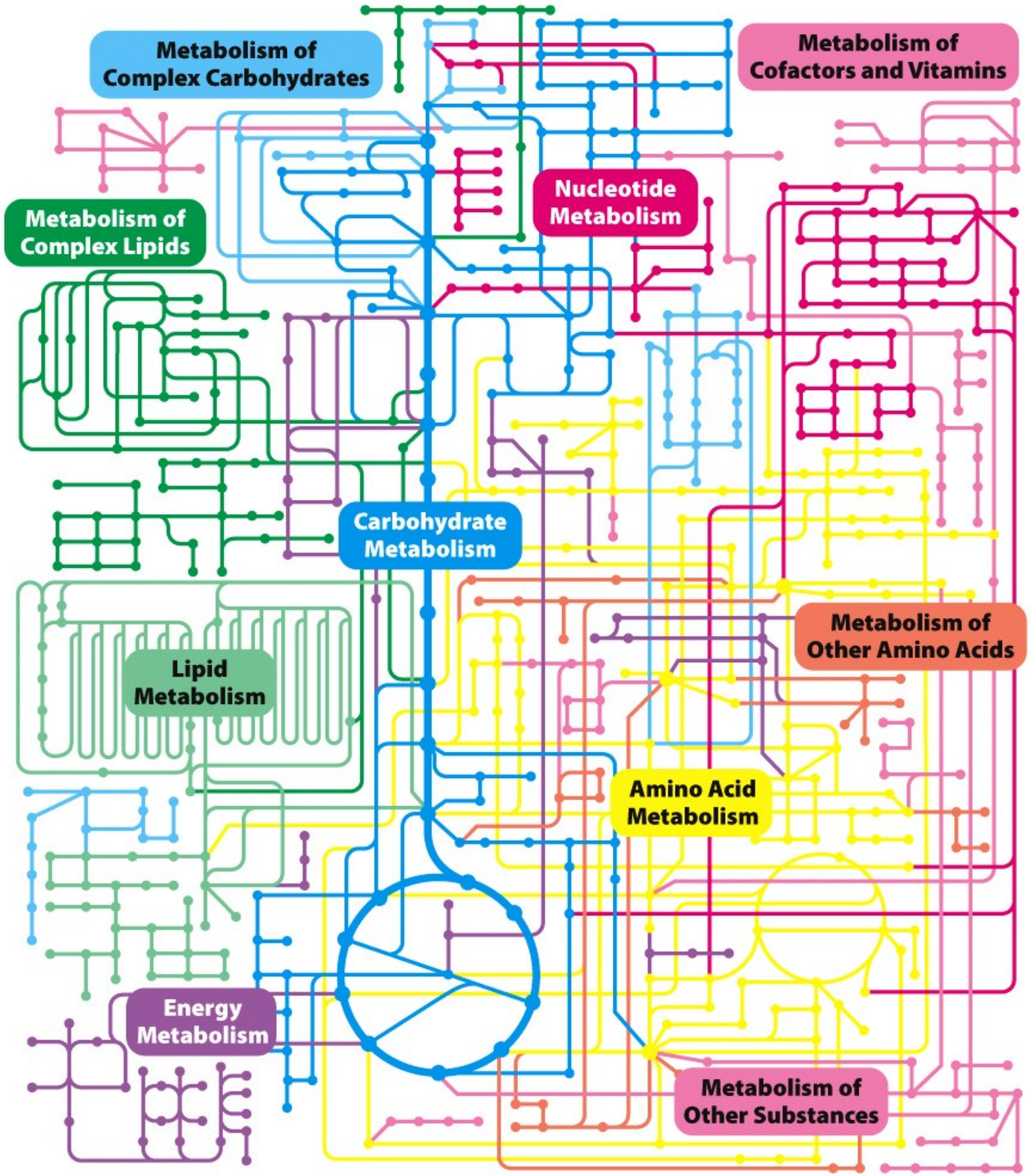

Figure 15.2

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15.23 *Not all alike*. The concentrations of ATP, ADP, and P_i differ with cell type. Consequently, the release of free energy with the hydrolysis of ATP will vary with cell type. Using the following table, calculate the ΔG for the hydrolysis of ATP in liver, muscle, and brain cells. In which cell type is the free energy of ATP hydrolysis most negative?

	ATP (mM)	ADP (mM)	P_i (mM)
Liver	3.5	1.8	5.0
Muscle	8.0	0.9	8.0
Brain	2.6	0.7	2.7

TABLE 15.1 **Standard free energies of hydrolysis of some phosphorylated compounds**

Compound	kJ mol^{-1}	kcal mol^{-1}
Phosphoenolpyruvate	−61.9	−14.8
1,3-Bisphosphoglycerate	−49.4	−11.8
Creatine phosphate	−43.1	−10.3
ATP (to ADP)	−30.5	− 7.3
Glucose 1-phosphate	−20.9	− 5.0
Pyrophosphate	−19.3	− 4.6
Glucose 6-phosphate	−13.8	− 3.3
Glycerol 3-phosphate	− 9.2	− 2.2

Table 15.1
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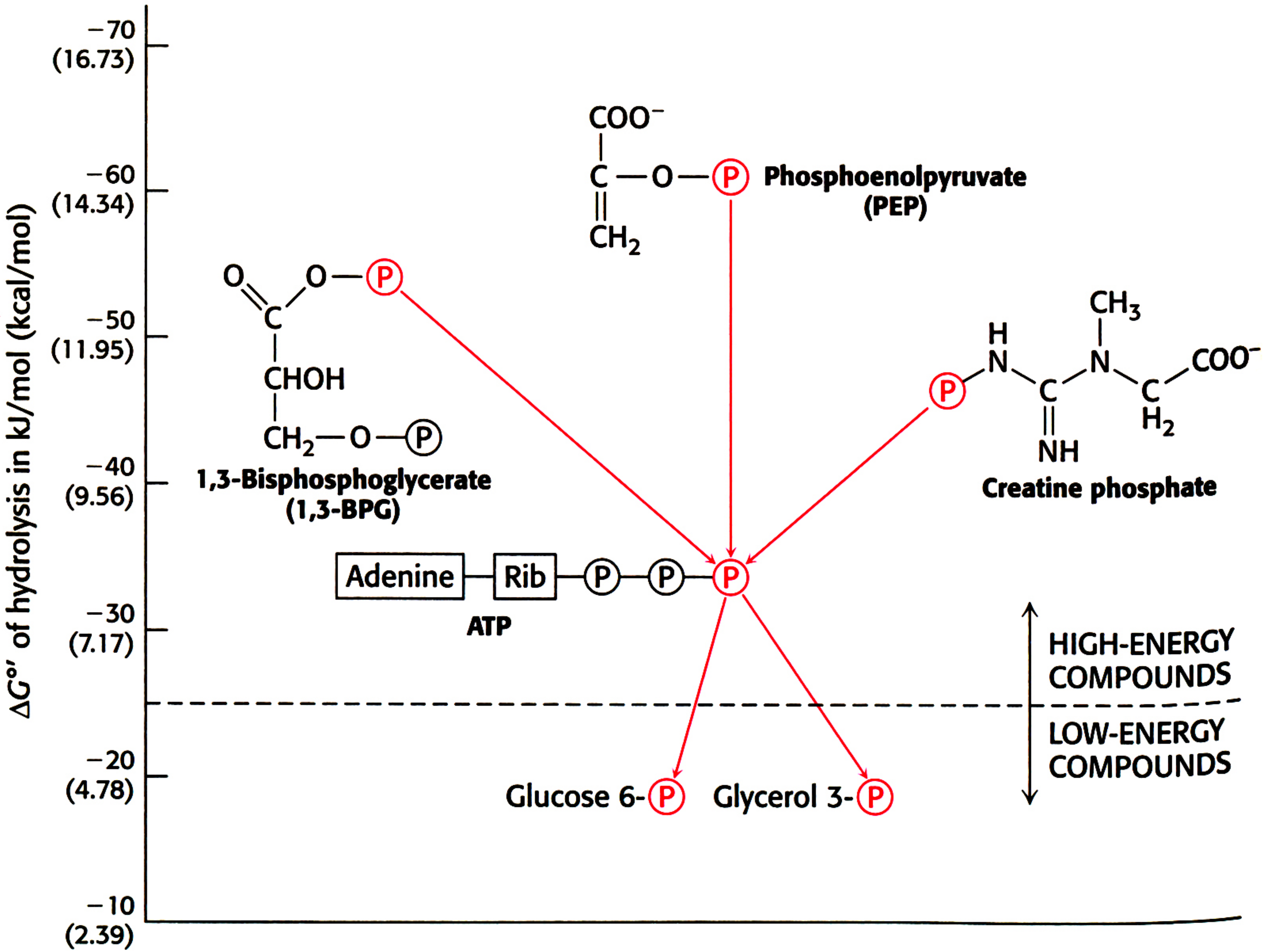

Stryer 8th edition: Fig. 15.6

this is a potential exam question

15.14 *A potent donor.* Consider the following reaction:

$$\text{ATP} + \text{pyruvate} \rightleftharpoons \text{phosphoenolpyruvate} + \text{ADP}$$

(a) Calculate $\Delta G^{\circ\prime}$ and K'_{eq} at 25°C for this reaction by using the data given in Table 15.1.

(b) What is the equilibrium ratio of pyruvate to phosphoenolpyruvate if the ratio of ATP to ADP is 10?

Table 15.1 **Standard free energies of hydrolysis of some phosphorylated compounds**

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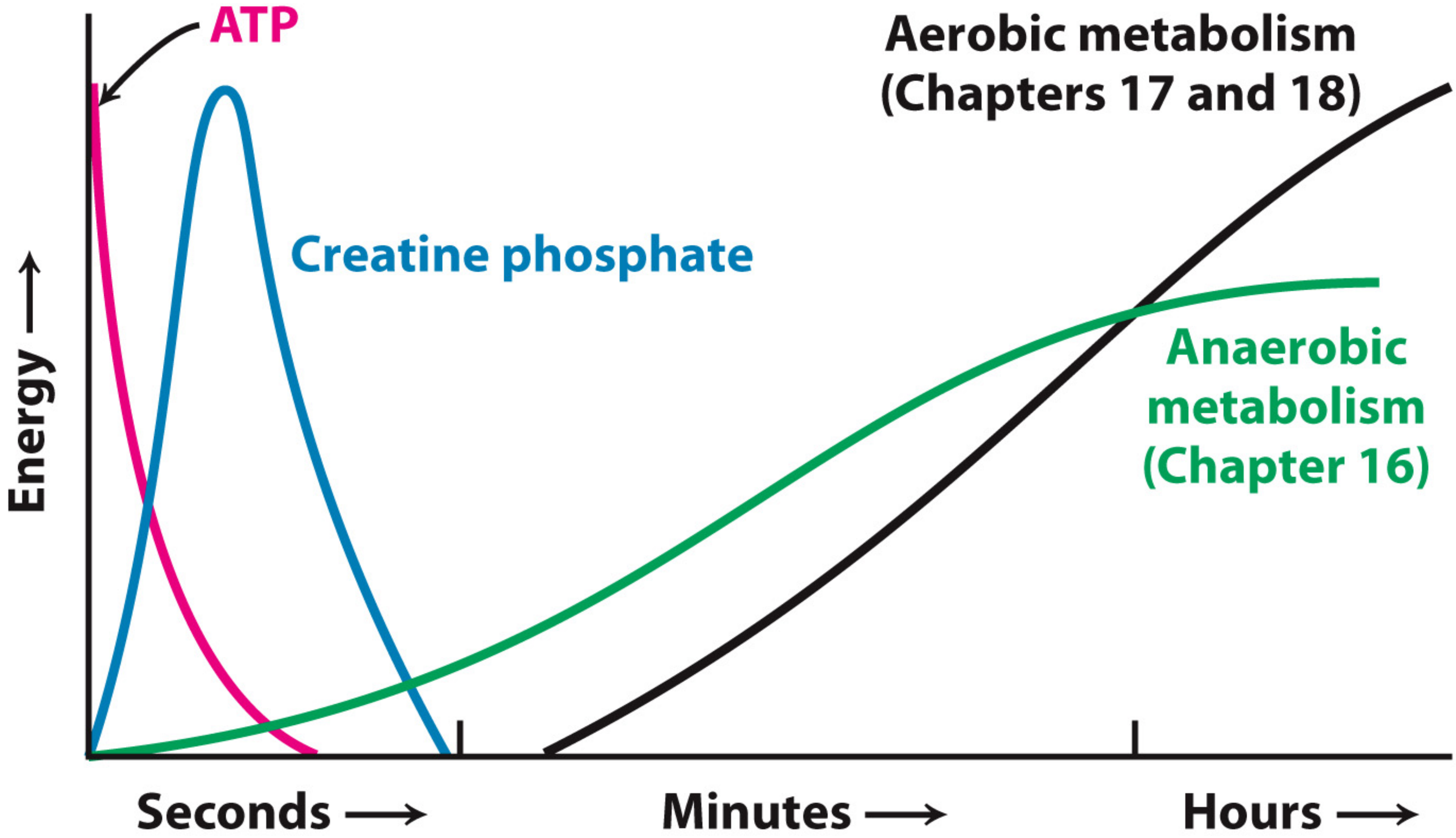

Figure 15.7
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Homework:

solve this yourself

A: Berechnen Sie das $\Delta G^{o\prime}$ der folgenden Reaktion:

$$\text{Kreatin-Phosphat} + \text{ADP} \rightleftharpoons \text{Kreatin} + \text{ATP}$$

B: Wie muss das Konzentrationsverhältnis [Kreatin-Phosphat] / [Kreatin] sein, damit im Gleichgewicht die Konzentration von ATP 12-mal höher als jene von ADP ist? Stellen Sie die entsprechende Gleichung auf und berechnen Sie unter der Annahme von R = 8.3145 J K^{-1} mol^{-1} und T = 37°C.

Table 15.1 Standard free energies of hydrolysis of some phosphorylated compounds

Compound	kJ mol^{-1}	kcal mol^{-1}
Phosphoenolpyruvate	−61.9	−14.8
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ATP use and regeneration

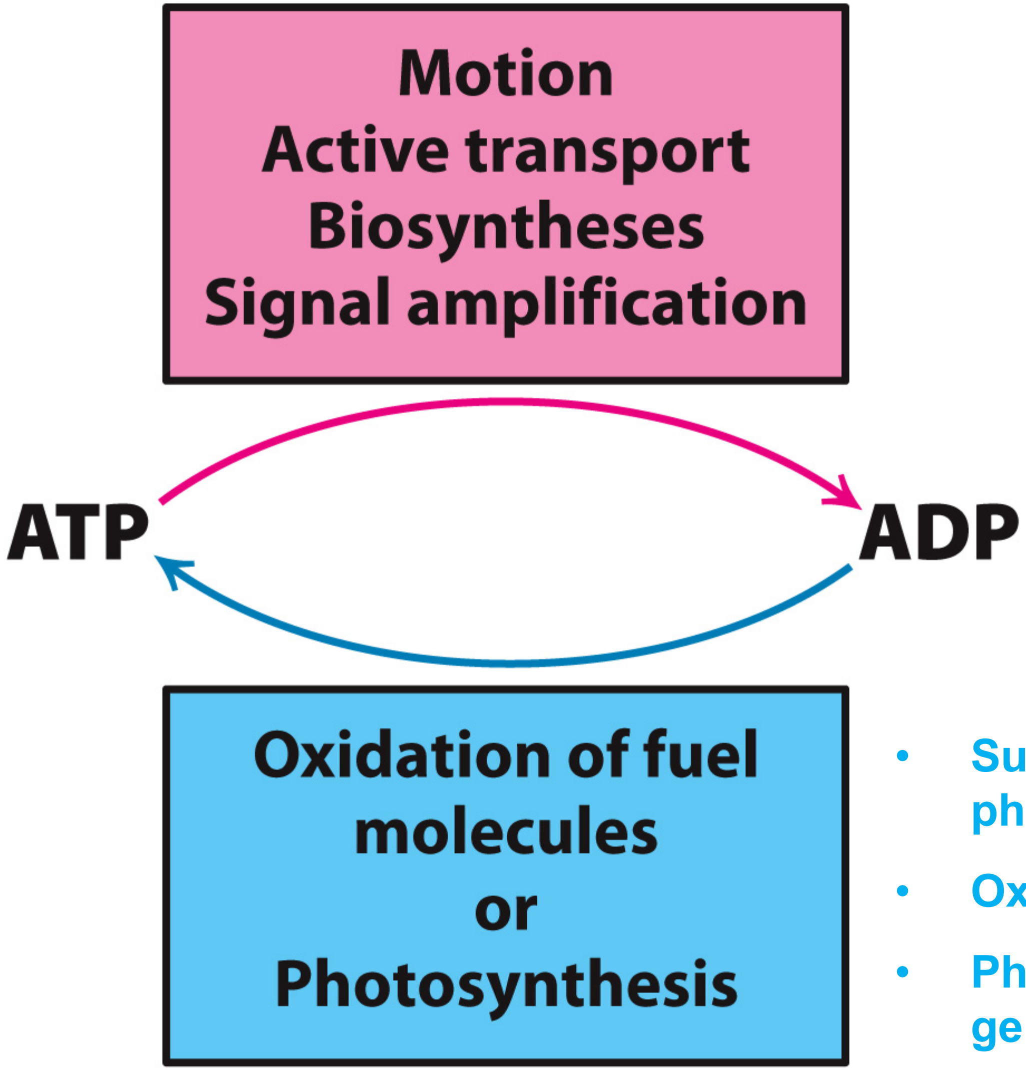

Figure 15.8
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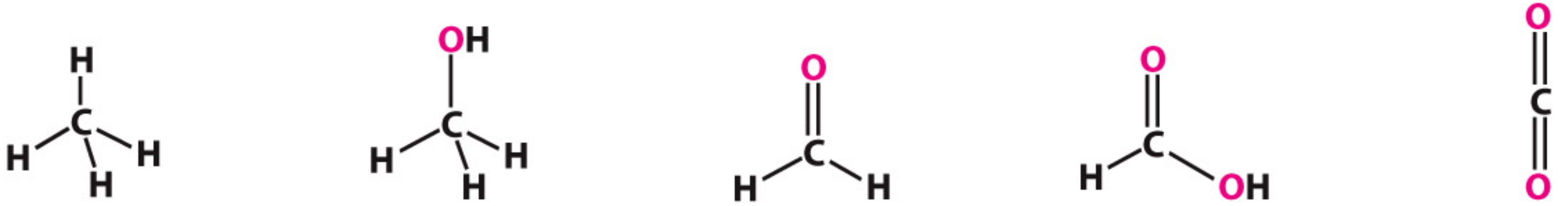
- Substrate-level phosphorylation
- Oxidative phosphorylation
- Photosynthetic ATP generation

mechanistically similar processes

Most energy ⟶ **Least energy**



	Methane	Methanol	Formaldehyde	Formic acid	Carbon dioxide
$\Delta G^{\circ\prime}_{\text{oxidation}}$ (kJ mol^{-1})	−820	−703	−523	−285	0
$\Delta G^{\circ\prime}_{\text{oxidation}}$ (kcal mol^{-1})	−196	−168	−125	−68	0

Figure 15.9
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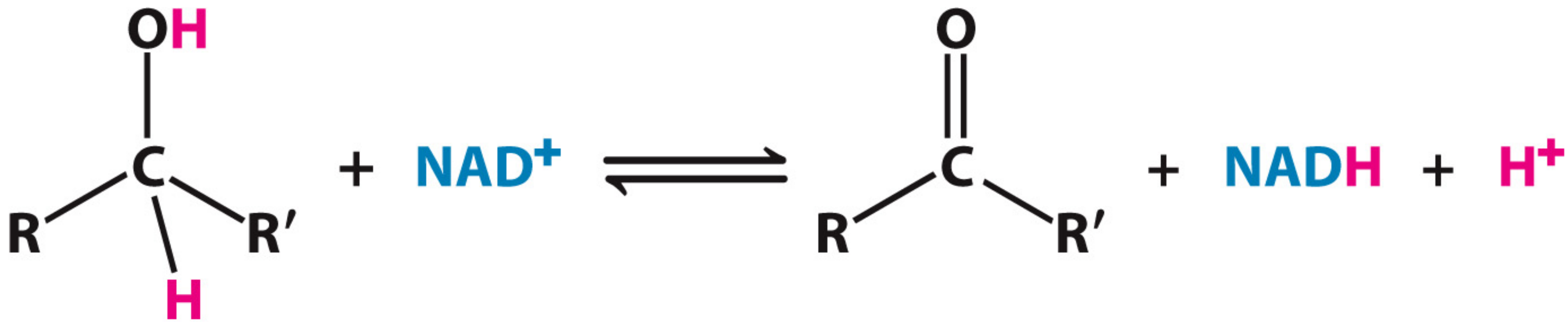

Unnumbered 15 p435a
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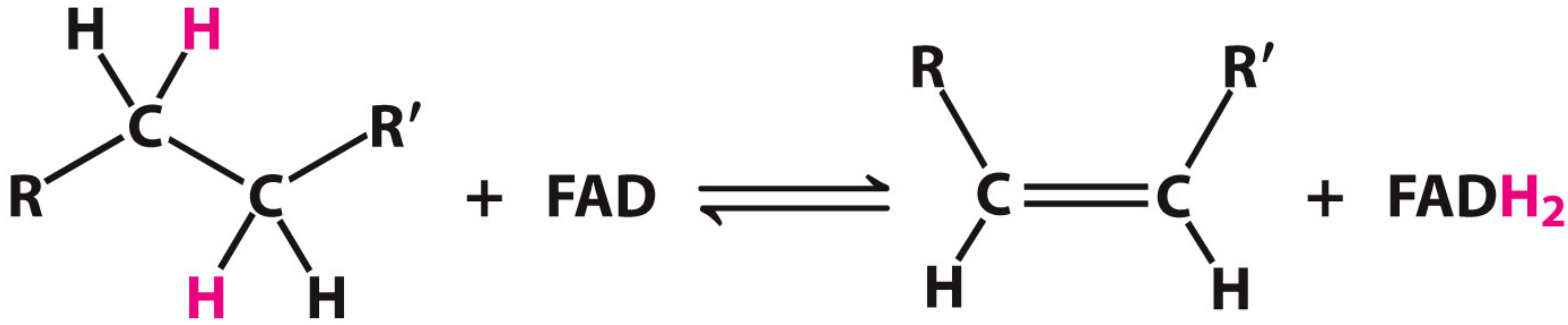

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Flavine adenine dinucleotide (FAD – $FADH_2$)

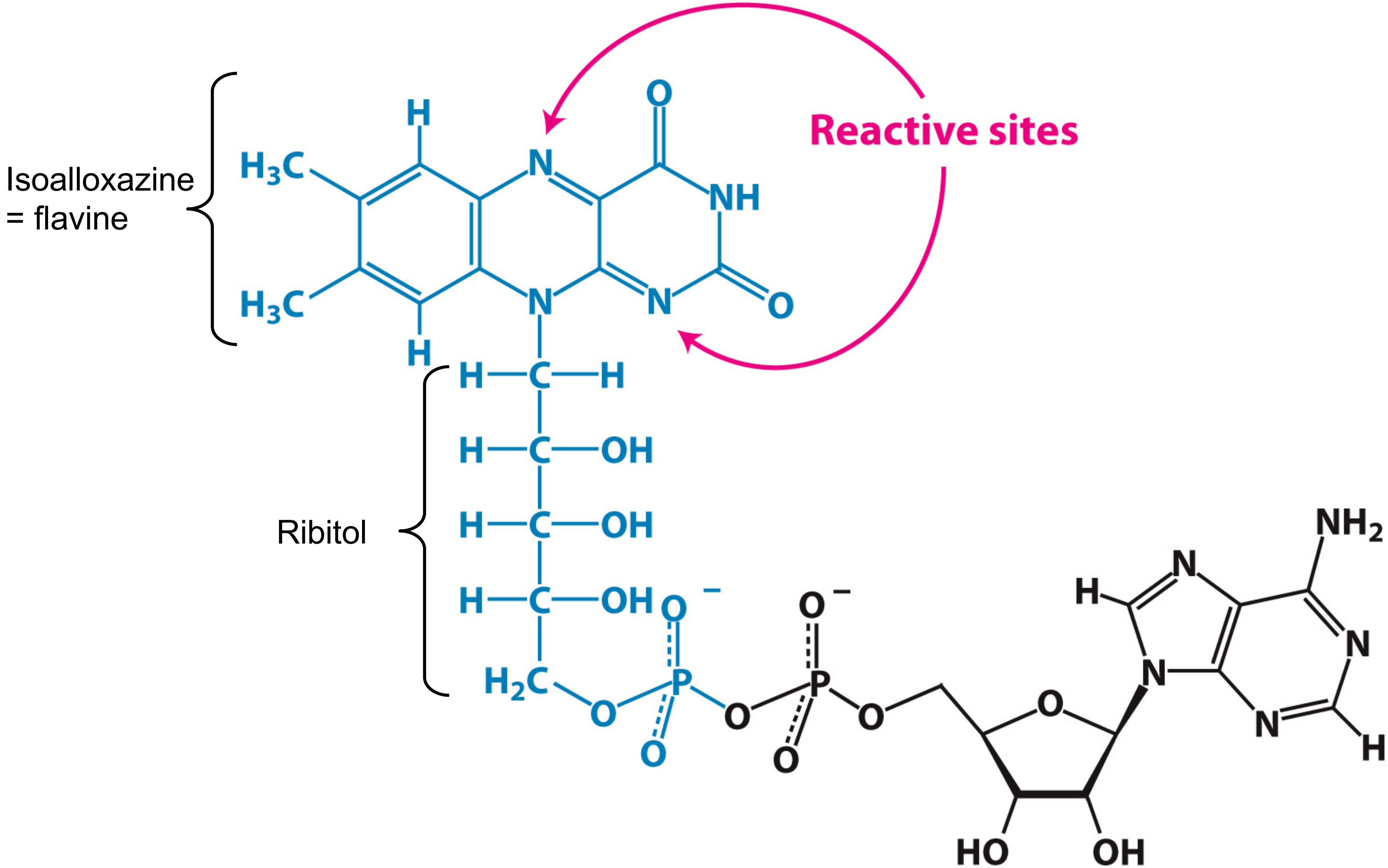

Figure 15.14
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Flavine adenine dinucleotide (FAD – $FADH_2$)

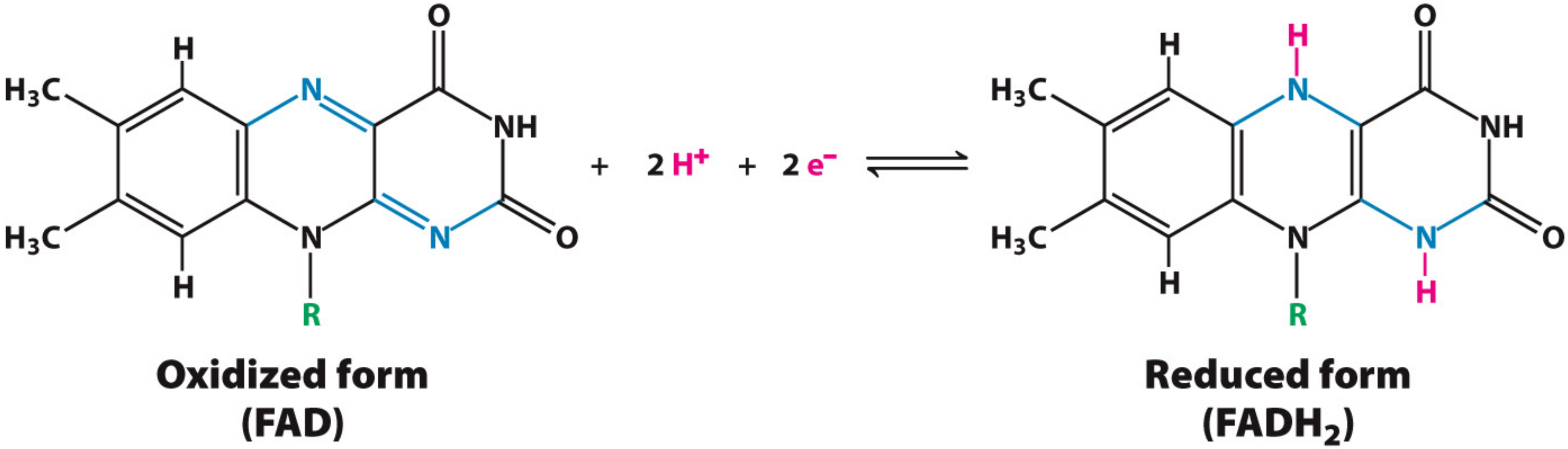

Figure 15.15
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TABLE 15.2 Some activated carriers in metabolism

Carrier molecule in activated form	Group carried	Vitamin precursor
ATP	Phosphoryl	
NADH and NADPH	Electrons	Nicotinate (niacin) (vitamin B_3)
$FADH_2$	Electrons	Riboflavin (vitamin B_2)
$FMNH_2$	Electrons	Riboflavin (vitamin B_2)
Coenzyme A	Acyl	Pantothenate (vitamin B_5)
Lipoamide	Acyl	
Thiamine pyrophosphate	Aldehyde	Thiamine (vitamin B_1)
Biotin	CO_2	Biotin (vitamin B_7)
Tetrahydrofolate	One-carbon units	Folate (vitamin B_9)
S-Adenosylmethionine	Methyl	
Uridine diphosphate glucose	Glucose	
Cytidine diphosphate diacylglycerol	Phosphatidate	
Nucleoside triphosphates	Nucleotides	

Note: Many of the activated carriers are coenzymes that are derived from water-soluble vitamins.

Table 15.2
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$$\text{Energy charge} = \frac{[\text{ATP}] + \frac{1}{2}[\text{ADP}]}{[\text{ATP}] + [\text{ADP}] + [\text{AMP}]}$$

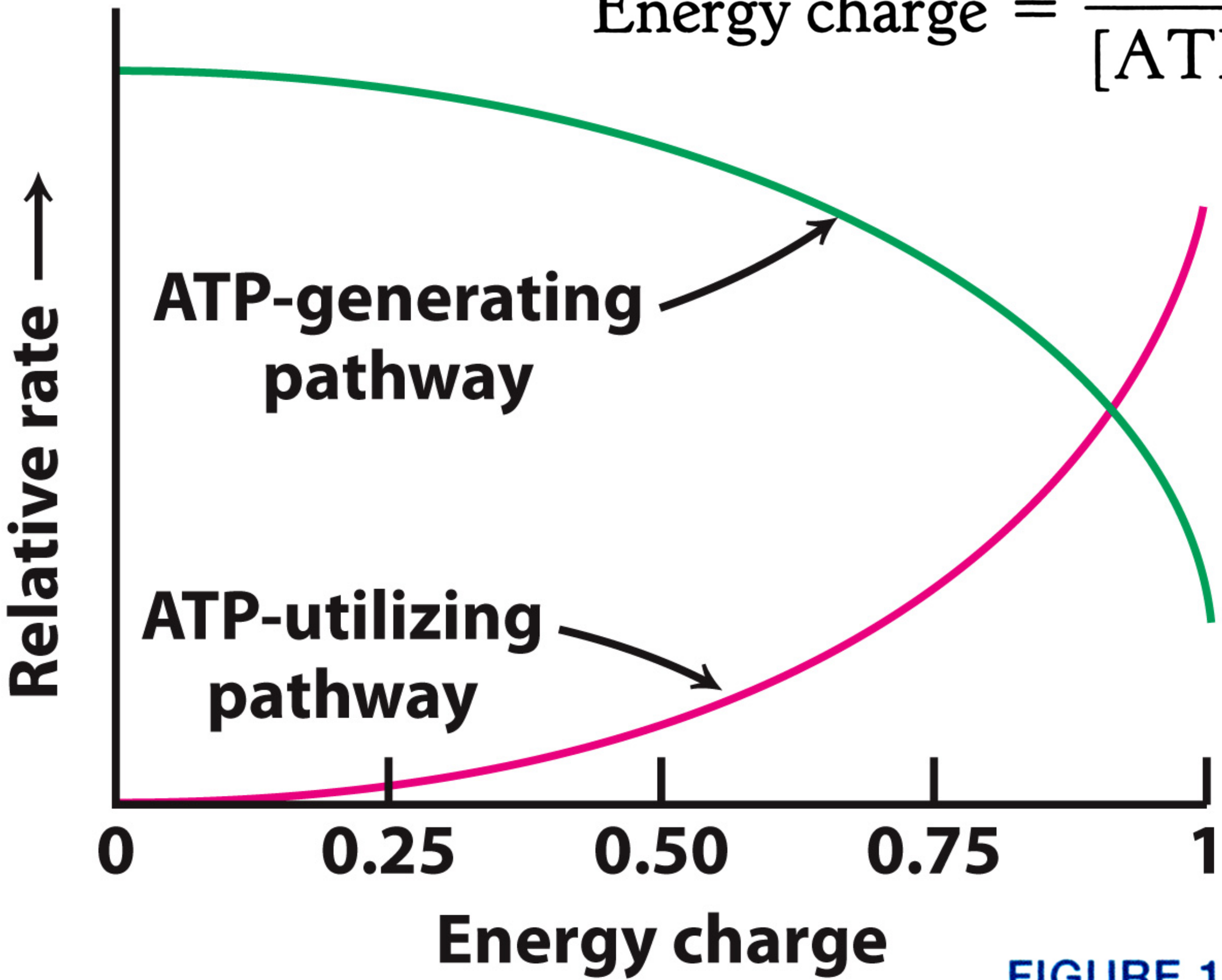

Figure 15.20
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FIGURE 15.20 Energy charge regulates metabolism. When the energy charge is high, ATP inhibits the relative rates of a typical ATP-generating (catabolic) pathway and stimulates the typical ATP-utilizing (anabolic) pathway.