

Unnumbered 6 p93

*Biochemistry: A Short Course, Second Edition*

© 2013 W. H. Freeman and Company

**Table 6.1** Rate enhancement by selected enzymes

Enzyme	Nonenzymatic half-life	Uncatalyzed rate ( $k_{un} s^{-1}$ )	Catalyzed rate ( $k_{cat} s^{-1}$ )	Rate enhancement ( $k_{cat} s^{-1}/k_{un} s^{-1}$ )
OMP decarboxylase	78,000,000 years	$2.8 \times 10^{-16}$	39	$1.4 \times 10^{17}$
Staphylococcal nuclease	130,000 years	$1.7 \times 10^{-13}$	95	$5.6 \times 10^{14}$
AMP nucleosidase	69,000 years	$1.0 \times 10^{-11}$	60	$6.0 \times 10^{12}$
Carboxypeptidase A	7.3 years	$3.0 \times 10^{-9}$	578	$1.9 \times 10^{11}$
Ketosteroid isomerase	7 weeks	$1.7 \times 10^{-7}$	66,000	$3.9 \times 10^{11}$
Triose phosphate isomerase	1.9 days	$4.3 \times 10^{-6}$	4,300	$1.0 \times 10^9$
Chorismate mutase	7.4 hours	$2.6 \times 10^{-5}$	50	$1.9 \times 10^6$
Carbonic anhydrase	5 seconds	$1.3 \times 10^{-1}$	$1 \times 10^6$	$7.7 \times 10^6$

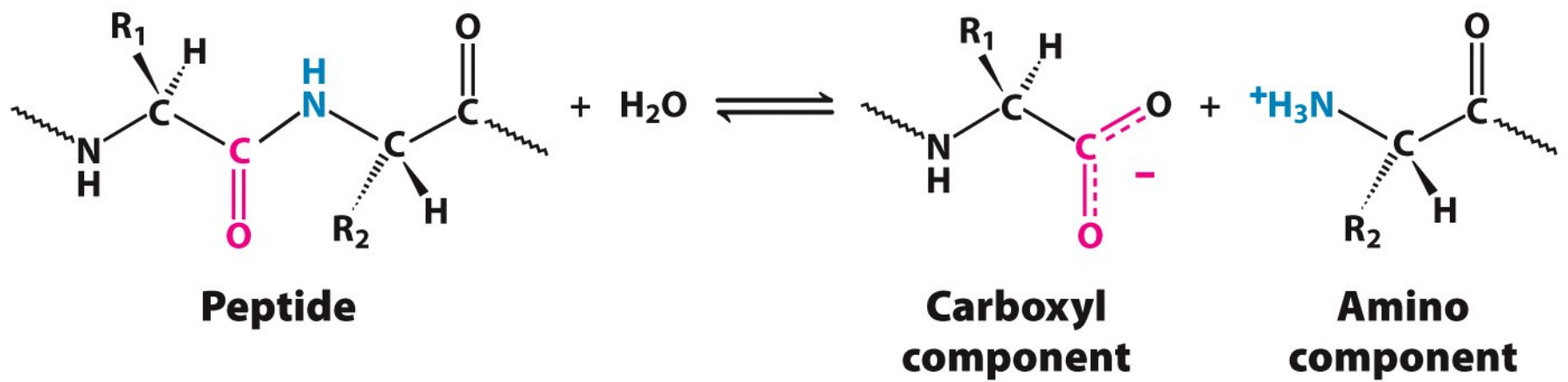
Abbreviations: OMP, orotidine monophosphate; AMP, adenosine monophosphate.

Source: After A. Radzicka and R. Wolfenden, *Science* 267:90–93, 1995.

**Table 6.1**

*Biochemistry: A Short Course*, Second Edition

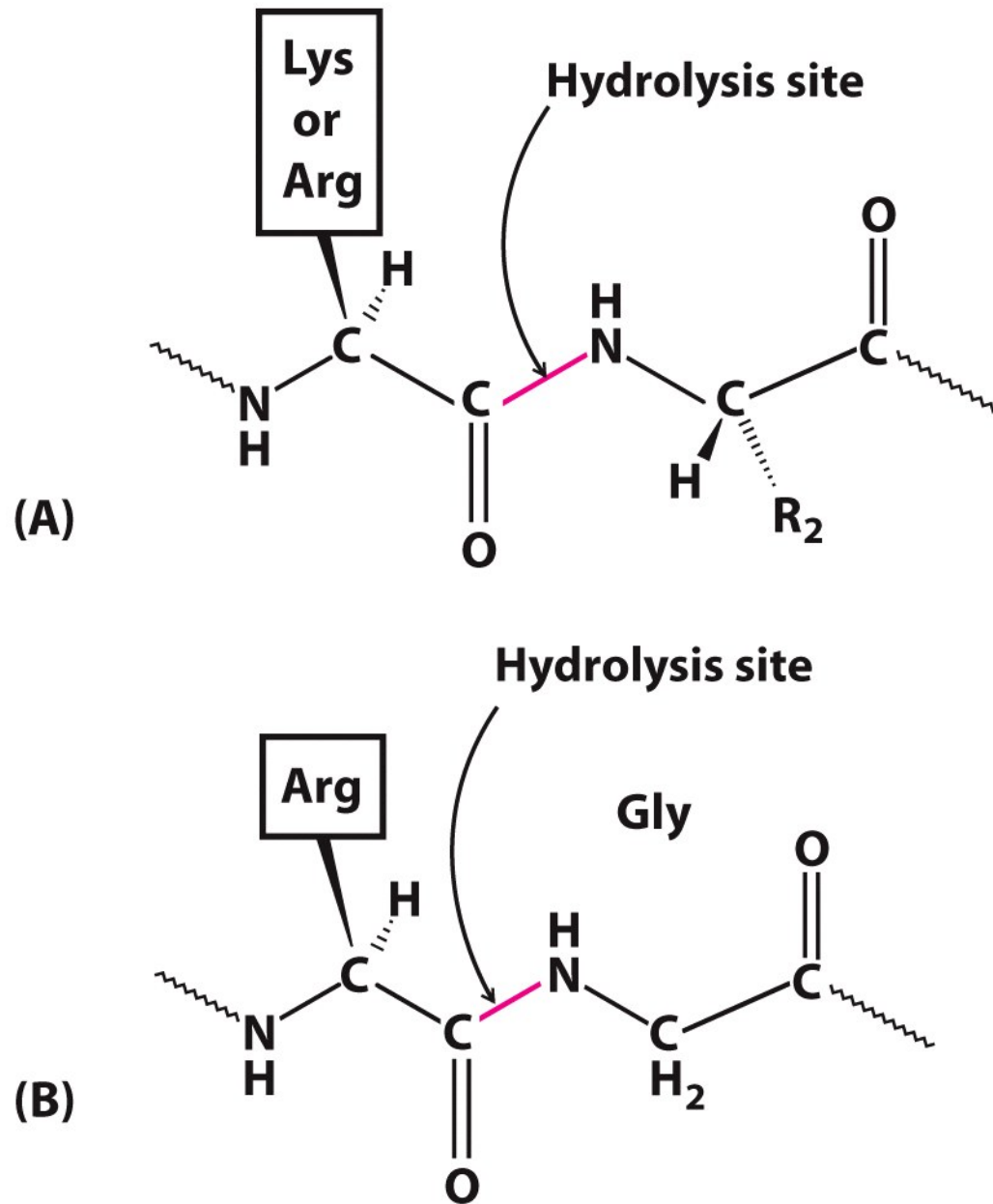
© 2013 W. H. Freeman and Company



Unnumbered 6 p94

*Biochemistry: A Short Course, Second Edition*

© 2013 W. H. Freeman and Company



**Figure 6.1**  
*Biochemistry: A Short Course, Second Edition*  
© 2013 W. H. Freeman and Company

TABLE 5.1

**Enzyme Classification Based on Type of Chemical Reaction Catalyzed**

Class	Type of Chemical Reaction Catalyzed	Examples
Oxidoreductase	Oxidation-reduction in which oxygen and hydrogen are gained or lost	Cytochrome oxidase, lactate dehydrogenase
Transferase	Transfer of functional groups, such as an amino group, acetyl group, or phosphate group	Acetate kinase, alanine deaminase
Hydrolase	Hydrolysis (addition of water)	Lipase, sucrase
Lyase	Removal of groups of atoms without hydrolysis	Oxalate decarboxylase, isocitrate lyase
Isomerase	Rearrangement of atoms within a molecule	Glucose-phosphate isomerase, alanine racemase
Ligase	Joining of two molecules (using energy usually derived from the breakdown of ATP)	Acetyl-CoA synthetase, DNA ligase

Copyright © 2004 Pearson Education, Inc., publishing as Benjamin Cummings.

**Table 6.2** Enzyme cofactors

Cofactor	Enzyme*
<b>Coenzyme<sup>†</sup></b>	
Thiamine pyrophosphate (TPP)	Pyruvate dehydrogenase
Flavin adenine nucleotide (FAD)	Monoamine oxidase
Nicotinamide adenine dinucleotide (NAD <sup>+</sup> )	Lactate dehydrogenase
Pyridoxal phosphate (PLP)	Glycogen phosphorylase
Coenzyme A (CoA)	Acetyl CoA carboxylase
Biotin	Pyruvate carboxylase
6'-Deoxyadenosyl cobalamin	Methylmalonyl mutase
Tetrahydrofolate	Thymidylate synthase
<b>Metal</b>	
Zn <sup>2+</sup>	Carbonic anhydrase
Mg <sup>2+</sup>	<i>EcoRV</i>
Ni <sup>2+</sup>	Urease
Mo	Nitrogenase
Se	Glutathione peroxidase
Mn <sup>2+↔3+</sup>	Superoxide dismutase
K <sup>+</sup>	Acetoacetyl CoA thiolase

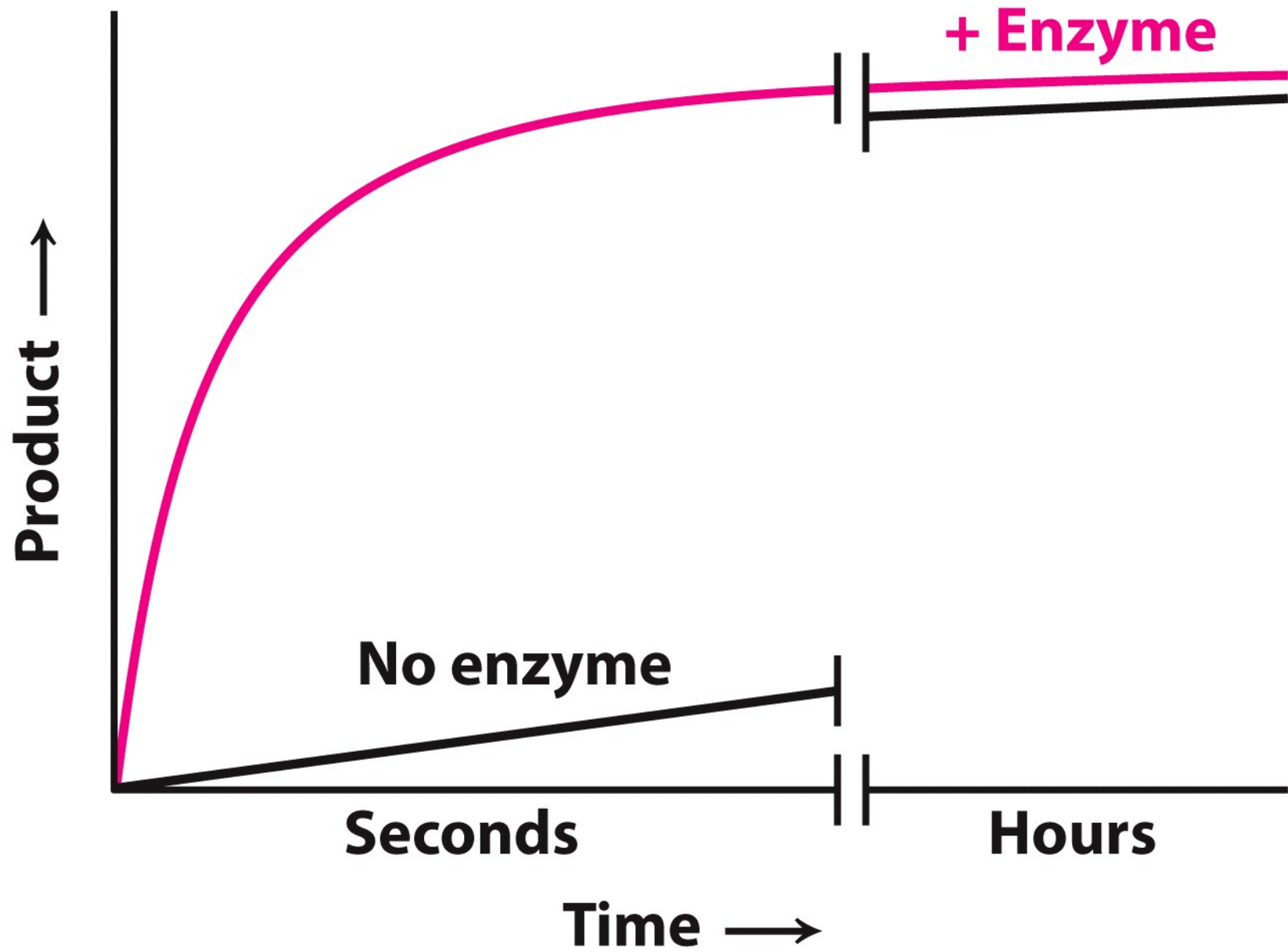
\*The enzymes listed are examples of enzymes that employ the indicated cofactor.

<sup>†</sup>Often derived from vitamins, coenzymes can be either tightly or loosely bound to the enzyme.

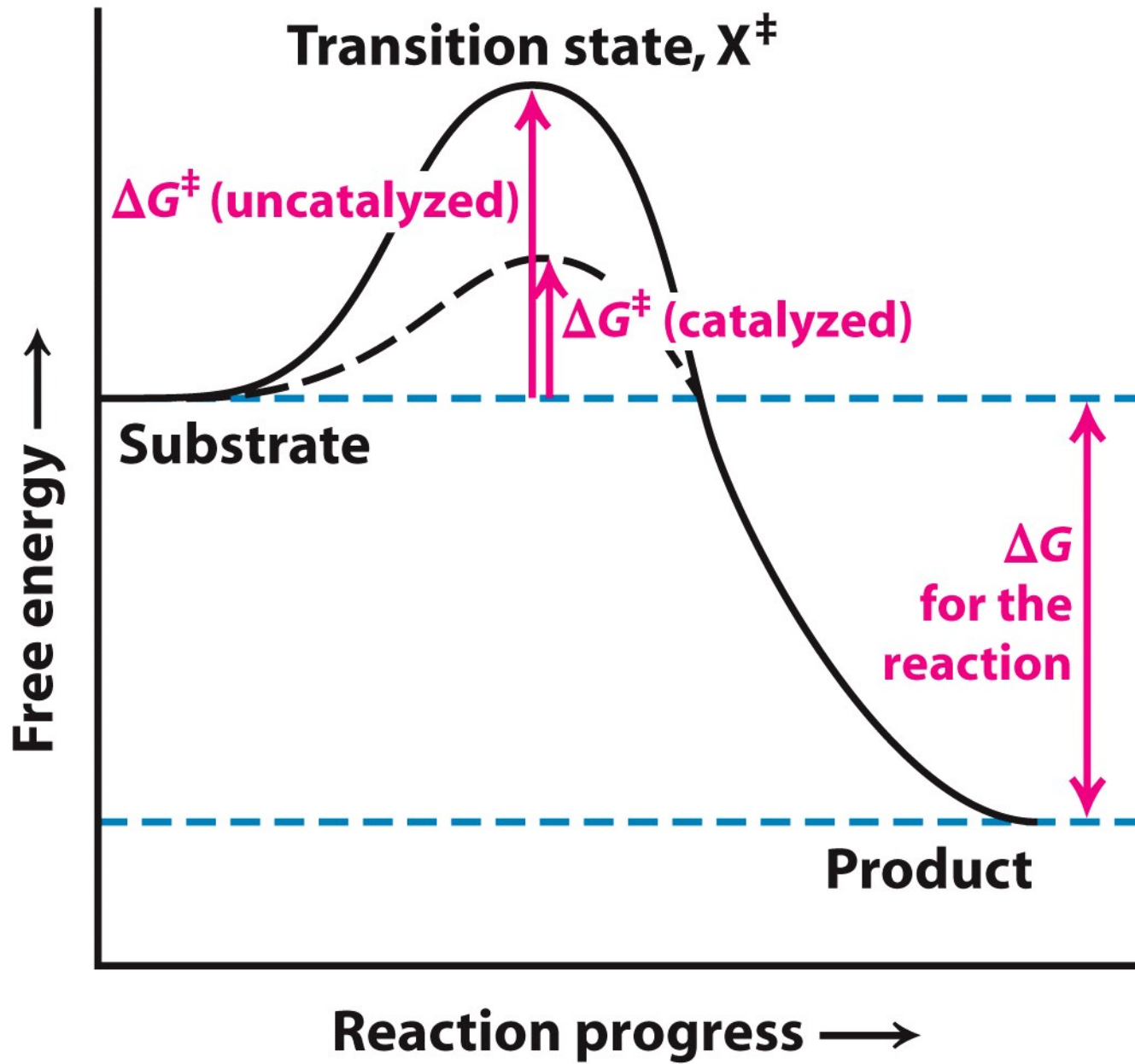
**Table 6.2**

*Biochemistry: A Short Course*, Second Edition

© 2013 W. H. Freeman and Company



**Figure 6.2**  
*Biochemistry: A Short Course, Second Edition*  
© 2013 W. H. Freeman and Company



**Figure 6.3**  
*Biochemistry: A Short Course, Second Edition*  
© 2013 W. H. Freeman and Company



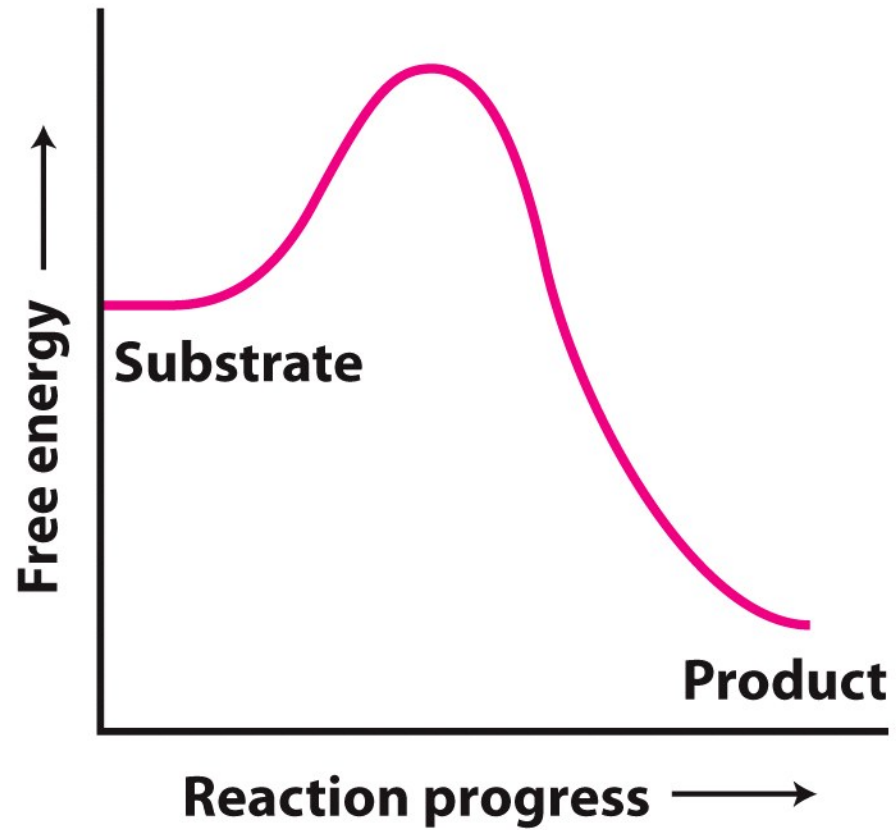
**Table 6.3** Relation between  $\Delta G^{\circ'}$  and  $K'_{eq}$  (at 25°C)

$K'_{eq}$	$\Delta G^{\circ'}$	
	$\text{kJ mol}^{-1}$	$\text{kcal mol}^{-1}$
$10^{-5}$	28.53	6.82
$10^{-4}$	22.84	5.46
$10^{-3}$	17.11	4.09
$10^{-2}$	11.42	2.73
$10^{-1}$	5.69	1.36
1	0	0
10	-5.69	-1.36
$10^2$	-11.42	-2.73
$10^3$	-17.11	-4.09
$10^4$	-22.84	-5.46
$10^5$	-28.53	-6.82

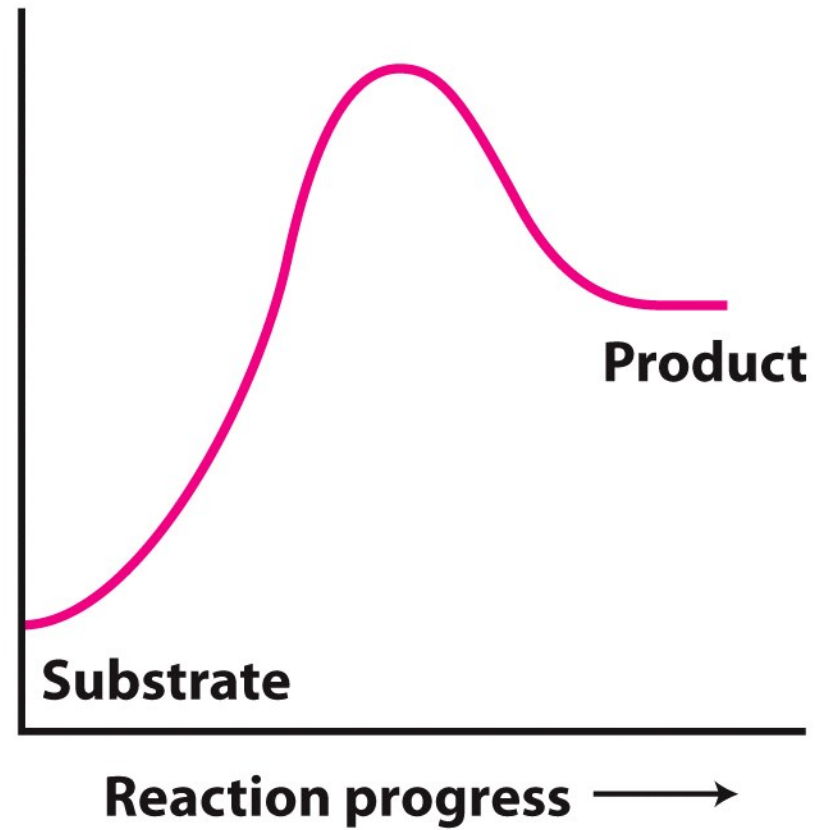
**Table 6.3***Biochemistry: A Short Course, Second Edition*

© 2013 W. H. Freeman and Company

(A)



(B)

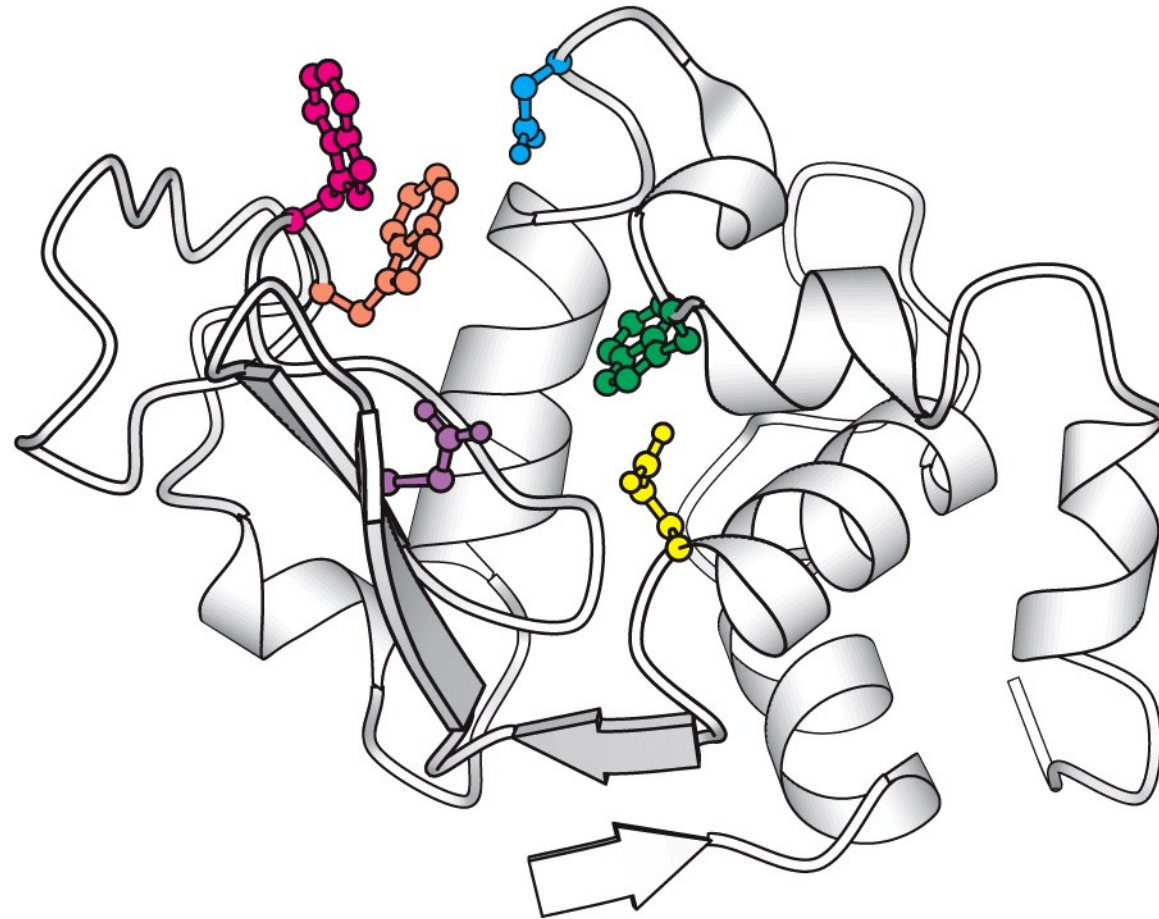


**Problem 6.13**

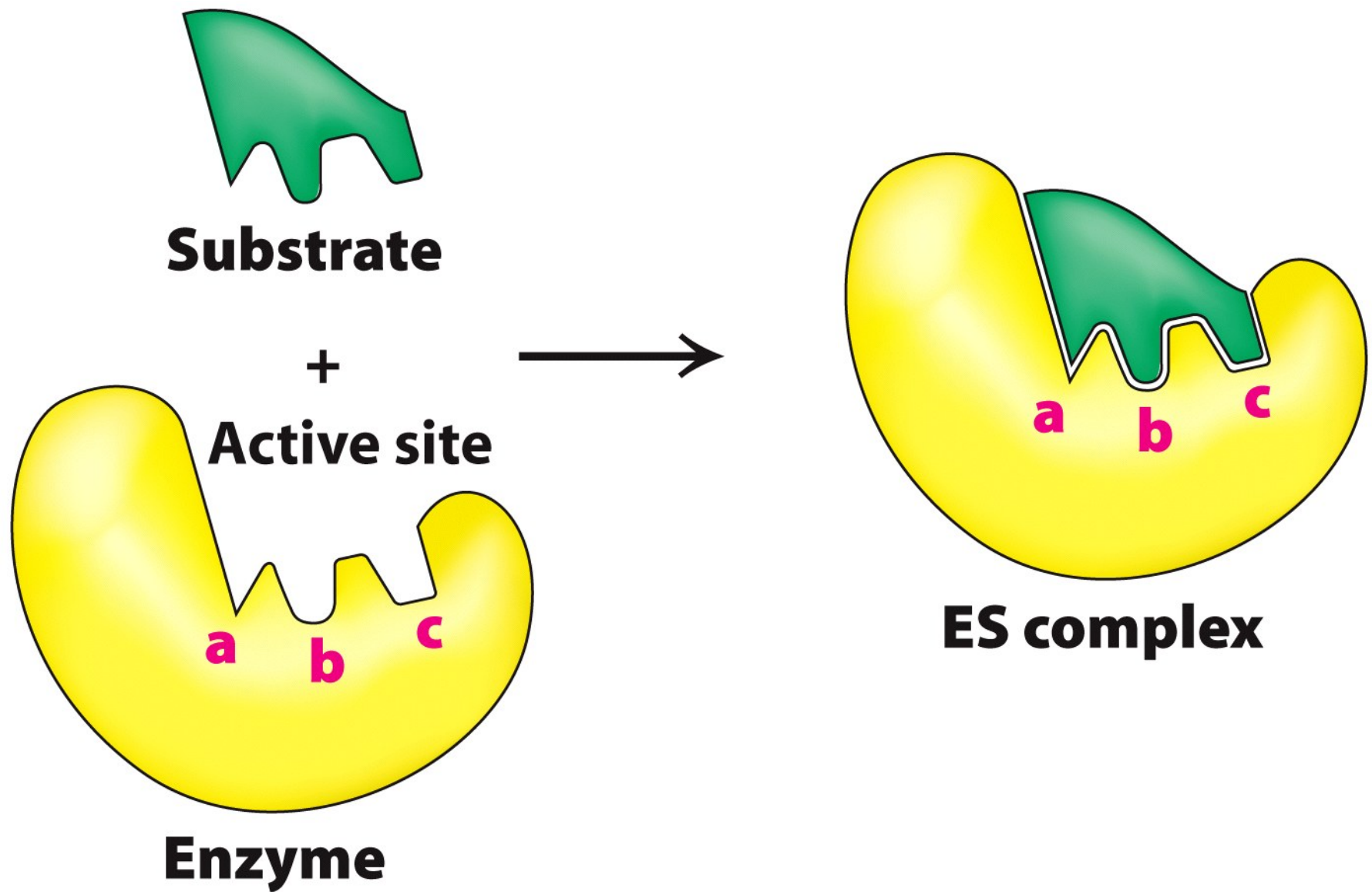
*Biochemistry: A Short Course, Second Edition*

© 2013 W. H. Freeman and Company

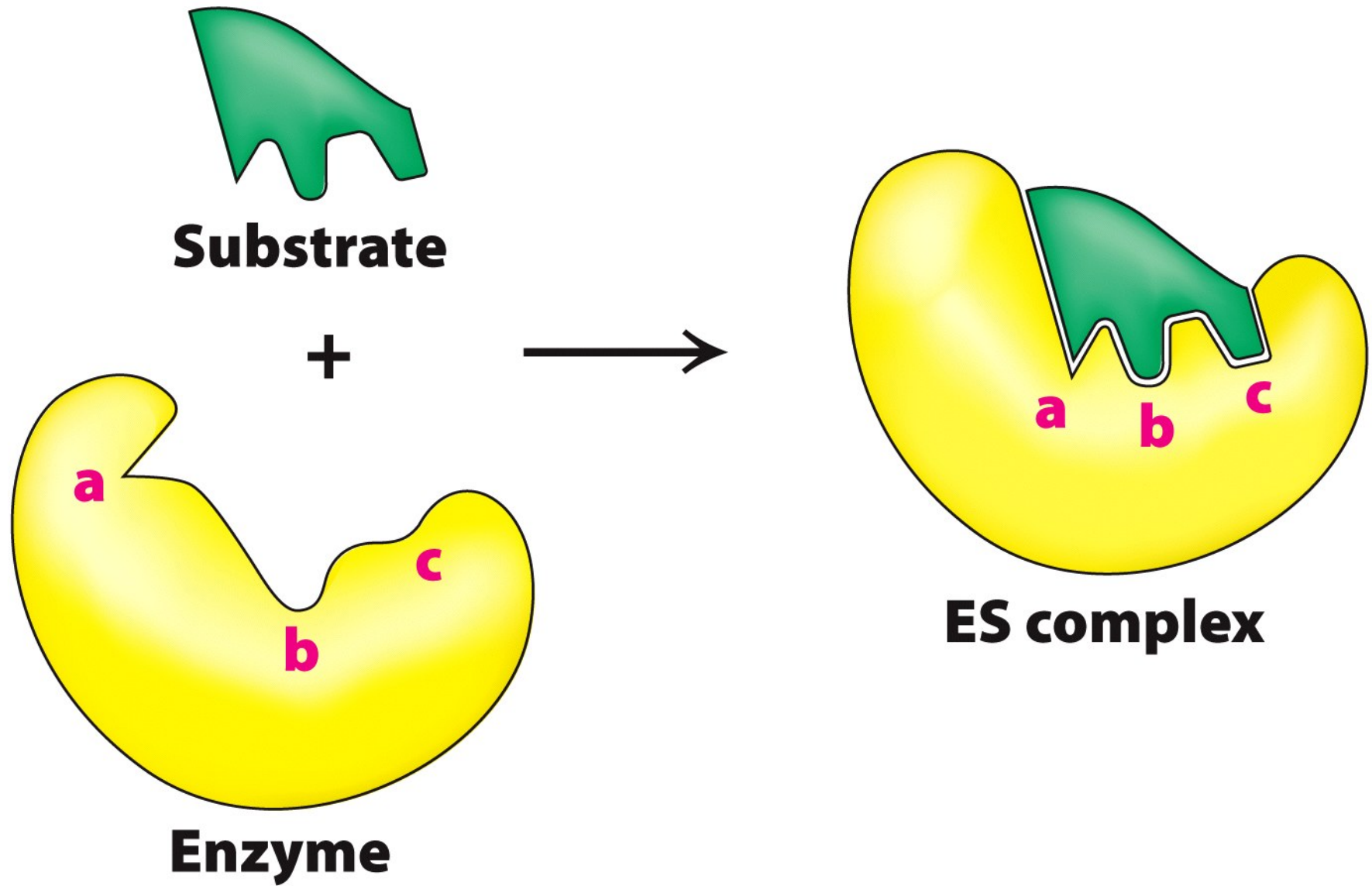
(A)



**Figure 6.4**  
*Biochemistry: A Short Course, Second Edition*  
© 2013 W. H. Freeman and Company



**Figure 6.5**  
*Biochemistry: A Short Course, Second Edition*  
© 2013 W. H. Freeman and Company



**Figure 6.6**  
*Biochemistry: A Short Course, Second Edition*  
© 2013 W. H. Freeman and Company