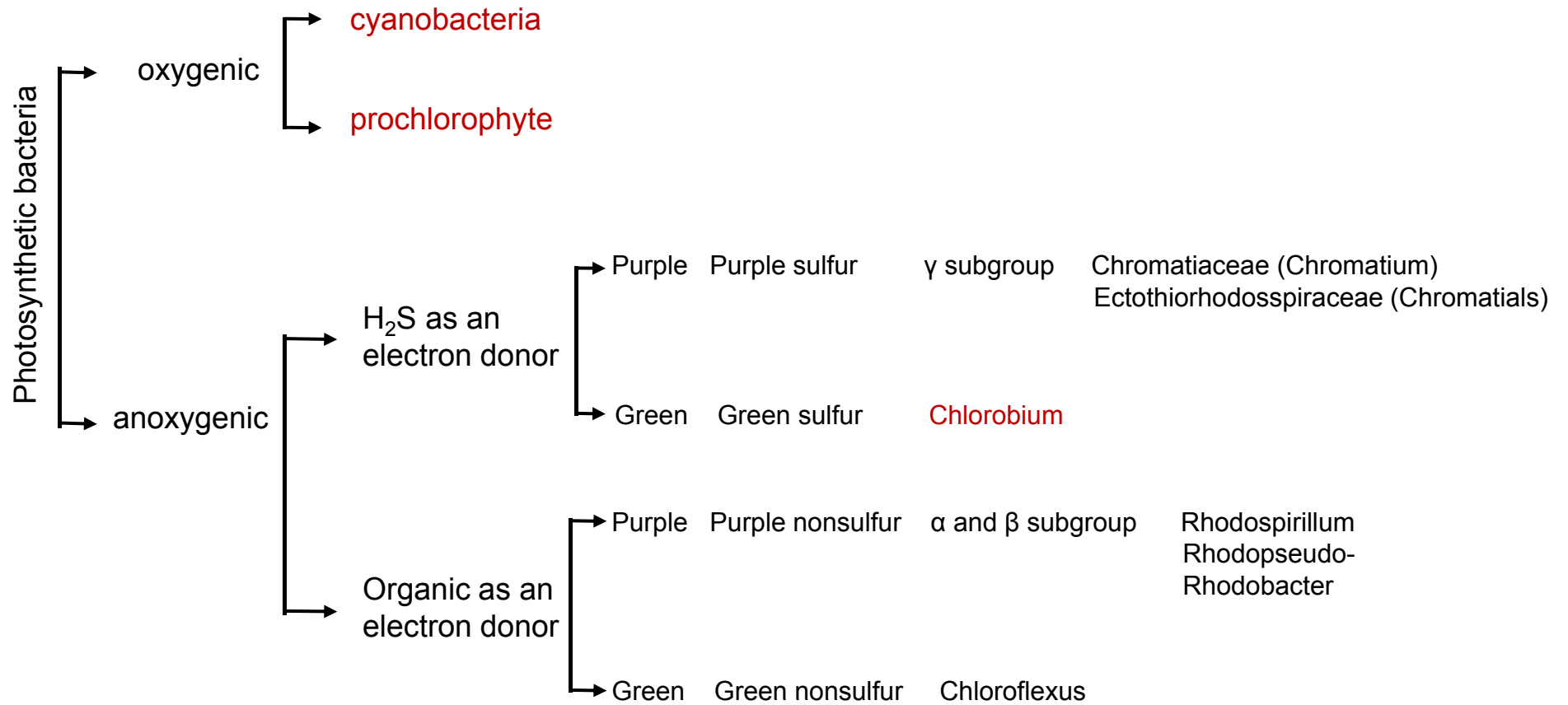
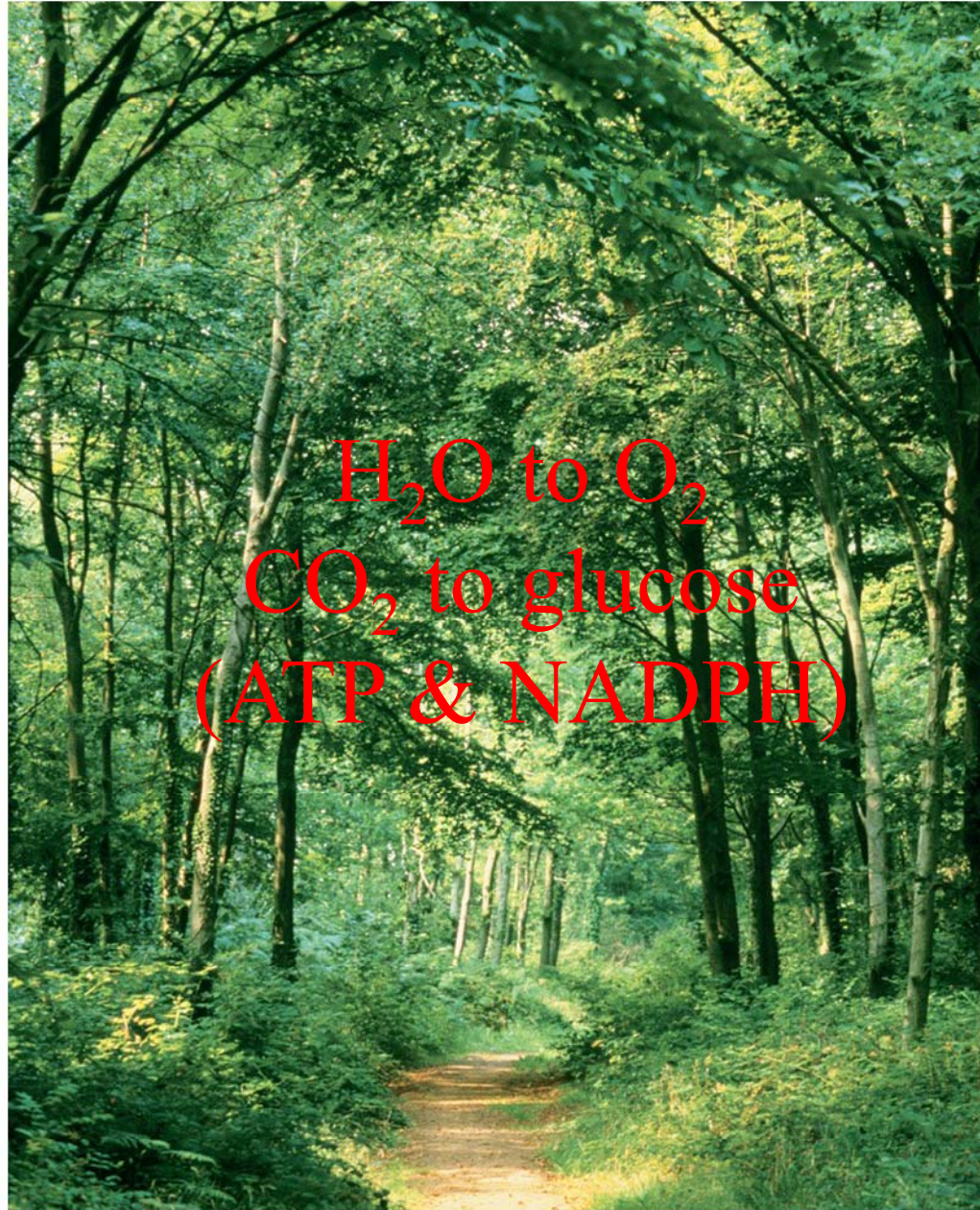


Chapter 6-I:

Photosynthesis





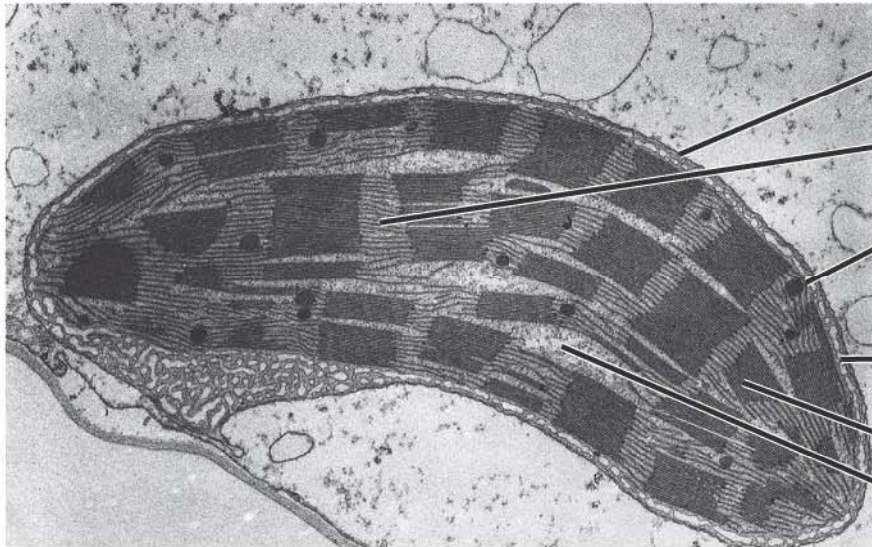
H_2O to O_2
 CO_2 to glucose
(ATP & NADPH)

Chloroplasts

1~1000 per cell

Evolved from photosynthetic bacteria

(a)



(b)

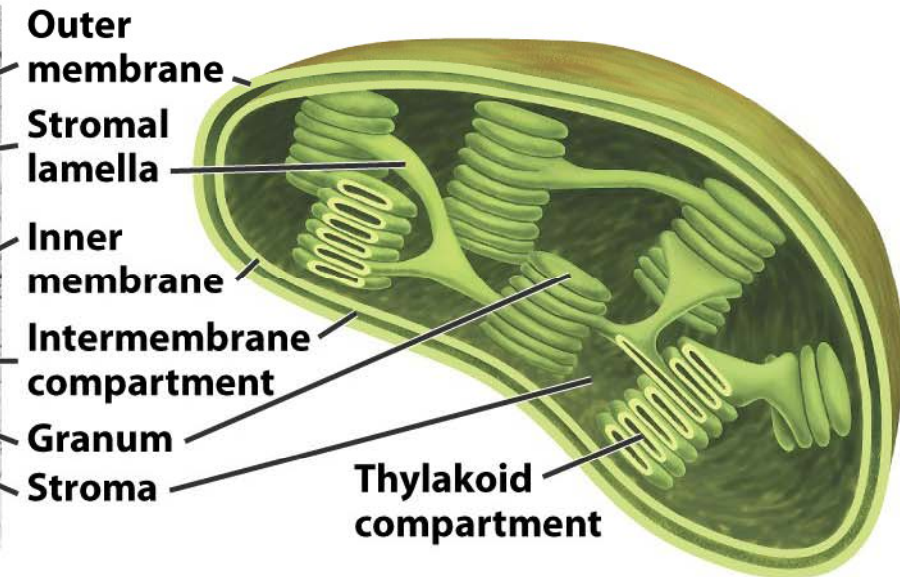
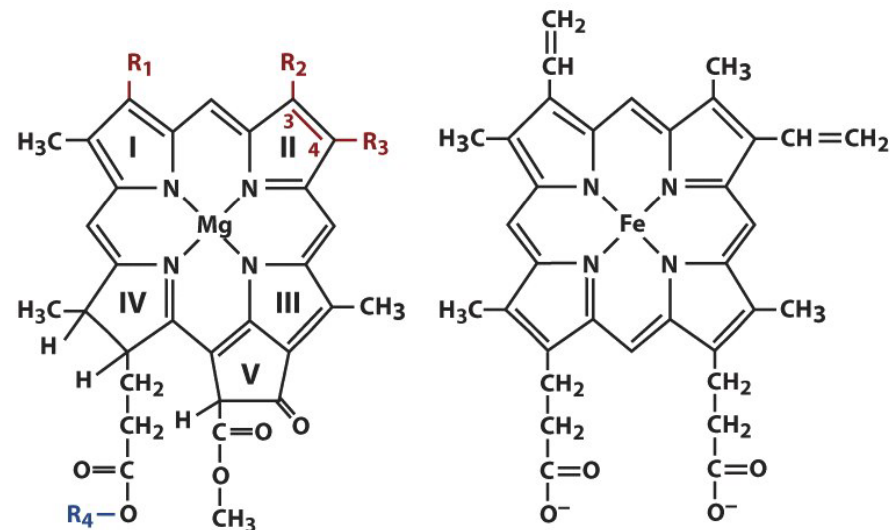


Figure 18-1 Fundamentals of Biochemistry, 2/e

Light-absorbing pigments

Plant & cyanobacteria: Chl a, Chl b

Photosynthetic bacteria: BChl a, BChl b



Chlorophyll

Iron-protoporphyrin IX

	R_1	R_2	R_3	R_4
Chlorophyll a	$-\text{CH}=\text{CH}_2$	$-\text{CH}_3$	$-\text{CH}_2-\text{CH}_3$	P
Chlorophyll b	$-\text{CH}=\text{CH}_2$	$-\text{C}(=\text{O})-\text{H}$	$-\text{CH}_2-\text{CH}_3$	P
Bacteriochlorophyll a	$-\text{C}(=\text{O})-\text{CH}_3$	$-\text{CH}_3^a$	$-\text{CH}_2-\text{CH}_3^a$	P or G
Bacteriochlorophyll b	$-\text{C}(=\text{O})-\text{CH}_3$	$-\text{CH}_3^a$	$=\text{CH}-\text{CH}_3^a$	P

^aNo double bond between positions C3 and C4.

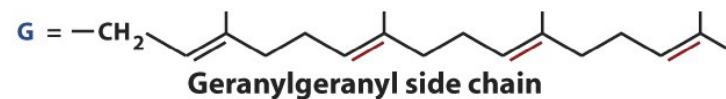
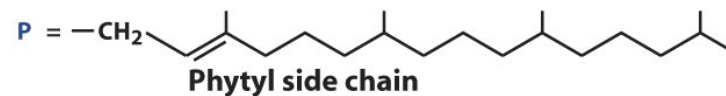


Figure 18-2 Fundamentals of Biochemistry, 2/e
© 2006 John Wiley & Sons

Absorption spectra of various photosynthetic pigments

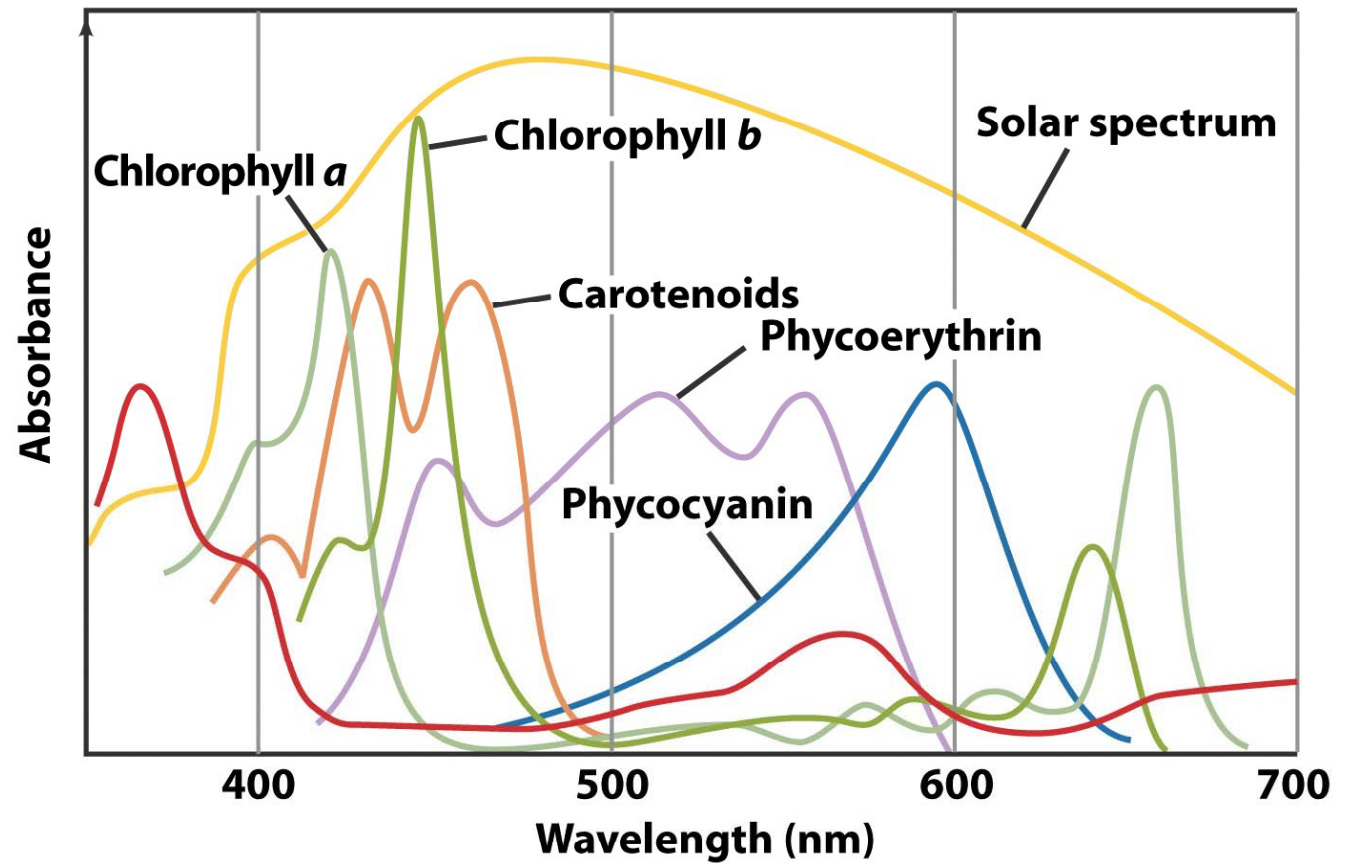


Figure 18-3 Fundamentals of Biochemistry, 2/e
© 2006 John Wiley & Sons

Transfer of energy

From Light-harvesting complex (LHC): antenna chlorophylls, accessory pigments

To Photosynthetic reaction center (RC)

Occurs in $<10^{-10}$ s with an efficiency of $>90\%$

Flow of energy through
a photosynthetic antenna complex

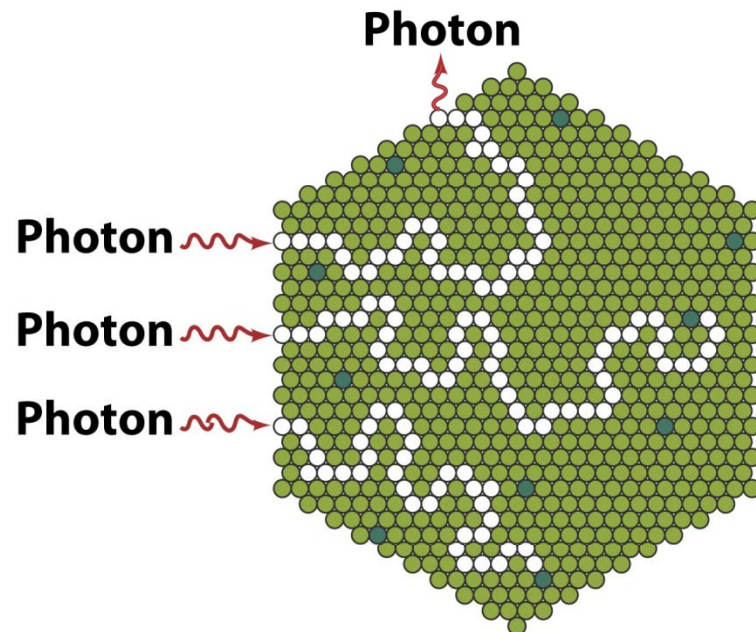
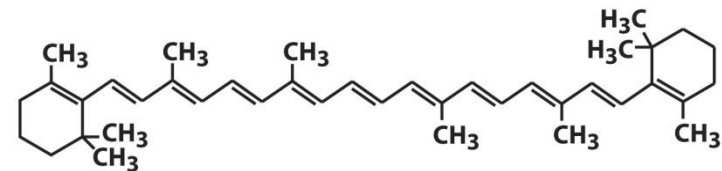
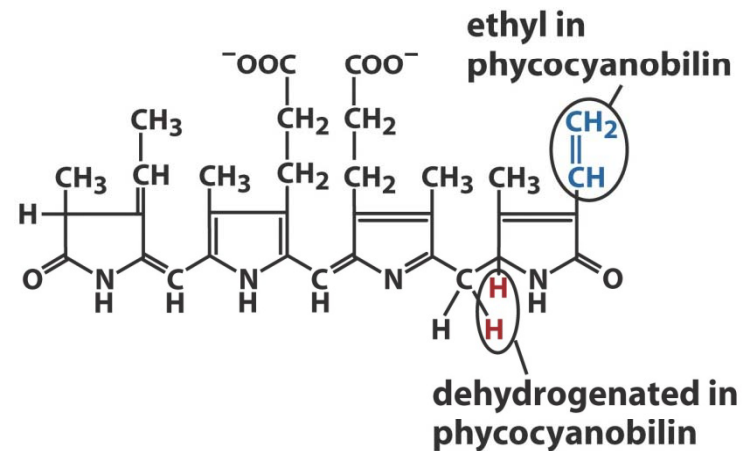


Figure 18-4 Fundamentals of Biochemistry, 2/e
© 2006 John Wiley & Sons



β -Carotene

Unnumbered figure pg 594 Fundamentals of Biochemistry, 2/e
© 2006 John Wiley & Sons



Phycoerythrobilin and Phycocyanobilin

Unnumbered figure pg 595 Fundamentals of Biochemistry, 2/e
© 2006 John Wiley & Sons

Light-harvesting complex LH-2 from *Rs. molischianum*

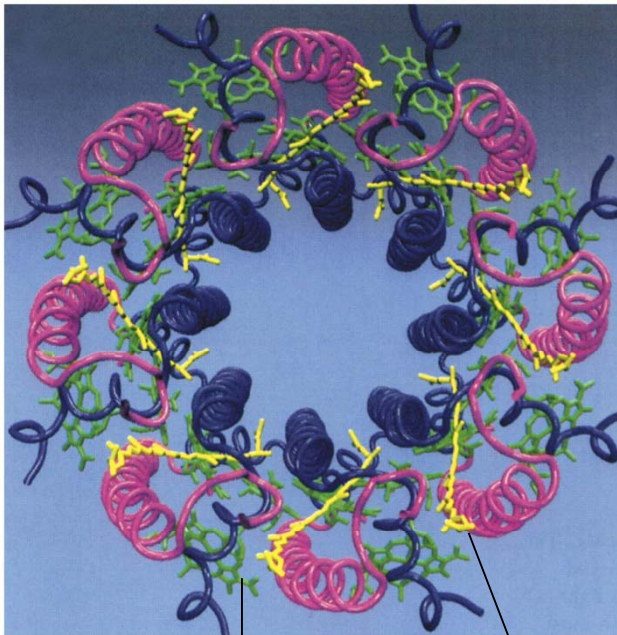


Figure 18-5a Fundamentals of Biochemistry, 2/e

24 BChl a

8 lycopene

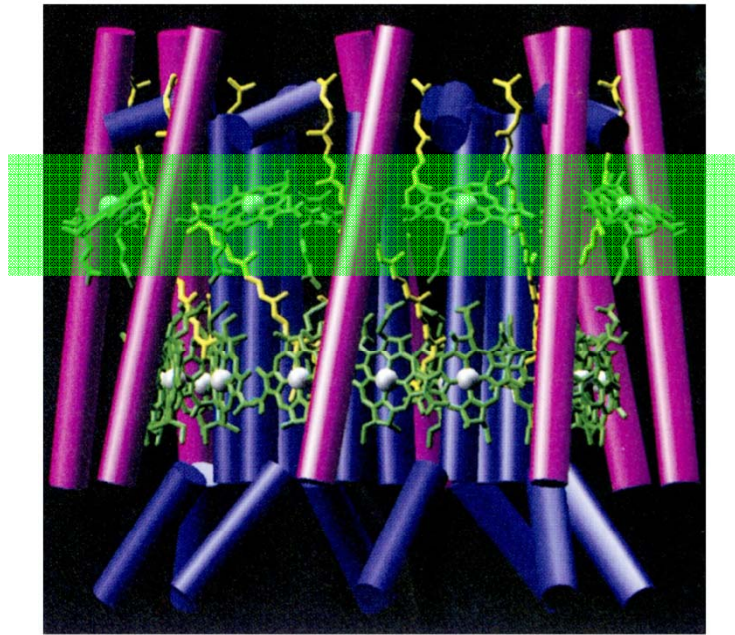


Figure 18-5b Fundamentals of Biochemistry, 2/e

8 BChl a

The light reactions

Conversion of electronic E to chemical E

$$E = h\nu = hc/\lambda$$

h : Plank's constant

ν : frequency of radiation

c : light speed

λ : wavelength

Excitation & dissipation

Internal conversion

Fluorescence

Exciton transfer (resonance E transfer)
photooxidation

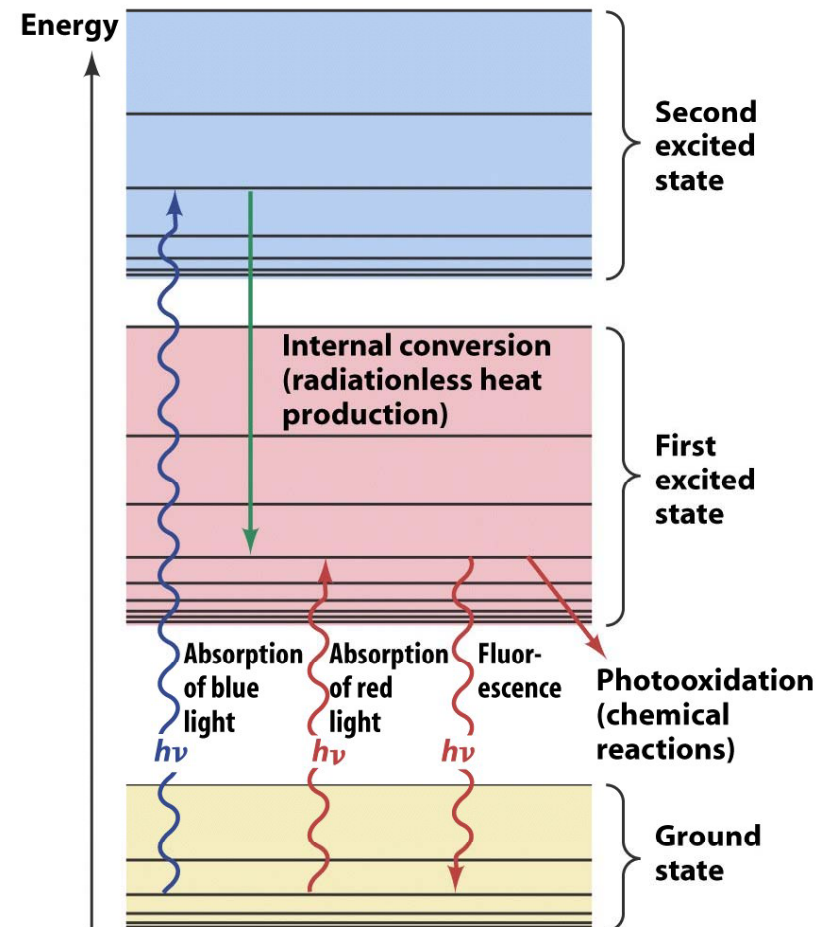
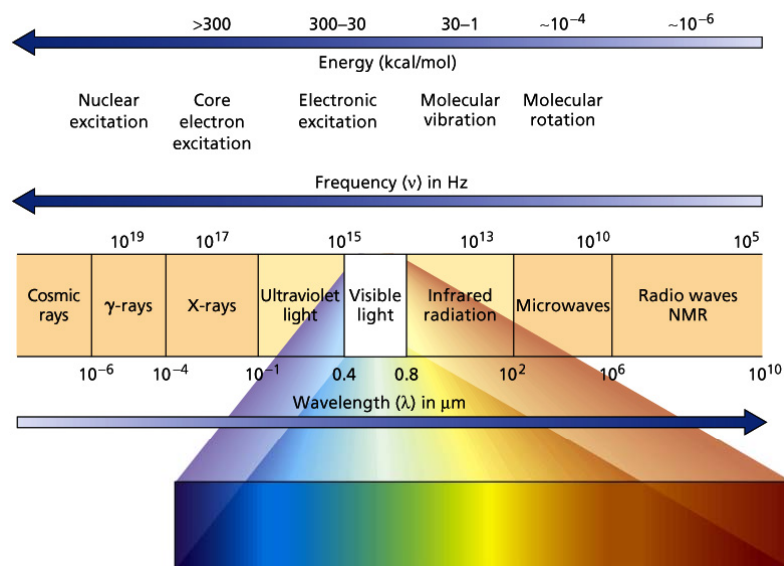
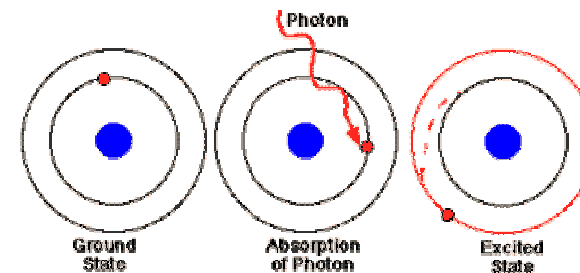


Figure 18-6 Fundamentals of Biochemistry, 2/e
© 2006 John Wiley & Sons



Excitation energy trapping by the photosynthetic reaction center

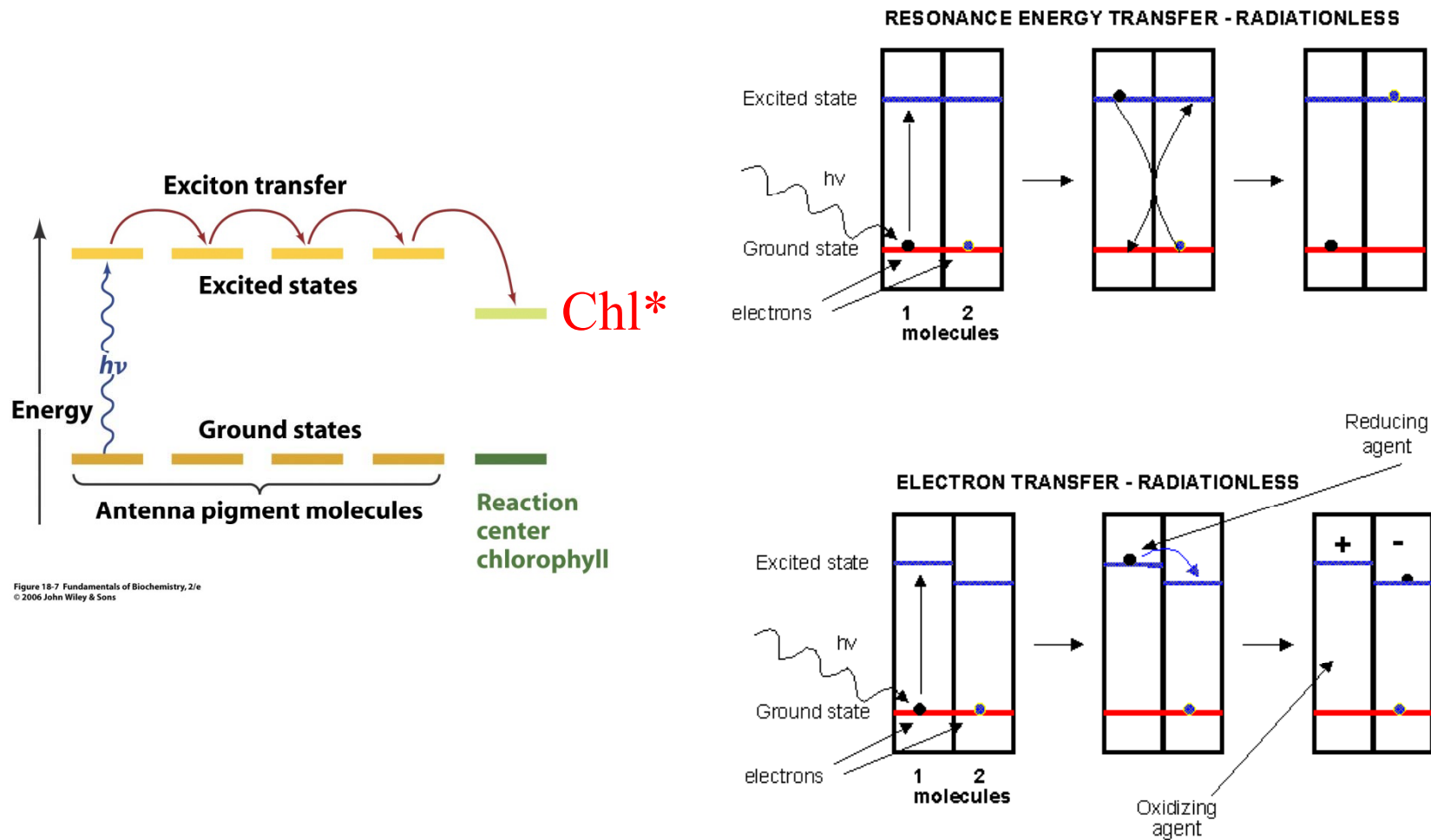
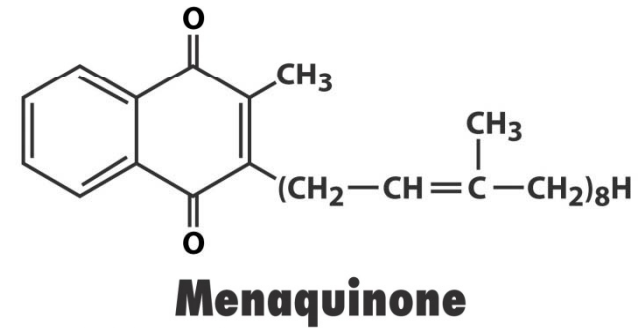


Figure 18-7 Fundamentals of Biochemistry, 2/e
© 2005 John Wiley & Sons

Electron transport in photosynthetic bacteria



Unnumbered figure pg 598 Fundamentals of Biochemistry, 2/e
© 2006 John Wiley & Sons

RC from *Rhodobacter sphaeroides*

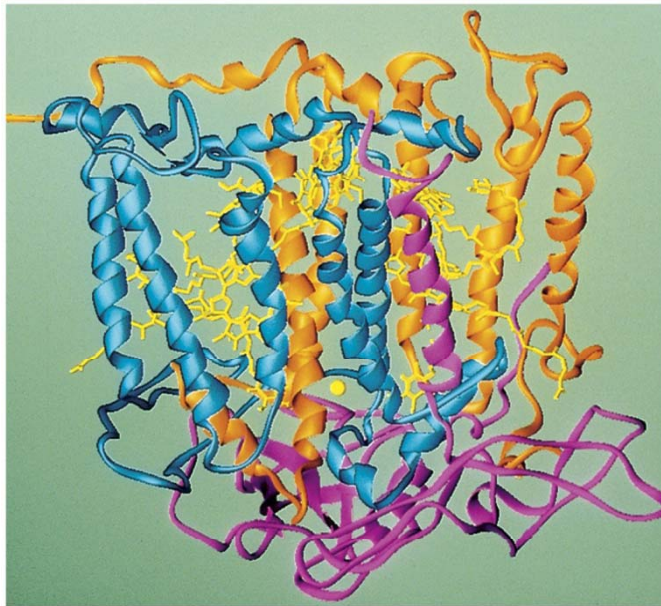


Figure 18-8 Fundamentals of Biochemistry, 2/e

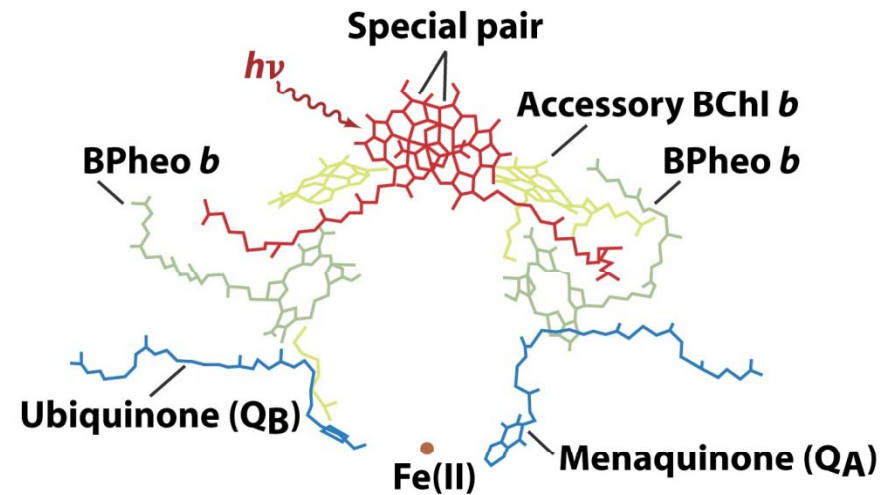


Figure 18-9 Fundamentals of Biochemistry, 2/e
© 2006 John Wiley & Sons

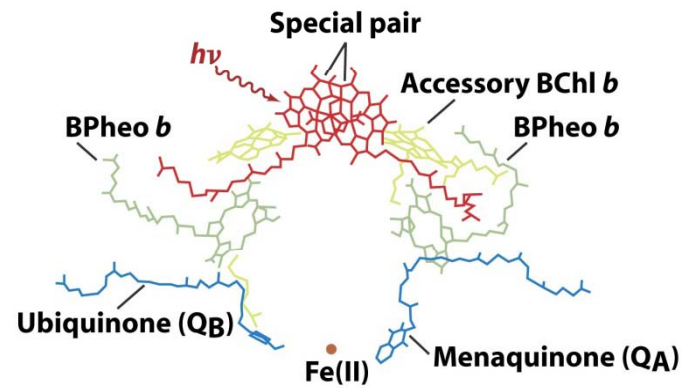


Figure 18-9 Fundamentals of Biochemistry, 2/e
© 2006 John Wiley & Sons

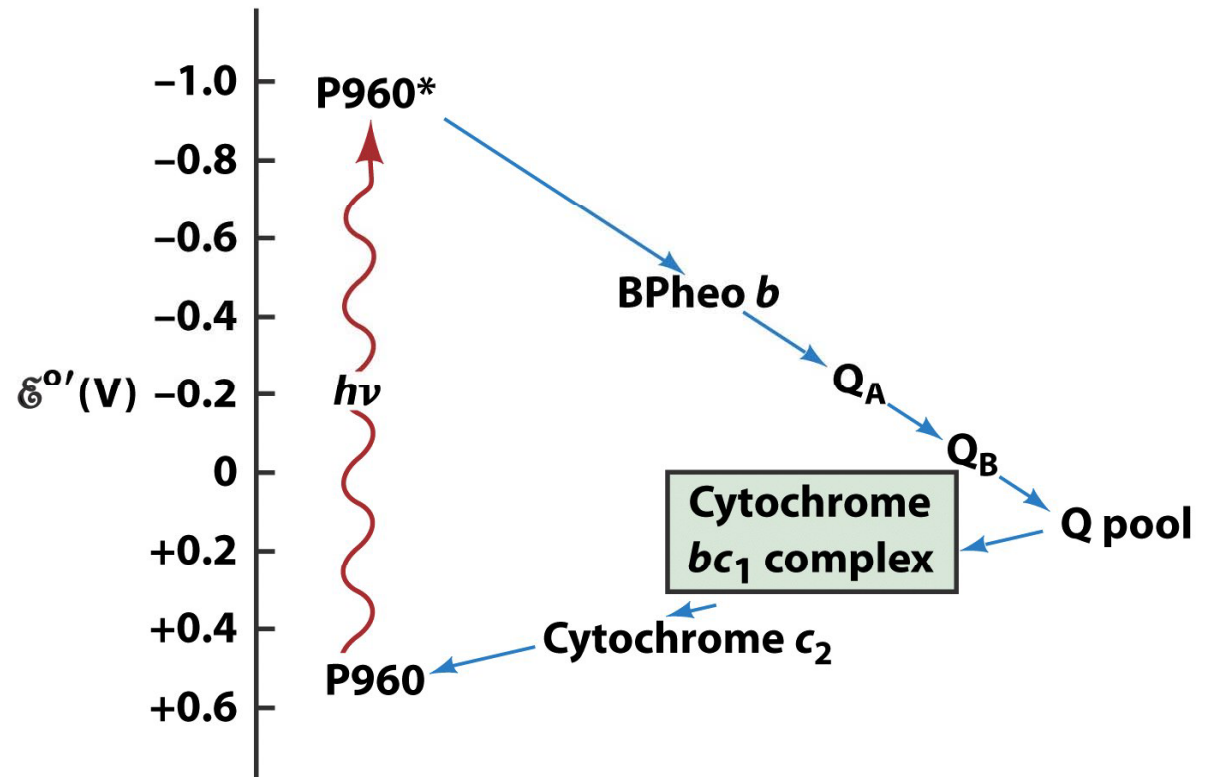


Figure 18-10 Fundamentals of Biochemistry, 2/e
© 2006 John Wiley & Sons

Two-center electron transfer

PSII

PSI

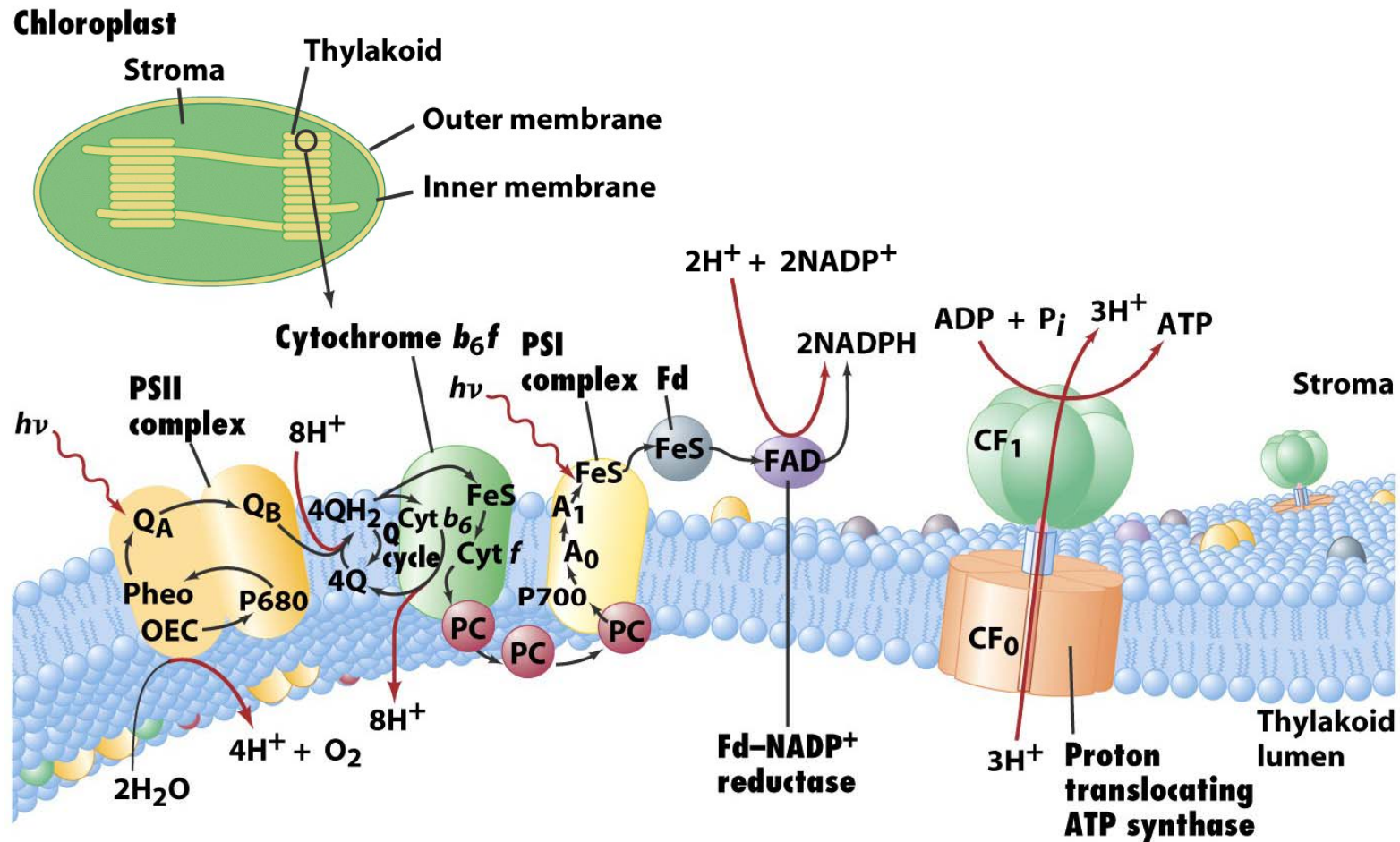


Figure 18-11 Fundamentals of Biochemistry, 2/e
© 2006 John Wiley & Sons

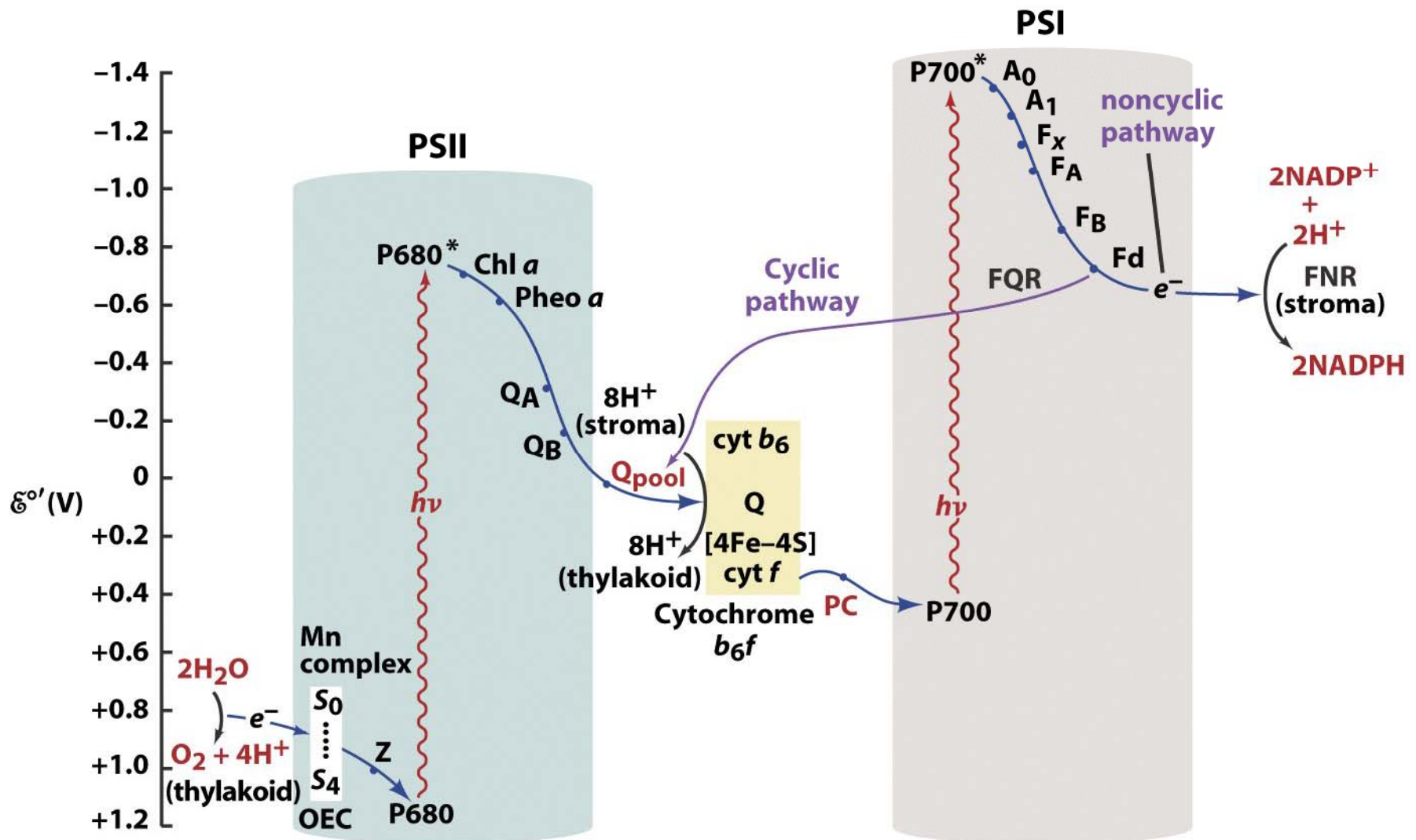


Figure 18-12 Fundamentals of Biochemistry, 2/e
© 2006 John Wiley & Sons

Oxygen evolving center: water splitting enzyme
4 light-dependent reactions before releasing O₂

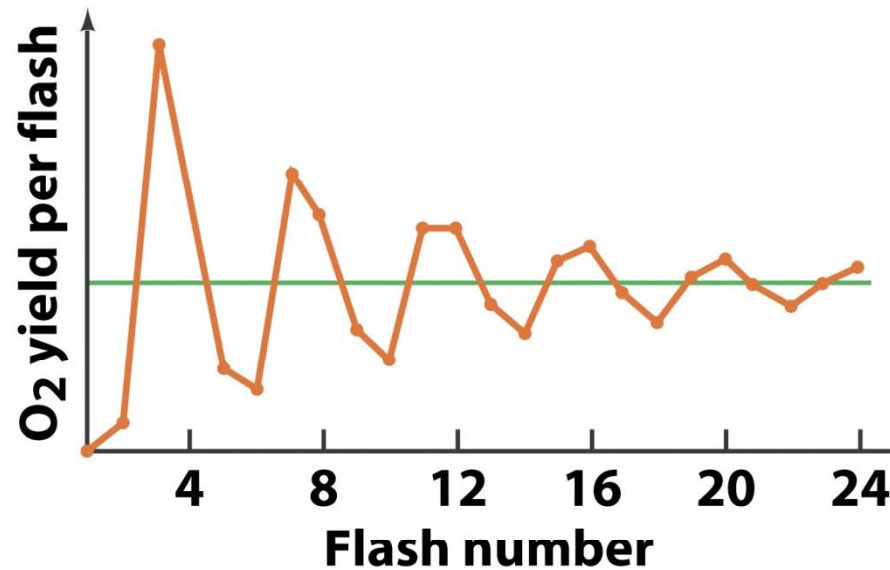


Figure 18-13 Fundamentals of Biochemistry, 2/e
© 2006 John Wiley & Sons

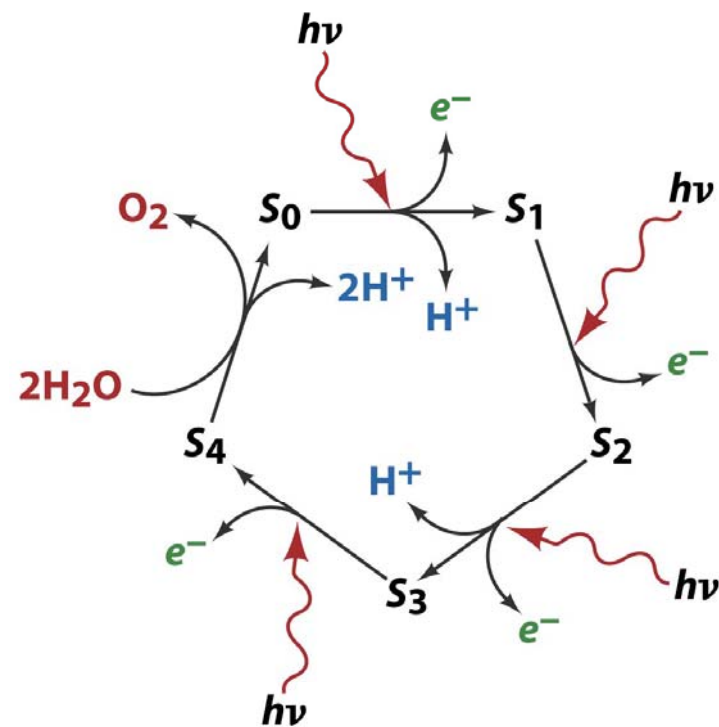


Figure 18-14 Fundamentals of Biochemistry, 2/e
© 2006 John Wiley & Sons

