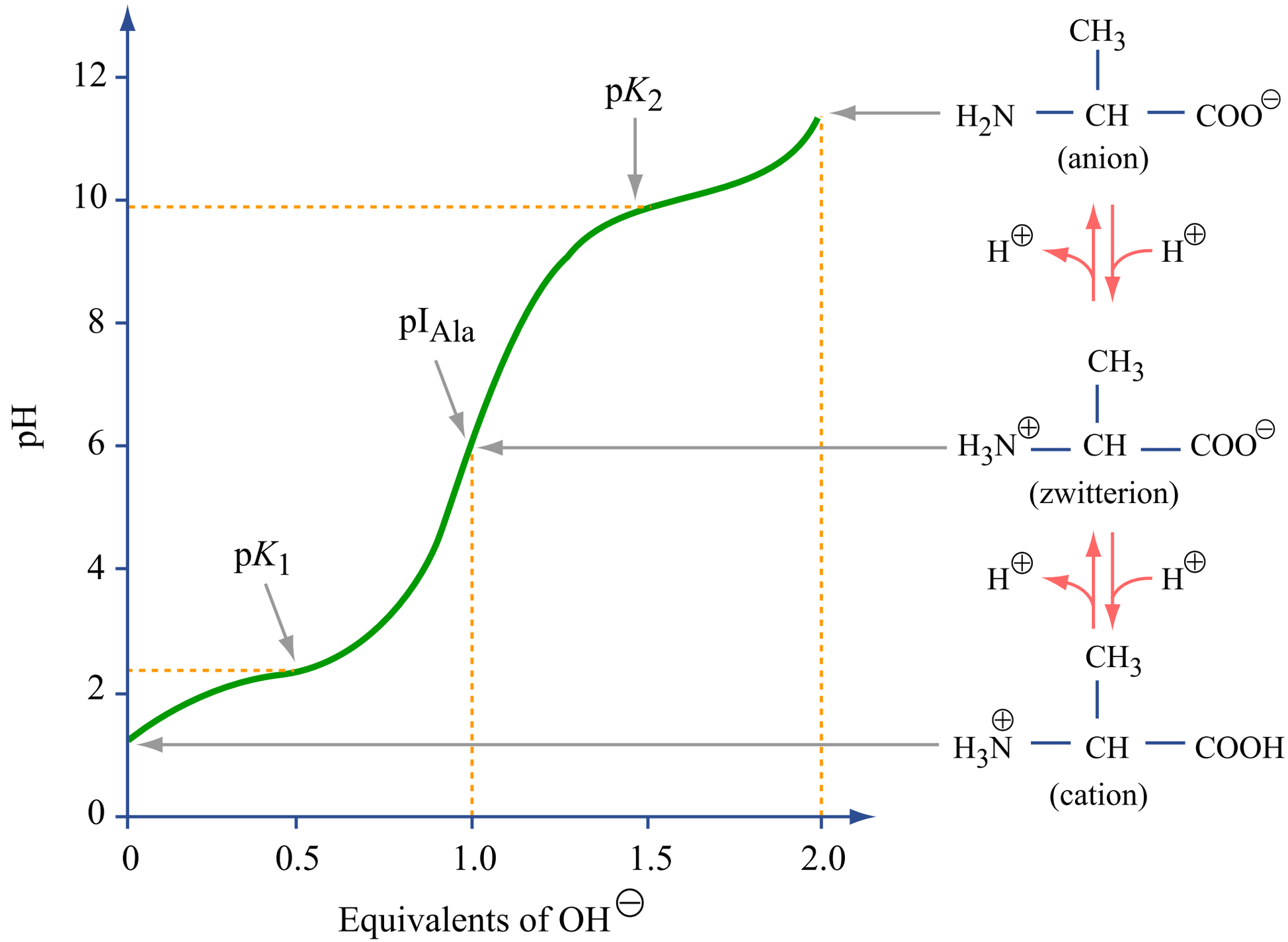
Welcome to 3.091

Lecture 31

November 30, 2009

Biochemistry: Protein Structure

Titration Curve for Alanine



AMINO ACID	pKa VALUE		
	Carboxyl Group	*Amino Group*	*Side Chain*
Glycine	2.4	9.8	
Alanine	2.4	9.9	
Valine	2.3	9.7	
Leucine	2.3	9.7	
Isoleucine	2.3	9.8	
Methionine	2.1	9.3	
Proline	2.0	10.6	
Phenylalanine	2.2	9.3	
Tryptophan	2.5	9.4	
Serine	2.2	9.2	
Threonine	2.1	9.1	
Cysteine	1.9	10.7	8.4
Tyrosine	2.2	9.2	10.5
Asparagine	2.1	8.7	
Glutamine	2.2	9.1	
Aspartic acid	2.0	9.9	3.9
Glutamic acid	2.1	9.5	4.1
Lysine	2.2	9.1	10.5
Arginine	1.8	9.0	12.5
Histidine	1.8	9.3	6.0

pK_a values for constituents of free amino acids 25°C

TABLE P.2 Common Condensation Polymers

Structure	*Trade Name / Common Na*
Polyamides	
$(-NH-(CH_2)_6-NH-\overset{O}{\overset{\|}{C}}-(CH_2)_4-\overset{O}{\overset{\|}{C}}-)_n$	Nylon 6, 6
$(-NH-(CH_2)_6-NH-\overset{O}{\overset{\|}{C}}-(CH_2)_8-\overset{O}{\overset{\|}{C}}-)_n$	Nylon 6, 10
$(-NH-(CH_2)_5-\overset{O}{\overset{\|}{C}}-)_n$	Nylon 6
$(-NH-\langle\bigcirc\rangle-CH_2-\langle\bigcirc\rangle-NH-\overset{O}{\overset{\|}{C}}-(CH_2)_{10}-\overset{O}{\overset{\|}{C}}-)_n$	Qiana

amino end

amide bond

carboxylic acid end

amide bond

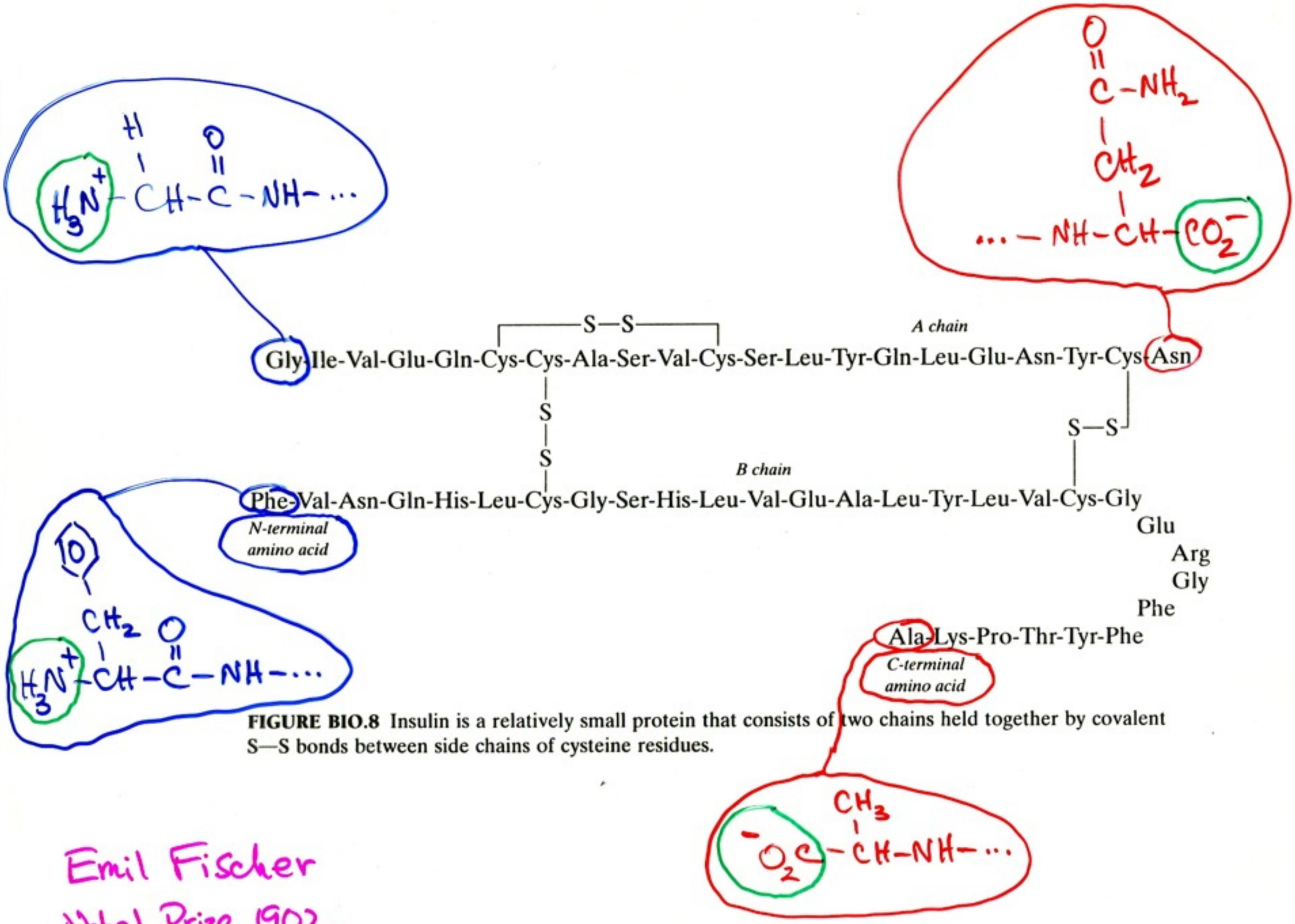
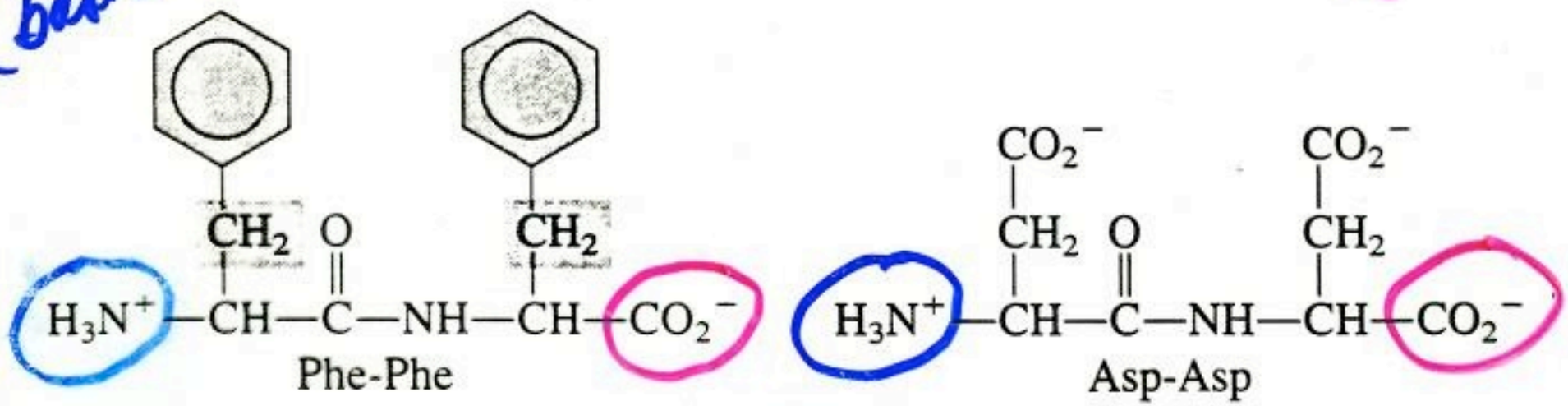


FIGURE BIO.8 Insulin is a relatively small protein that consists of two chains held together by covalent S—S bonds between side chains of cysteine residues.

Emil Fischer
Nobel Prize 1902
Structure of sugars ⇒ amino acids / protein synthesis

N-terminal (basic)

C-terminal (acidic)



combinations of phenylalanine and aspartic acid

(Phe) (Asp)

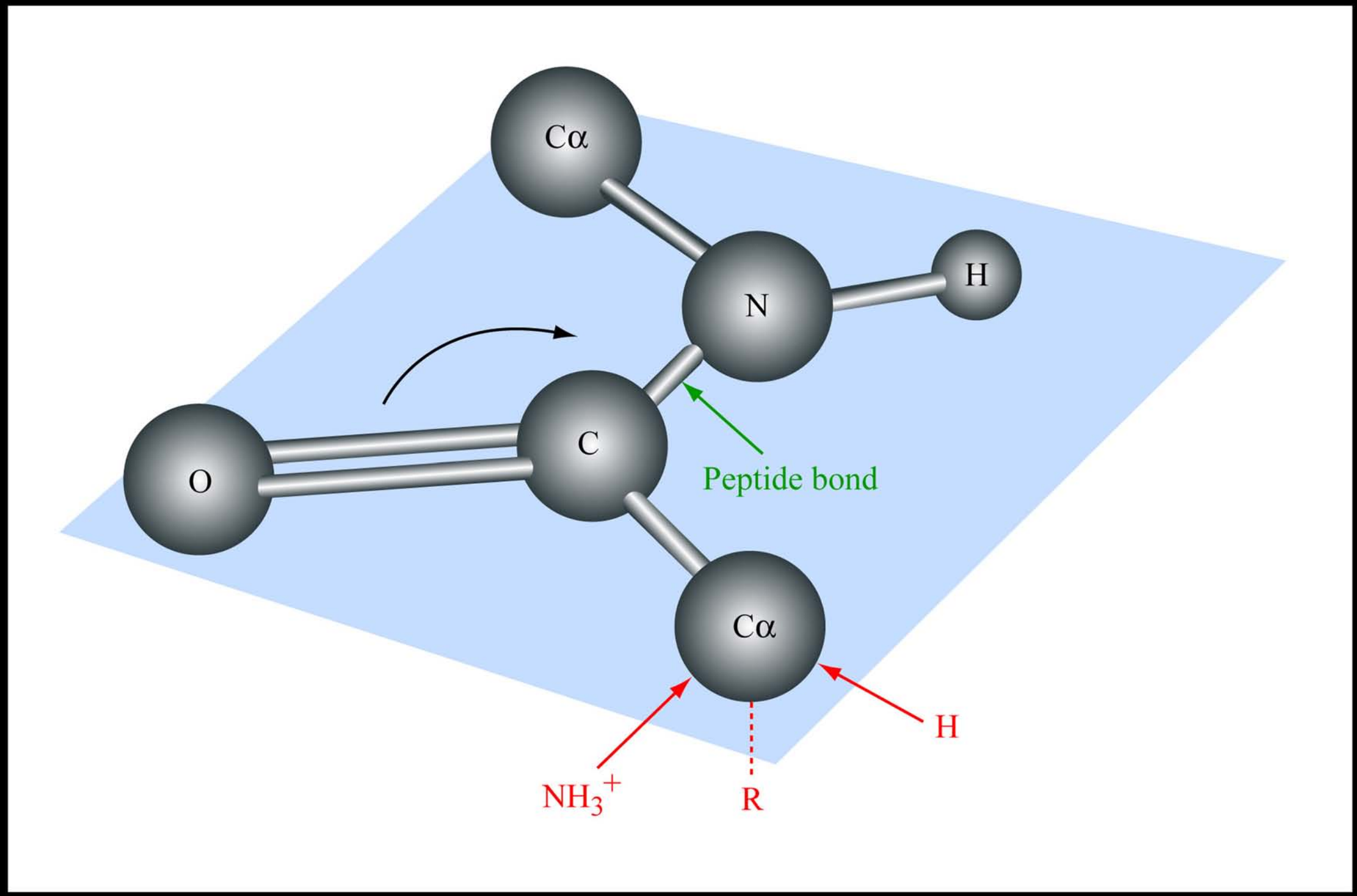
(Phe) (Asp)

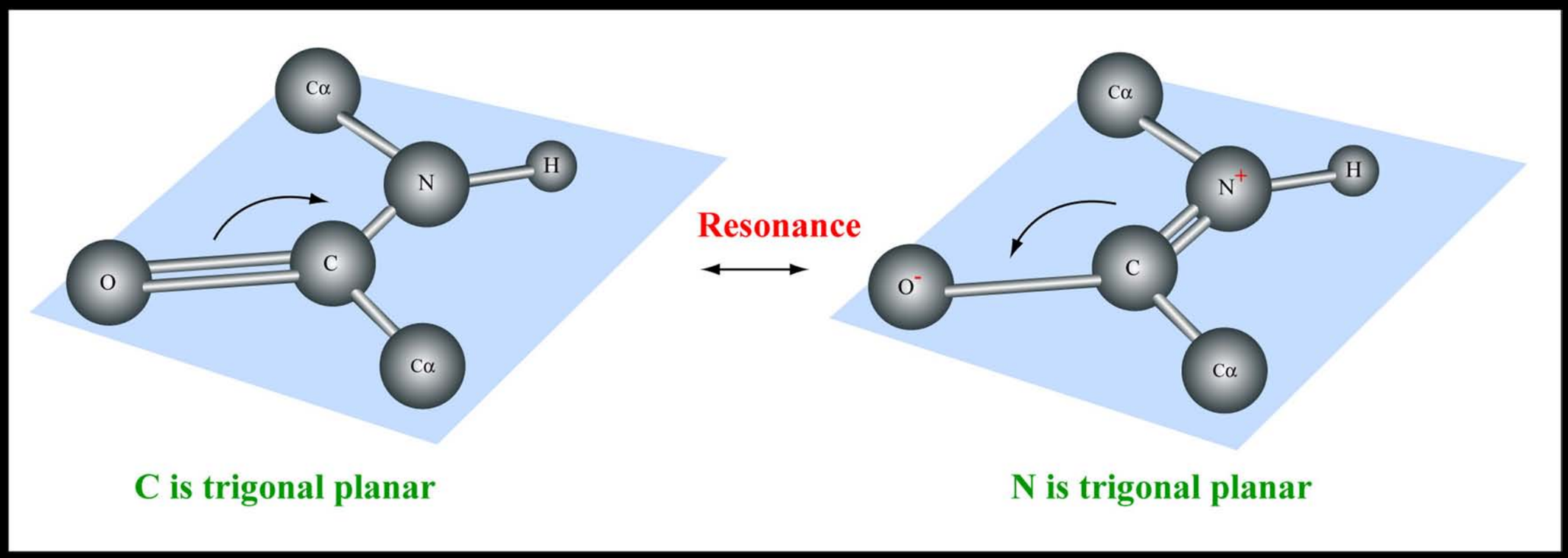
The Amino Acids and Their Airport Symbols

Symbol	*Amino Acid*	*Airport*
GLY	Glycine	Mount Goldsworthy Airport Mount Goldsworthy, Australia
ALA	Alanine	Alma-Ata Airport Alma Ata, Kazakhstan
VAL	Valine	Valenca Airport Valenca, Brazil
LEU	Leucine	Seo De Urgel Airport Seo De Urgel, Spain
ILE	Isoleucine	Killeen Muni Airport Killeen, Texas
PRO	Proline	Perry Muni Airport Perry, Iowa
MET	Methionine	Moreton Airport Moreton, Australia
PHE	Phenylalanine	Port Hedland Airport Port Hedland, Australia
TRP	Tryptophan	Tree Point Airport Tree Point, Alaska

SER	Serine	Freeman Muni Airport Seymour, Indiana
THR	Threonine	Mehrabad/Qualeh Morgeh Airport Teheran, Iran
TYR	Tyrosine	Tyler Pounds Field Tyler, Texas
CYS	Cysteine	Cheyenne Airport Cheyenne, Wyoming
ASN	Asparagine	Talladega Muni Airport Talladega, Alabama
GLN	Glutamine	Goulimime Airport Goulimime, Morocco
ASP	Aspartic Acid	Alice Springs Airport Alice Springs, Australia
GLU	Glutamic Acid	does not exist
LYS	Lysine	Satolas Airport Lyon, France
ARG	Arginine	Walnut Ridge Regional Airport Walnut Ridge, Arkansas
HIS	Histidine	Hayman Island Airport Hayman Island, Australia

data show that all six atoms lie in a plane





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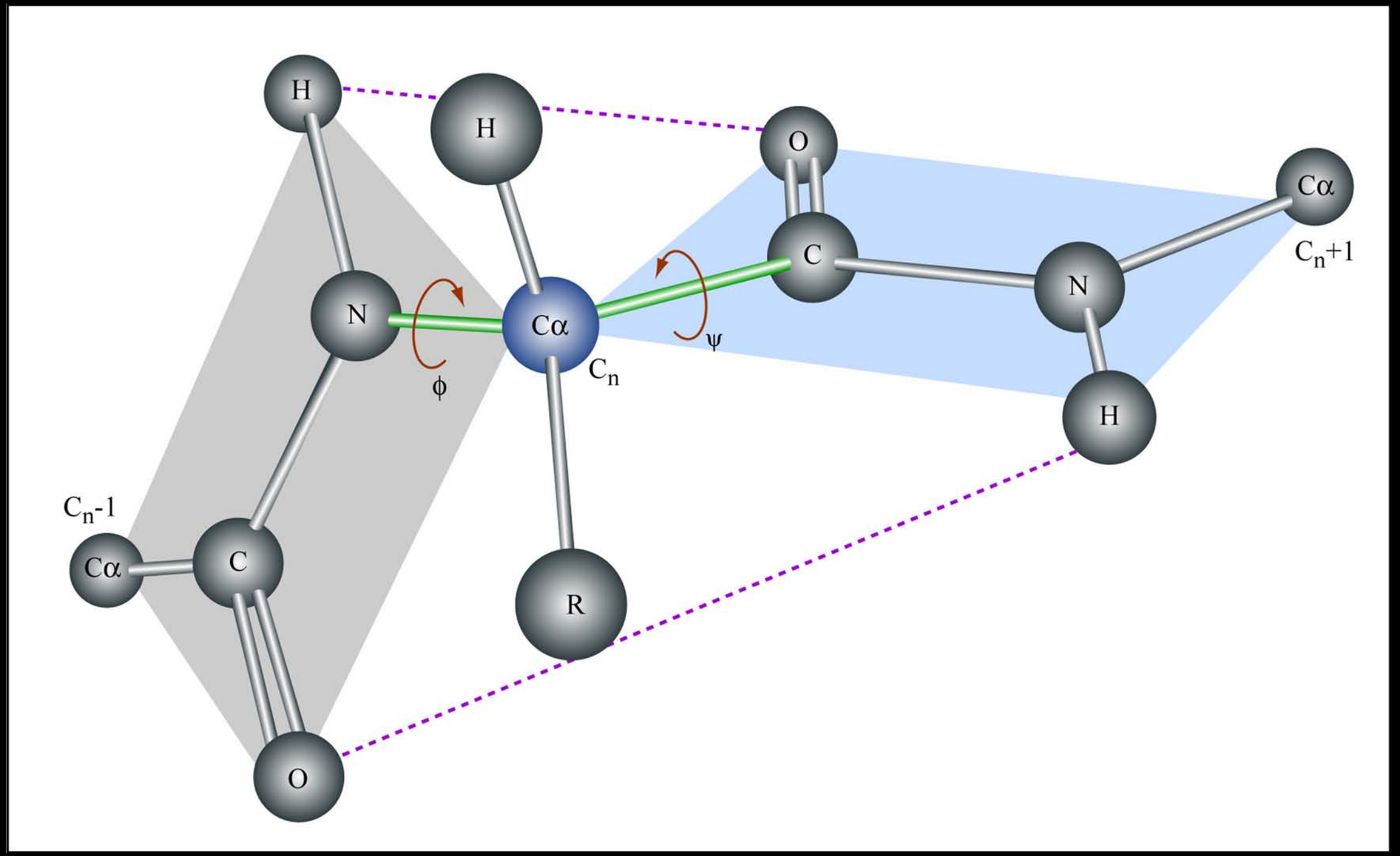

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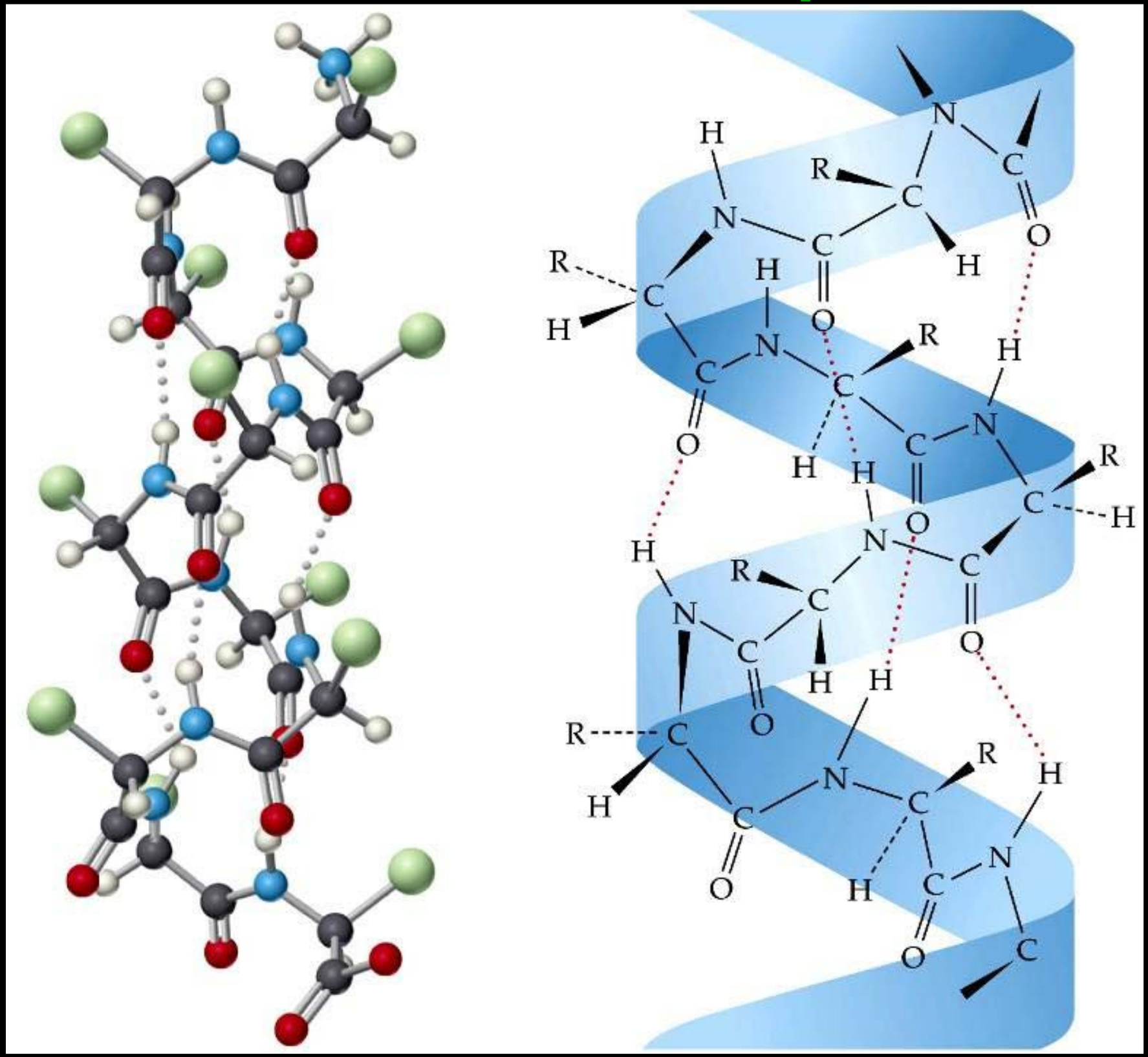
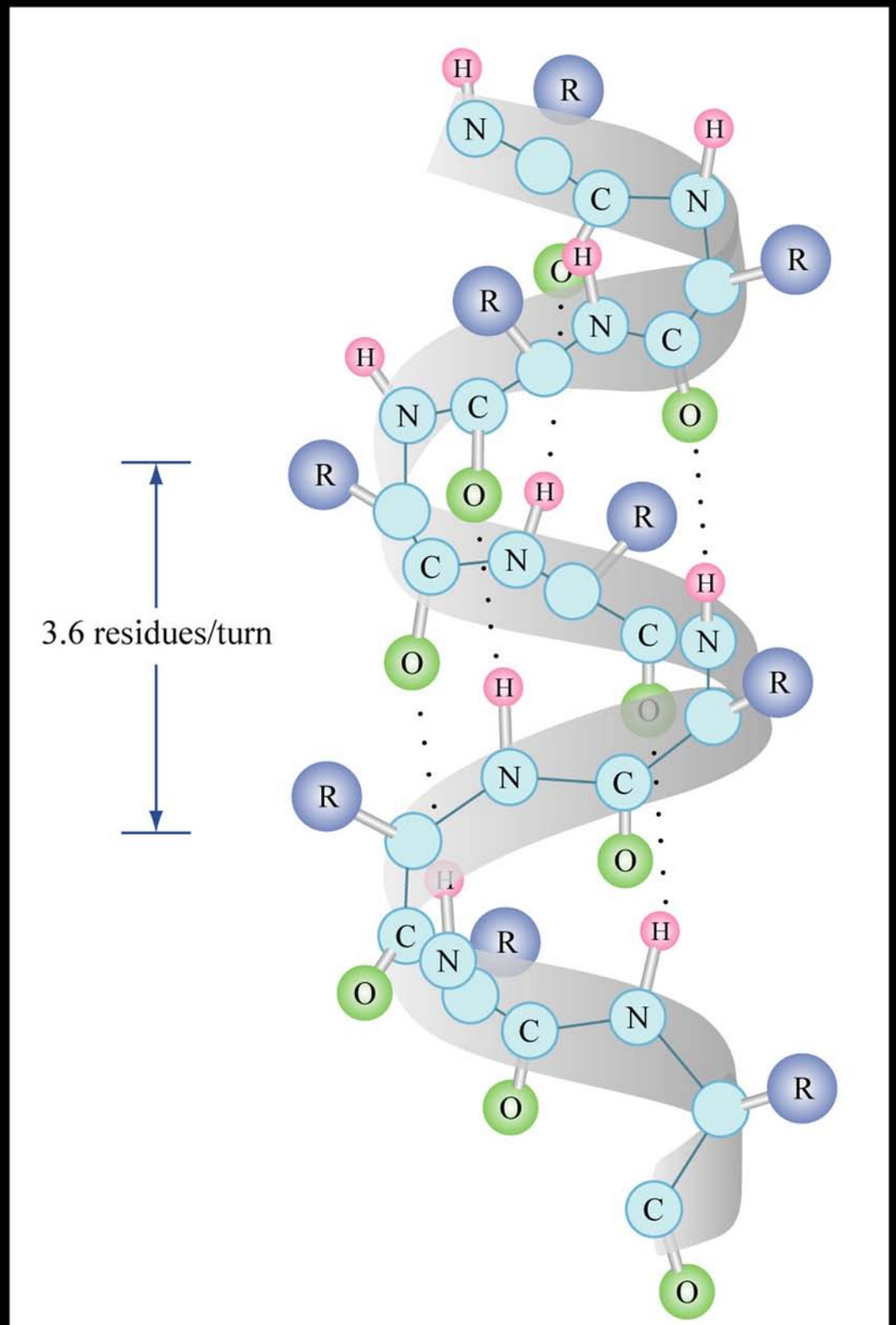
DNA alpha-helix



Source: Fig. 24.7 in McMurry & Fay. *Chemistry,* 4th ed. Prentice Hall, 2003.



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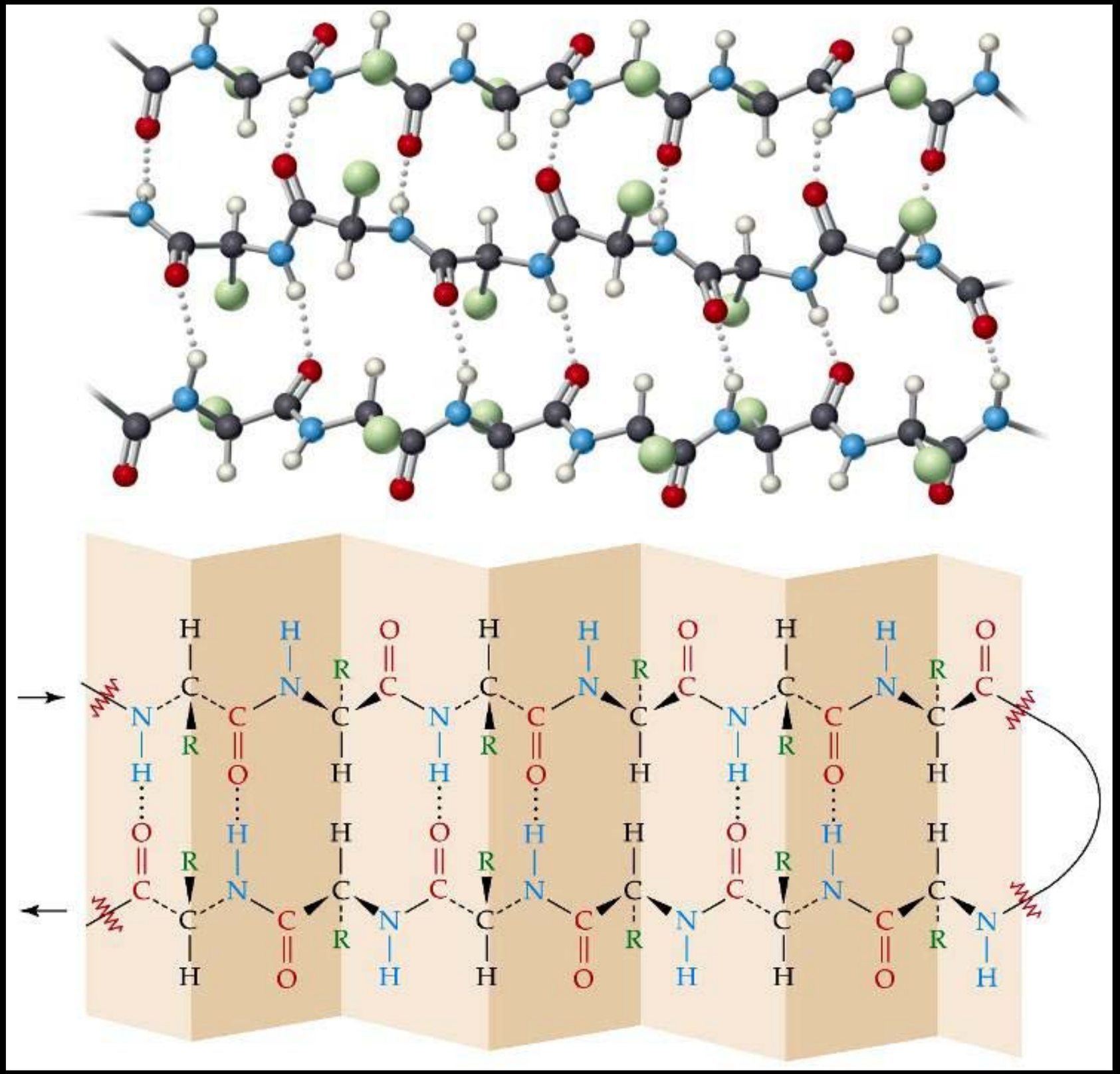
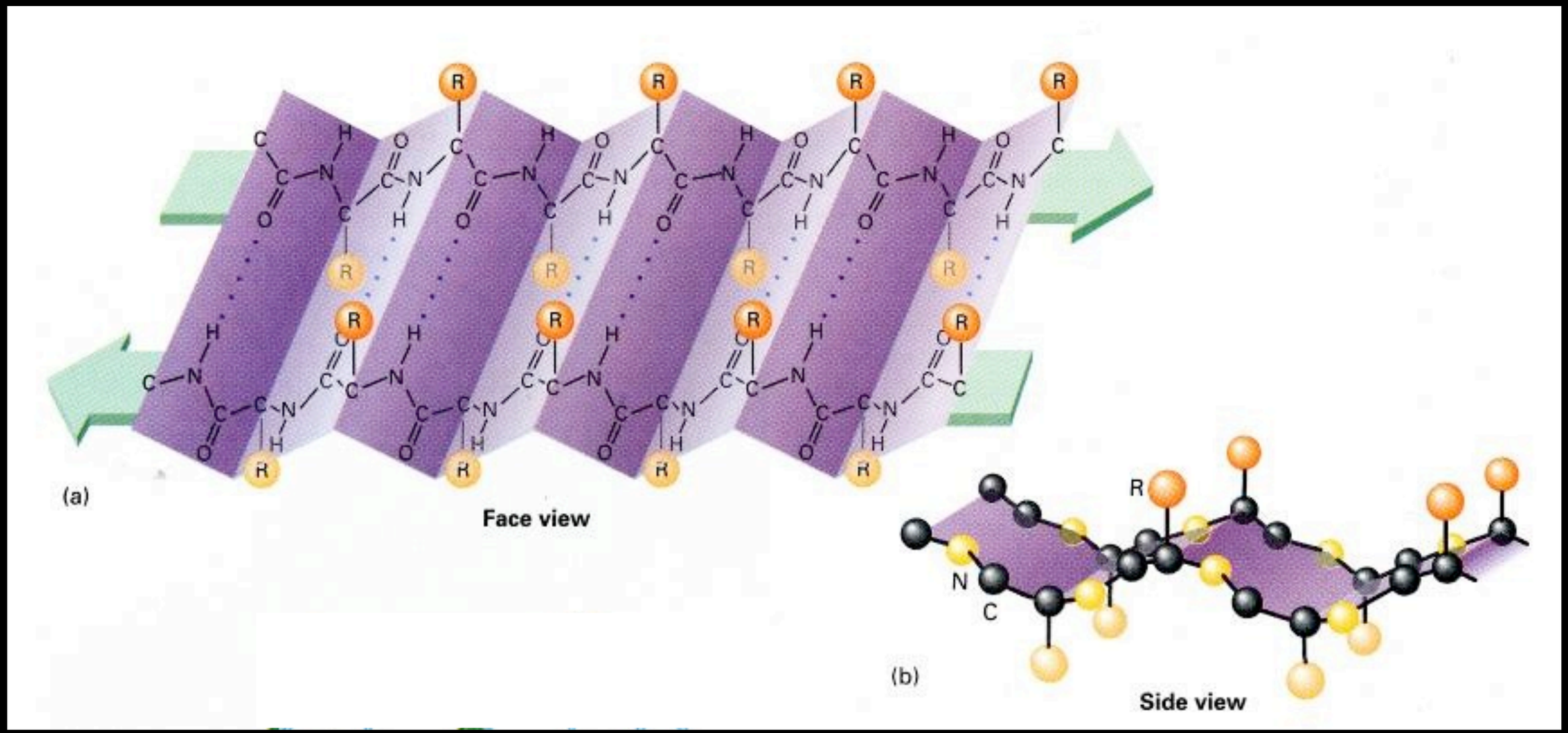
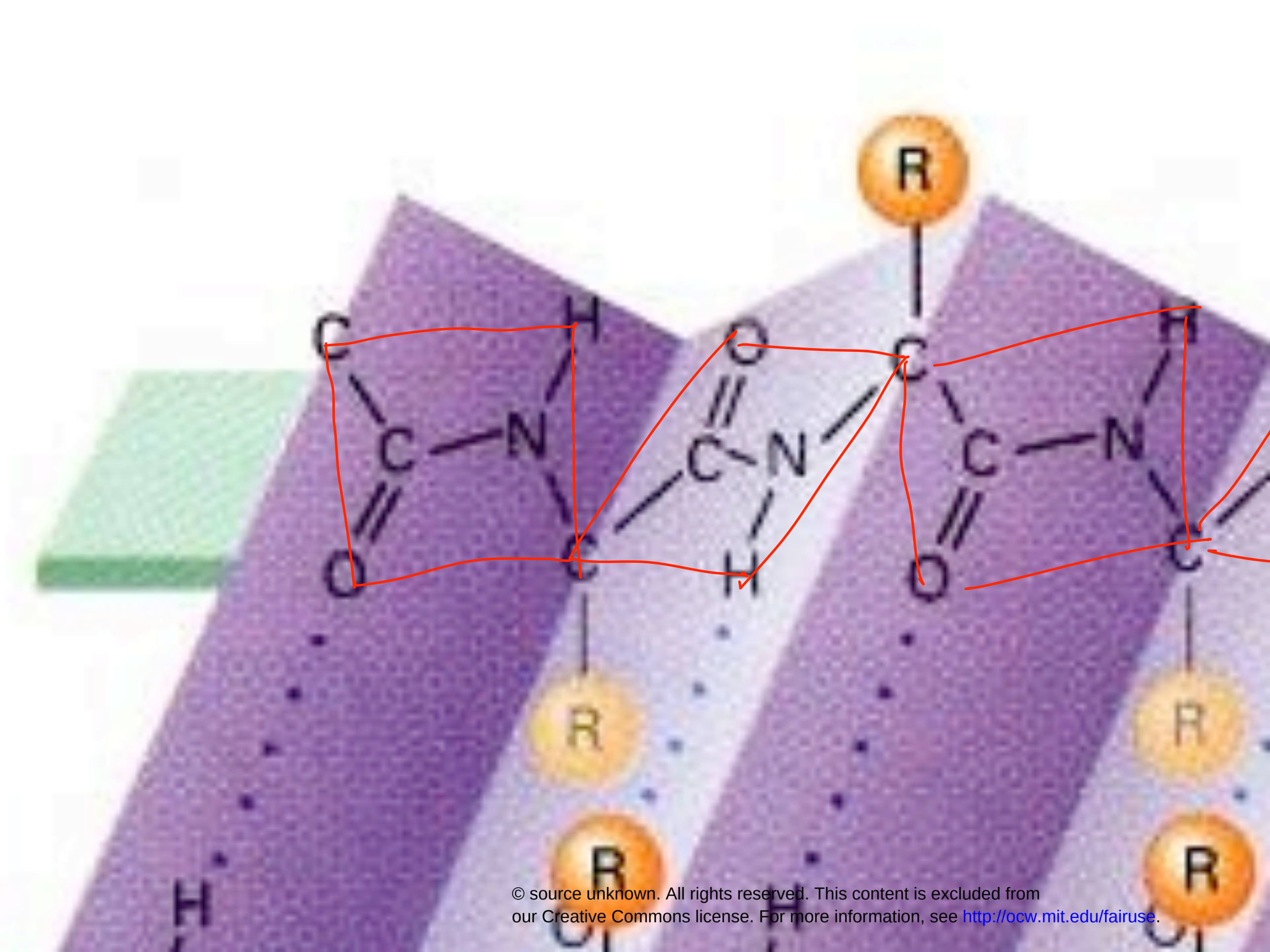
DNA beta-pleated sheet

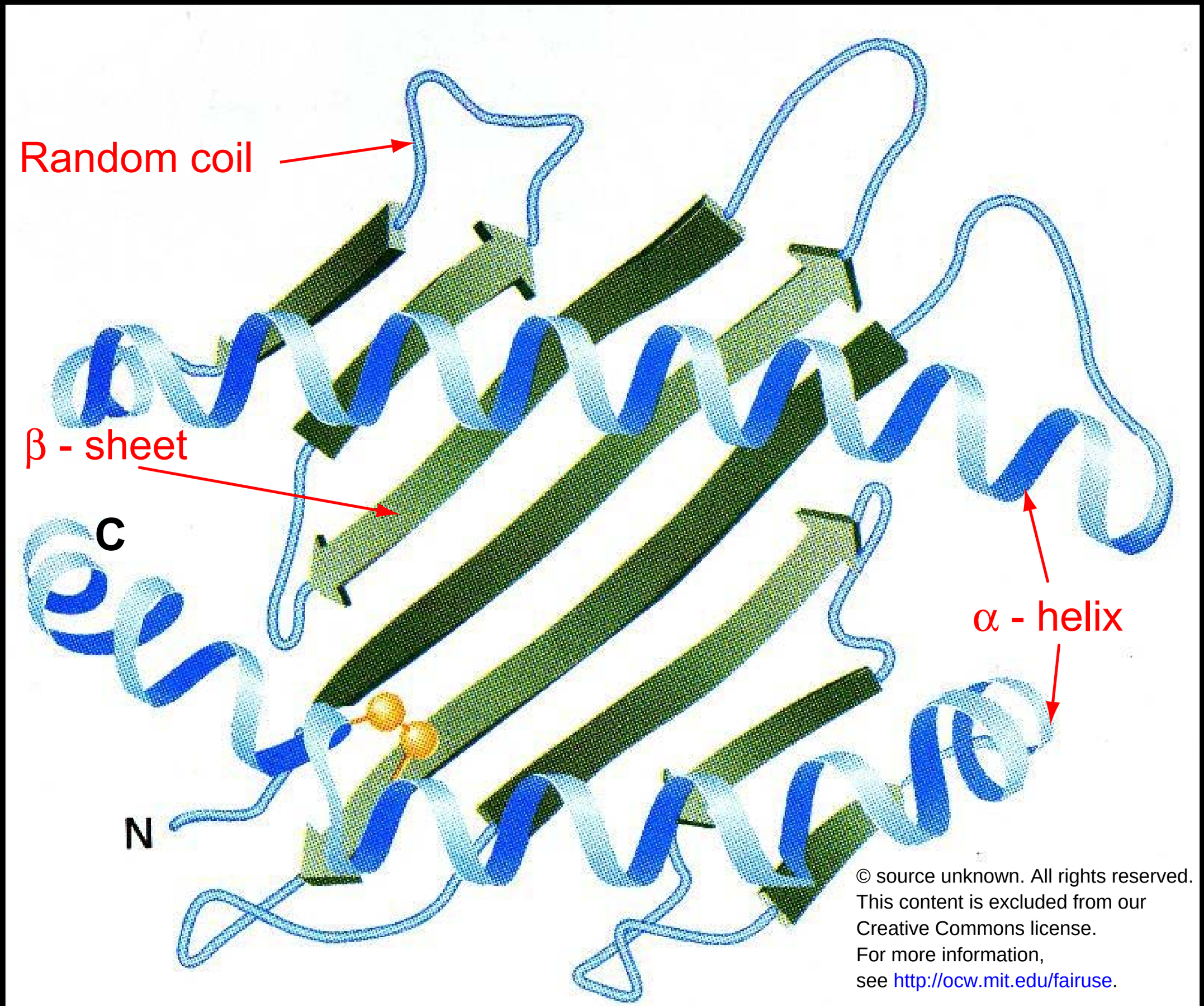


Source: Fig. 24.8 in McMurry & Fay. *Chemistry*, 4th ed. Prentice Hall, 2003

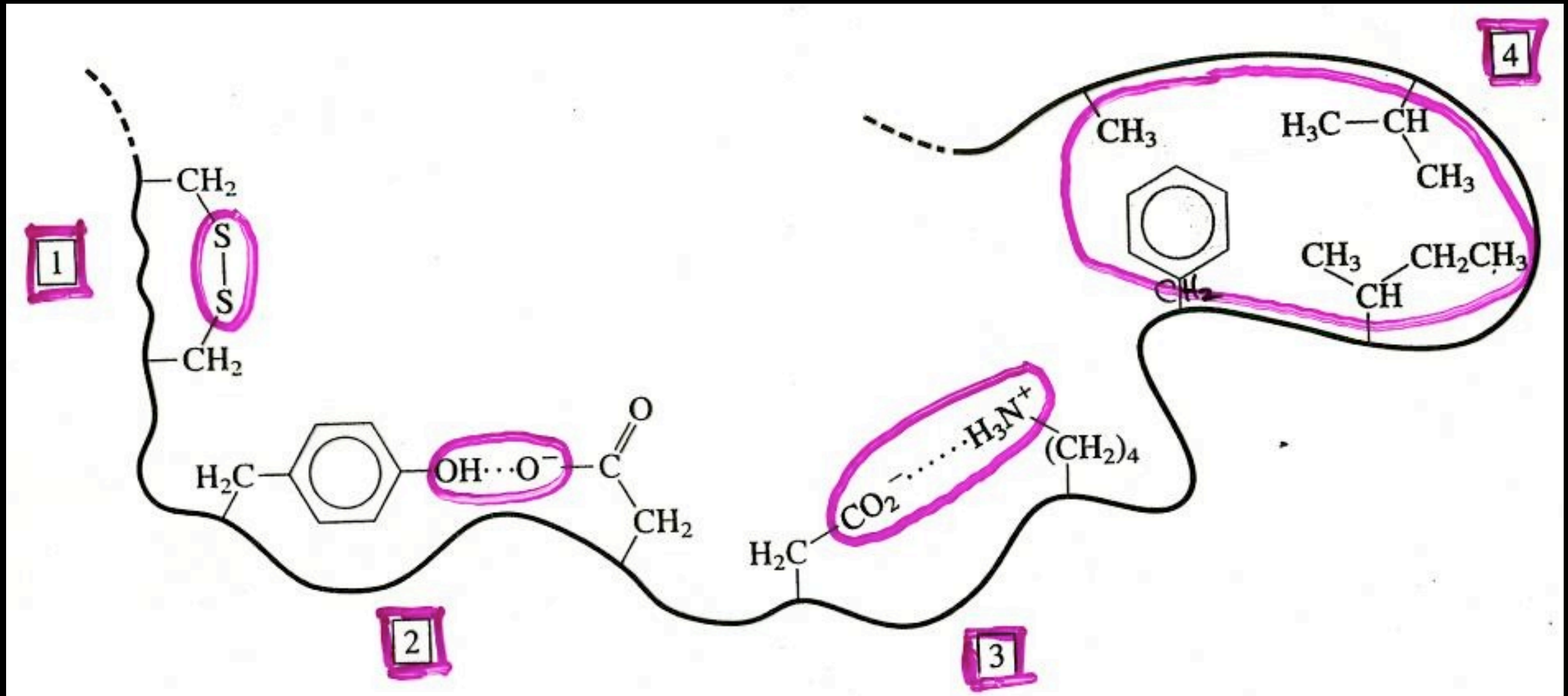


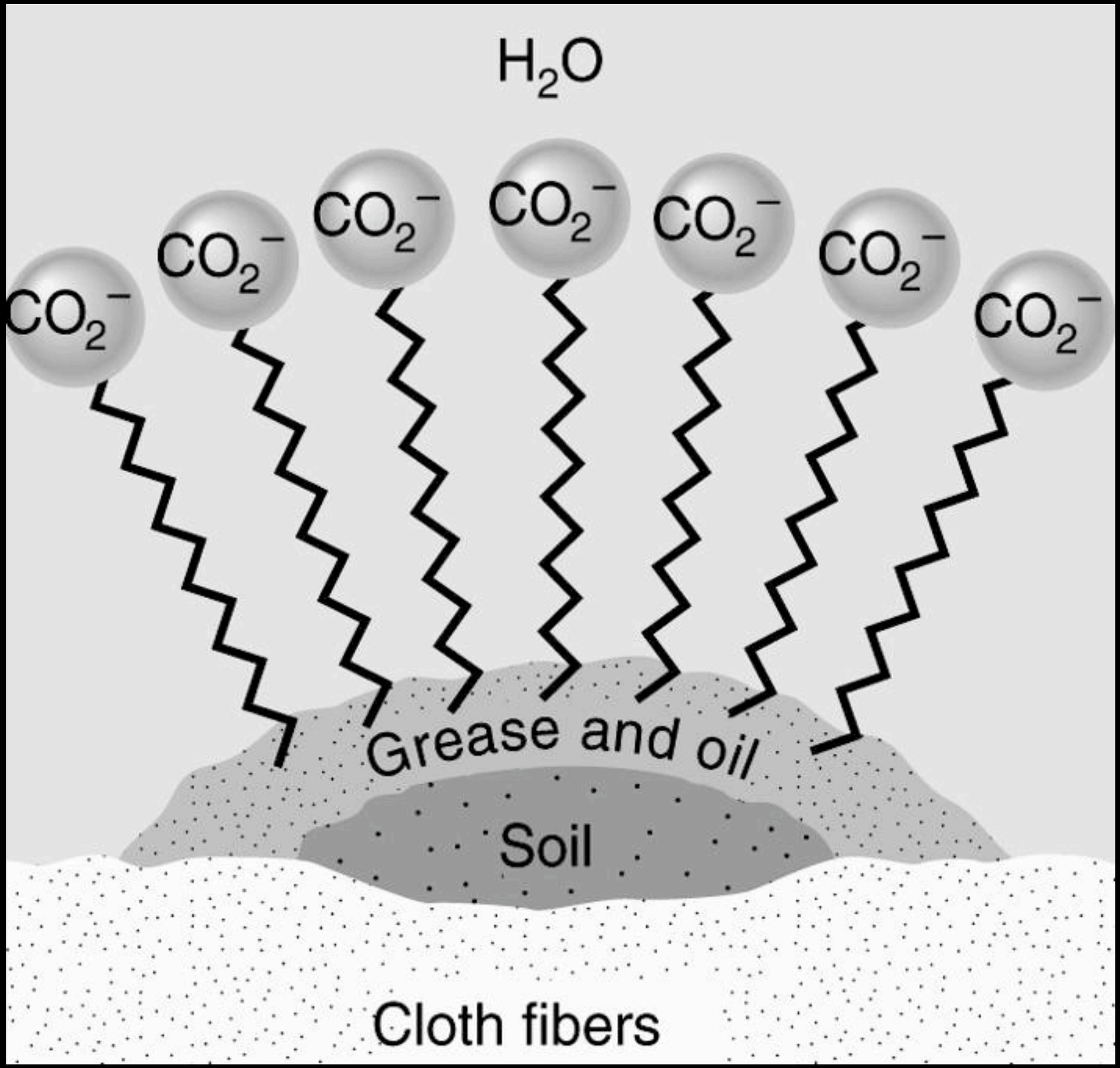


protein exhibiting various secondary structures



tertiary structure of proteins





3.091SC Introduction to Solid State Chemistry

Fall 2009