Lecture 2: Amino acids and Proteins

zwitterion

- The amino end is protonated and the carboxylic end is deprotonated to form the zwitterion, the dipolar form of an amino acid

PEPTIDE BOND

- Bond which connects 2 amino acid residues
- Possesses double bond character
- Connects the carboxyl group of one amino acid to the amino end of the other amino acid
- Formed via a condensation reaction (formation of a new bond upon the removal of water)

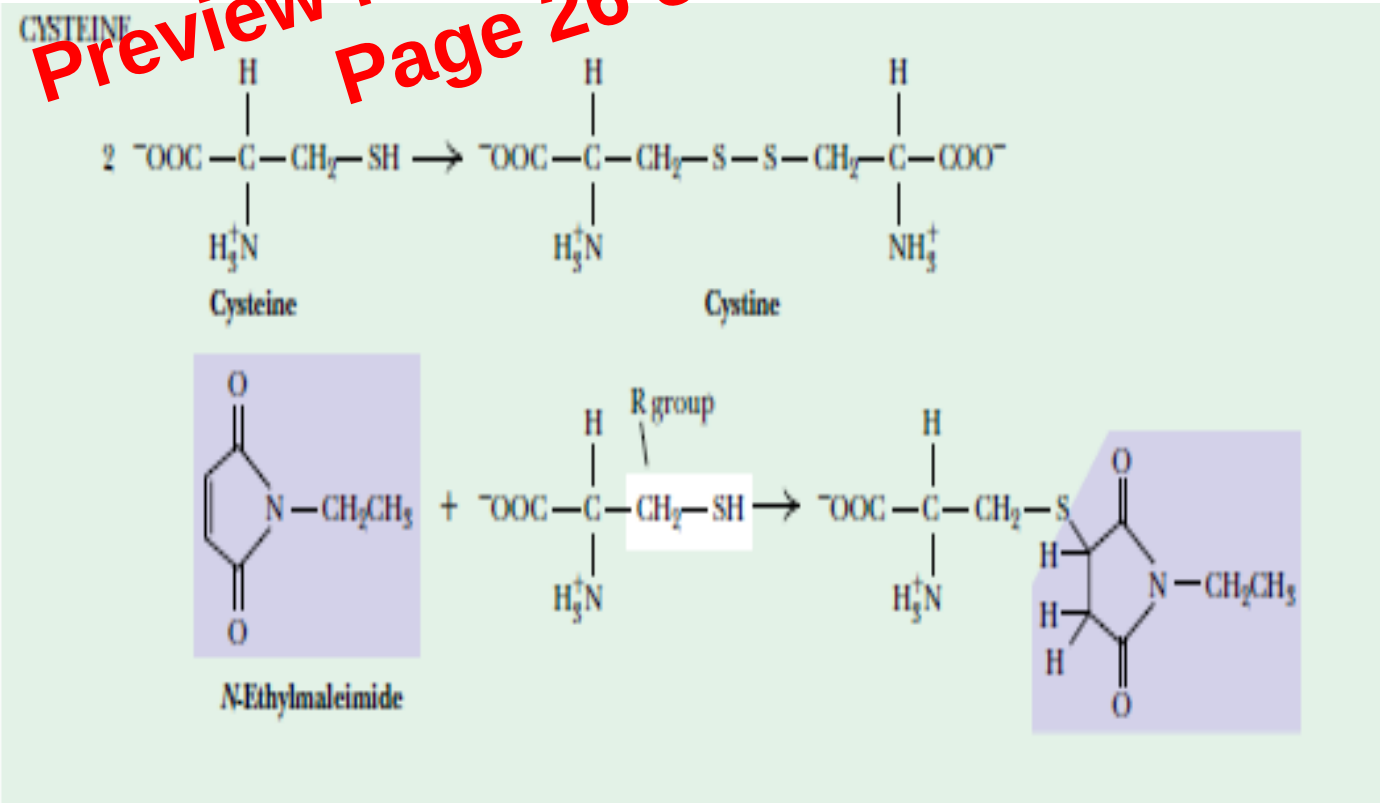
proteins

Table 5.1

Size of Protein Molecules*

Protein	M_r	Number of Residues per Chain	Subunit Organization
Insulin (bovine)	5,733	21 (A) 30 (B)	$\alpha\beta$
Cytochrome *c* (equine)	12,500	104	α_1
Ribonuclease A (bovine pancreas)	12,640	124	α_1
Lysozyme (egg white)	13,930	129	α_1
Myoglobin (horse)	16,980	153	α_1
Chymotrypsin (bovine pancreas)	22,600	13 (α) 132 (β) 97 (γ)	$\alpha\beta\gamma$
Hemoglobin (human)	64,500	141 (α) 146 (β)	$\alpha_2\beta_2$
Serum albumin (human)	68,500	550	α_1
Hexokinase (yeast)	96,000	200	α_4
γ-Globulin (horse)	149,900	214 (α) 446 (β)	$\alpha_2\beta_2$
Glutamate dehydrogenase (liver)	332,694	500	α_6
Myosin (rabbit)	470,000	1800 (heavy, *h*) 190 (α) 149 (α') 160 (β)	$h_2\alpha_1\alpha'_2\beta_2$
Ribulose bisphosphate carboxylase (spinach)	560,000	475 (α) 123 (β)	$\alpha_8\beta_8$
Glutamine synthetase (*E. coli*)	600,000	468	α_{12}

R GROUP MODIFICATION OF AMINO ACIDS



TERTIARY STRUCTURE

Tertiary Structure

Once it has started folding, the protein eventually tightens into a specific three-dimensional shape, called its tertiary structure. Just like humans have unique sets of fingerprints, every protein has a unique tertiary structure, which is responsible for its properties and function. The tertiary structure is held together by bonds between the R groups of the amino acids in the protein, and so depends on the amino acid sequence. There are three kinds of bonds involved in tertiary protein structure:

1. H bonds, which are weak. Since they are easy to break and reform, they make a protein flexible.
2. Ionic bonds between R groups with positive or negative charges, which are quite strong.

PROTEIN FUNCTIONS

Biological Functions of Proteins and Some Representative Examples	
Functional Class	**Examples**
Enzymes	Ribonuclease Trypsin Phosphofructokinase Alcohol dehydrogenase Catalase "Malic" enzyme
Regulatory proteins	Insulin Somatotropin Thyrotropin *lac* repressor NF1 (nuclear factor 1) Catabolite activator protein (CAP) AP1
Transport proteins	Hemoglobin Serum albumin Glucose transporter

PROTEIN FUNCTIONS

Storage proteins	Ovalbumin
	Casein
	Zein
	Phaseolin
	Ferritin
Contractile and motile proteins	Actin
	Myosin
	Tubulin
	Dynein
	Kinesin
Structural proteins	α-Keratin
	Collagen
	Elastin
	Fibroin
	Proteoglycans
Scaffold proteins	Grb 2
	crk
	shc
	stat
	IRS-1