TABLE 2.2 **Main structural and functional features of specific amino acids in proteins.**

Amino Acid	Structural and Functional Features in Proteins
Glycine	• Confers flexibility to proteins
Proline	• Creates rigid kinks in proteins
Methionine	• Participates in weak polar interactions via sulfur's nonbonding electron pair • Possible antioxidant • Participates in enzymatic metal catalysis
Serine and threonine	• Important to regulation of protein and cellular functions via phosphorylation • Important to solubility, protection and recognition of membrane and secreted proteins via glycosylation • Act as nucleophiles in covalent catalysis in enzymes

Amino Acid	Structural and Functional Features in Proteins
Cysteine	• Appeared late in evolution • Participates in weak hydrogen bonds and σ-π interactions • Binds metals covalently • Contributes to protein stabilization, protection, folding, and signaling via disulfide bond formation • Participates in signal transduction (farnesylation, palmitoylation) • Participates in enzymatic covalent, redox and metal catalysis • Antioxidant • Target of alkylating agents (toxins, lab reagents)
Asparagine	• Important to solubility, protection and recognition of membrane and secreted proteins via glycosylation
Glutamate and aspartate	• Interact electrostatically with cationic amino acids, ligands, and metals • Bind metals covalently • Participate in enzymatic acid, base, and metal catalysis • Important to regulation of blood clotting when γ-carboxylated (glutamate)
Lysine	• Interacts electrostatically with anionic amino acids and ligands • Binds cofactors via Schiff base • Stabilizes and protects proteins by forming isopeptide bonds • Stabilizes protein complexes by forming covalent crosslinks • Participates in enzymatic acid and base catalysis • Important to regulation of cellular processes by acetylation, ubiquitinylation, and SUMOylation
Arginine	• Interacts electrostatically with anionic amino acids and ligands • Participates in enzymatic catalysis by p*Ka* modulation and stabilization of anionic transition states
Histidine	• Appeared late in evolution • Binds metals covalently • Participates in enzymatic acid, base, and metal catalysis
Aromatic amino acids	• Appeared late in evolution • Form gates in ion channels and transporters • Important to ligand binding via van der Waals, nonpolar, hydrogen bonding, π-π and π-cations • UV light absorption (protein characterization in lab)
Tyrosine	• Important to regulation of protein and cellular functions via phosphorylation • Facilitates protein secretion, viral entry into cells and metal binding via sulfation • Participates in enzymatic acid-base, redox, and radical-based catalysis
Tryptophan	• Has the largest side chain of all amino acids • Has low frequency in proteins • Participates in electron transport • Fluorescent (lab characterization of conformational changes and ligand binding)