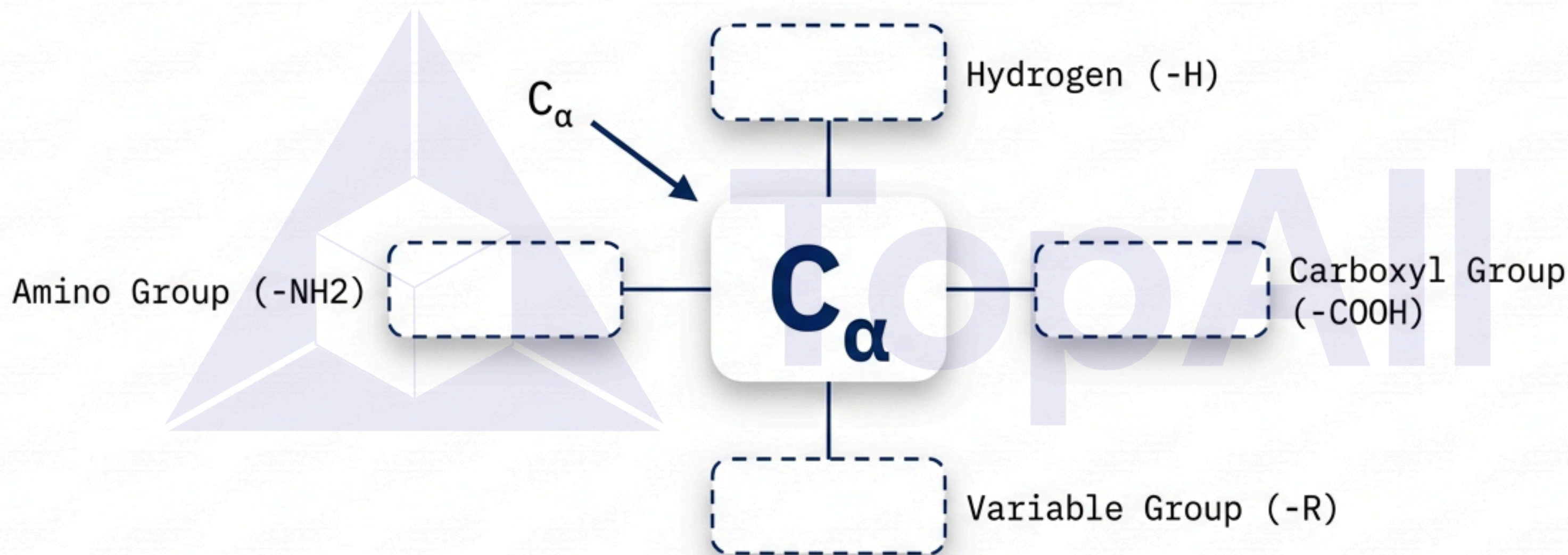


The Monomers That Build Proteins

Decoding the structural anatomy, diversity, and dynamic behavior of amino acids.

The α -Carbon: The Central Hub

Amino acids are structurally “substituted methanes.” They feature four distinct substituent groups occupying four valency positions around a single, central carbon atom.



Warning: Do not confuse the central α -carbon with other carbons that may appear later within complex R-groups.

The Dual Nature: Amino & Carboxyl Groups

Amino Group



Imparts basic chemical properties to the molecule.



Carboxyl Group



Imparts acidic chemical properties to the molecule.

Context: Because they possess both an amino (basic) and an acidic group attached to the exact same carbon, they are specifically classified as α -amino acids.



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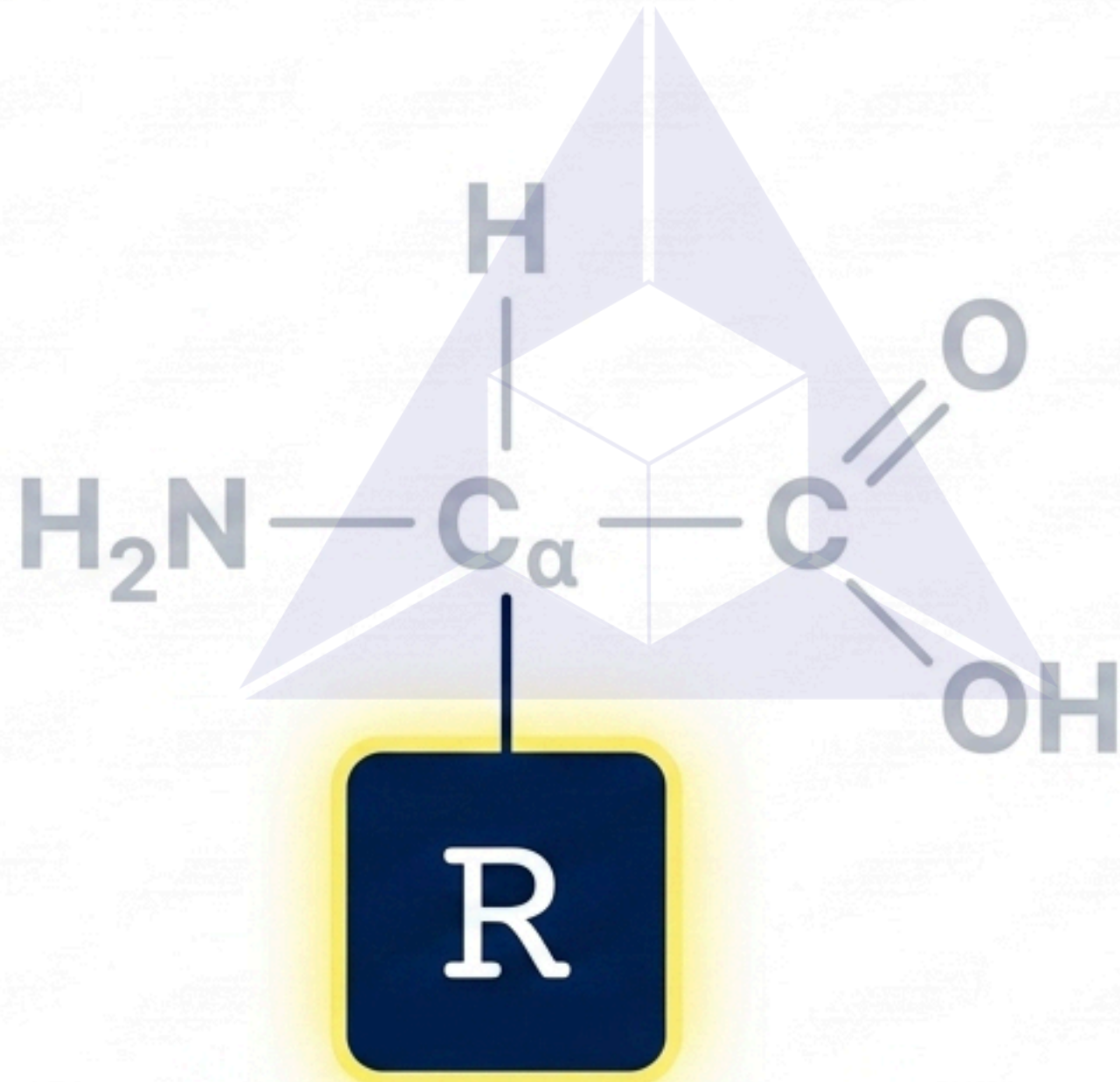
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R Group: The Variable Identity

The physical and chemical properties of an amino acid are entirely dictated by the R group. While many amino acids exist in nature, only 20 specific types occur in proteins.



Based on the R group, amino acids fall into distinct chemical classes:

Acidic: e.g., Glutamic acid

Basic: e.g., Lysine

Neutral: e.g., Valine

Aromatic: e.g., Tyrosine, Phenylalanine, Tryptophan

Modular Substitution in Action

Glycine



The simplest amino acid.

Alanine

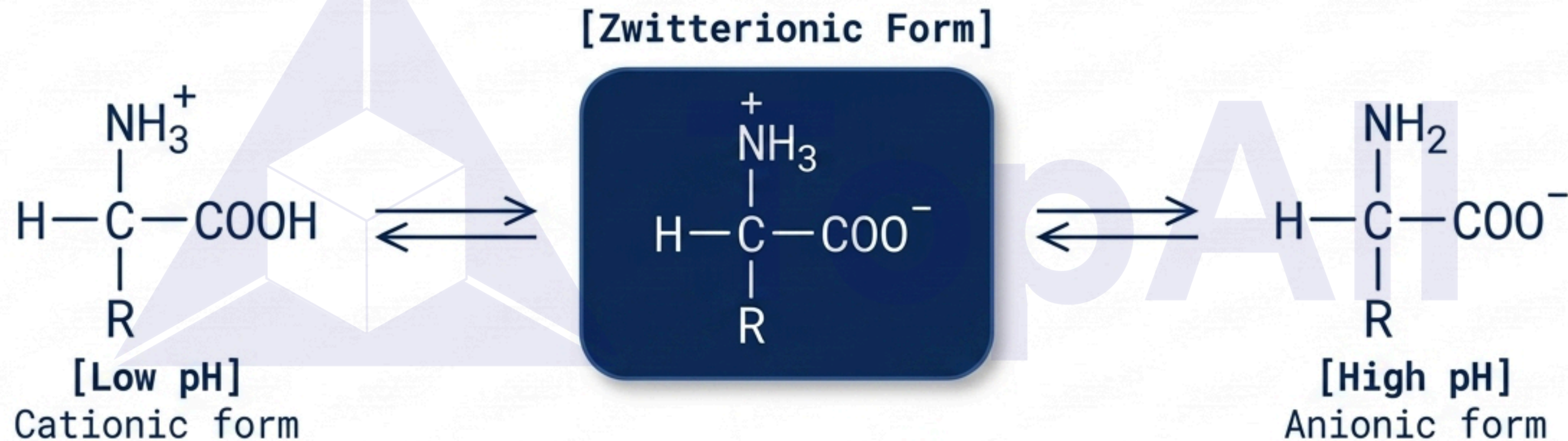


Serine



Ionization and the Zwitterionic Form

Due to the ionizable nature of the -NH_2 and -COOH groups, the structure of amino acids fundamentally changes depending on the pH of the surrounding solution.



Zwitterion Definition: A unique structural form where the molecule is electrically neutral overall, yet simultaneously carries both positive and negative charges.

From Monomers to Macromolecules

Amino acids are the alphabet of life.

The specific sequence and diverse chemical properties of their R-groups allow these 20 small monomers to link together via peptide bonds, ultimately folding into the infinite variety of 3D protein structures required for biological function.

Did you know? Dietary proteins are our primary source of essential amino acids—the specific monomers our bodies cannot synthesize on their own and must extract from food.



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