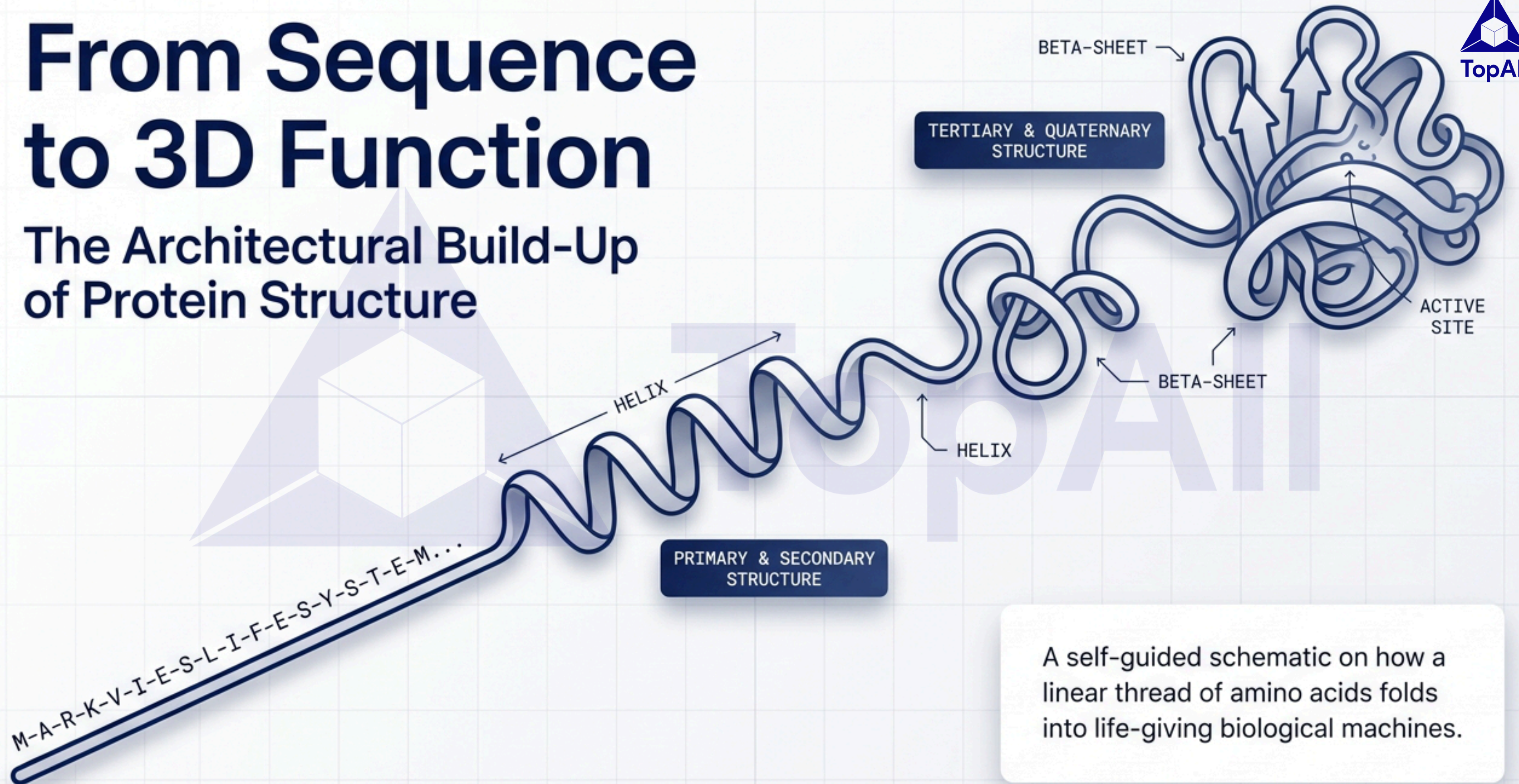


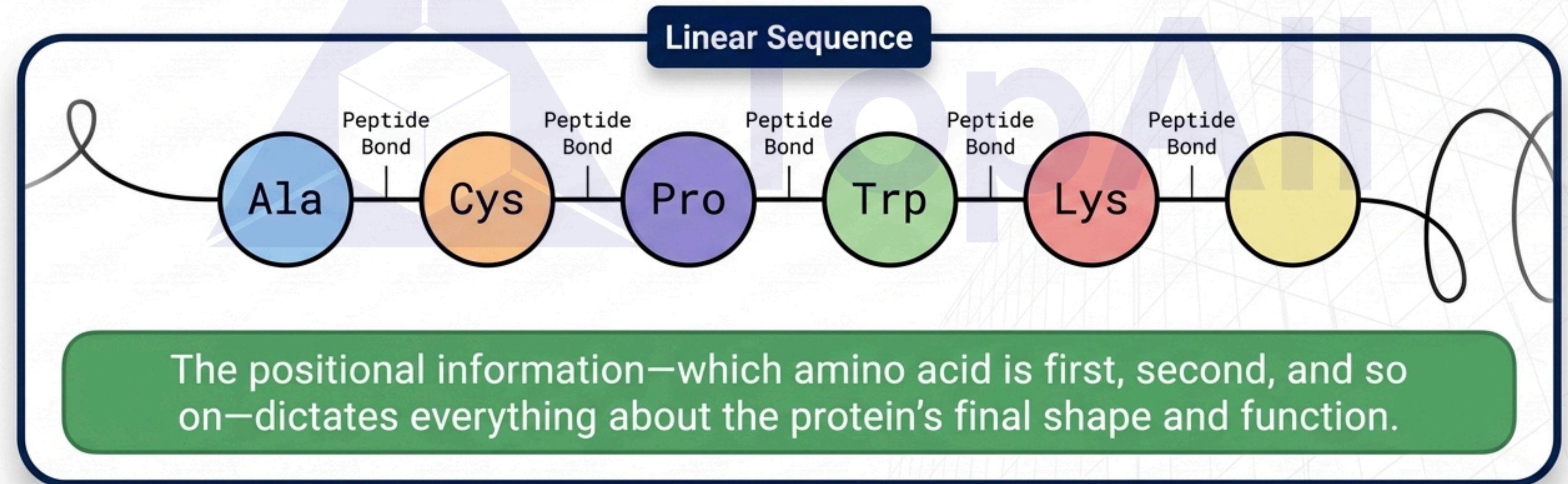
From Sequence to 3D Function

The Architectural Build-Up of Protein Structure

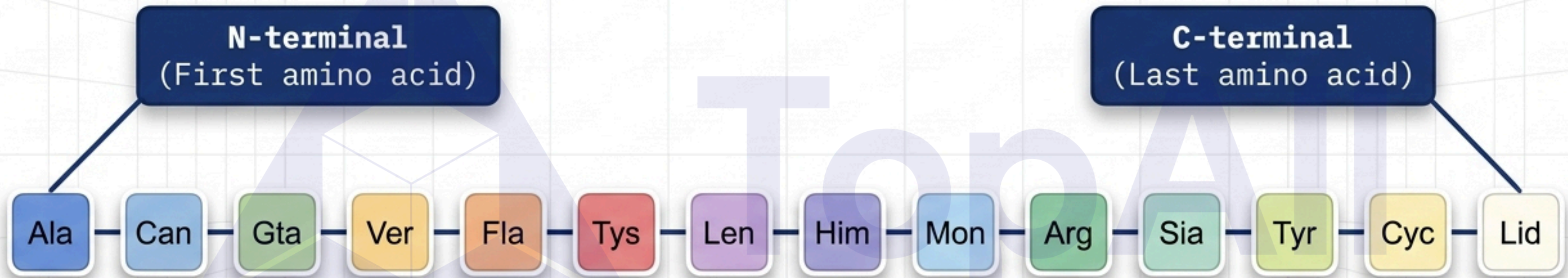


Primary Structure: The Positional Blueprint

A protein is a linear chain of amino acids. Because there are 20 different types of amino acids, a protein is a **heteropolymer** (a chain of mixed, unique units), not a homopolymer (a chain of identical, repeating units).



Anatomy of the Chain: N-Terminal and C-Terminal Ends



How Biologists Read the Blueprint: A protein is always imagined as a line, with the left end representing the very first amino acid in the sequence and the right end representing the last.



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Key Highlights

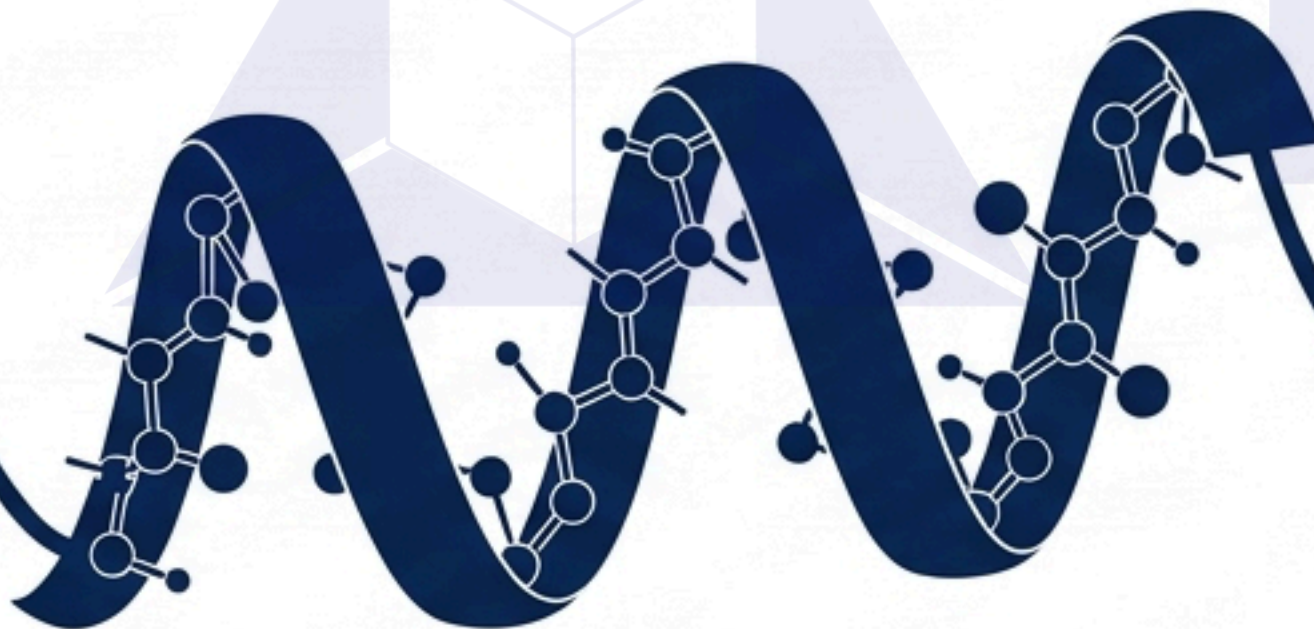
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Secondary Structure: The Initial Folds

A protein thread does not exist as an extended, rigid rod. Specific portions of the thread begin to locally fold and twist into organized structures, such as helices, driven by interactions between the amino acids.

Alpha-Helix Formation



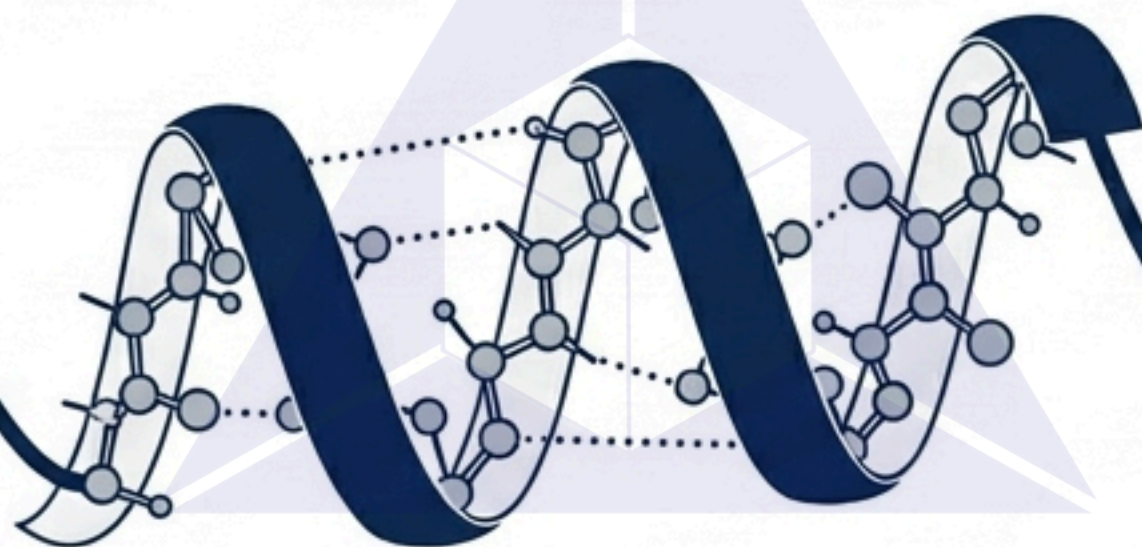
Do Not Confuse:

In proteins, **ONLY** right-handed helices are observed in nature.

Local Folding

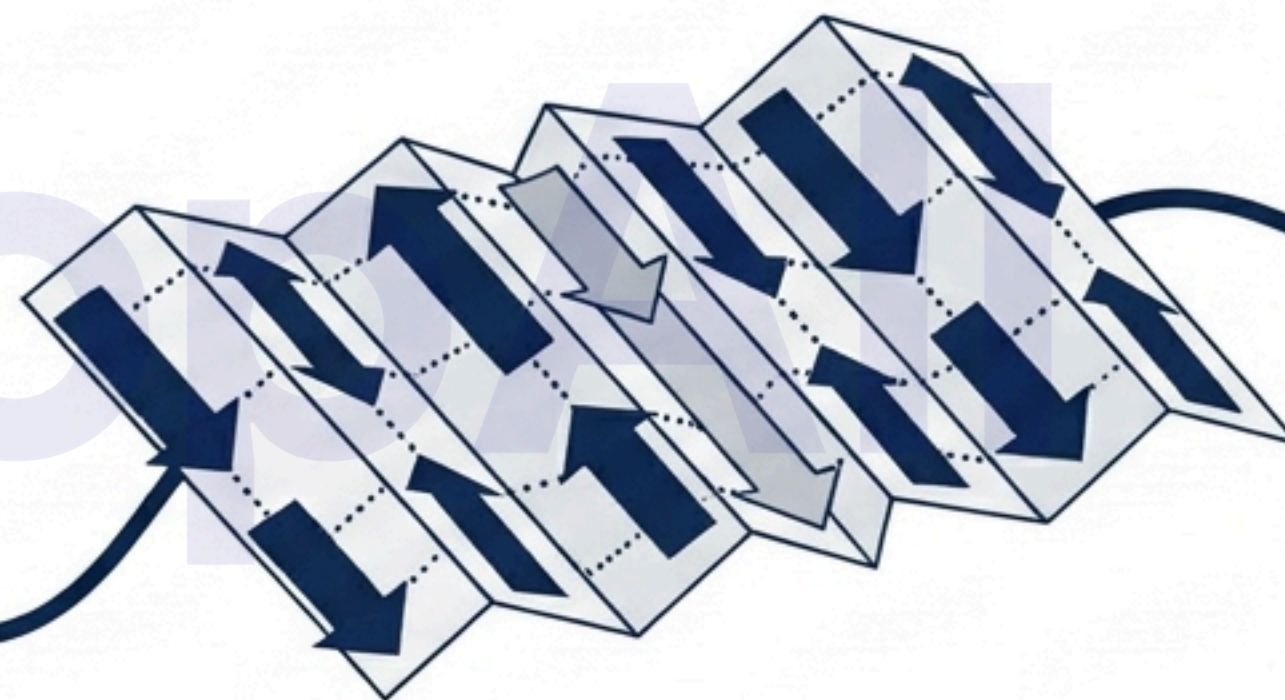
Alpha Helix vs. Beta-Pleated Sheet

Alpha Helix



Forms a rigid, twisting cylinder.

Beta-Pleated Sheet



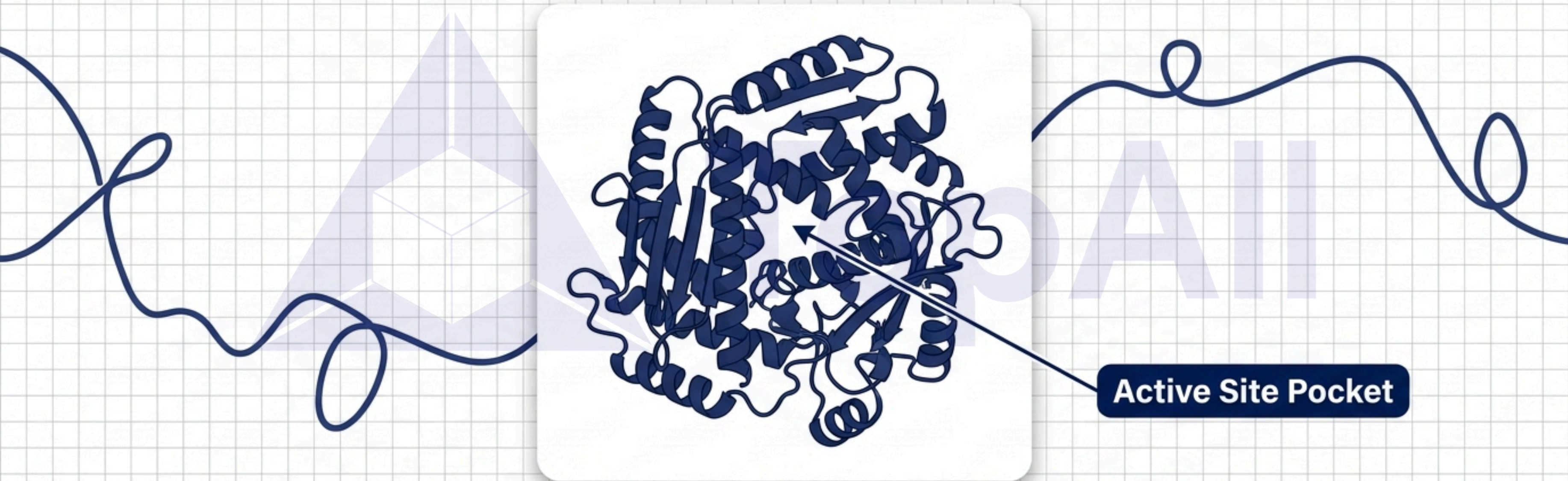
Forms a flat, corrugated surface.

Both are local formations. The rest of the protein thread connects these structures.

Tertiary Structure: The Global 3D Fold



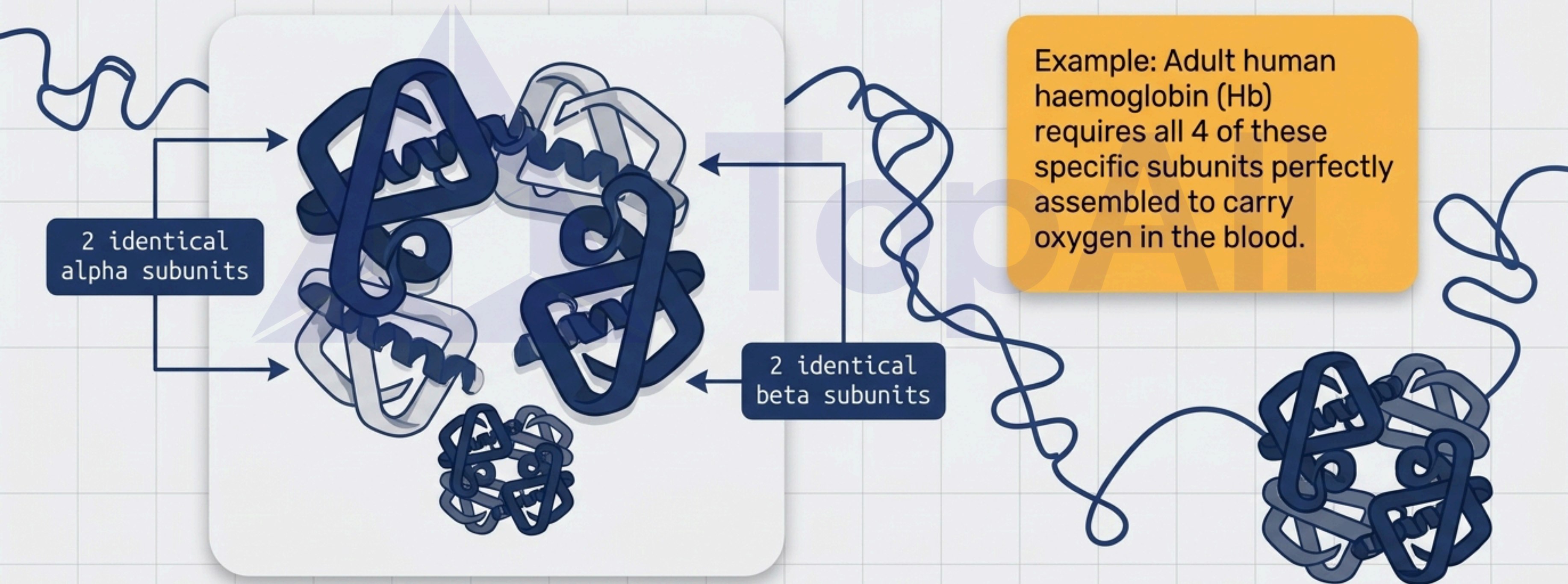
The long protein chain folds completely upon itself, criss-crossing into a dense 3-dimensional architecture.



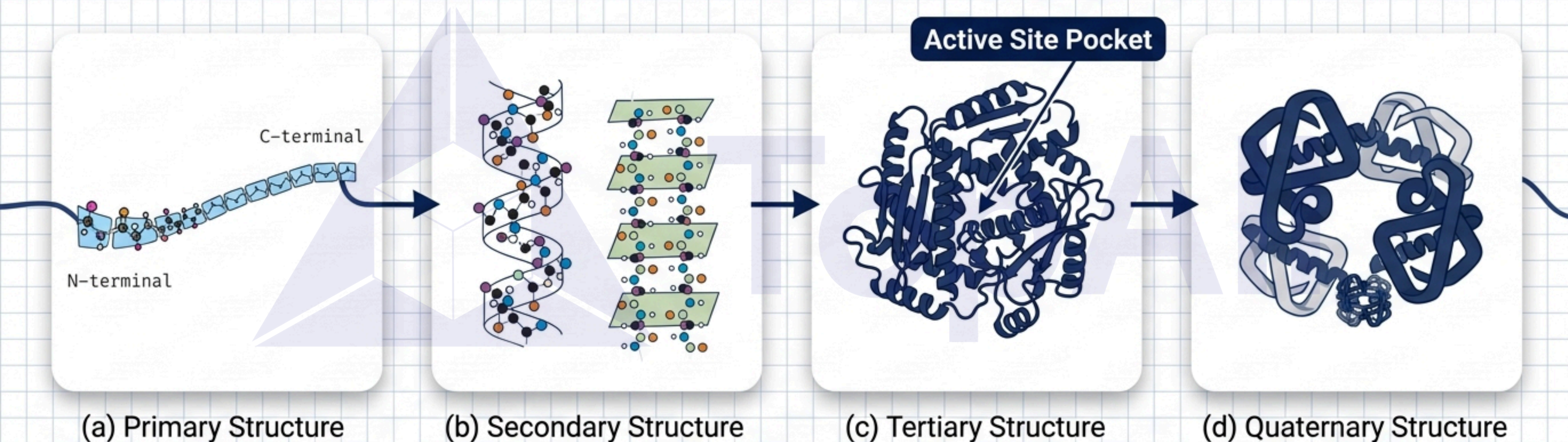
Biological Imperative: This specific 3-dimensional view is absolutely necessary for the many biological activities of proteins, such as forming active sites in enzymes.

Quaternary Structure: Multi-Subunit Assembly

Some proteins are an architecture of more than one folded polypeptide subunit arranged together (e.g., as a linear string, a cube, or a plate).



Synthesis: From Sequence to Architecture



The Molecular Blueprint: Every level of this complex 3D architecture is ultimately dictated by the exact sequence of amino acids in the primary 1D thread.



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