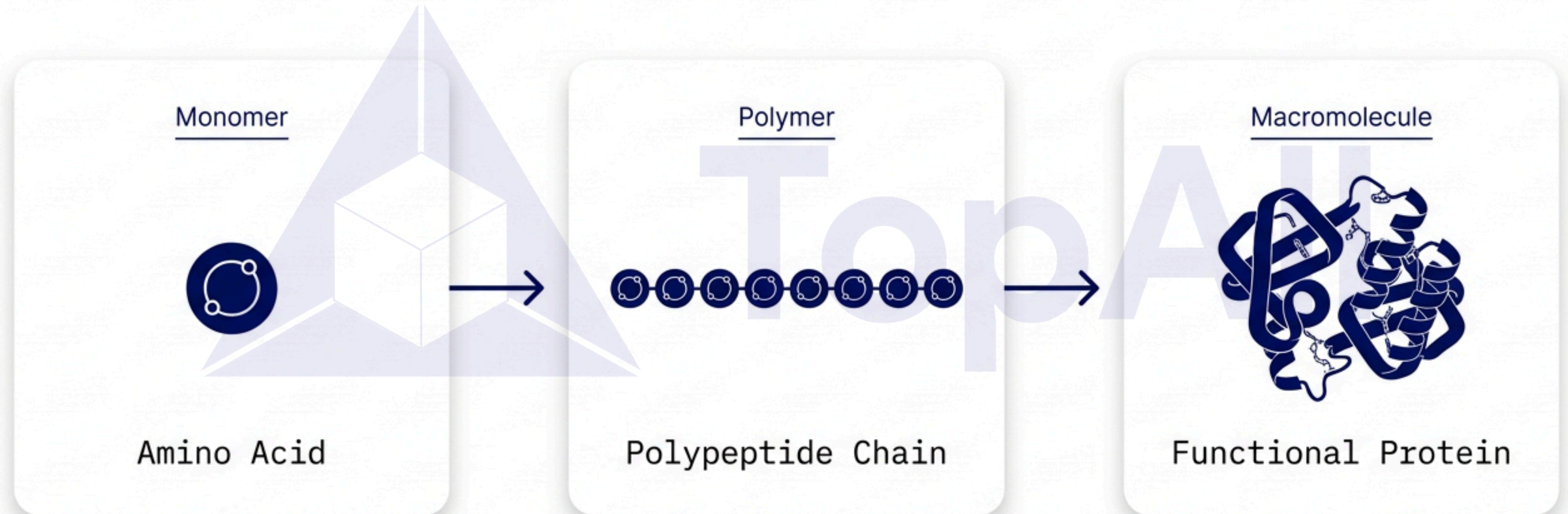


Polypeptide Chains That Run the Cell

The structural and functional
macromolecules of living organisms.

The Architecture of a Protein

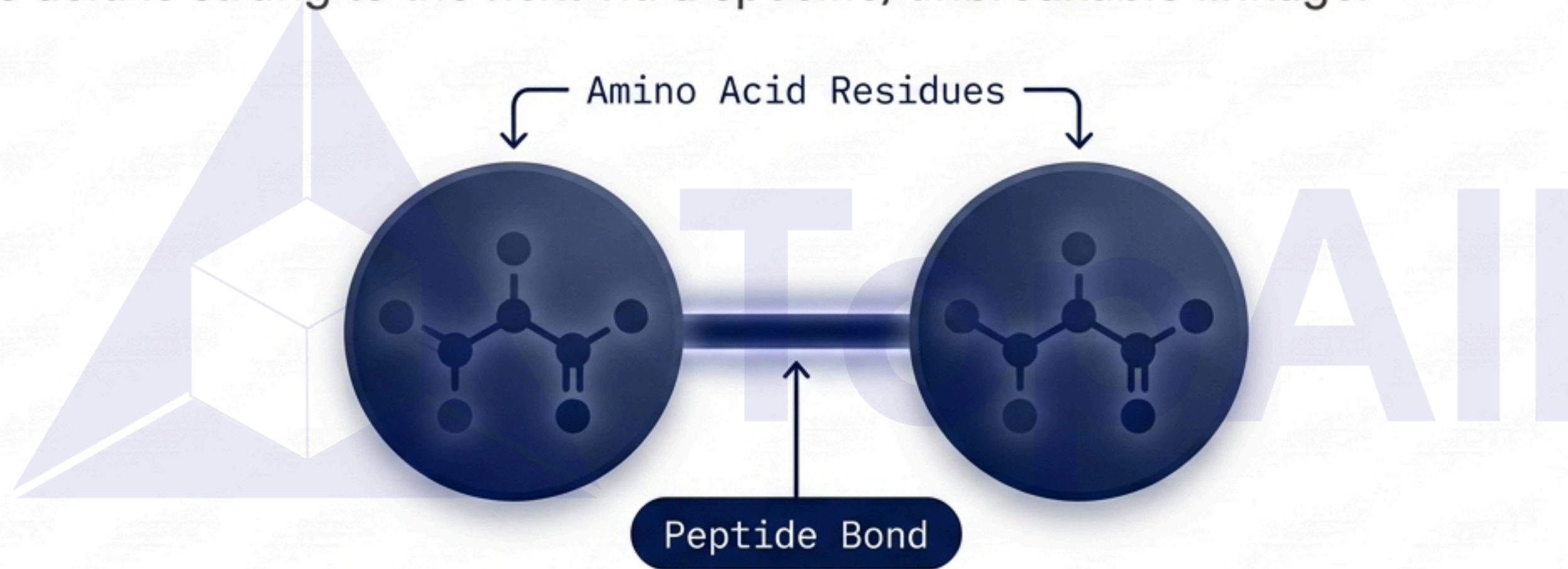
Proteins are linear, unbroken chains of amino acids. Found in the acid-insoluble fraction of living tissues, proteins stand out as one of the four primary types of true organic macromolecules.



A single protein is constructed as a polypeptide—a continuous linear thread of amino acids.

Linked by Peptide Bonds

The linear architecture of a protein is maintained by strong chemical connections. Each amino acid is strung to the next via a specific, unbreakable linkage.



Lightbulb Icon Structural Note

The sequence of these amino acids—determined by genetic information—creates the **primary structure** of the protein thread.



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$$E=mc^2$$



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Proteins are Heteropolymers

Because there are 20 different types of amino acids (e.g., alanine, cysteine, proline, tryptophan, lysine), proteins exhibit immense structural diversity.

Homopolymer



Contains only one type of monomer repeating "n" number of times (e.g., Cellulose made entirely of repeating glucose units).

Heteropolymer



Contains multiple different types of monomers. frg. **Proteins** strictly fall into this category.

Do Not Confuse

A protein is never a homopolymer. It relies on the distinct chemical properties of its 20 different amino acid building blocks to function.

Sourcing the Building Blocks

Our bodies require all 20 amino acids to build necessary proteins, but they are sourced in two fundamentally different ways.

Non-Essential Amino Acids



Amino acids that our body has the internal metabolic machinery to synthesize on its own.

Essential Amino Acids



Amino acids that our body cannot make. They are strictly essential for health and must be supplied externally.

Dietary proteins are the exclusive source of essential amino acids for the human body.

The Workforce of the Cell

Proteins do not have a single role; they are the physical operators of the cell, carrying out almost every dynamic and structural function in a living organism.



Transport

Transport crucial nutrients across cell membranes.



Defense

Fight infectious organisms and external threats (antibodies).



Regulation

Act as systemic hormones to regulate physiology.



Catalysis

Function as enzymes to vastly accelerate chemical reactions.

Functional Protein Matrix

Adapted from Table 9.5: Key Proteins and Their Biological Roles

Protein	Function
Collagen	Intercellular ground substance
Trypsin	Enzyme
Insulin	Hormone
Antibody	Fights infectious agents
Receptor	Sensory reception (smell, taste, hormone, etc.)
GLUT-4	Enables glucose transport into cells

The Heavyweights of the Biosphere

Key Icon Key Takeaways: Global Abundance

Collagen

The most abundant protein in the entire animal world. It functions as the crucial intercellular ground substance holding tissues together.

RuBisCO

(Ribulose biphosphate Carboxylase-Oxygenase)

The single most abundant protein in the whole of the biosphere, driving the foundational carbon-fixing reactions of life.



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