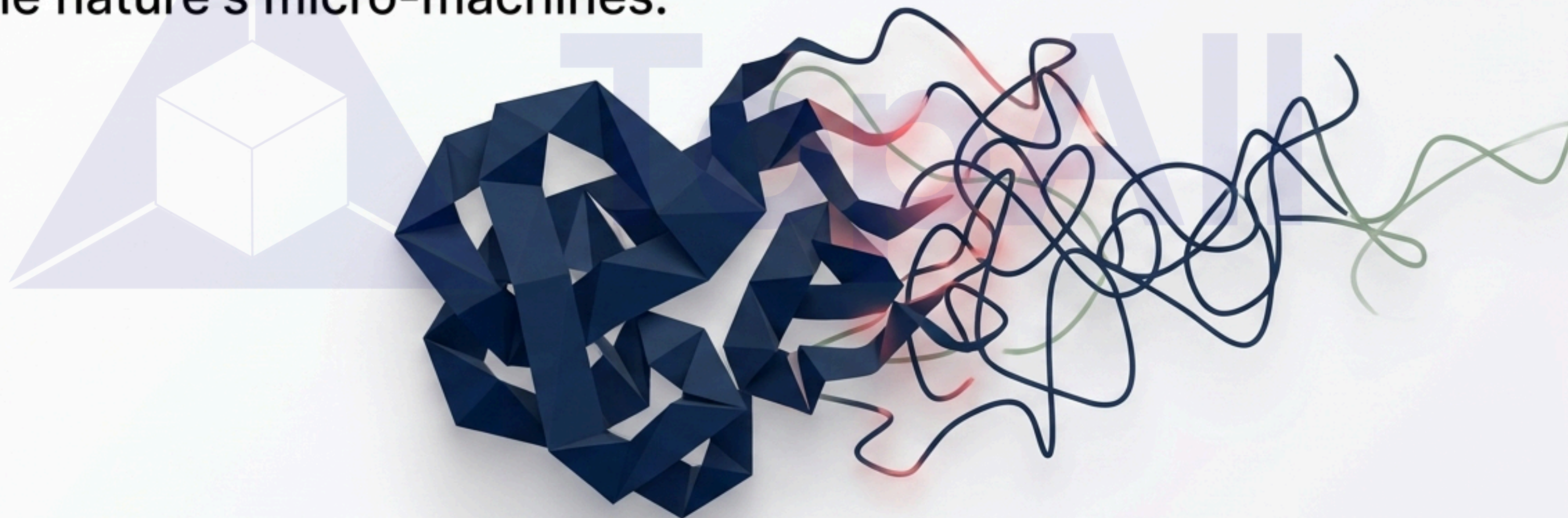


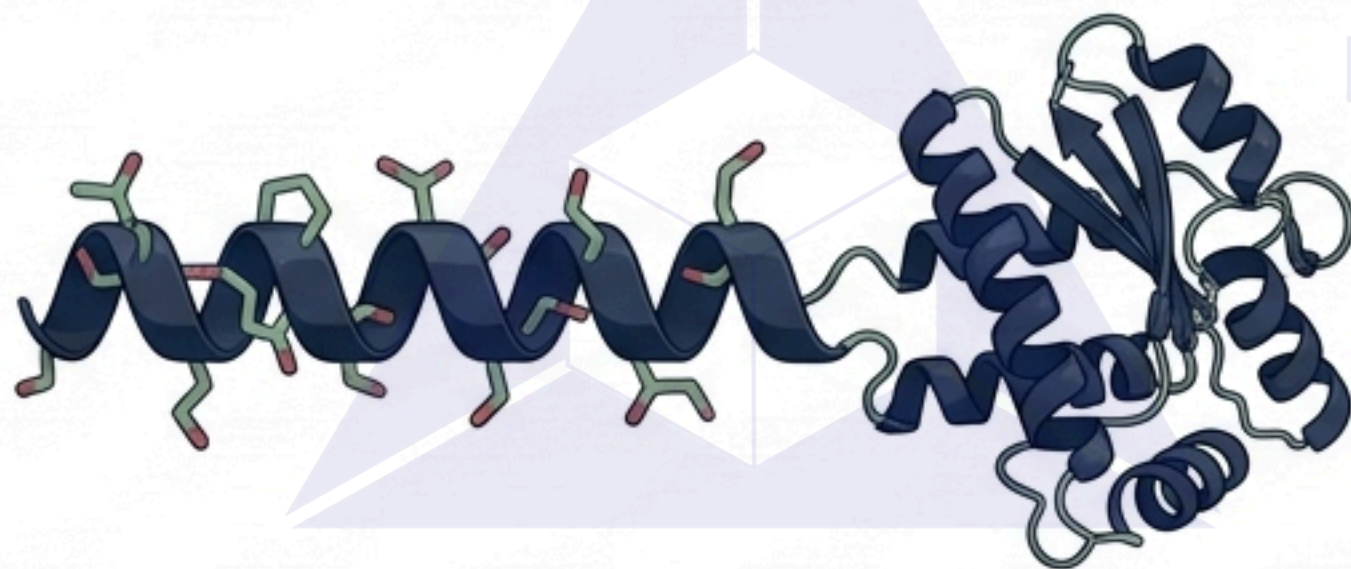
Denaturation of Proteins

How physical and chemical triggers dismantle nature's micro-machines.



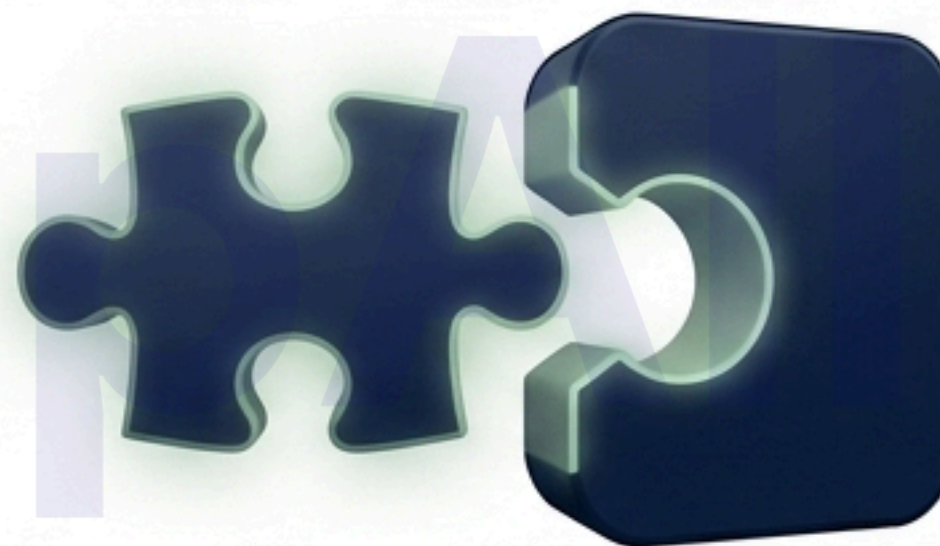
What Is a Native Protein?

Unique 3D Structure



A highly specific, meticulously folded molecular architecture.

Biological Activity



The functional capability to perform specific tasks within a biological system.

[UNIQUE 3D STRUCTURE] + [BIOLOGICAL ACTIVITY] = NATIVE PROTEIN

What Causes Denaturation?

Physical Change



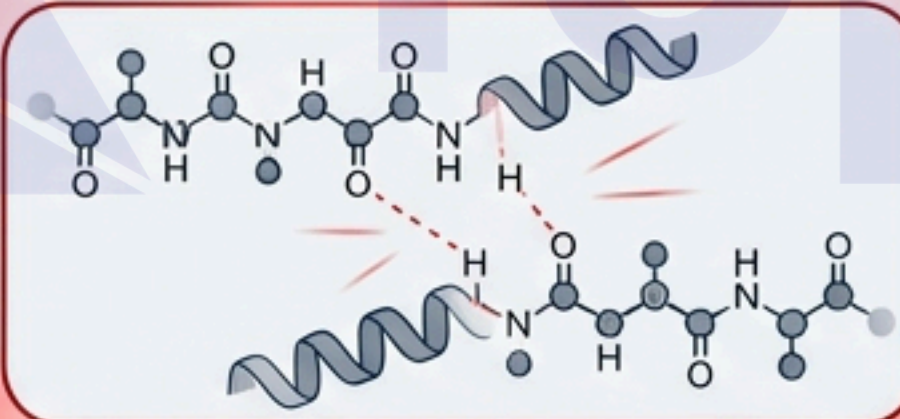
Change in
Temperature

Chemical Change



Change in pH

**Target: Hydrogen
Bonds Disturbed**



When hydrogen bonds break, the architecture loses its structural integrity.



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$$E=mc^2$$



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Key Highlights

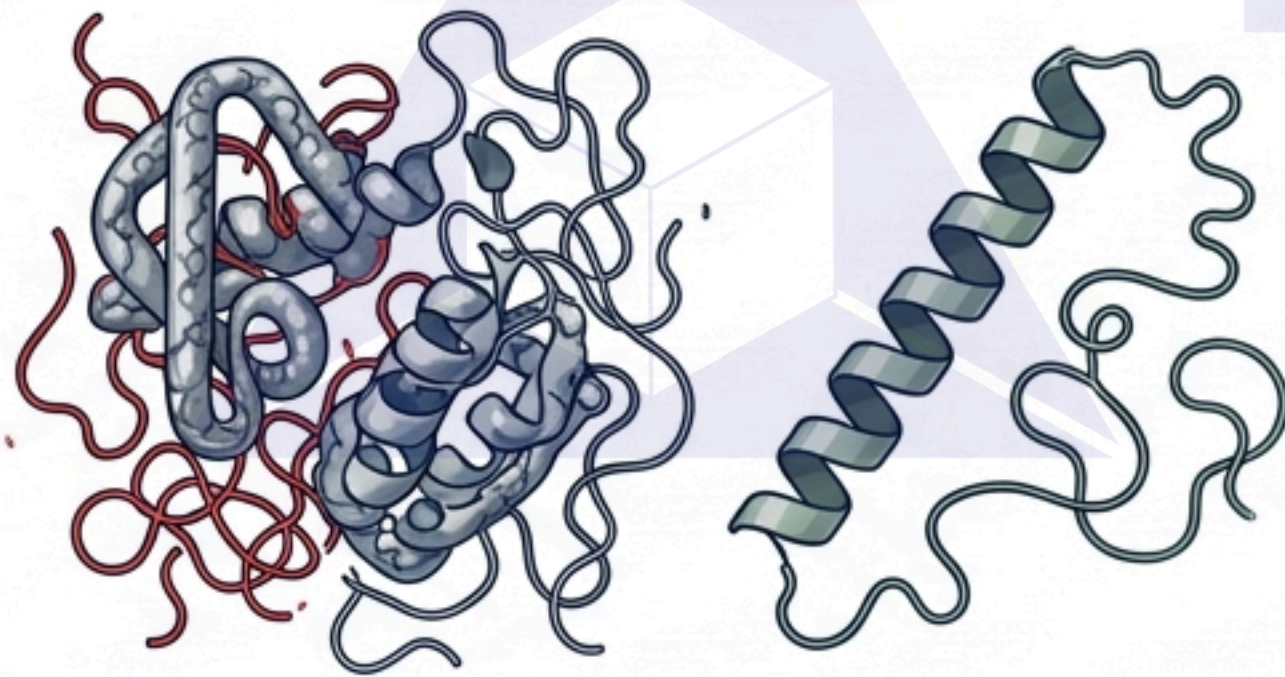
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What Changes and What Stays Intact

Secondary (2°) & Tertiary (3°) Structures

DESTROYED



Biological activity is **permanently lost**.
Globules unfold; helices uncoil.

Primary (1°) Structure

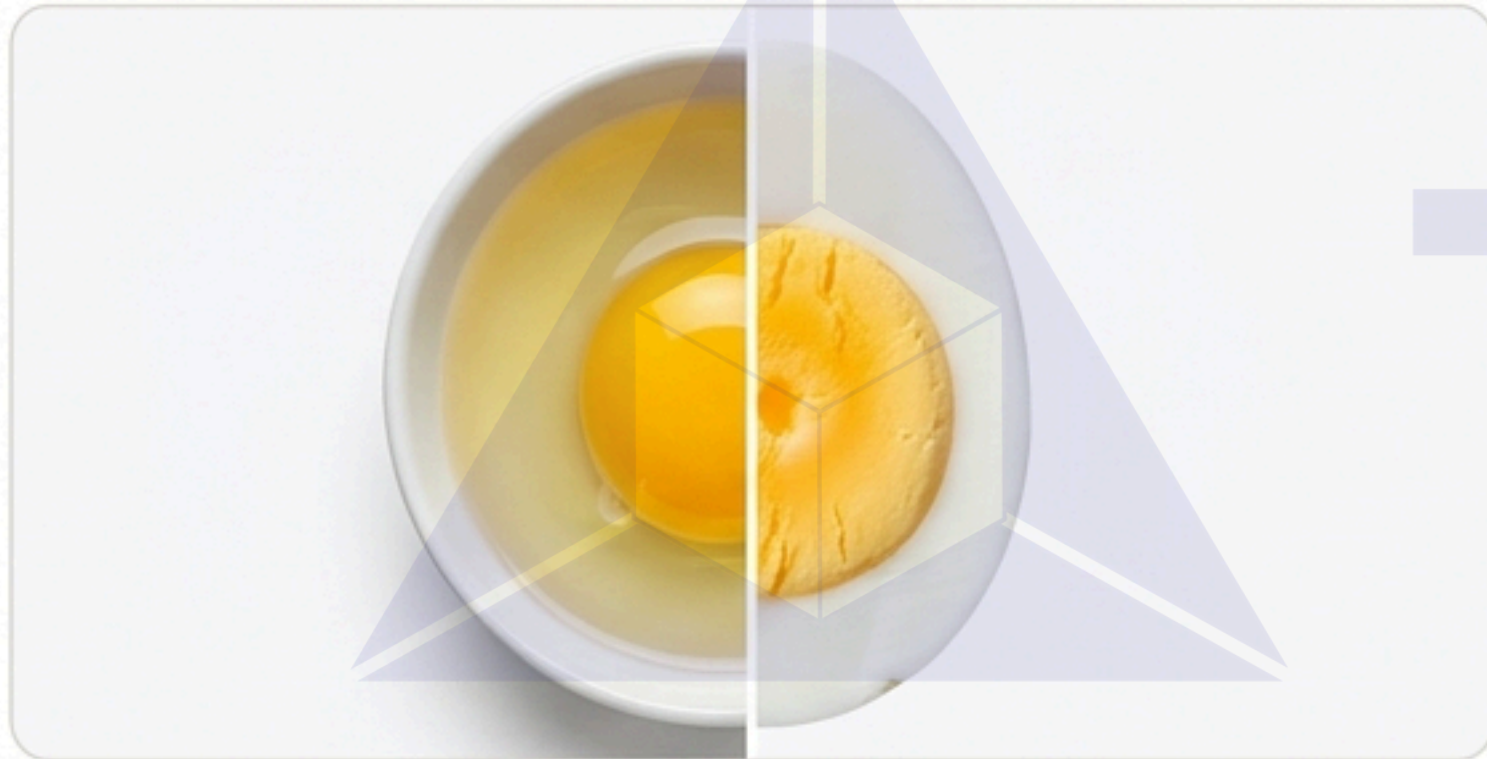
SURVIVES



The sequence of amino acids remains **perfectly intact**. Peptide bonds are unaffected.

Everyday Examples in the Kitchen

[PHYSICAL TRIGGER]



Mechanism: Boiling (Temperature $\uparrow$)

Result: Coagulation of the egg white.

[CHEMICAL TRIGGER]



Bacteria $\rightarrow$ Lactic Acid $\rightarrow$ Drop in pH $\rightarrow$ Curdling

Result: Milk proteins denature and clump together.

Whether boiled or acidified, the visible change in texture is the direct result of proteins unwinding at the molecular level.



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