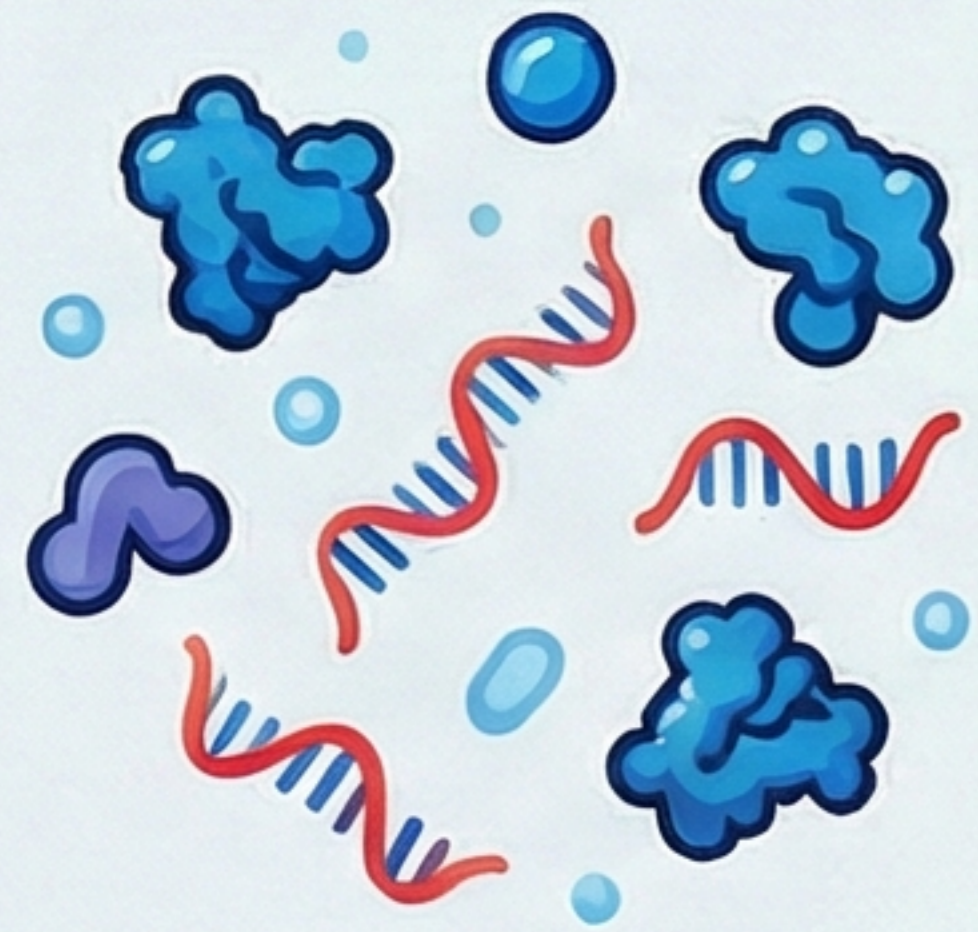


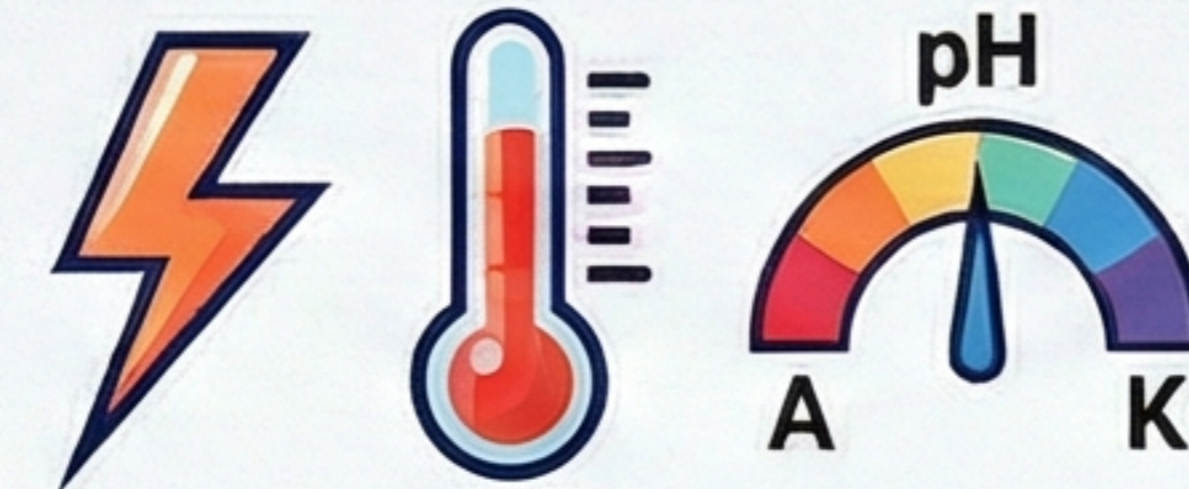
The Bacterial Stress Sensor: Biomolecular Condensates

Bacteria use membraneless 'condensates' as rapid, physical sensors to survive environmental stress.



Membraneless Organelles via Phase Separation

Proteins and RNA "demix" like oil in water to form dense, functional droplets.



INSTANT RESPONSE



SLOW GENE EXPRESSION



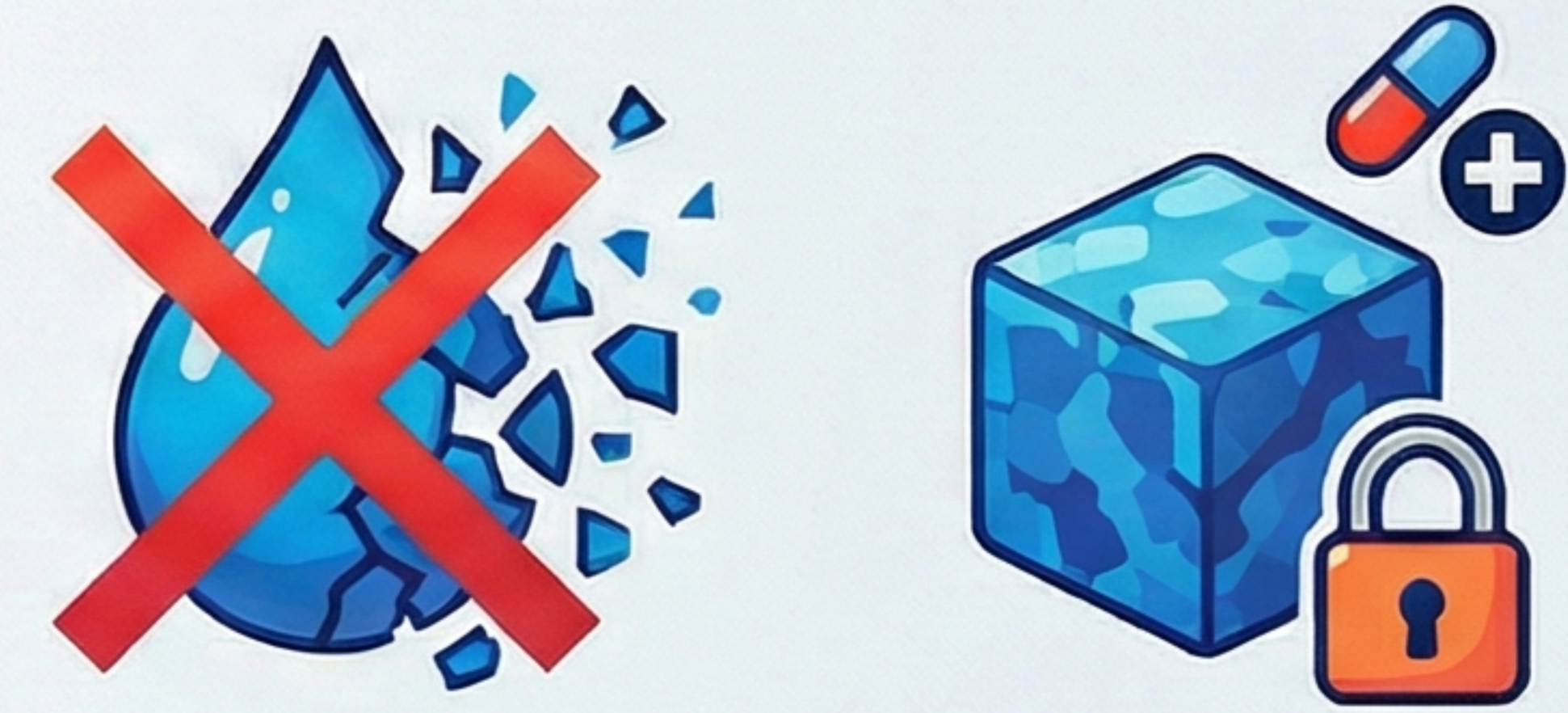
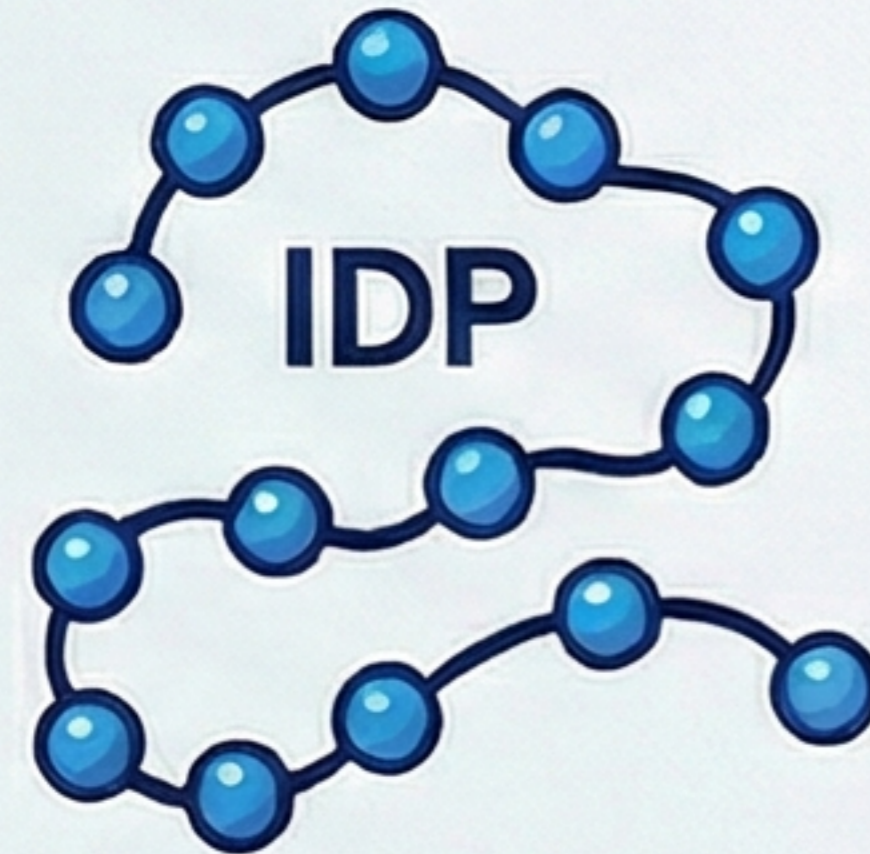
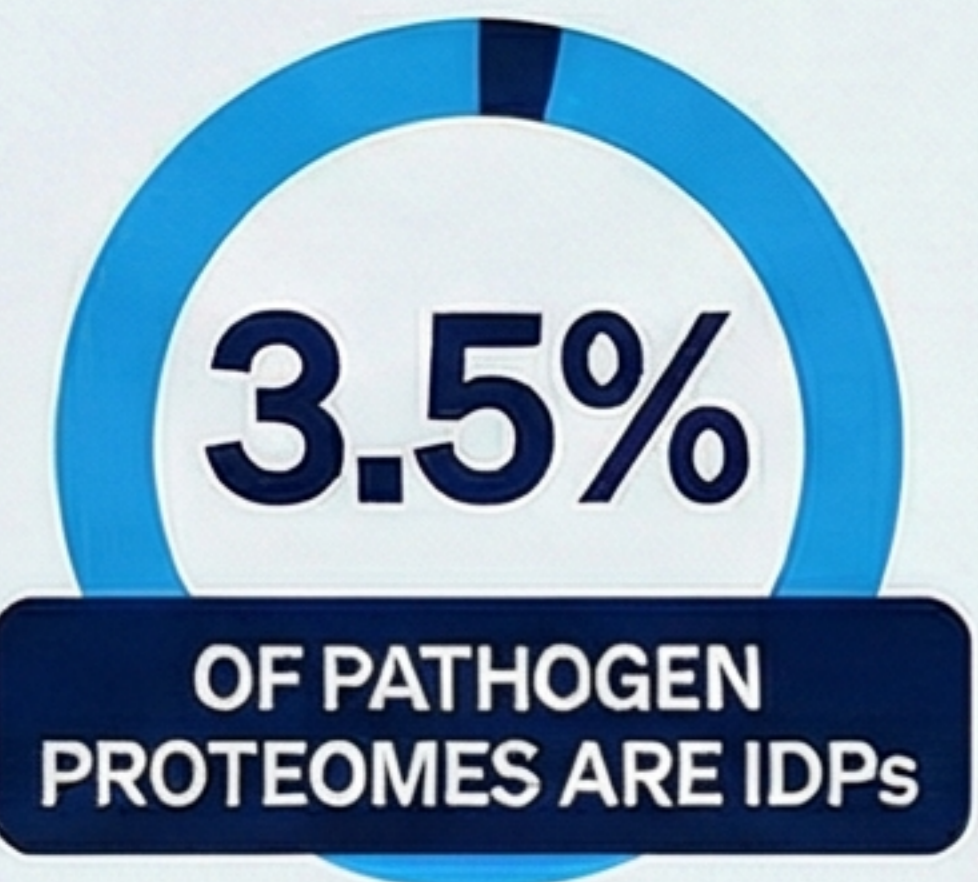
NEAR-IMMEDIATE



DELAYED

Instant Response vs. Slow Gene Expression

Unlike traditional genetic signaling, phase transitions provide immediate near-immediate physical adaptation to stressors like pH or temperature.



Triggered by the Csat Threshold

Condensates only form when local protein concentration reaches a "Critical Saturation" point (Csat), tuned by metabolic fluctuations.

A New Target for Antimicrobials

Disrupting condensate formation or "hardening" them into solids offers a revolutionary strategy to kill drug-resistant bacteria.

ESKAPE pathogens contain ~70–144 Intrinsically Disordered Proteins (IDPs) that act as the flexible building blocks for these sensors.