SEQUENCE-PROGRAMMED CONTROL OF COACERVATE STABILISATION MECHANISMS USING MODULAR PEPTIDES

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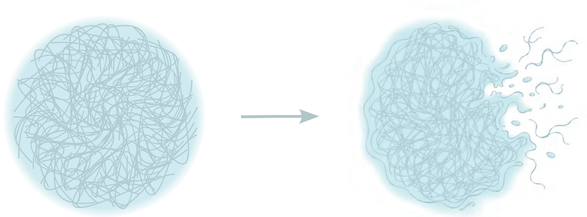
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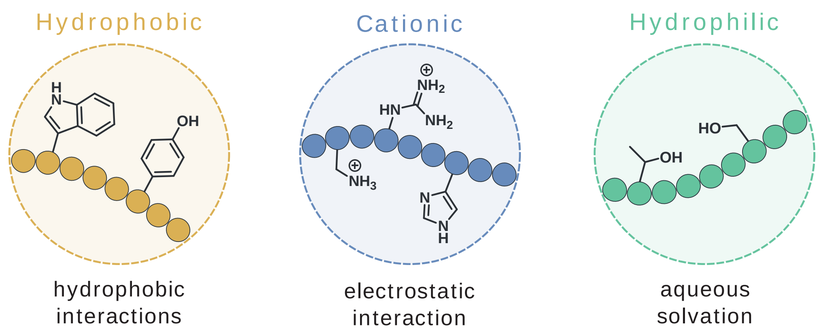
Background and objectives

- Coacervates are dynamic, crowded compartments with potential as artificial cell models.
- Their liquid nature promotes fusion and coalescence, limiting long-term stability.
- Current interfacial stabilisers improve robustness but offer limited programmability.

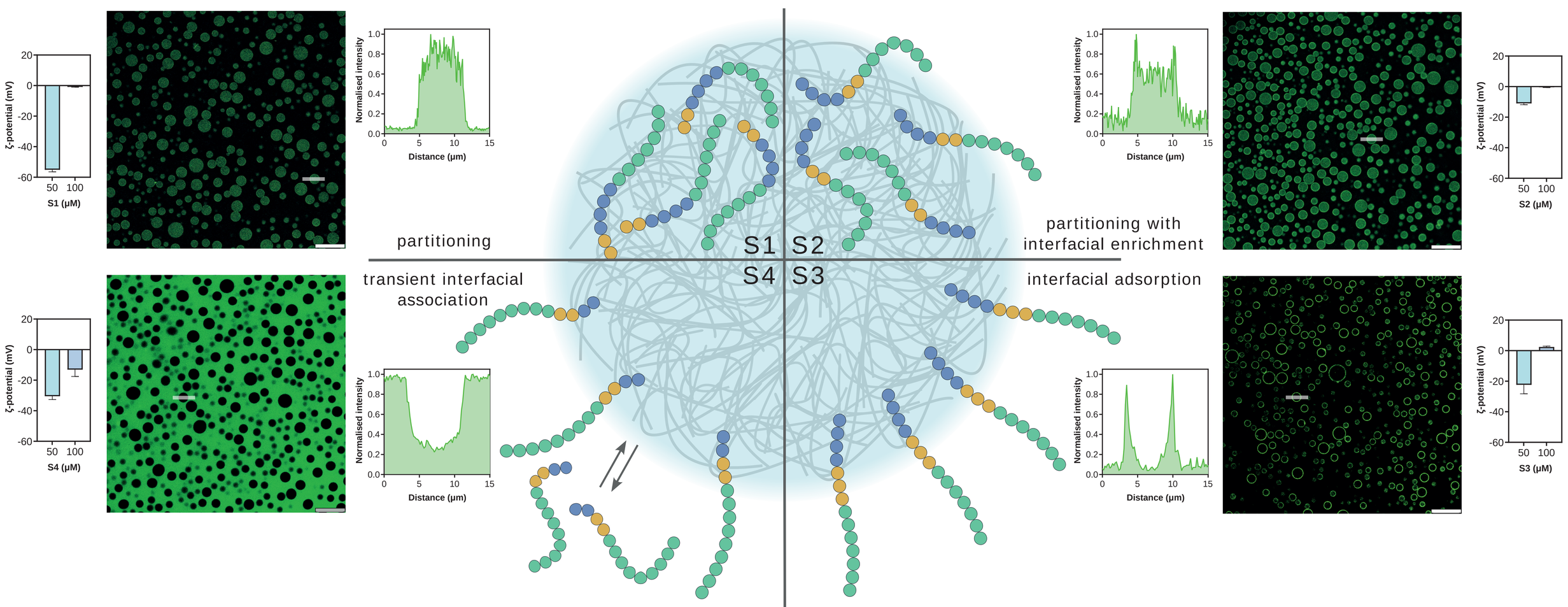


Can short, sequence-defined peptides provide programmable coacervate stabilisation?

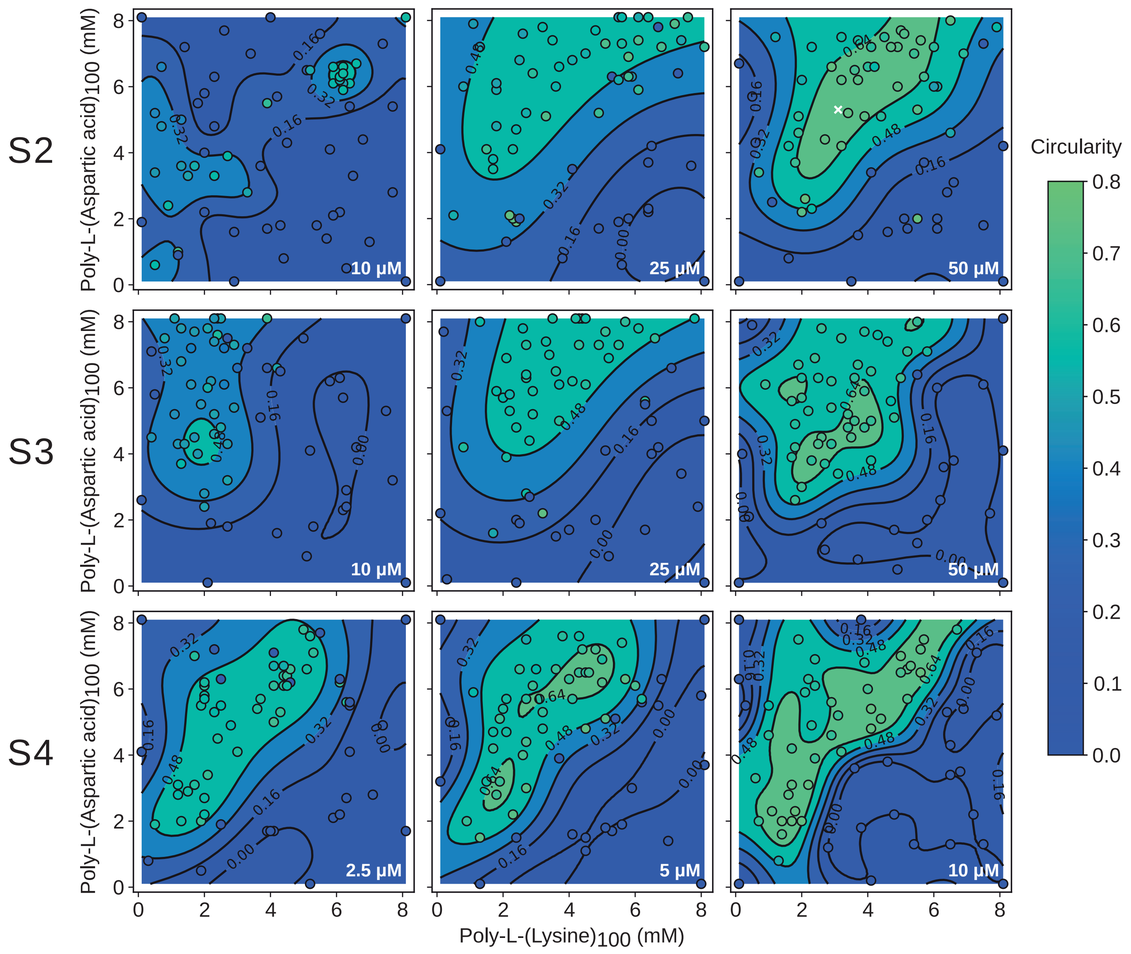
Peptide design



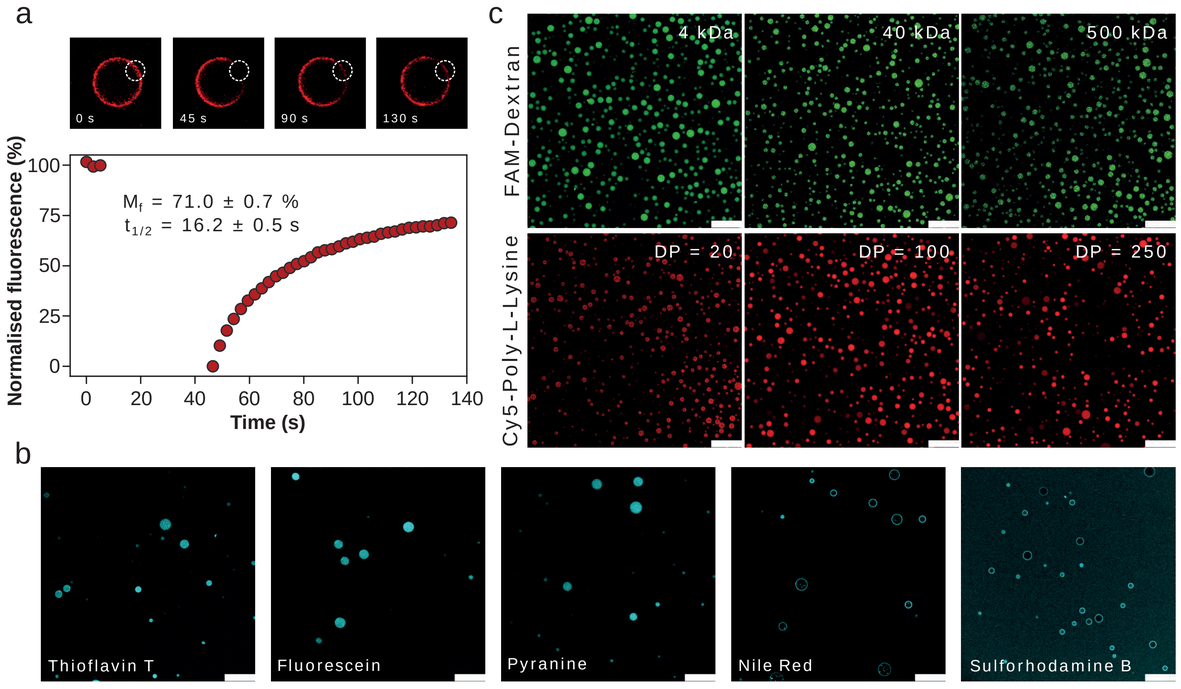
Domain position and composition rationalise peptide stabilisation modes



Sequence-dependent stabilisation landscapes



A dynamic peptide-enriched interface



FRAP of S3-enriched interface (a). Confocal microscopy micrographs of small-molecule (b) and macromolecular (c) fluorescent probes. Scale bars, 20 μm

Take-home messages

Domain order and composition
Domain order and composition dictates the stabilisation mechanism.

Single modular peptide scaffold, four stabilisation modes
A single modular scaffold spans a full mechanistic continuum: partitioning, interfacial enrichment, adsorption, or dynamic association.

Stabilised, not sealed
The interfacial layer stays dynamic and permeable.

A peptide code for programmable coacervate stabilisation
A modular peptide code for programming coacervate and protocell stabilisation modes on demand.

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