Supplementary Information for

Dynamic satellite-parent liposome networks for quantitative microreactions

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Supplementary Figures S1-14

Table 1

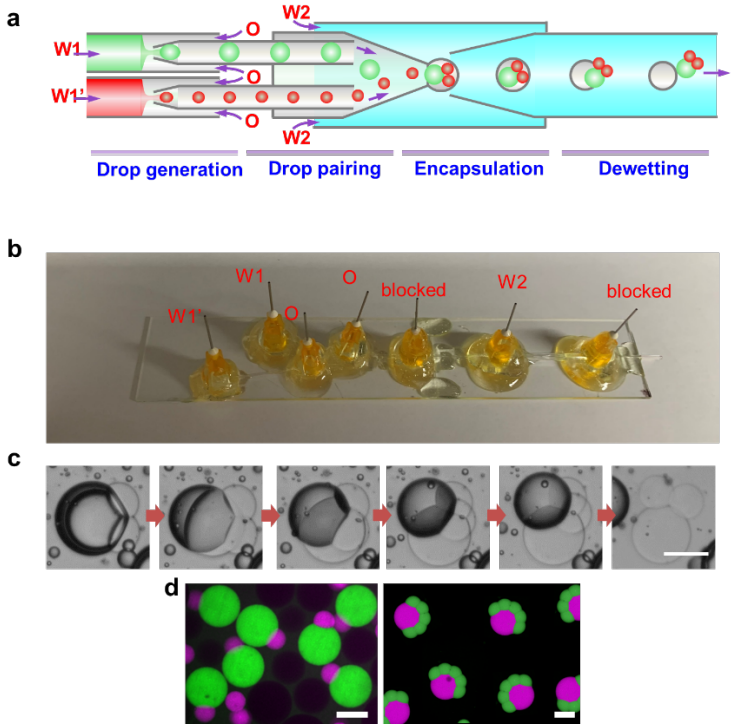

Fig. S1. Scheme (**a**) and optical image (**b**) of the microcapillary-based microfluidic device for preparation of satellite-parent liposome networks. **c**, Optical images of assembly of satellite-parent liposome networks from dewetting of complex W/O/W templates. **d**, Confocal images showing more liposome networks. Scale bar, 100 μm.

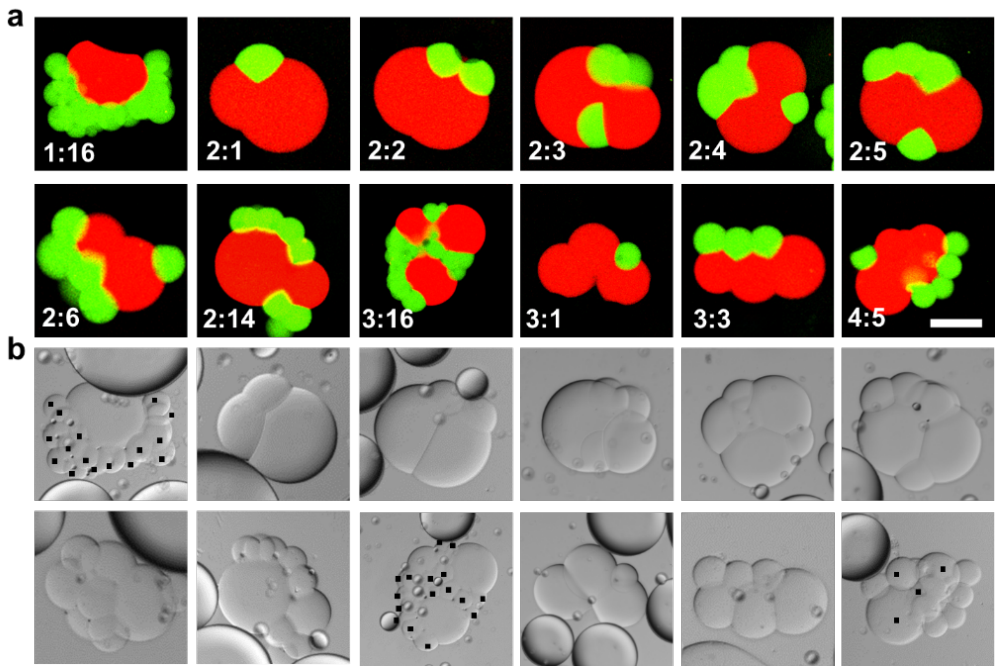

Fig. S2. Confocal images showing satellite-parent liposome networks with different numbers of parent (from 1 to 4) and satellite (from 1 to16) compartments. Scale bars are 100 μm.

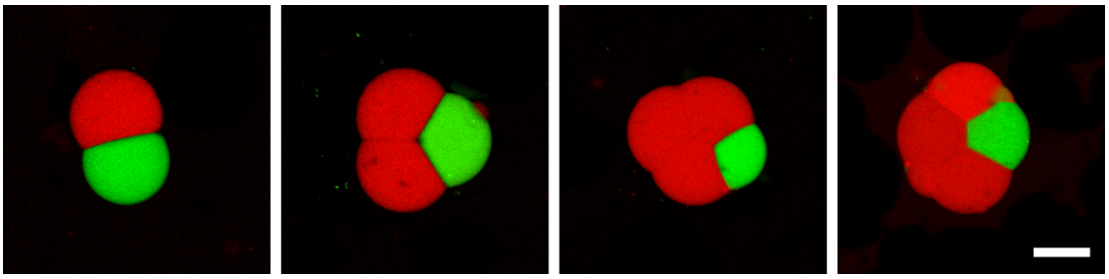

Fig. S3. Confocal images showing liposome networks when W1/O and W1'/O droplets have a comparable size. Scale bars are 50 μm.

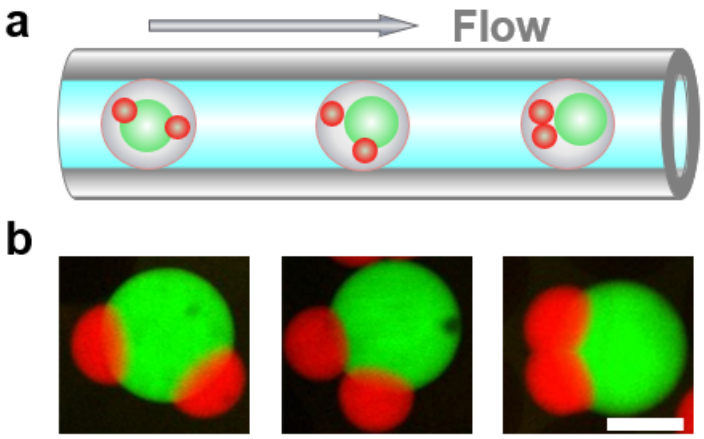

Fig. S4. Scheme (a) and confocal images (b) showing The flow in the microchannels drags the "satellite" compartments into contact with each other. Scale bars are 100 μm.

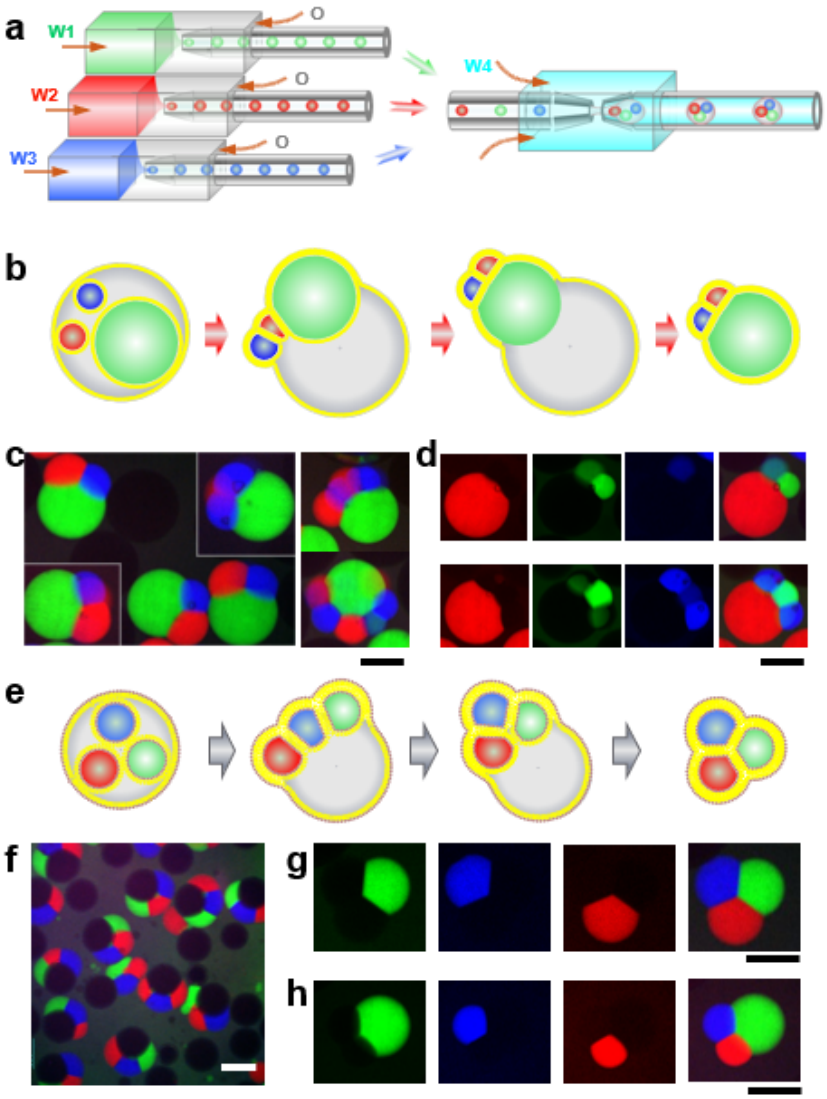

Fig. S5. Scheme (a) showing the preparation of double emulsions with three types of inner cores in a microcapillary-based microfluidic device. Scheme (b) showing assembly of satellite-parent liposome networks with two different types of satellite compartments from dewetting of complex double emulsion templates. Confocal images (c) and (d) showing the as-prepared satellite-parent liposome networks with two different types and numbers of satellite compartments. Scheme (e) showing assembly liposome networks with three different types of satellite compartments from dewetting of double emulsion droplets when the inner phase speed of W1, W2 and W3 were almost the same. Confocal images (f) showing the overview as-prepared liposome networks with three different types of satellite compartments. The black dots in f were oil droplets. Confocal

images (g) and (h) showing the liposome networks fabricated from the same device but with different flow rate ratios between W1, W2 and W3, showing triangular configurations in **g** and satellite-parent configurations in **h.** Scale bars are 100 μm.

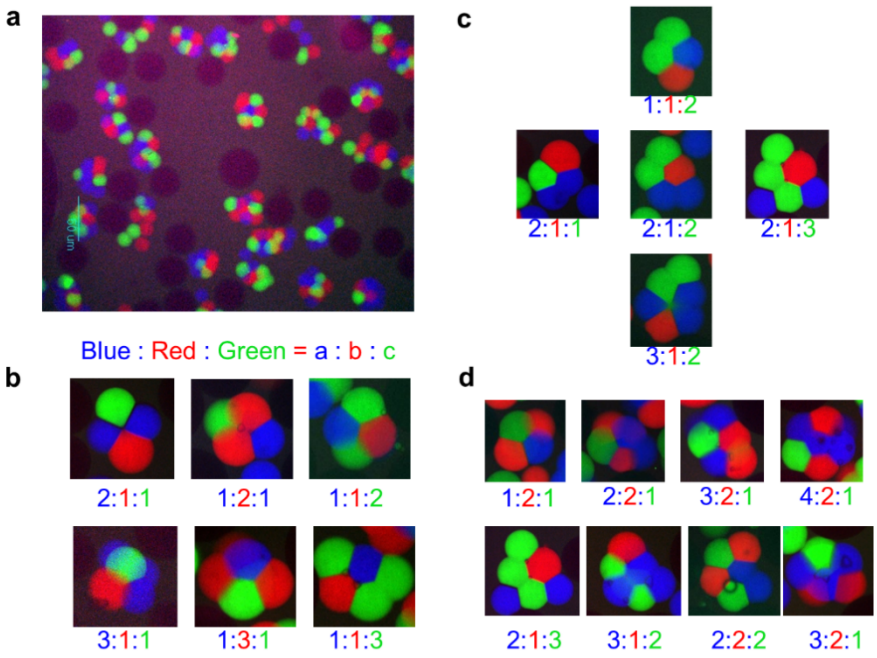

Fig. S6. Confocal images showing liposome networks with controlled numbers and various configurations. Scale bars are 100 μm.

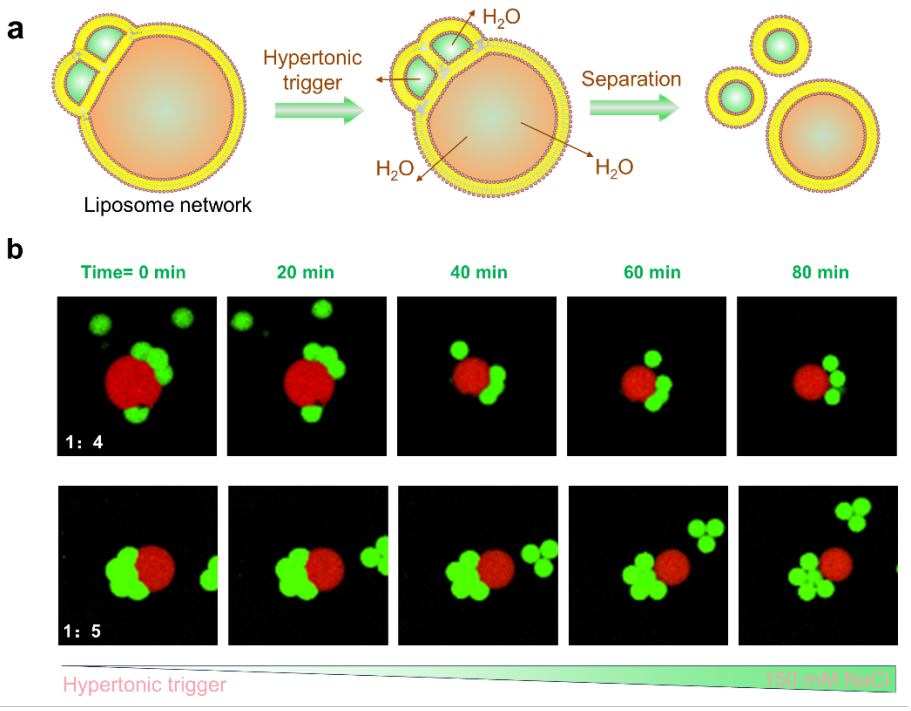

Fig. S7. Confocal images of the shrinking process of satellite-parent liposome networks with more satellite liposomes (green fluorescence, FITC-dextran stain. red fluorescence, TRITC-dextran stain) in response to hypertonic shock (150 mM NaCl).

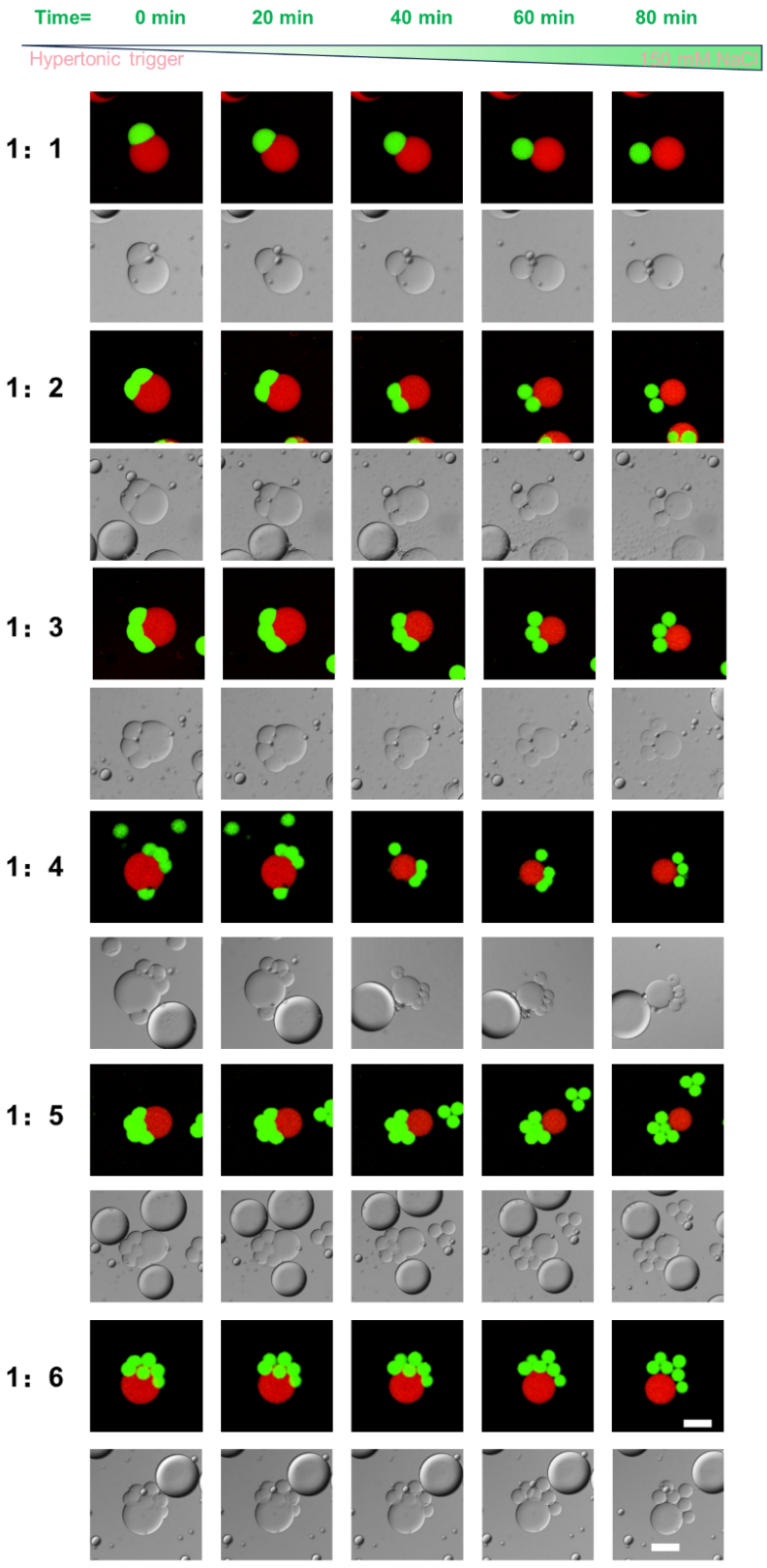

Fig. S8. Confocal and optical images of the shrinking process of satellite-parent liposome networks in response to hypertonic shock (150 mM NaCl).

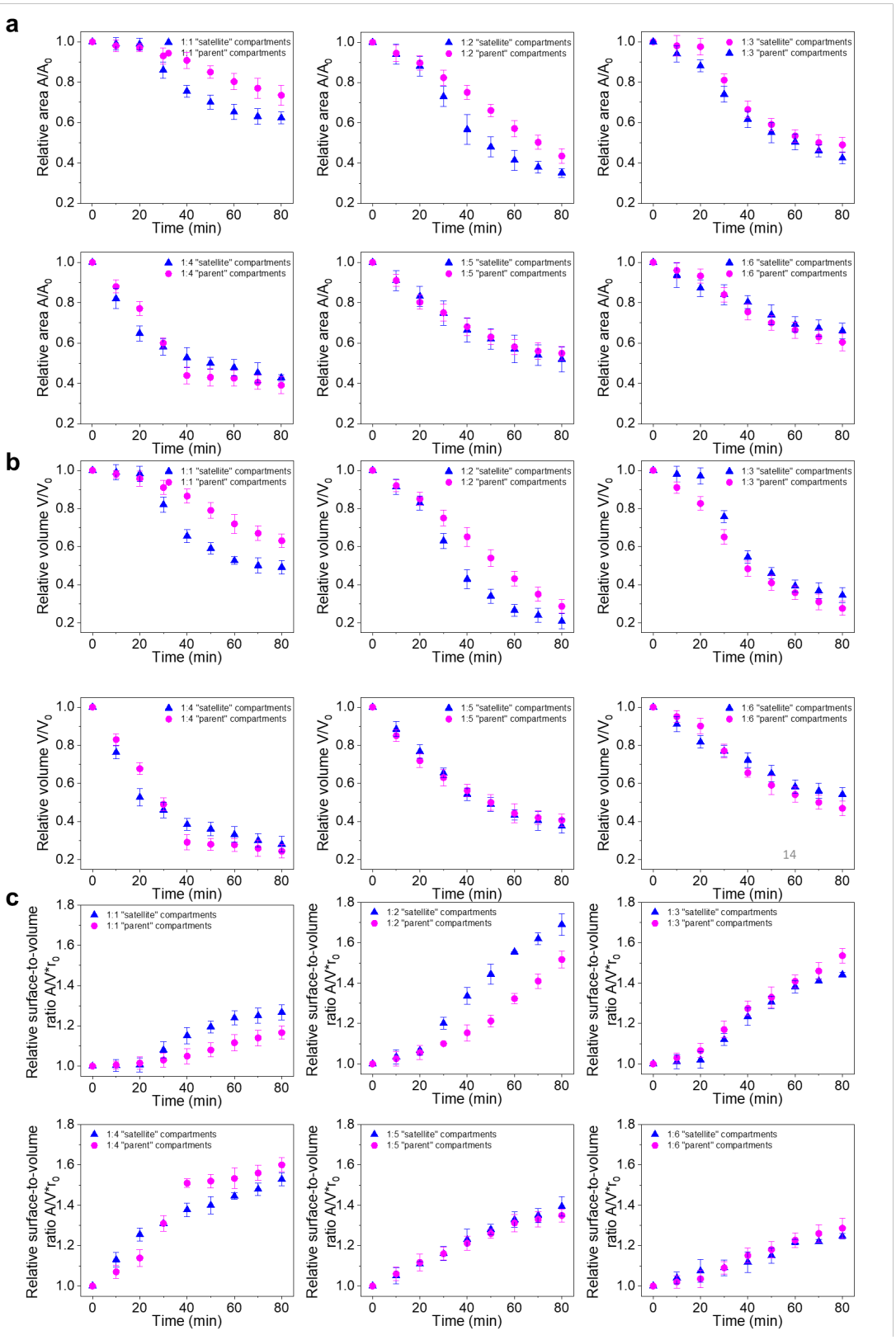

Fig. S9. Plots of relative area(a), relative volume(b) and relative surface to volume ratio (c) of satellite-parent networks over time.

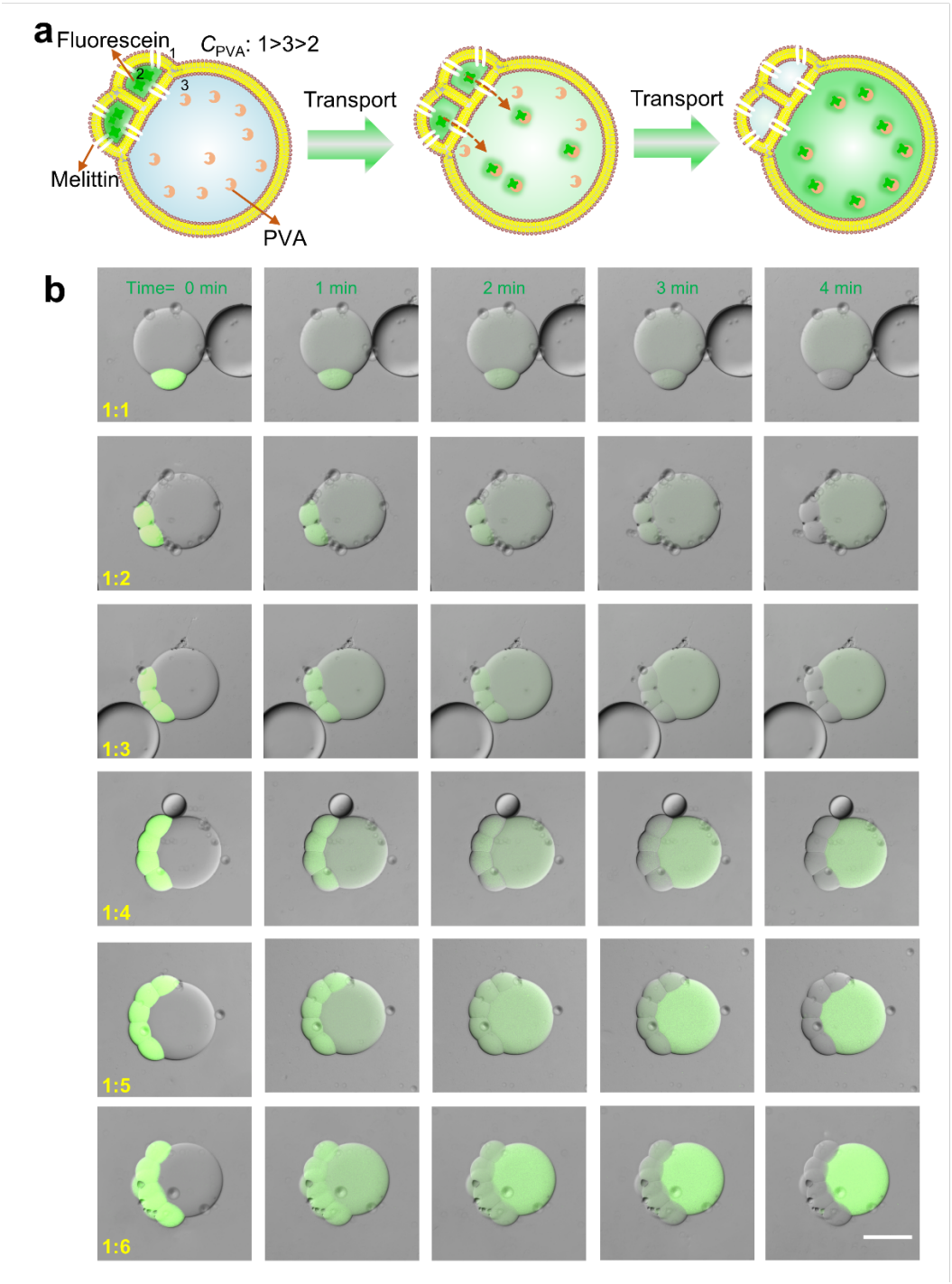

Fig. S10. Schematics (a) and confocal images (b) showing whole process of cargoes (fluorescein) in satellite compartments were transported into parent compartments of liposome networks. PVA concentrations are 3% (w/v) in the satellite compartments, 5% (w/v) in the parent compartments and 1% (w/v) in the outer phases.

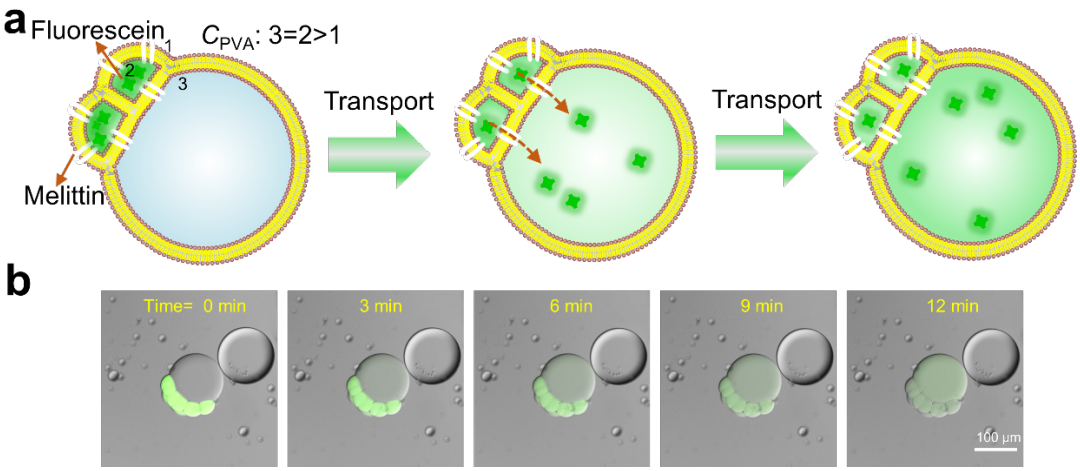

Fig. S11. Schematics (a) and confocal images (b) showing free diffusion process of fluorescein in satellite compartments were transported into parent compartments of liposome networks. PVA concentrations are 3% (w/v) in the satellite compartments, 3% (w/v) in the parent compartments and 1% (w/v) in the outer phases.

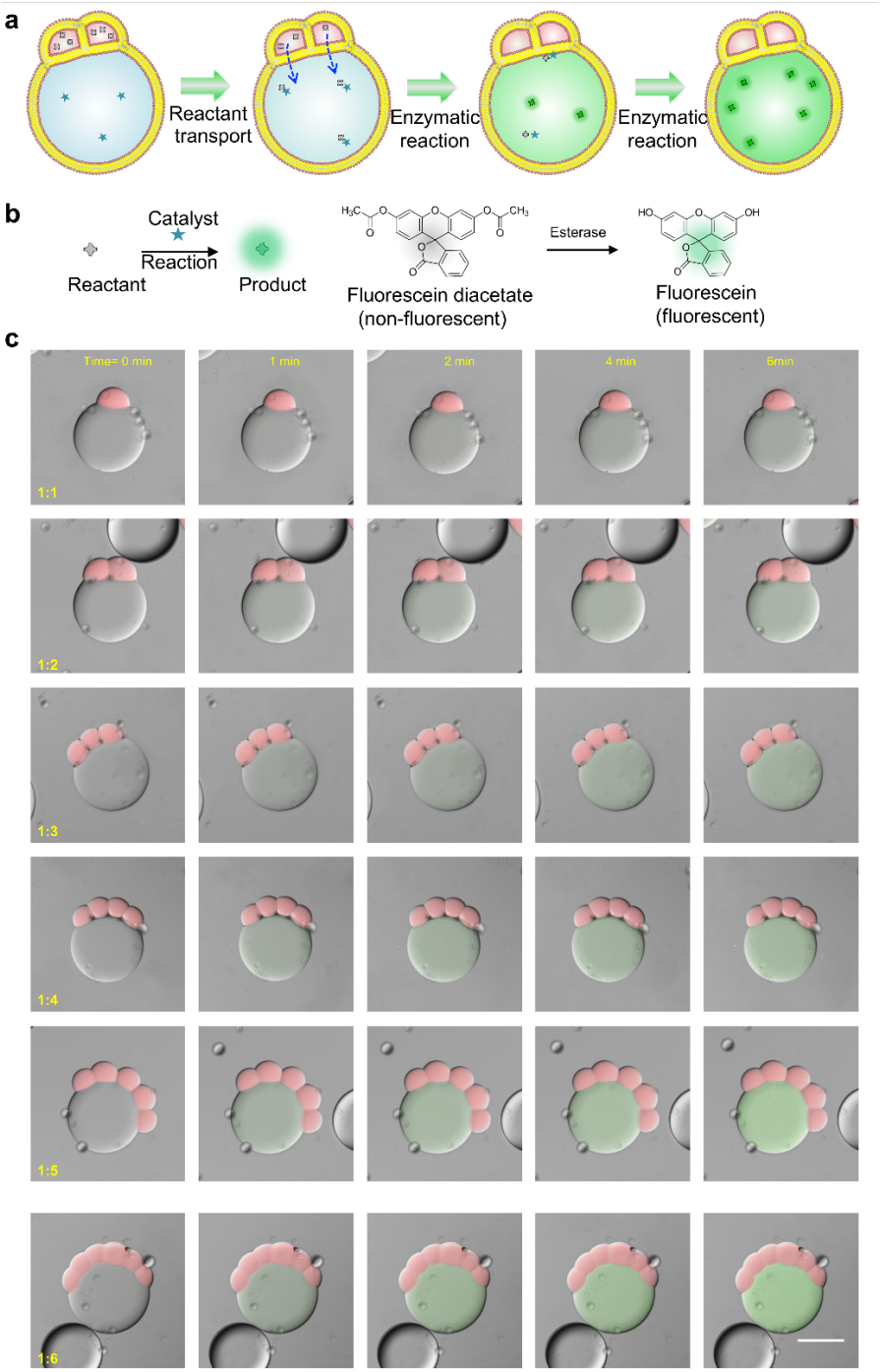

Fig. S12. Schematics (a, b) and confocal images (c) showing non-fluorescent substrates (fluorescein diacetate) transport from satellite compartments to parent compartments in liposome networks, enzymatic degradation of the substrates to generate fluorescein (green fluorescence) (b) in the parent compartments.

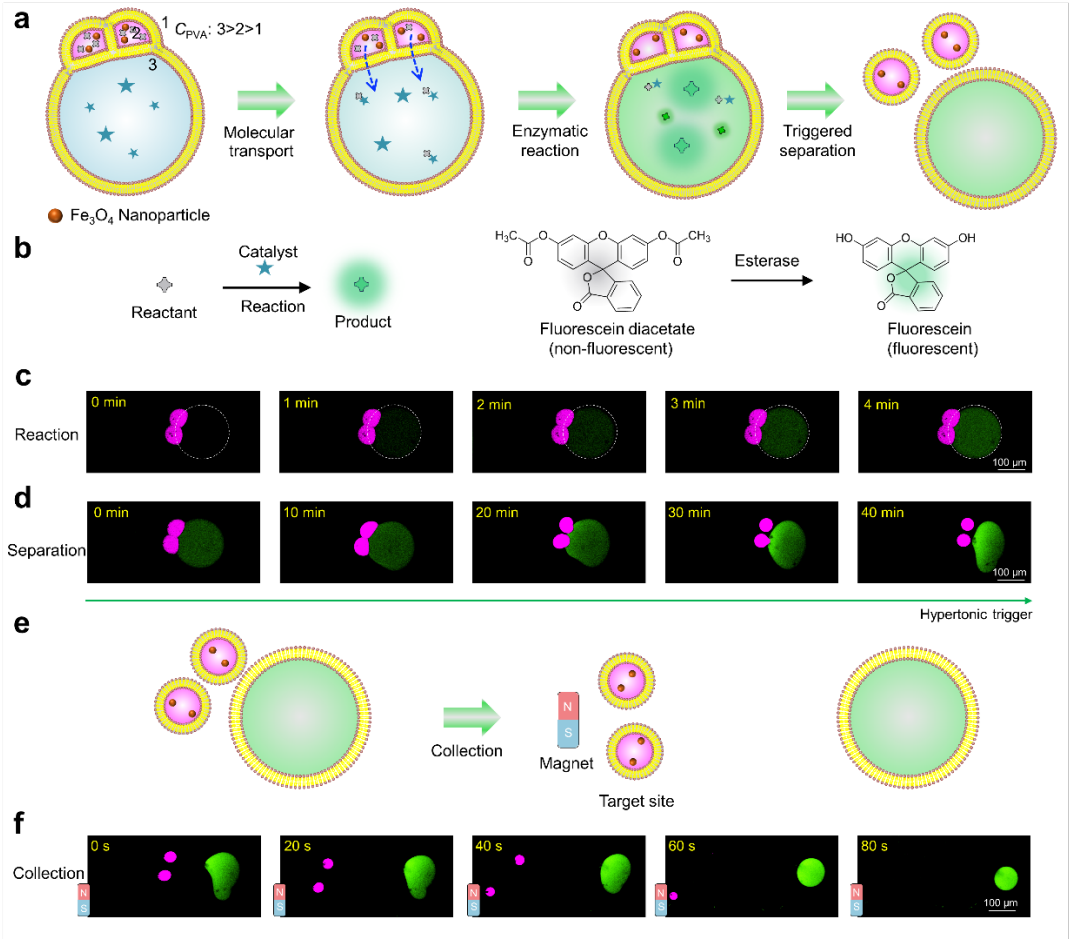

Fig.S13. Reaction, separation and collection of satellite-parent liposome networks. a-c, Schematics and confocal images showing non-fluorescent substrates (fluorescein diacetate) are transported from satellites to parent compartments. **b,** showing the enzymatic degradation of the substrates to generate fluorescein (green). **d**, CLSM images showing the detachment between satellites and parent liposomes in a hypertonic trigger. **e-f**, Schematics and confocal images showing collection different products. Scale bars, 100 μm.

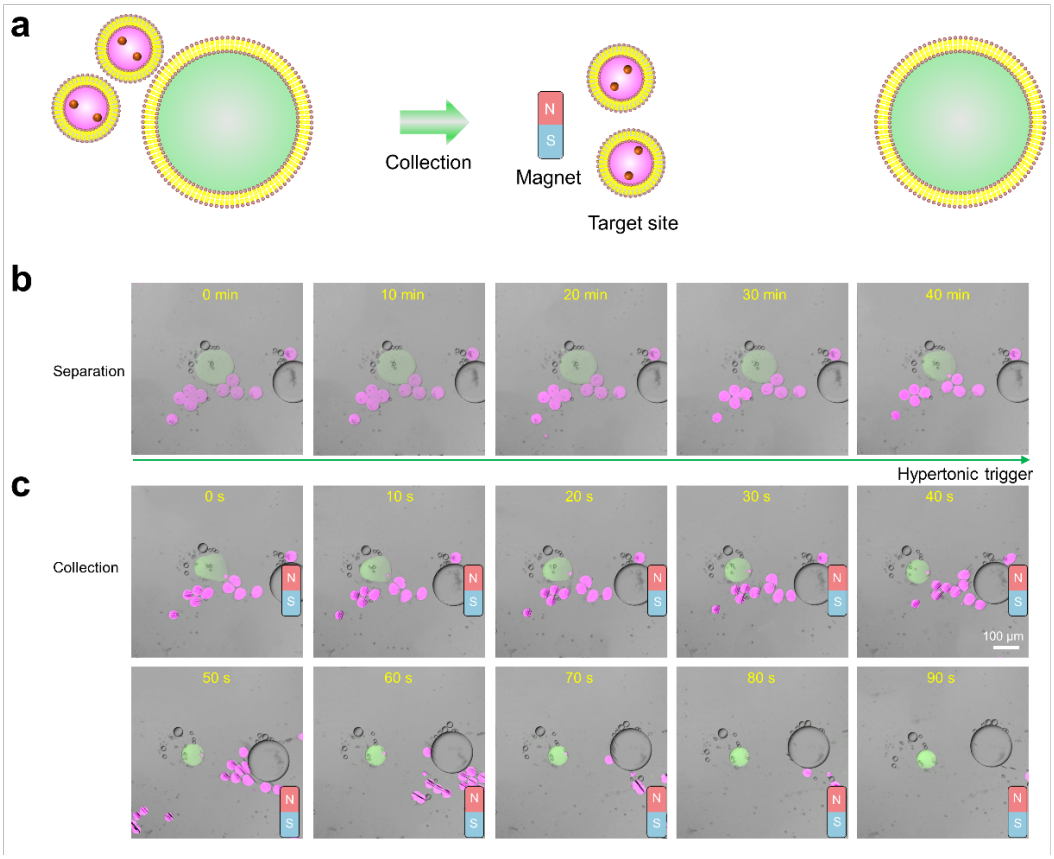

Fig.S14. Schematics and confocal images showing separation and collection different products.

Table 1. Components of W1, W1',O and W2 in different experiments

Satellite compartments	Parent compartment			Experiment
W1	W1'	O	W2	
2% (w/v) PVA + 8% (w/v) PEG+0.03% tetramethyl rhodamine (TRITC)-dextran)	2% (w/v) PVA + 8% (w/v) PEG+0.03% fluorescein isothiocyanate (FITC)-dextran	5 mg ml^{-1} DOPC in chloroform and hexane (36:64, v/v)	10% (w/v) PVA + 1.5% (w/v) F-68	Fig.1 Microfluidic construction of satellite-parent liposome networks
10% (w/v) PVA +0.03% fluorescein isothiocyanate(FITC)-dextran	10% (w/v) PVA +0.03% tetramethyl rhodamine (TRITC)-dextran)	5 mg ml^{-1} DOPC in chloroform and hexane (36:64, v/v)	10% (w/v) PVA + 1.5% (w/v) F-68	Osmotic pressure-induced separation of satellite-parent liposome networks
3 % (w/v) PVA+7 %(w/v) PEG+0.5 μM L^{-1} fluorescein+ 2 μM melittin	5 % (w/v) PVA +5 %(w/v) PEG	5 mg ml^{-1} DOPC in chloroform and hexane (36:64, v/v)	1% (w/v) PVA +9% PEG+ 1.5% (w/v) F-68	Transport of molecular cargoes between subcompartments of satellite-parent liposome networks
3 % (w/v) PVA+7 %(w/v) PEG+ fluorescein diacetate (10 μg mL^{-1}) in PBS buffer (pH 7.0)	5 % (w/v) PVA+5 %(w/v) PEG + 0.1 units mL^{-1} esterase in PBS buffer (pH 7.0)	5 mg ml^{-1} DOPC in chloroform and hexane (36:64, v/v)	1% (w/v) PVA +9% PEG+ 1.5% (w/v) F-68 in PBS buffer (pH 7.0)	Micro-reaction stoichiometry in satellite-parent liposome networks