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Ternary liquid mixtures control the multiplicity, shape and internal structure of emulsion droplets MARTIN F. HAASE, JASNA BRUJIC, New York University — It is important to control the shape, internal structure and stability of emulsion droplets for drug delivery, biochemical assays, and the design of materials with novel physical properties. Successful methods involve the mechanical manipulation of the flow of oil in water using complex microfluidic devices to make multiple emulsions with a sequential introduction of specific reactants. Instead, here we show how the thermodynamics of immiscible liquid mixtures tailor emulsions using a single dripping instability. For example, the initial composition and choice of surfactant govern the multiplicity of concentric alternating oil and water layers inside the droplets. Stabilizing ternary droplets using nanoparticles gives rise to a plethora of shapes whose geometry is defined by the deformability of the shell and the flow rate. Another option is to incorporate lipids to the multiple emulsion droplet, which form vesicles upon expulsion of the inner water droplets. Depending on the number of initial water droplets, these vesicles eventually form complex hollow topologies, which can be used as junctions or scaffolds for the self-assembly of colloidal particles in the future.

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