Lab-on-a-particle technologies based on armored emulsions

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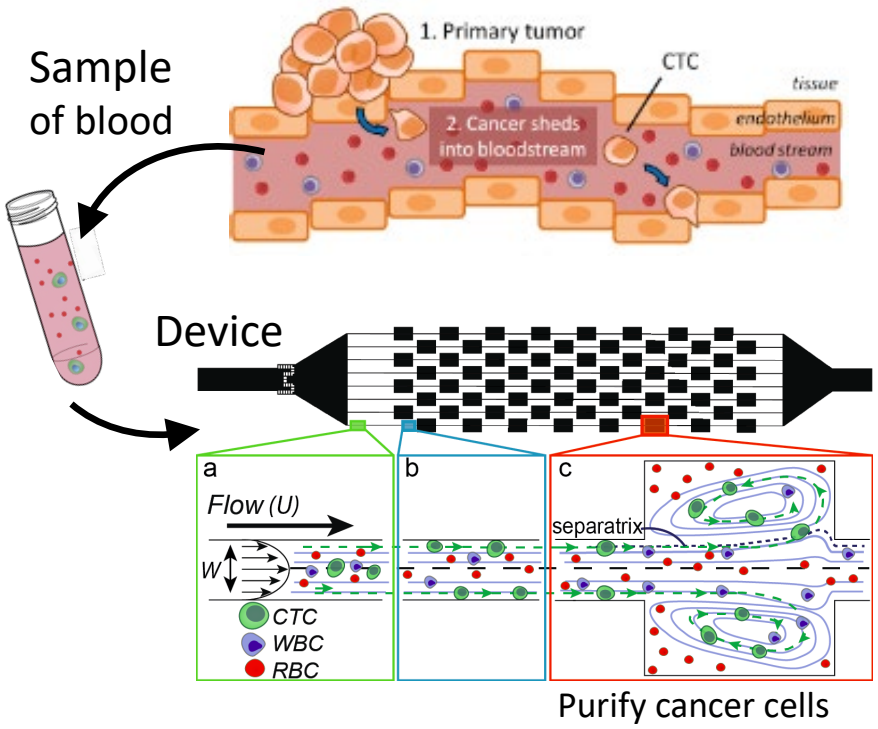
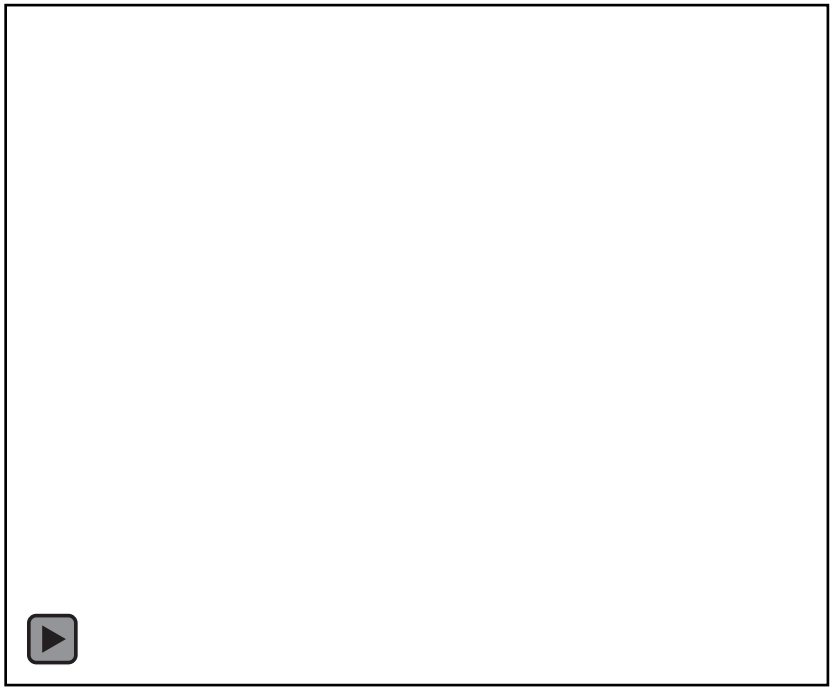
From Lab-on-a-**chip** to Lab-on-a-*particle*



Purify cancer cells

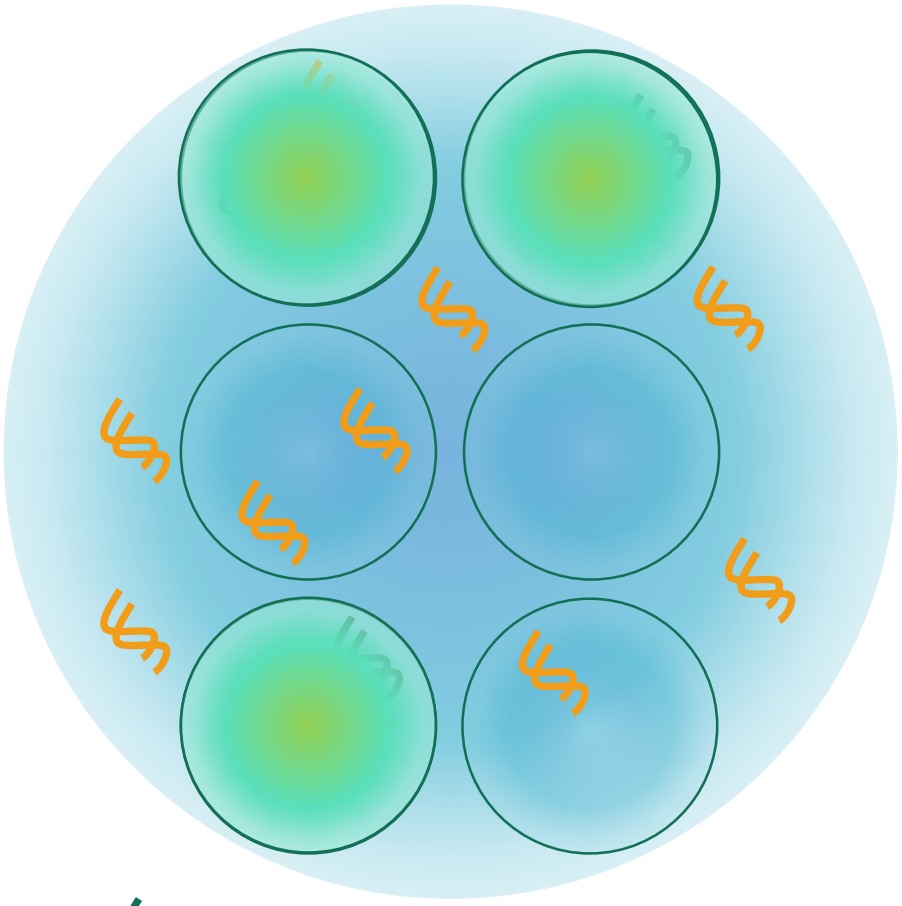


Vortex Trapping

Vortex's VTX-1 Liquid Biopsy System

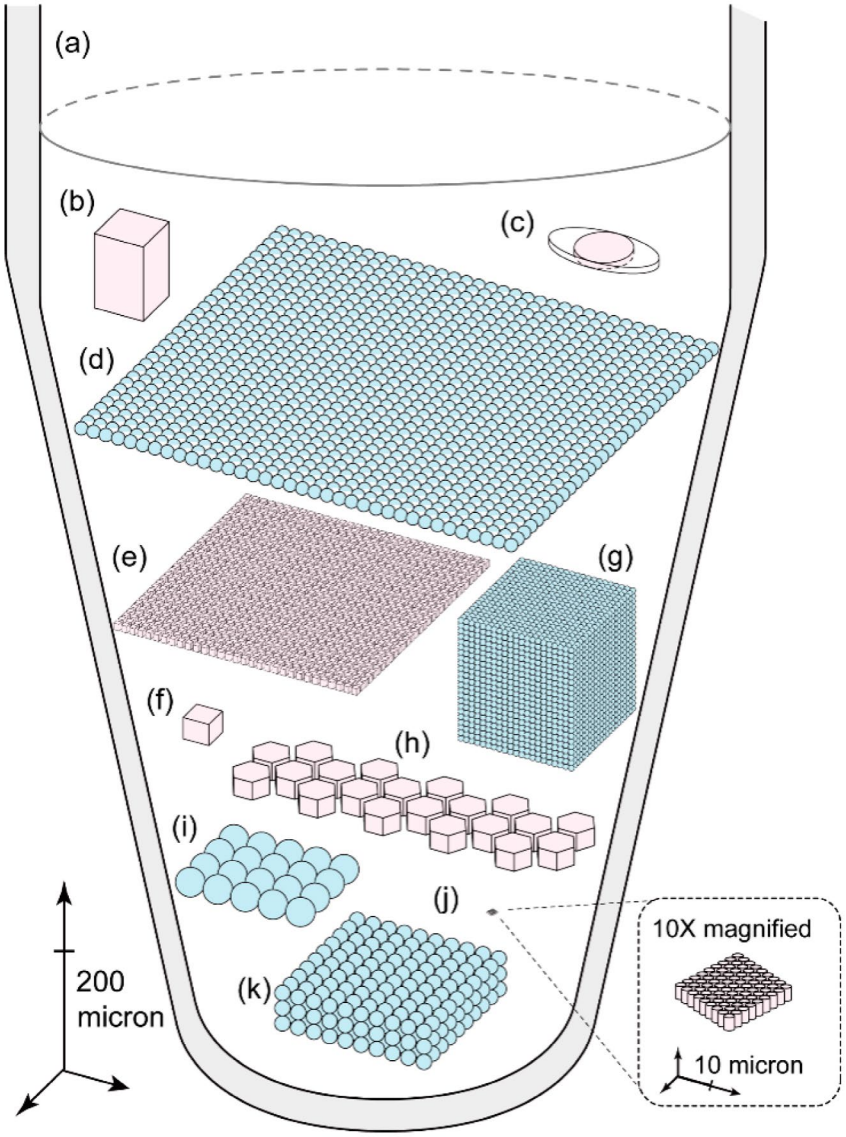
** Financial Interests in Vortex

The power of compartments



Target

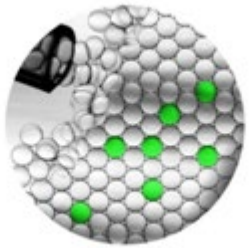
Non-target



Liao and Huang *Micromachines* 2017

Current compartments

- Depend on new infrastructure and disposables



Creating compartments

Reading compartments

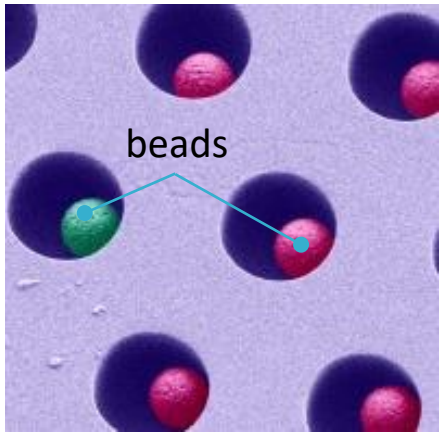
Droplet generation

Optical readout of drops

Current compartments

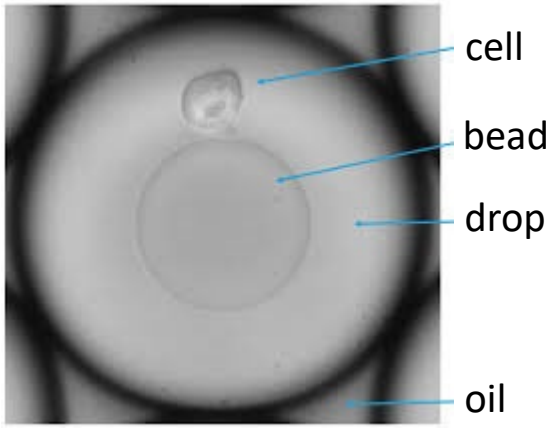
- Dependent on introducing a solid phase for reaction

Digital ELISA



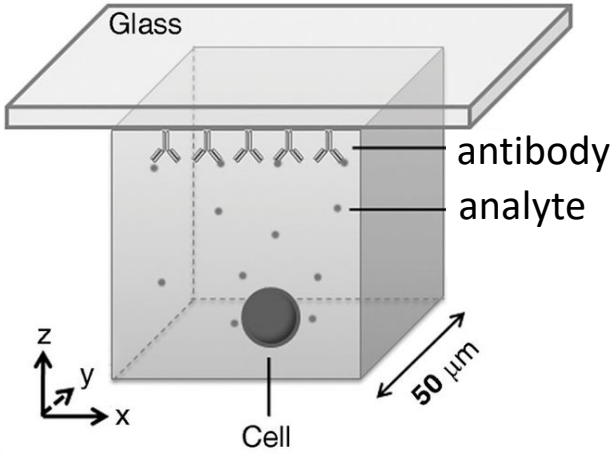
Quanterix SIMOA

Single-cell RNA-seq



10X Genomics

Single-cell secretions



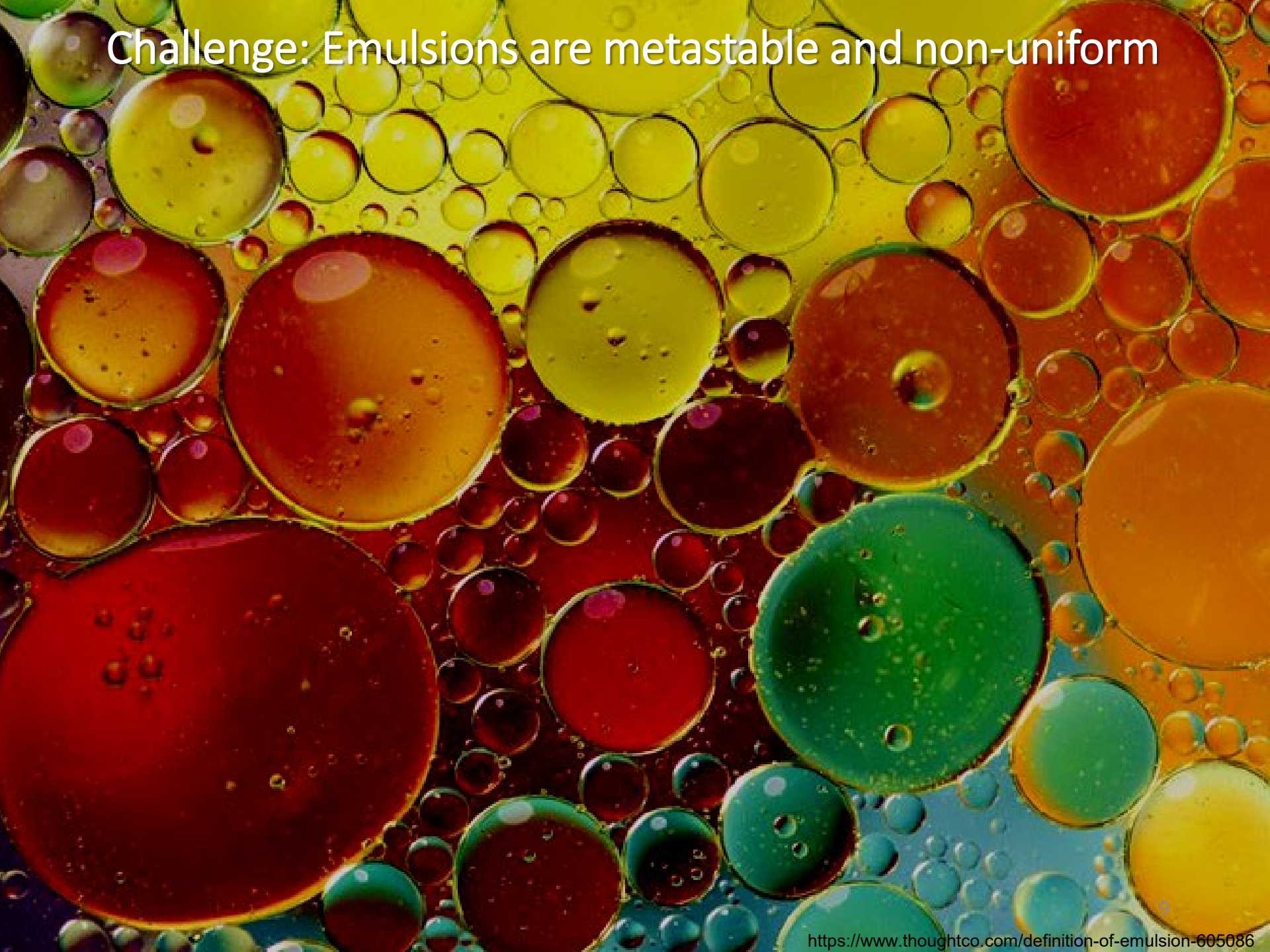
Love et al. *Lab Chip* 2010

Can we create **uniform small volumes** with a **solid phase** and **analyze** without new equipment?

What is a **highly sensitive** and **high-throughput** fluorescence analyzer present in almost every research or clinical lab?

Flow cytometers as ubiquitous analyzers

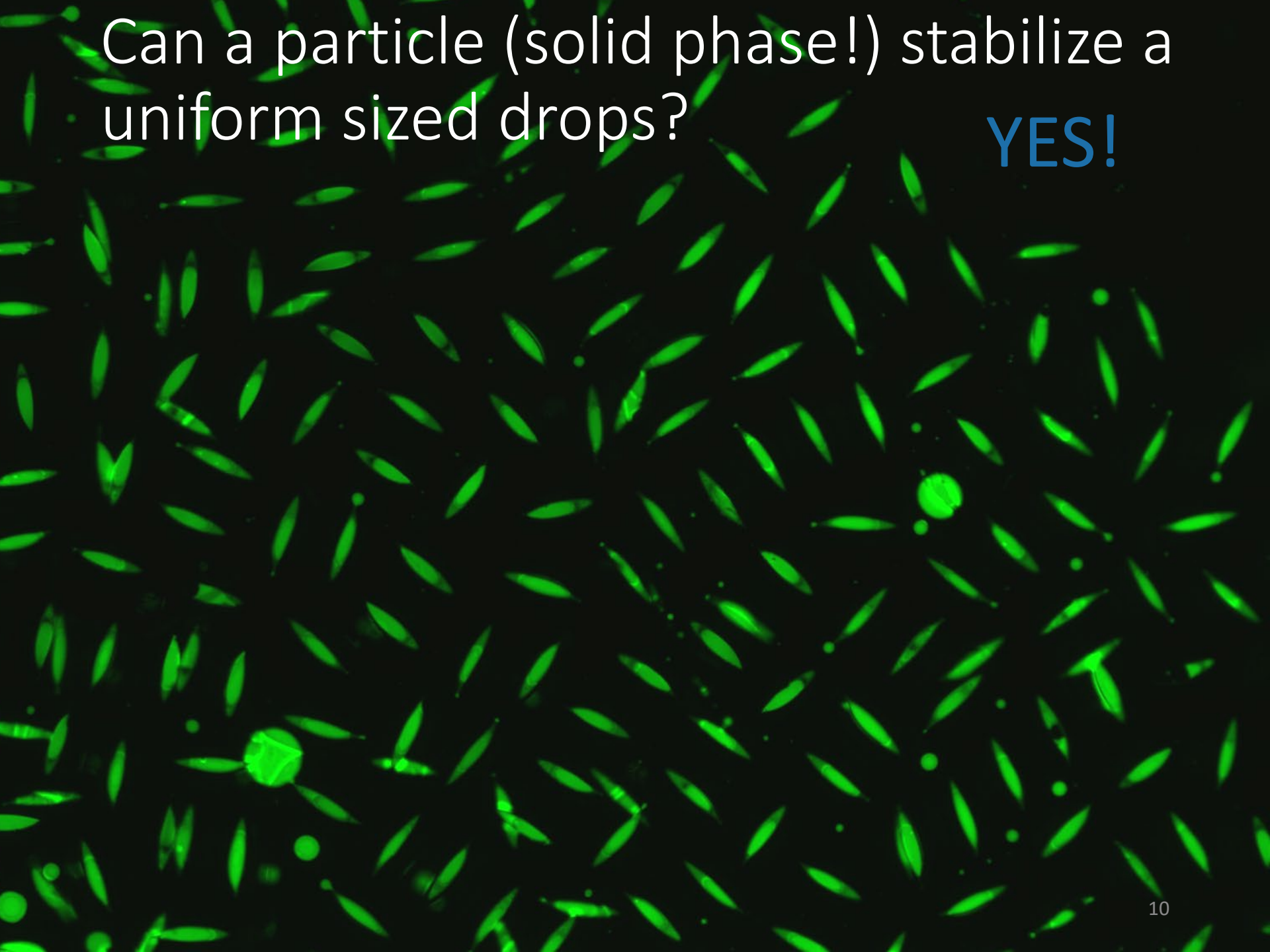
Challenge: Emulsions are metastable and non-uniform



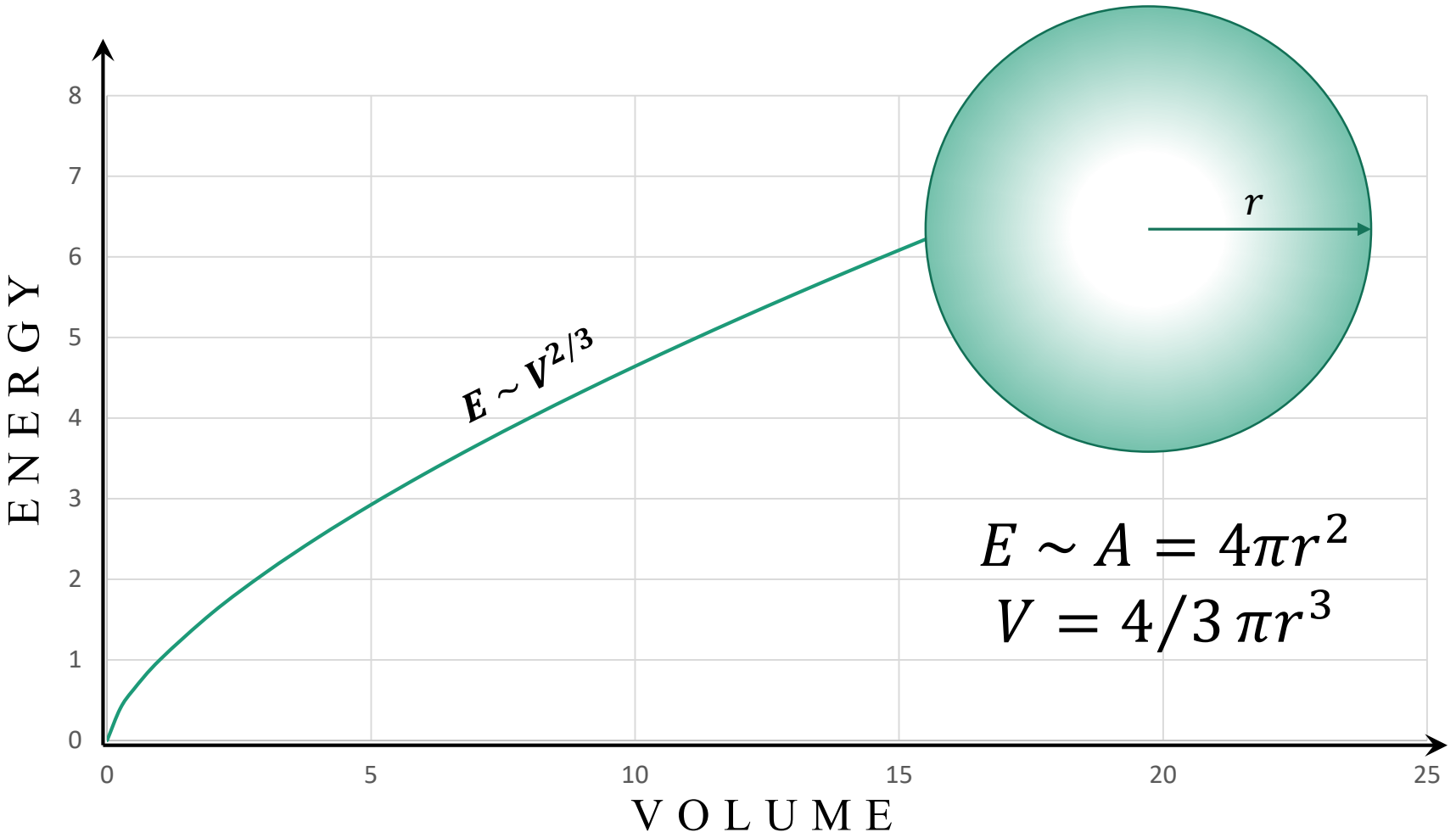
https://www.thoughtco.com/definition-of-emulsion-605086

Can a particle (solid phase!) stabilize a uniform sized drops?

YES!

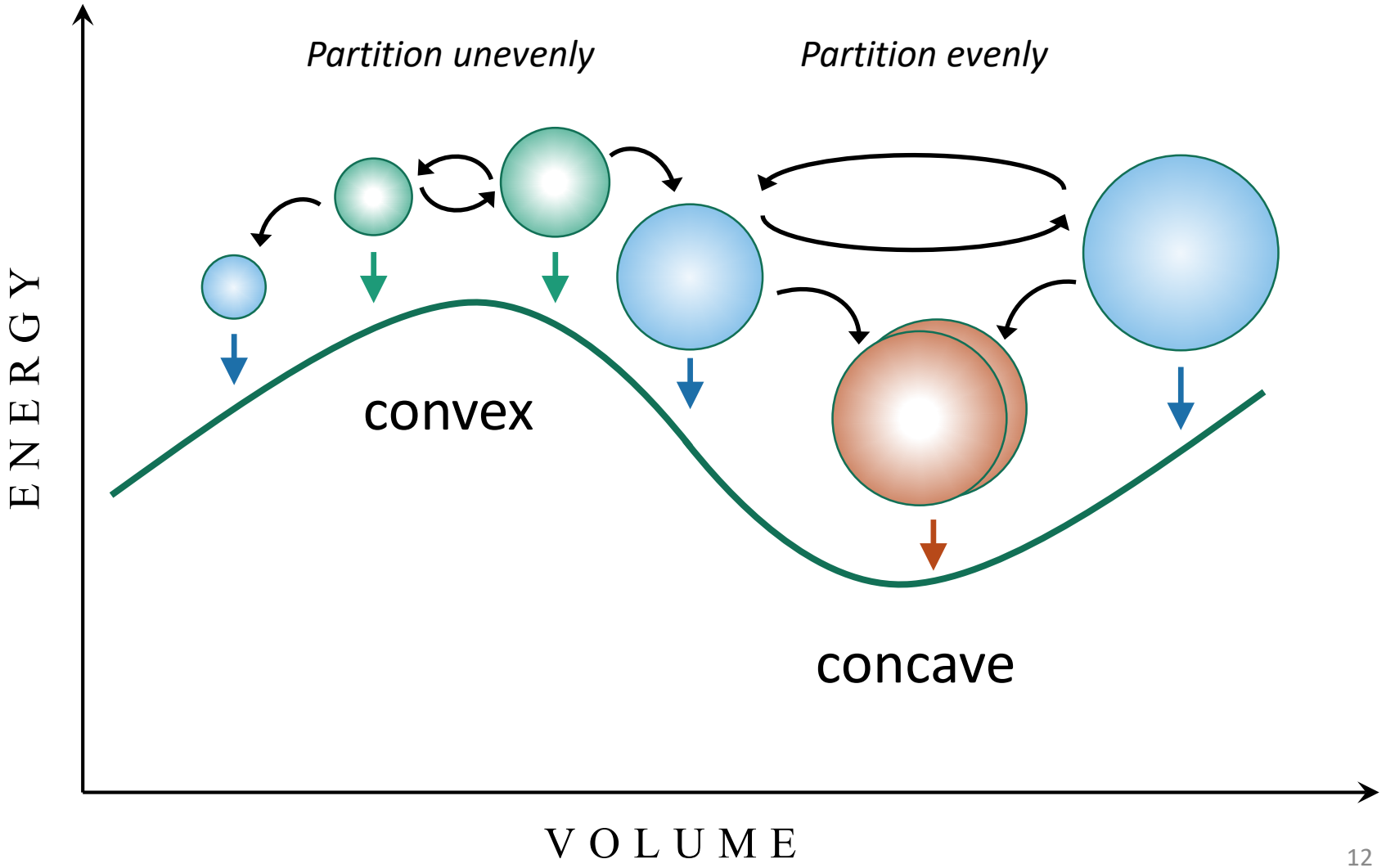


Interfacial energy of free drops



V-E curve indicates drops will spontaneously coarsen

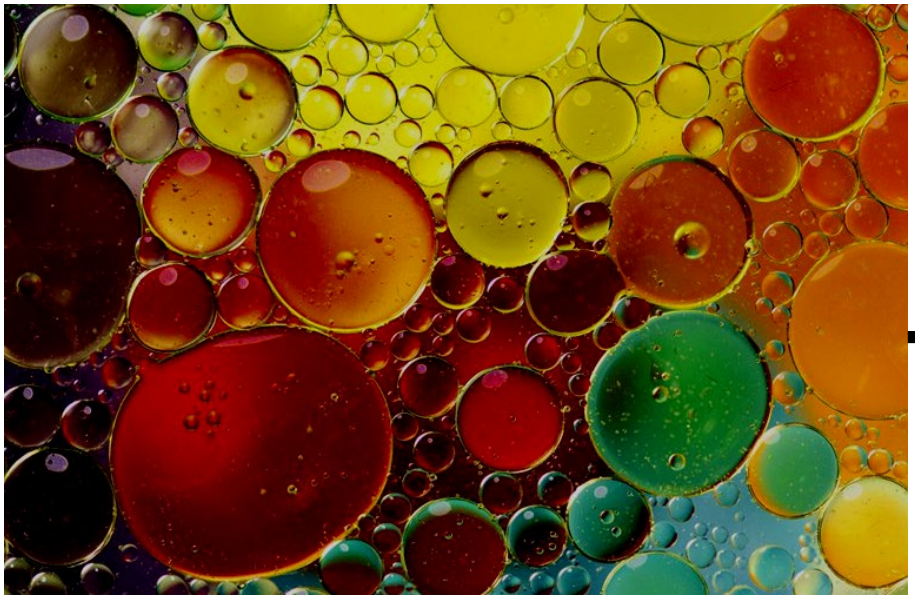
V-E curve convexity drives monodispersity

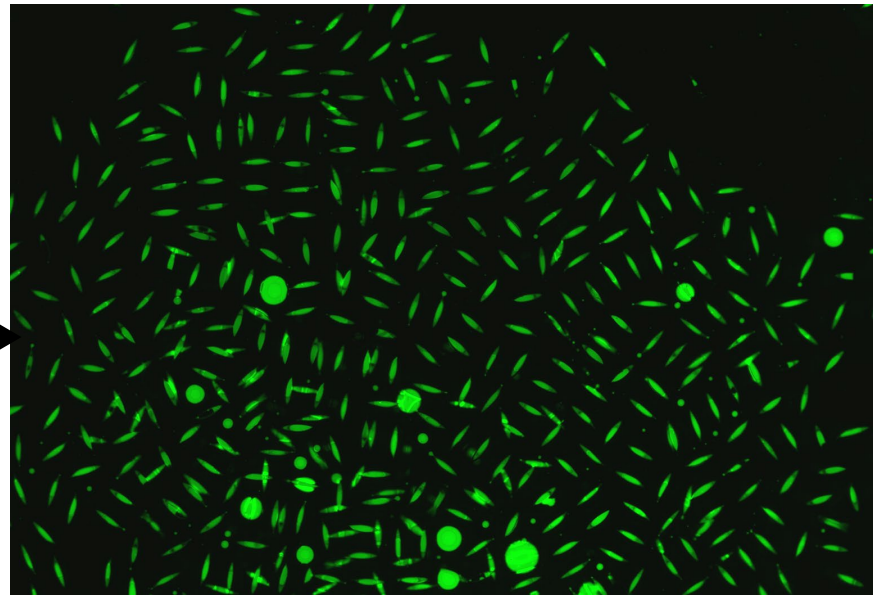


How can we make (many) microscale **multi-material** ***3D structured*** particles?

From lab-on-a-chip to lab-on-a-particle

- Efficient and economic monodisperse droplet generation by “shaking”





https://www.thoughtco.com/definition-of-emulsion-605086

- Solid phase associated with each droplet enables new opportunities as **“lab-on-a-particle”** systems
- Potential to leverage standard laboratory instruments (e.g. flow cyometers) for readout

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PATHS-UP

Precise Advanced Technologies and Health Systems for Underserved Populations

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