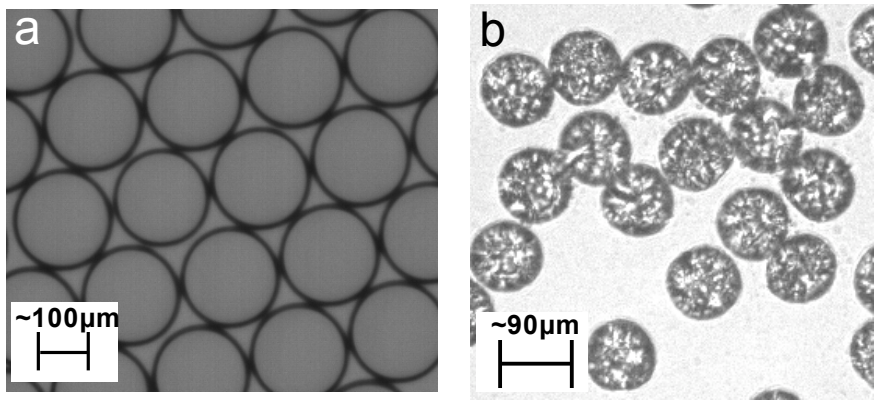
Droplets Stabilized Using Gold Nanoparticles

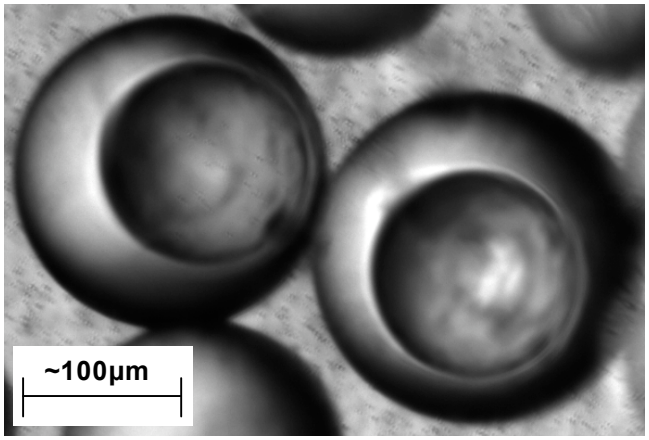
Kathryn Greenberg[1], Anderson Shum[2], Daeyeon Lee[2], Rhutesh Shah[2], and David Weitz[2]

[1]Mt. Holyoke College, [2]Harvard University

Have you ever noticed that when you shake a container of oil and water, for example most salad dressings, that droplets of all different sizes form, but quickly break apart? In this research, I am creating small oil droplets that are of the same size (emulsions) using a device that I built in the lab from microcapillaries. Water-in-oil-in-water drops, or drops inside drops, are also formed using a similar device.Traditionally surfactants, compounds with one side that binds to the water phase and one side that binds to the oil phase, have been used to reduce the surface tension in the drops and keep the emulsions from breaking apart. Instead of using surfactants, this research focuses on using two solutions which, when they are in contact, form gold nanoparticles at the interface. By using these solutions in the microcapillary devices, I am able to create both single and double emulsions with gold nanoparticles at the interfaces. Tight packing of the gold nanoparticles stabilizes the emulsions and a gold capsule can be seen upon drying. One potential use for these emulsions in medicine is as a transport device for various drugs. Since the emulsions are surrounded by gold, they can easily be broken apart releasing the contents to a specific area in a very controlled fashion.



a) Single emulsions stabilized using gold nanoparticles
b) Formation of a gold capsules by drying of single emulsions.



Water in oil in water double emulsions stabilized at each interface by gold nanoparticles.

Supported by BASF Advanced Research Initiative at Harvard and NSF DMR-0649199