THE PHYSICS COLLOQUIUM

Thursday, 16 juni 2022, 4:00 p.m.
Nijenborgh 4, Lecture Hall 5111.0080

A Tale of Two Droplets: from Synthetic Cells to Biosensors

Siddharth Deshpande

Wageningen University & Research

In this talk, I will elaborate on two exciting stories from my newly established lab, each revolving around a specific type of droplet.

The first story is about a novel and easy way to make biocompatible containers for synthetic cells. Engineering synthetic cells has a broad appeal, from understanding living cells to designing novel biomaterials for therapeutics and hybrid interfaces. Here, we use phase-separated liquid droplets and coat it with actin cytoskeleton, an intracellular protein polymer (Fig. 1A). Under the right conditions, the droplets are transformed into cell-sized porous containers, which we call actinosomes. We show the functionality of actinosomes by using them as bioreactors capable of protein synthesis. Actinosomes have appealing properties like ease-of-production, inherent encapsulation capacity, and an active surface to form multicellular assemblies, with potential in medical and biotechnological applications.

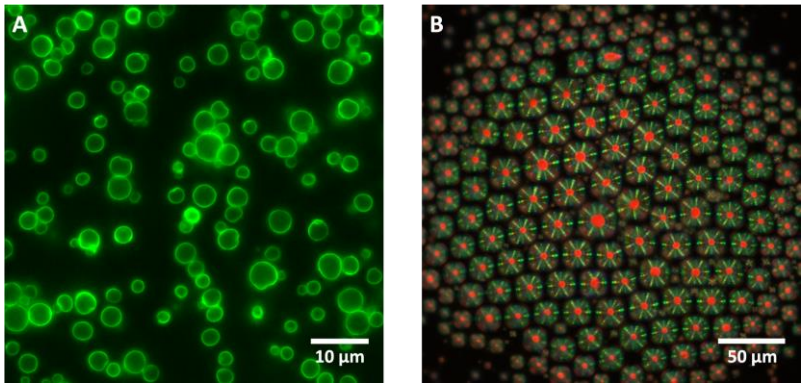

Figure 1: (A) actinosomes in the making. (B) an array of liquid crystal biosensors.

The second story is about using liquid crystal droplets as microsensors to sense amphiphiles. We utilize chiral nematic liquid crystal micro-droplets, which show strongly reflected structural colour, as sensing platforms. We systematically quantify the optical response of closely related biological amphiphiles and find unique optical signatures for each species. We show lab-on-a-chip capability of our method by drying droplets in two-dimensional arrays (Fig. 1B) and hydrating the chip to detect dissolved analytes.

Finally, we show proof-of-principle in vivo biosensing in the intestinal tracts of live zebrafish larvae, where the droplets show a clear optical response in healthy and inflamed tissues. Our results show the potential of liquid crystals in developing detection platforms and for in vivo detection of biomolecules.

References
[1] K.A. Ganar, L. Leijten, S. Deshpande, bioRxiv, Actinosomes: condensate-templated proteinaceous containers for engineering synthetic cells, 2021, DOI: https://doi.org/10.1101/2021.10.26.465899
[2] L.W. Honaker, C. Chen, F.M.H. Dautzenberg, S. Brugman, S. Deshpande, bioRxiv, Designing biological micro-sensors with chiral nematic liquid crystal droplets, 2021, DOI: https://doi.org/10.1101/2021.10.25.465736

Join us for coffee starting 3:30 p.m. Refreshments will be served after the lecture.
For more information contact the host: Rifka Vlijm (r.vlijm@rug.nl)
Website: http://www.rug.nl/research/vsi/colloquia/
To join online: https://p2gonew.serverspace.rug.nl/P2G/Player/Player.aspx?id=5111-0080