JACS
JOURNAL OF THE AMERICAN CHEMICAL SOCIETY
Spotlights
pubs.acs.org/JACS

Spotlights on Recent *JACS* Publications

MICROFLUIDIC APPROACH TO CREATING UNIFORM VESOSOMES FOR ARTIFICIAL CELL MODELS

Vesosomes are liposomal structures composed of multiple layers of concentric spheres. They have captured the interest of researchers owing to their potential to serve as both advanced drug delivery vehicles and artificial cell models. One of the hurdles to these applications lies in the creation of uniform, monodisperse structures. Now, researchers led by Wilhelm Huck demonstrate the use of microfluidic devices to produce monodisperse vesosomes of controlled size (DOI: 10.1021/jacs.6b10977).

The team uses a surfactant-assisted microfluidic strategy and a technique known as "multidewetting" to hierarchically assemble the compartments. The use of microfluidics allows the researchers to control the vesosomes' dimensions and configurations, which is demonstrated by the formation of three kinds of liposomes: concentric, pericentric, and multicompartment. Moreover, the flow rate can be tuned to alter the number of interior liposomes. The researchers show that vesosomes can mimic the architecture of eukaryotic cells and perform *in vitro* transcription within its "nucleus" liposomes. By inserting nanopores into the bilayers, they also demonstrate that small molecules can be transported across the nucleic envelope. The authors say next steps for this work include nanopore-mediated transfer of RNA across the lipid membranes. The work could greatly facilitate artificial cell related research like vesicle transport, membrane fusion, and enzyme storage and release.

Christine Herman, Ph.D.

NEXT-GENERATION NUCLEIC ACID ANALYSIS FOR ROUTINE MEDICINE

The quest for tools that reveal molecular-level information about diseases has been driven by the promise of improved diagnostics and therapeutics in personalized medicine. Chemists have embraced this quest, with the creation of new tools and techniques for the rapid analysis of nucleic acid sequences. In a new Perspective, Shana Kelley and colleagues review the progress made in chemistry-driven approaches for analyzing DNA and RNA sequences in laboratory and clinical settings (DOI: 10.1021/jacs.6b10850).

The team discusses the underlying motivation behind nucleic acid analysis for clinical applications and provides a general overview of the strengths and limitations of current approaches. As one of several examples, polymerase chain reaction is a workhorse in clinical diagnostic laboratories. However, this technique requires sophisticated equipment for sample processing and is susceptible to false positives. To provide a breakthrough that would allow genotypic analysis to become routine, the researchers explore how nanomaterials have enhanced DNA and RNA detection at the nanoscale, discuss new signal amplification approaches for direct detection, and also highlight the promise of fluidic devices for automated analysis. With a look to the future, new chemistries are needed to enable the development of new tools for rapid, simple, sensitive, and cost-effective nucleic acid analysis in a clinical setting.

Christine Herman, Ph.D.

NITRIC OXIDE ON NEW ROUTE

Nitric oxide (NO) plays an important role in a wide variety of biological processes in the nervous, immune, and cardiovascular systems that include vasodilation, neurotransmission, and microbial host defense. Previous biomedical studies closely connect NO levels to a number of pathologies, such as hypertension, cardiovascular dysfunctions, neurodegeneration, arthritis, and asthma. Under oxygen-deficient conditions, NO release involves interactions with a host of other molecular signals, including nitrite and *S*-nitrosothiols at copper- and iron-based enzymes. Their complex interplay is poorly understood at the molecular level. Subrata Kundu, Timothy Warren, and co-workers reveal new mechanistic insights into some of these interactions (DOI: 10.1021/jacs.6b11332).

The team performs model studies that show how *S*-nitrosothiols and nitrite work together through electrophilic activation at copper(II), to enable the nitrosation of thiols and other biologically relevant nucleophiles, such as amines and alcohols. The new findings shed light on reactivity pathways that are available to nitrite groups at biological copper sites, revealing how nitrite may be interconnected with nitric oxide and *S*-nitrosothiols as complementary molecular signals in nitric oxide biology.

Christine Herman, Ph.D.

Published: January 18, 2017

DOI: 10.1021/jacs.7b00317
J. Am. Chem. Soc. 2017, 139, 565−565