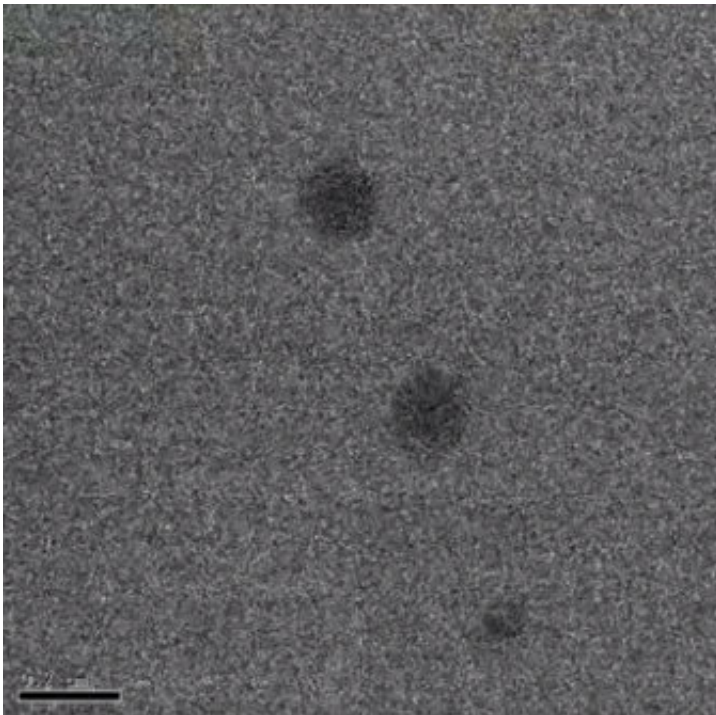


Scientists capture colliding organic nanoparticles on video for first time

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A Northwestern University research team is the first to capture on video organic nanoparticles colliding and fusing together. This unprecedented view of "chemistry in motion" will aid Northwestern nanoscientists developing new drug delivery methods as well as demonstrate to researchers around the globe how an emerging imaging technique opens a new window on a very tiny world.

This is a rare example of particles in motion. The dynamics are reminiscent of two bubbles coming together and merging into one: first they join and have a membrane between them, but then they fuse and become one larger bubble.

"I had an image in my mind, but the first time I saw these fusing nanoparticles in black and white was amazing," said professor Nathan C. Gianneschi, who led the interdisciplinary study and works at the intersection of nanotechnology and biomedicine.

"To me, it's literally a window opening up to this world you have always known was there, but now you've finally got an image of it. I liken it to the first time I saw Jupiter's moons through a telescope. Nothing compares to actually seeing," he said.

Gianneschi is the Jacob and Rosaline Cohn Professor in the department of chemistry in the Weinberg College of Arts and Sciences and in the departments of materials science and engineering and of biomedical engineering in the McCormick School of Engineering.

The study, which includes videos of different nanoparticle fusion events, will be published Nov. 17 by the *Journal of the American Chemical Society*.

The research team used liquid-cell [transmission electron microscopy](#) to directly image how polymer-based [nanoparticles](#), or micelles, that Gianneschi's lab is developing for treating cancer and heart attacks change over time. The powerful new technique enabled the scientists to directly observe the particles' transformation and characterize their dynamics.

"We can see on the molecular level how the polymeric matter rearranges when the particles fuse into one object," said Lucas R. Parent, first

author of the paper and a National Institutes of Health Postdoctoral Fellow in Gianneschi's research group. "This is the first study of many to come in which researchers will use this method to look at all kinds of dynamic phenomena in organic materials systems on the nanoscale."

In the Northwestern study, organic particles in water bounce off each other, and some collide and merge, undergoing a physical transformation. The researchers capture the action by shining an electron beam through the sample. The tiny particles—the largest are only approximately 200 nanometers in diameter—cast shadows that are captured directly by a camera below.

"We've observed classical fusion behavior on the nanoscale," said Gianneschi, a member of Northwestern's International Institute for Nanotechnology. "Capturing the fundamental growth and evolution processes of these particles in motion will help us immensely in our work with synthetic materials and their interactions with biological systems."

The paper is titled "Directly Observing Micelle Fusion and Growth in Solution by Liquid-Cell Transmission Electron Microscopy."

More information: Directly Observing Micelle Fusion and Growth in Solution by Liquid-Cell Transmission Electron Microscopy, *Journal of the American Chemical Society* (2017).

Provided by Northwestern University

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