New material allows for unprecedented imaging deeper in tissues

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A team from the Department of Chemistry has established an approach for the creation of a metal-organic framework material that provides new perspectives for the sensitization of near-infrared luminescent lanthanide ions, including unprecedented possibilities of imaging deeper in tissues for more comprehensive studies of biological systems with light.

Professor Nathaniel Rosi and his team worked with Professor Stephane Petoud, INSERM Research Director for the Center for Molecular Biophysics in France and Adjunct Professor in the Department of Chemistry on the paper, "Ship-in-a-bottle preparation of long wavelength molecular antennae in lanthanide metal-organic frameworks for biological imaging."

The research details the process in which small molecular precursors are loaded into the rigid three-dimensional cavities within lanthanide metal-organic frameworks, where they combine to form a dense array of extended molecular systems that work as an "antennae" that sensitize the lanthanide cations with long wavelengths excitation light. Those long wavelengths activate the near infrared emitting properties of the lanthanide, which may help to create images of areas located more deeply within biological systems.

Rosi also noted the luminescence from lanthanides lasts longer than background radiation in standard biological images, so researchers will have a time advantage when studying lanthanide samples.

"We've achieved a system that's sufficiently bright, that we can see using biological imaging in the near infrared. We can also excite it at long wavelengths, up to 600 nanometers which is highly desired so as not to disturb the biological systems." said Rosi.

The paper published in April in the *Journal of the American Chemical Society*.

Rosi said this novel optical imaging agent will also help researchers detect greater numbers of biological targets from a single experiment than what is possible with current methods.

"Current limitations in imaging allow one to only detect 4 maybe 5 molecules at best in a single imaging experiment. What if we wanted to detect five or six, or 10? There are 14 lanthanide elements across the periodic table. Most of them have very distinct, sharp, luminescent signals. We can potentially make up to 10 optical imaging probes with different lanthanides and be able to detect all of them because they don't have overlapping signals."

Provided by University of Pittsburgh