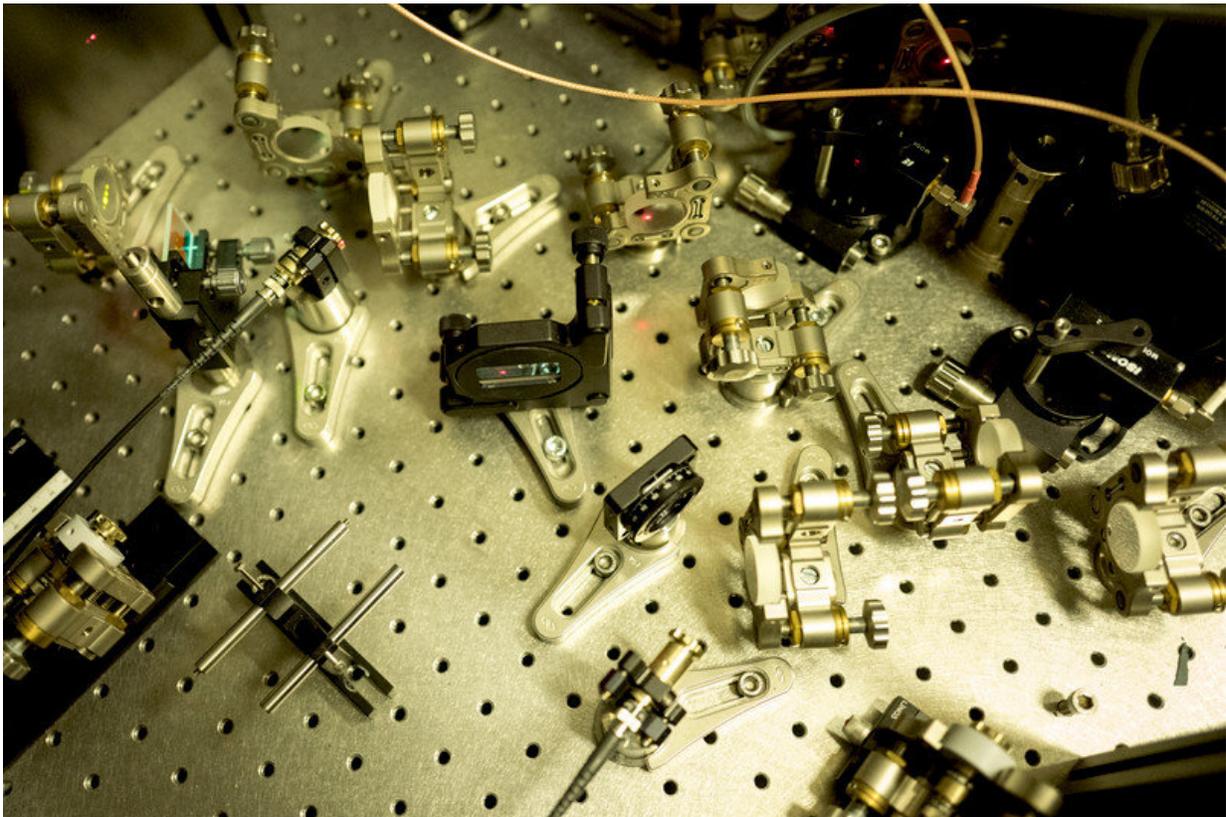


# Simultaneous monitoring of surfaces and protein distribution in cells

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In order to facilitate analysis in living cells, the team is planning to develop a combined instrument in the next step. Credit: © RUB, Kramer

In a first proof-of-concept study, researchers at Ruhr-Universität Bochum (RUB) have combined two microscopy methods that render

both a cell's surface and the distribution of a protein in the cell visible, at a resolution in the nanometre range. The method can be used for living cells. It might for example help analyse how cancer metastases are formed or assess the efficacy of specific drugs. The researchers from the nanoscopy workgroup at Rubion, the Central Unit for Ionbeams and Radionuclides at RUB, reported their findings in the renowned journal *ACS Nano* on May 23, 2018.

## **A first step**

Significantly smaller than 250 nanometres, [protein](#) complexes cannot be depicted in detail using light-microscopy techniques. In order to find a way in, the RUB workgroup combined stimulated emission depletion microscopy (STED) with scanning ion conductance microscopy (SICM).

"STED microscopy enables us to analyse the distribution of proteins in [high resolution](#). SICM facilitates high-resolution probing of the [cell membrane](#). Accordingly, we have been able to link the distribution of the cellular protein actin with the nanostructure of the cell [membrane](#)," explains Philipp Hagemann, Ph.D. researcher in the workgroup. "Our results constitute a first step towards high-res analysis of the surface structure, i.e. the biochemical organisation of the cell and its surrounding membrane," elaborates Dr. Patrick Happel, head of the nanoscopy workgroup.

## **Understanding the role of the cell membrane**

The cell membrane is a fatty layer that encloses each cell, thus separating it from its surroundings. In order to communicate with their environment, [cells](#) have a number of different proteins that are embedded in the cell membrane and convey external stimuli into the interior of the cell. "The way proteins are organised in the cell

membrane, the way their position changes, and the way those changes are orchestrated has not yet been fully understood," says Happel. The proteins in the cell membrane as well as the cell membrane itself are significant factors in this process, as cells alter their position during wound healing, during development, and also while cancer metastases are formed. Researchers refer to this process as migration.

Even though cell migration differs between different cell types, one common aspect is an expansion of the cell membrane into the direction of movement. Within the organism, migrating cells have to move through extremely narrow gaps between other cells. This is only possible if the cell is considerably deformed, and if adhesion complexes are formed at the front edge of the cell and are detached at the trailing edge. The interplay of these biochemical and biophysical processes has as yet been barely understood on the molecular level, as no method exists capable of monitoring this dynamic process in high resolution over an extended period of time.

## **Two-part device planned**

"We have recorded the data successively with different devices. Thus, we were able to demonstrate that our method makes novel analyses possible," explains Astrid Gesper, Ph.D. researcher in the workgroup.

In order to facilitate analysis in living cells, the team is planning to develop a combined instrument in the next step. "The combination of both methods will render the transport processes visible in detail – which also plays a crucial role for targeted application of drugs via nanoparticles," concludes Patrick Happel.

**More information:** Philipp Hagemann et al. Correlative Stimulated Emission Depletion and Scanning Ion Conductance Microscopy, *ACS Nano* (2018). [DOI: 10.1021/acsnano.8b01731](https://doi.org/10.1021/acsnano.8b01731)

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