The motor protein dancing in all our cells

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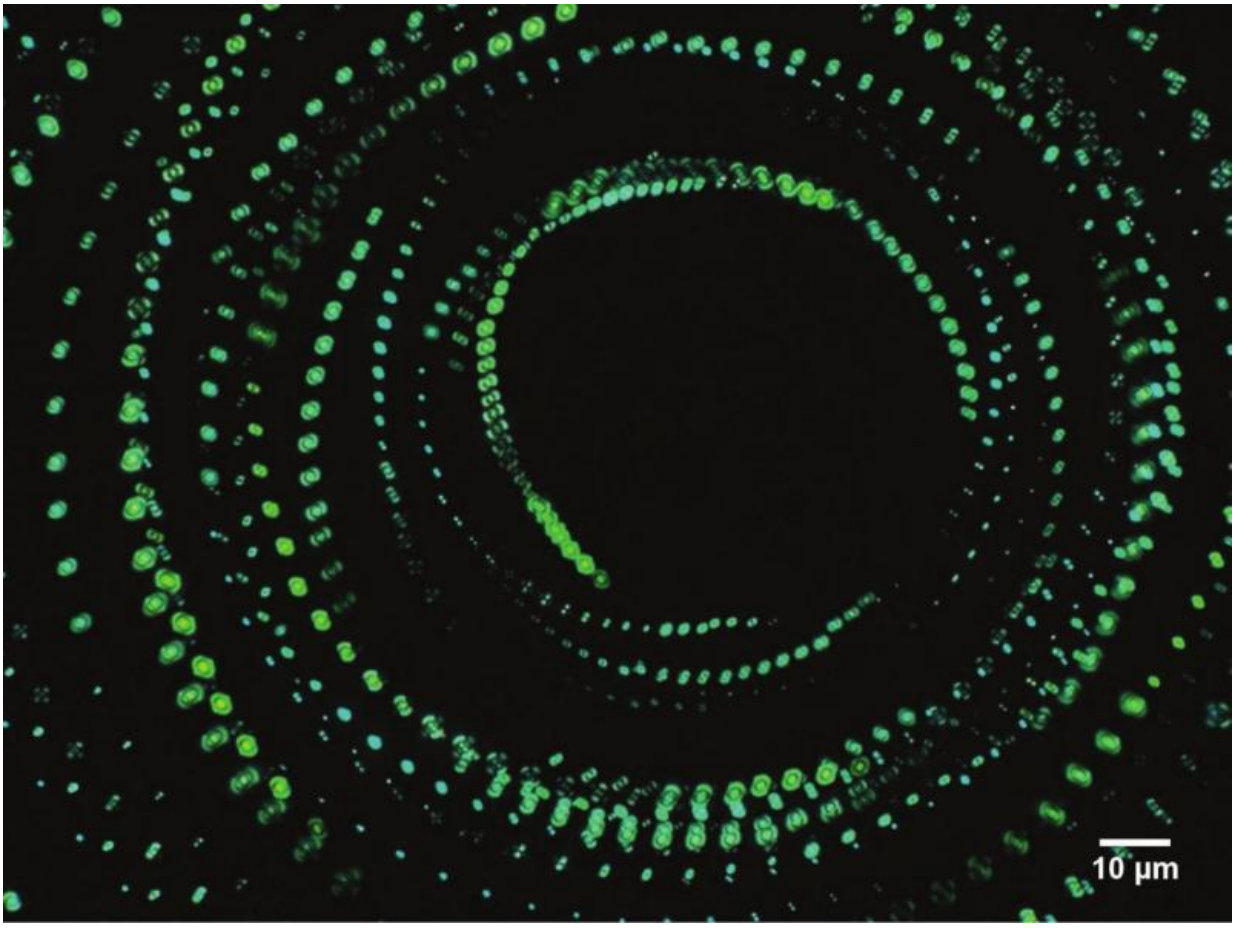

The researchers caused the motor proteins to transport liquid crystalline spheres with a diameter of one micrometer; these served as rotation detectors because they change depending on their angle of rotation. Here: superimposed numerous images of the spheres, taken by polarization microscopy. Credit: Avin Ramaiya

Motor proteins drive many of the essential processes in our cells. They move with a dancing motion, as Professor Erik Schäffer and his team have shown in a new study. In order to observe the tiny proteins, which are measured in nanometers, Schäffer uses optical tweezers he developed himself. The results of the study have been published in the latest edition of *PNAS*.

Motor proteins like kinesin are the driving force behind key processes in the cell. For example, when cells divide, kinesins mechanically pull the chromosomes apart; they transport "packages" from one part of the cell to another along tiny 13-lane "freeways"—the cell's microtubules. With a length of about 60 nanometers, these microproteins are invisible to the eye—yet they have tremendous effects. If internal cell transport within cells ceases to work, for instance, Alzheimer's disease may result. It is therefore of basic importance in biology to understand just how the "motors" move along the microtubules. Information about their function may be helpful in the development of treatments for neurodegenerative diseases or unwanted cell division in cases of cancer.

Schäffer is a biophysicist and has developed a new microscope—a pair of optical tweezers with a rotary sensor that can measure both the forward movement and the rotation of the motors. Current knowledge indicates that kinesin has two "feet," which move in steps of eight nanometers one after another, to move it forward—a little like the human walk. However, the latest measurements show that kinesin not only steps forward; it also turns—rather like a person waltzing. Each step takes it half a turn. Both the motor and the "packages" it carries keep turning in the same direction.

The researchers aim to find out what effect this kind of movement has on this transportation and on cell division.

More information: Avin Ramaiya el al., "Kinesin rotates

unidirectionally and generates torque while walking on microtubules," *PNAS* (2017). www.pnas.org/cgi/doi/10.1073/pnas.1706985114

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