Revealing Nanoscale Morphology of the Primary Cilium using Super-Resolution Fluorescence Microscopy

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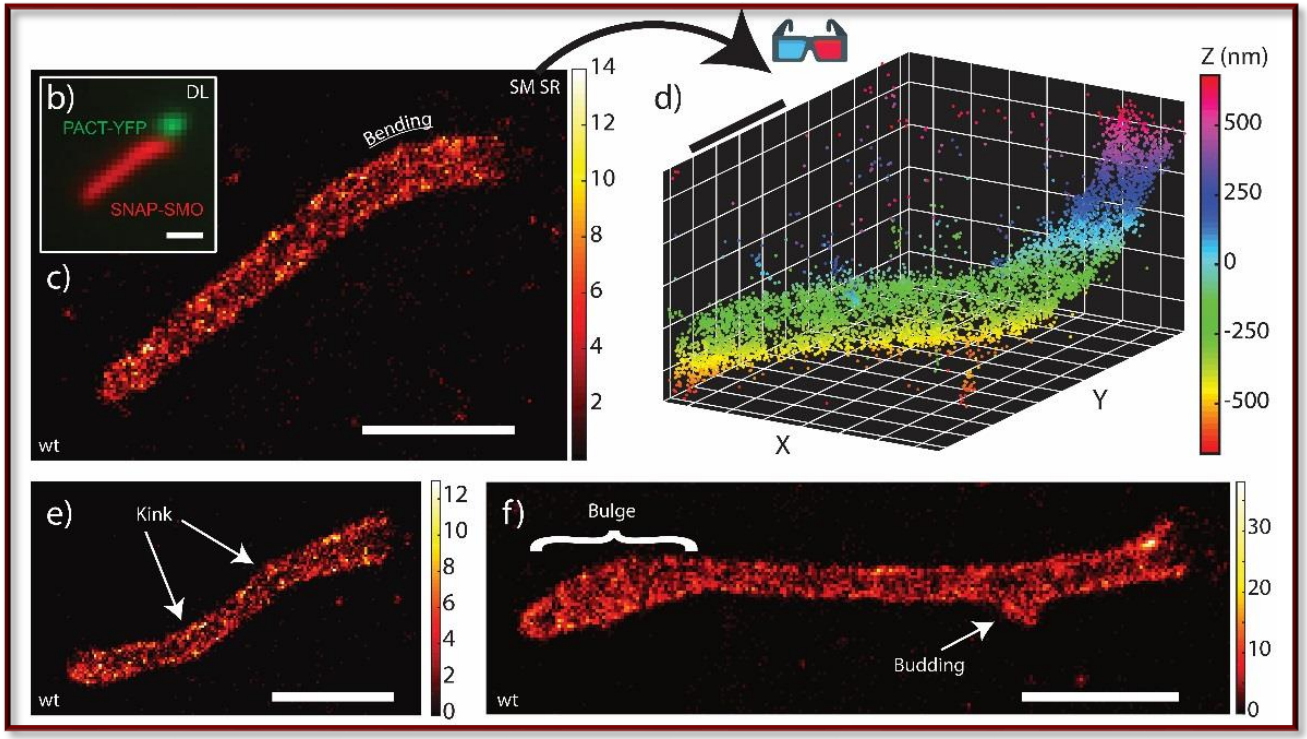
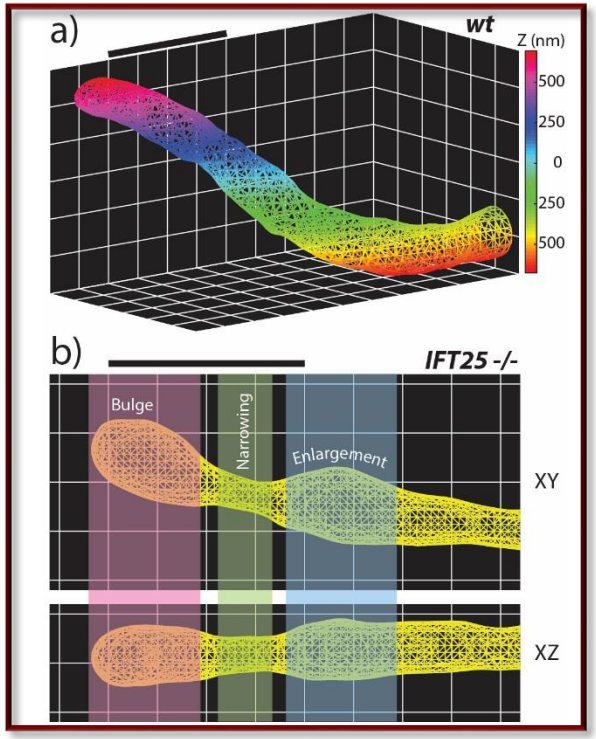
Using a combination of 3D super-resolution fluorescence microscopy and quantitative image analysis methods, we now have a framework for answering questions related to the **shape** of the primary cilium surface at the nanoscale level



Smoothened (SMO) is an important transmembrane protein involved in Hedgehog signaling and localizes specifically to the primary cilium when the pathway is activated. 3D single-molecule (SM) imaging of SMO is performed using the double-helix point spread function (DH-PSF). Even within the same cell line of mammalian cells, primary cilia appear very different and exhibit a wide range of topological features along its surface.



Surface fitting is performed on our localization "point cloud," which produces a triangulated mesh of the ciliary surface. When a component responsible for retrograde transport is impaired, bulging is a prominent feature found at the tip of the primary cilium.

Yoon, J., Comerci, C. J., Weiss, L. E., Milenkovic, L., Stearns, T., & Moerner, W. E., *Biophys. J.,* 2019, **116** doi: 10.1016/j.bpj.2018.11.3136