TELEDYNE PHOTOMETRICS
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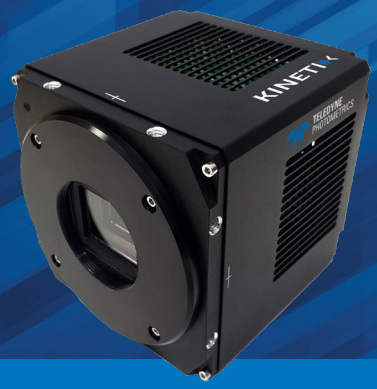

CUSTOMER REFERENCE

Kinetix Scientific CMOS Camera

iSIM Live Cell Imaging

Dr. Daniel Dickinson

Department of Molecular Biosciences, University of Texas at Austin

BACKGROUND

The Dickinson lab aims to understand the generation of polarity in cells, namely when two ends of a living cell become molecularly distinct from each other. Polarity is vital for proper function of cells, and can become disrupted in diseases such as cancer.

Dr. Dickinson and team employ a multi-disciplinary approach including fluorescence microscopy of live samples and quantitative image analysis. Working mainly with the embryos of the genetically manipulable model system, the nematode worm Caenorhabditis. elegans, the Dickinson Lab uses imaging and single molecule interrogation techniques, to determine the biochemical interactions that lead to determination of the direction of the polarity axis and the timing of polarity establishment.

Tracking single molecules expressed at native levels in the C. elegans embryo allows them to measure diffusion constants, and using single molecule pull down techniques, establish protein-protein interactions during the biogenesis of cell polarity.

> “The Kinetix has a uniform background, high sensitivity and low read noise, allowing us to collect enough photons to make precise measurements.”

CHALLENGE

Tracking single molecules in time and space in living embryos requires high spatial and temporal resolution from a detector. The embryo is sensitive to total illumination power, and the proteins of interest move in all dimensions of position (X, Y, Z) and time. Capturing the position and temporal information allows the lab to draw conclusions about molecular interactions contributing to the formation of cell polarity.

As Dr Dickinson pointed out, “Low read noise is really critical”. The total amount of light collected is so low in any one frame. Without low read noise, high quantum efficiency and a uniform camera background, they often couldn’t collect enough photons for precise measurements.

TELEDYNE IMAGING
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SOLUTION

The Kinetix sCMOS provides a unique solution, with both high speed or very low read noise options. Fast particle tracking in Speed mode provides robust data for calculation of molecular diffusion constants, while Sub-Electron mode allows for precise molecular localization with limited signal thanks to the ultra-low read noise of less than 0.7 e^-.

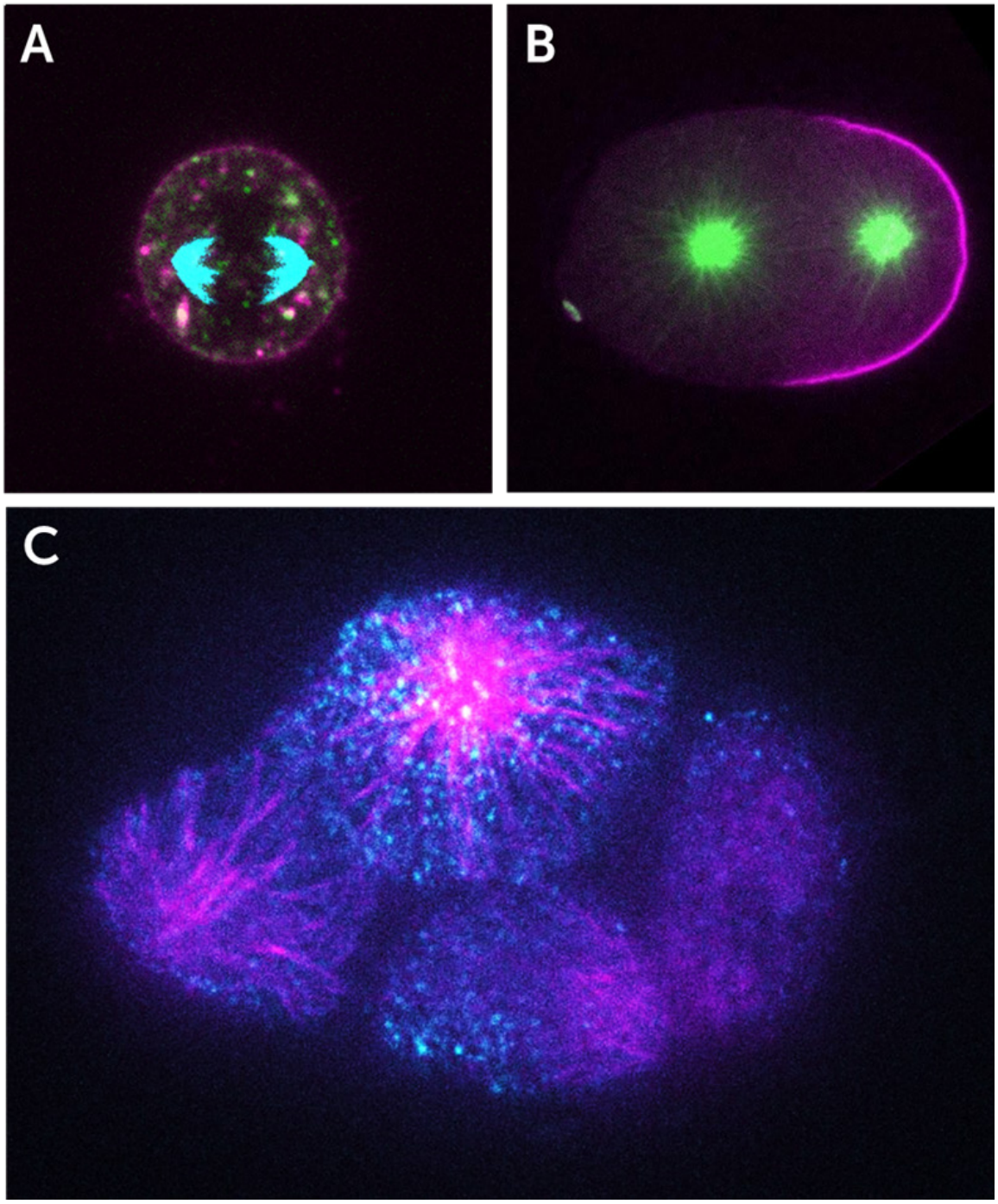

Figure 1: Images of dividing cells taken with the Kinetix on a Nikon Ti2 with a Visitech iSIM super-resolution confocal head. A) A C. elegans zygote, microtubules (green) and cell polarity marker PAR-2 (magneta).

B) A dividing mouse embryonic cell embedded in 3D Matrigel, microtubules (cyan), cell tracking dye (magenta) and apical polarity marker Podacalyxin (green). C) An 8-cell C. elegans embryo, microtubule TPXL-1 protein (magenta) and cell polarity determinant PAR-3 (cyan).