



PHOTOMETRICS®  
HIGH PERFORMANCE EMCCD & CCD  
CAMERAS FOR LIFE SCIENCES



Evolve™ 512 Delta EMCCD Camera

CUSTOMER REFERENCE

## Electrophysiology and Calcium Imaging

Nick Spencer, PhD, Associate Professor

Flinders University, Department of Human Physiology, School of Medicine

The Department of Human Physiology was established in 1974 as the first department in the School of Medicine at Flinders University. The department has a research focus in neuroscience in three major areas; sensory and autonomic neurobiology, roles of neurotrophic factors and neurodegenerative diseases. The team is interested in how pain is detected from internal organs, such as the gastrointestinal tract.

Traditionally, all recordings from nerves that detect pain have been made outside the organ of interest, as these nerves project toward the spinal cord. However, these recording sites are not where sensory transduction takes place. The team wanted to identify and record directly from the nerve endings that detect pain from internal organs, from the site where sensory transduction occurs. This is a challenging task and one that has not been performed previously.

The team has succeeded in using calcium imaging to record dynamic changes in excitability from multiple sites along single axons that underline pain perception. However, they encountered many technical challenges.

One of the greatest was recording from nerve endings with electrophysiology. They found that using this approach, they could not record from multiple sites simultaneously. Another major obstacle was making sure that the nerve endings that they recorded from were in fact spinal afferent neurons that underlie pain perception.

“We would summarize our experience with **Photometrics’** personnel and the **quality of their EMCCD cameras as outstanding.**”

The team performed tests with other competitive cameras and did not find them superior in any characteristic. What they did find was that the products and people at Photometrics exceeded their expectations. Dr. Spencer adds, “We would summarize our experience with **Photometrics personnel and the quality of their EMCCD cameras as outstanding.**” Having purchased several cameras, including Cascade EMCCDs, over the past decade, and now using the advanced capabilities of Evolve 512 Delta, the team describes the camera in one word—“phenomenal.”

BACKGROUND

CHALLENGE

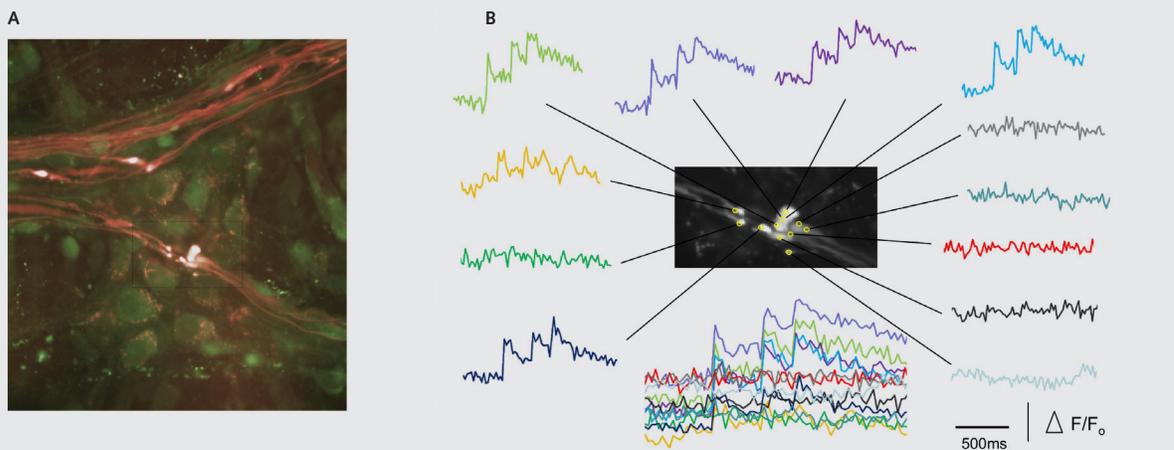
# CUSTOMER REFERENCE

## SOLUTION

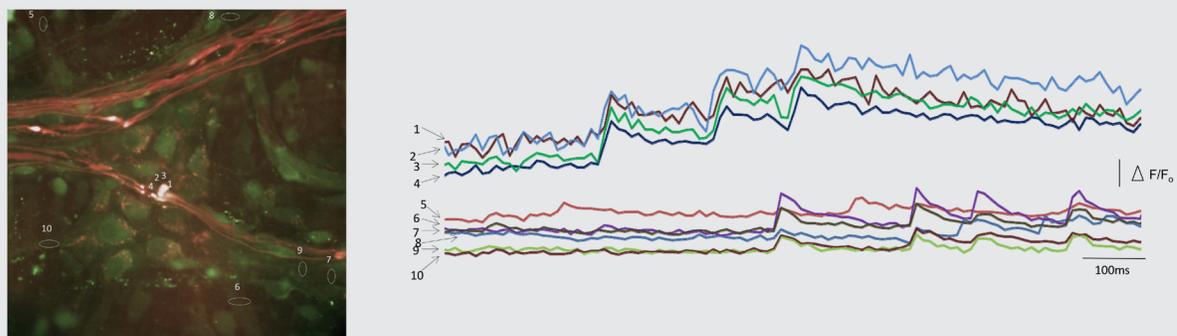
The team's challenges were overcome with the Evolve 512 Delta. Using the camera for calcium imaging enabled them to record from multiple sites simultaneously along single axons of interest. They were also able to ensure that nerve endings were recorded accurately by stimulating dorsal nerve roots and demonstrating that those calcium transients were evoked in the same nerve endings that were activated by stretch or acid. This work has recently been published.

Of significance, due to the sensitivity of the Photometrics range of EMCCD cameras, the team has been able to perform the first and only recordings from nerve endings that detect pain from internal organs.

They are now answering many new and exciting questions using this technique. "We have been stunned by the incredible sensitivity of the EMCCD cameras produced by Photometrics," states Dr. Spencer. Also, the high frame rate acquisition of the new Evolve Delta camera at full resolution is just what was needed to record dynamic physiological activation of fine nerve endings.



**Figure 1:** Panel A, shows a superimposed image of calcium fluorescence (green) and CGRP fluorescence (red) in live mouse colon enteric ganglia. The axons and nerve endings in red indicate neural tissue that expresses the CGRP neuropeptide. Calcium imaging is performed on these immunoreactive nerve endings. B, shows a recording using the new Evolve Delta EMCCD camera. Each yellow circle represents the mean dynamic calcium fluorescence from discrete CGRP positive nerve endings.



**Figure 2:** Upper panel image shows CGRP expressing nerve endings (red) and calcium fluorescence (green). The numbers 1-4 represent regions of interest in CGRP expressing nerve endings and the numbers 5-10 represent the regions of interest of dynamic calcium fluorescence in non-CGRP expressing nerve axons. During peristalsis, enteric ganglia (regions 5-10) show synchronised activation that is independent of the synchronised activation of CGRP expressing spinal afferent nerve endings. These nerve endings in red are the likely nerve endings that encode nociception from the gastrointestinal tract.



[www.photometrics.com](http://www.photometrics.com)

[info@photometrics.com](mailto:info@photometrics.com)

tel: +1 520.889.9933