

Macroscopic target search and high-resolution 3D imaging of gastric afferent nerve endings showing various shapes using a confocal microscope and Denoise.ai

Afferent nerve endings in the gastric wall have various morphologies to detect the mechanical stimuli of the gastric wall associated with peristalsis. Dr. Tomoyuki Saino, Dr. Takuya Yokoyama, and Dr. Masato Hirakawa at the Department of Anatomy (Cell Biology), Iwate Medical University have reported that web-like vagal afferent nerve endings express P2X3 purinoceptors and are distributed in the subserosal tissue in the lesser curvature of the gastric antrum. Web-like nerve endings are distributed lateral to the gastric sling muscles in the antral lesser curvature. Morphologically, web-like nerve endings may be a subtype of vagal mechanoreceptors that detect mechanical deformation of the antral wall associated with peristalsis. They have also reported that web-like nerve endings form basket-like terminal structures wrapping around the subserosal ganglia. It has been suggested that basket-like nerve endings may be specialized ending structures that increase the sensitivity of the web-like nerve endings to antral peristalsis. In this application note, we introduce examples of afferent nerve endings in the stomach exhibiting various shapes, captured using an AX R confocal microscope and a silicone immersion objective.

Keywords: confocal microscopy, stomach, P2X3 purinoceptor, nerve endings, immunohistochemistry

Overview

Staining: Blue; DAPI (nuclear marker)

Green; P2X3

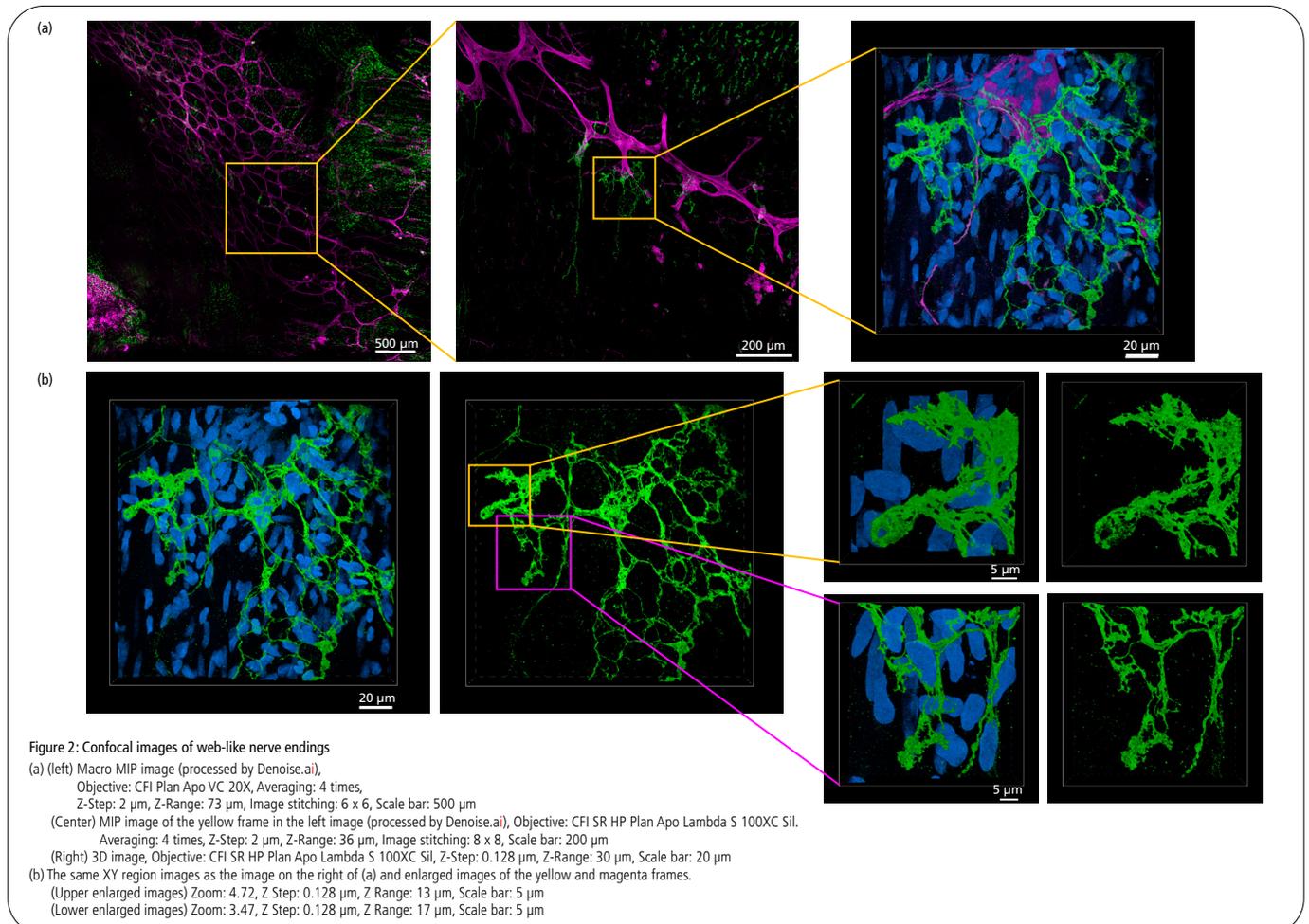
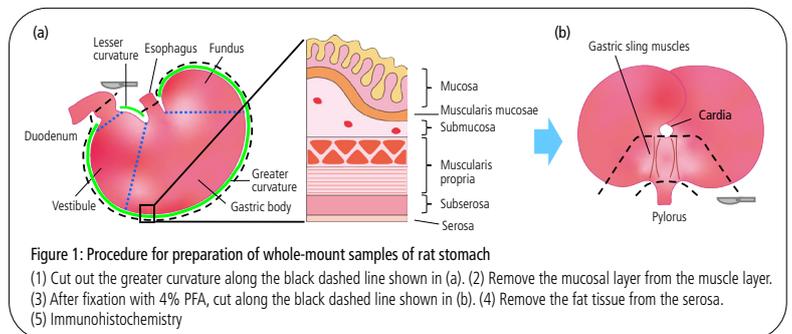
Magenta; Neurofilament 200 (neuronal marker)

System: AX R

Scanner: Resonant (left and center of Figure 2 (a)), Galvano

Averaging time: Resonant;4, Galvano;1

Resolution: 1024×1024 pixels



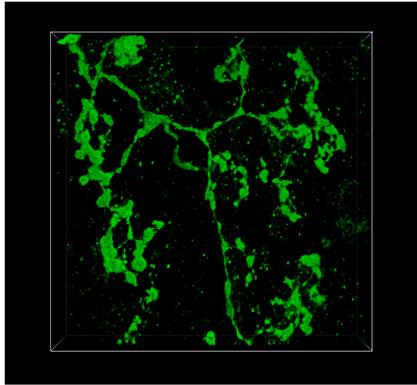
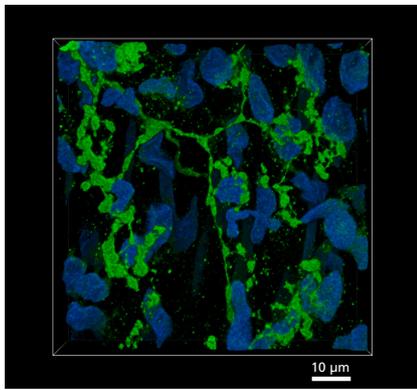


Figure 3: Confocal images of web-like nerve endings
 Objective: CFI SR HP Plan Apo Lambda S 100XC Sil,
 Zoom: 2.4, Z Step: 0.128 µm, Z Range: 30 µm, Scale bar: 10 µm
 A leaf-like shape with rounded tips is observed, unlike Figure 2.

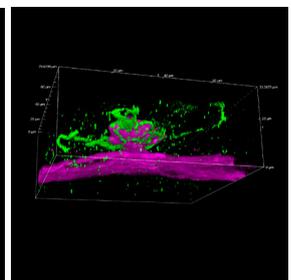
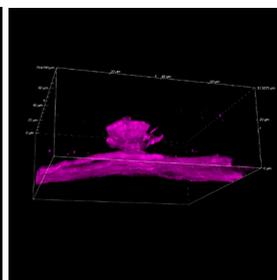
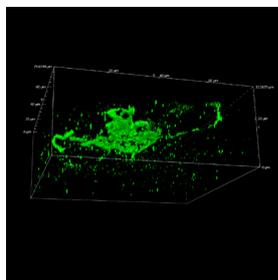
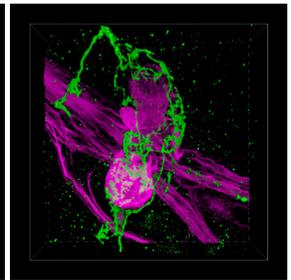
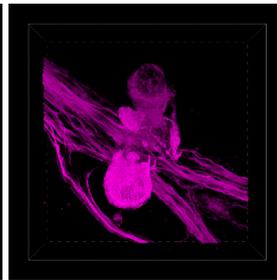
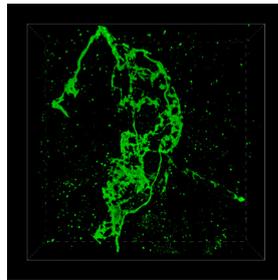
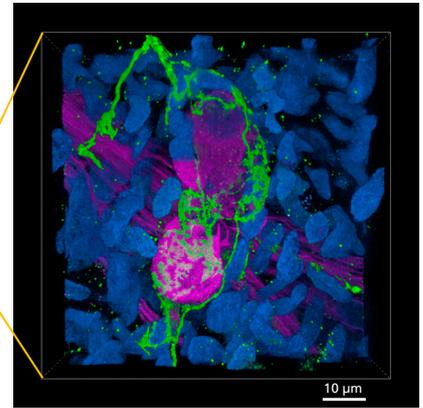
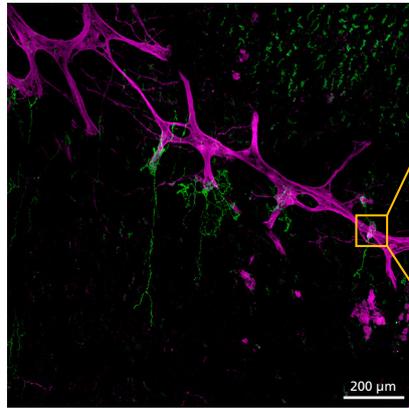


Figure 4: Confocal images of basket-like nerve endings
 Objective: CFI SR HP Plan Apo Lambda S 100XC Sil, Zoom: 2.2, Z Step: 0.17 µm, Z Range: 33.6 µm

Summary

The AX R confocal microscope enables high-speed Z stack imaging and image stitching even when imaging thick specimens such as whole-mount preparations (Figure 2 (a)). The details of various shaped nerve endings were captured by first identifying the approximate location of afferent nerve endings in the stomach from macro images taken in resonant mode with Denoise.ai, and then imaging in Galvano mode with a high-magnification objective (Figures 2, 3, and 4). 3D reconstruction views from different angles also allowed basket-like subserosal nerve endings surrounding neurons labeled with Neurofilament 200 (Fig 4) to be captured.

Acknowledgments

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References

Morphology of P2X3-immunoreactive basket-like afferent nerve endings surrounding serosal ganglia and close relationship with vesicular nucleotide transporter-immunoreactive nerve fibers in the gastric antrum

Masato Hirakawa, Takuya Yokoyama, Yoshio Yamamoto, Tomoyuki Saino
<https://doi.org/10.1002/cne.25219>

Distribution and morphology of P2X3-immunoreactive subserosal afferent nerve endings in the rat gastric antrum

Masato Hirakawa, Takuya Yokoyama, Yoshio Yamamoto, Tomoyuki Saino
<https://doi.org/10.1002/cne.25069>

Product information

CFI SR HP Plan Apochromat Lambda S 100x Sil

With minimal asymmetric aberrations and improved axial chromatic aberration correction, this objective is ideal for high power laser applications.

- NA: 1.35
- WD: 0.31-0.28
- Cover glass thickness: 0.15-0.19



AX R Confocal Microscope

Supports high-speed, high-resolution, large field-of-view confocal imaging, with reduced phototoxicity to living cells and photobleaching.

- High speed: Up to 720 fps (resonant at 2048 x 16 pixels)
- High resolution: Up to 8K (galvano)/2K (resonant)
- High throughput: Ultra-wide FOV of 25 mm

