

# Deciphering Stomach Myoelectrical Slow Wave Conduction Patterns via Confocal Imaging of Gastric Pacemaker Cells and Fractal Geometry

Sue Ann Mah, Recep Avci, Peng Du, Jean-Marie Vanderwinden, Leo K Cheng

PMID: 36085915 DOI: 10.1109/EMBC48229.2022.9870891

## Abstract

Interstitial Cells of Cajal (ICC) are specialized gastrointestinal (GI) pacemaker cells that generate and actively propagate slow waves of depolarization (SWs) of the muscularis propria. SWs regulate the motility of the GI tract necessary for digestion, absorption of nutrients, and elimination of waste. Within the gastric wall, there are three main inter-connected layers of ICC networks: longitudinal muscle ICC (ICC-LM), myenteric plexus ICC (ICC-MP) & circumferential muscle (ICC-CM). Fractal structural parameters such as Fractal Dimension (FD), Lacunarity and Succolarity, have many advantages over physically-based parameters when it comes to characterizing the complex architectures of ICC networks. The analysis of networks of ICC throughout the proximal and distal murine gastric antrum with the FD and Lacunarity metrics was previously performed. Although the application of Succolarity is relatively nascent compared to the FD and Lacunarity; nevertheless, numerous studies have demonstrated the capability of this fractal measure to extract information from images associated with flow by which neither the FD nor Lacunarity are capable of discerning. In this study, Succolarity analysis of ICC-MP and ICC-CM networks were performed with confocal images taken across the proximal and distal murine antrum. Our findings demonstrated the Succolarity of ICC-MP and ICC-CM varied with directions and antral regions. The Succolarity of ICC-MP did not vary considerably with direction, however, Succolarity was higher in the aboral direction with  $0.2113 \pm 0.1589$ , and  $0.0637 \pm 0.0822$  in the proximal and distal antrum, respectively. The overall Succolarity of ICC-MP was significantly higher than that of ICC-CM in the proximal antrum ( $0.1580 \pm 0.1325$  vs [Formula: see text]) and in the distal antrum ( $0.0449 \pm 0.0409$  vs [Formula: see text]). Clinical Relevance-Modeling SWs conduction patterns via image analysis of detailed ICC networks help to facilitate an improved understanding of the mechanisms underpinning GI myoelectric activity and the diseases associated with its dysfunction.