

# Localization of cannabinoid receptors CB1, CB2, GPR55, and PPAR $\alpha$ in the canine gastrointestinal tract

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## Abstract

The endocannabinoid system (ECS) is composed of cannabinoid receptors, their endogenous ligands, and the enzymes involved in endocannabinoid turnover. Modulating the activity of the ECS may influence a variety of physiological and pathophysiological processes. A growing body of evidence indicates that activation of cannabinoid receptors by endogenous, plant-derived, or synthetic cannabinoids may exert beneficial effects on gastrointestinal inflammation and visceral pain. The present *ex vivo* study aimed to investigate immunohistochemically the distribution of cannabinoid receptors CB1, CB2, G protein-coupled receptor 55 (GPR55), and peroxisome proliferation activation receptor alpha (PPAR $\alpha$ ) in the canine gastrointestinal tract. CB1 receptor immunoreactivity was observed in the lamina propria and epithelial cells. CB2 receptor immunoreactivity was expressed by lamina propria mast cells and immunocytes, blood vessels, and smooth muscle cells. Faint CB2 receptor immunoreactivity was also observed in neurons and glial cells of the submucosal plexus.

GPR55 receptor immunoreactivity was expressed by lamina propria macrophages and smooth muscle cells. PPAR $\alpha$  receptor immunoreactivity was expressed by blood vessels, smooth muscle cells, and glial cells of the myenteric plexus. Cannabinoid receptors showed a wide distribution in the gastrointestinal tract of the dog. Since cannabinoid receptors have a protective role in inflammatory bowel disease, the present research provides an anatomical basis supporting the therapeutic use of cannabinoid receptor agonists in relieving motility disorders and visceral hypersensitivity in canine acute or chronic enteropathies.

## Keywords

Enteric nervous system Immunohistochemistry Inflammatory bowel disease  
Mast cells Palmitoylethanolamide

Marco Pietra and Roberto Chiocchetti shared the senior authorship of this study.

## Electronic supplementary material

The online version of this article (<https://doi.org/10.1007/s00418-018-1684-7> (<https://doi.org/10.1007/s00418-018-1684-7>)) contains supplementary material, which is available to authorized users.

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## Notes

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## Compliance with ethical standards

## Conflict of interest

The authors declare that they have no conflicts of interest.

## Ethical Approval

All applicable international, national and/or institutional guidelines for the care and use of animals were followed.

## Supplementary material

[418\\_2018\\_1684\\_MOESM1\\_ESM.pdf](#) (334 kb)

Supplementary material 1 (PDF 333 KB)

[418\\_2018\\_1684\\_MOESM2\\_ESM.pdf](#) (131 kb)

Supplementary material 2 (PDF 130 KB)

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Supplementary material 3 (PDF 141 KB)

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