2. Summary

The nervous system, which plays an important role in all vital processes, is one of the most structurally and functionally complex systems in all mammals. Neurons are one of the elements of the central (CNS) and peripheral (PNS) nervous system. They contain diverse biologically active substances, which mainly act as neurotransmitters or neuromodulators. One of the best known and frequently studied neurotransmitters is extracellular adenosine triphosphate (ATP). The wide spectrum of biological activity of ATP is conditioned by activation of its specific purinergic receptors, including P2X2 receptors. P2X2 receptors have mainly been shown in the CNS and PNS of laboratory animals, but also in some domestic animals or primates. However, there is a lack of research on the presence of P2X2 receptors in the nervous system of the domestic pig, which is increasingly used in neuroanatomical research. Furthermore, the global scientific literature contains little data on the co-localization of P2X2 receptors with various biologically active substances, and thus knowledge of their functions is quite poor. Therefore, the aim of this dissertation was to investigate (using double immunofluorescence staining) the expression of P2X2 receptors in entorhinal cortex (EC) neurons; cervical (C_1-C_8), thoracic (Th_1-Th_{15}), lumbar (L_1 -L_6), and sacral (S_1-S_3) dorsal root ganglia (DRG) neurons; and neurons of enteric nervous system (ENS) ganglia located in the small intestine (duodenum, jejunum, and ileum) of the pig. In addition, the biochemical profile of P2X2-immunoreactive (IR) neurons was analysed by examining their coexistence with substance P (sP), somatostatin (SOM), and galanin in the DRG; with vasoactive intestinal polypeptide (VIP), sP, and galanin in the small intestine; and with neuropeptide Y (NPY), SOM and VIP in the EC, also using the double immunofluorescence staining technique.

The presence of P2X2-IR neurons was demonstrated in the DRG of all examined segments of the spinal cord: the fewest in the cervical segment (32.18 ± 1.60%) and the most in the lumbar segment (46.51 ± 1.48%). P2X2-IR/sP-IR, P2X2-IR/SOM-IR, and P2X2-IR/galanin-IR neurons were present in varying proportions in the C_1 to S_3 DRG. P2X2-IR/sP-IR neurons were the largest population.

P2X2-IR neurons were present in the myenteric plexus (MP), outer submucosal plexus (OSP), and inner submucosal plexus (ISP) of all sections of the small intestine (duodenum, jejunum, and ileum). From 44.78 ± 2.24% (duodenum) to 63.74 ± 2.67% (ileum) of MP neurons were P2X2-IR. The corresponding ranges in the OSP were from 44.84 ± 1.43% (in the duodenum) to 53.53 ± 1.21% (in the jejunum), and in the ISP, from 53.10 ± 0.97% (duodenum) to 60.57 ± 2.24% (ileum). Immunofluorescence staining showed the presence of P2X2-IR/galanin-IR and P2X2-IR/VIP-IR neurons in the MP, OSP, and ISP of the sections of the small intestine. The presence of sP was not detected in the P2X2-IR neurons of any ganglia tested in the ENS.

Immunofluorescence staining revealed the presence of P2X2-IR neurons in all examined layers (LII, LIII, and LV) of both the lateral (LEC) and medial (MEC) entorhinal cortex. In general, the most P2X2-IR neurons were found in layer LII of the LEC and MEC (79.29 ± 6.36%; 77.07 ± 5.76%, respectively), while the fewest were present in the LV of the LEC and MEC (50.33 ± 4.85%; 49.84 ± 3.69% respectively). P2X2-IR/NPY-IR, P2X2-IR/SOM-IR, and P2X2-IR/VIP-IR neurons were present in all layers tested in both the LEC and MEC, but in different proportions.

The paper discusses the probable function(s) of P2X2-IR neurons, including those coexisting with the tested biologically active substances, in the nervous system structures of the domestic pig.