Galanin is a modulator of eccrine sweat gland physiology

Douglas L. Bovell[1], Bernhard Brodowicz[2], Olatayo Odusanwo[1], Barbara Holub[2,3], Andreas Lang[1], Isabella Rauch[2], Barbara Kofler[2], Roland Lang[3]. *[1]Department of Biological and Biomedical Science, Glasgow Caledonian University, Glasgow, UK, [2]Laura Bassi Centre of Expertise THERAPEP, Research Program for Receptor Biochemistry and Tumor Metabolism, Department of Pediatrics, Paracelsus Medical University, Salzburg, Austria, [3]Department of Dermatology, Paracelsus Medical University, Salzburg, Austria*

Galanin is widely expressed in the central and peripheral nervous systems and has been ascribed different roles in modulating physiological functions. Since galanin peptide and galanin binding sites are also present in human sweat glands, the aim of the present study was to examine the function of galanin in eccrine sweat gland physiology.

We demonstrated secretion of galanin by sweat glands in vivo by radioimmunoassay of the sweat derived from volunteers exercising on a bicycle ergometer; galanin concentrations ranged from 20 to 199 fmol/ml (n=17). RT-PCR analysis revealed that cells of the human sweat gland cell line NCL-SG3 express mRNA of galanin and galanin receptors (GalR2 and GalR3 but not GalR1). Activation of NCL-SG3 cells by galanin inhibited forskolin-induced cAMP accumulation in a dose-dependent manner. Furthermore, short-circuit current (Isc) measurements made with an Ussing chamber showed that application of 5 µM galanin to the basolateral side of NCL-SG3 cells led to a significant increase in Isc . The galanin-evoked increase in Isc was not altered by the presence of the sodium channel blocker amiloride or by potassium channel blockers. However, the presence of chloride channel blockers in the bath solution inhibited the response to galanin as did incubation in chloride-free Krebs solution. Additionally, application of SNAP 37889, a nonpeptidergic selective antagonist of GalR3, abolished the effect of galanin on Isc. Western blot analysis with a GalR3-specific antibody confirmed the presence of GalR3 in NCL-SG3 cells. IHC staining of human skin also demonstrated the presence of GalR3 in eccrine sweat glands, which appeared to be localised to the secretory coil region of the gland.

In summary, our results show that galanin can regulate transepithelial chloride ion transport and fluid secretion from the eccrine secretory coil by stimulating GalR3 in NCL-SG3 cells and demonstrate a possible important extraneural function of galanin in sweat gland physiology.

Funded by the Paracelsus Medical University Salzburg (PMU-FFF E-10/11/059-LAN) and the Austrian Research Promotion Agency (FFG, 822782/THERAPEP)