The beginning of this story goes back to an outstanding Polish neuroanatomist, J. S. Alexandrowicz, who contributed to the initial discovery and description of the cardiac ganglion in the heart of different decapods, the description of the pericardial organs, and explanation of their function. In 1909, he published a paper (this might have been his first scientific publication) titled “Zur Kenntnis des sympathischen Nervensystems der Crustaceen”. The paper was based on an investigation which he conducted under the guidance of Professor A. Lang. The work was conducted in Zürich, Switzerland and at the zoological station in Villefranche-sur-Mer, France. He investigated several crustacean species but his main focus was on the crayfish and spiny lobster.

The title of this paper may mislead a current reader: now the term ‘sympathic, or sympathetic, nervous system’ means a subdivision inside the autonomous nervous system. At that time, the same term meant a system that controls the vegetative organs including the hindgut. Thus, the aim of the investigation was, in the author’s words, “die feineren histologischen Verhältnisse in der Innervation des Hinterdarmes zu prüfen” [Translation: ... to determine the fine histological interrelations in the innervation of the hindgut.]

He demonstrated by histological techniques that there is a nerve plexus on the outer surface of the hindgut (“Grundplexus”) formed by the nerve fibers leaving the terminal abdominal ganglion. The nerve fibers from this plexus reach single muscle bundles where they are seen as “Endplexuses”. In addition, he revealed many (3-4 thousands) bipolar nerve cells that are distributed uniformly over the
length of the hindgut. One process of such a cell goes to the hindgut’s lumen and ends there between the epithelial cells, whereas the other is directed to its outer wall, “indem er sich unterwegs mit den gleichen Fortsätzen der anderen Zellen verbindet” [so that on its way it establishes contacts with similar processes of [the] other [nerve] cells]. Alexandrowicz (1909) noted that he failed to trace the way of these outside-directed processes in Astacus, therefore his conclusions were made from investigations of the spiny lobster, Palinurus. The processes form a net on the surface of the hindgut, “in dem die Fasern in zahlreichen Anastomosen nach allen Richtungen hin verlaufen ... Das ganze Geflecht tritt zu dem Grundplexus, der vom Nervus intes. Posterior gebildet wird, in engere Beziehungen, indem die Wege des letzteren durch die Fasern der ersteren benutzt werden und höchstwahrscheinlich ziehen die Nerven beider nebeneinander zu den Muskeln” [the fibers [of the net] run in all directions building numerous anastomoses with each other. ... The whole network has close connections with the “Grundplexus”, which consists of the fibers belonging to the nervus intestinalis posterior, so that the ways of the latter are used by the fibers of the former; most likely, the fibers of both [origins] go to the muscles together].

The second part of the same paper contains results of the physiological experiments on the isolated hindgut of the crayfish. Alexandrowicz (1909) appears to have been the first one who conducted such experiments. It was shown that the hindgut, isolated from the abdominal nerve cord and placed into Ringer’s solution, contracted spontaneously for a long time (up to 36 hours!). The contractions existed not only in the whole hindgut but also in its fragments. A problem was, however, in the direction of these contractions: they were directed forwards (antiperistaltic movements). The author tried to explain this fact but his explanation does not seem convincing.

The results of the physiological experiments were very important for Alexandrowicz because they confirmed his anatomical data. Taken altogether, they allowed him to conclude:


2. Das autonome Nervensystem ... besteht aus bipolaren Zellen, die den einen (rezeptorischen) Fortsatz zum Lumen des Darmes schicken, der zweite dagegen, effektorischer Natur, tritt mit den Fortsätzen anderer Zellen in ein Geflecht ein, von dem die Fasern zu den Muskeln ziehen ...

3. Der vom letzten Abdominalganglion kommende Nerv mit seinen zahlreichen Verästelungen in der Muskulatur, wo er sich mit den motorischen Fasern vereinigt, hat die Regulierung der automatischen Bewegung zu besorgen.”

[(1) The nervous system of the crayfish hindgut consists of autonomous nervous devices, which are connected with the central nervous system. (2) The autonomous