The Influence of Endotoxic (LPS) on Primary Sensory Neurons in Crustaceans: Impact on Human Proprioception

Kelsi Vela [1] • Alexandra E. Stanback [1] • Maddie Stanback [1] • Ross Basham [1] • Bernardo Aguzzoli Heberle [1] • Aaron Silverstein [1] • Allison Lane [1] • Bennett Collis [1] • Bharath Chithrala [1] • Catherine Stanley [1] • Emma Higgins [1] • Matthew Ponder [1] • Prachi Raichur [1] • Saadia Akhtar [1] • Saisindhu Marella [1] • Robin L. Cooper, PhD [1]

[1]Neurophysiology, University of Kentucky

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Neurophysiology

Gram negative bacteria such as Serratia marcescens (S.m.) and Pseudomonas aeruginosa (P.a), which are fairly ubiquitous, not only infect humans and other land animals but also freshwater and seawater organisms. The actions of the immune system in crustaceans has been investigated over the years and, similar to mammals, the endotoxin lipopolysaccharide (LPS), which is released from gram negative bacterial strains, induces an immune response. It is unknown if LPS itself has direct actions on sensory neurons in crustaceans or in mammals. An early study reported LPS resulted in a Ca2+ leak in motor neurons. Thus, it is reasonable to postulate that sensory neurons may also be directly affected, causing altered responsiveness to stimuli and transmittance of electrical activity. Since investigations of the direct action of LPS on sensory neurons in mammals and crustaceans is lacking, we set out to test this possibility in two model preparations used to study sensory neuronal function, which also have some functional correlation to mammalian proprioception. The propodite-dactylopodite (PD) chordotonal organ in the blue crab was used due to its accessibility in the leg and allowance for the most reproducible stimulus, as it monitors joint activity by the rate of movement and static position. The second preparation is the crayfish muscle receptor organ (MRO), which is analogous to the human muscle spindle, that is comprised of sensory endings rooted within muscle fibers. The endotoxin did not demonstrate clear, direct effects for the crab PD organ or the crayfish MRO. It was noted that, as the movement was performed on the MRO, the muscles seemed to tighten and contract on their own after the addition of LPS. The motor neurons innervating the crayfish abdominal muscle may have increased in evoked synaptic response from the endotoxin. Since the primary sensory neurons are embedded in muscle fibers, the effects may in part be contributed by the innervating motor neurons on the fibers.