Automated Quantitative Analysis of Nerve Fiber Conduction Velocity

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The baroreflex (BRX) is essential for reliable autonomic control of arterial blood pressure. Central to BRX function is a rapid, negative feedback control of heart rate. Arterial pressure sensors known as baroreceptors (BR) encode heart rate and blood pressure information into patterns of neural discharge that is conveyed to the central nervous system via a network of sensory afferent nerve fibers. These BR fibers are broadly classified as myelinated *A*-fibers with diameters in the range of 1-10 µm and unmyelinated *C*-fibers with diameters typically less than 1 µm. Fiber diameter and conduction velocity are related with the large A-fibers being much faster (> 10 m/sec) than the smaller diameter C-fibers (< 1 m/sec). Recently, our lab has documented an additional phenotype of myelinated BR afferents termed Ah-fibers that are notably present in female; but only rarely observed in male rats. In response to an electrical stimulus, the nerve fibers produce a compound action potential (CAP) that propagates away from the stimulation site. The CAP of each fiber type is observable in the evoked waveform on account of the differing conduction velocities. As Ah-fibers have conduction velocities in the range of 10 m/sec - 2 m/sec, the resulting CAP is clearly separated in time from the faster A-fibers and much slower C-fibers. Root-mean-square analysis of these distinct time segments provides a quantitative measure of the total signal energy from each of the A-, Ah-, and C-type fibers. This project sought to create MATLAB scripts that would import nerve recording files from both male and female rats and automate the energy analysis in an efficient and reliable manner. Doing so not only facilitates the analysis of these large data files, but also reduces the possibility for biases and errors that can occur during a manual measurement of nerve activity.

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