

# AN EVOKED INDIRECT RESPONSE IN THE CERVICAL VAGAL NERVE

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## 1. Introduction

The response of fibers in the vagal nerve, evoked by electrical stimulation, has been studied in both animals and humans [1-4]. These compound action potentials (CAPs) consist of components coming from thick, myelinated fibers to thin, unmyelinated fibers. In our study, the possibility is addressed of an indirect component in the CAP which is involved in reflexive control. By using multiple, consecutive electrode sites along the cervical vagal nerve, both the direction and the velocity along the nerve of the CAPs can be analyzed. This information can be used to distinguish direct from indirect components.

## 2. Methods

The experiments were performed in seven female Dutch Landrace pigs. Cuff electrodes with three circular electrode sites were used for stimulation and sensing. Nerve stimulation was performed with individual pulses (1Hz). Stimulation parameters ranged from 35-500 $\mu$ s for the pulse width, and 0.1-5mA for the pulse amplitude. The signals were analyzed offline in Matlab R2007a (The Mathworks Inc.). The common signal for each electrode cuff was subtracted from the individual electrode sites on that cuff. In this way disturbing common signals were removed. Using the stimulation artifacts as reference points, CAPs from the same stimulation parameters in a stimulation train were ensemble averaged. An ensemble averaged CAP was obtained for each electrode site. From this ensemble averaged signal the components of the CAP were identified.

## 3. Results/Discussion

Four components were classified from the CAP (see figure). The fourth component had a low threshold value, comparable to that of myelinated fibers (0.05-0.5 mA). However, its latency between stimulation and recording cuff would better match unmyelinated fibers. The consecutive electrode sites along the nerve were used to classify this component. Since it had a high velocity along the nerve ( $>40$  m.s<sup>-1</sup>) it was concluded to come from myelinated fibers. Combining this finding with the long latency time between stimulus and recording cuff, it shows that it cannot be a direct response to stimulation. It had travelled a longer path before entering the recording

cuff. Therefore, it must be an indirect component. This indirect response was still present after the nerve was centrally cut and disappeared after the nerve was peripherally cut. This verified the direction found on the consecutive electrode sites along the nerve; the indirect component did not originate in the brain stem but came from the periphery.

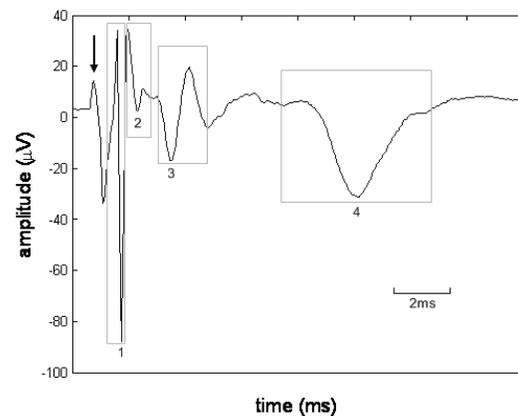


Figure: A typical example of an ensemble averaged compound action potential (average of 120 CAPs) with the four components identified. The arrow indicates the stimulus artifact.

## References

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