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## Physiological mechanisms of post-slaughter electrical stimulation

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Electrical stimulation is a standard part of processing technology, due to its effectiveness in enhancing tenderness by decreasing the pH of meat (by the increase of glycogen usage via muscle contraction; Polidori et al. 1999). There is, however, a lack of understanding between the interactions of electrical stimulation parameters and nerve/muscle responses to the applied current, which has led to less than optimal results in commercial use. In order to elucidate these interactions, an *in vitro* isolated nerve/muscle preparation has been developed, which allows for the detailed study of electrophysiological mechanisms underpinning muscle contraction in post mortem animals, which will allow electrical stimulation systems to be optimised, resulting in better and more consistent meat qualities.

These preliminary experiments validated the isolated nerve/muscle preparation by measuring muscle contraction responses over time and to electrical stimulation parameters that distinguish between nerve-mediated and direct muscle stimulation. The technique was optimised using the semimembranosus and semitendinosus muscles of male Wistar rats (10–14wks old), and sheep (various breeds and ages). The work confirms that this technique is ideal for use in monitoring and refining electrical stimulation systems.

*In vitro* mechanical recordings were performed according to the procedure outlined in Chen and Creed (2004). It was shown that muscle strips can remain viable over a period of 1h (when stimulated for 0.5sec at 80hz, 0.1 msec and 60V for 1 h every 7 minutes), thus ensuring that in future experiments any decrease in muscle tension is a result of the variable being tested (e.g. due to the effect of the stimulation or pharmacological agent), rather than fatigue of the muscle. Furthermore, the parameters that distinguish nerve-mediated from direct muscle stimulation have been established (by the use of D-tubocurarine, a neuromuscular blocking agent), hence ensuring that certain stimulation parameters are inducing either nerve-mediated responses or direct responses, depending upon the pulse width and frequency of stimulation used.

It is anticipated that future experiments will establish the response of muscle contraction to various electrical currents under abattoir-like conditions *in vitro* (i.e., ischemic tissue), and be followed by in-house abattoir testing to correlate the responses from the *in vitro* set-up with those in commercial settings.

Polidori, P., Lee, S., Kauffman, R. G., Marsh, B. B., 1999. Low voltage electrical stimulation of lamb carcasses: effects on meat quality. *Meat Science*. 53, 179–182.

Chen, X. and Creed, K.E., 2004. Histochemical and contractile properties of striated muscles of urethra and levator ani of dogs and sheep. *NeuroUrol Urodyn*. 23(7), 702–708.