

Characterization of the muscle-motor neuron topography of the mouse forelimb

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Purpose: Our current focus is exploring strategies to deliver therapeutic genes to specific populations of motor neurons. This can be achieved *via* intramuscular injections of viral vectors and the ensuing retrograde transport of the therapeutic gene into targeted motor neurons. We have previously described the organization of the motor columns in the rat forelimb (Tosolini & Morris, 2012). With the increasing prevalence of mouse models of motor neuron disease and spinal cord injury, we aimed to define the precise relationship between different forelimb muscles and the motor neurons that innervate them in the mouse.

Methods: On forelimbs obtained through tissue sharing, the motor end plates (MEP) were revealed using acetylcholinesterase histochemistry and this information was used to create a motor end plate map. This map was subsequently used as a guide to perform intramuscular injections of retrograde tracer along the entire MEP region of individual forelimb muscles. These injections were performed on C57BL/6 mice that were anaesthetized using the inhalant Isoflurane. One week later the animals were intra-cardially perfused and the spinal cords were dissected, sectioned and analysed under epifluorescence. For each muscle, labelled motor neurons were plotted on a spinal cord schematic representation and stacked thereafter to create a motor neuron map.

Results: This study reveals that mice motor neurons are arranged in columns spanning multiple spinal segments. Individual motor columns have substantial overlap with other motor columns in all axes.

Conclusion: Both the motor end plate map and the motor column map constitute a valuable guide for the selection of appropriate muscle(s) for the delivery of therapeutic genes into specific motor neurons within the cervical spinal cord.

Tosolini AP, Morris R. (2012) Spatial characterization of the motor neurons innervating the rat forelimb. *Neuroscience* **200**: 19-30.