

CANDIDATE NEURONS MEDIATING GROUP II AFFERENT REFLEXES DURING FICTIVE LOCOMOTION.

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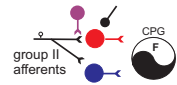


INTRODUCTION

As part of the flexor reflex afferent (FRA) system, group II afferents evoke flexion reflexes during no locomotor activity in animals with intact spinal cords.

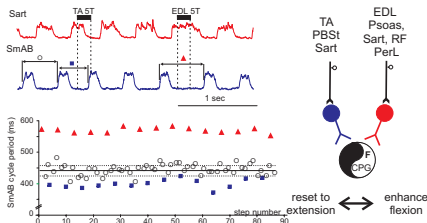
During locomotor activity

- group II afferent input is suppressed
- group II afferents are removed from FRA pathways



Presynaptic inhibition may underlie the suppression of group II evoked flexion reflexes during locomotion. (Parnault et al 1999)

Despite this suppression during fictive locomotion, flexor group II fibres evoke strong reflexes that influence phase transitions in stepping. (Parnault et al 1996, McCrea et al 2000)



What types of interneurons mediate the reflex actions of group II afferents from flexor muscles during locomotion?

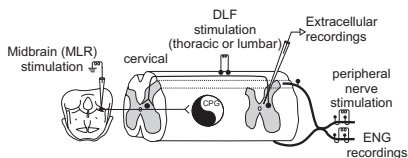
There are several populations of spinal interneurons (IN) with input from muscle group II afferents.

For example: mid-lumbar last order interneurons, lower-lumbar interneurons, sacral interneurons, ascending propriospinal neurons. (Jankowska 1992).

Only one group II interneuron population has been examined during fictive locomotion.

Group II (mainly from Q) activated mid-lumbar last-order interneurons are phasically active during fictive locomotion but their input from group II afferents is suppressed (Sheltych et al 1990).

METHODS



Interneuron characterization:

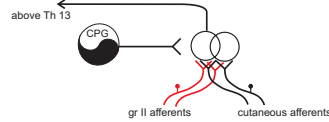
- location
- input from group I and II muscle afferents
- input from cutaneous afferents
- input from MLR region
- axonal projections in thoracic or cervical tracts
- spontaneous activity during locomotion
- activity during perturbation of step cycle

APPROACH

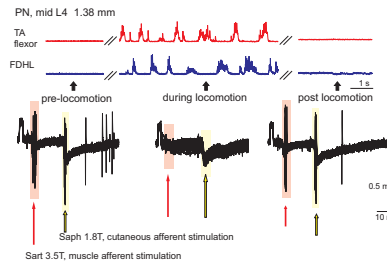
--neurons monosynaptically excited by 5T stimulation of muscle nerves

--propriospinal group II neurons (PN) had axonal projections to thoracic levels but not higher than first cervical

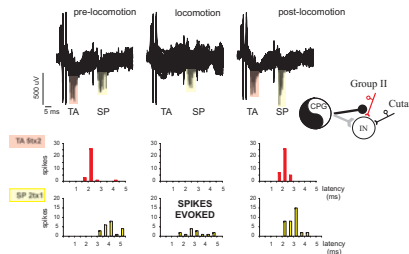
--tested neuronal response to single shock and trains of nerve stimulation that perturbed the step cycle during locomotion



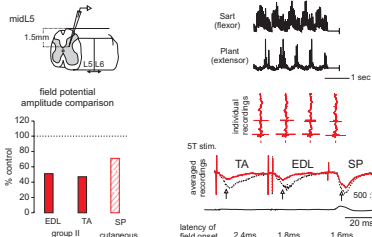
Depression of both muscle group II and cutaneous input during fictive locomotion



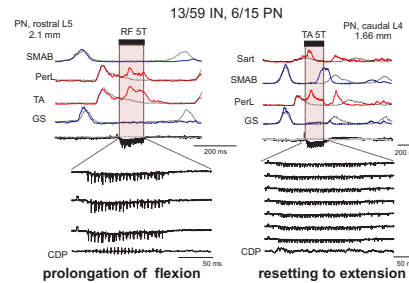
Selective suppression of group II afferent input during fictive locomotion



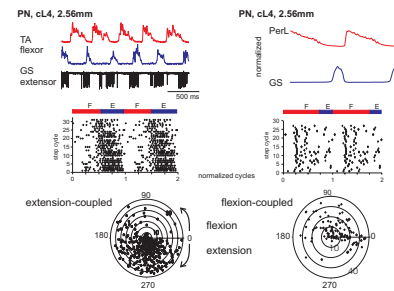
Field potential recordings suggest the selective presynaptic suppression of group II input



Only a few neurons are responsive to group II input during fictive locomotion



Phase-related spontaneous activity of neurons responsive to group II input



SUMMARY

total of 74 group II neurons examined
PN: 15, IN: 59

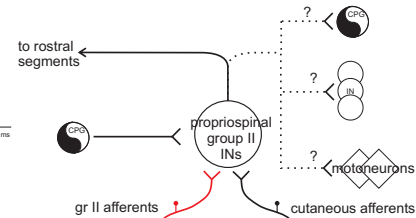
suppression of group II input: 55
PN: 9, IN: 46

responsive to group II input: 19
PN: 6, IN: 13

spontaneous activity: PN: 6 IN: 1

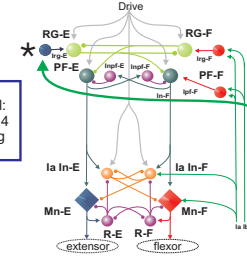
PN location	depth (mm)	latency: Sart	TA	SP	spont. activity
L4-L5	1.6	1.4 ms	4.9 ms	2.7 ms	none
L4-L5	1.6	1.9 ms	1.5 ms	---	SP
L4-L5	1.7	0.7 ms	1.3 ms	---	SP
L4-L5	1.5	1.2 ms	1.0 ms	---	SP
L4-L5	2.1	---	1.5 ms	1.6 ms	SP
L4-L5	2.5	4.3 ms	4.8 ms	1.2 ms	none
L4-L5	2.1	1.6 ms	---	2.6 ms	spontaneous

Where do propriospinal neurons, that follow group II evoked perturbation of stepping, project?



A computational model used for making predictions about the identity of group II interneuron populations

Posters on this model:
883.2 883.3 883.4
Oct 27, Wed. morning



Abbreviations & References

CDP	Cord dorsum potential	PbSt	Posterior biceps-semi-tendinosus
CPG	Central pattern generator	PerL	Peroneus longus
DLF	Dorsolateral funiculus	Plant	Plantaris
E	Extensor	PN	Propriospinal neuron
EDL	Extensor digitorum longus	Q	Quadriceps
ENG	Electroneurogram	RF	Rectus femoris
F	Flexor	Sart	Sartorius
FRA	Flexor reflex afferent	SMAB	Semimembranosus anterior biceps
GS	Gastrocnemius-Soleus	SP	Superficial peroneal
IN	Interneuron	TA	Tibialis anterior
MLR	Mesencephalic locomotor region		

Jankowska, E. Interneuron relay in spinal pathways from proprioceptors. Prog. Neurobiol. 1992; 38:335-378.
Jankowska, E. and Hammar, I. How can studies in animals contribute to the understanding of spinal interneuronal systems in the man? Brain Research Reviews 2002; 40:19-28.
Sheltych, S.; McCrea, D.; Krellars, D.; Fortier, P., and Jordan, L. Activity of L4 interneurons during brainstem evoked fictive locomotion in the mesencephalic cat. Exp. Brain Res. 1990; 80:290-295.

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