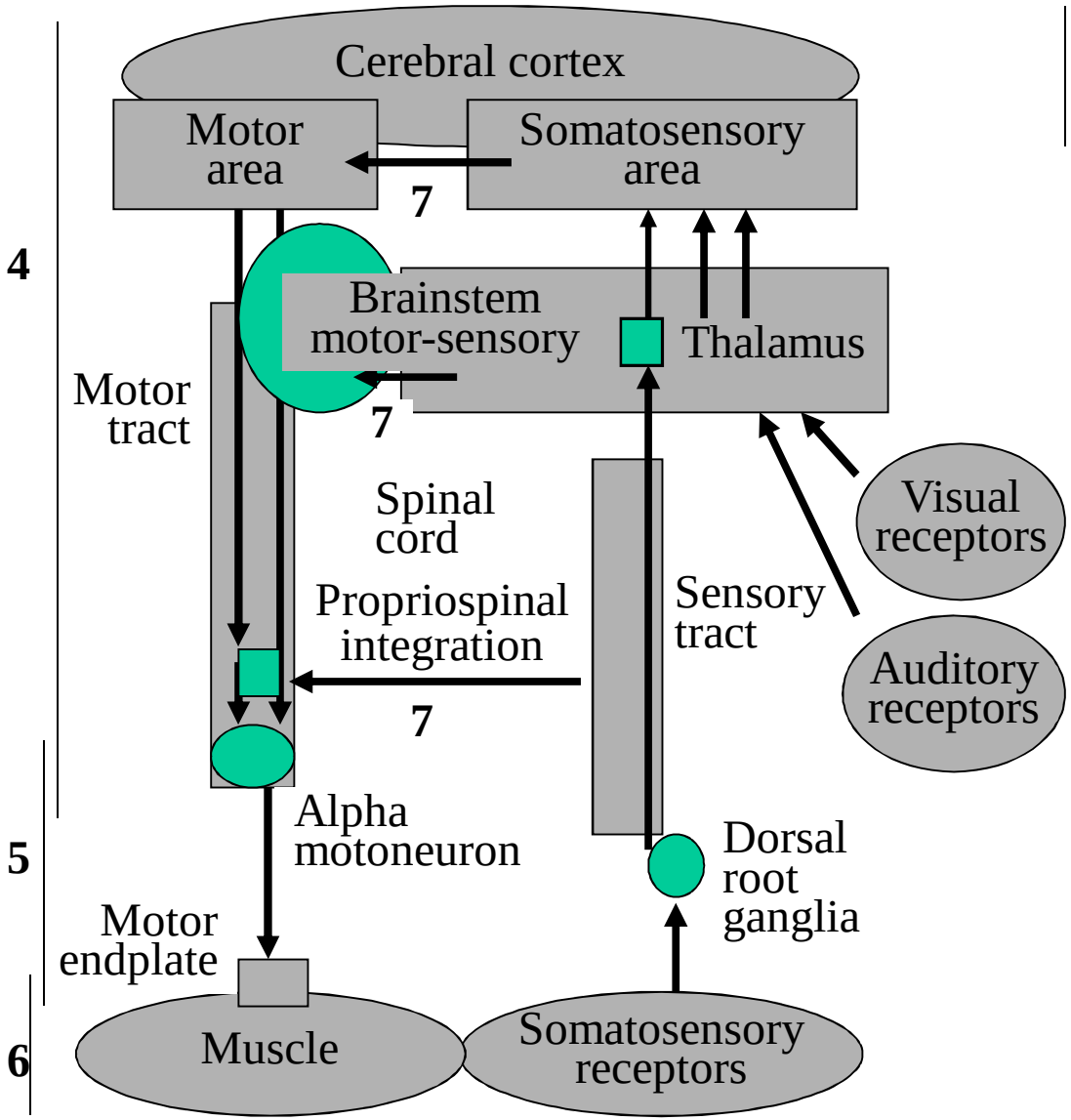
NEUROLOGY IN THE AGE OF GLOBALIZATION

6 September 2013 Vienna, Austria

Reflexes and late responses

Josep Valls-Solé.
Neurology Department
Hospital Clinic.
Barcelona. Spain
jvalls@clinic.ub.es

ELECTRODIAGNOSIS OF THE NERVOUS SYSTEM IN HUMANS



1: Sensory nerve conduction

2: Evoked potentials

3: EEG activity

4: Cortical stimulation

5: Motor nerve conduction
Repetitive stimulation
Needle electromyography

6: Needle electromyography

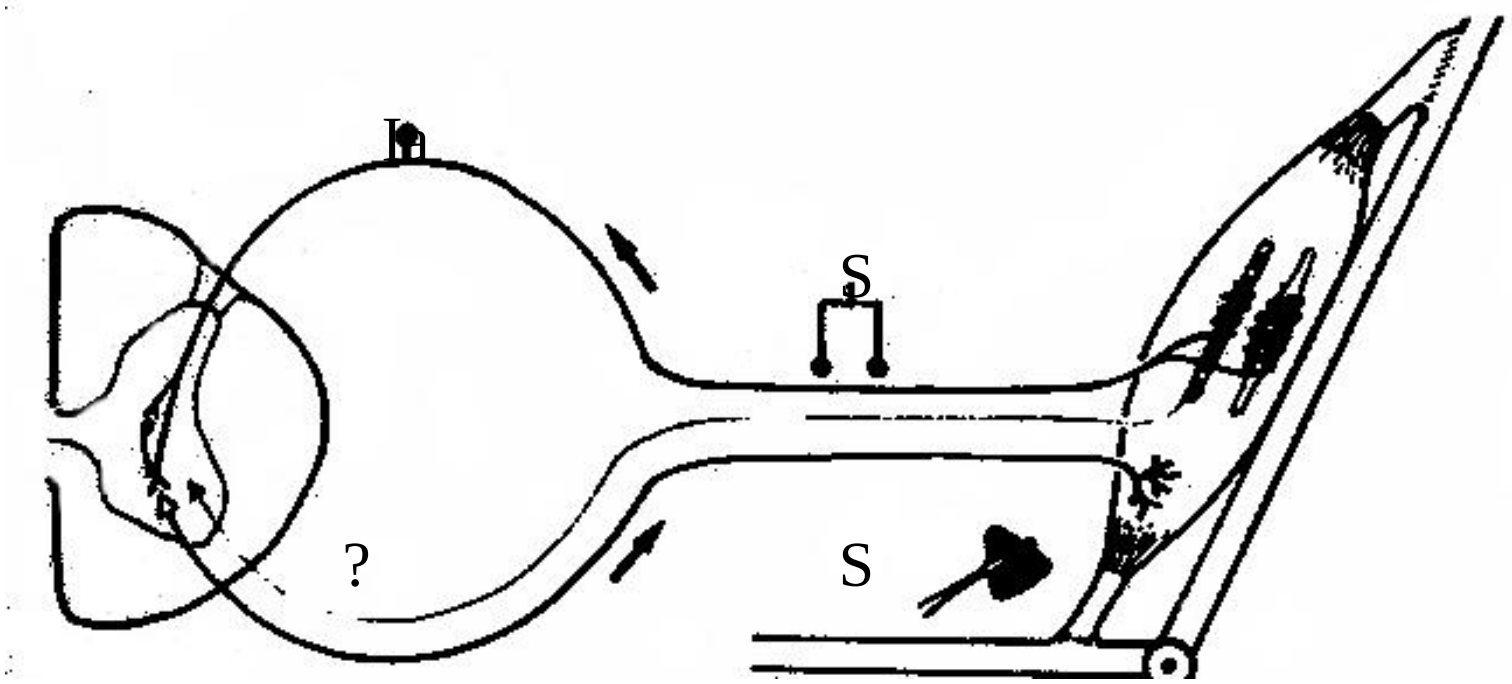
7: Short and long-latency reflexes

REFLEXES INVOLVING MUSCLE RESPONSES

	Stimuli	Rest	Contraction
Monosynaptic	Mechanical	Tendon jerk (T wave)	
	Electrical -Ia afferents	H reflex	
Polysynaptic	Electrical -Cutaneous	Blink reflex (R1, R2, R3)	Cutaneo-muscular reflex (E) Voluntary potential (V) Masseteric inhibitory reflex (MIR)
	Electrical -Cutaneous -Mixed	C reflex (C wave) Nociceptive withdrawal (RIII) Palmomental	Long latency reflexes (LLR)
	Vibration	Tonic vibration reflex (TVR)	
	Muscle stretch		Stretch reflex (M2, M3)
	Muscle shortening	Shortening reaction (SR)	

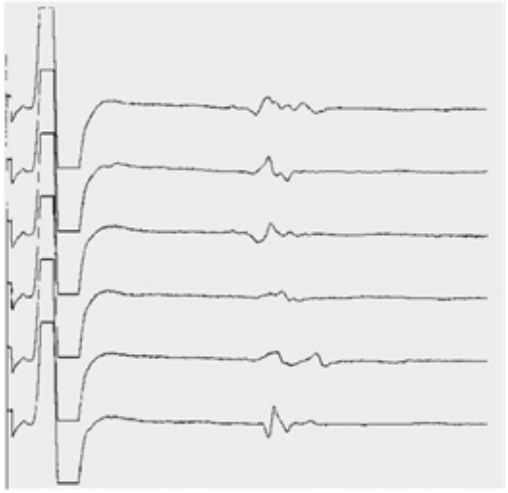
MONOSYNAPTIC REFLEX RESPONSES AND THEIR CIRCUITS AND INTEGRATION SITES

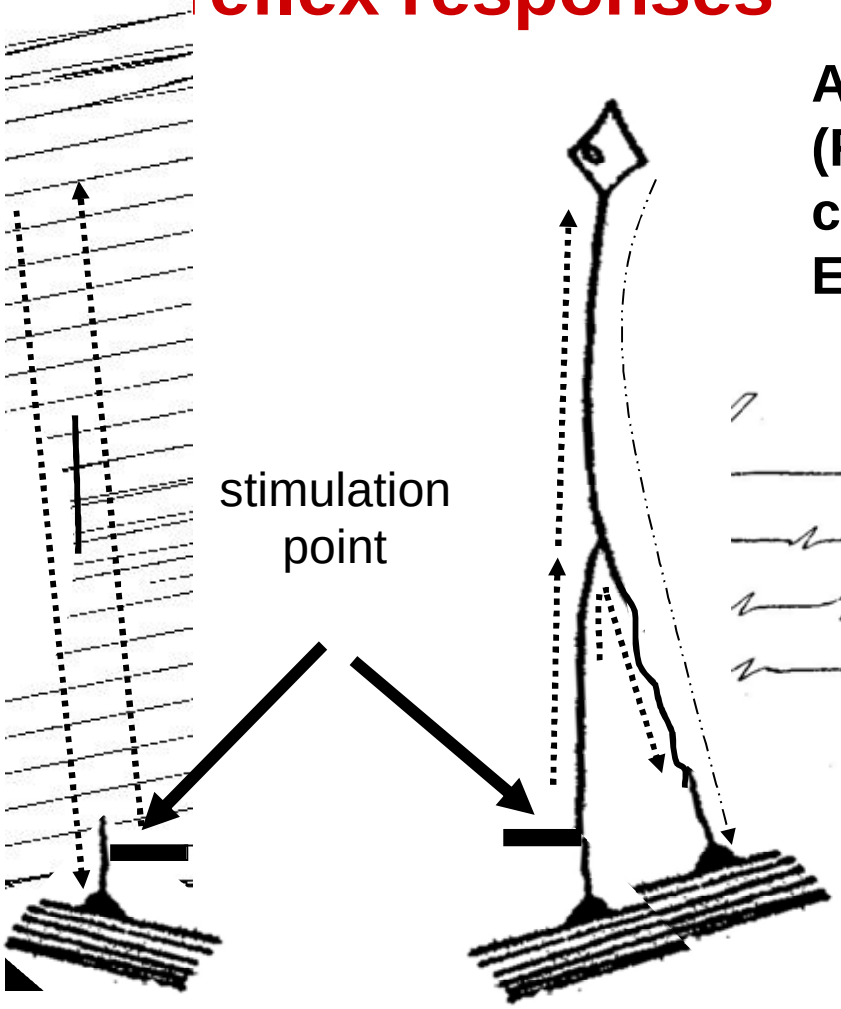
H wave	Ia afferents Alpha motoneurons
T wave	Gamma motoneurons Muscle spindles and Ia afferents Alpha motoneurons



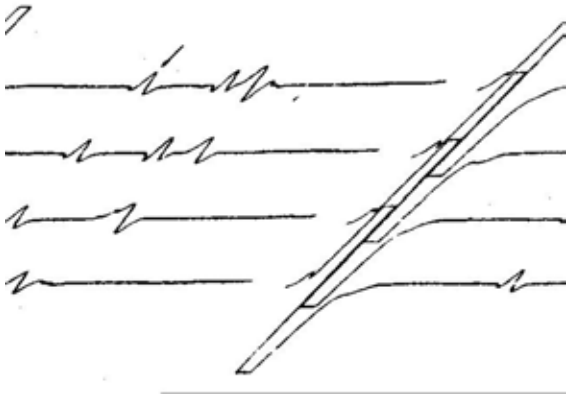
reflex responses

F wave
Rebound in the ?ú motoneuron

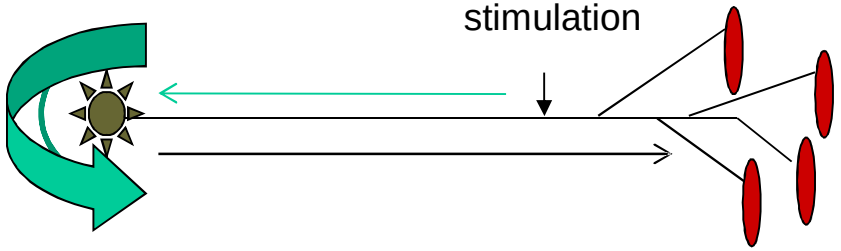




A wave
(Rebound in a collateral branch)
Ephaptic/ectopic



Stimuli in the motor nerve can elicit long latency action potentials



The utility of the H reflex and F waves in clinical practice

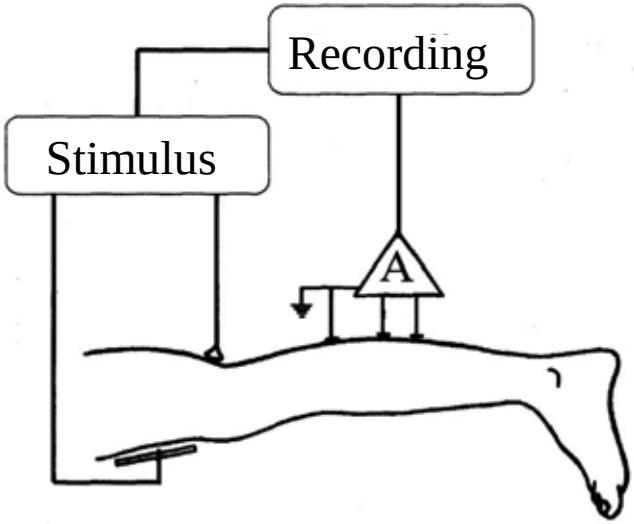
Peripheral nervous system

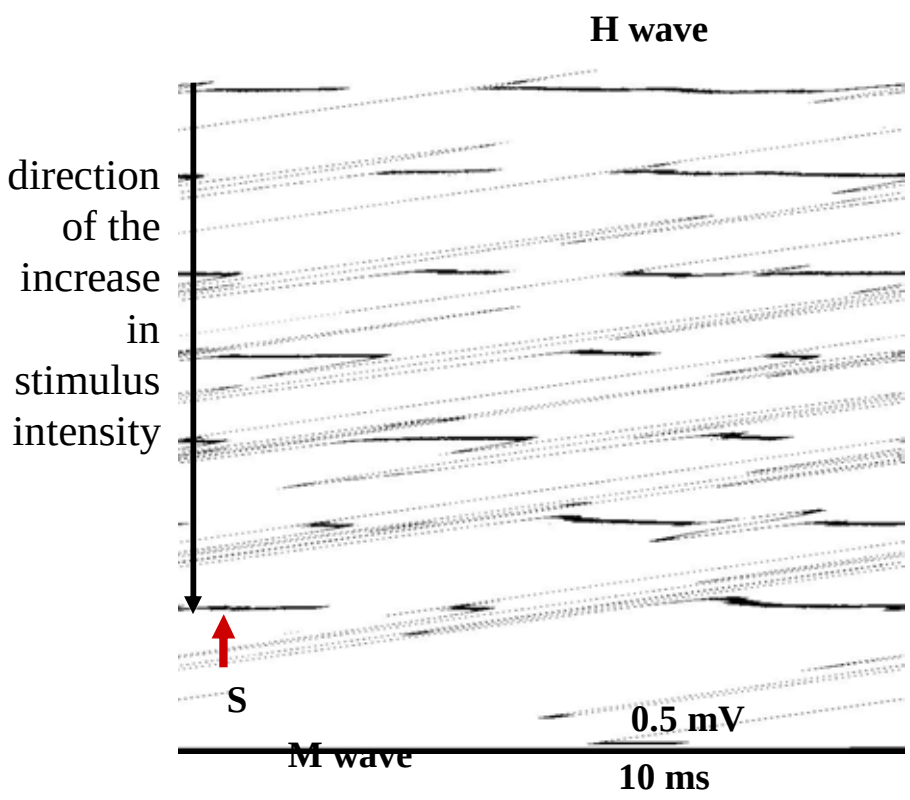
Polyneuropathies
Focal lesions
Radiculopathies

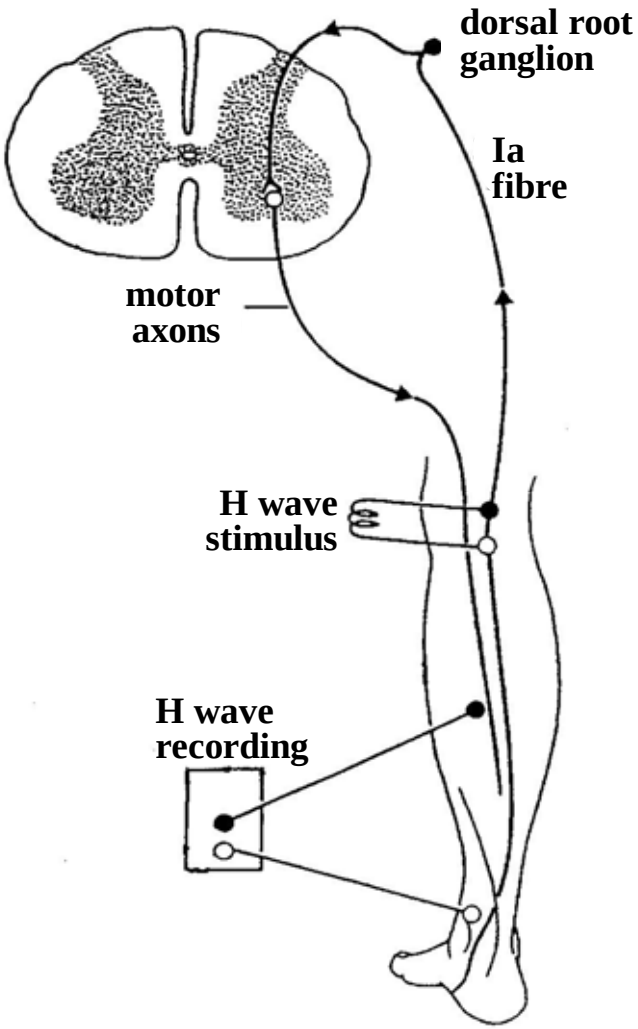
Central nervous system

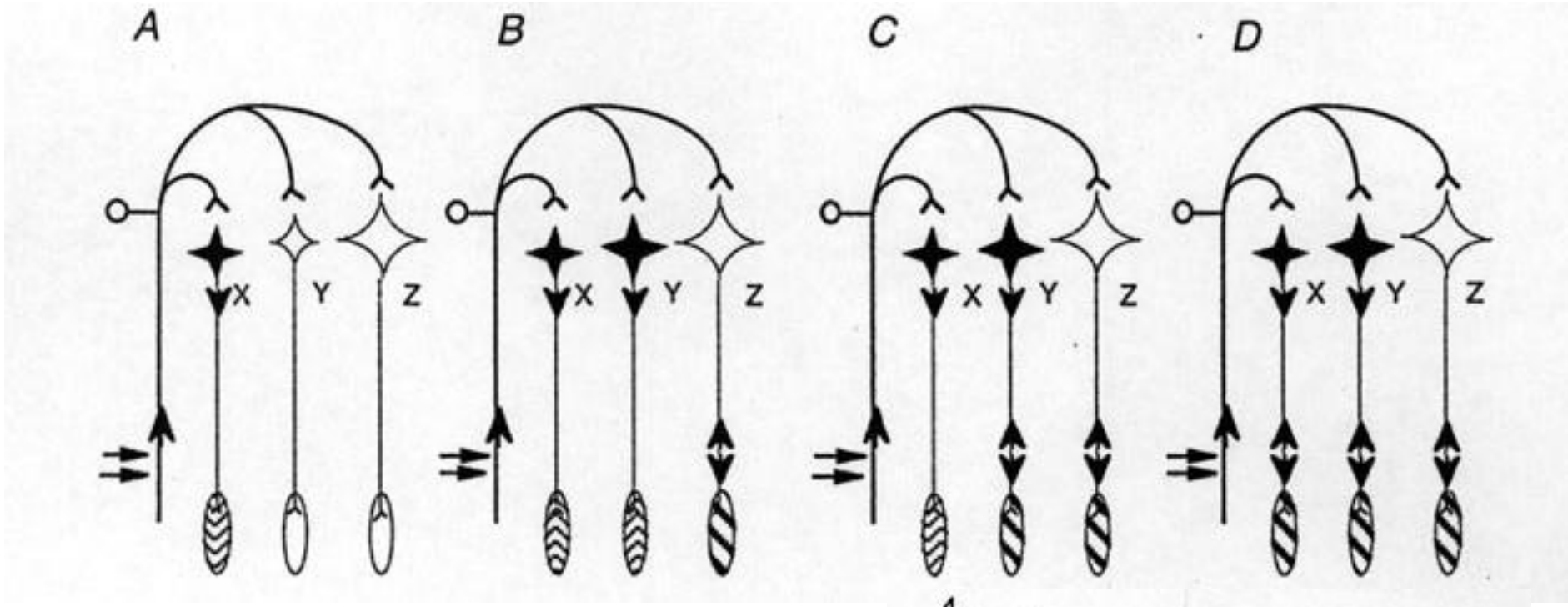
Spasticity
Dystonia
Rigidity and other disorders of propriospinal interneurons

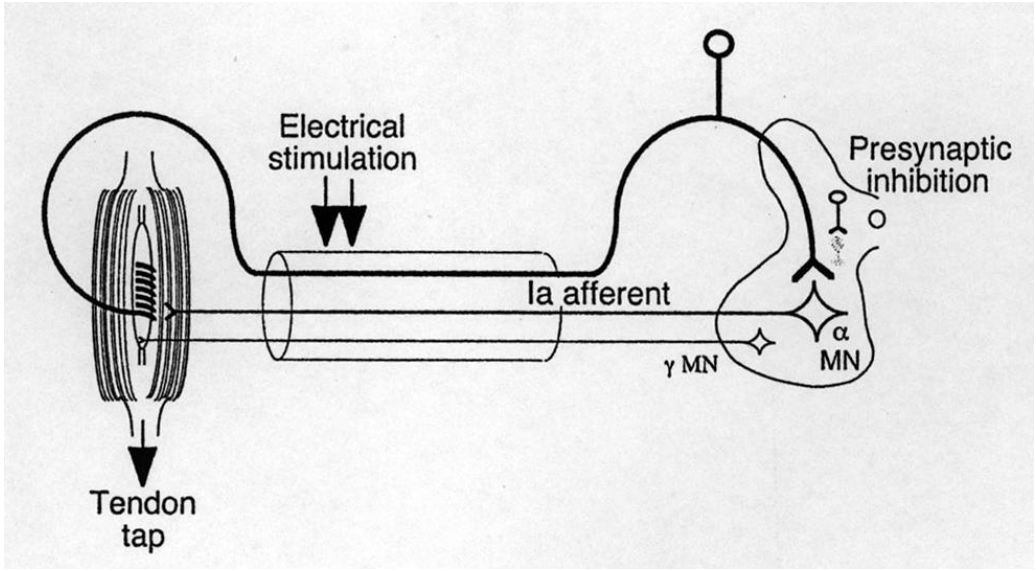
Soleus
H wave

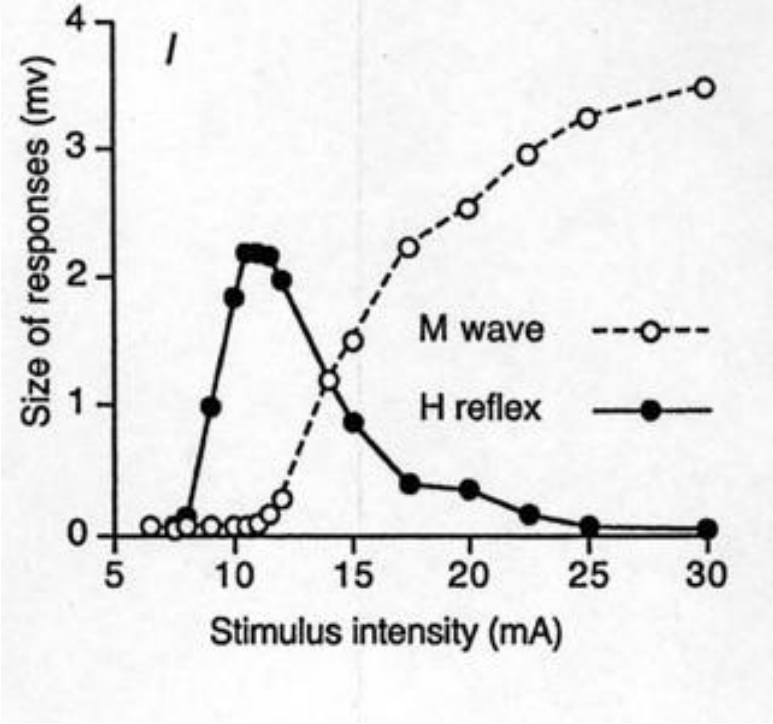


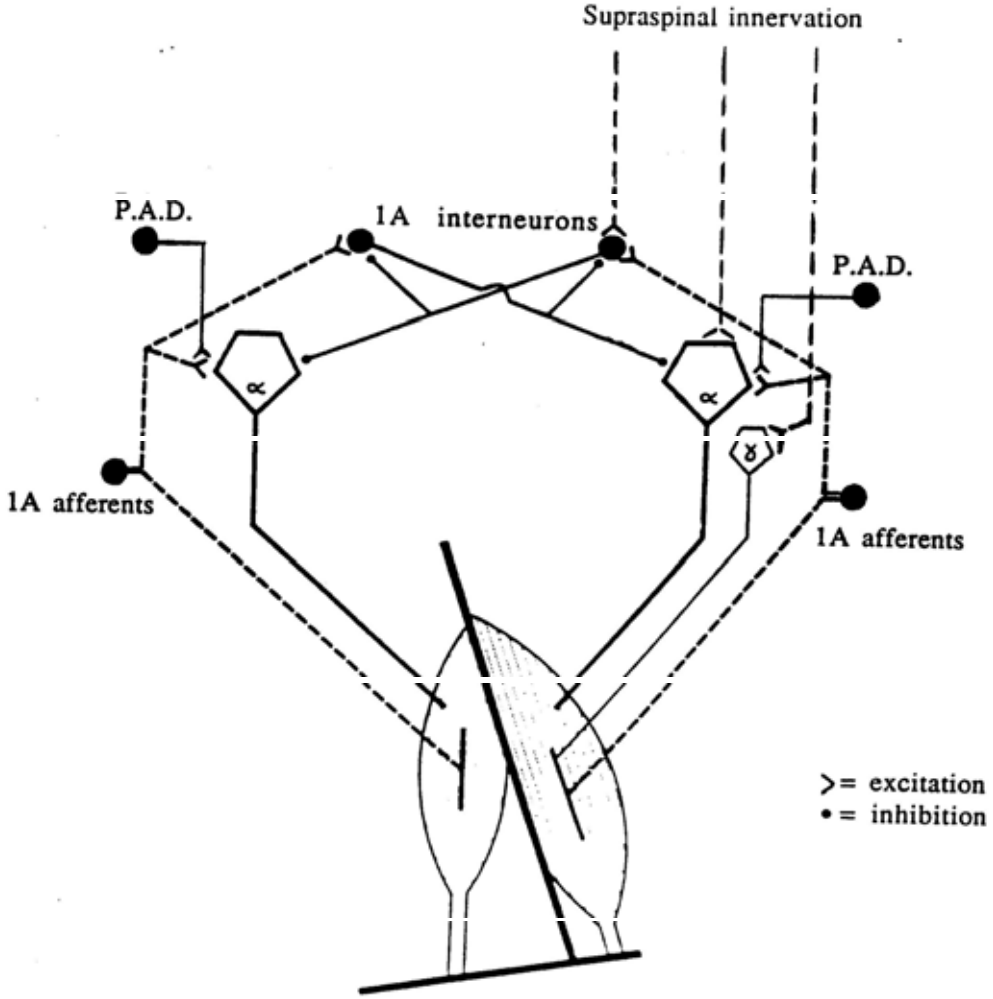





A
B
C
D
X
Y
Z

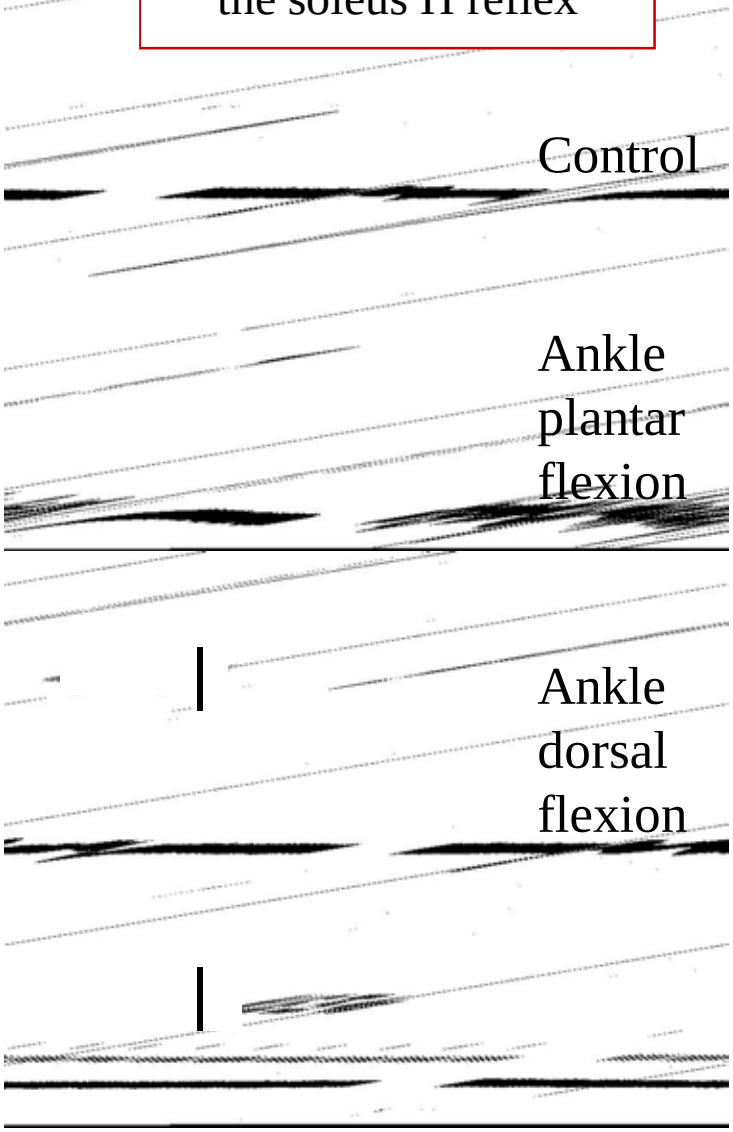

Electrical stimulation
Presynaptic inhibition
Ia afferent
γ MN
α MN
Tendon tap


I
Size of responses (mv)
M wave
H reflex
Stimulus intensity (mA)
0
1
2
3
4
5
10
15
20
25
30

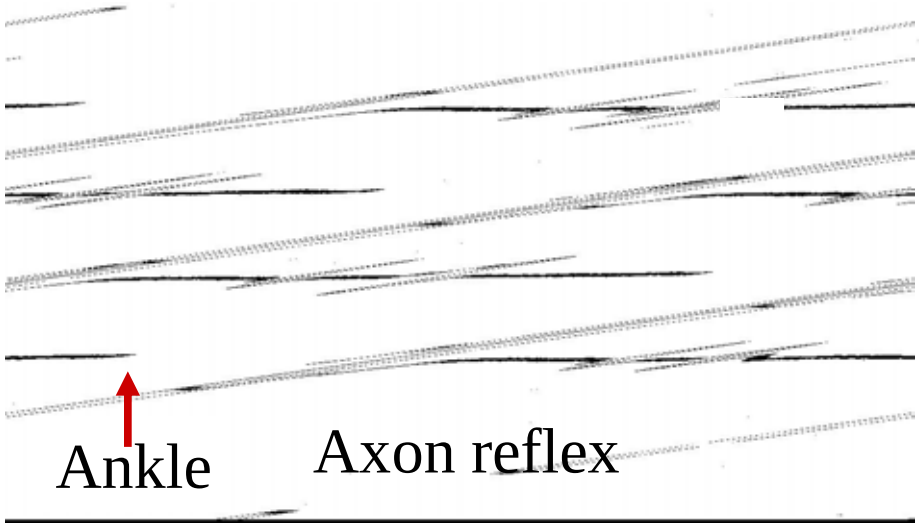


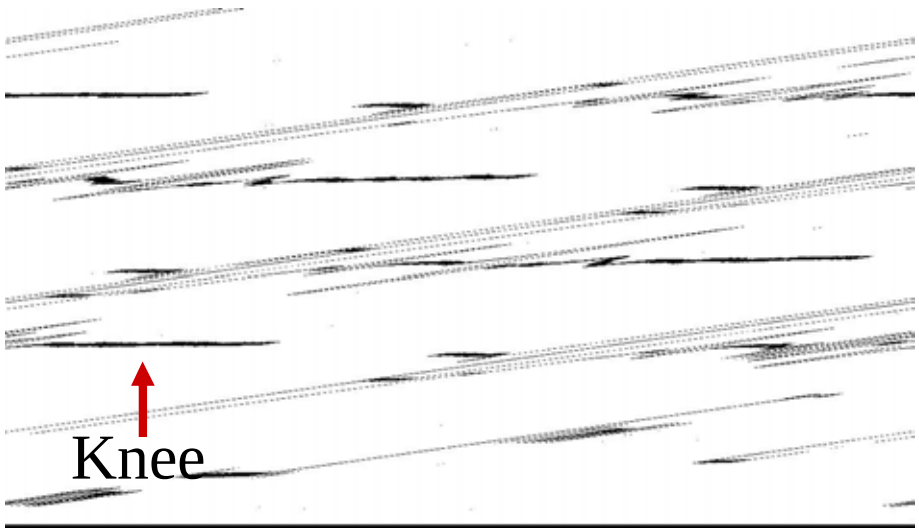
Presynaptic inhibition
Reciprocal Ia inhibition
Autogenic Ib inhibition
Recurrent (Renshaw) inhibition

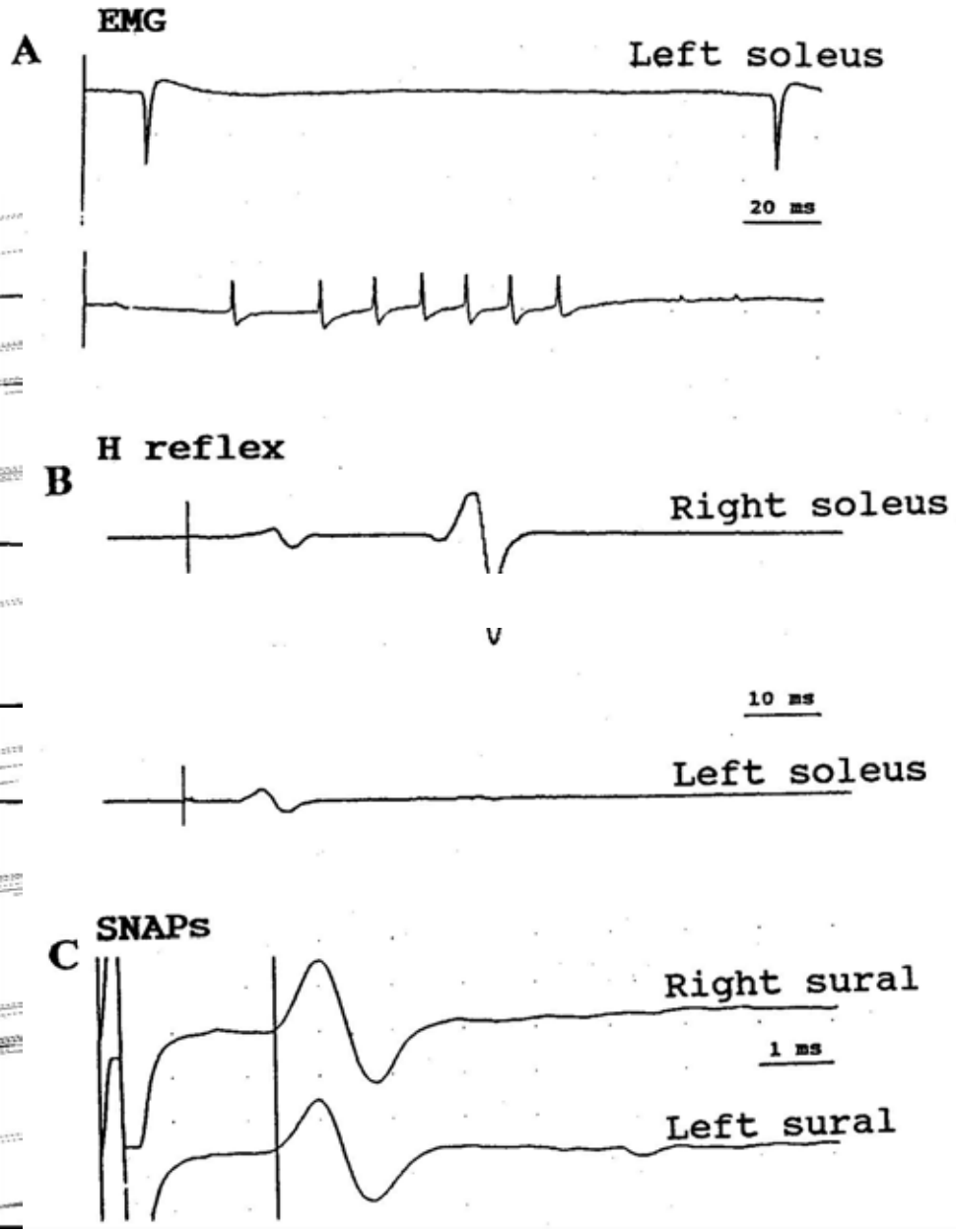
A fast evaluation of reciprocal inhibition in the soleus H reflex



Results from a patient with S1 radiculopathy



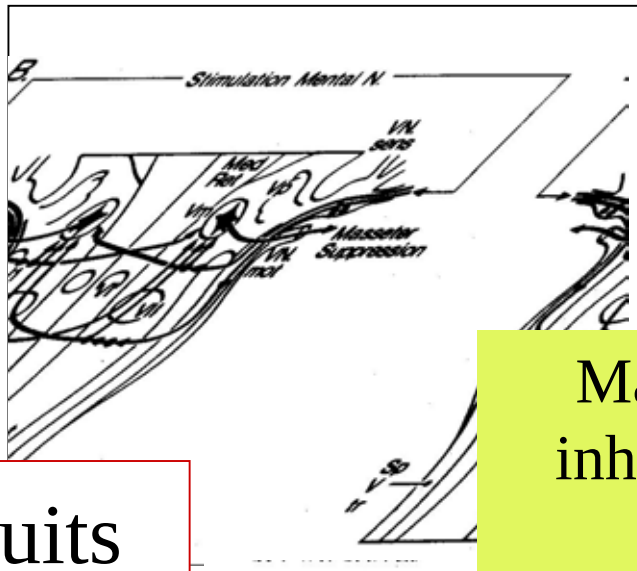




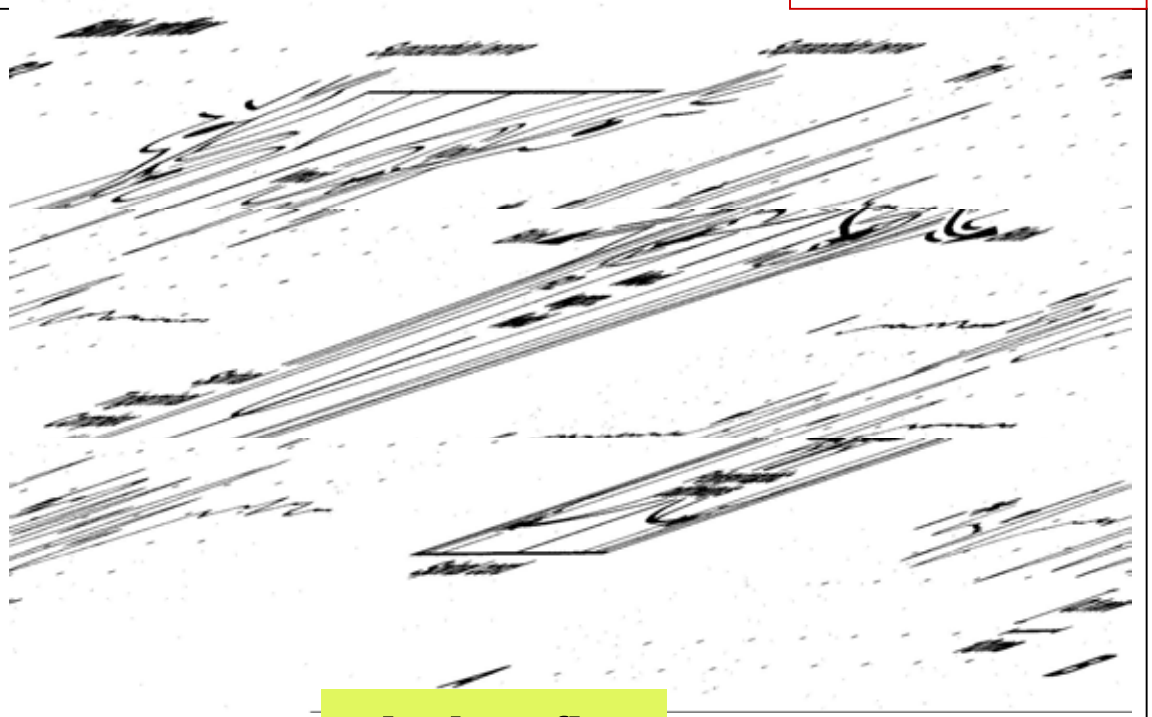
CRANIAL NERVE REFLEXES

Jaw jerk (mandibular reflex)

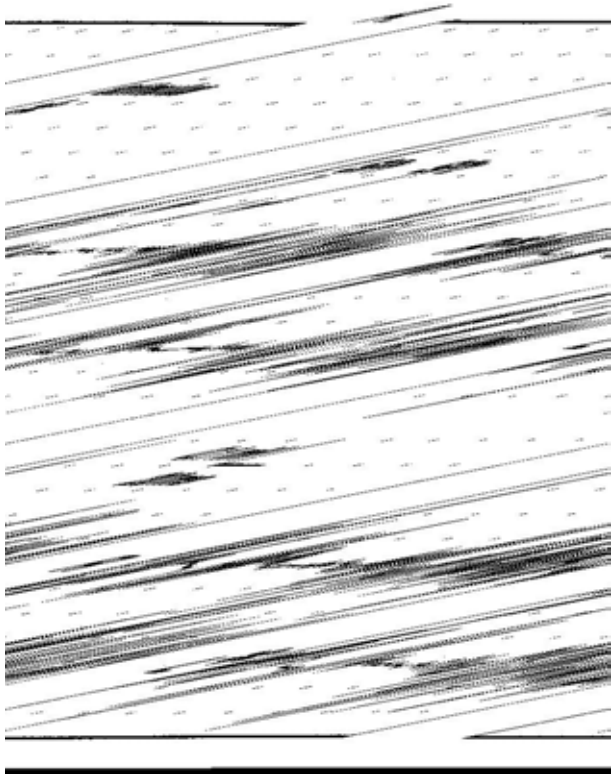
Circuits

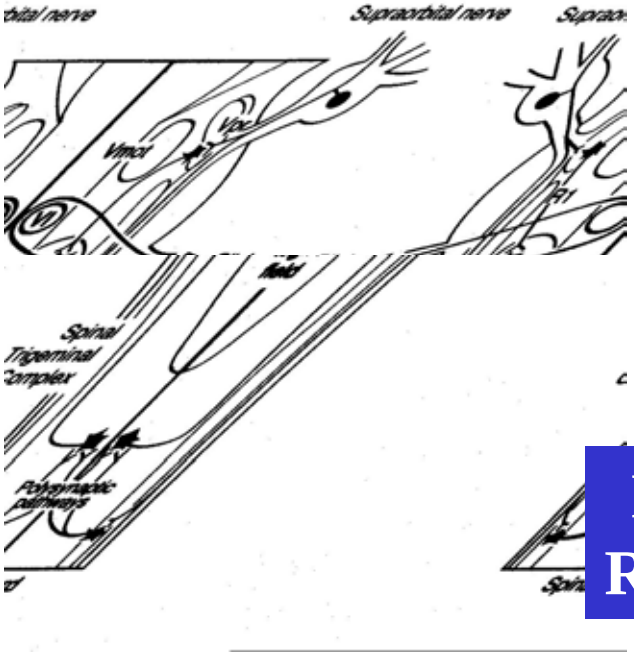


Masseter inhibitory reflex



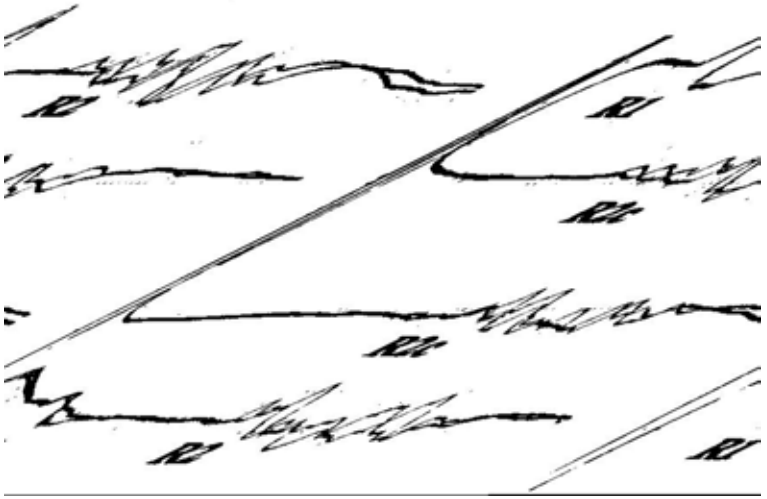
Blink reflex

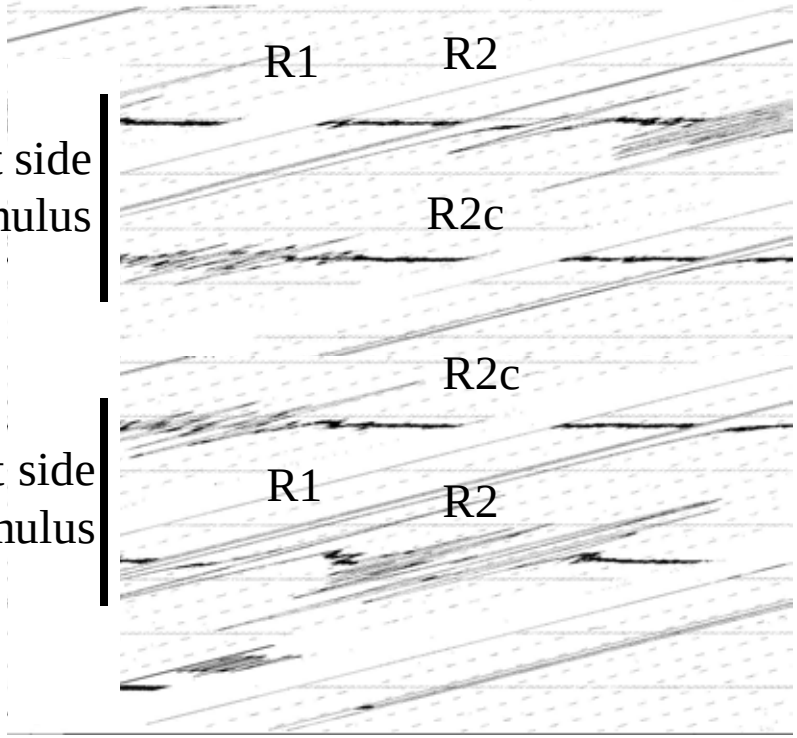




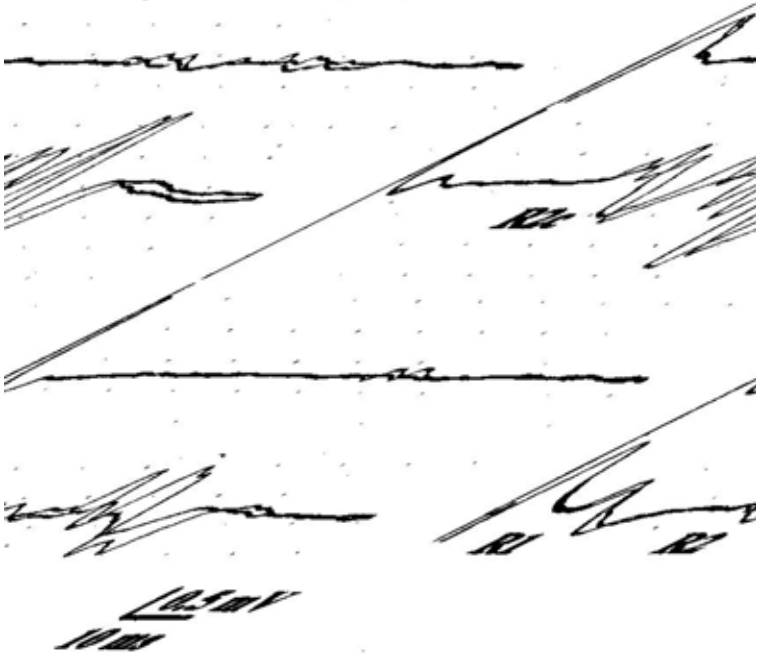
BLINK REFLEX

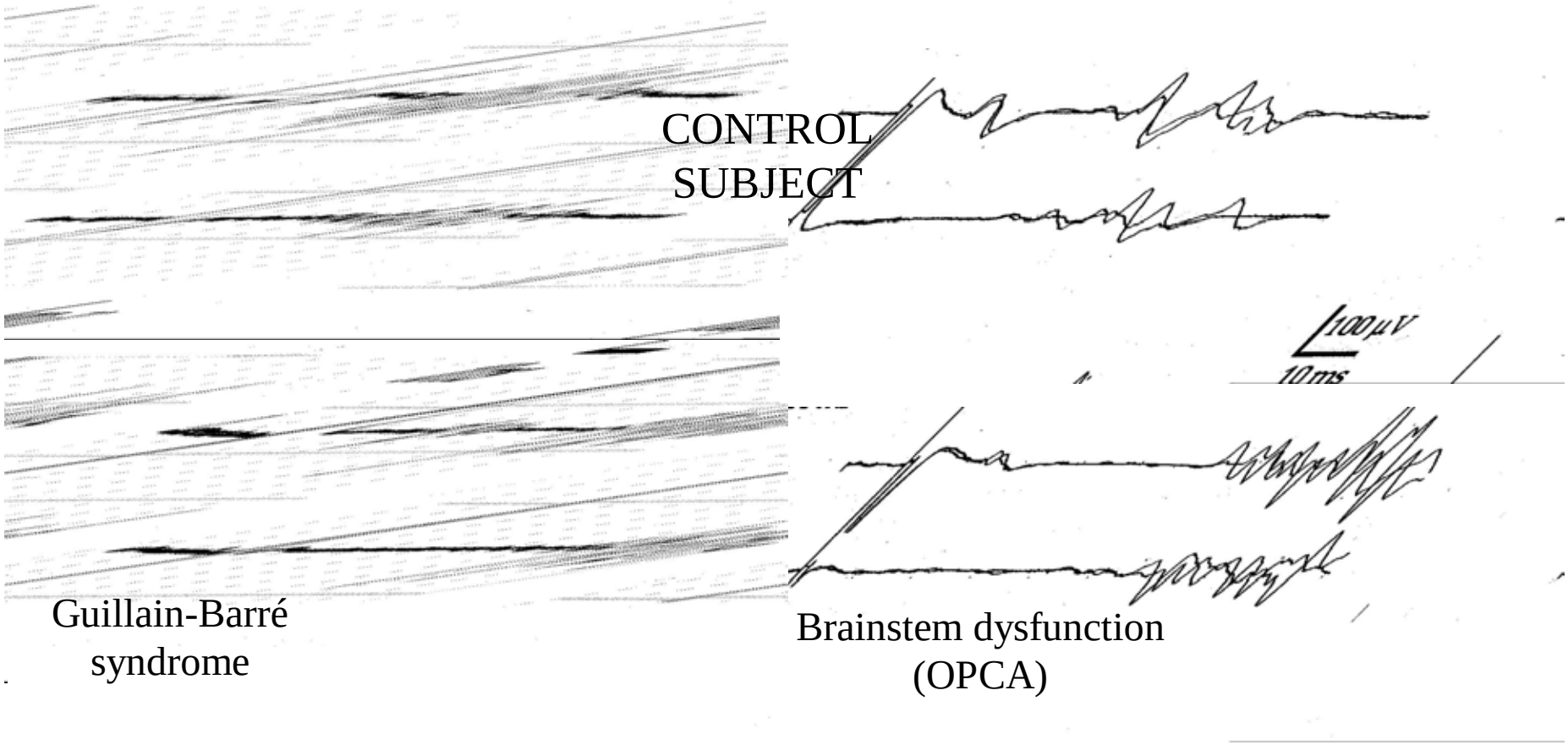
Left afferent pattern





Right efferent pattern





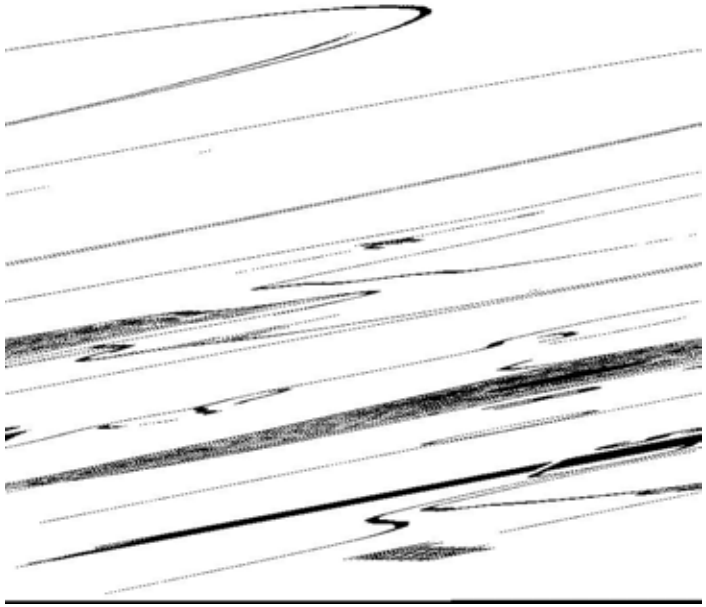
Guillain-Barré syndrome

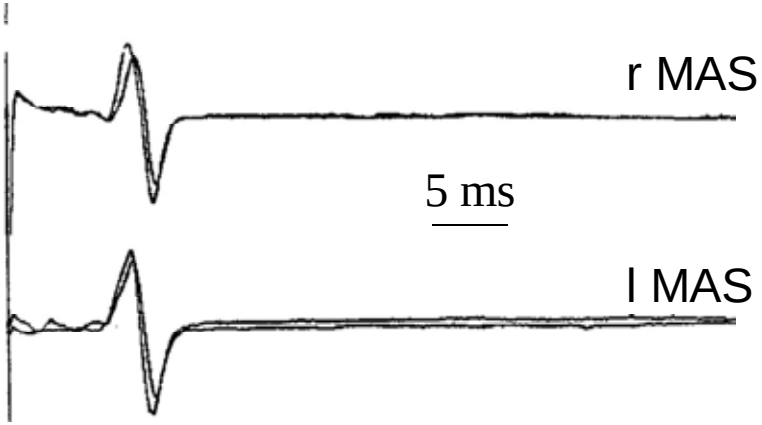
Brainstem dysfunction (OPCA)

‘Peripheral pattern’
The delay in R1 is relatively more pronounced than the delay in R2

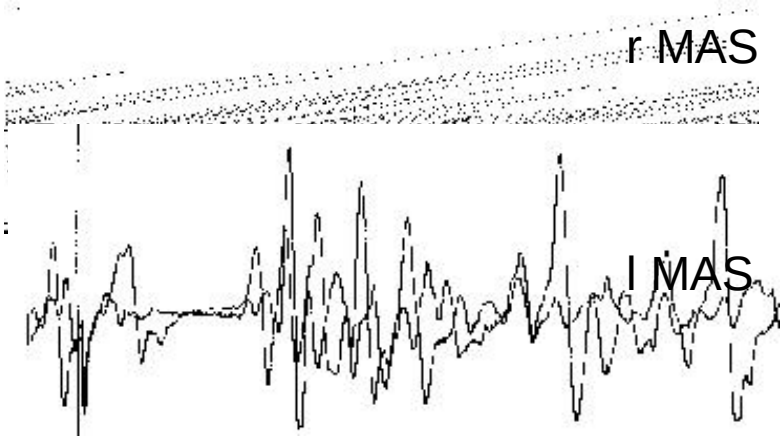
‘Central pattern’
The R1 response is normal, whereas the R2 is absent, reduced or delayed

Trigemino-trigeminal reflexes in a healthy subject



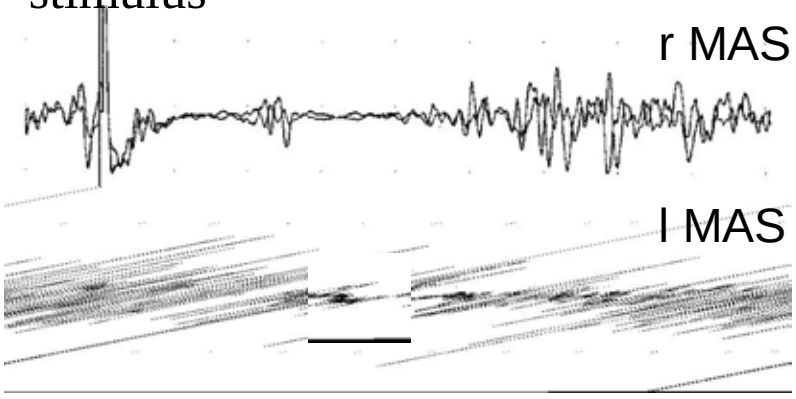


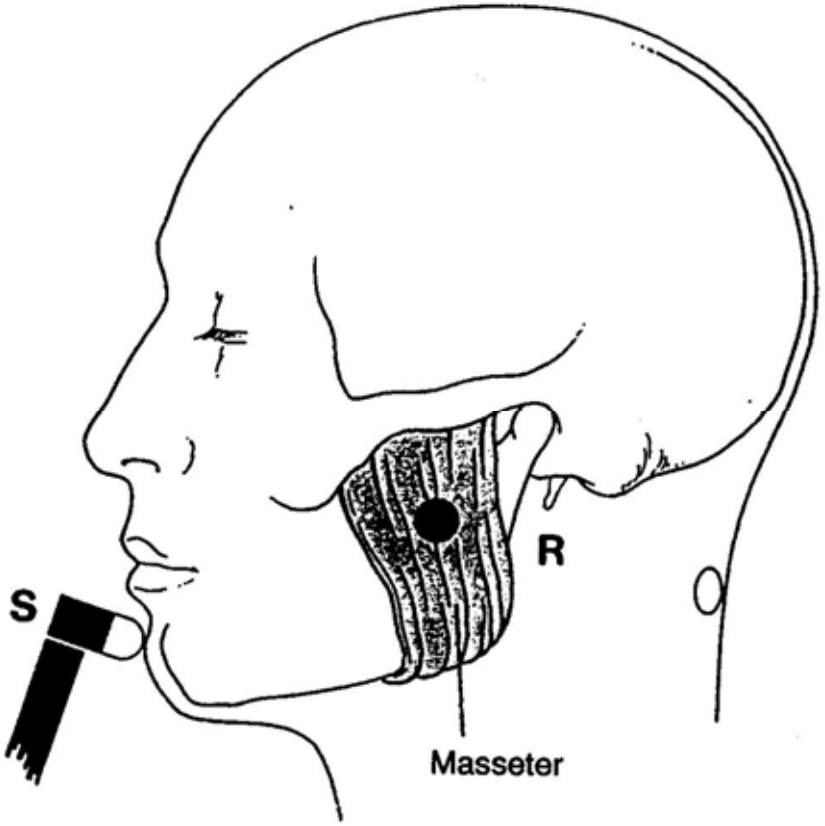
tapping

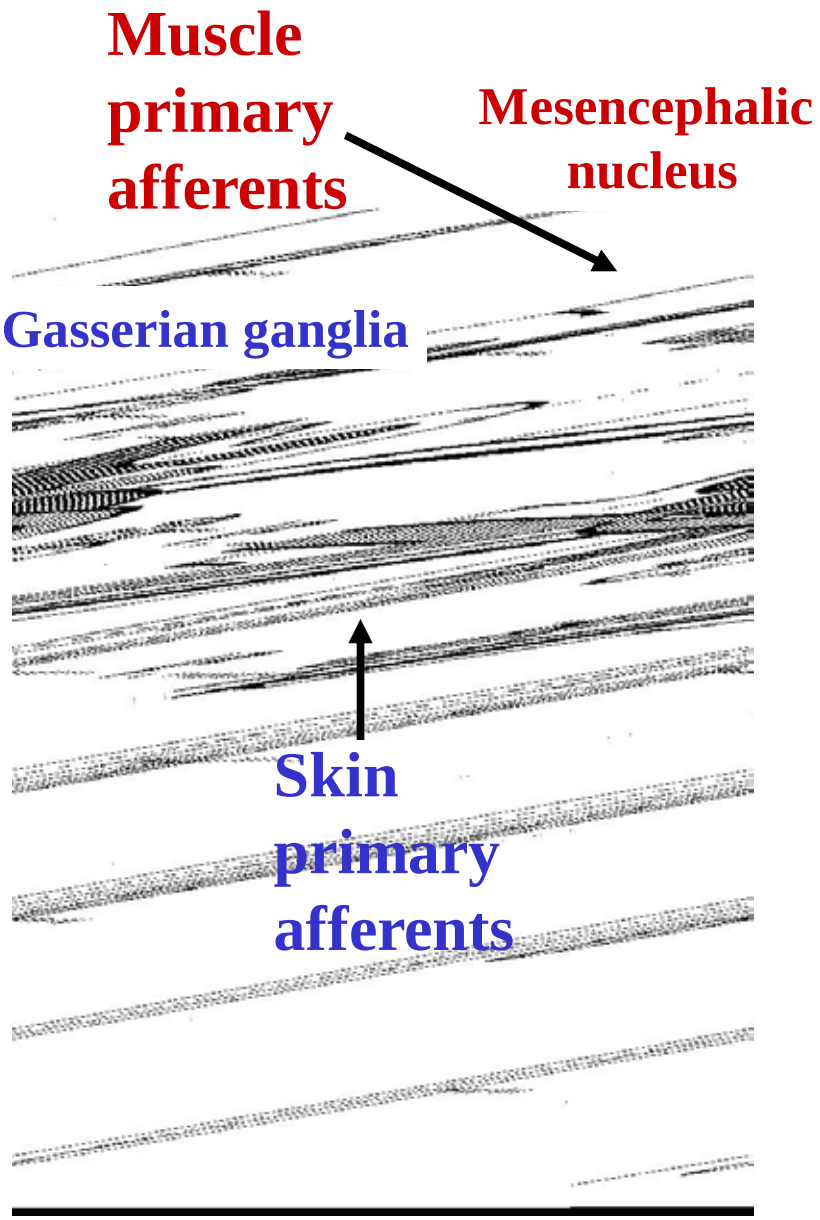


10 ms

electrical stimulus





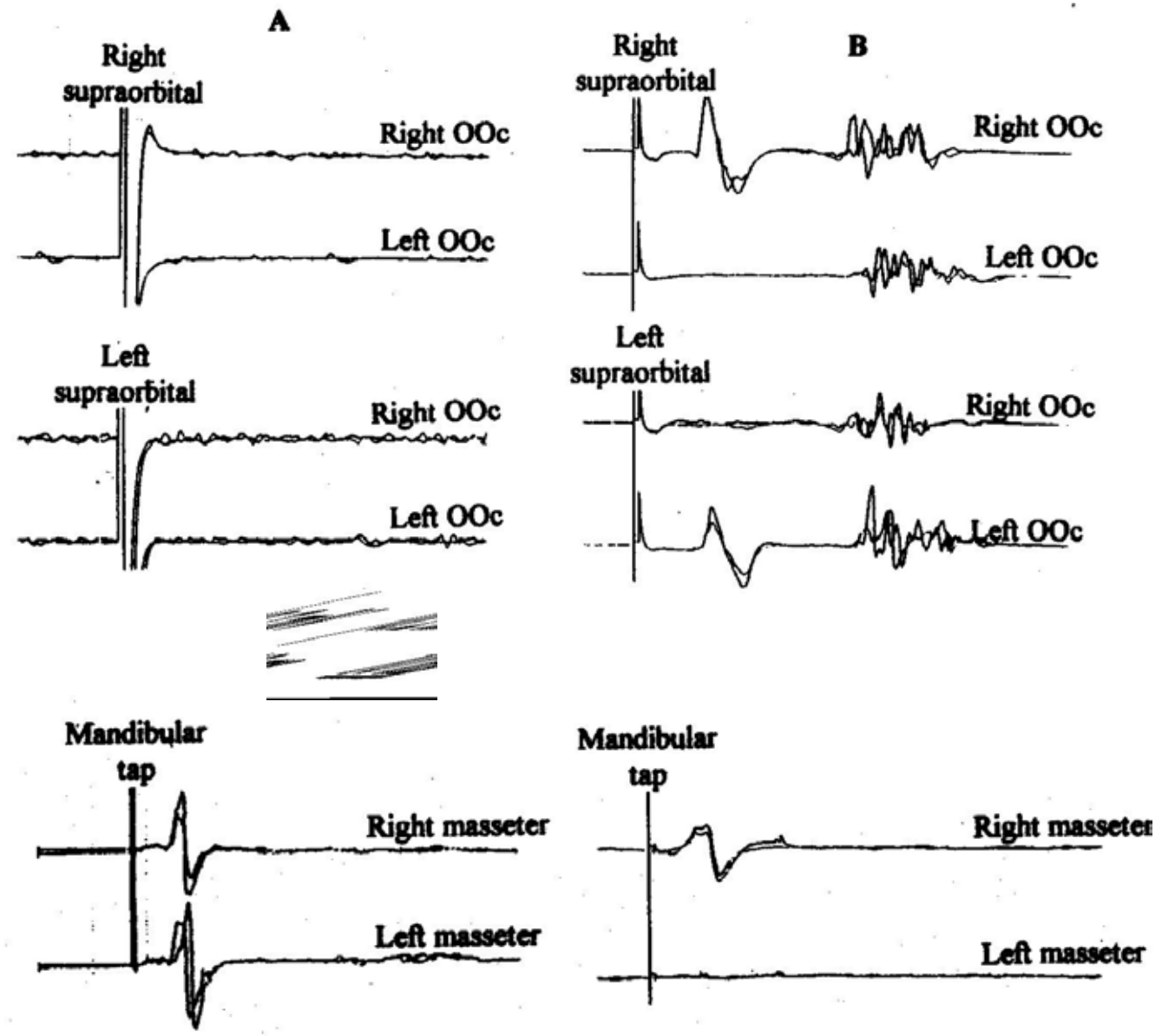


Mean latency: 7.0 ms
Interside differences: 0.7 ms

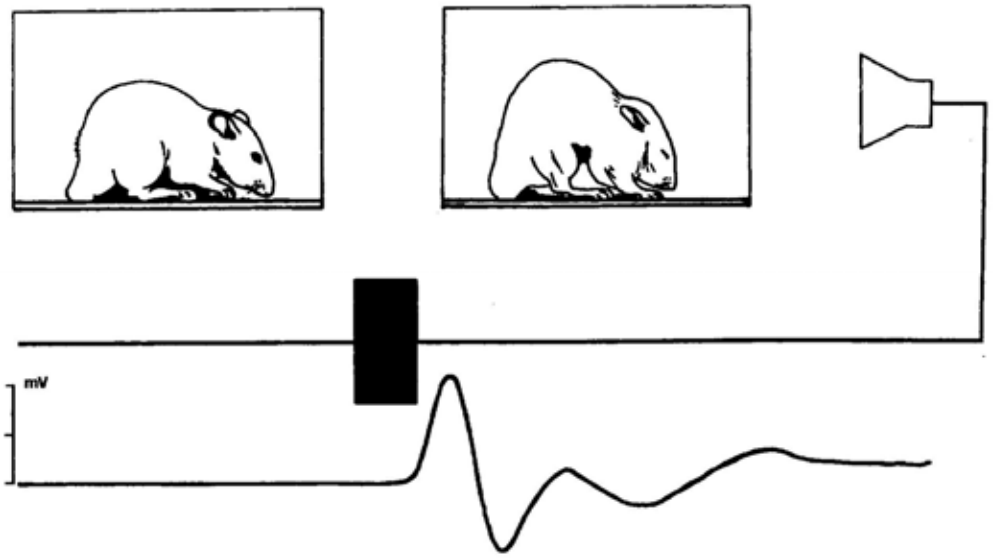
Hopf H Muscle Nerve 1994; 17, 475-484.

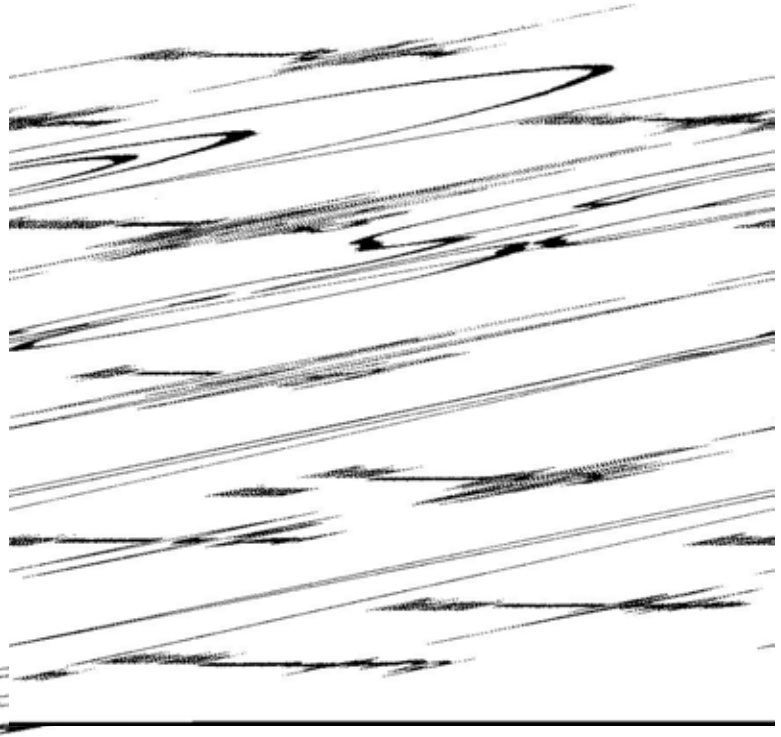
A: Patient with Sjögren's syndrome and trigeminal neuropathy

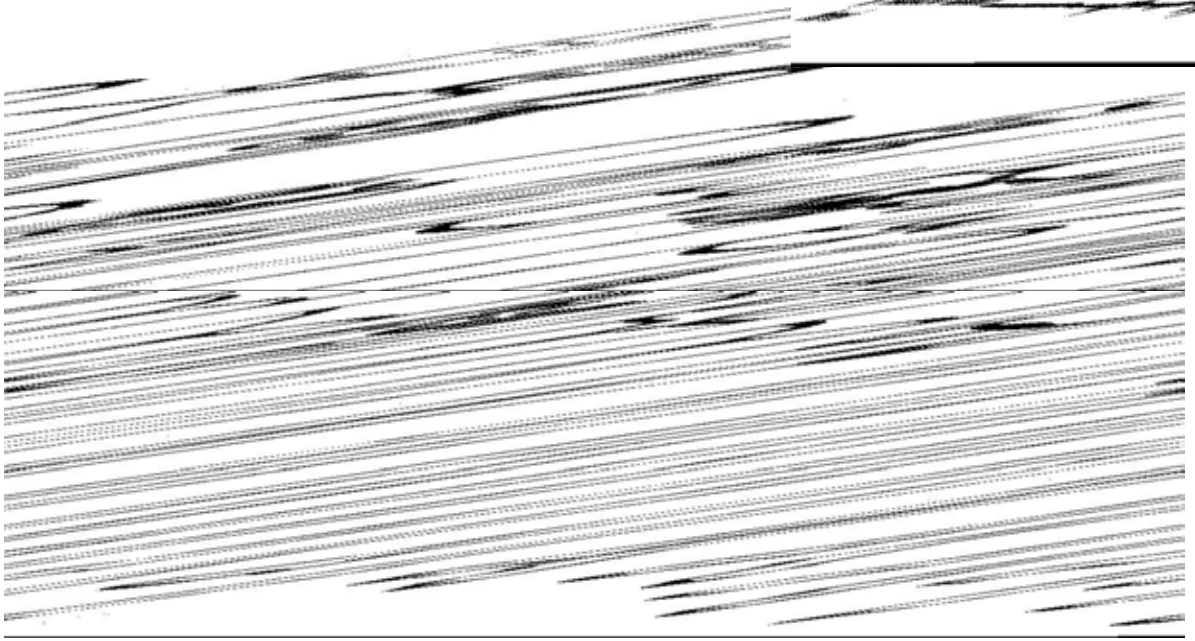
B: Patient with midbrain lymphoma

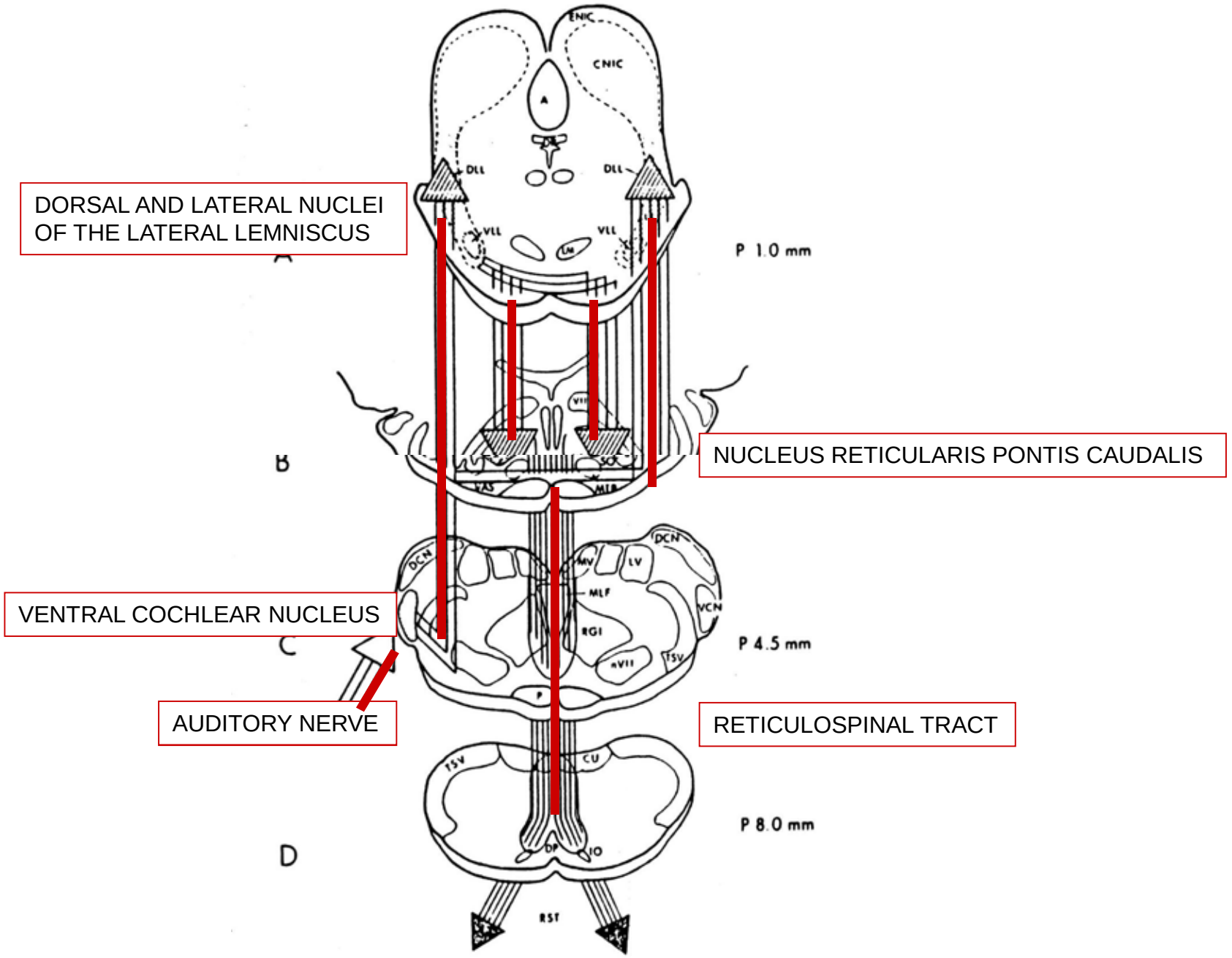


Ann Neurol., 1990(28): 786-790


mV

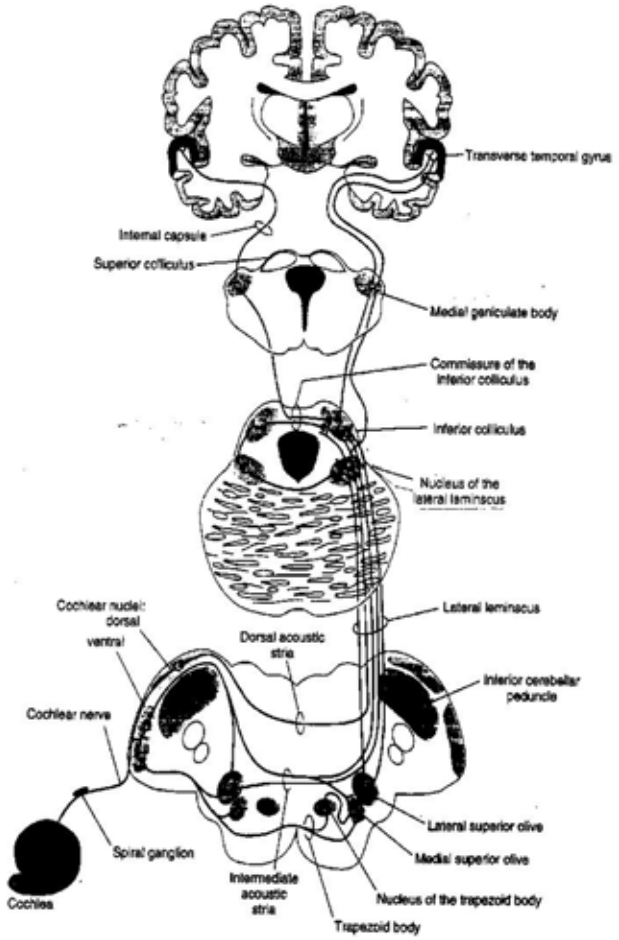




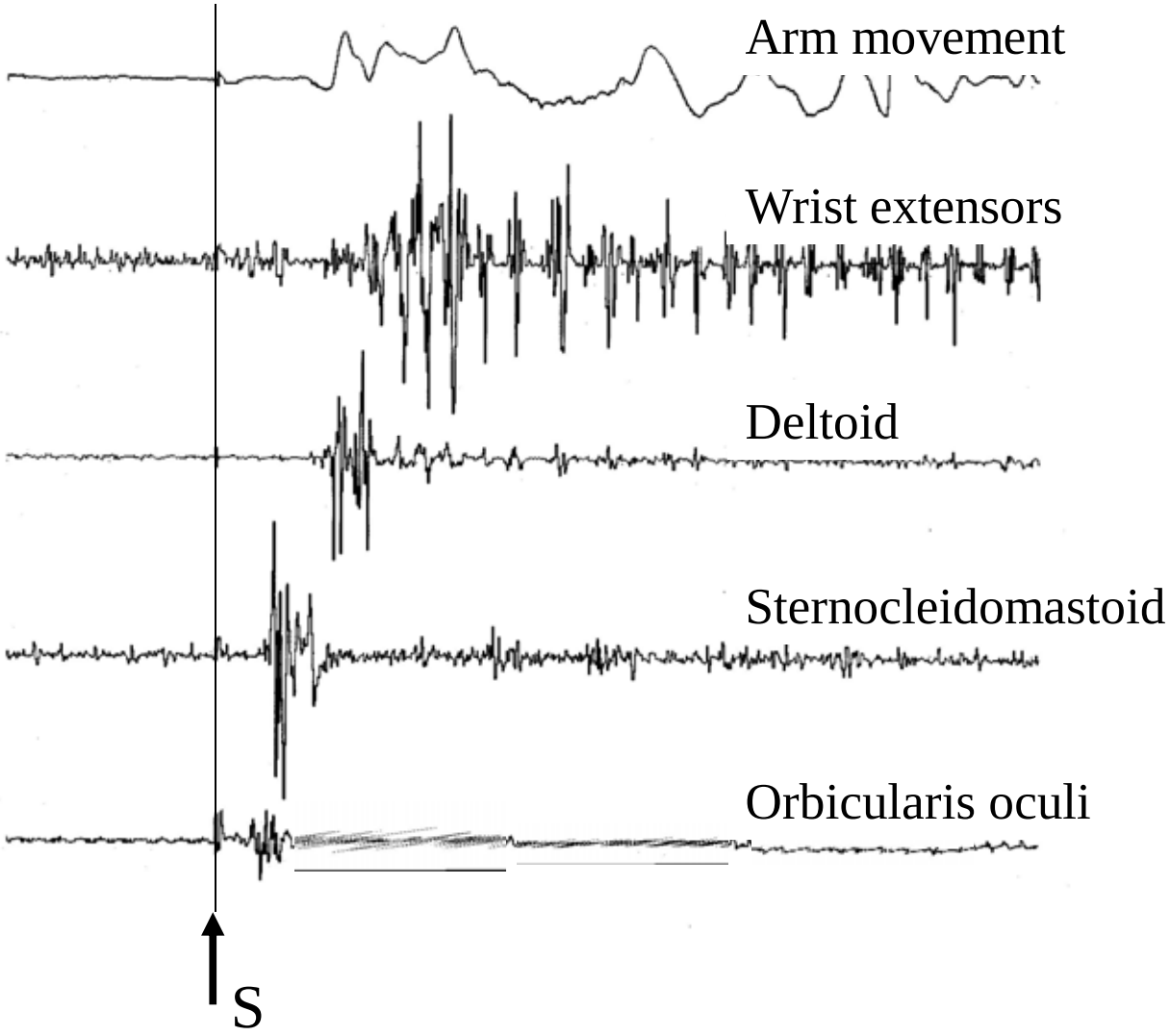


Davis M, Gendelman DS, Tischler MD, Gendelman PM. A primary acoustic startle circuit: lesion and stimulation studies. ***J Neurosci* 1982**;2:791-805.

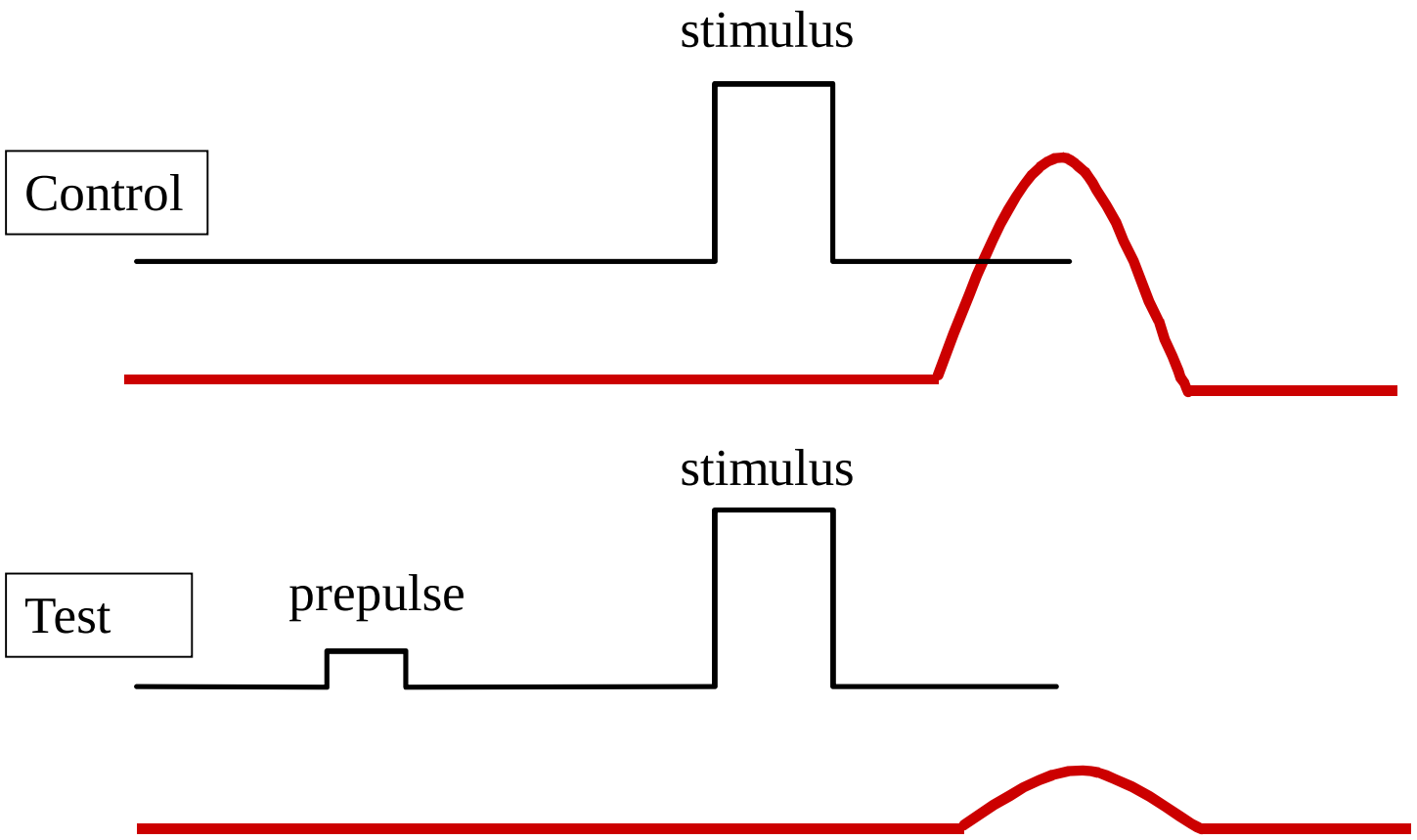
The startle reaction to an auditory stimulus



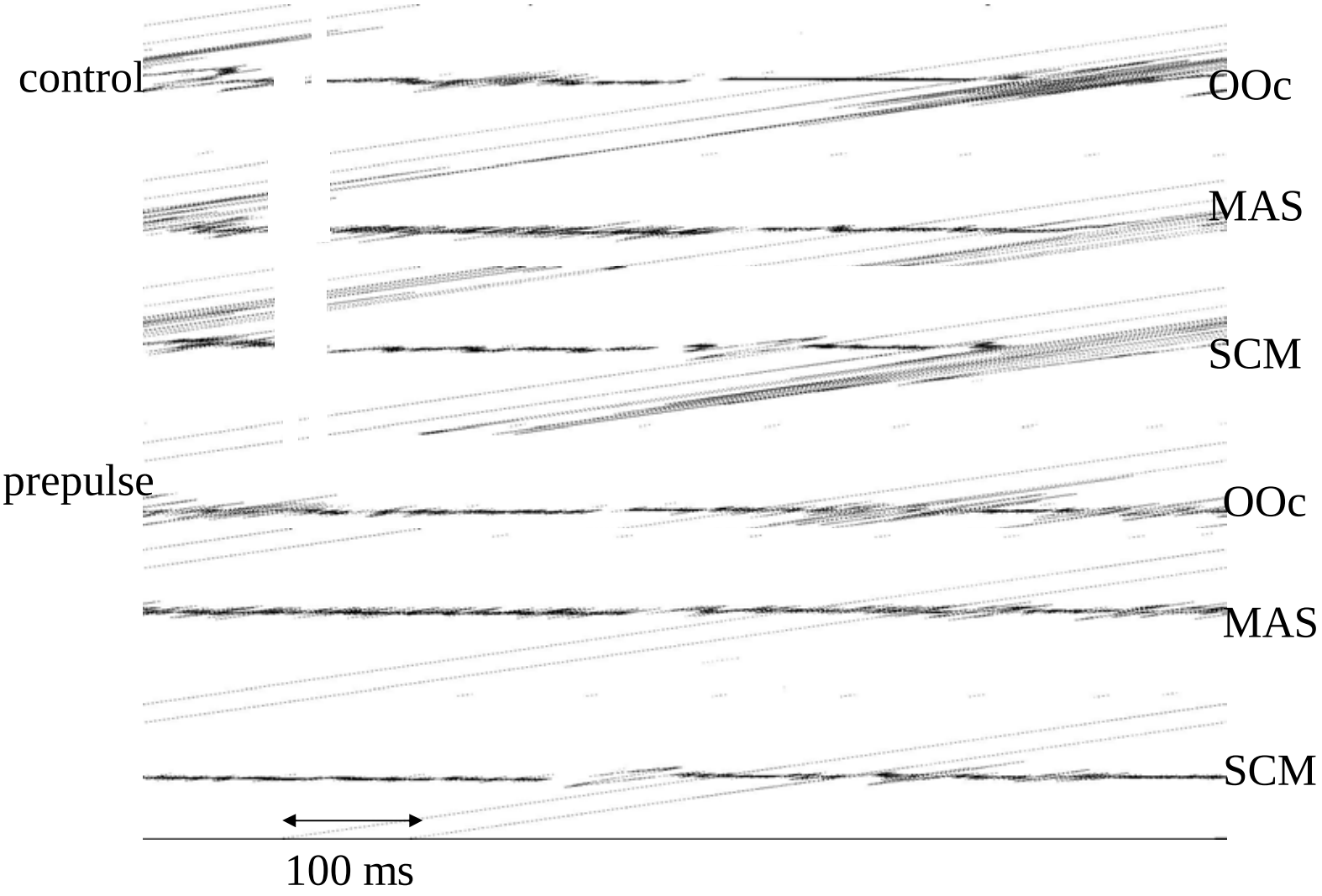
Via auditiva



Prepulse inhibition:
A weak stimulus that is unable to induce a response by itself, causes inhibition of the response to a subsequent stimulus

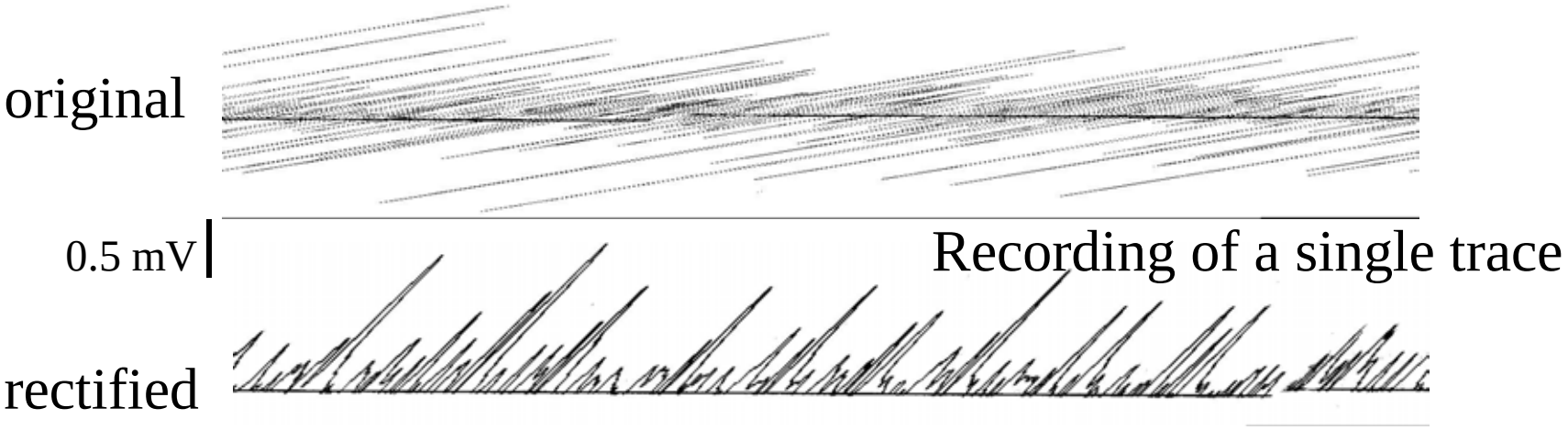


STARTLE REACTION

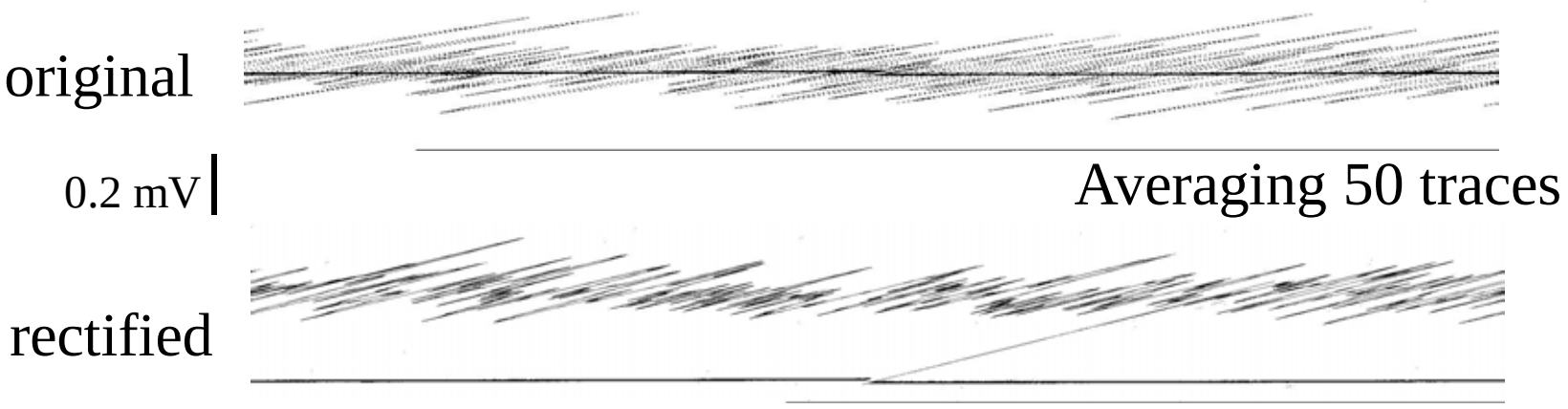


SILENT PERIODS
AND
INHIBITORY REFLEXES

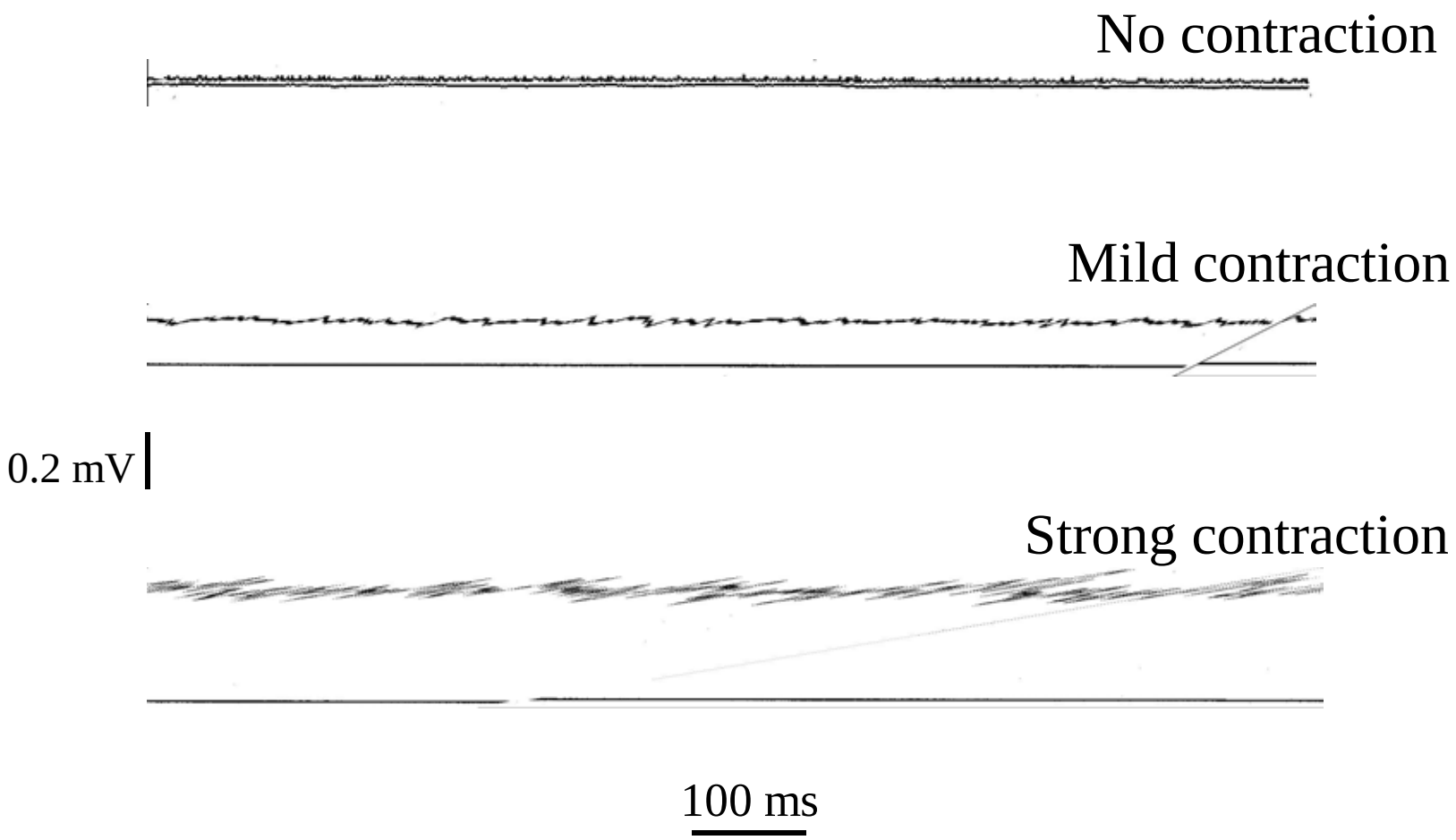
REFLEXES REQUIRING BACKGROUND CONTRACTION



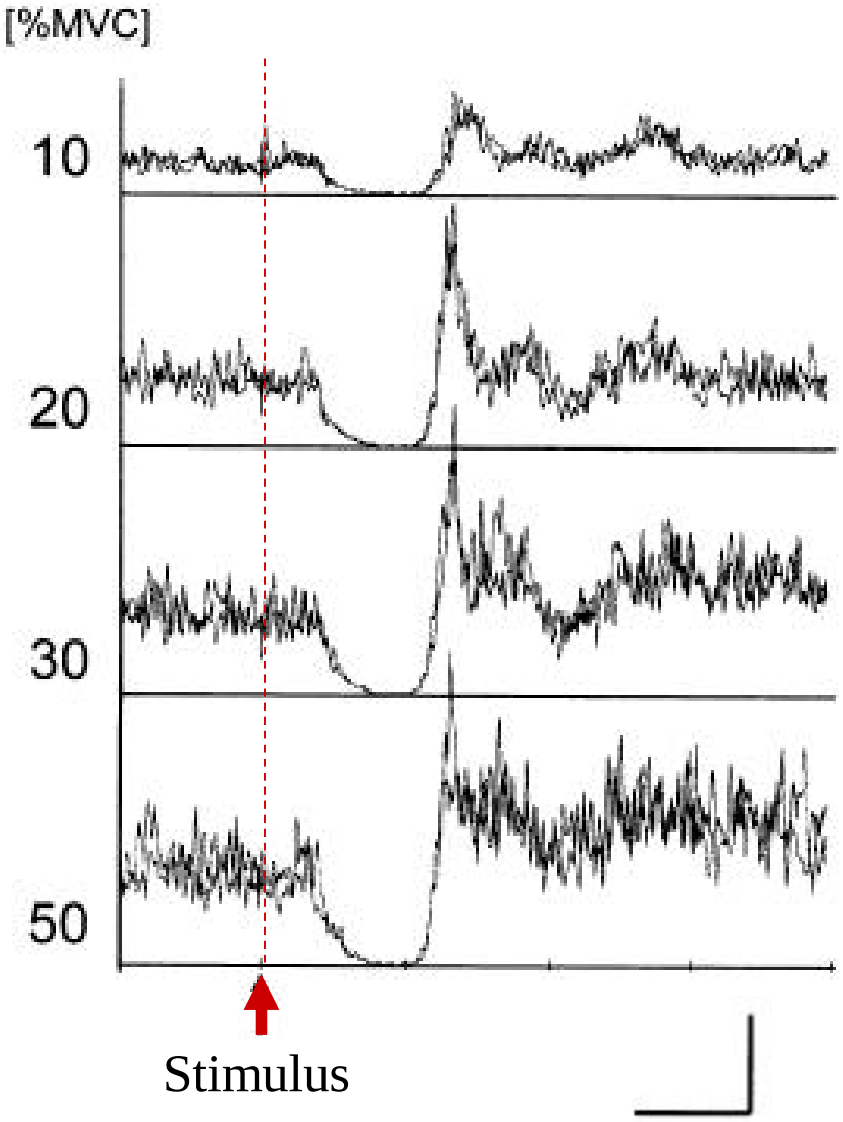
AVERAGING OF RECTIFIED EMG

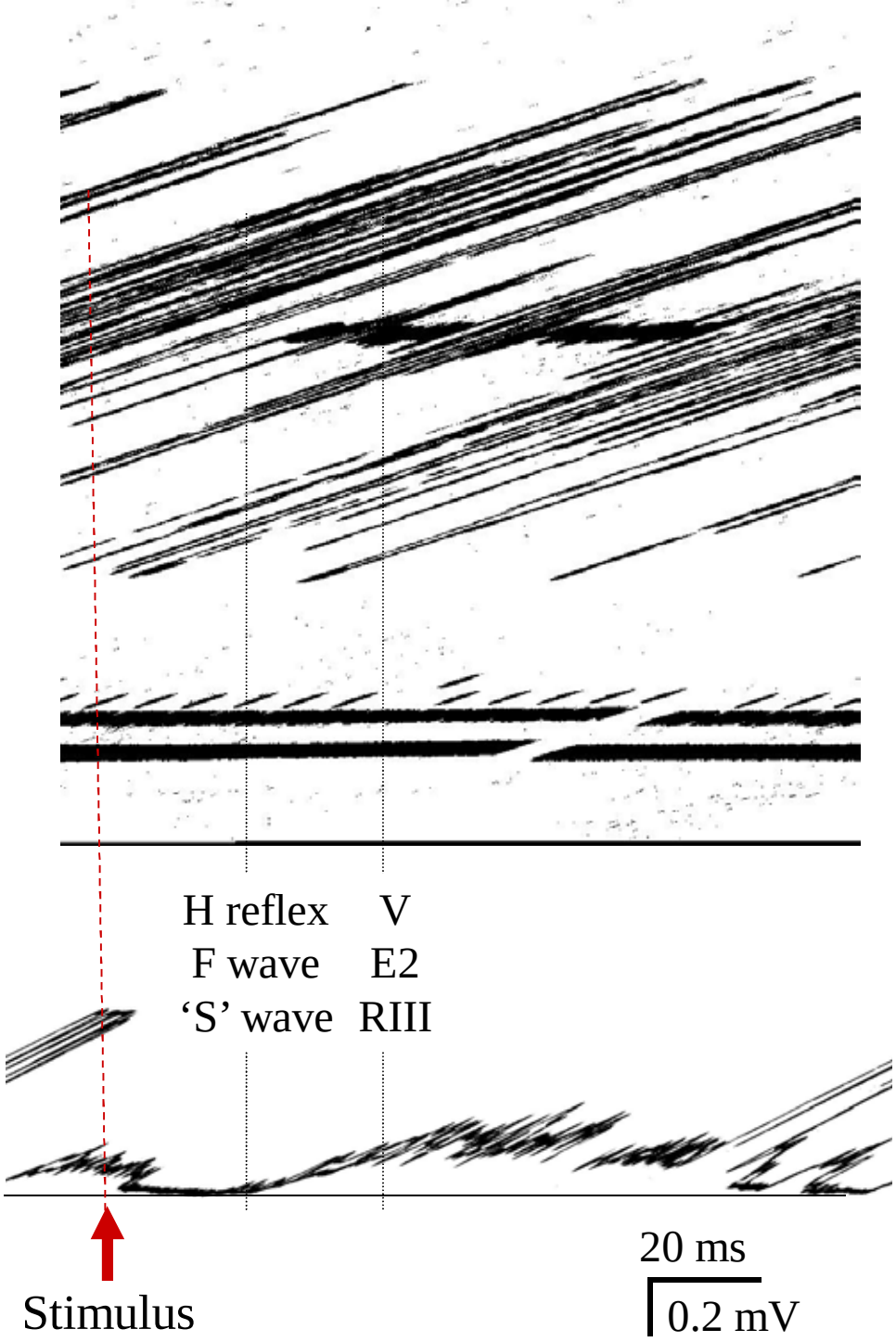


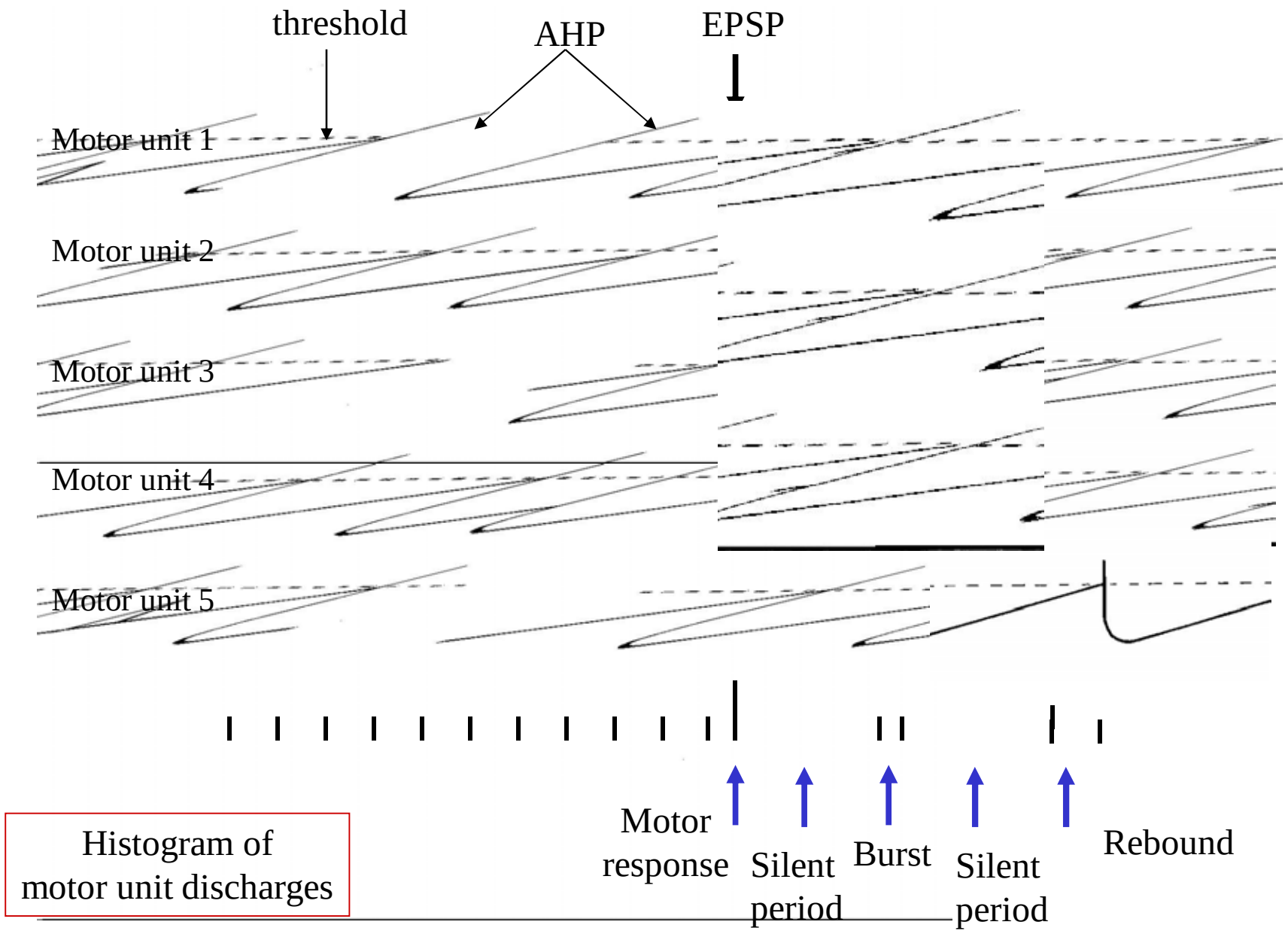
Averaging 100-200 traces of rectified EMG



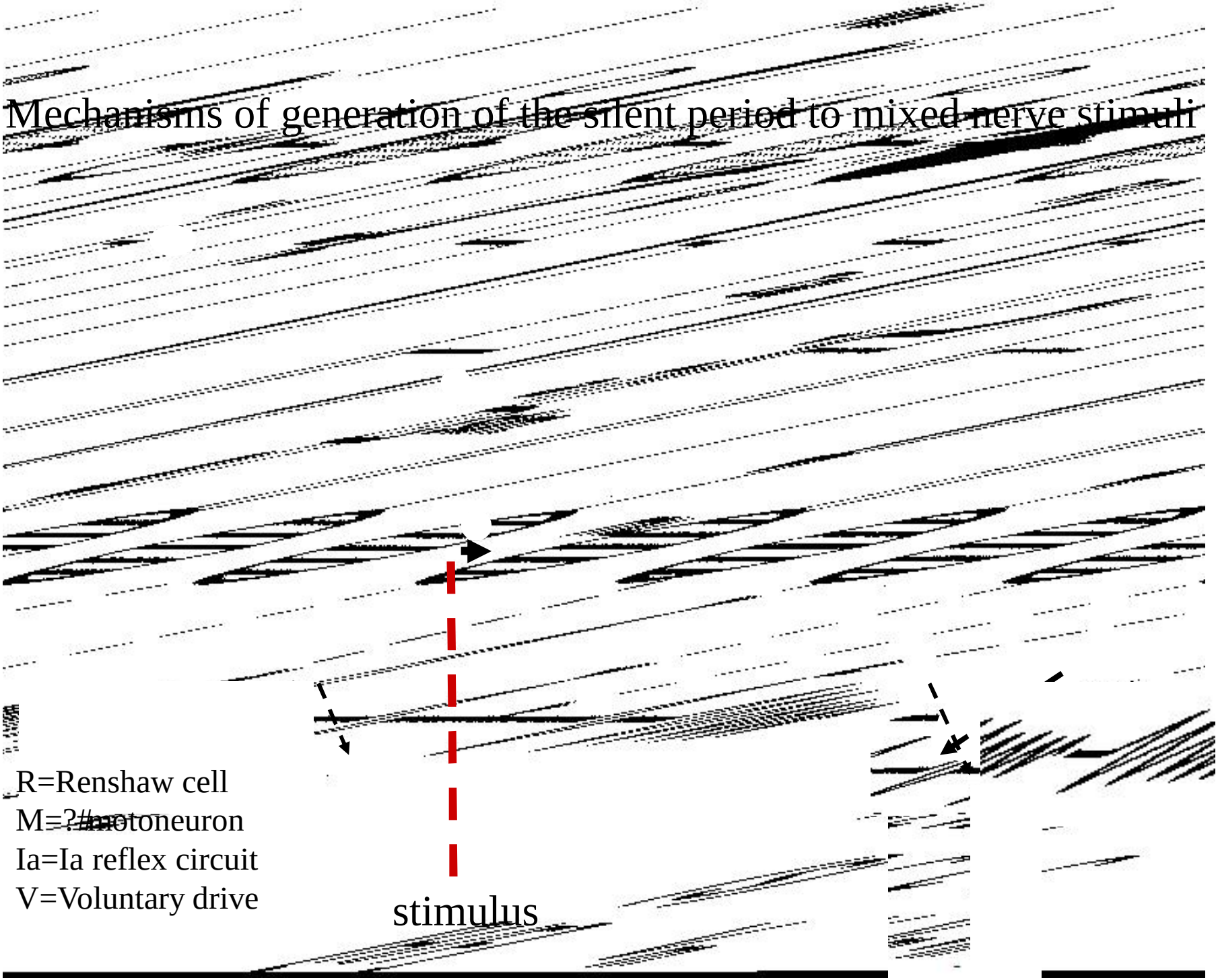
Cutaneous nerve - silent period






threshold
AHP
EPSP
Motor unit 1
Motor unit 2
Motor unit 3
Motor unit 4
Motor unit 5
Histogram of motor unit discharges
Motor response
Silent period
Burst
Silent period
Rebound

Mechanisms of generation of the silent period to mixed nerve stimuli



CONCLUSIONS

The H reflex, T wave and F wave should be part of the clinical studies of proximal nerve conduction when suspecting polyneuropathies or radiculopathies

The blink reflex, jaw jerk and masseteric inhibitory reflex are useful in the study of cranial nerves and brainstem lesions

The study of inhibitory reflexes requires modulation of the EMG activity. The silent period to cutaneous afferents differs from that to mixed nerve afferents.
Collision between antidromic impulses and descending volleys explains the presence of bursts in the middle of the silent period to mixed nerve stimuli