EMG; clinical practice

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What do we want to express

- **Muscle membrane function - spontaneous**
- **Muscle fibre characteristics; diameter**
- **MU organisation**
  - number of fibres
  - grouping
- **N-M transmission**
- **# motor units**
  - total
  - activation; pattern, fullness

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Steps in EMG analysis

- **at rest** - spontaneous activity
  - fibs, psw, myotonia, complex rep discharges
  - fasciculations, myokymia

- **at slight voluntary contraction** - MUP
  - shape parameters, stability (jiggle), behaviour

- **at strong contraction** - interference pattern
  - recruitment, fullness, MUP parameters

At rest

- No electrical activity, NOTE, muscle position for complete rest

- EXCEPTIONS (we may hear something!)
  - insertion activity
  - motor end-plate noise
  - nerve spikes
  - few positive waves in end-plate region

Spontaneous EMG activity
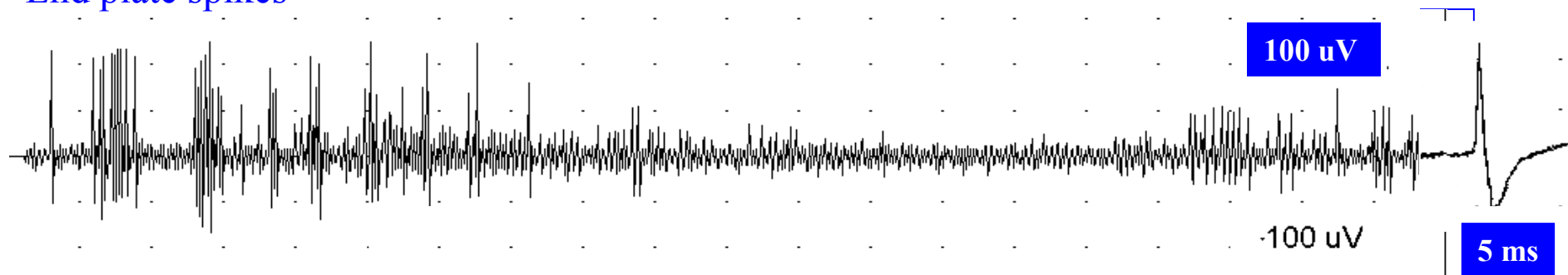
– **Spontaneous activity generated in the muscle**

»Insertional activity Myotonic discharges

»End-plate spikes CRD

Myogenic doublets

– **Spontaneous activity generated in the nerve or anterior horn cell**

»Fasciculations Fasciculations

»Double discharges Double discharges

Neurotonic discharges

Myokymic discharges

Double discharges

Cramp discharges

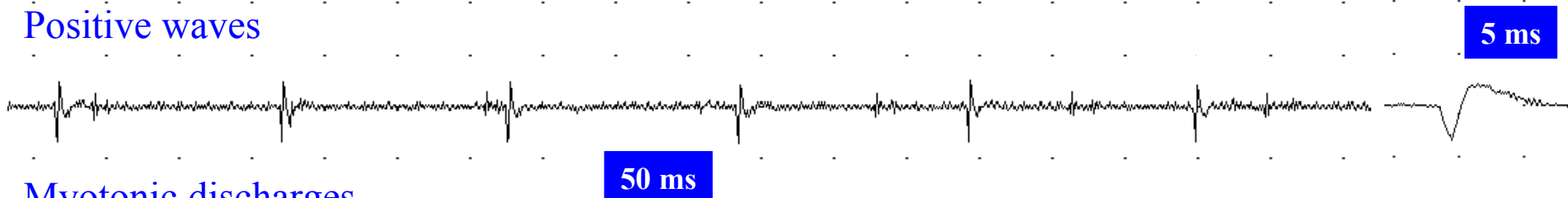Synkinesis

Generated in the muscle fibre

End plate spikes

100 uV

-100 uV

5 ms

Seen in end-plate region also in normal muscle: irrgular, with initial negativity
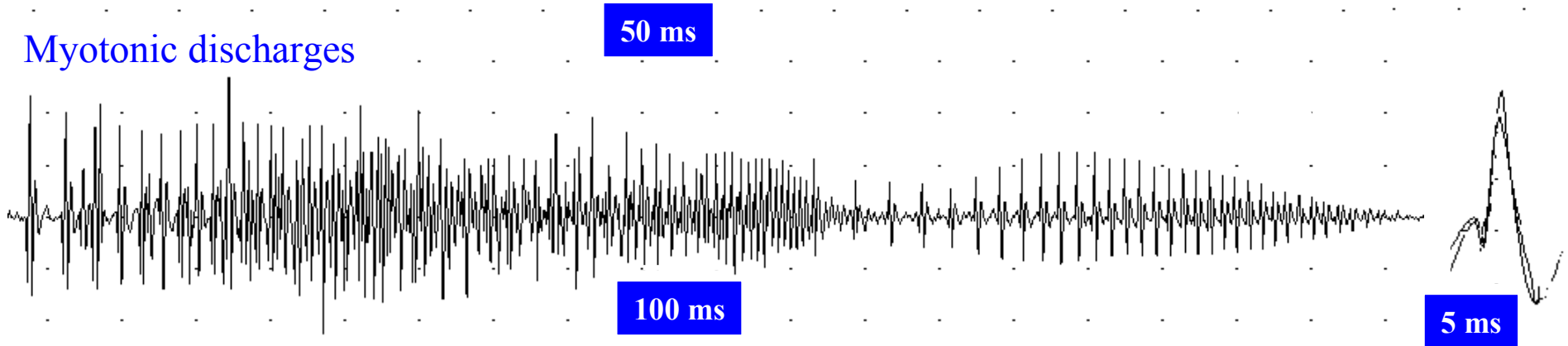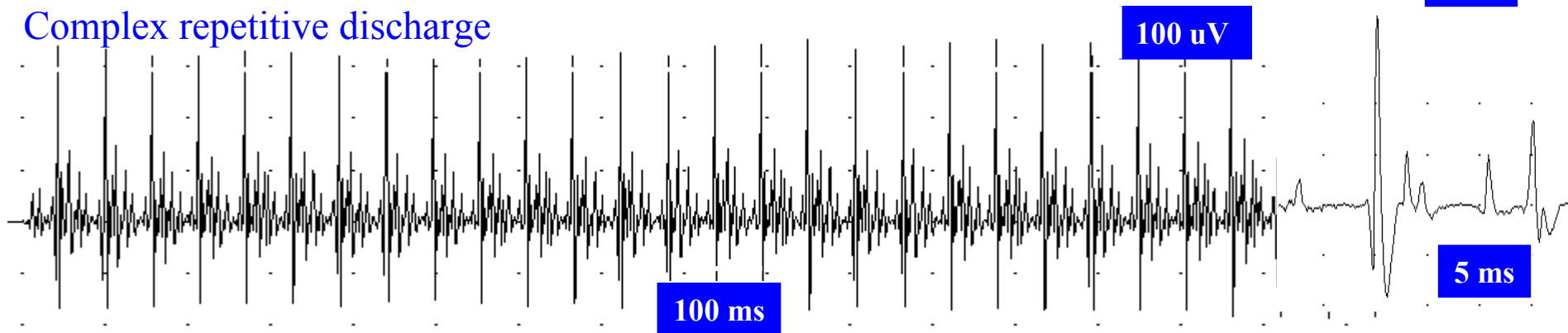
Generated in the muscle fibre

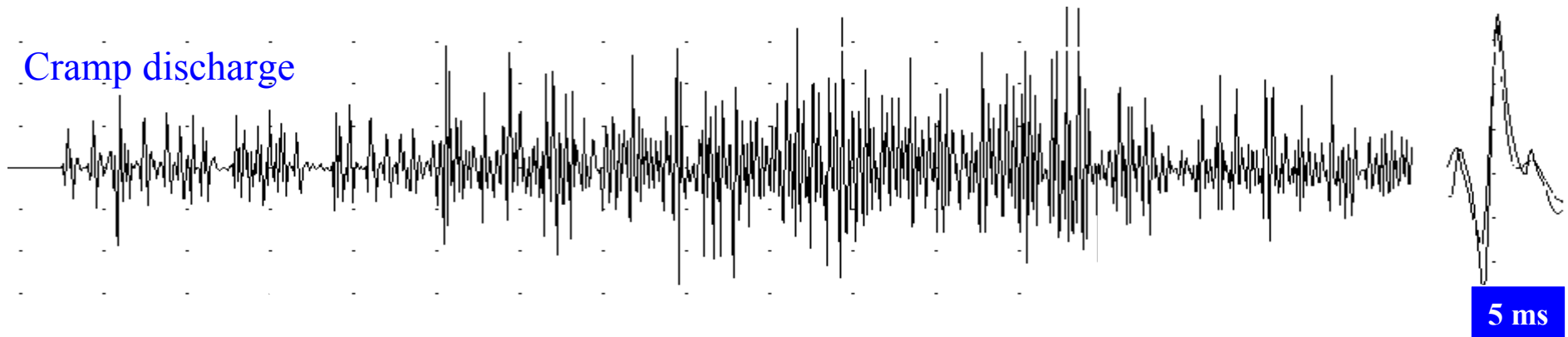**Fibrillation potentials**

5 ms

500 ms

Positive waves

5 ms

50 ms

Myotonic discharges

100 ms

5 ms

Complex repetitive discharge
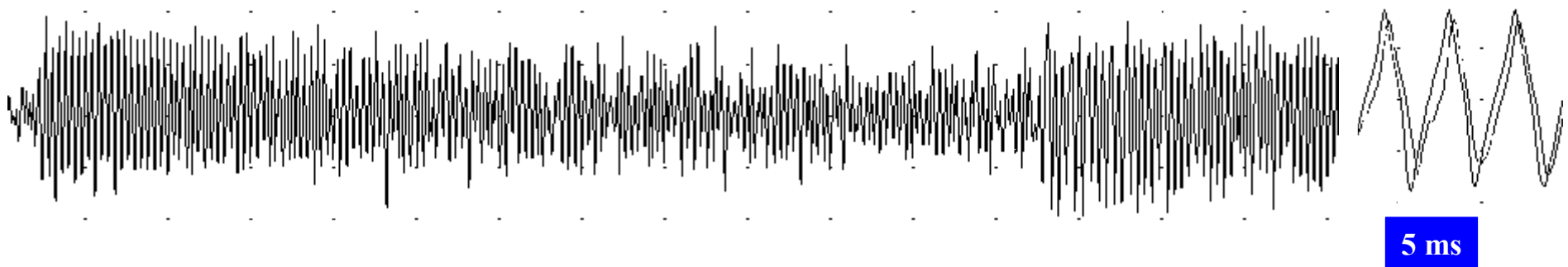
100 uV

100 ms

5 ms

Generated in the nerve/motor neurone
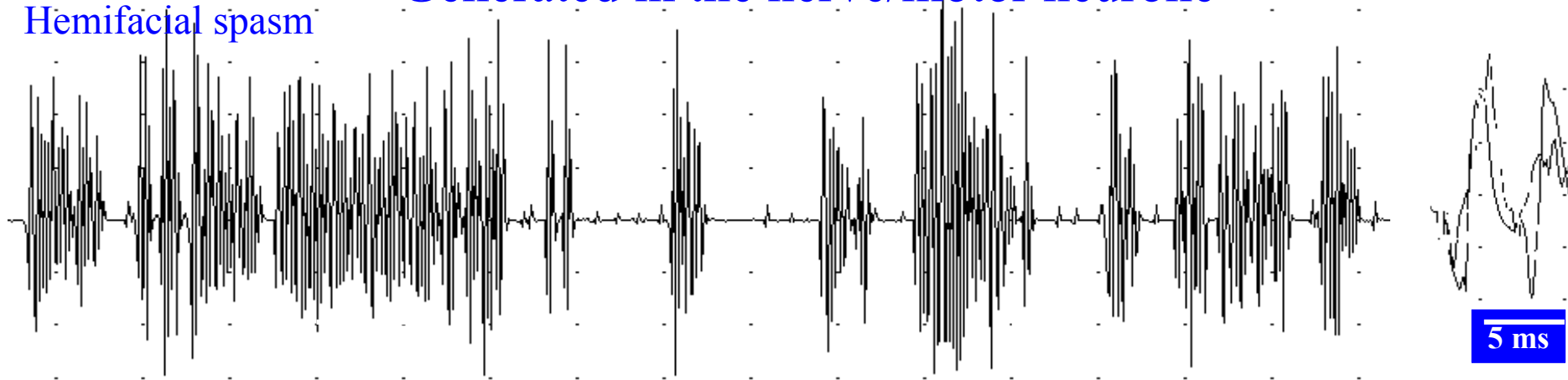
Cramp discharge
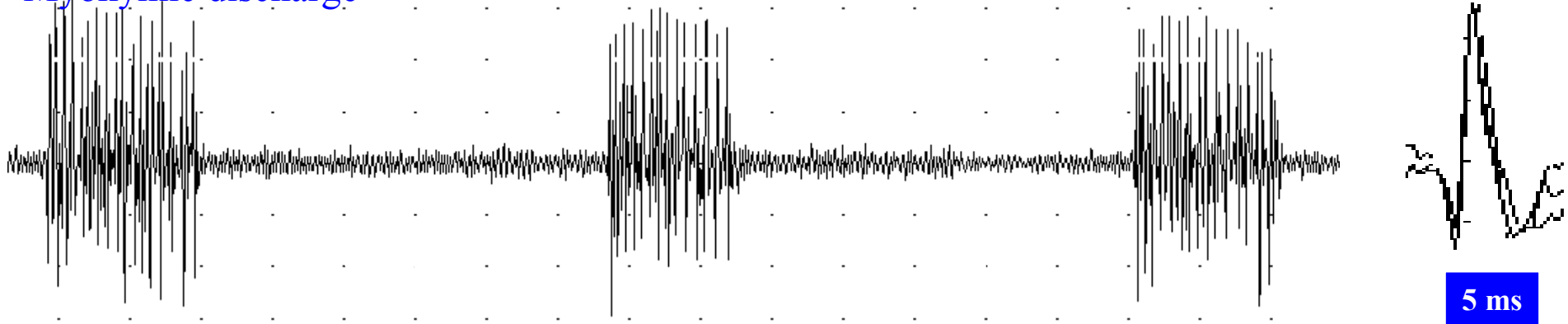
5 ms

Neurotonic discharges

5 ms

Generated in the nerve/motor neurone

Hemifacial spasm

5 ms

Myokymic discharge

5 ms

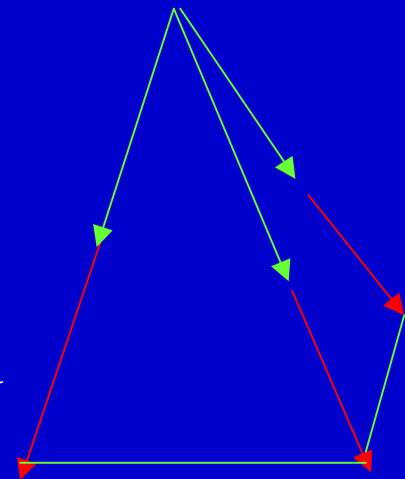Fasciculation potentials

5 ms
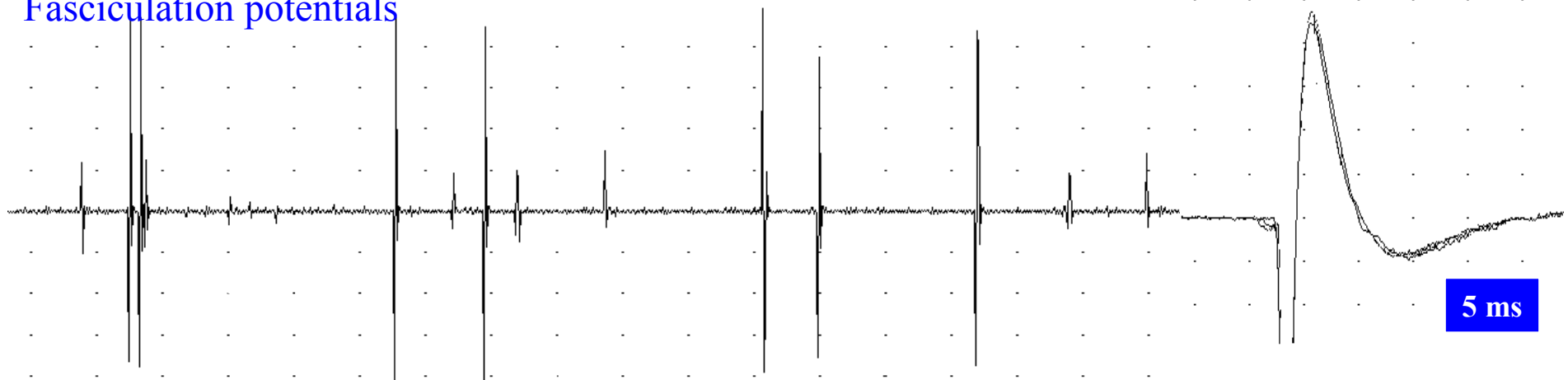
Slight contraction

- Pinch the skin at insertion point (distraction)
- Ask for slight contraction. Move the electrode a little to reach "focus", sharp signals
- Move the needle to new position
  - 2 mm deeper
  - 2 mm deeper
  - out and then new direction--pyramid
- 2-3 skin insertions, total 30 MUPs

A

B

C

0,5 mV

5 ms
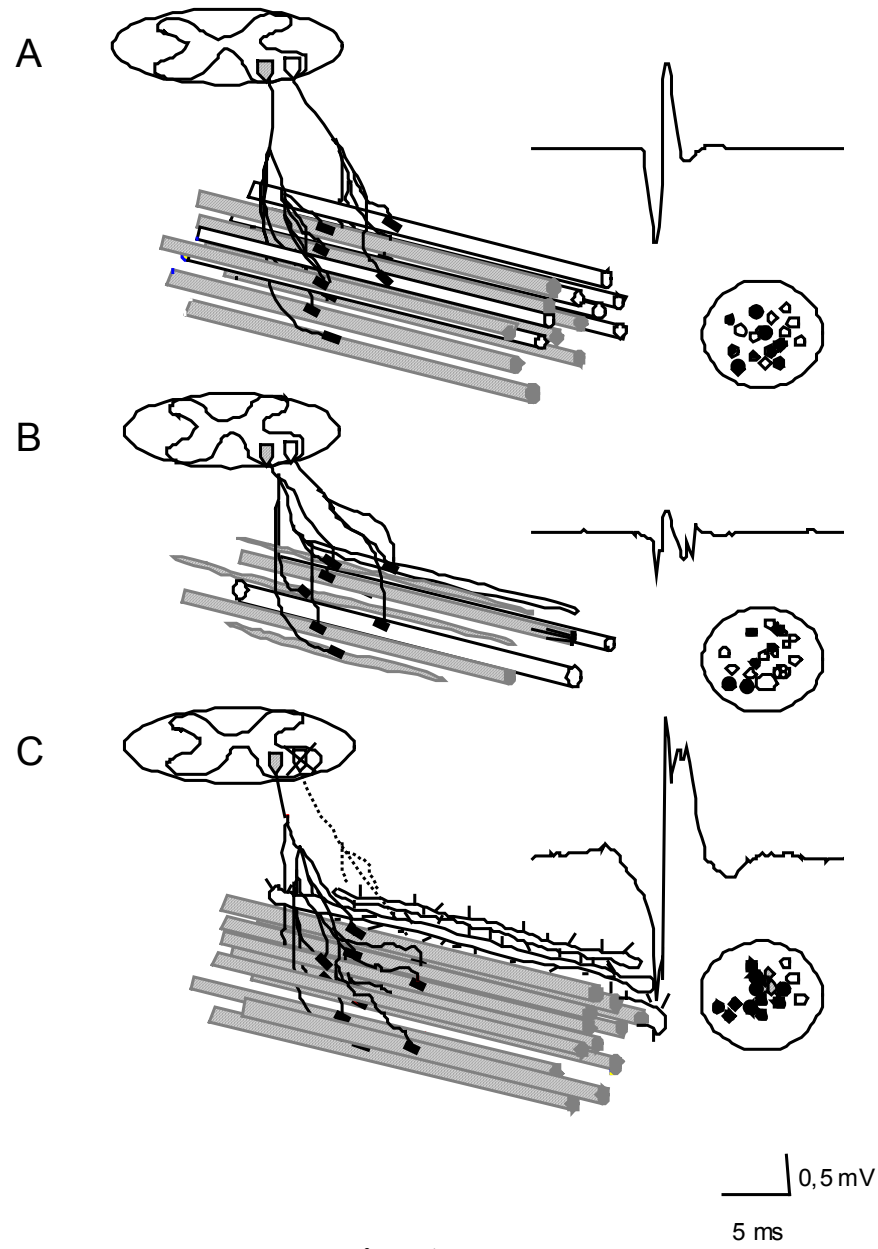
Fig. 1

EMG - interference pattern
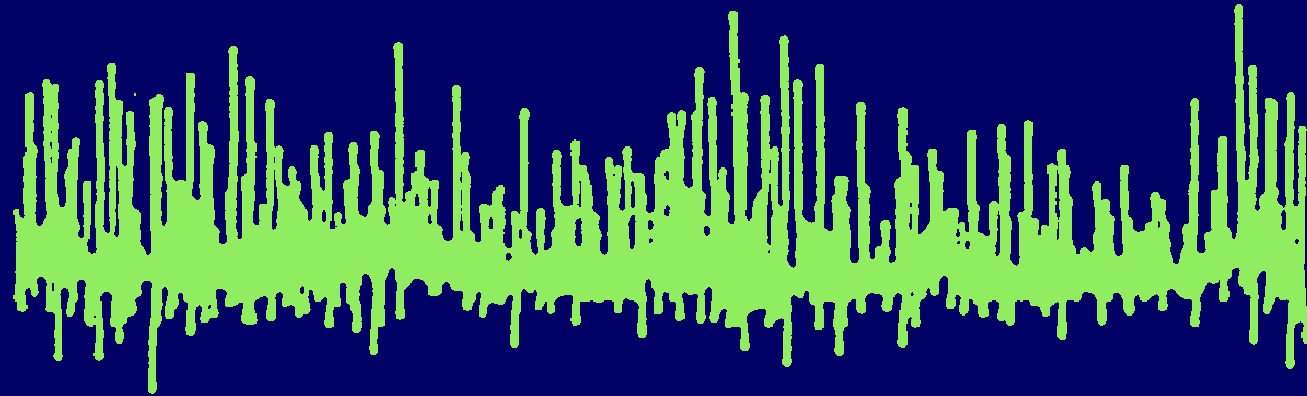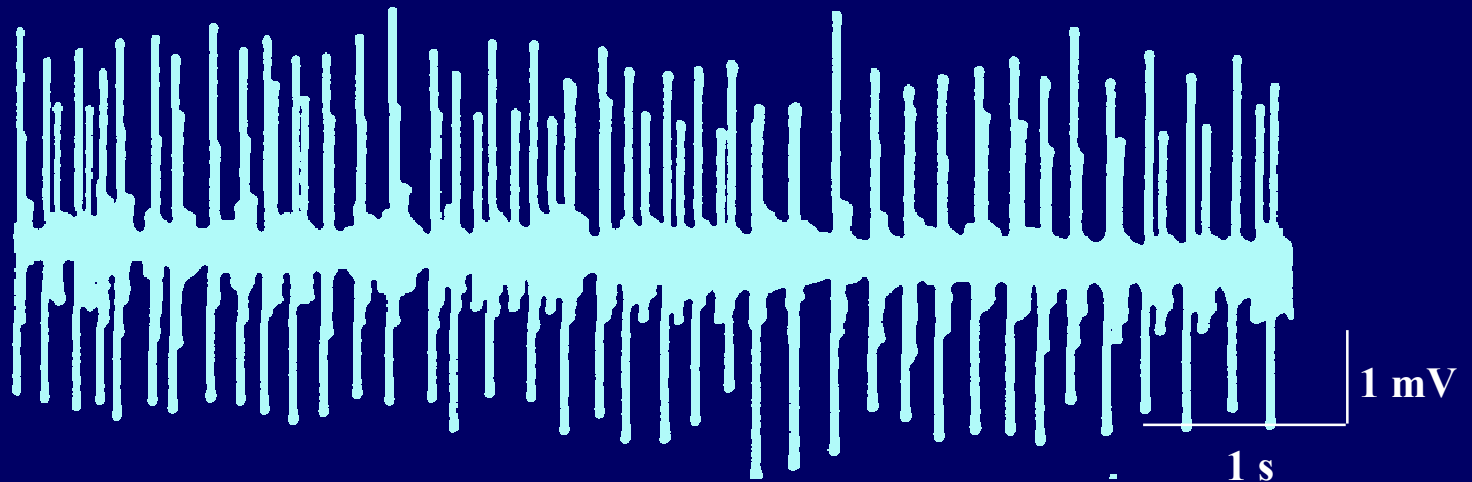
Myopathy

- **spont (m)**   fib/psw   myotonic   CRD
- **spont (n)**   **neurotonia myokymia**
- **MUP**   **normal**   **↑ ampl**   **↑ dur**   ↓ ampl   ↓ dur
- **shape**   **normal**   poly
- **jiggle**   **normal**   ↑
- **recruitment**   **normal**   early   **late**
- **TA/FFT**   **normal**   **neurog**   myopathic
- **fullness**   normal   **no activity ↓**
- **FD**   **normal**   ↑
- **jitter**   normal   ↑

Inactive neurogenic

spont (m)	fib/psw	myotonic	CRD		
spont (n)	neurotonia	myokymia			
MUP	normal	↑ ampl	↑ dur	↓ ampl	↓ ampl
shape	normal	poly			
jiggle	normal	↑			
recruitment	normal	early	late		
TA/FFT	normal	neurog.	myopathic		
fullness	normal	no activity ↓			
FD	normal	↑			
jitter	normal	↑			

Subacute neurogenic

- **spont (m)**   fib/psw   **myotonic**   CRD
- **spont (n)**   neurotonia myokymia
- **MUP**   **normal**   ↑ ampl   ↑ dur   ↓ **ampl**   ↓**ampl**
- **shape**   **normal**   poly
- **jiggle**   **normal**   ↑
- **recruitment** **normal**   **early**   late
- **TA/FFT**   **normal**   neurog.   **myopathic**
- **fullness**   **normal**   **no activity** ↓
- **FD**   **normal**   ↑
- **jitter**   **normal**   ↑

Myasthenic pattern

- spont (m)   (fib/psw)   myotonic   CRD
- spont (n)   neurotonia myokymia
- MUP   normal   ↑ ampl   ↑ dur   ↓ ampl   ↓ampl
- shape   normal   poly
- jiggle   normal   ↑
- recruitment normal   early   late
- TA/FFT   normal   neurog.   myopathic
- fullness   normal   no activity ↓
- FD   normal   ↑
- jitter   normal   ↑

Central weakness

- **spont (m)**   **fib/psw**   **myotonic**   **CRD**
- **spont (n)**   **neurotonia myokymia**
- **MUP**   normal   **↑ ampl**   **↑ dur**   **↓ ampl**   **↓ ampl**
- **shape**   normal   **poly**
- **jiggle**   normal   **↑**
- **recruitment**   normal   **early**   **late**   irregular
- **TA/FFT**   normal   **neurog.**   **myopathic**
- **fullness**   normal   **no activity** ↓
- **FD**   normal   **↑**
- **jitter**   normal   **↑**

Practical hints - the patient

- inform the patient about reason for EMG
- explain expected discomfort
- do not display the electrode
- term "pin" (or similar) better than needle
- keep bloody tissues away
- do not state number of remaining muscles
- inform about soreness for 1-2 days
- inform the patient about next step

Practical hints - the examiner

- medical consultation
- read referral before you see the patient
- check history, phys exam
- formulate strategy
- inform the patient about the progress
- have all supplies ready before exam
- use gloves

Practical hints - the investigation

- no skin preparation is necessary
- support your hand on patients extremity
- electrode perpendicular to the skin
- small but brisk insertion through the skin
- do not go very deep, just beneath the fascia
- investigate the muscle at
  - rest (denervation),
  - slight contraction (MUP) and
  - strong contraction (IP)

EMG and neurography in nerve-muscle disorders

Assesses:

- site - central, nerve, nmj, muscle
- pathophysiology
- distribution
- degree of pathology
- dynamics (active - inactive)
- specific findings (myotonia …cond. block)
- changes over time - monitoring (quantitatively)
- guidance for biopsy

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