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 activity from the muscle

FINDING

- fibrillation potentials, psw
- myotonic discharges
- CRD
- myokymic discharges
- myogenic extra discharges

MEASURE AS

- **#/ 10 recording sites**
- **or +, ++, +++, ++++**
  - **few**
  - **moderate**
  - **abundant**
- **or**
  - **spontaneous or**
  - **after provocation**

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Spontaneous activity from the nerve

FINDING

- neurotonic discharges
- myokymic discharges
- muscle cramps
- fasciculations
- neurogenic extra discharges

MEASURE AS

- **#/ 10 recording sites**
- **or +, ++, +++, ++++**
  - **few (per time unit)**
  - **moderate**
  - **abundant**
- **indicate**
  - **spontaneous or**
  - **after provocation**

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Spontaneous EMG activity

–Spontaneous activity generated in the muscle

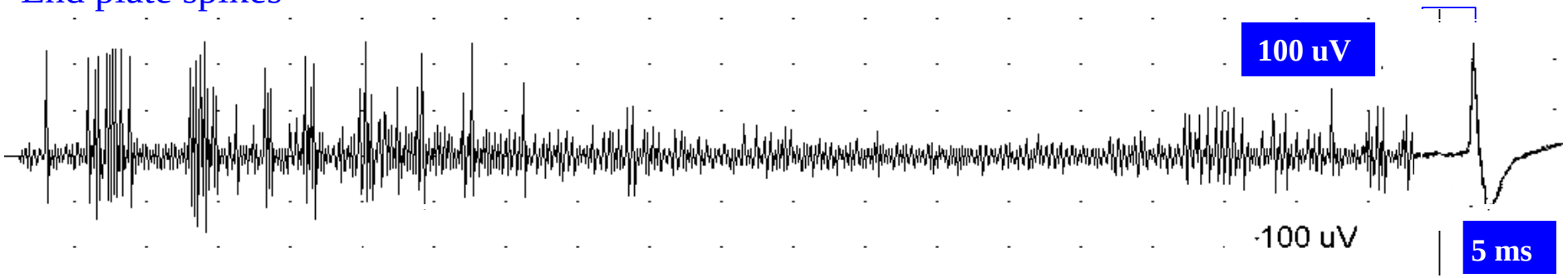
- »Insertional activity — Myotonic discharges
- »End-plate spikes — CRD
  Myogenic doublets

–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

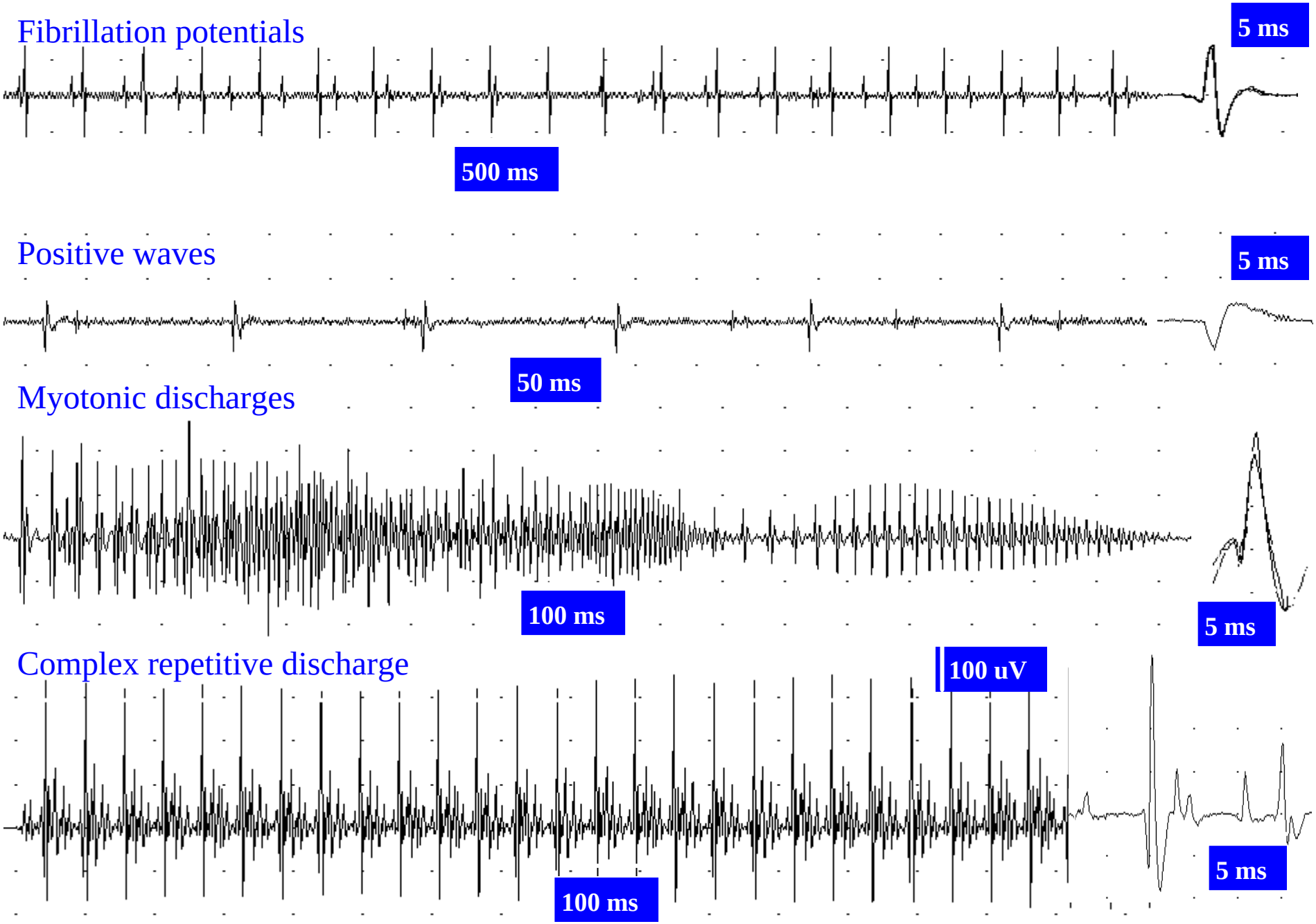
Generated in the muscle fibre

End plate spikes

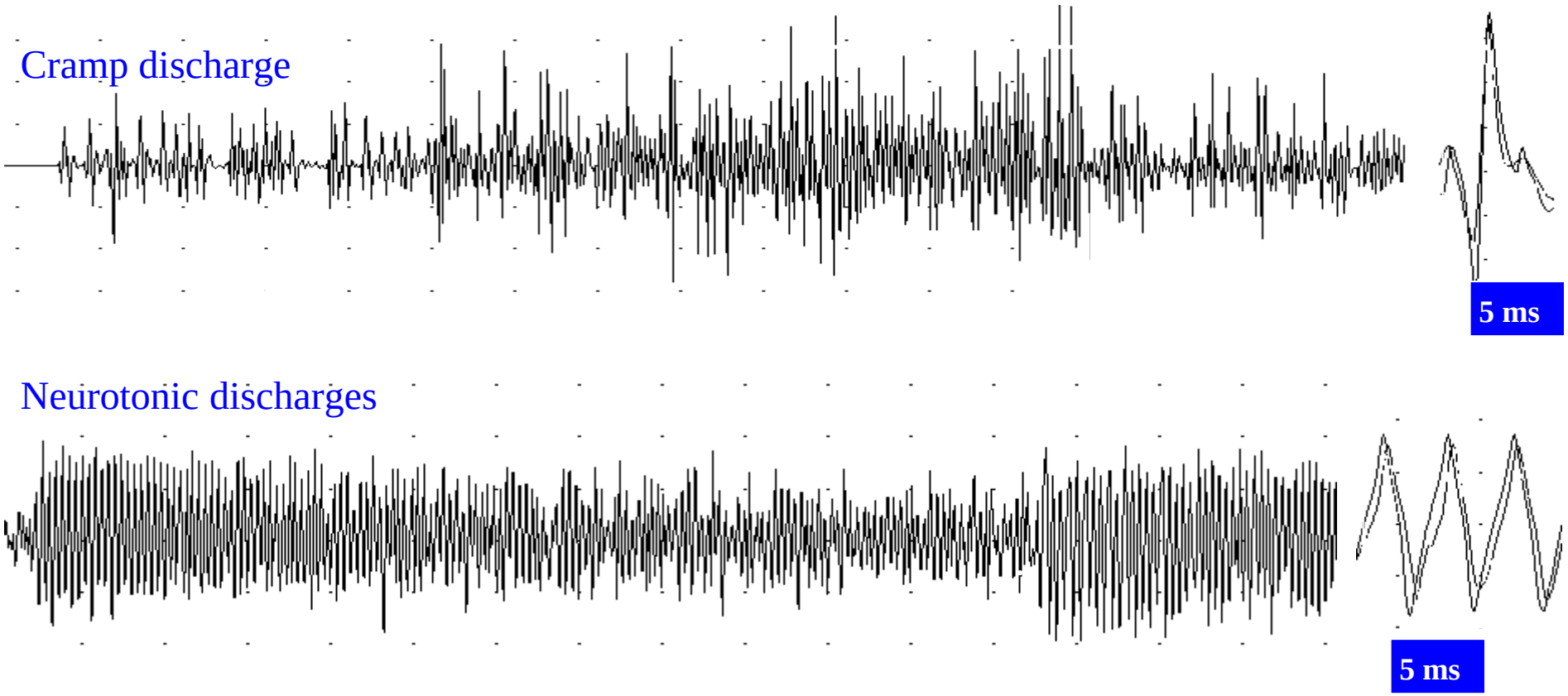


Seen in end-plate region also in normal muscle:
irrgular, with initial negativity

Generated in the muscle fibre

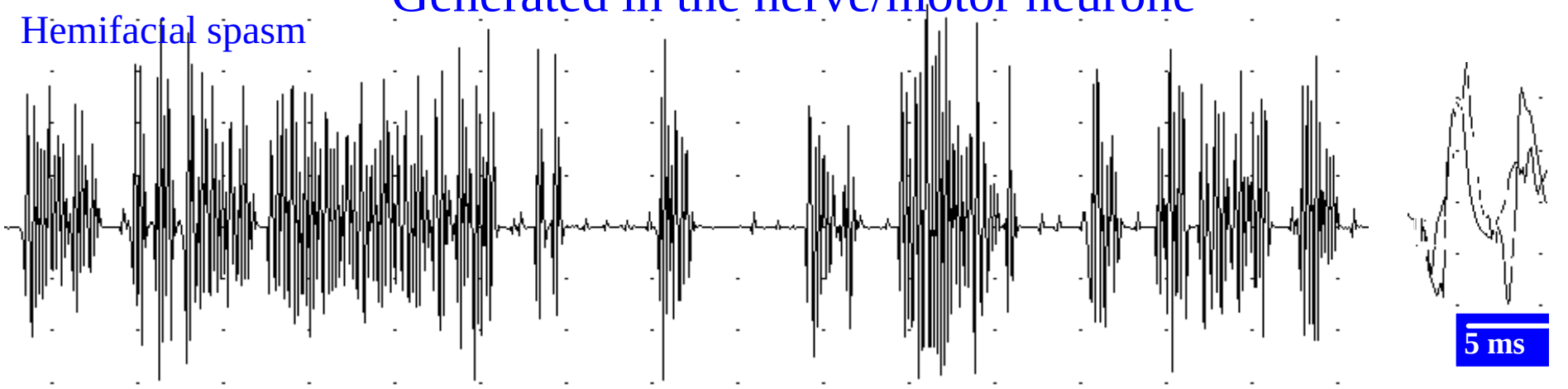


Generated in the nerve/motor neurone

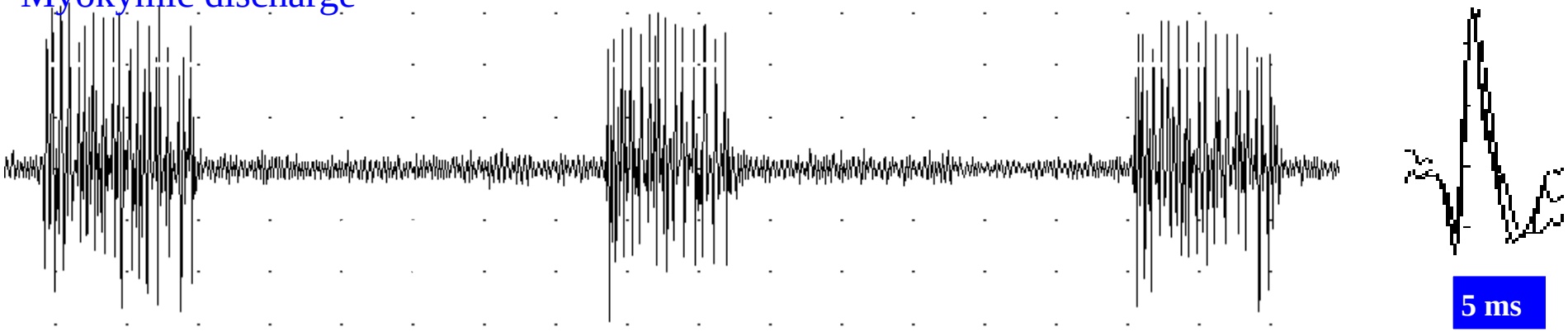


Generated in the nerve/motor neurone

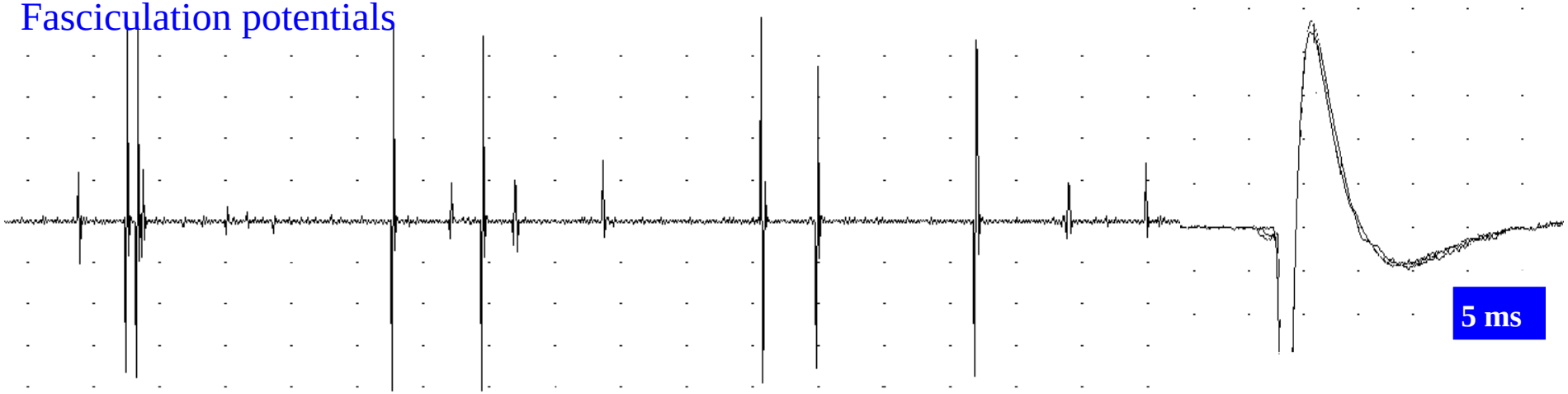
Hemifacial spasm



Myokymic discharge



Fasciculation potentials



Insertional activity

- **Description:** burst of psw or biphasic act, < 300 msec
- **Generated by**: needle movement
- **Seen in:** all normal. May be prolonged in denervation
- **Not seen in**: fibrosis, hyperkal.per.par

End-plate noise

- **Description:** low amplitude noise, neg waves
- **Generated by**: mepp
- **Seen in:** normal muscle
  - at end-plate region
  - often accompanied by pain
- **Not seen in**: denervation

End-plate spikes

- **Description:** irregular negative spikes (100-200 uV) in end-plate regions (often with end-plate noise in the backgound)
- **Generated by**: needle irritation of terminal nerve activating the muscle fibres
- **Seen in:** normal end-plate region
- **Not seen in**: denervation

Fibrillation potentials and positive sharp waves

- **Description:** Fib: usually regular(> 50%), s.f.a.p, rate 0.5-15
  psw: often irregular discharges or runs

- **Generated by**: denervated muscle fibres 7-21 days after axonal damage

- **Seen in:**
  - nerve lesions
  - axonal neuropathies
  - MND
  - muscular dystrophies

Myotonic discharges

- **Description:**s.f.a.p., waxing and waning trains, 20-100 Hz
- **Generated by**: membrane instability of single muscle fibres
- **Seen in:**
  - myotonic dystrophy
  - myotonia congenita
  - paramyotonia
  - acid maltase deficiency
  - hypercalemic per paralysis

Complex repetitive discharges, CRD

- **Description:** abrupt onset and end of trains (few to hundreds discharges in each), repeated with regular low (1-20) or high frequency (>50/sec)
- **Generated by**: ephaptic activation of adjacent denervated muscle fibres
- **Seen in:**

polymyositis
Duchenne myopathy
distal her myopathy
myxoedema
LG dystrophy
post radiation neuropathy
Schwartz-Jampel syndrome
ALS
Her neuropathies
CT

Fasciculations

- **Description:** variable complexes, 0.1-10 Hz
- **Generated by**: neurone, axon (terminal), muscle
- **Seen in:**
  - normal (more after exercise)
  - MND
  - CJD
  - radiculopathy
  - metabolic disorders (thyretoxicosis,tetany, antiACh-esterase therapy)

Double discharges

- **Description:** extra discharge following 4-50 msec after a regular MUP
- **Generated by**: repetition of a MUP discharge. The extra discharge comes within relative refractory period,has reduced amplitude and may block next discharge
- **Seen in:**

normal as first discharge after a pause

st p GBS

st p radiculopathy

polymyositis

dystr myotonica

Myokymia

- **Description:** irregular bursts, 0.5-10/sec, with 2-10 discharges in each, 20-80Hz
- **Generated by**: usually by MUPs (nerve initiation) but sometimes by single muscle fibers (myogenic)
- **Seen in:**
  - focal: st p Bell palsy, MS (facial myokymia), post-radiation
  - segmental: syringomyelia
  - generalized: CIDP, thyr.tox, familial parox kinesiogenic ataxia

Neurotonia

- **Description:** Doublets, triplets, burts of MUPS 150-300 Hz, few seconds
- **Generated by**: activity or spont (K-channels?)
- **Seen in:** neurotonia, chron pnp, paramalign
- **Not seen in**: myotonia

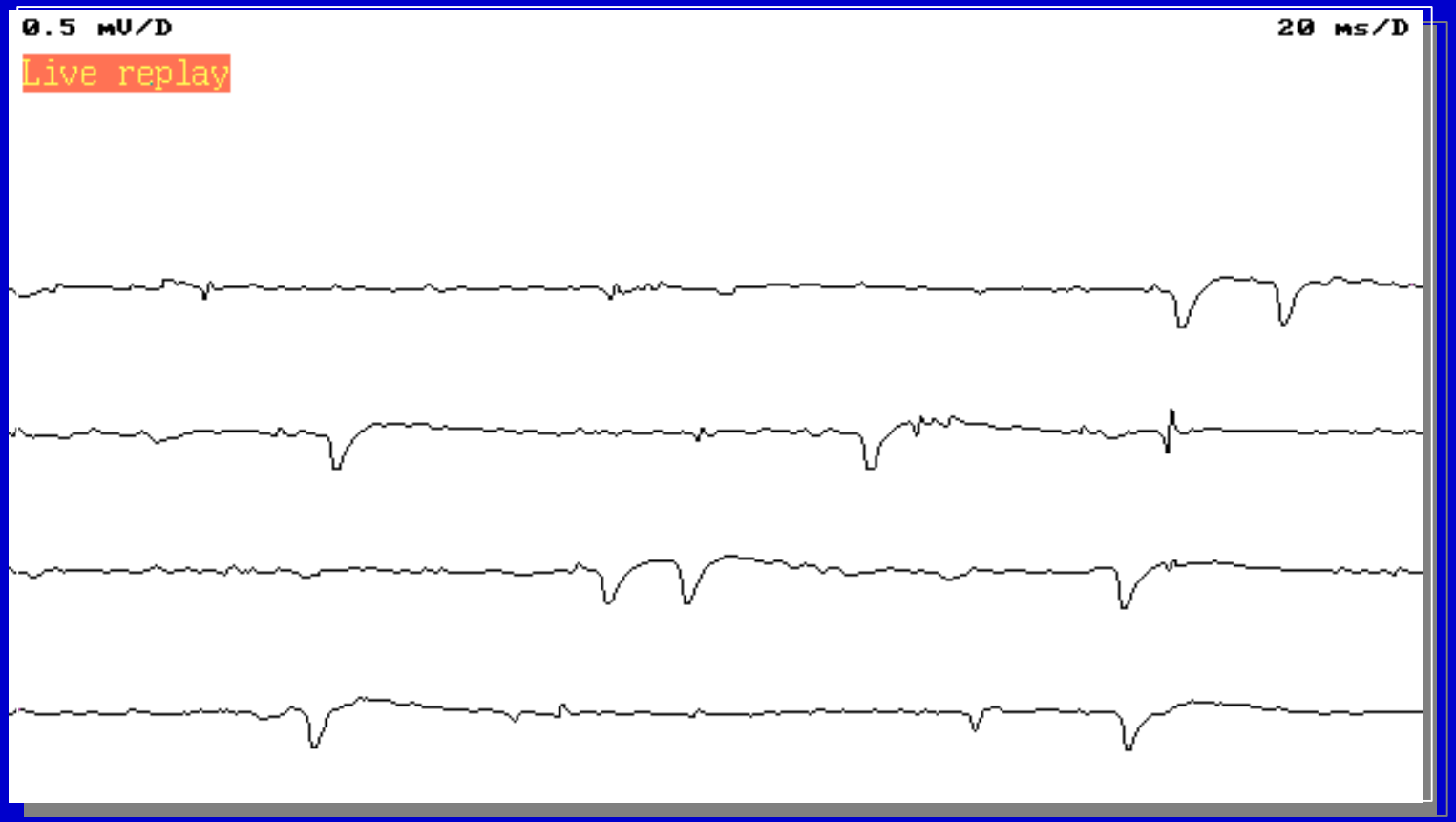
Muscle cramps

- **Description:** EMG activity as in voluntary
- **Generated by**: motor neurone hyperexcitability
- **Seen in:** all normal, chron neurogenic disorders,

Synkinesia

- **Description:** involuntary activity triggered by remote vol activity
- **Generated by**: ephaptic transmission, aberrant innervation, central hyperexcitability
- **Seen in:**
  - St p Bell palsy
  - syrinx
  - st p trauma

Denervation activity - positive waves and fibrillation potentials



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