

Electromyography (EMG)

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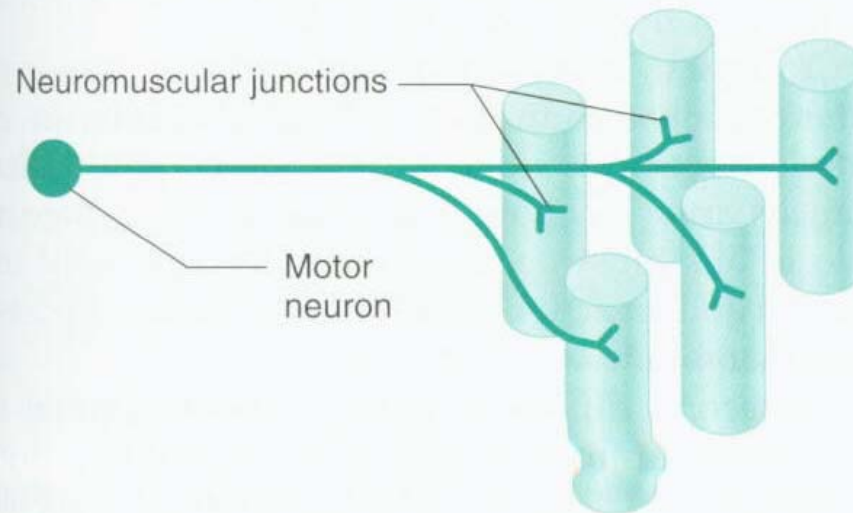
Motor Nerve Conduction Velocity Study (MNCV)



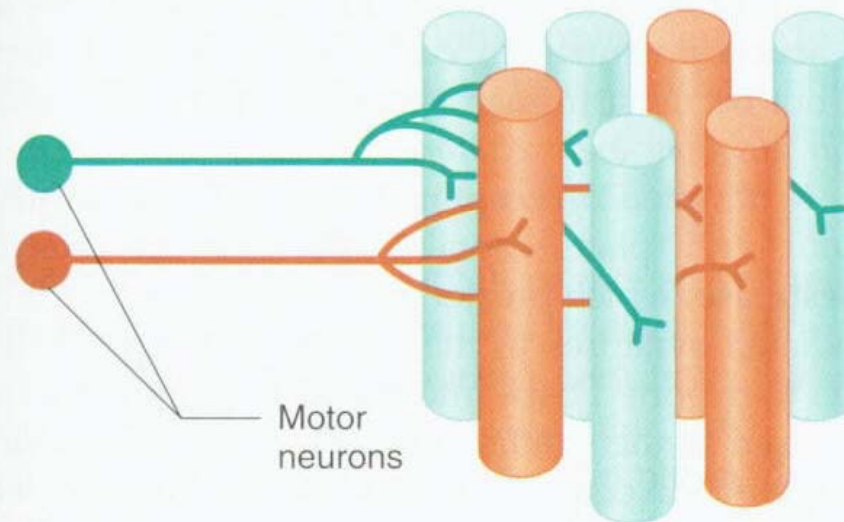
Motor Unit

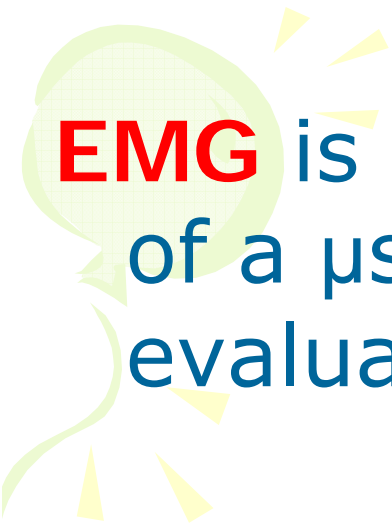
- ❖ consists of **a motor neuron and all the muscle fibers it innervates**
- ❖ When an action potential occurs in a motor neuron, all the μ sl fibers in its MU are stimulated to contract

(a) Single motor unit



(b) Two motor units





EMG is the recording of electrical activity of a μ sl at rest & during contract^o: (to evaluate the electrophysiology of a MU)



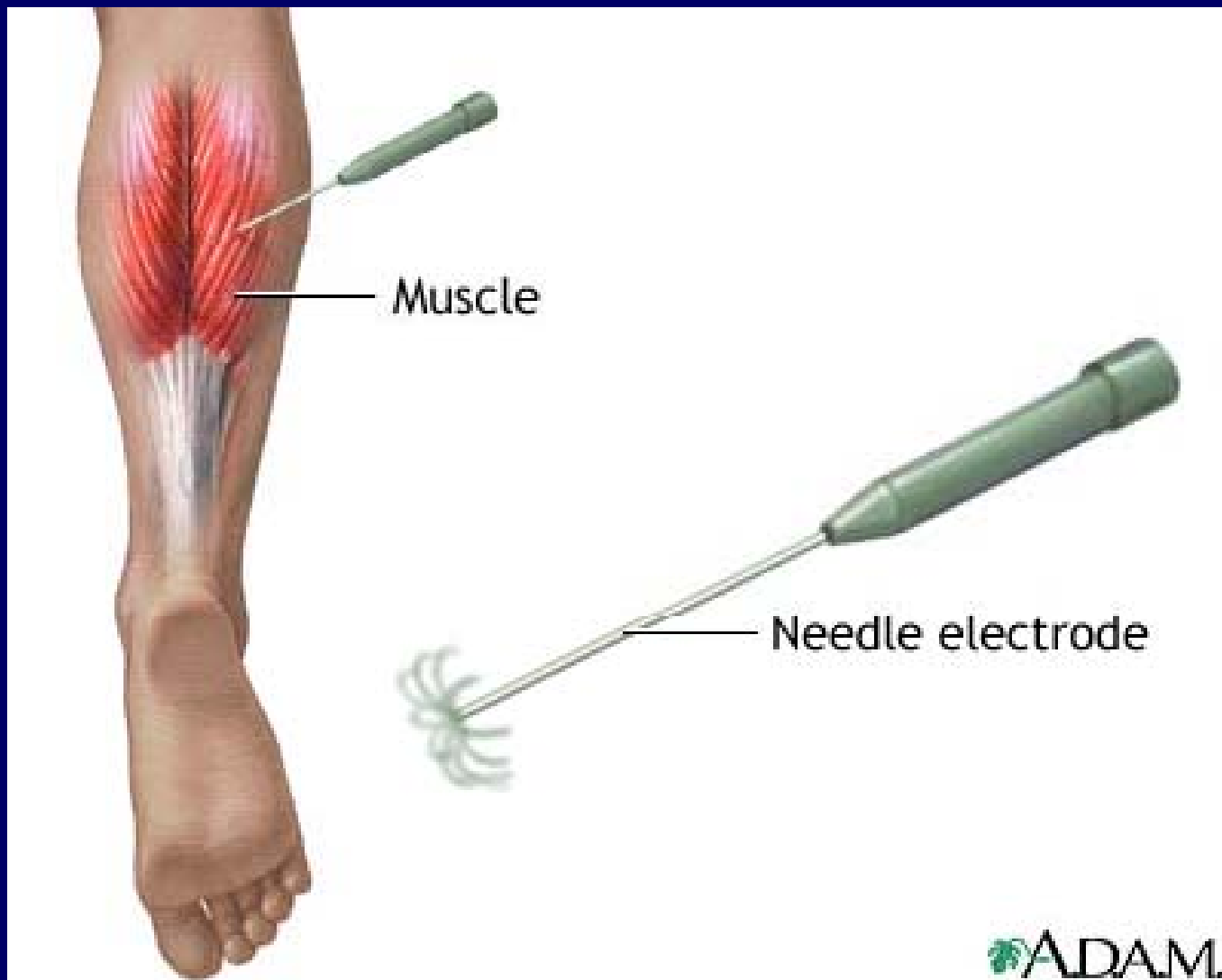
 Activity is amplified and displayed on an oscilloscope

Instrument : electromyograph

Record: electromyogram

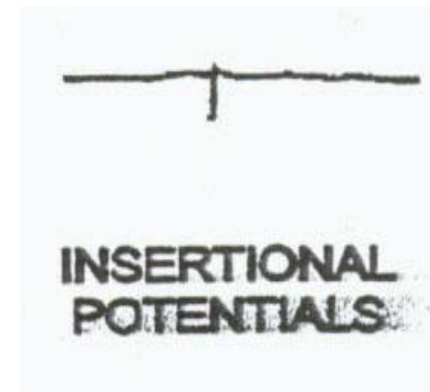


■ A concentric needle electrode inserted into the belly of the muscle.



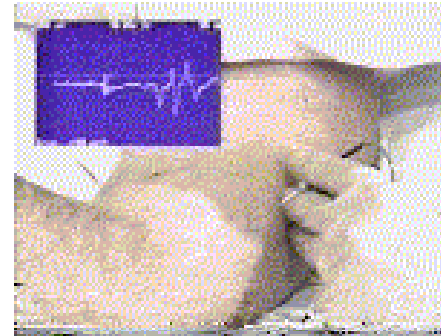
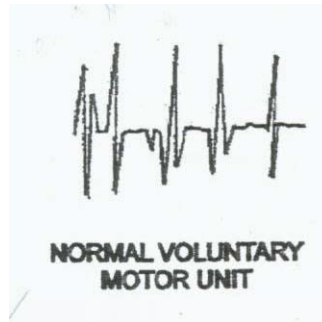
■ Needle EMG does not introduce any electrical stimulation instead it records the **intrinsic electrical activity of skeletal muscle fibers.**

■ Normally a muscle is **silent at rest** after **insertional activity** has ceased.




■ Then the patient is asked to contract the μ l smoothly.

■ With muscle contraction, MUs are activated and **MUAPs** appear on the screen




■ **Motor unit potential** : represents the summation of the potentials generated by **μsI fibers** belonging to the **MU**

■ The amplitude of a MUAP is determined by the nb of muscle fibers recorded with the needle



■ With increasing strength of contract^o
→ recruitment of MUs → ↑ number & size of MUAPs



■ At full contraction separate MUAP will be indistinguishable resulting in a complete recruitment = **interference pattern**



MOTOR UNIT POTENTIAL DURING MILD EFFORT

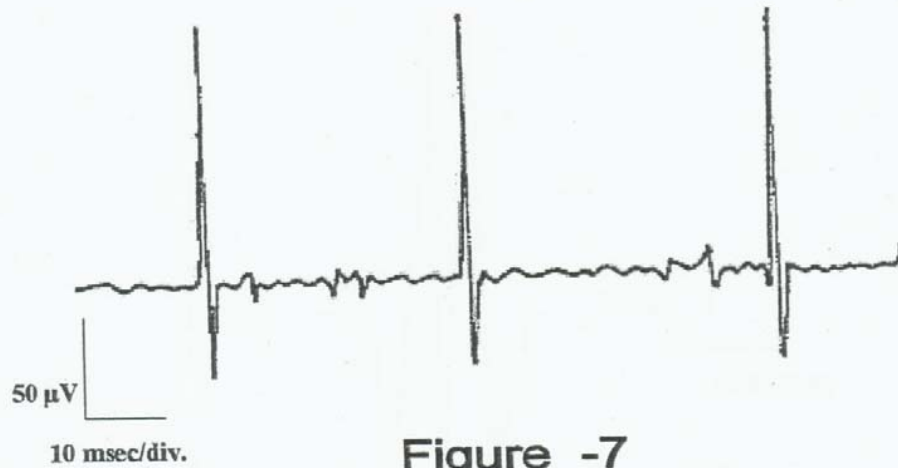
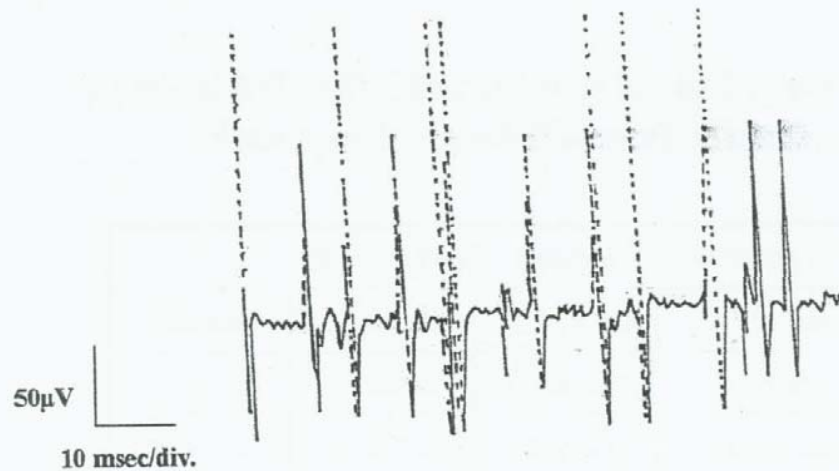
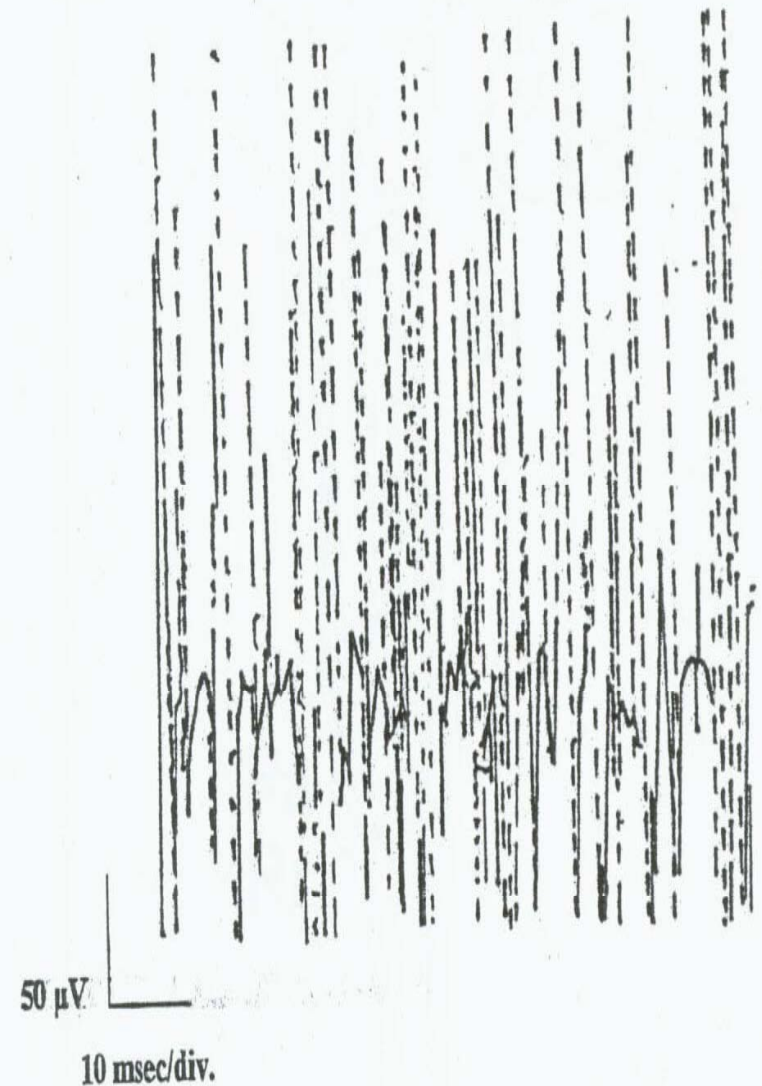


Figure -7

MOTOR UNIT POTENTIAL DURING MODERATE EFFORT



MOTOR UNIT POTENTIAL AT FULL VOLUNTARY EFFORT






Analysis

The EMG is used to investigate both neuropathic and myopathic disorders (weakness, numbness, pain)

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- **Myopathy**: progressive degeneration of skeletal muscle fibers

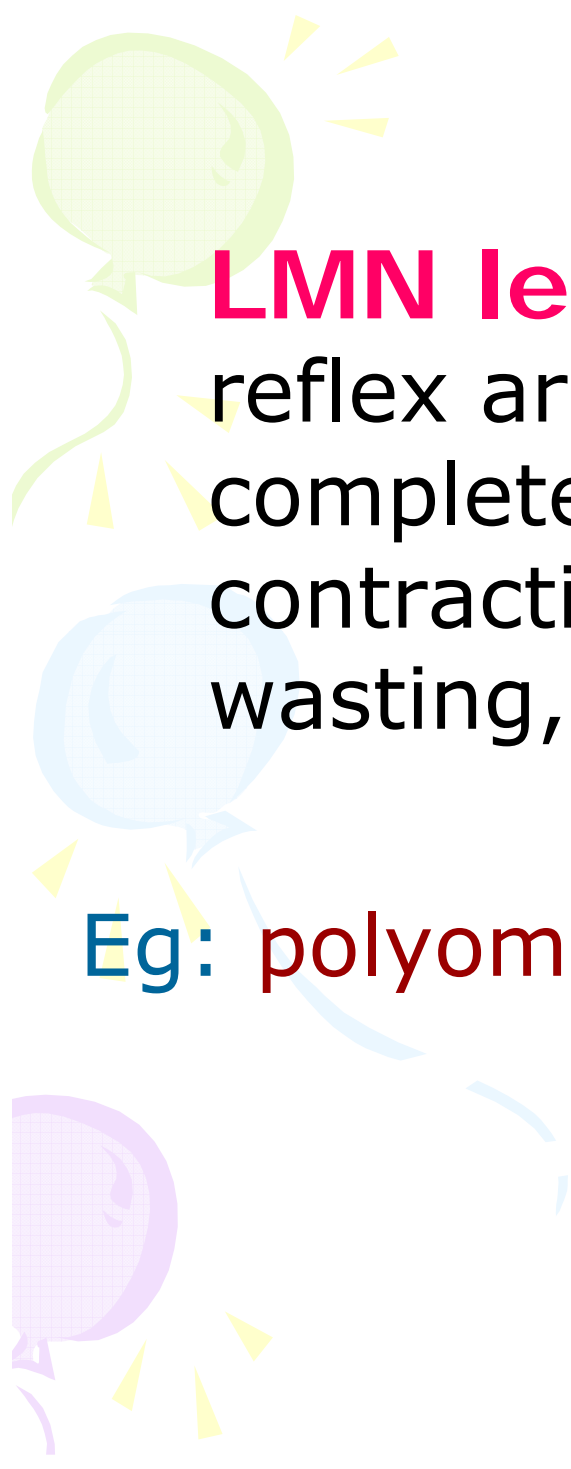


Eg: Duchenne Muscular dystrophy

- 
- **Neuropathy** : Damage to the distal part of the nerve.
peripheral neuropathy mainly affects feet & legs

Most common etiologies:

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- Guillain Barré syndrome
 - Diabetes mellitus
 - Alcohol abuse
- 



LMN lesions: interrupt the spinal reflex arc (α motor N) → Partial or complete loss of voluntary contraction , muscle wasting, ↓reflexes, fasciculation

Eg: **polyomyelitis**



Needle EMG finding suggestive of denervation include:

- Positive sharp waves
- Fibrillations
- Giant motor unit potentials



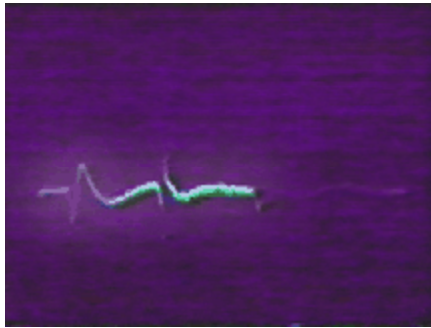
◆ **Fibrillation potentials:**

Low amplitude, short duration potentials, correspond to the spontaneous discharge of a **denervated single muscle fiber** due to denervat^o hypersensitivity to acetylcholine

Audio-amplifier: **sound of rain in a tin shade house**

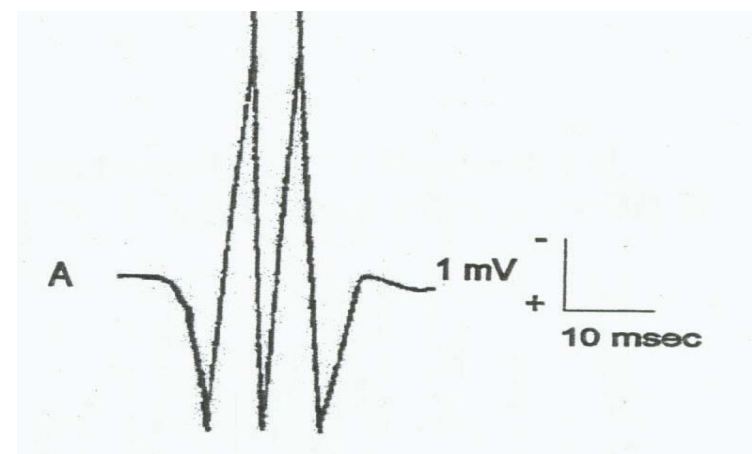
◆ **Positive sharp waves**

Fibrillation APs whose propagation is blocked at the level of the recording Ede

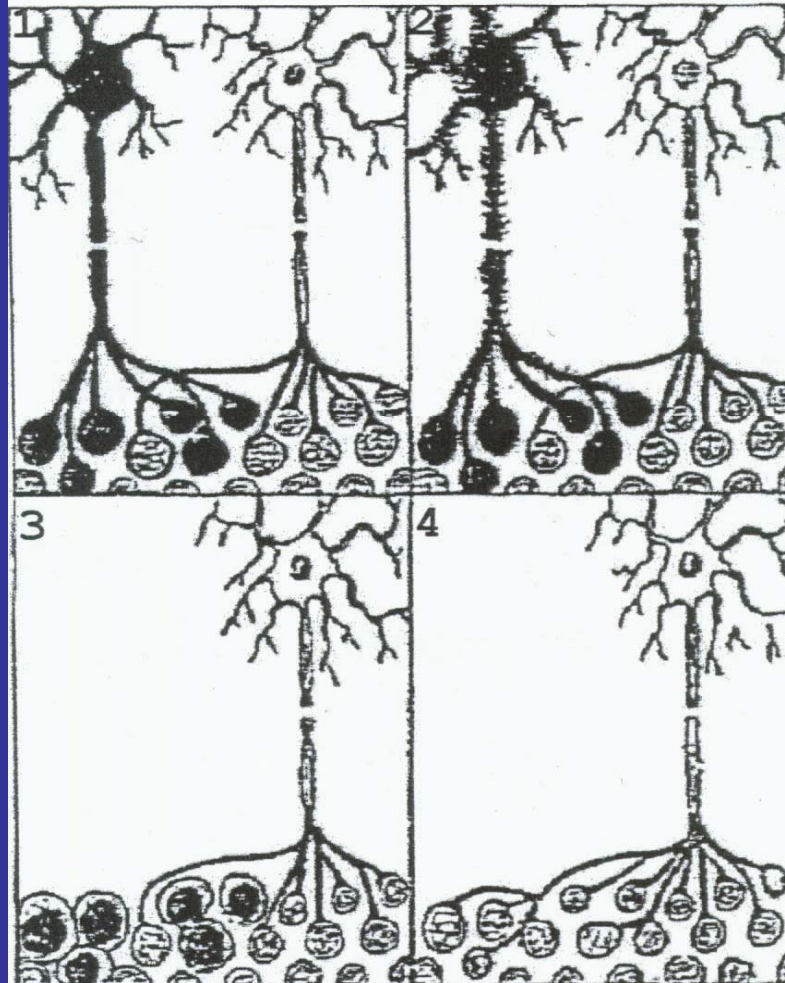


◆ **Fasciculation potentials** spontaneous discharge of a **MU** at **rest**, can be **seen** and **felt** by the patients

- Partial re-innervation of denervated muscle, by sprouting of the remaining nerve terminals, produces abnormally **large, long polyphasic** potentials (**giant potential**)

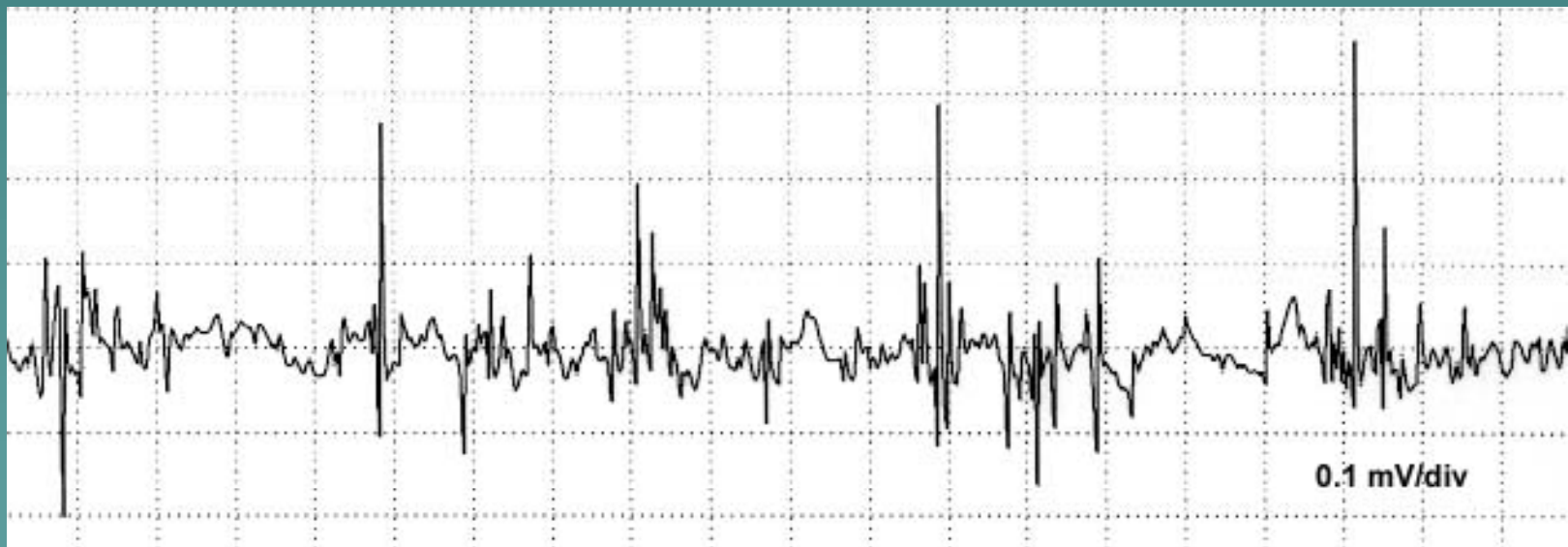


REINNERVATION



Myopathic alteration of the EMG:

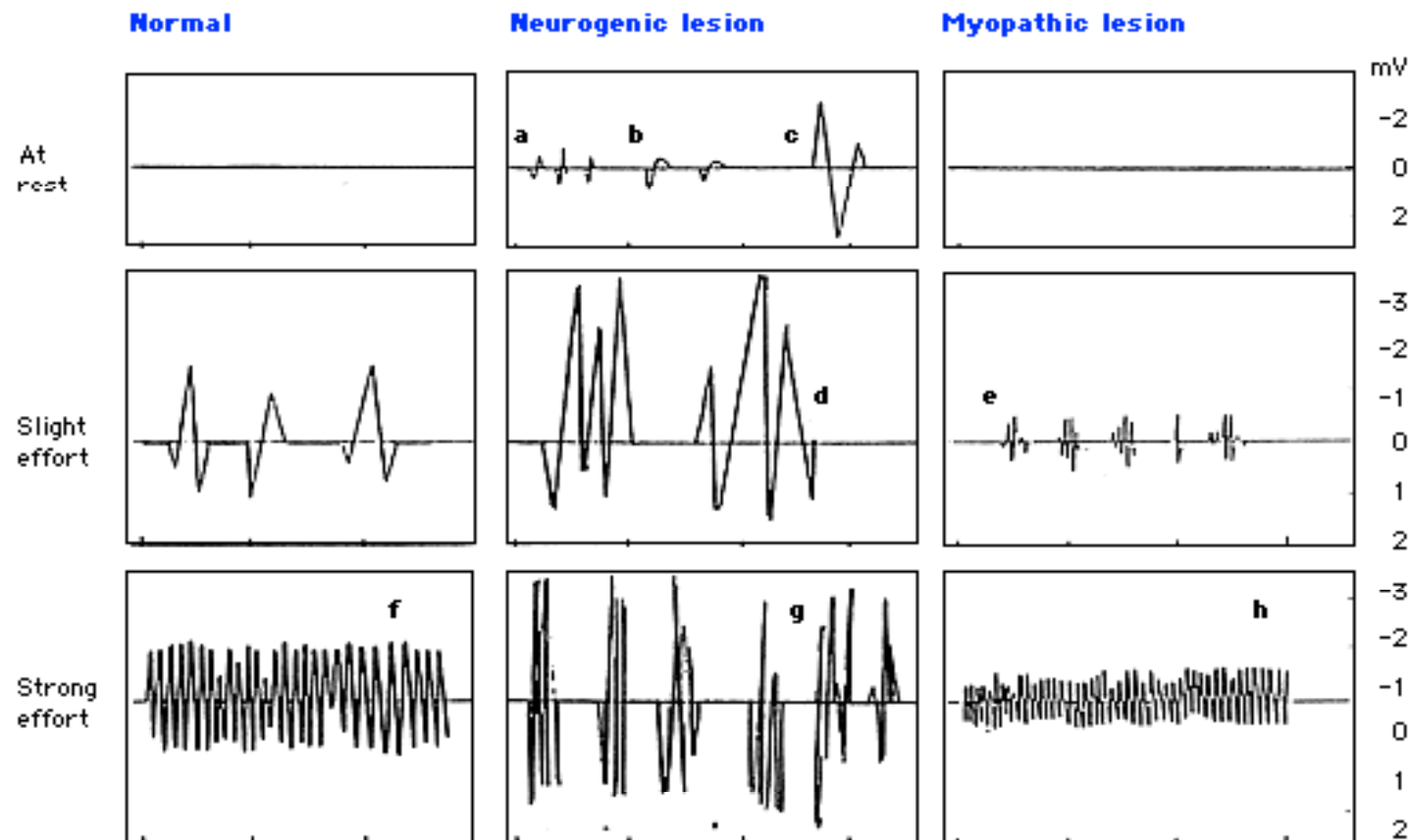
Polyphasia ,short duration ,reduced voltage of MUPs



B. Analysis of a Motor Unit Potentials (MUP) (Figure – 6):

MUP	NORMAL	NEUROGENIC	MYOPATHIC
Duration msec	10 to 12	Longer	Shorter
Amplitude μ V	300 to 500	Larger	Smaller
Phases	Biphasic/Triphasic	Polyphasic	May be Polyphasic
Interference* Pattern	Full	Partial	Full

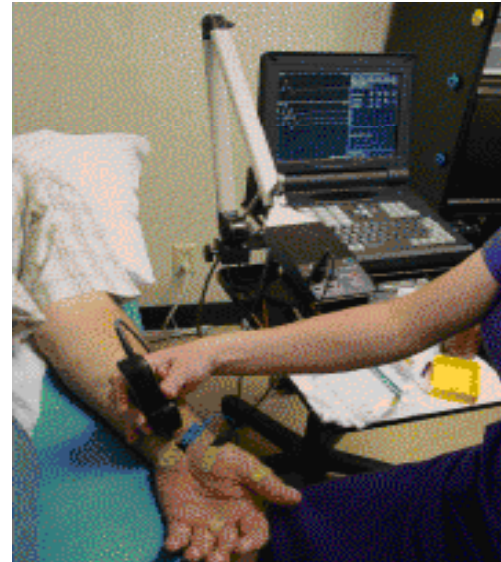
Electromyography*



1. At rest (spontaneous activity): a. fibrillations, b. positive sharp waves, c. fasciculation.
 2. Slight effort (motor unit potentials): d. giant polyphasic, e. BSAPS (brief-small-abundant polyphasic).
 3. Strong effort (interference pattern): f. full, g. reduced units, h. reduced amplitude.
- * (helpful in selecting denervated muscles [in radiculopathies (myotomal), mononeuropathies (distal to lesion), generalized neuropathies (distal muscles)] and myopathies)

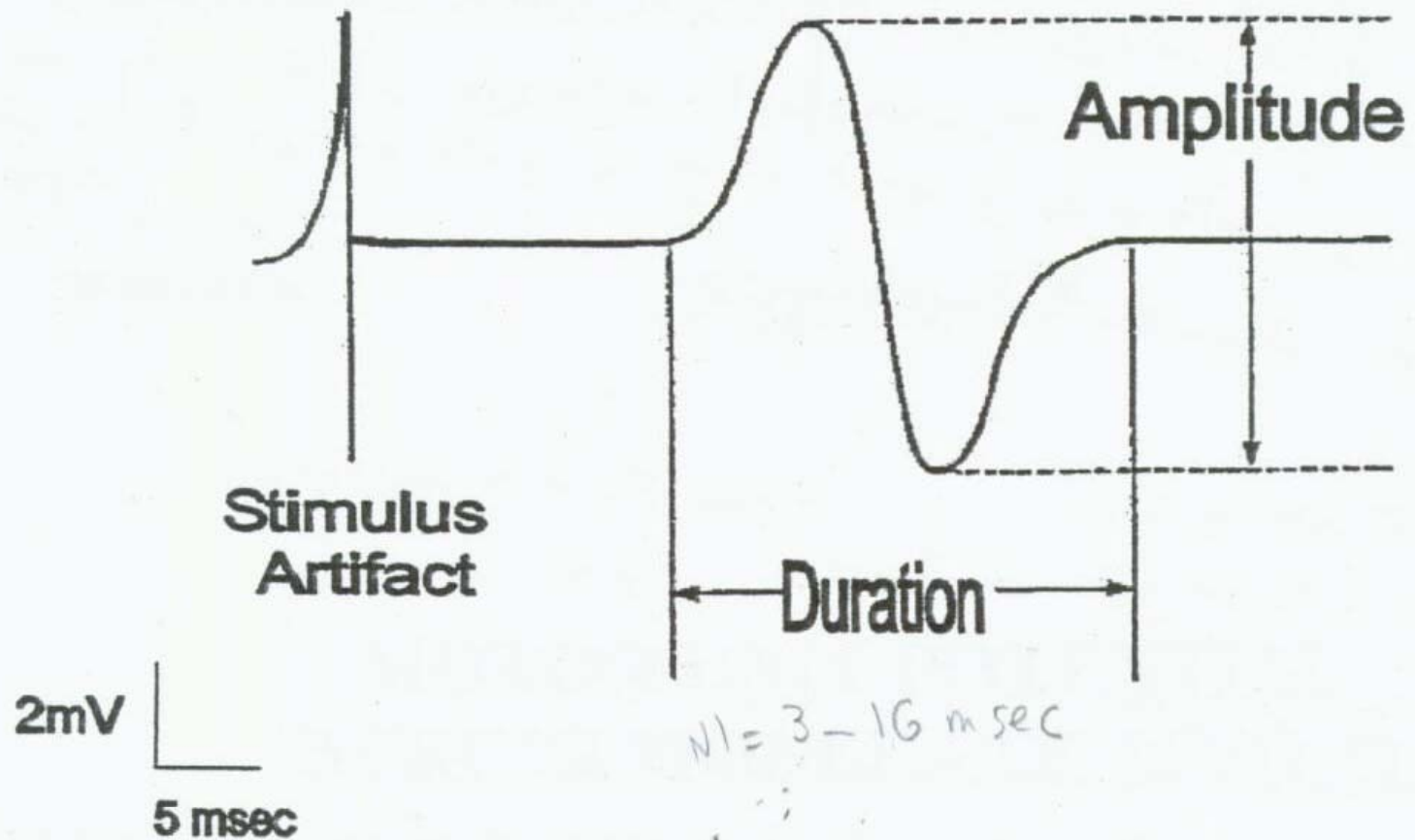
Motor Nerve Conduction Study

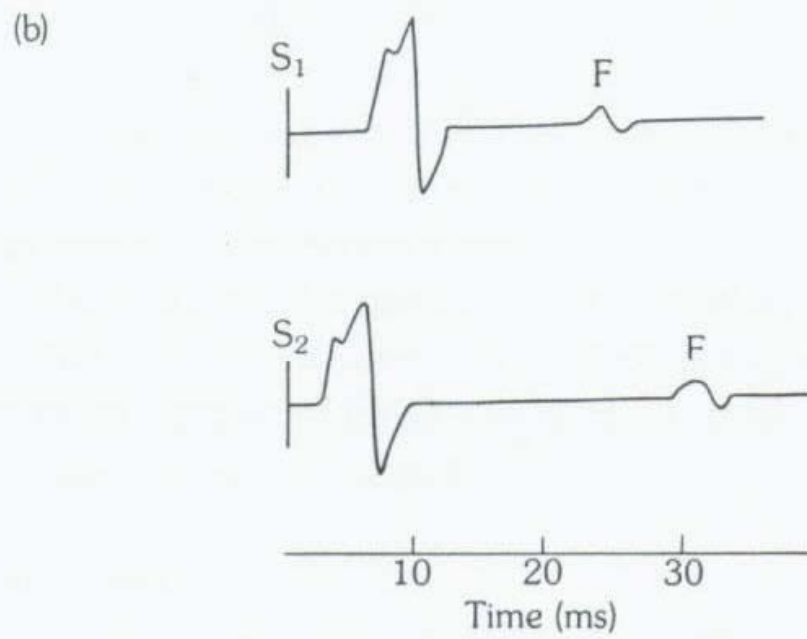
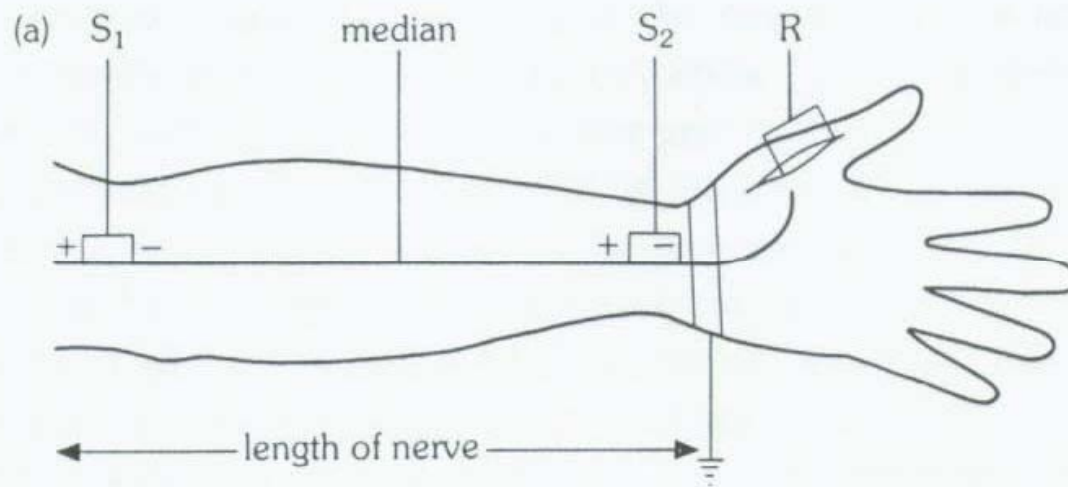
- Stimulat^o of median nerve until visible muscle contract^o is seen and a reproducible Compound Muscle A P is recorded

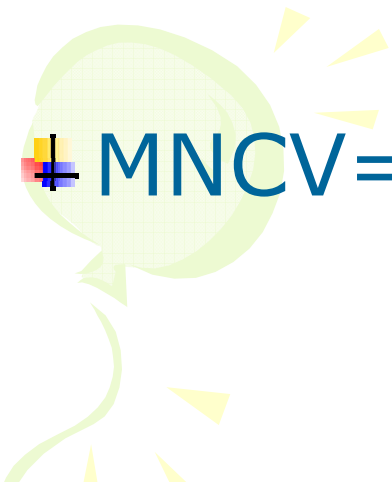


CMAP: summated potentials from all Motor Units in a muscle

COMPONENTS OF THE CMAP







$$\text{MNCV} = \frac{\text{distance}}{t_1 - t_2} \quad \text{m/sec}$$

abNI if < 40 m/sec

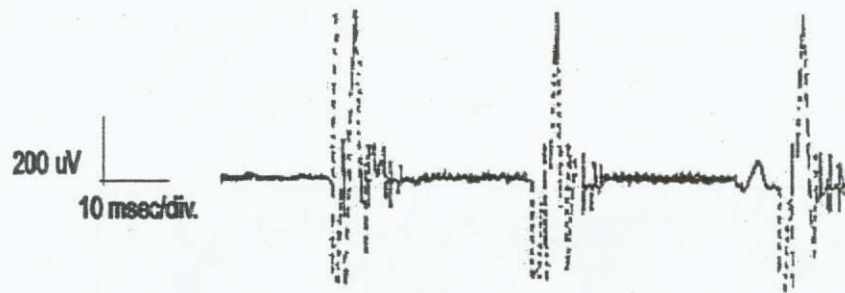


Conduction is faster in myelinated fibres



Diseases which produce demyelinated peripheral nerves (diabetes, Guillain Barré) slow the conduct^o greatly (20-30 m/s)

REINNERVATION BY COLLATERAL SROUTING



LONG DURATION POLYPHASIC MOTOR UNIT POTENTIAL

