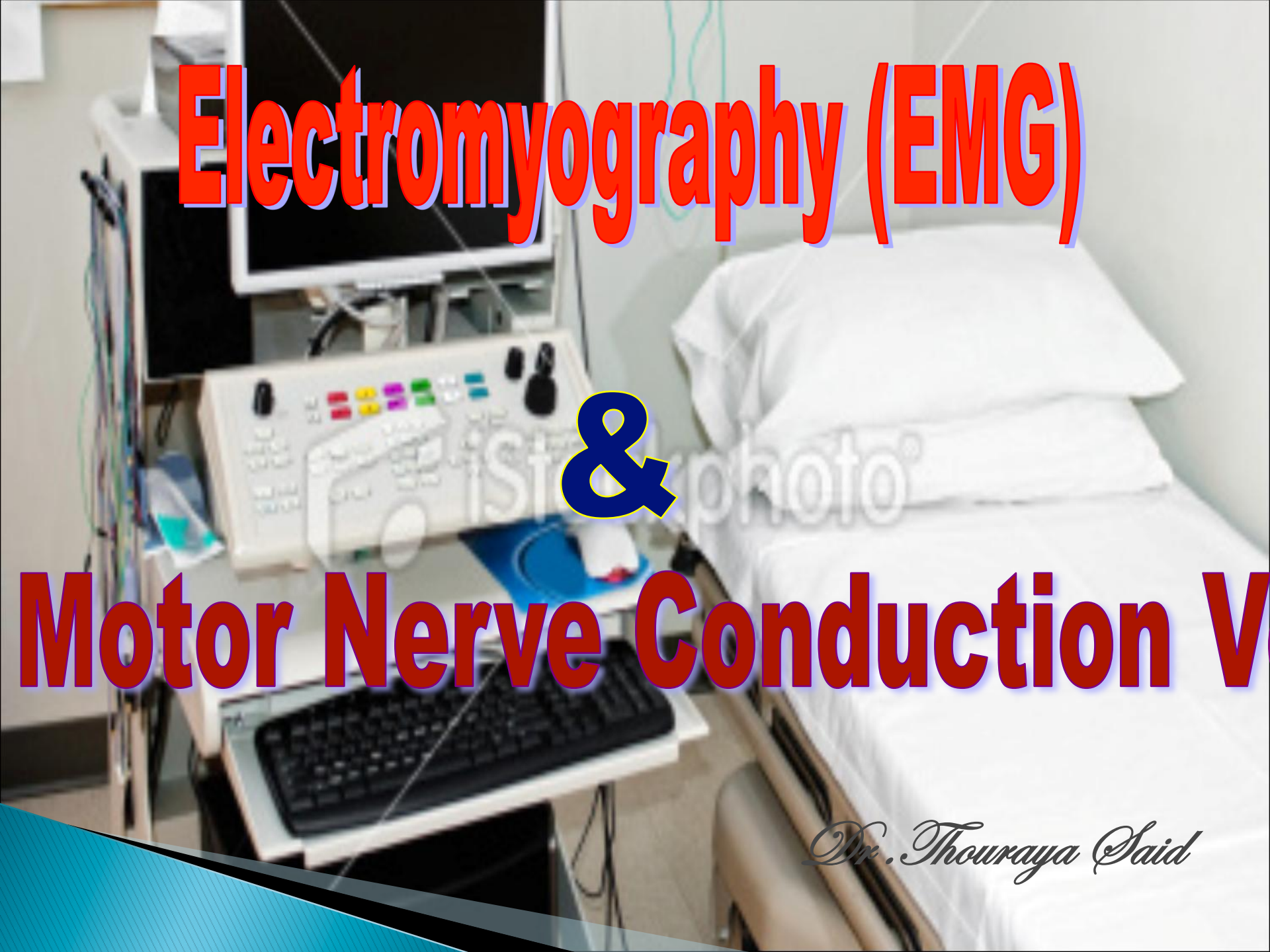


Electromyography (EMG)

&

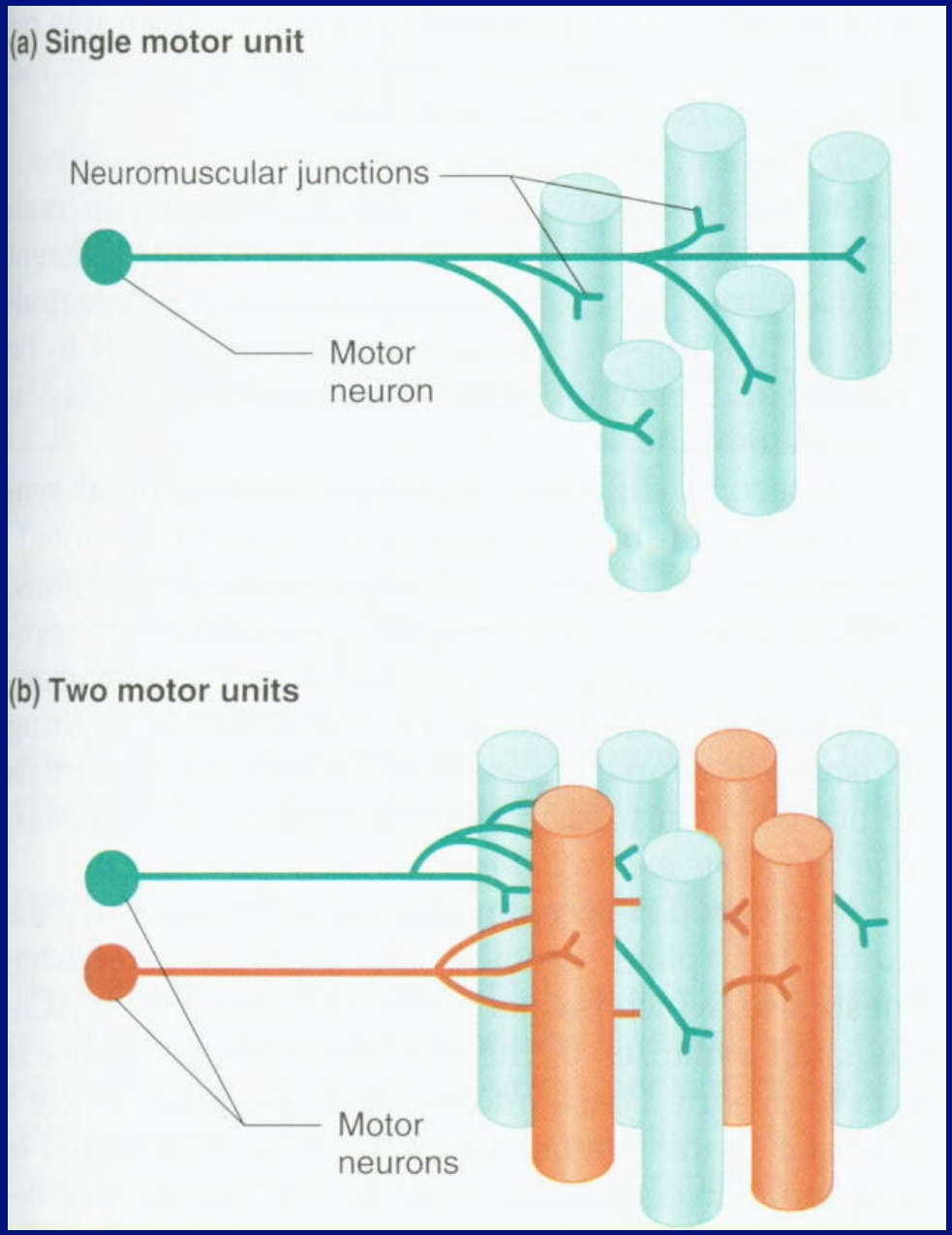
Motor Nerve Conduction V

Dr. Thouraya Said

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 Msl fibers in its MU are stimulated to contract


(a) Single motor unit
Neuromuscular junctions
Motor neuron
(b) Two motor units
Motor neurons

EMG is the recording of electrical activity of a Msl at rest & during contraction:

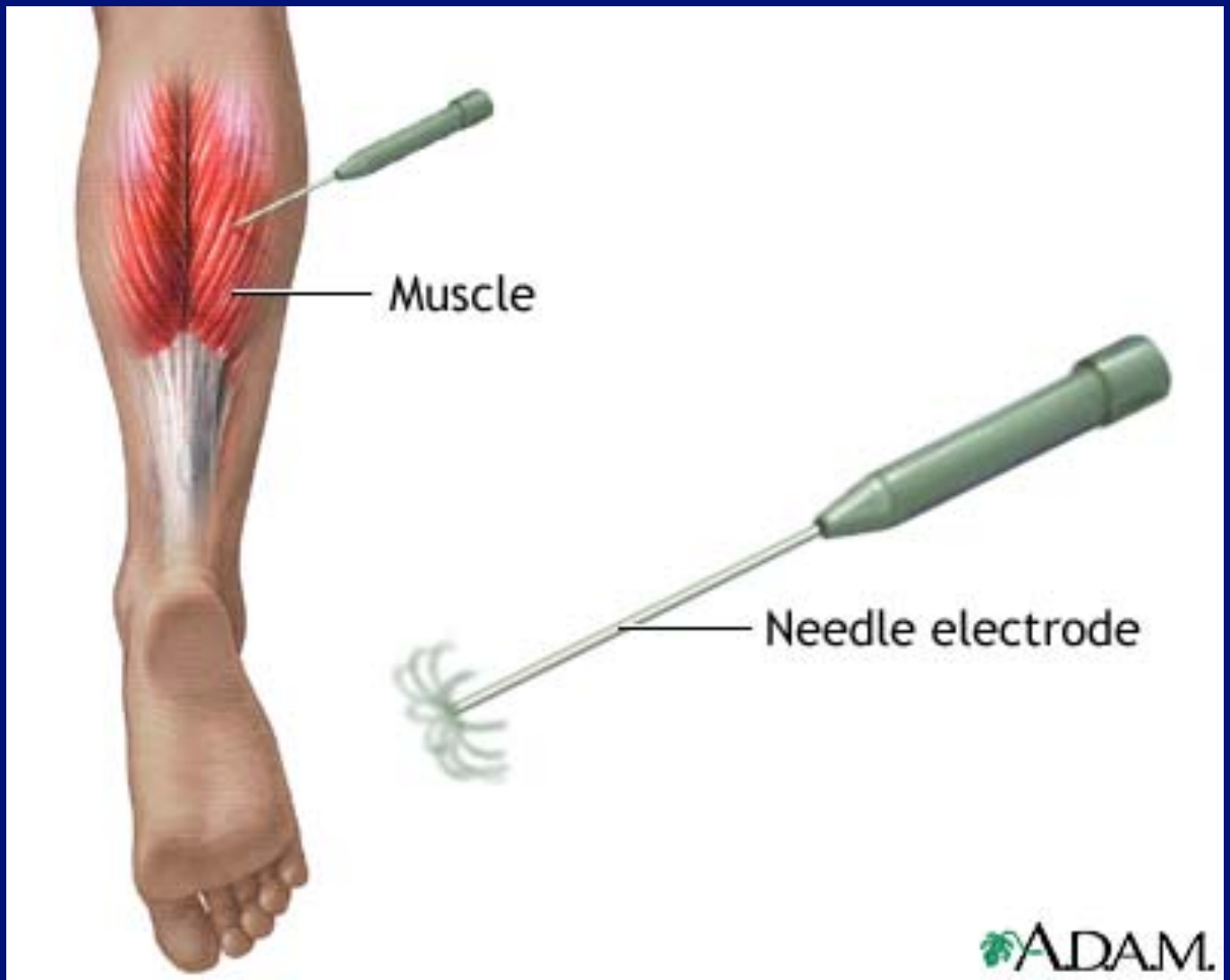
(to evaluate the electrophysiology of a MU)

- Activity is amplified and displayed on an oscilloscope.

Instrument : **Electromyograph**

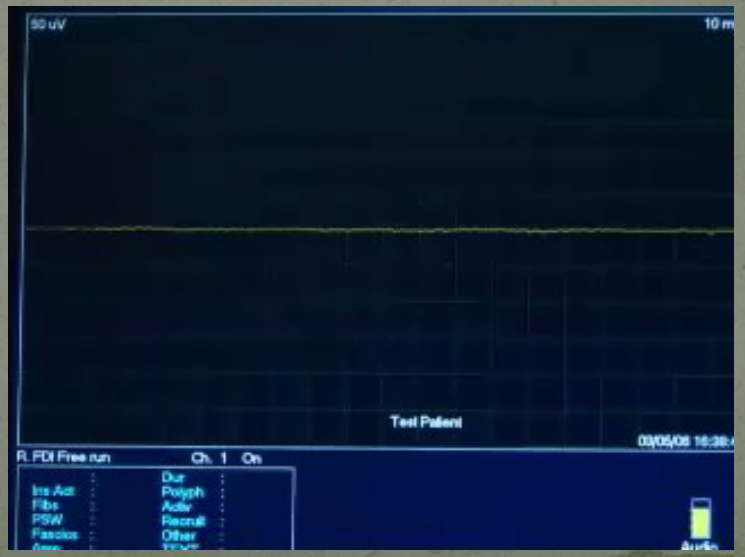
Record: **Electromyogram**

A concentric needle Ede inserted into the belly of the Msl .



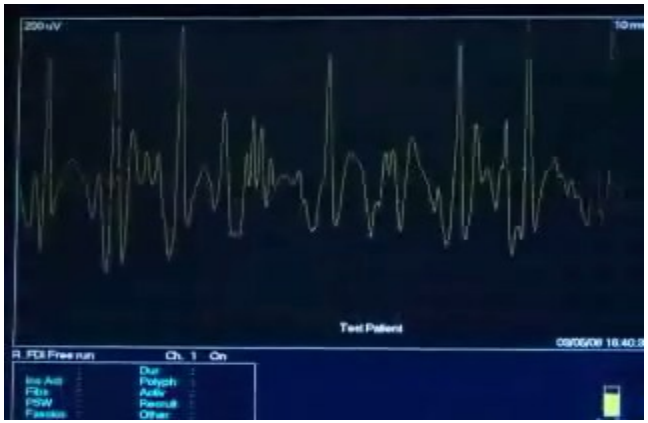
- Needle EMG does not introduce any electrical stimulation instead it records the **intrinsic electrical activity of skeletal muscle fibers**.

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



- Then the patient is asked to contract the Msl smoothly.

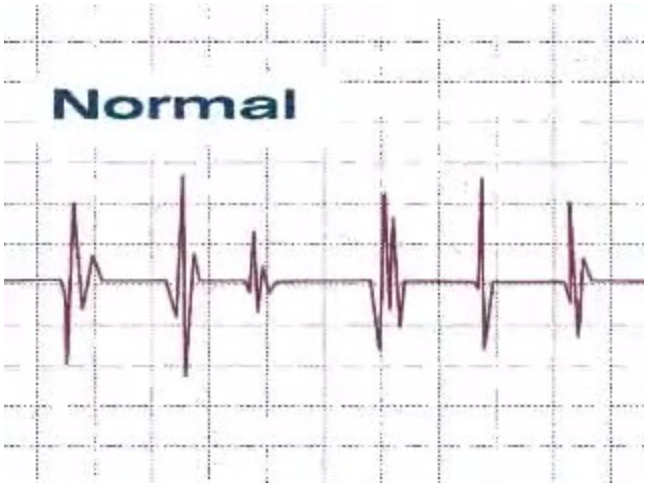
- With muscle contraction, MUs are activated and MUAPs appear on the screen:



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

Normal MUPs

- Bi – Triphasic
- Duration – 3 – 16 mSec.
- Amplitude – 300μV – 5 mV



- 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

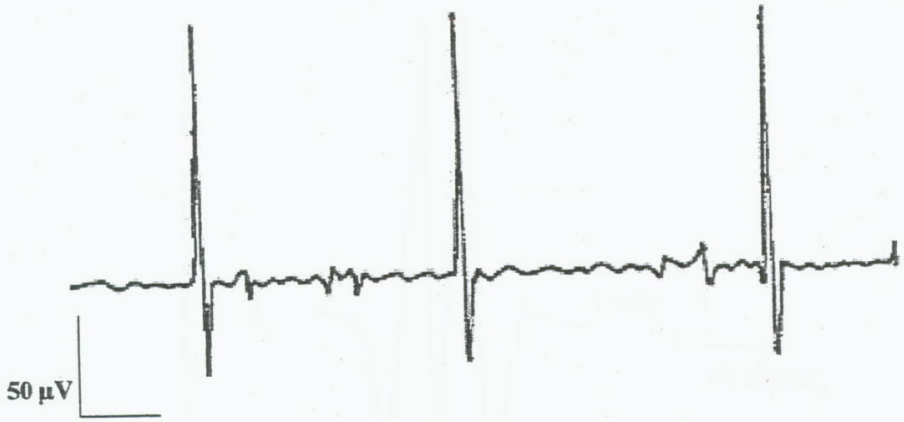
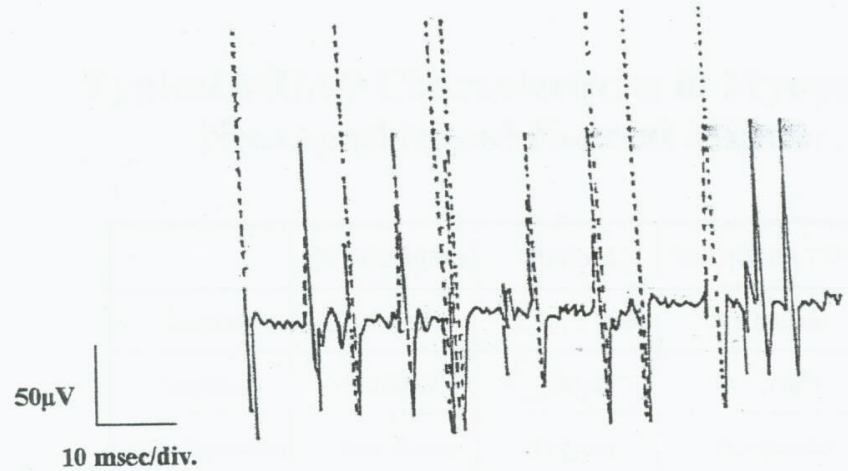
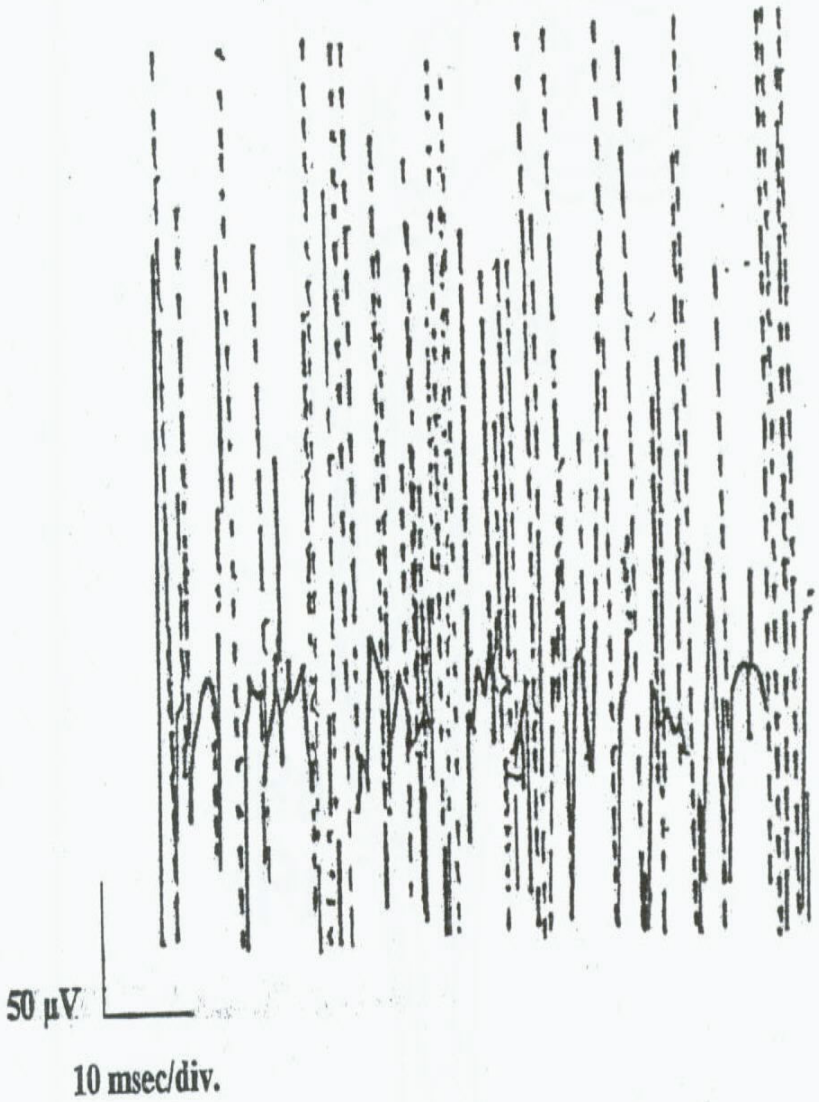


Figure -7

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)

- **The size, duration, frequency of the electrical signals generated by Msl cells help determine if there is damage to the Msl or to the nerve leading to that Msl.**

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

  Eg: Duchenne Muscular dystrophy

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

Most common etiologies:

- 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

Example: Polyomyelitis

In neurogenic lesion or in active myositis, the following **spontaneous activity** is noted:

- Positive sharp waves
- Fibrillations
- Giant motor unit potentials or fasciculations

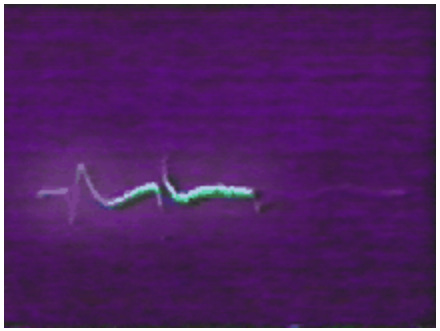
Fibrillation potentials:

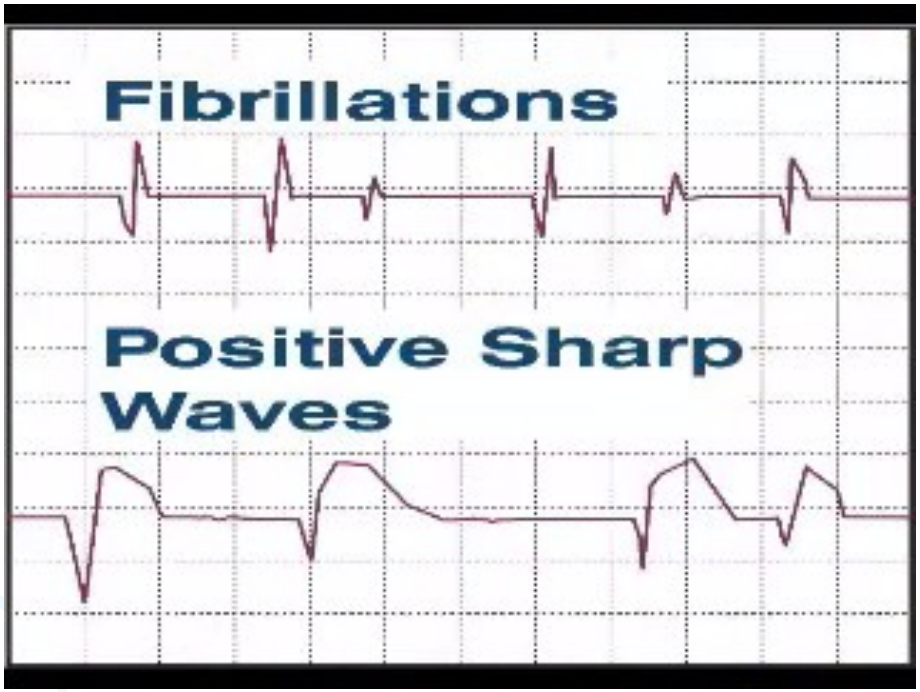
Low amplitude, short duration, biphasic potentials, correspond to the spontaneous discharge of a **denervated single muscle fiber** due to denervat^{o} hypersensitivity to acetylcholine.

Fine invisible,irregular contractions of individual muscle fibers.

Positive sharp waves

Small fibrillation APs (50 to 100 μV, 5 to 10 msec duration) whose propagation is blocked at the level of the recording Ede

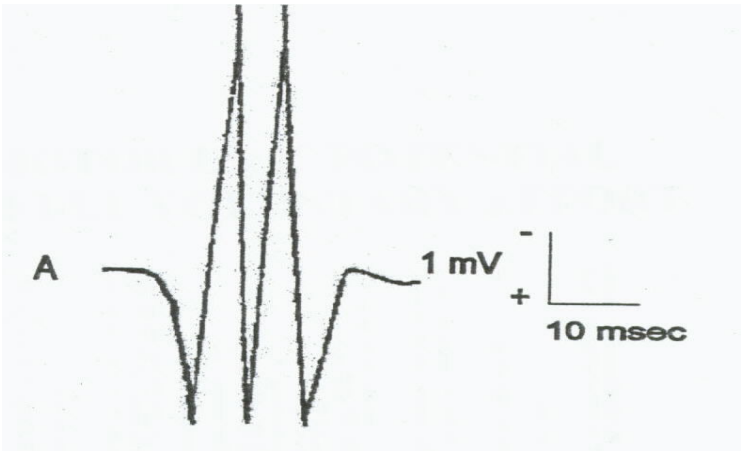



Fibrillations
Positive Sharp Waves

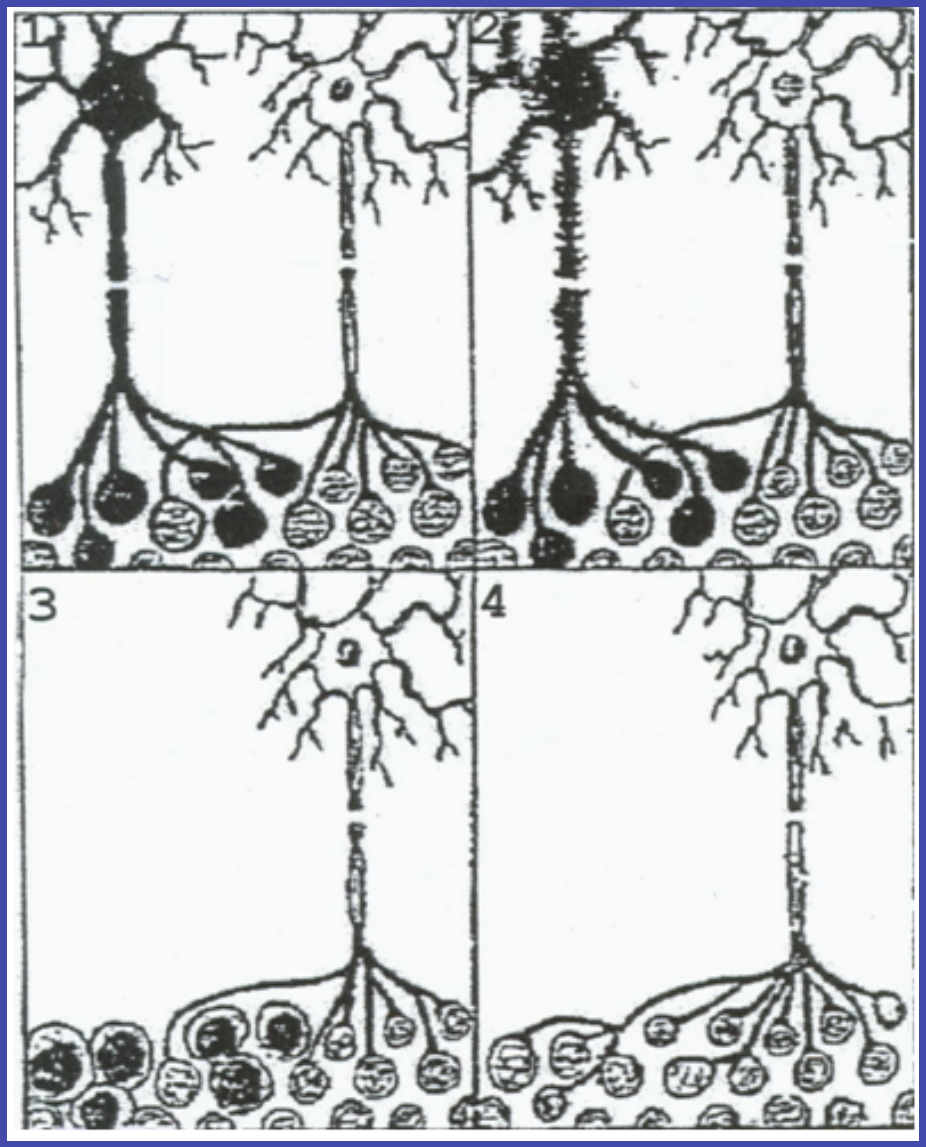
Fasciculation potentials

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**)

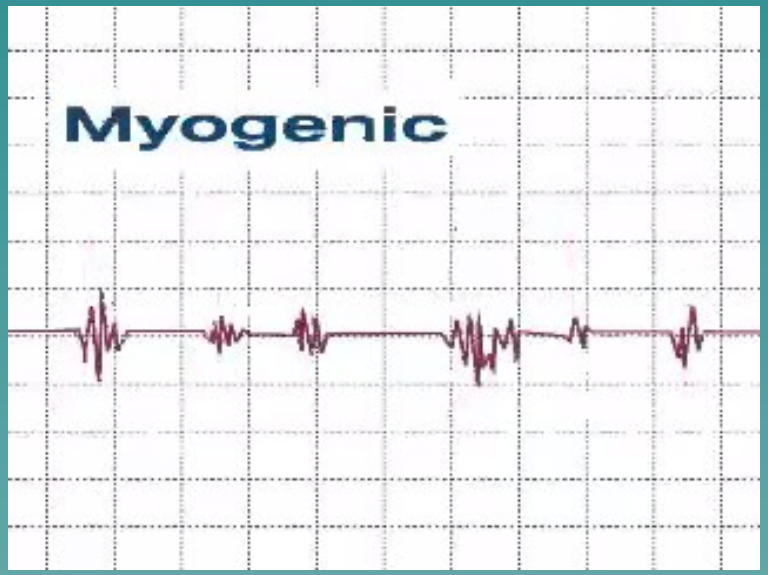


REINNERVATION BY COLLATERAL SROUTING



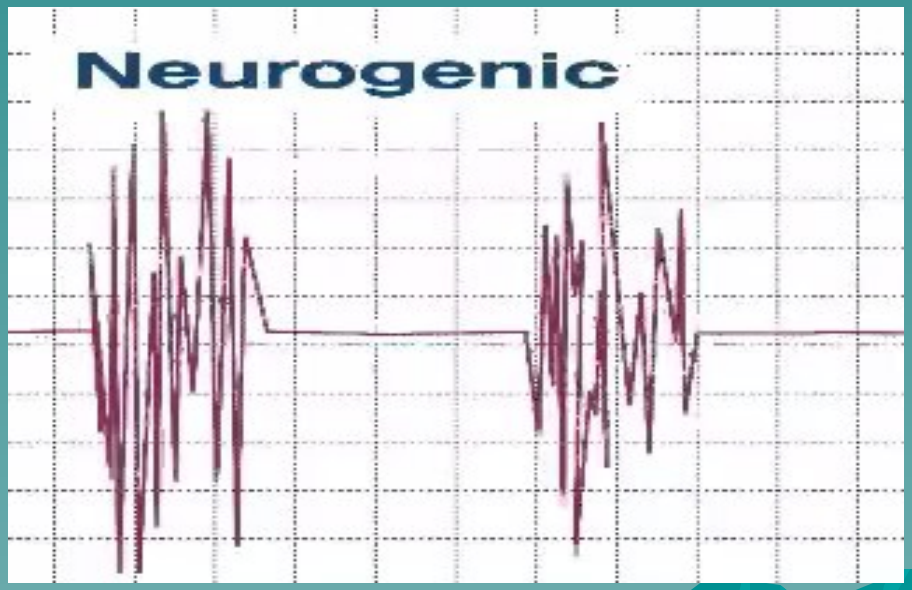
Myopathic alteration of the EMG:

Polyphasia ,short duration ,reduced voltage of MUPs



Neuropathic alteration of the EMG:

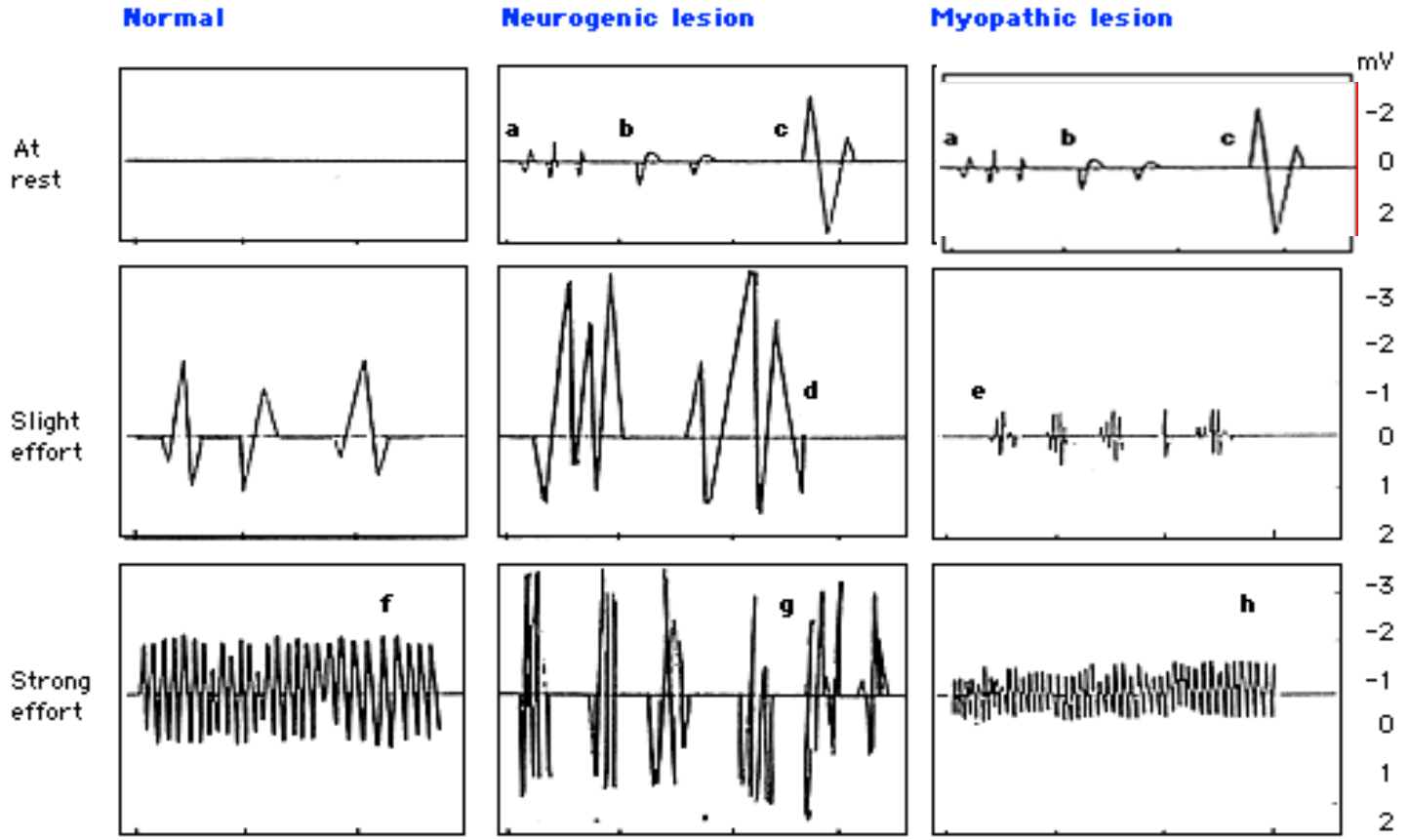
- Polyphasia ,long duration ,high voltage of MUPs



Analysis of MUP

MUP	NORMAL	NEUROGENIC	MYOPATHIC
Duration msec.	3 – 16 msec	> 16 msec	< 3 msec
Amplitude	300 – 5000 µV	> 5 mV	< 300 µV
Phases	Biphasic / triphasic	Polyphasic	May be polyphasic
Resting Activity	Absent	Present	Present
Interference pattern	full	partial	full

Electromyography*



1. At rest (spontaneous activity): a. fibrilations, b. positive sharp waves, c. fasiculation.
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.

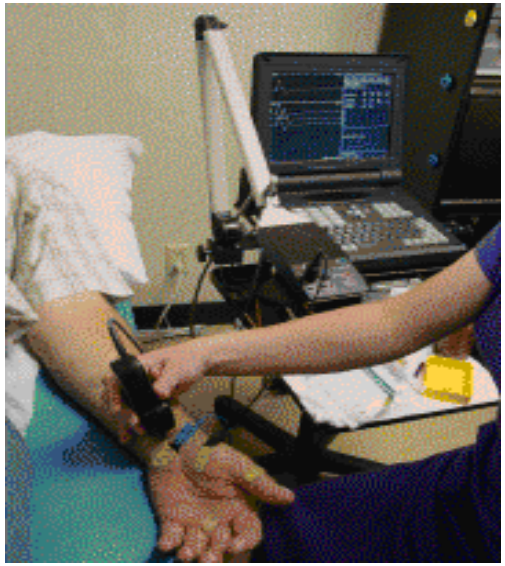
* (helpful in selecting denervated muscles [in radiculopathies (myotomal), mononeuropathies (distal to lesion), generalized neuropathies (distal muscles)] and myopathies)

Nerve Conduction studies

A nerve conduction study (NCS) is a test commonly used to evaluate the function, especially the ability of electrical conduction, of the motor and sensory nerves of the human body.

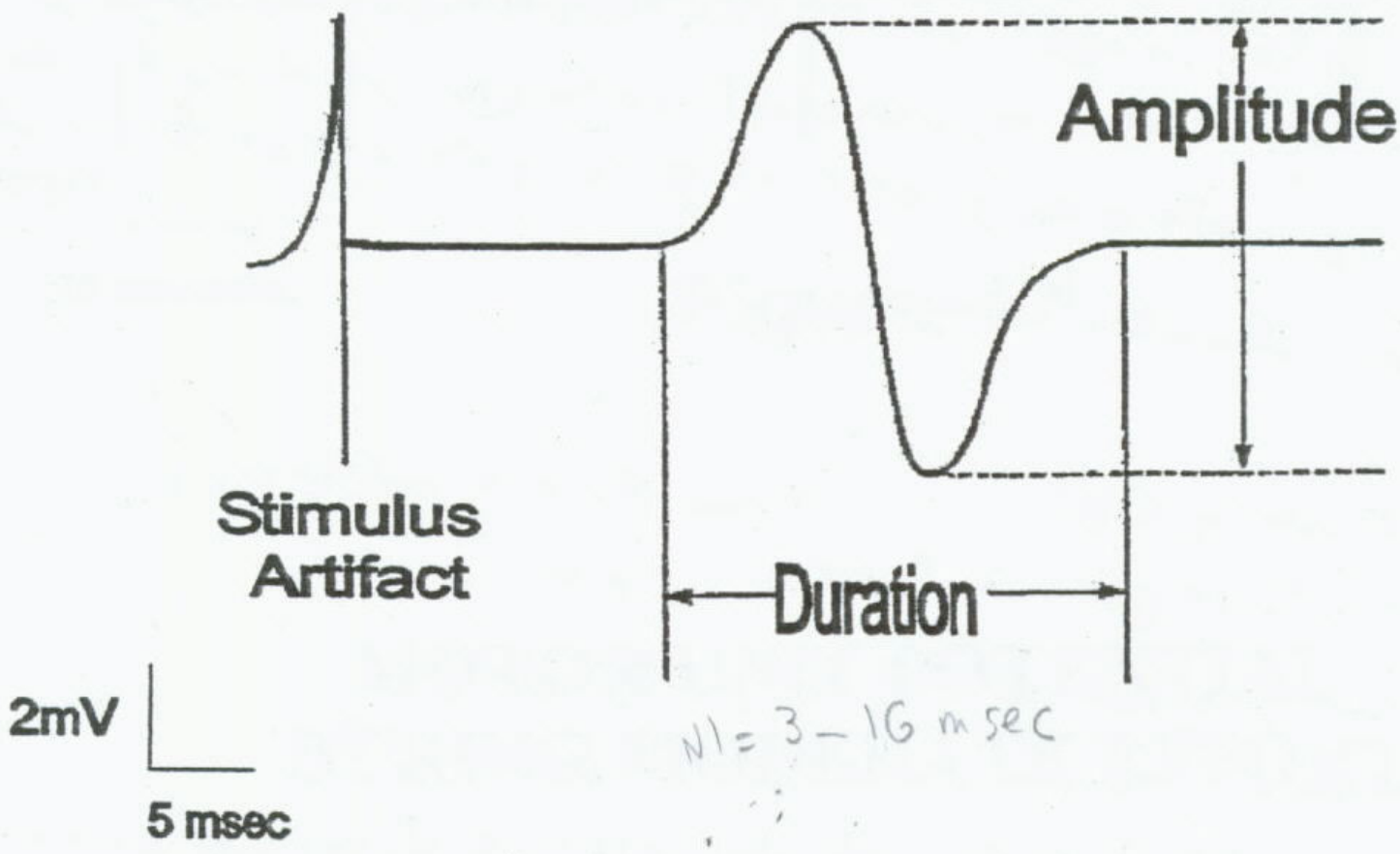
Motor Nerve Conduction Study

- Stimulatº of median nerve at two points until visible muscle contractº is seen and a reproducible Compound Muscle A P is recorded

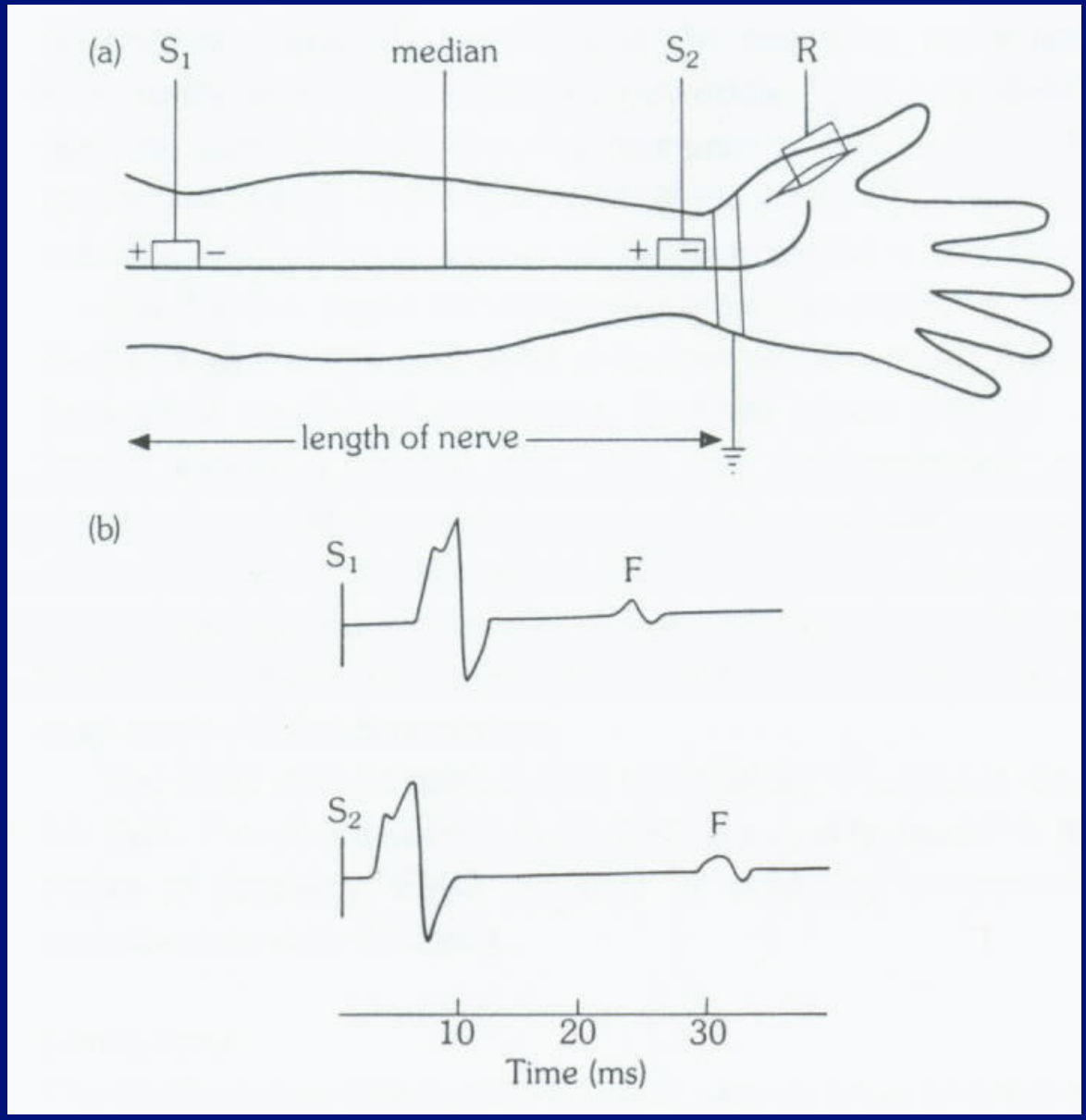


CMAP: summated potentials from all Motor Units in a muscle

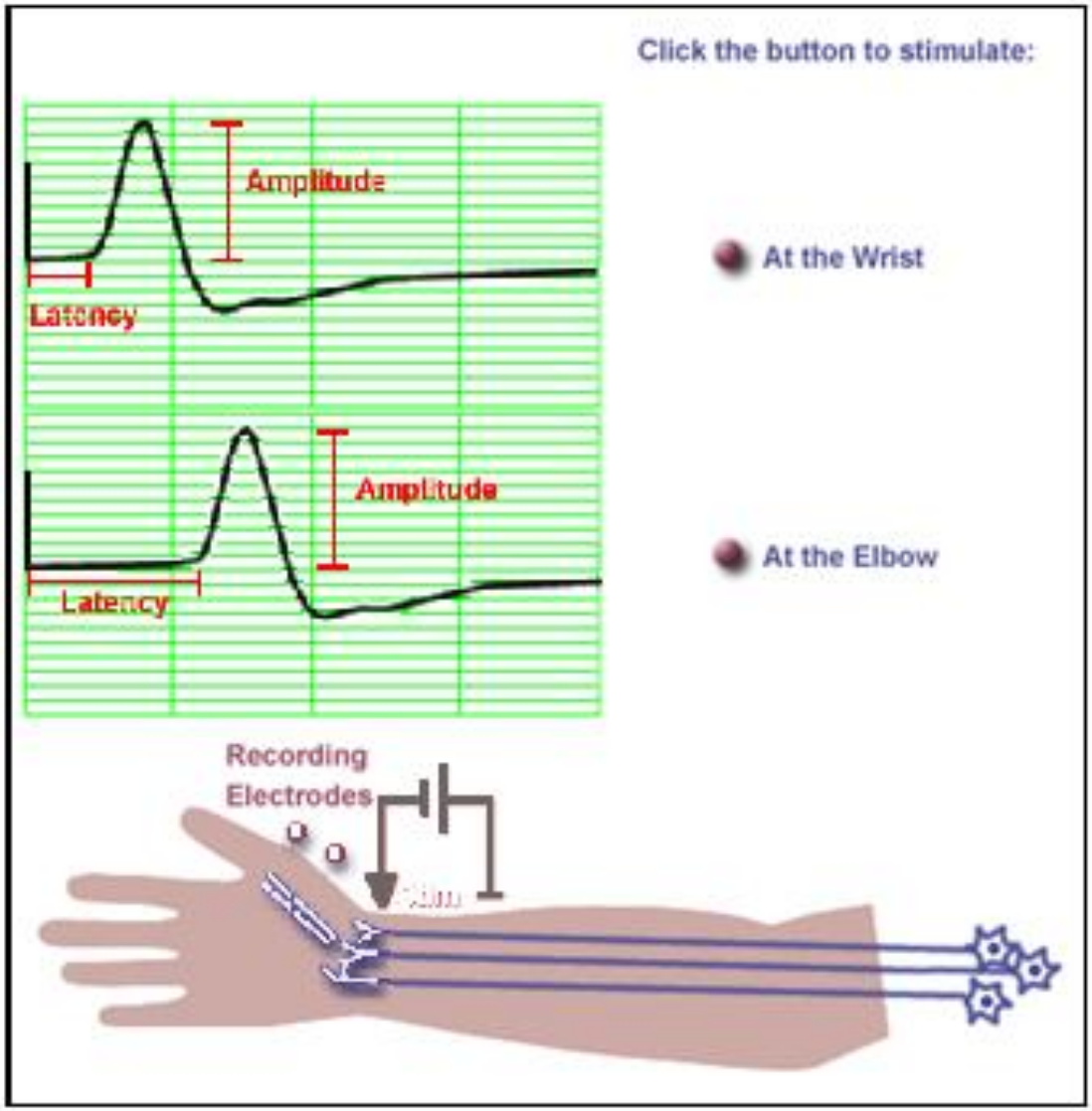
COMPONENTS OF THE CMAP



NI = 3 – 16 msec


(a)
S1
median
S2
R
+
−
+
−
length of nerve
(b)
S1
F
S2
F
10
20
30
Time (ms)

MOTOR NERVE CONDUCTION VELOCITY (MNCV)



- MNCV= $\frac{\text{distance}}{l_1 - l_2}$ (m/sec)

l_1 = latency at elbow.

l_2 = latency at wrist

Distance between the two stimulating electrodes

- abNl if < 40 m/sec

Normal values for conduction velocity

- In arm
  - 50 to 70 m / sec.
- In leg
  - 40 to 60 m / sec.

- Conduction is faster in myelinated fibres.

- Diseases which produce demyelinated peripheral nerves (diabetes,Gillain Barré)slow the conductº greatly(20-30 m/s).

THANK YOU...