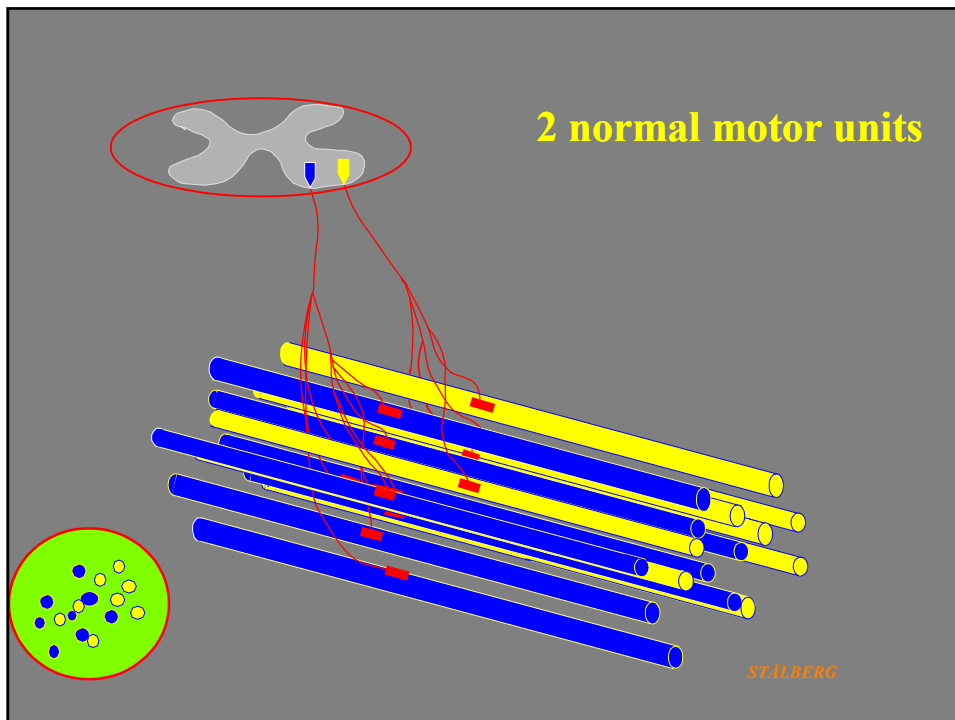


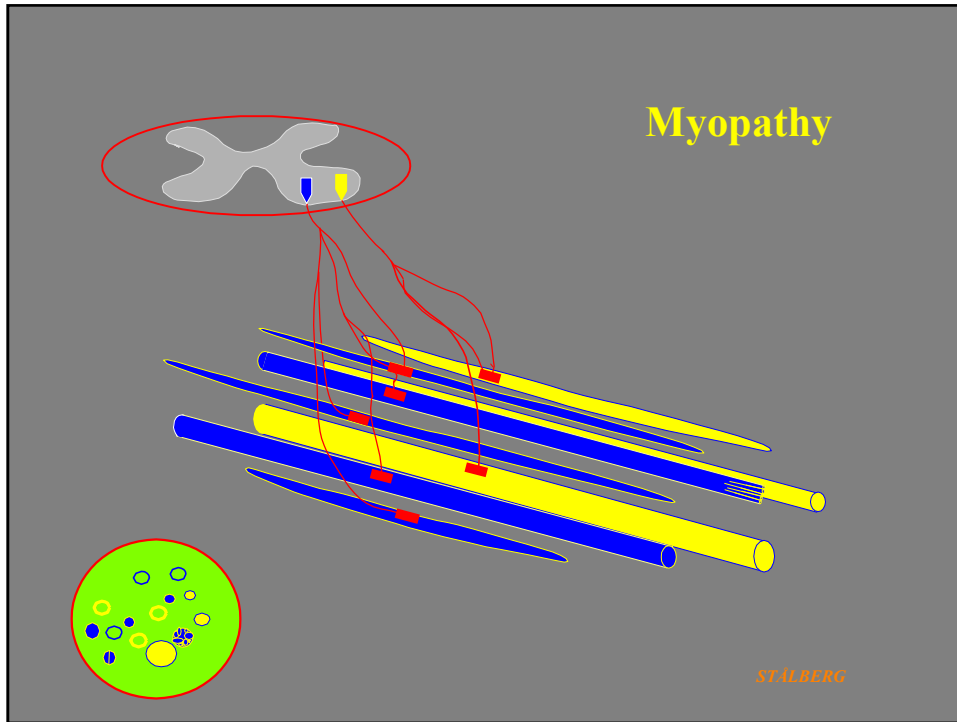
The motor unit; anatomy and physiology

Erik Stålberg

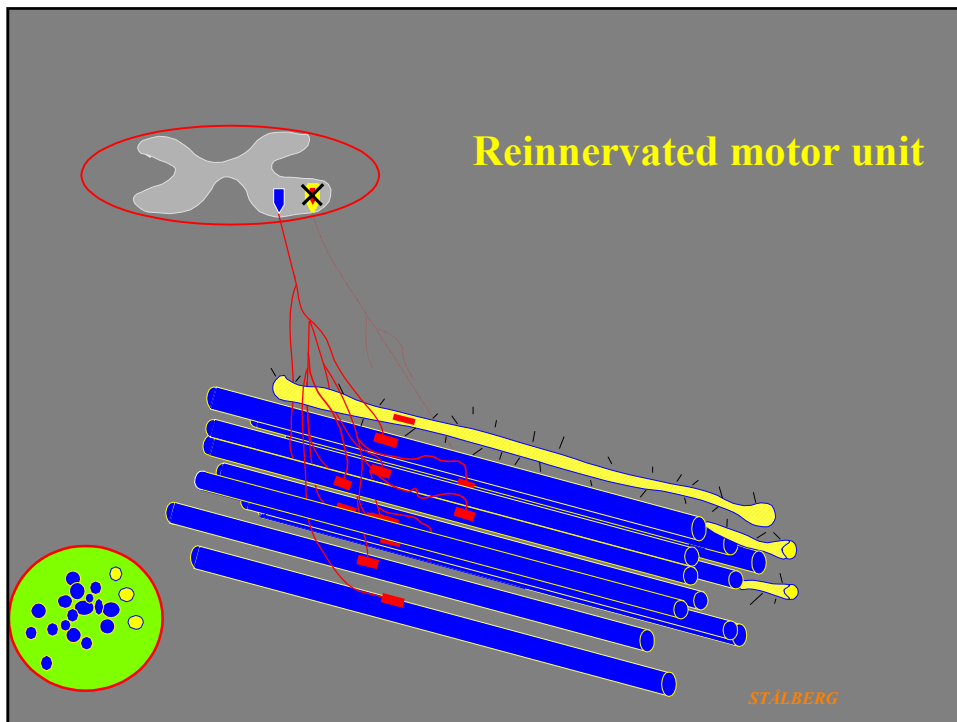
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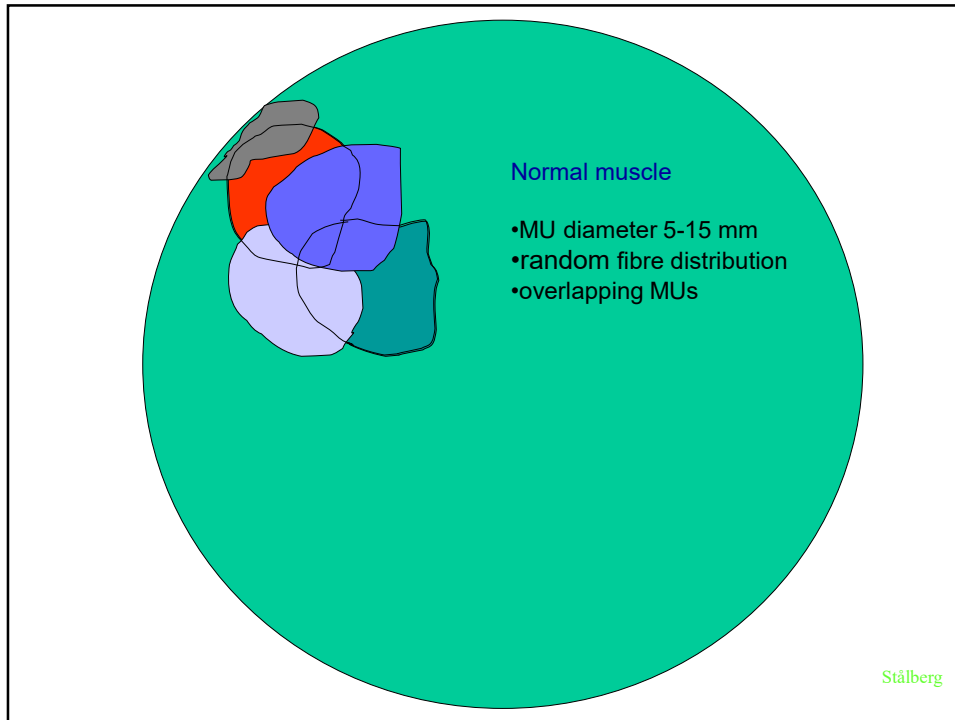
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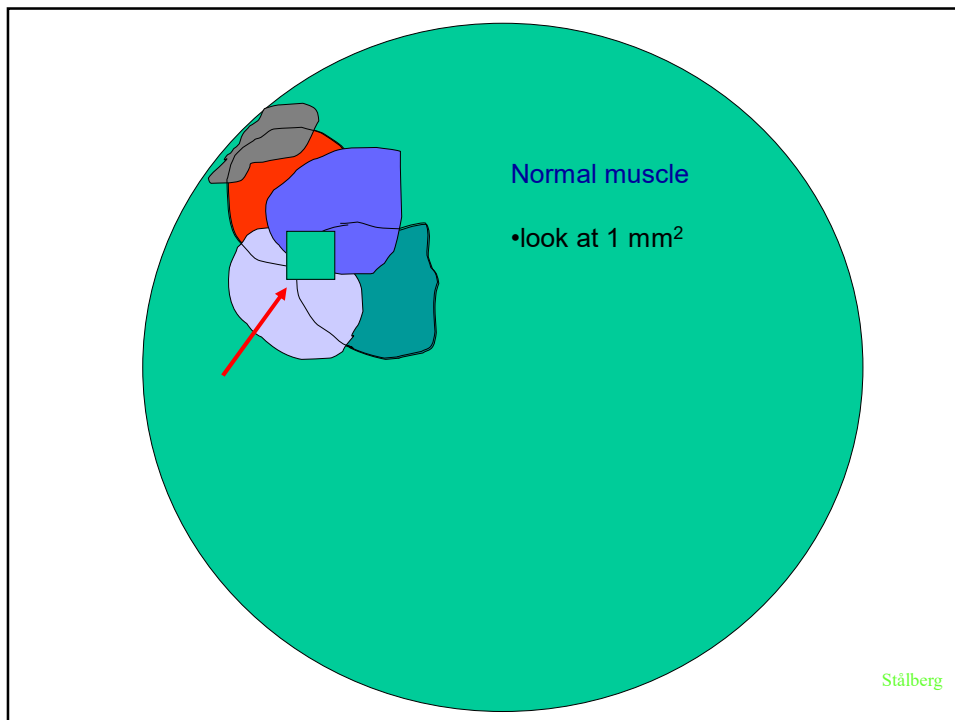
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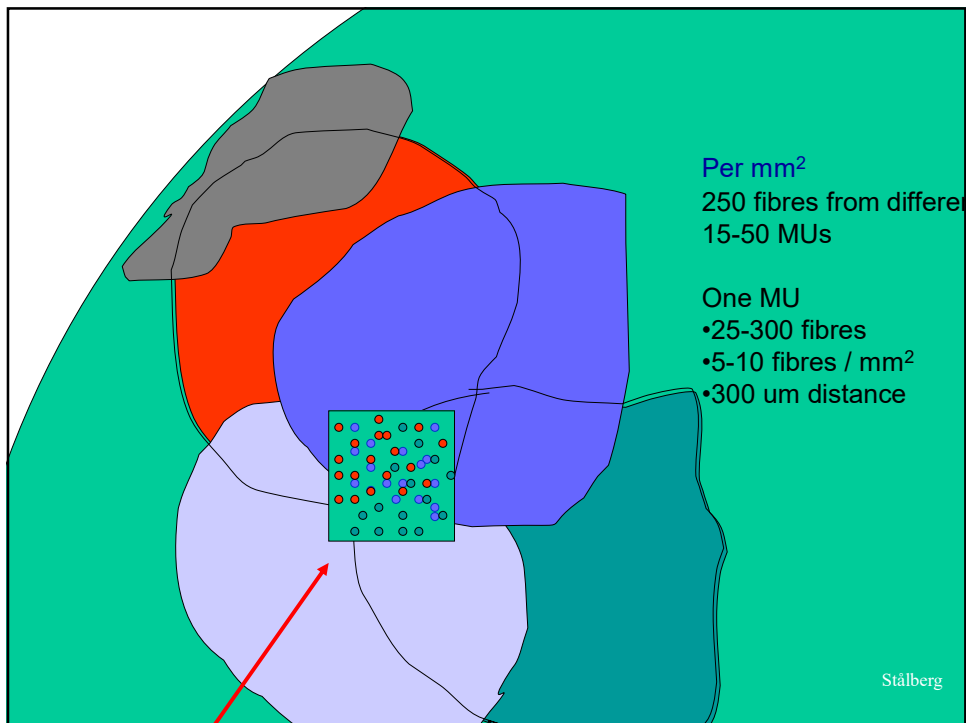
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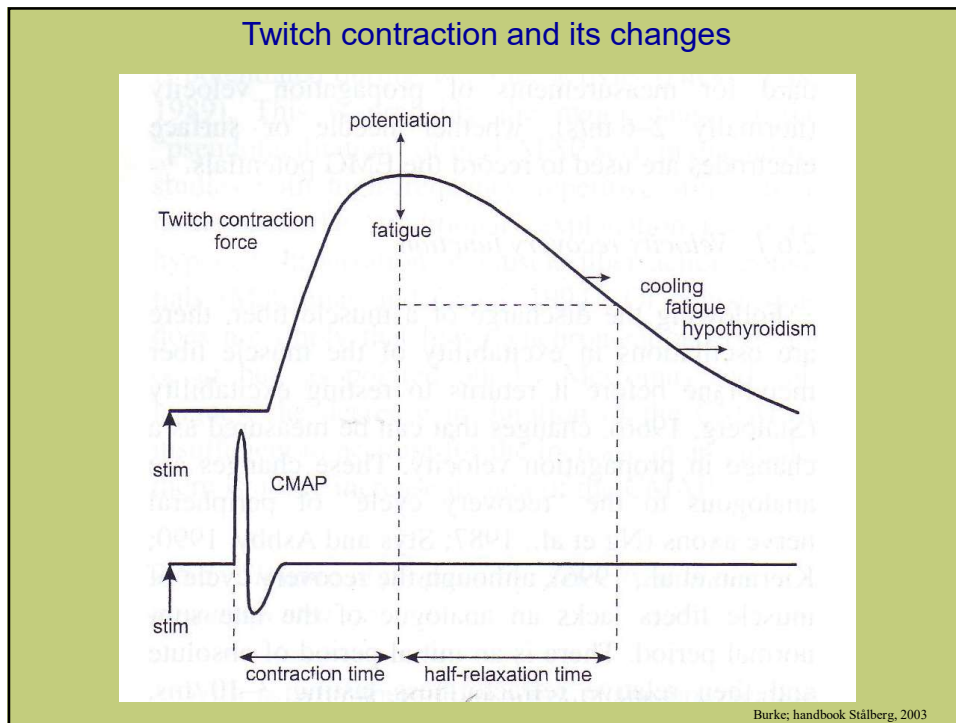


9

Parameters of normal motor units in limb muscles

- **Muscle fibre**
 - histochemistry, metabol. Same for all fibres in a given MU
 - type I slow, aerobic, fatigue persistent
 - type II (A,B,X) fast, anaerobic, fatiguing
 - fibres size 5-90 (50 um)
 - # motor end-plates 1 (1% of fibres have two)
- **Motor unit**
 - width of end-plate band 5 mm
 - distance between fibres 200 um
 - # fibres/MU 20-500 (100-200)
 - territory 2-15 mm (10 mm)

10

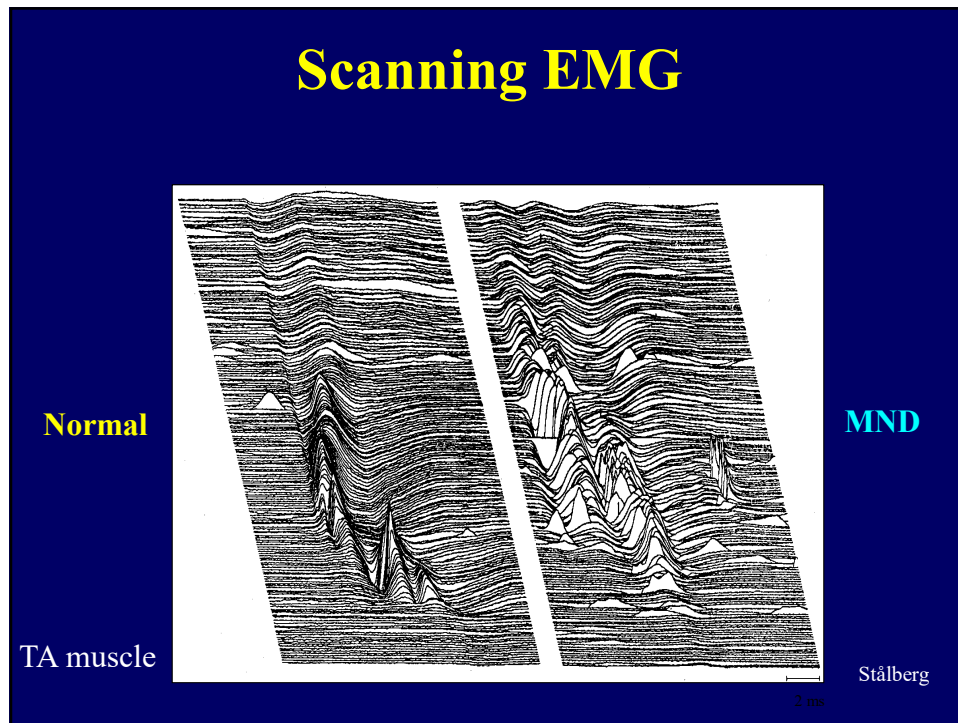


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Muscle fibre types

Type	I	IIA	IIB/IIX	IIC
class	SO	FOG	FG	
animal	S	FR	FF	
myosin	slow	fast IIA	fast IIB	
tension	low	intermediate	high	interm
contr speed	slow	fast	fast	slow
fatigue rest	high	interm/high	low	high
capillary	high	high	low	
recruitment	first	second	third	?

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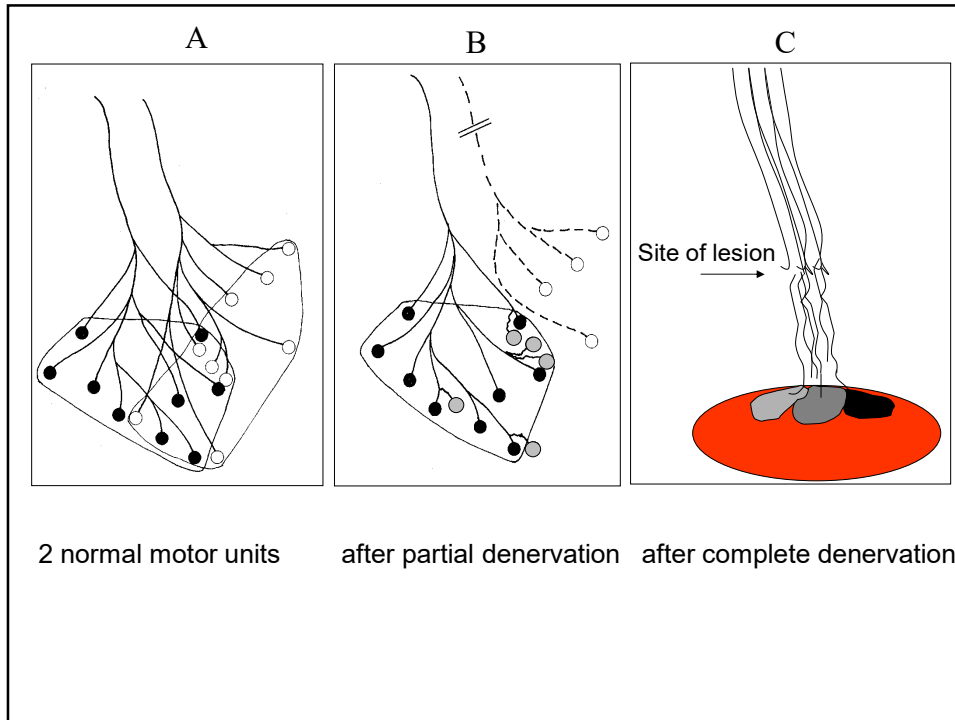
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Parameters of normal motor units in limb muscles

Anterior horn cell

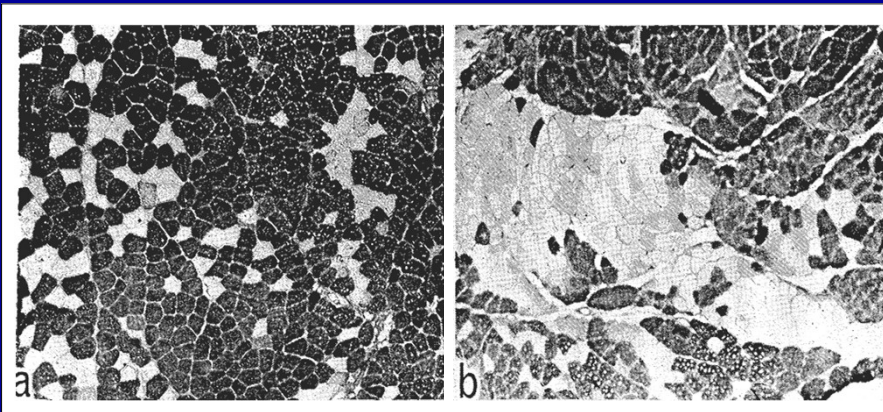
- monosynaptic from corticospinal and Ia afferents
- polysynaptic via interneurons
- firing pattern type I= tonic, type II= phasic
- size principle successively larger MUs are recruited
- H-reflex jitter 50-400 usec

14



15

Grouping after partial denervation in rats



Anterior tibial muscle reinnervated, following root section, by collaterals from intact nerve fibres.

Rat 13. a: moderate denervation after L5 motor root section, showing part of one motor unit of 454 fibres with some grouping.

Rat 16. b: severe denervation after L4 motor root section, showing part of one motor unit of 551

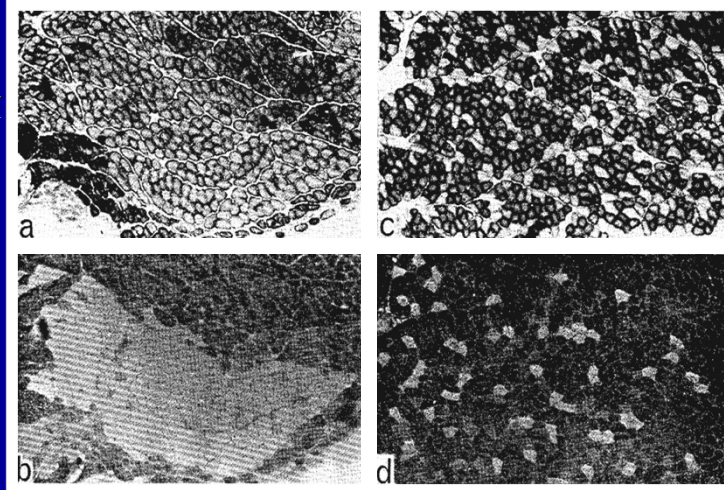
fibres, for the most part with compact distribution.

E Kugelberg et al 1970

16

Dense groups after nerve transection followed by union in rats

SADH



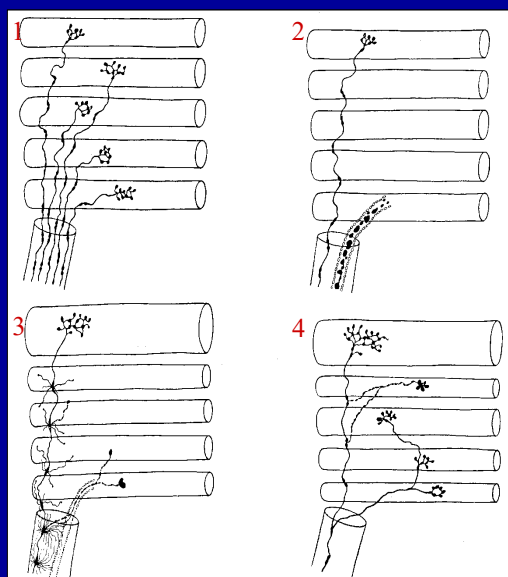
Reinnervated
tibial anterior muscle

Control rat

E Kugelberg et al 197

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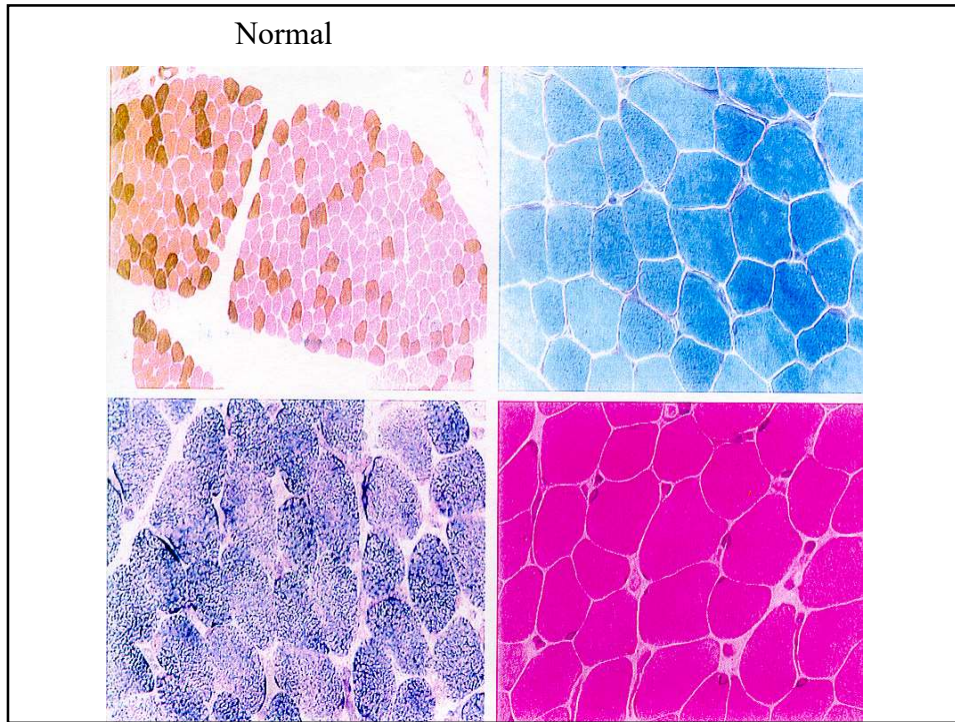
Diagrams showing collateral sprouting after partial denervation



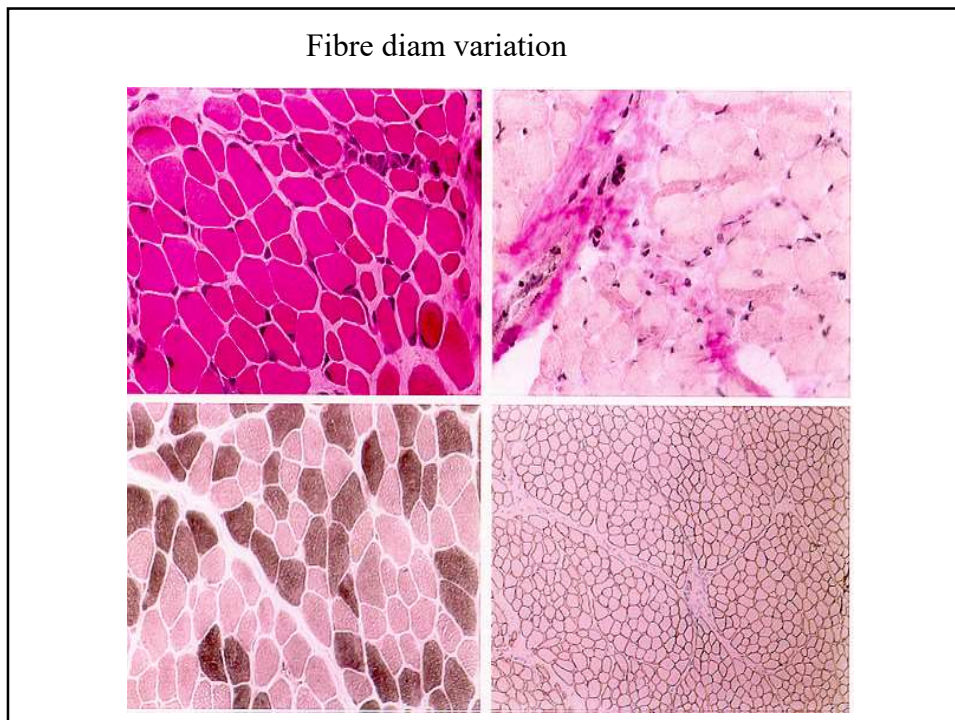
1. Normal
2. Partial denervation
3. Early sprouts
4. Collateral sprouting

Coërs and Woolf 1959

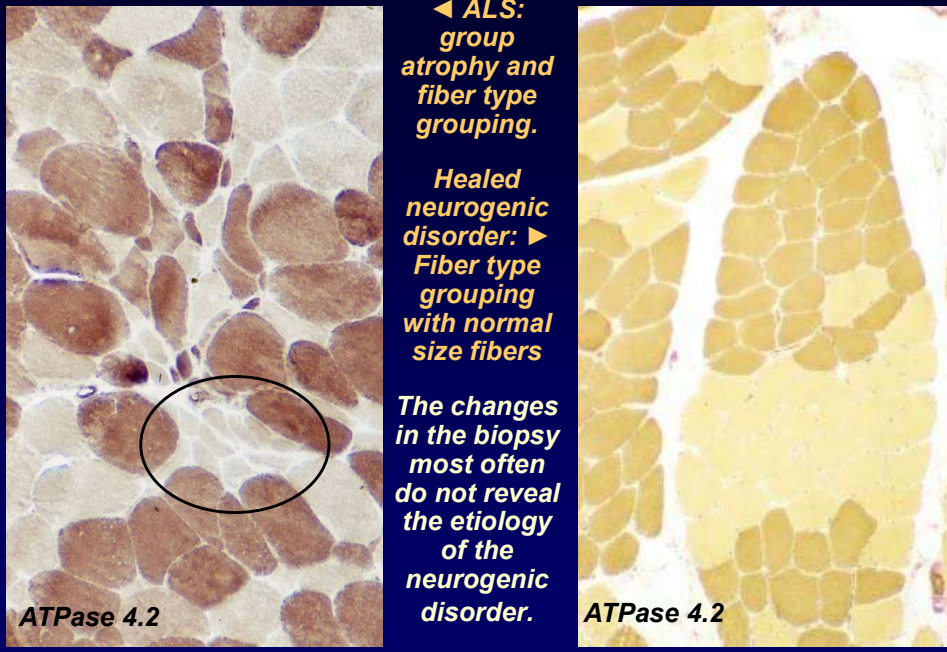
18



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◀ **ALS:**
group atrophy and fiber type grouping.

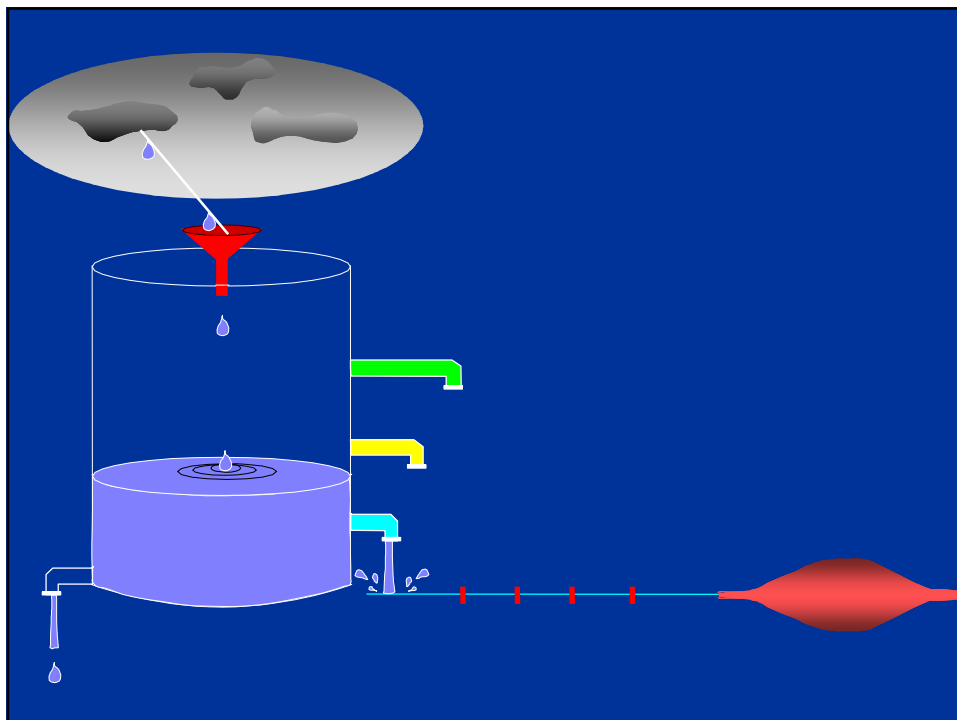
Healed neurogenic disorder: ▶
Fiber type grouping with normal size fibers

The changes in the biopsy most often do not reveal the etiology of the neurogenic disorder.

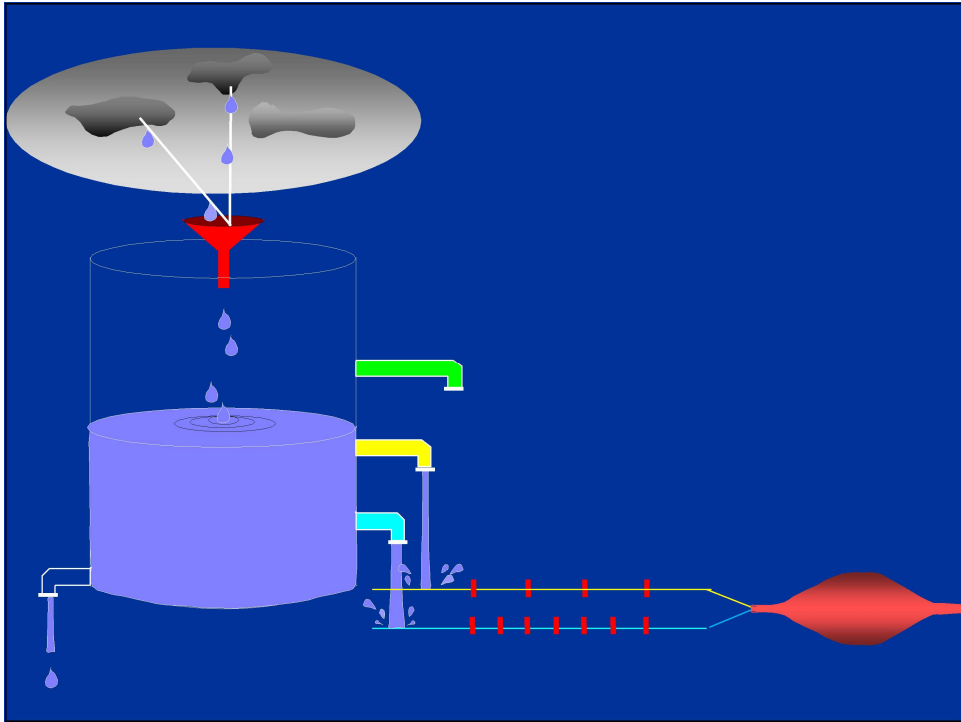
ATPase 4.2

ATPase 4.2

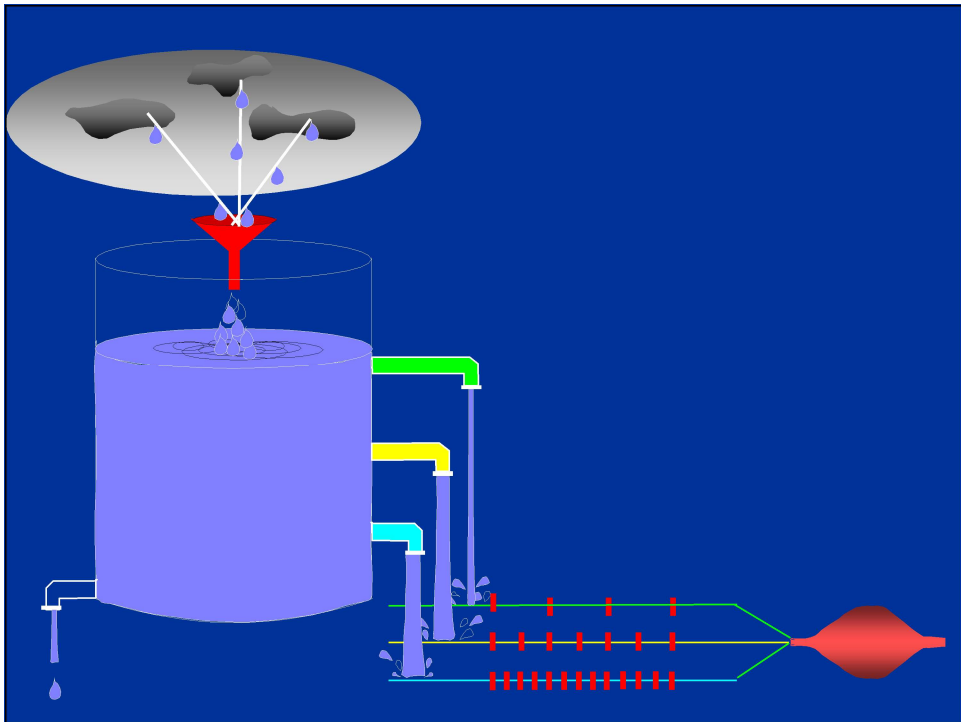
28



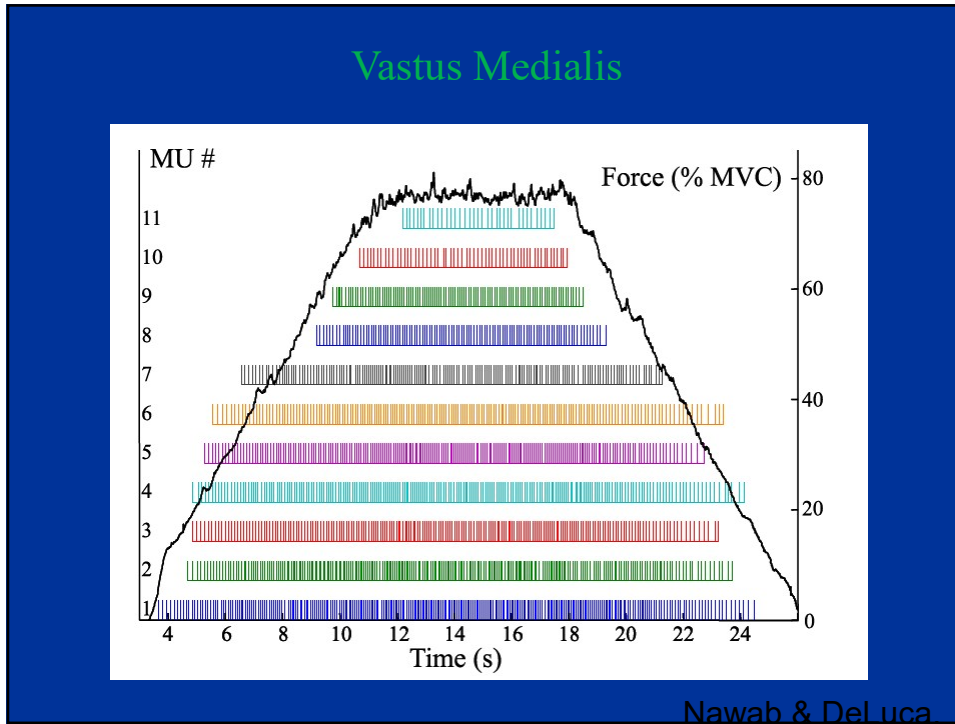
29



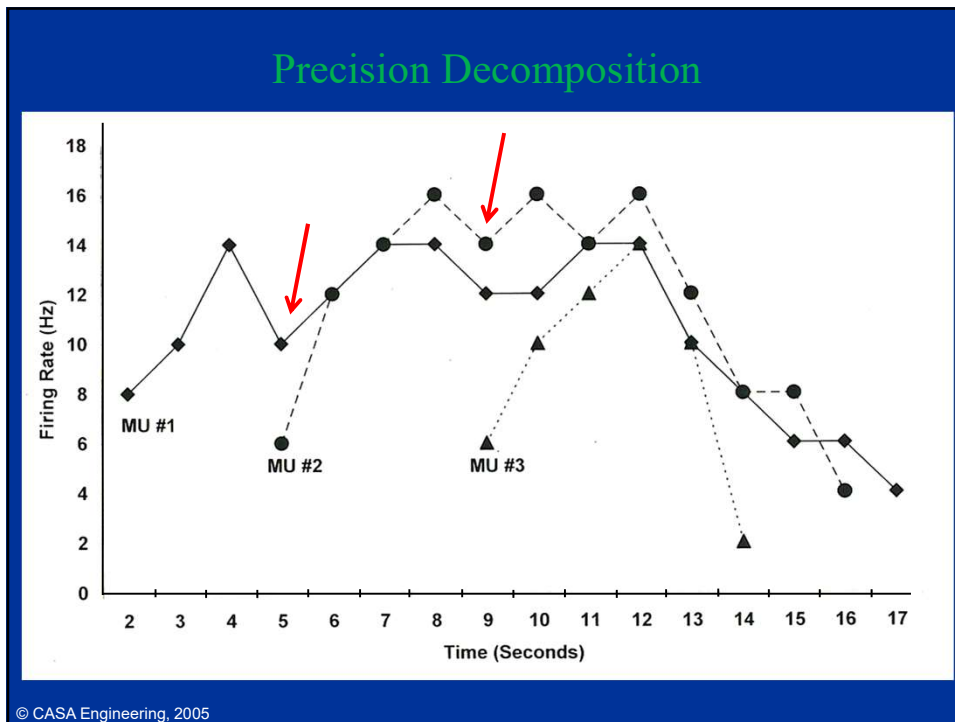
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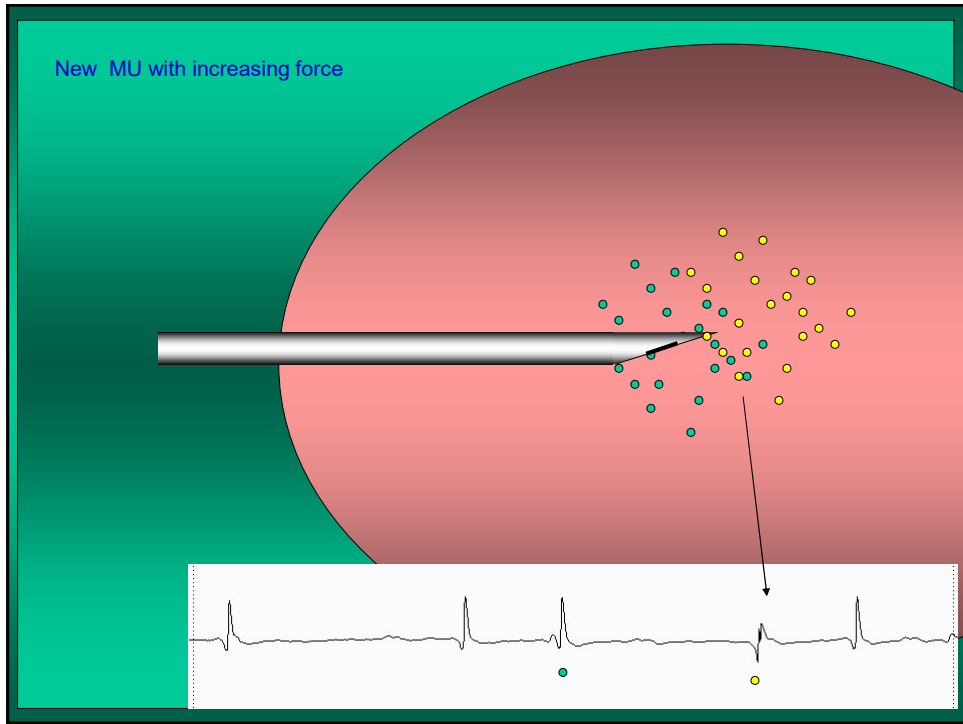
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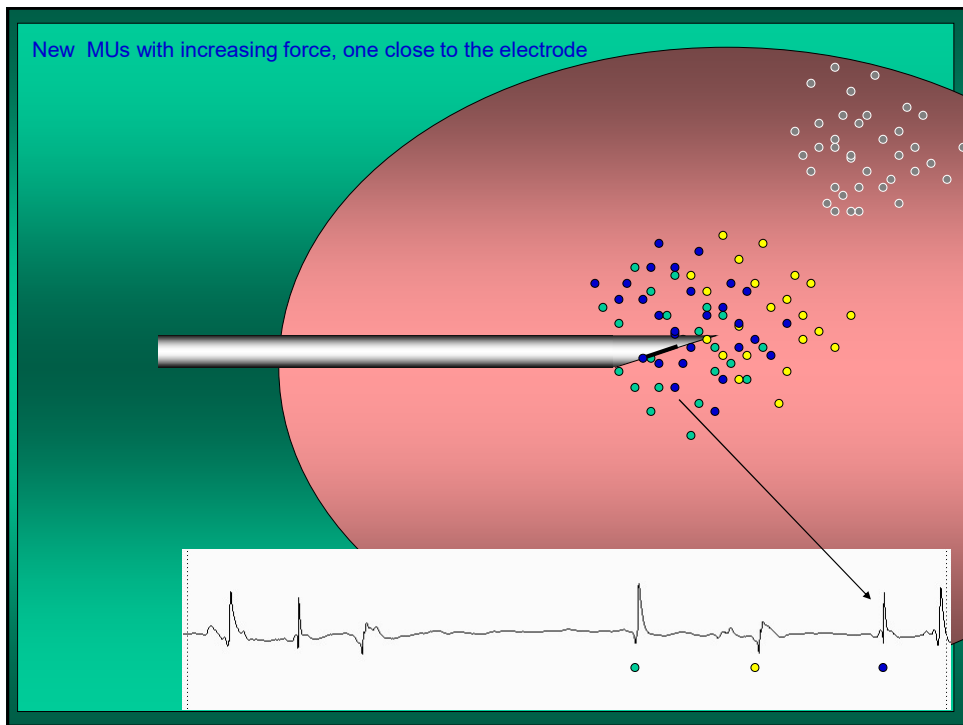
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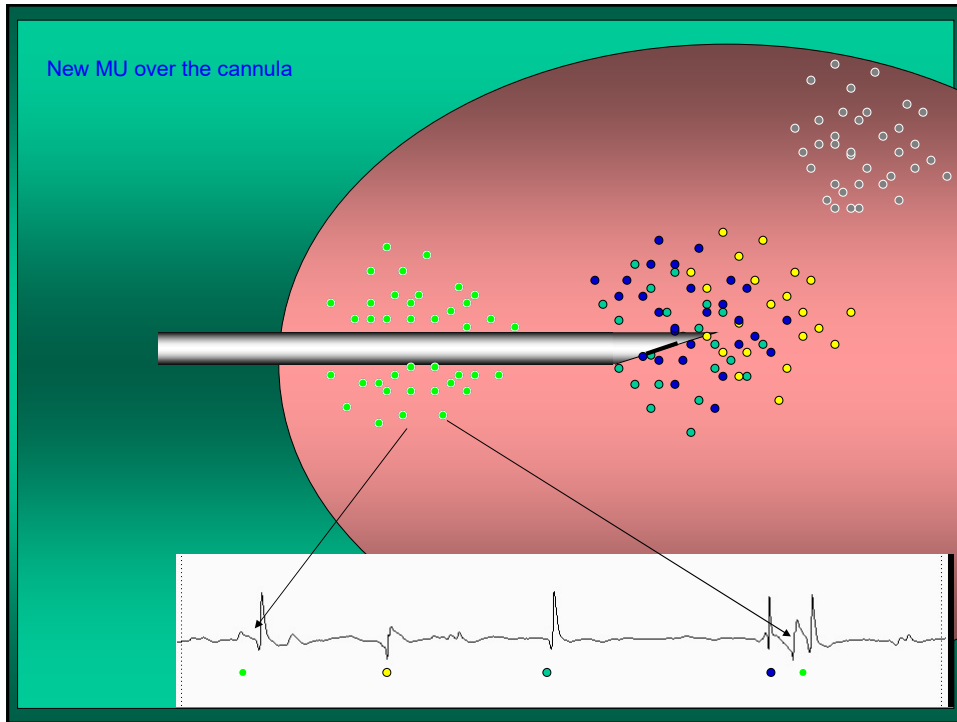
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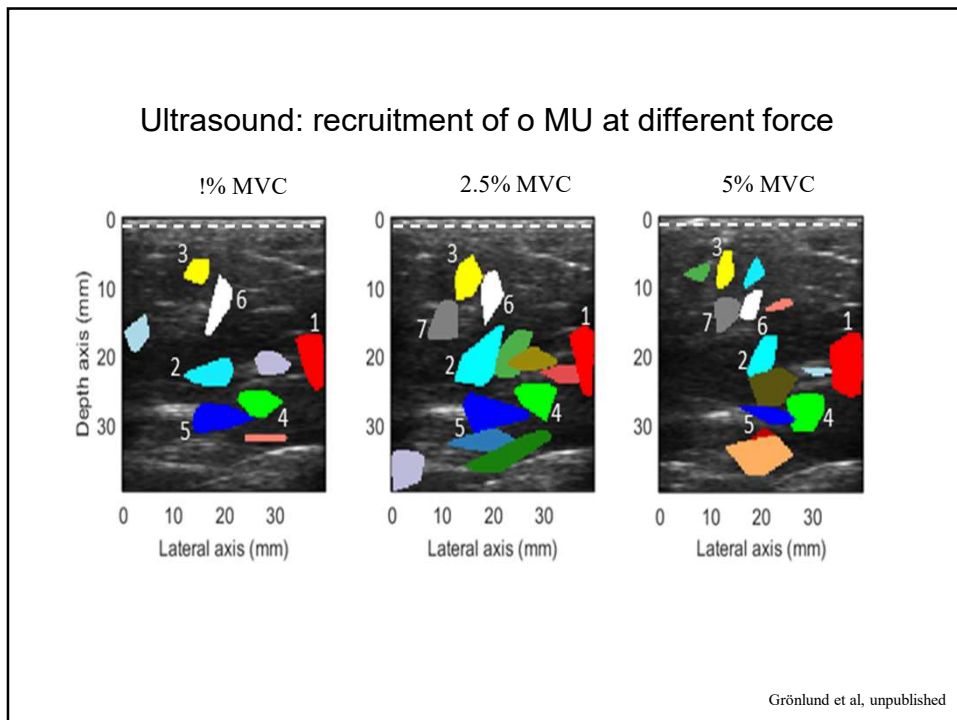
42



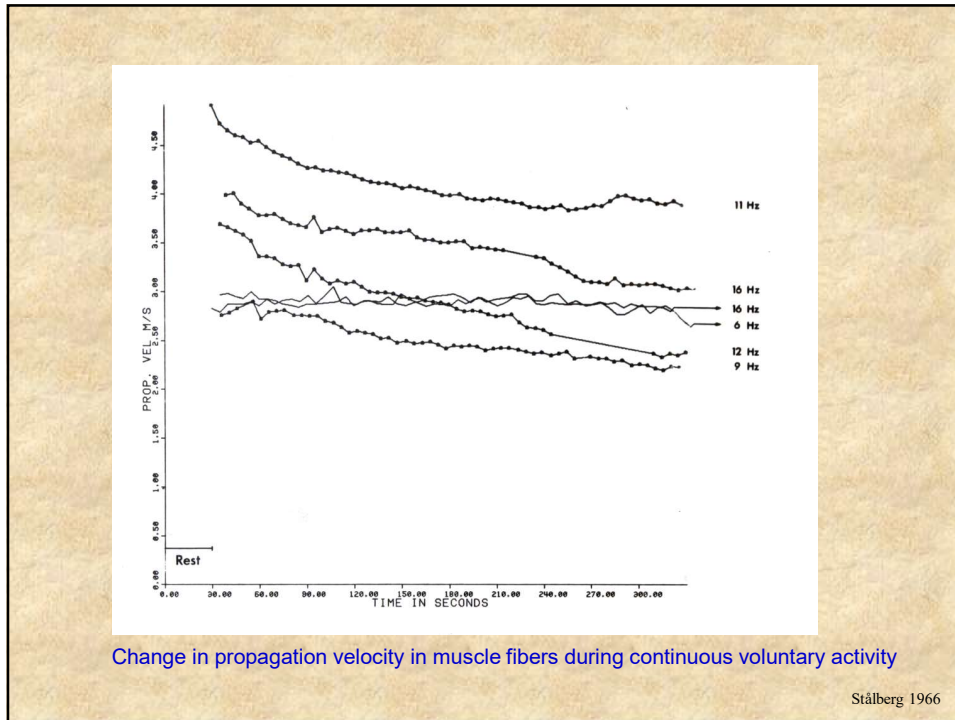
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Electrophysiological methods to study the Motor Unit

• Structure

- anterior horn cell
- nerve
- n-m junction
- muscle unit
- muscle fibre

• Method

- reflexes, firing pattern
- conduction studies
- microneurography
- MUNE
- SFEMG, rep stim
- EMG, twitch
- SFEMG



Stålberg

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