Neuromuscular System

by Dr Grant Ralston

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Objectives

- Describe anatomy of the muscular unit
- Understand force production
- Understand reflexes
- Describe neuromuscular training adaptations

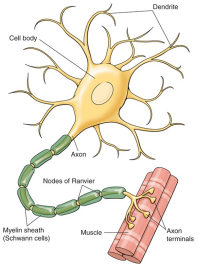
2

Nervous System

- Anatomical divisions
  - Central nervous system
  - Peripheral nervous system
- Functional divisions
  - Somatic (voluntary)
  - Autonomic (involuntary)

3

The Neuron



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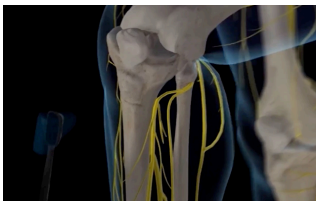
Reflexes

- Involuntary motor response to a stimulus
- Knee jerk reflex
- Withdrawal reflex



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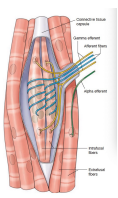
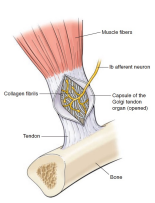
Proprioception and Kinesthesis





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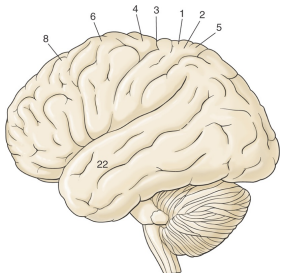

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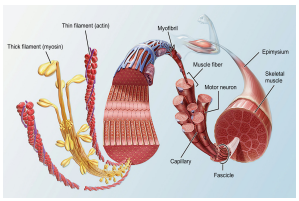
Structure of the Skeletal Muscle



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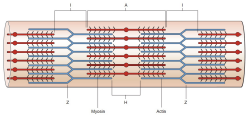
Structure of the Myofibril and the Contractile Mechanism



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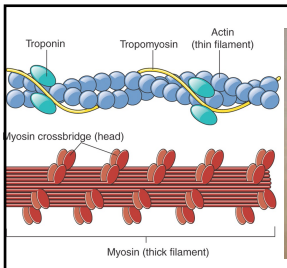

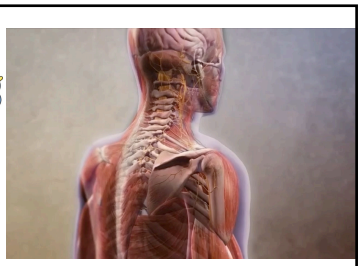

Sliding Filament Theory of Muscle Contraction

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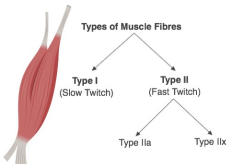
Muscle Fiber Types

- The three primary fiber types in human skeletal muscle are slow-twitch oxidative (SO), fast-twitch oxidative glycolytic (FOG), and fast-twitch glycolytic (FG).
- These fiber types are also identified as:
  - Type I
  - Type IIA
  - Type IIX



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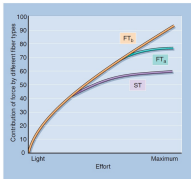

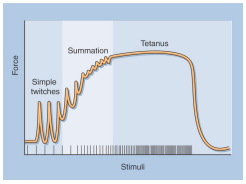

Graduation of Muscular Force

- Smaller MU are typically composed of ST fibers and have the lowest stimulus thresholds for contraction
- Increasingly forceful contractions, however, require the recruitment of larger MU containing fast-twitch fibers

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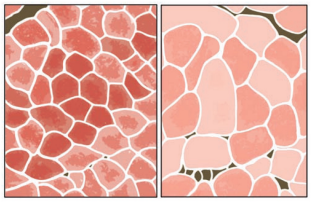
Muscular Fibre Adaptations

- Hypertrophy
- Atrophy
- Hyperplasia
- Sarcopenia



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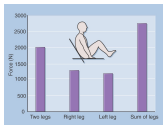
Bilateral/Unilateral Strength

- Unilateral cross-education
  - 60% increase in untrained limb
- Bilateral deficit
  - Inhibitory mechanism



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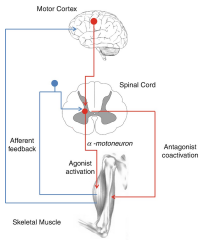

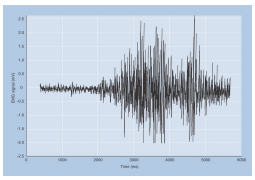

EMG Evidence of Neural Adaptations

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Multiple Sclerosis

by Dr Grant Ralston

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Objectives

- Epidemiology and aetiology of multiple sclerosis
- Pathophysiology of multiple sclerosis
- The disease process

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Estimates for the prevalence of MS in men and women in the UK

People with MS in the UK

131,000 live with MS

That's 1 in every 500 people

130 new people are diagnosed every week

	Number of people with MS*		Number of people with MS (per 100,000 people)†,#	
Age	**Women**	**Men**	**Women**	**Men**
Under 30	2,780	1,670	23	13
30-34	3,680	1,610	166	73
35-39	6,050	2,320	281	109
40-44	7,680	2,800	376	139
45-49	10,010	4,210	431	187
50-54	13,930	4,910	588	214
55-59	13,660	4,320	644	209
60-64	10,400	4,010	567	228
65-69	10,720	4,060	598	241
70-74	8,160	3,640	503	244
75+	8,490	2,620	272	115
Total	**95,560**	**36,160**	**286**	**111**
Total persons	**131,720**		**199**	

*Numbers rounded to nearest 10, †numbers rounded to 0 decimal places, # based on an incidence rate calculated from average annual incidence 2012-2017. (MS Society, 2020)

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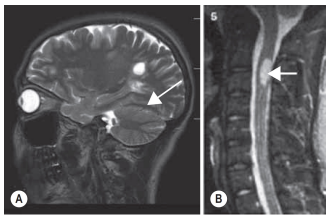
Epidemiology and Aetiology



An MRI image showing MS lesions in the brain (a) and spinal cord (b).

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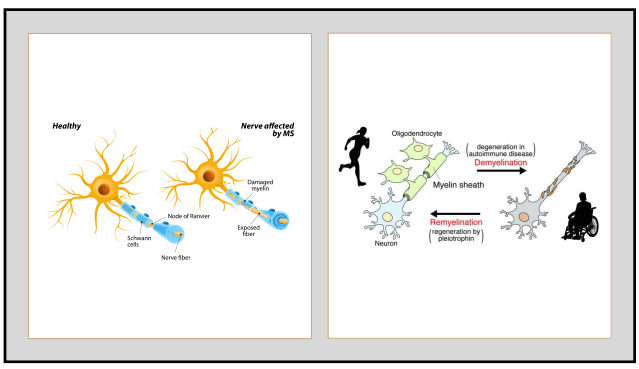

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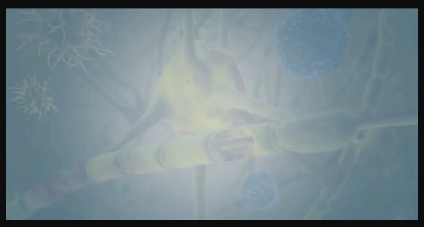
Multiple Sclerosis (MS): Key Points



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Symptoms of MS

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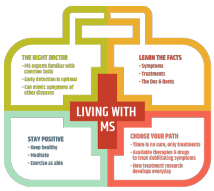
Treatment of MS

- Key supplementary elements to the physical management, through exercise, for MS include the following:
  - Diet
  - Medication
  - Catheterisation



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