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Exercise with Duchenne or Becker Muscular Dystrophy

Molly Stark, PT, DPT

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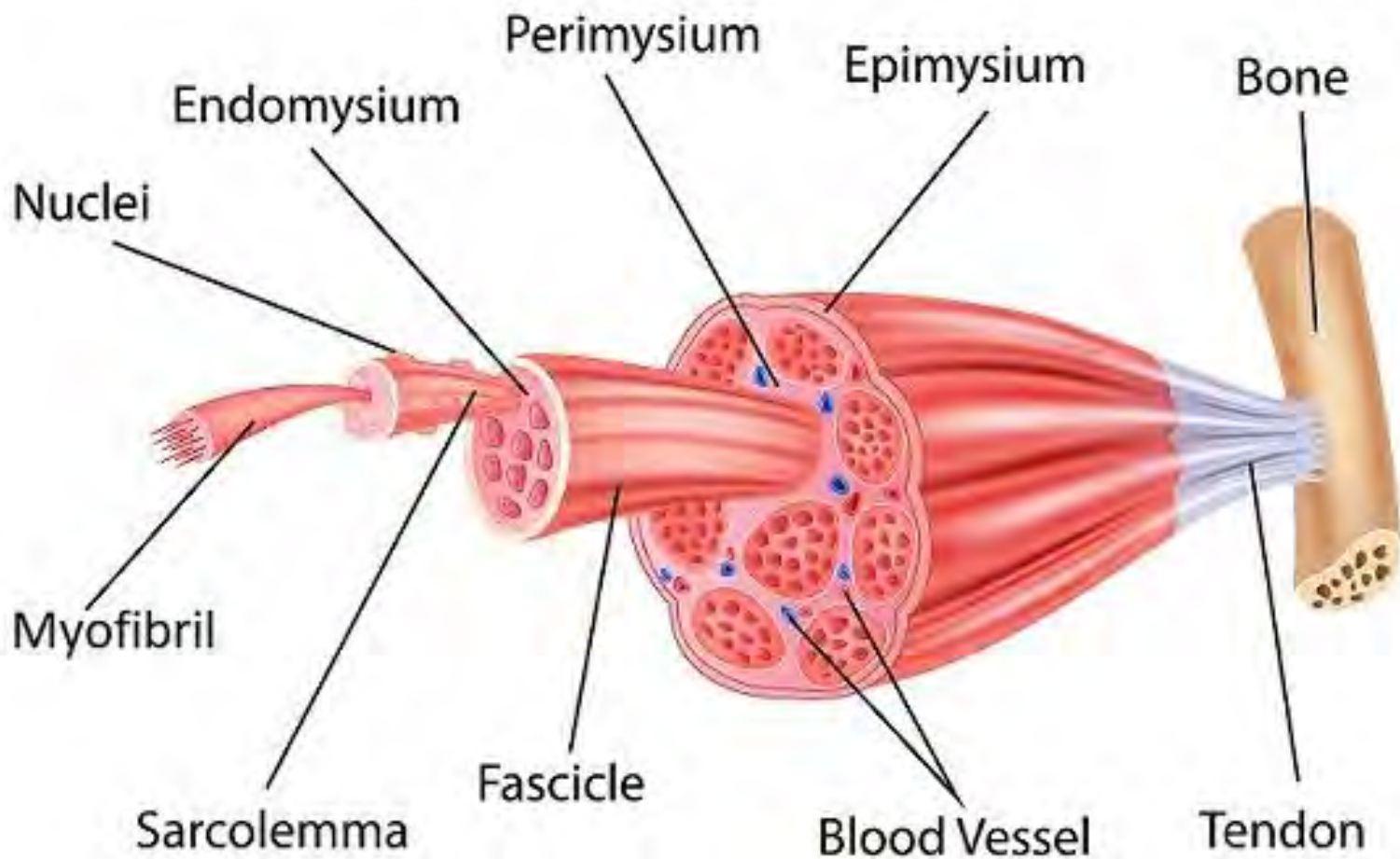
Disclosures

- I am a speaker for the Biogen speakers' bureau
- I am a clinical evaluator for clinical trials funded by the following companies: PTC Therapeutics, Avidity Biosciences, Baxalta Inc, Edgewise Therapeutics, ML Bio Solutions

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Skeletal Muscle Structure



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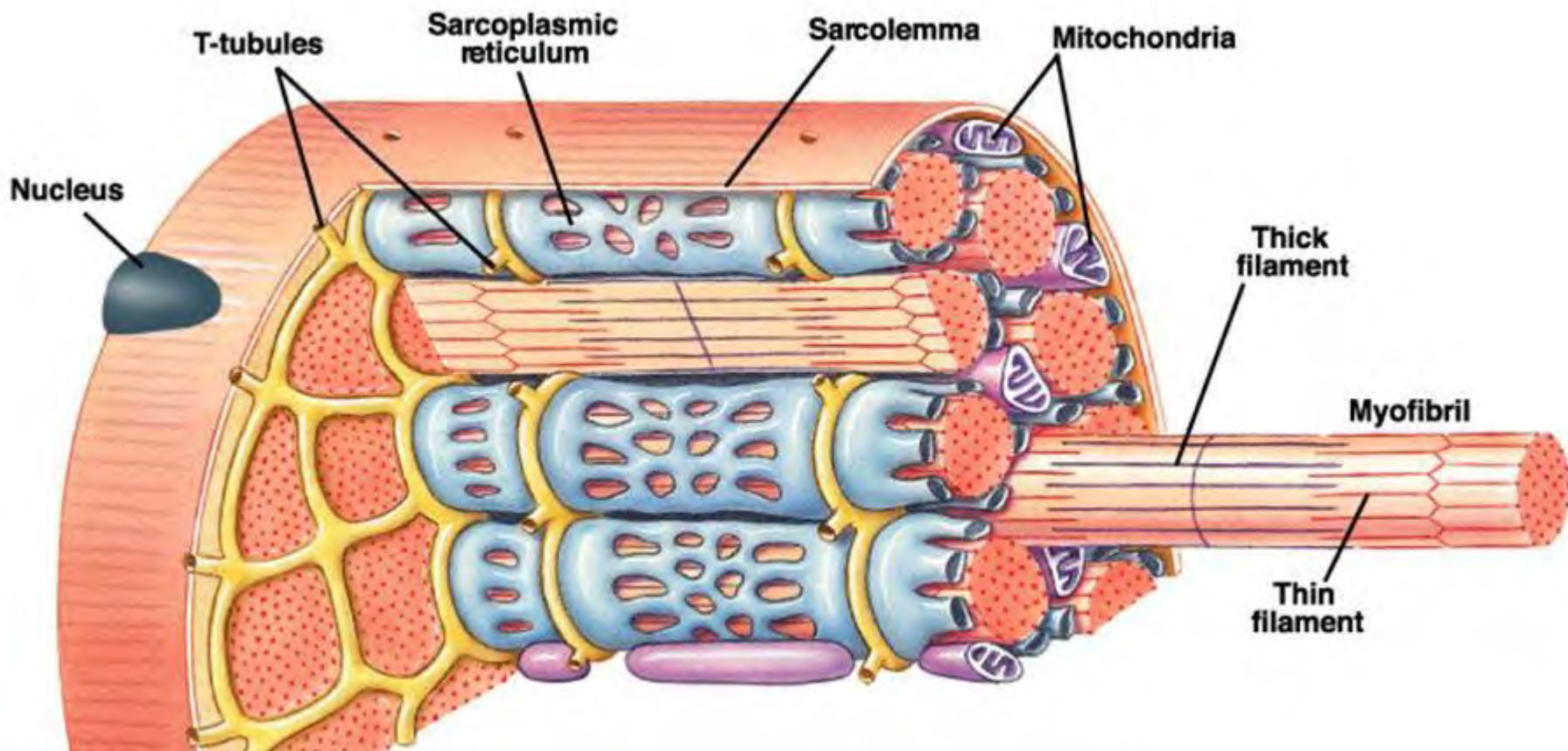


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Muscle Cell



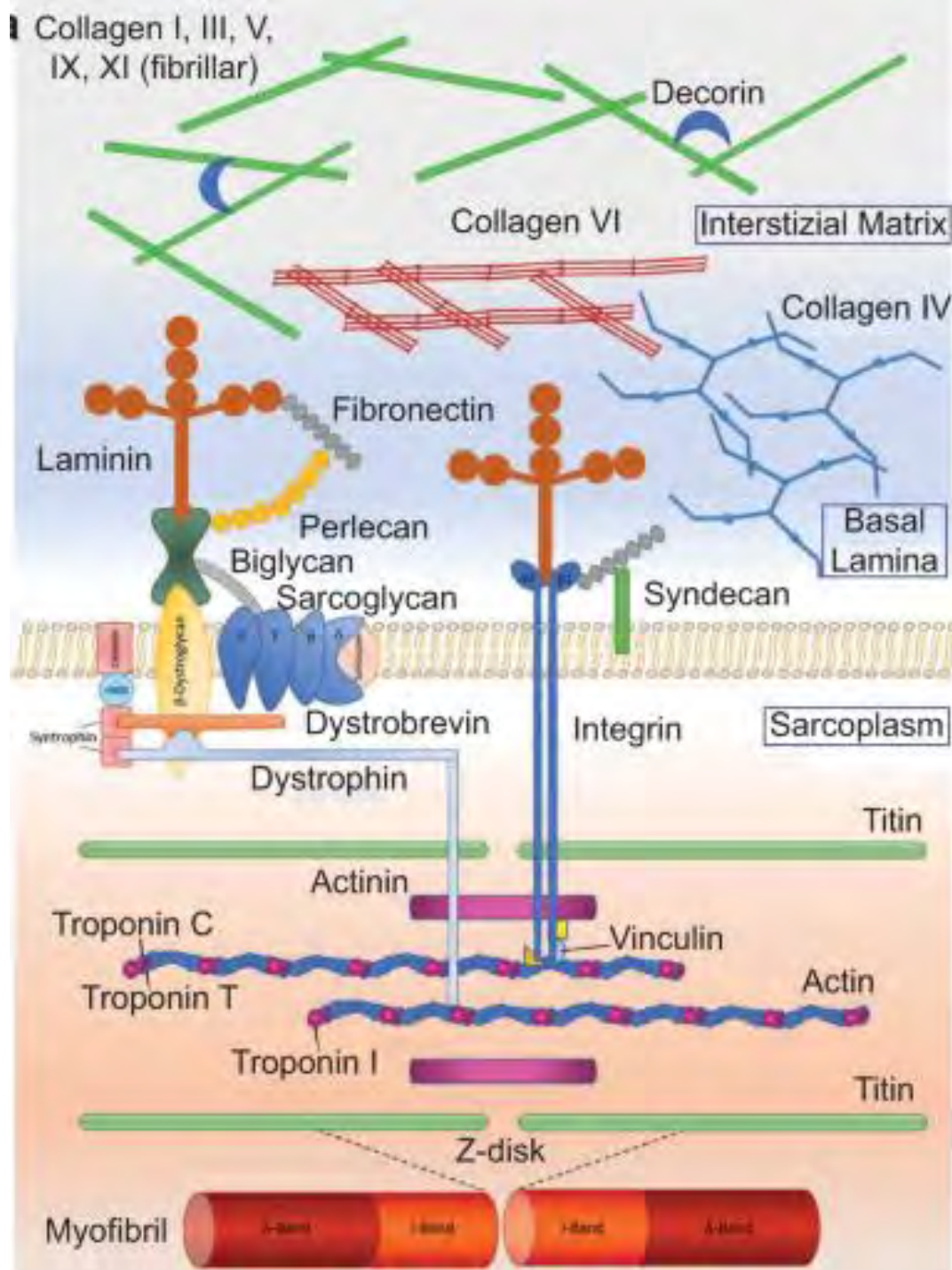
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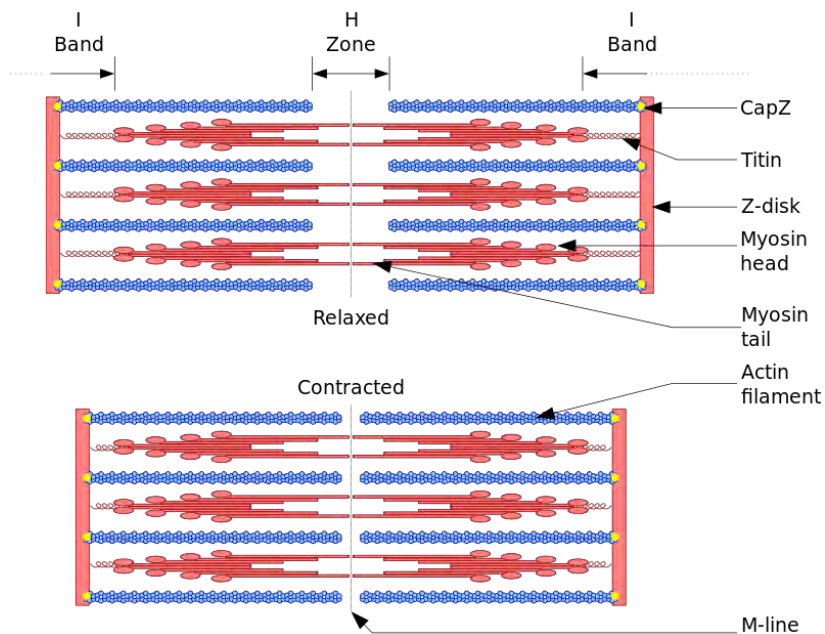


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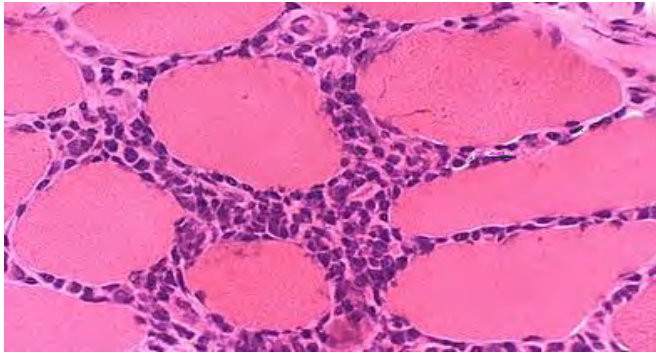
Muscle contractions



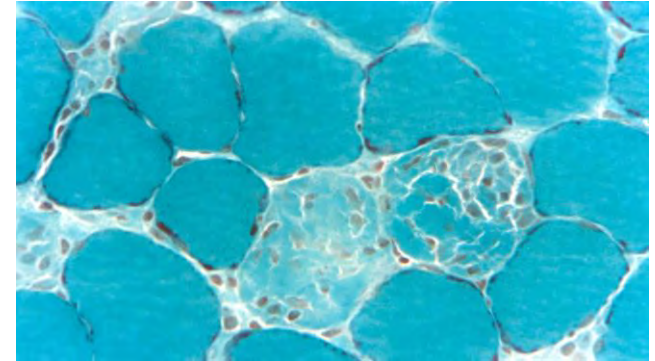
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Pathogenesis

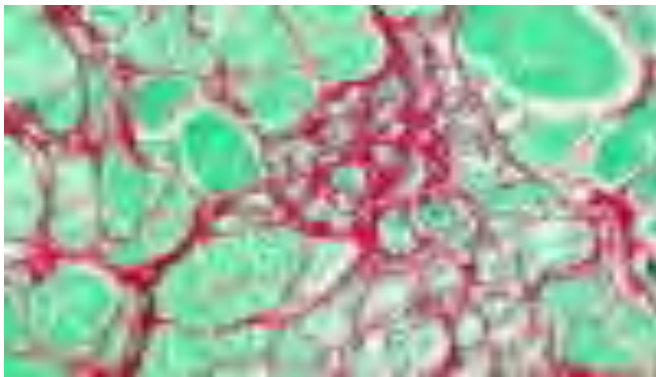
Inflammation



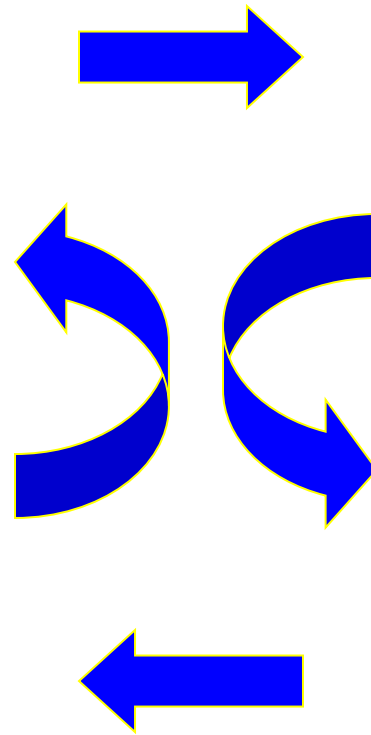
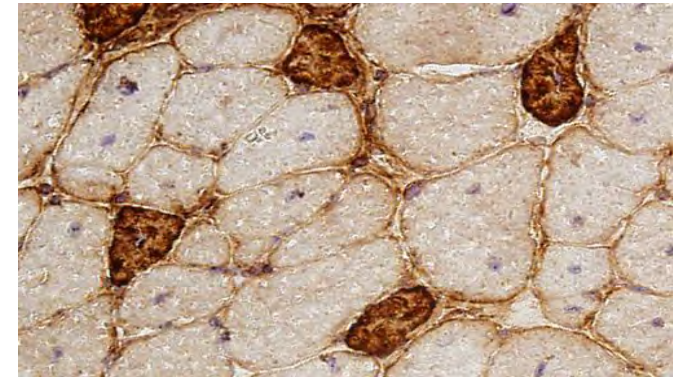
Degeneration



Fibrosis



Regeneration



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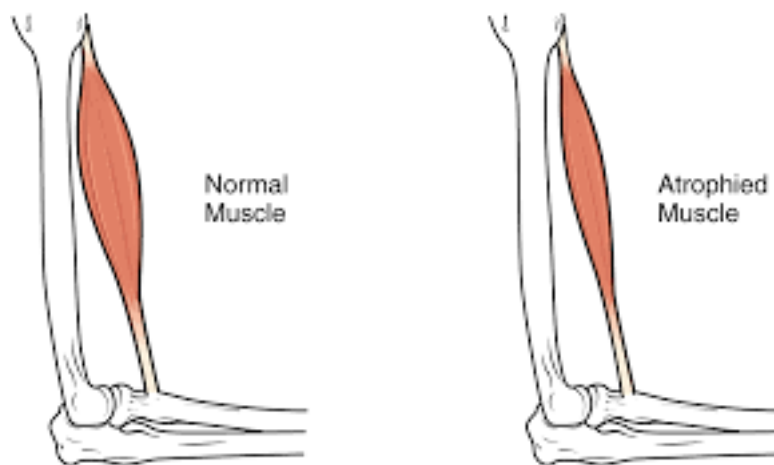
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Disuse Atrophy

- Muscle wasting caused by decreased use of the muscle



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Cardiopulmonary Considerations

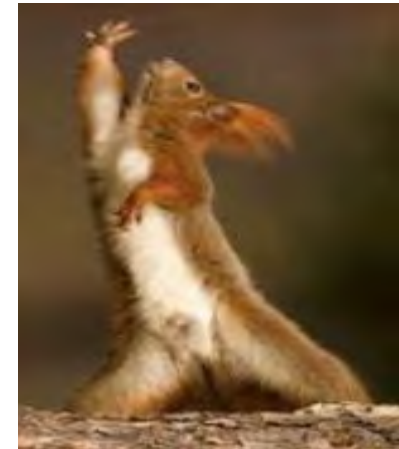
- Strenuous exercise can also trigger an acute heart or lung problem
 - Consult a cardiologist before starting an exercise program



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Meta-Analysis

- 12 studies included from 1966 to 2018
- Subject characteristics
 - N=282 (14-45 per study)
 - Mean age 10.7 yo (range 5-24 years)
 - 86 ambulatory, 108 non-ambulatory, 88 unknown
- Interventions
 - Limb exercise (5 studies)
 - Cycling (2 studies)
 - Videogames (1 study)
 - Resistance training (2 studies)
 - Respiratory muscle training (7 studies)
- Duration
 - Short term: 1-3 months (6 studies)
 - Long term: 5-12 months (6 studies)



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Respiratory Exercise

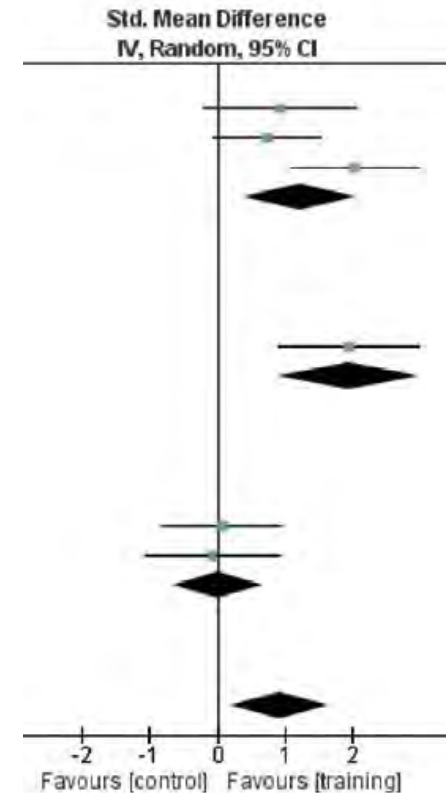
	Freq	Intensity	Type
Houser 1971	5x/wk	Vary pressure with CPAP	Exercises with CPAP, cough cycles, and forced expiration
Martin 1986	5x/wk	20% over vital capacity, in/exp 3-5 sec	Strength and endurance with circuit respiration device (limits flow)
Radillo 1989	5x/wk	20 inspirations with increased resistance	Inspiratory muscle training with Triflo
Stern 1989	5x/wk	Different resistance levels	Inspiratory training with flow resistance to play video game
Wanke 1994	2x/day, 5x/wk	1 min x10 reps with 20 sec rest	Maximal inspirations with training device
Zileili 1999	3x/day, 7x/wk	10 reps	Isolated chest breathing Triflo device
Topin 2002	2x/day, 5x/wk	30% of max	Inspiratory resistive muscle training with Triflo

Limb Exercise

	Freq	Intensity	Type
Alemdaruglo 2015	3x/wk	50% of max for 40 minutes	Arm cycling
Heutinck 2019	5x/wk	15 minutes	Arm training with gravity assisted videogame
Jansen 2013	5x/wk	<6/10 on OMNI scale for 15 min legs/15 min arms	Active assisted arm and leg cycling
Scott 1989	7x/wk	15 minutes	Leg exercises with manual resistance and passive stretching
Vignos 1966	3-7x/wk	10 reps with max resistance for 10 minutes	Resistance muscle training of arm, leg, and abdominal muscles

Muscular Strength

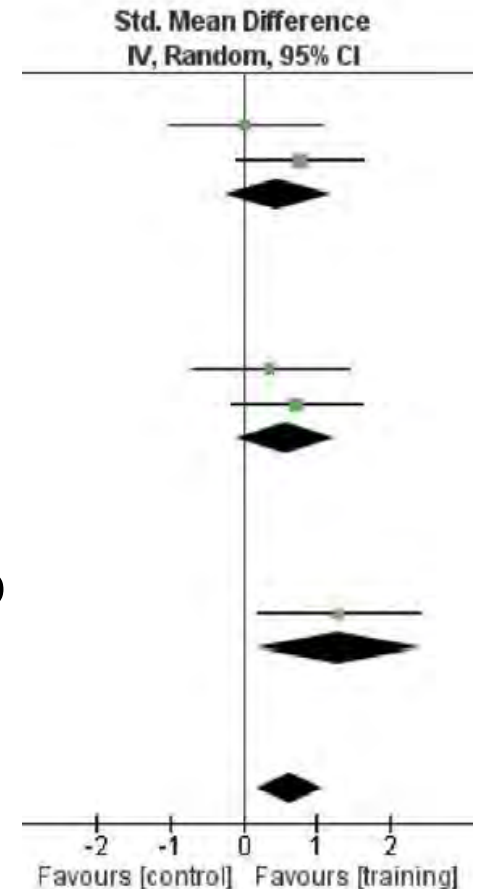
- Exercise training (limbs) versus none
- Respiratory muscle training versus none
- Respiratory muscle training versus placebo
- Total



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Muscular Endurance

- Exercise training (limbs) versus none
- Respiratory muscle training versus none
- Respiratory muscle training versus placebo
- Total



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Summary of Other Findings

- Functional assessments
 - Small or no effect
- Lung function
 - No effect
- Health-related quality of life
 - 1 study showed non-significant improvement
- Safety
 - No systematic adverse events



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Studies since 2021

- Dhargave 2022
 - Yoga + PT is equally as effective as PT alone
- Stessel 2022
 - Martial arts training is safe and feasible
- Bulut 2022
 - Aerobic training with ergometer may improve motor function with no negative effects to muscle

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Becker-Specific Studies

	Intensity/Frequency	Type
Sveen 2008	65% V02 max, 30 minutes, 4x/wk	Cycling
Sveen 2013	Low and high intensity	Arm and leg strengthening
Andersen 2013	65, 75, 85, and 95% of V02 max	High intensity aerobic exercise
Jensen 2016	3x/wk	Strength and aerobic
Berthelsen 2014	Up to 80% support	Anti-gravity treadmill



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Exercise Considerations

- Talk to your neurologist or physical therapist before beginning an exercise program
- Start slowly and gradually increase the intensity
- Focus on you



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Primary Goals

- Optimize function
- Minimize of impairment
- Improve tolerance to various positions
- Reduce secondary effects of the disease
- Avoid fatigue/overuse syndromes

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Benefits of Exercise

- Increase, maintain, or minimize progressive loss of muscle strength
- Higher level of functional capacity
- Improve body's regulatory and response system
- May decrease effects of disease process

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Exercise Prescription: FITT

- Frequency
- Intensity
- Time
- Type



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Stretching

- Goal
 - Maintain joint mobility, prevent or manage contractures, promote function, decrease pain, decrease muscle stiffness, increase blood flow to muscle
- Modalities
 - Orthoses, splints, standing aids, positioning techniques, manual stretching, self stretching
- Duration
 - To improve length, must maintain stretch for greater than 60 minutes
 - To maintain length, must hold stretch for at least 30 sec
- Frequency
 - Minimum: 3-5 times/week
 - Optimal: 5-7 times/week



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Standing

- Goal
 - Facilitate lower extremity stretching, promote bone health, enable upright participation, proper trunk posture, promote GI motility
- Duration
 - Up to 60 minutes
- Frequency
 - Minimum: 3-5 times/week
 - Optimal: 5-7 times/week



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Balance

- Goal
 - Train balance systems, prevent falls, improve sitting and standing balance
- Modalities
 - Static or dynamic home program, martial arts, yoga, video game-based activities
- Frequency
 - Minimum: 3-4 times/week
 - Optimal: 5-7 times/week



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Birnkrant et al 2018



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Strengthening

- Modalities
 - Body weight
 - Minimal to moderate resistance
 - Concentric and isometric
 - Proximal, distal, and core muscles
- Duration
 - Up to 30 minutes
- Frequency
 - 2-3 times/week



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Birnkrant et al 2018



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Aerobic exercise

- Modalities
 - Swimming, video game-based activities, upper and lower extremity cycling, yoga, wheelchair sports
- Duration
 - 15-45 minutes
- Frequency
 - Minimum: 2-3 times/week
 - Optimal: 3-5 times/week



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Aquatic Therapy

- Benefits of warm water therapy (85-95°F)
 - Resistance training to strengthen muscles
 - Endurance training to improve heart and lung capacity
 - Warmth to help stretch tight muscles
 - Low impact to take pressure off bones, joints, and muscles
- What to include
 - Warm up
 - Active range of motion exercises
 - Aerobic exercises
 - Stretching exercises
 - Cool down
- Frequency and duration
 - 2 times per week for 15-45 minutes per session



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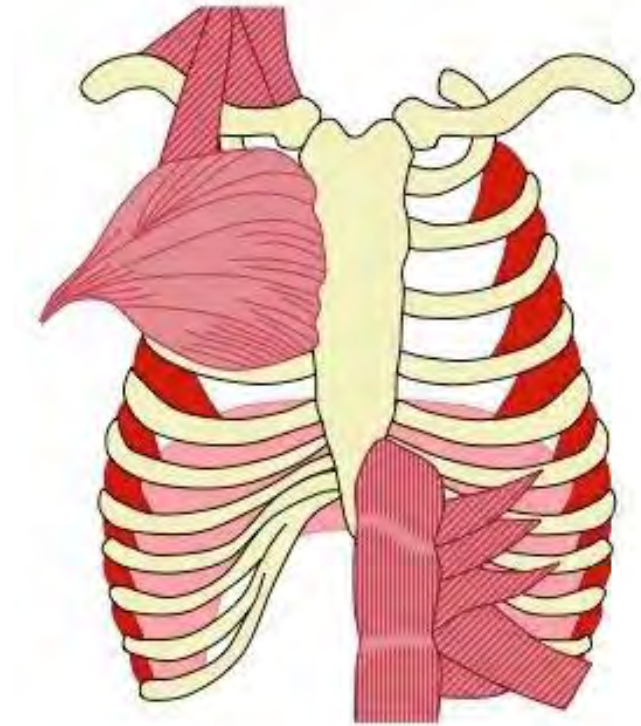
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Respiratory Muscle Training

- Modalities
 - Opening the chest
 - Shoulder shrug
 - Beach ball
 - Sniffles
 - Huffing/coughing
 - Maximum phonation time
 - Breath stacking
- Duration
 - Up 1 minute per exercise
- Frequency
 - 5-7 times/week



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Becker-Specific Recommendations

- Moore 2016
 - Practical recommendations for children and adults with BMD
- Frequency: 3-4x/week
- Intensity: Mild to moderate intensity physical activity (<65% of V02 max)
- Time: Up to 30 minutes
- Type
 - Avoid eccentric exercise and fatigue

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General Recommendations

- Balance activity with rest
- Avoid generalized fatigue and muscle soreness
- Stay hydrated
- Remember that movement and participation are important for physical and emotional health
- Choose age and functionally appropriate activities

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What interests you?



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Questions?



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