



Course unit English denomination	Neuromuscular Plasticity
SS	BIOS-06/A
Teacher in charge	Marco Narici
Teaching Hours	10
Number of ECTS credits allocated	2
Course period	To be defined
Course delivery method	<input checked="" type="checkbox"/> In presence <input type="checkbox"/> Remotely <input type="checkbox"/> Blended
Language of instruction	
Mandatory attendance	<input checked="" type="checkbox"/> Yes (80% minimum of presence) <input type="checkbox"/> No
Course unit contents	1) Skeletal muscle, structural and functional characteristics 2) Motor units, histological, biochemical and contractile properties, nervous control 3) Neuromuscular adaptations to chronic inactivity 4) Neuromuscular adaptations to exercise 5) Neuromuscular plasticity in ageing1) Skeletal muscle, structural and functional characteristics
Learning goals	<p>The course aims to provide students with fundamental knowledge on skeletal muscle physiology, analysing its morphological, biochemical and functional characteristics, as well as its nervous control during muscle activity and under fatigue conditions. A special focus will be devoted to neuromuscular plasticity, examining muscle responses to conditions of chronic disuse, such as exposure to hypogravity, physical training and ageing.</p> <p>The neurodegenerative processes associated with disuse and ageing will be explored, with a detailed analysis of the molecular and cellular mechanisms involved and their impact on neuromuscular function.</p> <p>Finally, the course will address the exercise-induced neuromuscular adaptations, highlighting their neuroprotective role in maintaining the integrity of the neuromuscular system.</p>
Teaching methods	Frontal lectures



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Course on transversal,  
interdisciplinary,  
transdisciplinary skills

☐ Yes

☒ No

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Available for PhD  
students from other  
courses

☒ Yes Classes are open to doctoral students only in the following courses:

Biosciences

☐ No

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Prerequisites  
(not mandatory)

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Examination methods  
(if applicable)

Multiple choice test

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Suggested readings

- 1) Narici M, Franchi M, Maganaris C. Muscle structural assembly and functional consequences. *J Exp Biol.* 2016 Jan;219(Pt 2):276-84. doi: 10.1242/jeb.128017.
  - 2) Motanova E, Sarto F, Negro S, Pirazzini M, Rossetto O, Rigoni M, Stashuk DW, Gasparini M, Šimunic B, Pišot R, Narici MV. Neuromuscular junction instability with inactivity: morphological and functional changes after 10 days of bed rest in older adults. *J Physiol.* 2025 Mar 17. doi: 10.1113/JP288448.
  - 3) Motanova E, Pirazzini M, Negro S, Rossetto O, Narici M. Impact of ageing and disuse on neuromuscular junction and mitochondrial function and morphology: Current evidence and controversies. *Ageing Res Rev.* 2024 Dec;102:102586. doi: 10.1016/j.arr.2024.102586.
  - 4) Murgia M, Rittweger J, Reggiani C, Bottinelli R, Mann M, Schiaffino S, Narici MV. Spaceflight on the ISS changed the skeletal muscle proteome of two astronauts. *NPJ Microgravity.* 2024 Jun 5;10(1):60. doi: 10.1038/s41526-024-00406-3.
  - 5) Sirago G, Pellegrino MA, Bottinelli R, Franchi MV, Narici MV. Loss of neuromuscular junction integrity and muscle atrophy in skeletal muscle disuse. *Ageing Res Rev.* 2023 Jan;83:101810. doi: 10.1016/j.arr.2022.101810.
  - 6) Franchi MV, Badiali F, Sarto F, Müller P, Müller NG, Rehfeld K, Monti E, Rankin D, Longo S, Lund J, Hökelmann A, Narici M. Neuromuscular Aging: A Case for the Neuroprotective Effects of Dancing. *Gerontology.* 2023;69(1):73-81. doi: 10.1159/000524843.
  - 7) Sarto F, Franchi MV, McPhee JS, Stashuk DW, Paganini M, Monti E, Rossi M, Sirago G, Zampieri S, Motanova ES, Valli G, Moro T, Paoli A, Bottinelli R, Pellegrino MA, De Vito G, Blau HM, Narici MV. Neuromuscular impairment at different stages of human sarcopenia. *J Cachexia Sarcopenia Muscle.* 2024 Oct;15(5):1797-1810. doi: 10.1002/jcsm.13531.
  - 8) Mitchell WK, Williams J, Atherton P, Larvin M, Lund J, Narici M. Sarcopenia, dynapenia, and the impact of advancing age on human skeletal muscle size and strength; a quantitative review. *Front Physiol.* 2012 Jul 11;3:260. doi: 10.3389/fphys.2012.00260.
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- 9) Franchi MV, Reeves ND, Narici MV. Skeletal Muscle Remodeling in Response to Eccentric vs. Concentric Loading: Morphological, Molecular, and Metabolic Adaptations. *Front Physiol.* 2017 Jul 4;8:447. doi: 10.3389/fphys.2017.00447.

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Additional information

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