

Teacher(s)	Dewolf Arthur ;Hardwick Robert (coordinator) ;
Language :	French
Place of the course	Louvain-la-Neuve
Main themes	• Reminder of the functional cortico-spinal regions involved in the control of human movement and the interactions between them. • Mechanisms for learning motor skills, their automation, and their neural substrates. • The use of neuroscientific techniques to control and/or improve the learning of motor skills. • Motor control models, motor imagery and observational learning • Modular control of movement: optimising coordination • Interaction between the central nervous system and muscle ('neuromechanics') in the regulation of performance • Description of sports movements through analysis of kinematics (position, speed, acceleration) and kinetics (forces), • Application of the principles of mechanics to understand the forces involved in sports movements. • Exploring the basic principles of electromyography and its application to the study of muscular activity during sports movements. • Understanding muscle activation patterns and their relationship to movement.
Learning outcomes	At the end of this learning unit, the student is able to : • Design motor skill learning interventions taking into account learning mechanisms/neuroscientific techniques and individual biomechanical characteristics of athletes (1.1, 1.5, 1.6, 1.7, 1.8). • Argue and communicate convincingly the results of studies on neural networks related to motor control and the results of biomechanical analyses using scientific knowledge, adapted to a varied audience, including athletes (1.1, 1.5, 4.1, 4.4). • Describe in detail the corticospinal regions involved in the control of human movement, and their specific roles in motor coordination (1.1) • Explain in depth how the central nervous system acquires new motor skills, the stages of learning, and the neural changes associated with the automation of skills (1.1). • Be able to keep abreast of ongoing advances in the neuroscience of motor control, motor learning and the biomechanics of movement, interpret the results in order to use them and adapt practice accordingly (1.1, 1.5, 1.6, 1.7, 1.8). • Analyse sports movements from a neuro-biomechanical to biomechanical perspective using appropriate measurement tools, identifying the main parameters that influence performance, in order to develop evaluation protocols for monitoring individual athletes.
Evaluation methods	# The course assessment comprises two parts. # Component A – Continuous assessment during practical sessions. Students will be assessed on the basis of a written assignment and/or an oral presentation, outside the examination period. # Weighting of component A : 6/20 # Component B – Oral presentation. # Weighting of component B : 14/20 # Rule for calculating the final mark: The final mark will be equal to the score out of twenty. # The assessment arrangements for the first session apply to the second session.
Teaching methods	Lectures: Theoretical concepts will be presented and discussed with reference to recent scientific literature. Practical sessions: Students will apply their knowledge to the analysis of concrete situations, such as specific sporting movements.
Content	This course addresses the neurophysiological and neuromechanical foundations of human motor control, from elementary mechanisms to complex processes of learning and adaptation. It presents the main models of motor control, as well as the brain regions involved in movement control and their functional interactions. Particular attention is given to the mechanisms underlying motor skill learning (error detection, use-dependent plasticity, reinforcement), the automation of motor behavior, and the brain networks activated during motor imagery and action observation. The course also discusses key neuroscientific methods (such as transcranial magnetic stimulation and functional magnetic resonance imaging) and their applications in the context of sport and physical activity. At the spinal level, emphasis is placed on the activity of central pattern generators (CPGs) during cyclic movements (walking, running, cycling), as well as on the modular organization of movement through muscle

	synergies. The study of the motor unit illustrates the link between the nervous system and the muscle, highlighting neuromechanical interactions. Finally, the course examines the influence of factors such as age, training, and fatigue on neural control of movement, with a particular focus on motoneuron function and the resulting neuromuscular adaptations.
Inline resources	Moodle
Other infos	This course is strictly reserved for FSM students. It is not open to other UCLouvain students.
Faculty or entity in charge	FSM

Programmes containing this learning unit (UE)				
Program title	Acronym	Credits	Prerequisite	Learning outcomes
Master [120] in Motor Skills: Physical Education	EDPH2M	5		