

Міністерство освіти і науки України  
Національний університет  
«Полтавська політехніка імені Юрія Кондратюка»  
Національний університет фізичного виховання і спорту України  
Полтавський державний медичний університет  
Сумський державний педагогічний університет імені А.С.Макаренка  
Прикарпатський національний університет імені Василя Стефаника  
ГО «Всеукраїнське об'єднання фізичних терапевтів»  
Vrije Universiteit, Belgium  
Strasbourg University, France

## **ФІЗИЧНА РЕАБІЛІТАЦІЯ ТА ЗДОРОВ'ЯЗБЕРЕЖУВАЛЬНІ ТЕХНОЛОГІЇ: РЕАЛІЇ І ПЕРСПЕКТИВИ**

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## **PHYSICAL REHABILITATION AND HEALTHSAVING TECHNOLOGIES: REALITIES AND PERSPECTIVES**

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### РОЗДІЛ 3

## ОЗДОРОВЧИ АСПЕКТИ ФІЗИЧНОЇ КУЛЬТУРИ, СПОРТУ ТА РЕКРЕАЦІЇ

Bart Roelands  
Associate Professor  
Human Physiology and Sports Physiotherapy Research Group  
*of the Vrije Universiteit Brussel*  
Viktoriia Horoshko  
Candidate of Medical Sciences  
*National University «Yuri Kondratyuk Poltava Polytechnic»*

### **INFLUENCE OF THE PROFILE OF THE LATERAL ORGANIZATION OF THE BRAIN ON THE PERFORMANCE OF SPORTS ACTIVITY**

*Key words:* lateral organization of the human brain, methods for revealing the profile of the lateral organization of the human brain, interhemispheric interaction.

The doctrine of interhemispheric asymmetry originates in 1861, when the French physician P. Broca established the presence of the so-called motor center of speech in the left hemisphere of the human brain. For more than 100 years, quite a lot of work has been published on the unequal role of the cerebral hemispheres in the implementation of various physiological functions of a person and their disturbances in case of damage to any of the departments [1]. Finally, in 1981, the American scientist R. Sperry was awarded the Nobel Prize for a series of works on interhemispheric interaction [2]. R. Sperry's Nobel Prize caused a great resonance in the scientific community and initiated a sharp increase in research in this direction.

Due to this, there is currently a large amount of data on the unequal nature of the left and right hemispheres of the human brain, both at the level of anatomical features and in the implementation of higher mental functions [2, 3, 4].

According to modern differential psychophysiology, the left hemisphere of the human brain in right-handed people specializes mainly in the performance of speech functions and controls operations with abstract symbols. The right hemisphere provides mainly a concrete-figurative reflection of reality. A person with a predominance of the right hemisphere is predisposed to contemplation and reminiscences, he subtly and deeply feels and worries, but is slow and talks little. The dominance of the left hemisphere is associated in humans with a large vocabulary, its active use, high motor activity, purposefulness, rationality. In the processes of learning, cognition, the right hemisphere implements the processes of deductive thinking (first, the processes of synthesis are carried out, and then analysis). The left hemisphere mainly provides the processes of inductive thinking (first, the process of analysis is carried out, and then synthesis). Accordingly, the left hemisphere is leading in the implementation of abstract, symbolic intellectual activity. The right one dominates in the implementation of concrete-figurative thinking and emotional activity. To date, psychology and psychophysiology have accumulated a significant amount of material regarding the

functional asymmetry of the brain. However, a unified approach to the study of lateral organization has not yet been developed.

Sports activity is currently one of the types of professional activity, the effectiveness of which depends not only on the motivational orientation of the individual, the desire to fight and win, but also on psychophysiological features that facilitate the performance of certain tasks in specific sport. By studying the psychophysiological characteristics of an individual, one can further influence the results of his purposeful activity [5] and sports activities, in particular [5, 6]. An important psychophysiological factor influencing the success of sports activity is the individual character of functional cerebral asymmetry (FMA) [7, 8], which is reflected in the profile of the lateral organization (LTO) of the brain [2].

The manifestation of such physical qualities as strength, speed, endurance, depends, among other things, on the type of interhemispheric organization of motor and sensory processes. The interhemispheric organization of the brain also affects the development of physical abilities that correspond to the specifics of purposeful sports activity [3]. It is known that at different stages of training, students involved in sports have a preference for the right or left hands (for example, in wrestling), legs in athletics or football, leading eyes in shooting, tennis [4, 6, 7, 10]. With the growth of sportsmanship among students, there is an increase in the symmetry of manual and visual functions.

In students involved in athletics, with the growth of sportsmanship, right-sided asymmetry in manual and sensory functions significantly increases (in 90.8% – the leading right leg, in 78.3% – the leading right ear, in 94, 1% – leading right eye); the symmetry of all functions decreases and left-sided asymmetry in manual and visual functions disappears [8]. Athletics places high demands on precise voluntary regulation of complexly coordinated exercises of movements of the whole body, which is ensured by the accumulation of right-sided lateral signs [3]. Among those involved in tennis and swimming, the majority are right-handed with various variants of lateralization of sensory functions; for people involved in wrestling, in particular, sambo, the most common type of PLO is ambidexterity. Right-sided dominance of manual, auditory-speech and visual functions is a favorable indicator of the success of visual-spatial activity. Spatial functions include not only the ability to navigate in the external visual space, but also the ability to navigate in one's own body, which is required for people involved in athletics in complex technical types. Martial artists who perform worse in technical training have a greater degree of asymmetry of complex motor acts [9].

PLO types in a certain way correlate with the features of sports activity, motor and sensory asymmetries are associated with the specifics of a particular sport and contribute to the formation of high sports achievements. In the available literature, the dependence of indicators of the physical qualities of athletes (speed, endurance, backbone strength) on the individual type of PLO was revealed: the best indicators of speed were more often observed in right-handers in combination with right-sided lateralization of auditory-speech functions, in left-handed when combined with symmetry or right-sided asymmetry of auditory-speech and visual functions, the best indicators of endurance and back strength were observed. At the same time, the facts of either weakening of the signs of asymmetry during the implementation of a

purposeful training process, or their strengthening depending on the sports specialization of the subjects were noted. In psychophysiology, it is expedient to identify not an integral indicator of dominance of one of the hemispheres, but a profile of the lateral organization, which is a pattern of partial signs of dominance of one or another hemisphere. For example, dominance by hand, foot, eye, ear, etc. And this, in turn, will make it possible to clarify the role of PLO in the systemic organization of purposeful human activity along with other features of its central nervous system and specific executive physiological mechanisms.

In connection with the foregoing, it becomes clear the need for a reliable assessment of the type of PLO of the brain in athletes for the purpose of expert assessment of the success of their future sports activities and the formation of individual training plans, including corrective procedures for optimizing the PLO, as well as assessment of PLO dynamics during a purposeful training process.

#### *Literature*

1. Araujo D. et al. Ecological approaches to cognition and action in sport and exercise: Ask not only what you do, but where you do it //International Journal of Sport Psychology. – 2009. – T. 40. – №. 1. – C. 5.
2. Davenport T. H. Analytics in sports: The new science of winning //International Institute for Analytics. – 2014. – T. 2. – C. 1-28.
3. Fotakopoulos G., Kotlia P. The value of exercise rehabilitation program accompanied by experiential music for recovery of cognitive and motor skills in stroke patients //Journal of Stroke and Cerebrovascular Diseases. – 2018. – T. 27. – №. 11. – C. 2932-2939.
4. Fu B. et al. Sensing technology for human activity recognition: A comprehensive survey //IEEE Access. – 2020. – T. 8. – C. 83791-83820.
5. Maroon J. C. et al. Cerebral concussion in athletes: evaluation and neuropsychological testing //Neurosurgery. – 2000. – T. 47. – №. 3. – C. 659-672.
6. Patel D., Shah D., Shah M. The intertwine of brain and body: a quantitative analysis on how big data influences the system of sports //Annals of Data Science. – 2020. – T. 7. – №. 1. – C. 1-16.
7. Perna F., Custódio M. J., Oliveira V. Local communities and sport activities expenditures and image: residents' role in sustainable tourism and recreation //European Journal of Tourism, Hospitality and Recreation. – 2019. – T. 9. – №. 1. – C. 49-59.
8. Seshadri D. R. et al. Wearable sensors for monitoring the internal and external workload of the athlete //NPJ digital medicine. – 2019. – T. 2. – №. 1. – C. 1-18.
9. Slim S. O. et al. Survey on human activity recognition based on acceleration data //International Journal of Advanced Computer Science and Applications. – 2019. – T. 10. – №. 3.
10. Voss M. W. et al. Acute exercise effects predict training change in cognition and connectivity //Medicine and science in sports and exercise. – 2020. – T. 52. – №. 1. – C. 131.