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Physical and rehabilitation medicine targets relational organs

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Lay people and many physicians perceive Physical and Rehabilitation Medicine (PRM) as a specialty focussed on musculoskeletal and, to a lesser extent, neural impairments. However, such persons do not typically appreciate the specific identity of this discipline. This blurred image may lead to the view of PMR as an ancillary discipline with low prestige (Album and Westin, 2008). Claims that PRM is 'holistic', 'person-centred', and 'comprehensive', reinforce the perception of this discipline as devoid of a sound biological foundation. This perception is incorrect. Here, it is proposed why, using arguments based upon biology.

From jellyfish to human: movement is the key to evolutionary success

Homo sapiens is a young species, aged 2–3 hundred thousand years (Tuttle, 2020). From eastern Africa, this species spread over the entire world between 60 000 and 12 000 years ago (Henn *et al.*, 2012). Beyond the development of intelligence and language skills, one key to this success was the unparalleled efficiency of the human locomotor apparatus and of the pendulum-like transfer of energy at each step (Cavagna, 2017). However, the evolution towards more effective movements started more than 1 billion years ago. Contractile proteins, neurons, and skeletons appeared on Earth in succession. Ancestors of the human actin-myosin complex (the engine of muscle contraction) are already present in Protozoa, such as *Amoeba proteus* (Sebé-Pedrós *et al.*, 2014). A true nervous system and eyes exist in jellyfish (Ghysen, 2003; Satterlie, 2011), which appeared 500 million years ago, at the beginning of the 'Cambrian explosion' of animal variety (Fox, 2016). The shark's cartilaginous endoskeleton appeared approximately 420 million years ago. Fins then evolved into limbs and wings, suitable for locomotion on land and air. These biological solutions allowed an increasing capacity to interact successfully with the terrestrial environment: for feeding, reproduction, and escaping predators. The sensory nervous system evolved in parallel, allowing more and more sophisticated motions and orientation. Sensation itself requires movement for orientation to the stimulus source (e.g. sound, light) and/or fine-tuning and gain-adjustment of transduction (e.g. tympanic stiffness, pupil sizing). Communication, either verbal, non-verbal, or written, also requires movements made by nerve and muscles (diaphragm, laryngeal and cranial muscles, and limb muscles). In short, nerves, muscles, and the skeletal apparatus represent the substrate of vertebrate behaviour. Behaviour here refers to the interaction of the entire individual with the outer world, an interaction that involves the exchange of energy, matter, or information (Tesio, 2003). Behaviour is the 'external' life of the individual.

Organs supporting the 'external' and 'internal' life of humans

Human behaviour also encompasses refined abstract thinking, appreciating and realizing artistic artefacts, ethics, religious beliefs, and the like. However, one should never forget that in humans the neurons, the muscles, and the skeleton are necessary for the manifestation of any behaviour. All other organs may be thought of as necessary to the person-world interaction, but not directly involved in it. As per the classic language of physiology, these organs only preserve the stability of the 'internal medium' [Bernard's *milieu intérieur* (Bernard, 1957)] and thus keep the body in 'equilibrium' with the environment [Cannon's *homeostasis* (Cannon, 1932)]; nevertheless, human behaviour is much more than lying still and surviving.

For these reasons, let me propose a pragmatic dichotomisation between (1) more recent, interactive-relational organs and apparatus dedicated to the external life: nervous system, muscles, bones and joints; and (2) older homeostatic organs and apparatus (heart, liver, kidneys, and so forth). Although this simplistic dichotomisation approximately reflects phylogenesis, it is proposed here to emphasize the perspective of PRM seen as a form of 'external', behavioural medicine (Tesio and Franchignoni, 2007). This perspective deliberately neglects that nerves and/or muscles are also engaged in neuroendocrine secretion, heart contraction, blood pressure regulation, gut peristalsis, and the like.

From jellyfish to physiatrists: claiming specific target organs AQ4

The 'relational'/'homeostatic' dichotomy implies that PMR addresses 'specific' organs. To the author's knowledge, this is explicitly accepted only by the American

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Academy of Physical and Rehabilitation Medicine (AAPMR) (American Academy of Physical Medicine and Rehabilitation, 2020). This professional Body states:

Physical medicine and rehabilitation physicians, also known as physiatrists, treat a wide variety of medical conditions affecting the brain, spinal cord, nerves, bones, joints, ligaments, muscles, and tendons

Most other professional bodies adopt generic definitions. For instance, the WHO states:

Rehabilitation is a set of interventions designed to optimize functioning and reduce disability in individuals with health conditions in interaction with their environment. Health condition refers to disease (acute or chronic), disorder, injury or trauma. A health condition may also include other circumstances such as pregnancy, ageing, stress, congenital anomaly, or genetic predisposition. Rehabilitation thus maximizes people's ability to live, work and learn to their best potential. Evidence also suggests that rehabilitation can reduce the functional difficulties associated with ageing and improve quality of life (WHO, 2017).

For a tentative list of other generic definitions, see Appendix in Tesio (2019). This decision suggests that most Bodies perceive highlighting the 'neuromotor' focus as an unjustified restriction on the scope of PMR. On the other hand, even the sharp, more restrictive definition of the AAPMR does not highlight the hidden commonality among these different 'organs', that is, that they serve a relational purpose.

By contrast, this commonality clarifies why physiatrists are well-suited for taking care of patients with diverse conditions, ~~such as very distinct conditions,~~ such as paraplegia, hip fracture, aphasia, dysphagia, imbalance, or incontinence.

The physiatrist is a physician with a general biomedical knowledge who must have high competence in the pathophysiology of the relational organs. However, his/her 'specialty' must be consistent with a specific perspective, namely that of diagnosing and treating the behavioural consequences of the diseases of relational organs (Tesio, 2012). Within this conceptual framework, PRM is far from a generic duplicate of the organ-based specialties. Instead, physiatry emerges as a bilingual, translational specialty with a unique perspective, that of linking biology to behaviour (Tesio, 2004). PMR roots lie in the biology of nerves, muscles, bone and joints; its trunk and branches spread into behavioural sciences (motor and cognitive assessment and treatment); and its fruits fall into the environment: they consist of more successful interaction between the person and the outer world.

Pragmatic consequences of the relational/homeostatic organ dichotomy

Two consequences stem from this perspective. First, 'organ-based' rehabilitation (cardiac, pulmonary rehabilitation, and the like) is an equivocal concept. PRM is intrinsically 'neuromotor'. PRM and the treatment of homeostatic organs may well complement each other, but the corresponding Specialties should be not confused.

Second, the popular statement that PRM is 'holistic', which is a rather ambiguous term, should be interpreted cautiously. PRM 'holism', if it indeed exists, resides in neither a universal (hence, generic) biomedical competence, nor in a specific psychosocial approach to the patient. PRM has its primary target organs – the relational organs – and it is 'holistic' only as far as it concentrates on their role in the whole person's behaviour.

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Conflicts of interest

There are no conflicts of interest. AQ5

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