Where motor disability and elite sports science meet

The love story of sports and disability has long been passionate and inspiring.[1] In recent years, it has generated countless fields of practice, both as leisure and at the highest Paralympic level. These developments tell us a great deal about enjoyment, self-fulfillment, and empowerment. But another more recent romance has blossomed from the encounter between motor disability and sport science. This has led to convergent interests in technological planning and evaluation of change. There has also been parallel reflection on personal factors that are relevant to both. Examples include attention, motivation, anticipatory action, biomechanical constraints, postural control, sensorimotor integration, and modulation of reflex activity. In addition, physical fitness, fatigue, diet, respiration, biochemical factors try to promote what they consider to be 'normal' motor patterns, or instead optimize the way in which the central nervous system may reconsider priorities in order to improve performance.[2] A famous illustration of an advantageous alternative motor coordination pattern is the Fosbury Flop, which won Dick Fosbury a gold medal for high jump at the 1968 Olympics and is now used universally. Many a therapist searches for similarly innovative strategies for individuals with motor impairments in skill learning and consolidation.

The rapprochement between motor disability and sport science has led to convergent interests in technological

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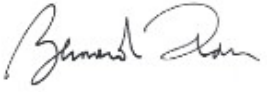

BERNARD DAN
Editor in Chief

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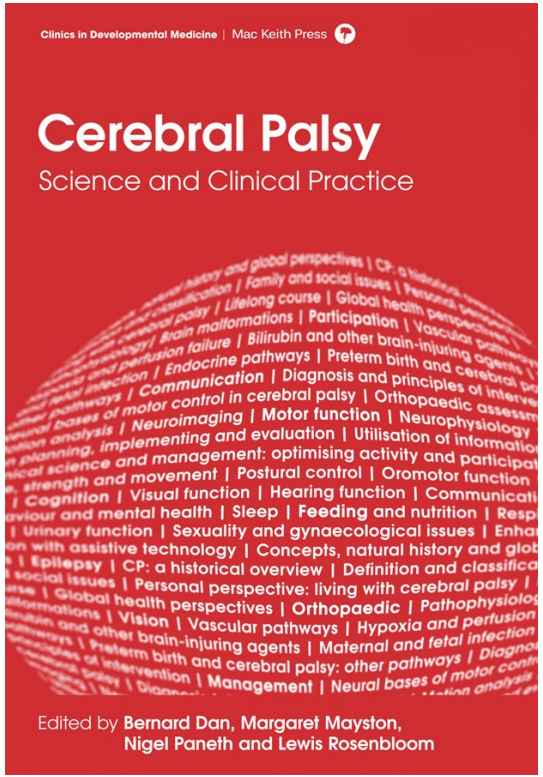

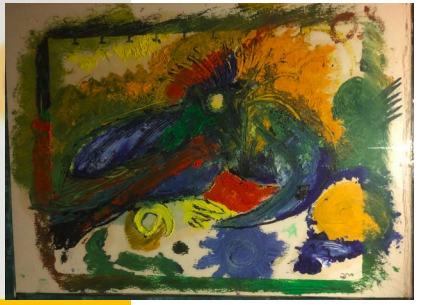

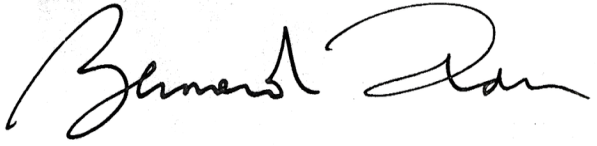

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Where motor disability and elite sports science meet

The love story of sports and disability has long been passionate and inspiring.[1] In recent years, it has generated countless fields of practice, both as leisure and at the highest Paralympic level. These developments tell us a great deal about enjoyment, self-fulfillment, and empowerment. But another more recent romance has blossomed from the encounter

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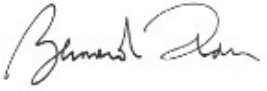

BERNARD DAN
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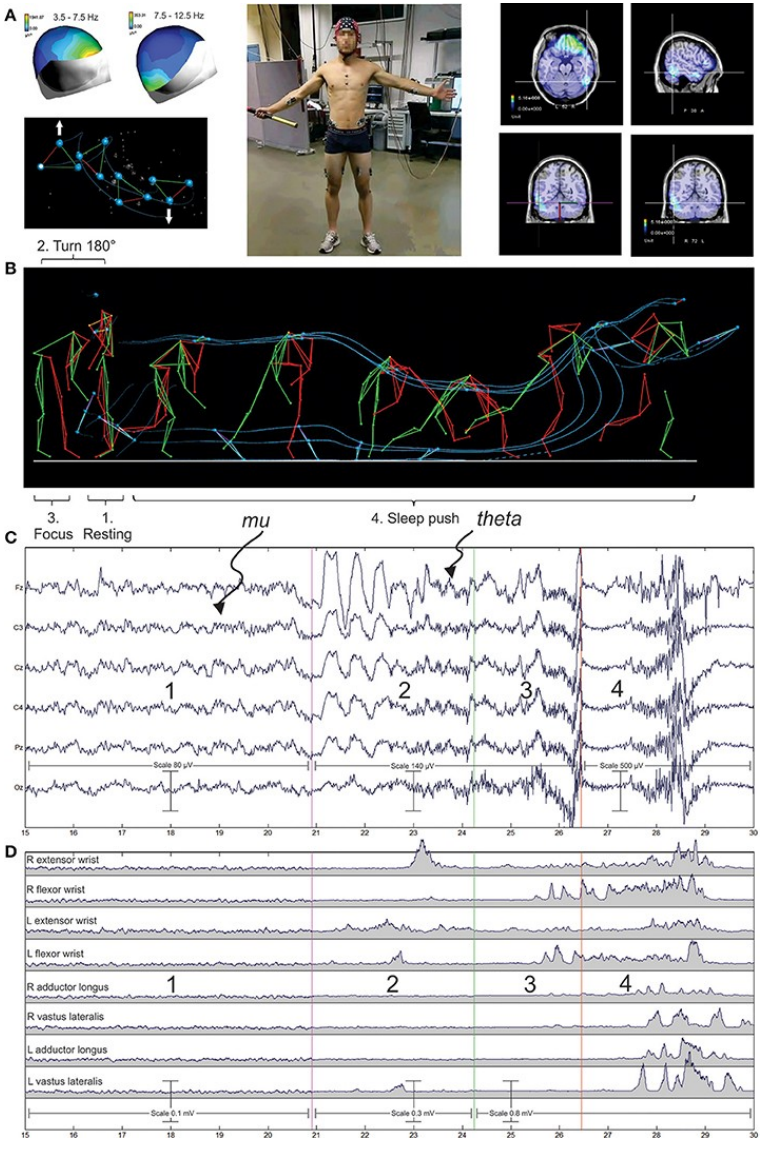
frontiers in Psychology

REVIEW
published: 26 February 2016
doi: 10.3389/fpsyg.2016.00246

Brain Oscillations in Sport: Toward EEG Biomarkers of Performance

Guy Cheron[1,2], Géraldine Petit[1], Julian Cheron[1], Axelle Leroy[1,3], Anita Cebolla[1], Carlos Cevallos[1], Mathieu Petieau[1], Thomas Hoellinger[1], David Zarka[1], Anne-Marie Clarinval[1] and Bernard Dan[1,4]*



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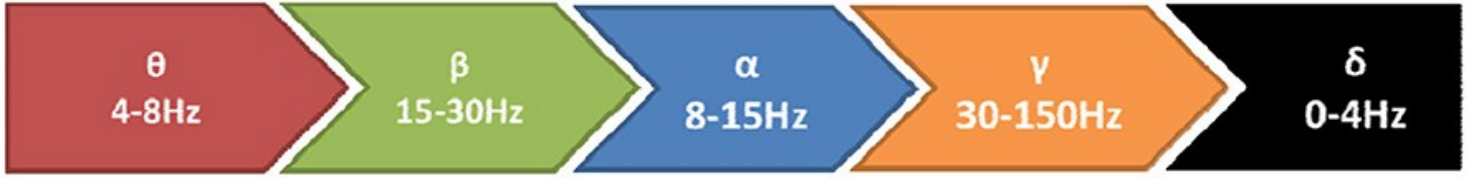
Biomarker #2

1. motor binding
2. sensorimotor association
3. sensory discrimination
4. fatigue
5. autonomous nervous system regulation
6. motor imagery

Biomarker #4

1. sensorimotor task
2. perception binding
3. attention
4. working and associative memory



Biomarker #1

1. navigation
2. eye-head-body movement
3. episodic memory
4. sensorimotor integration
5. goal setting
6. network coordination
7. motor control
8. Emotion
9. Dream recall

Biomarker #3

1. global resting state
2. selective attention
3. cognitive performance
4. inhibition and gating
5. consolidation of new motor sequence (sleep-spindle)

Biomarker #5

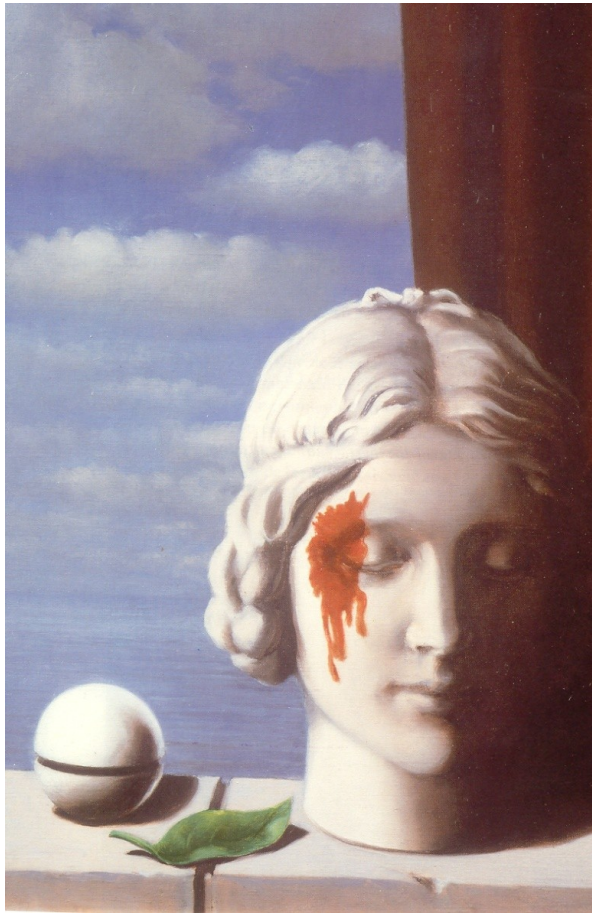
1. memory consolidation (sleep, slow wave activity)
2. facilitation of multiple unit activity
3. visual discrimination

National Institute of Health – National Institute of Neurological Disorders and Stroke

Definition of Cerebral Palsy

Rosenbaum P, Paneth N, Leviton A, Goldstein M, Bax M, Damanio D, Dan B

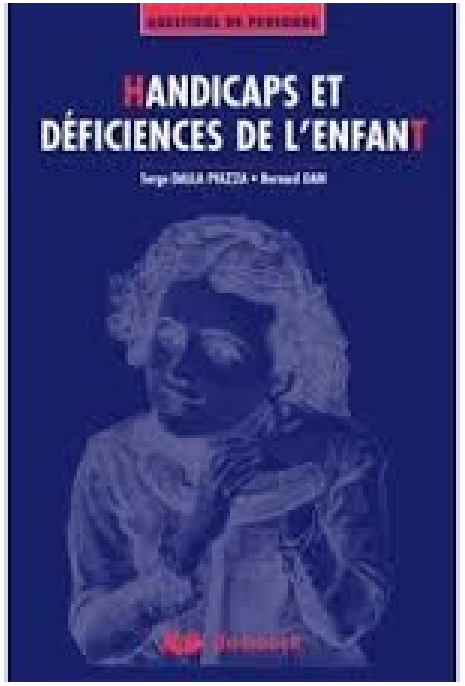
Developmental Medicine and Child Neurology 2007;109:8-14



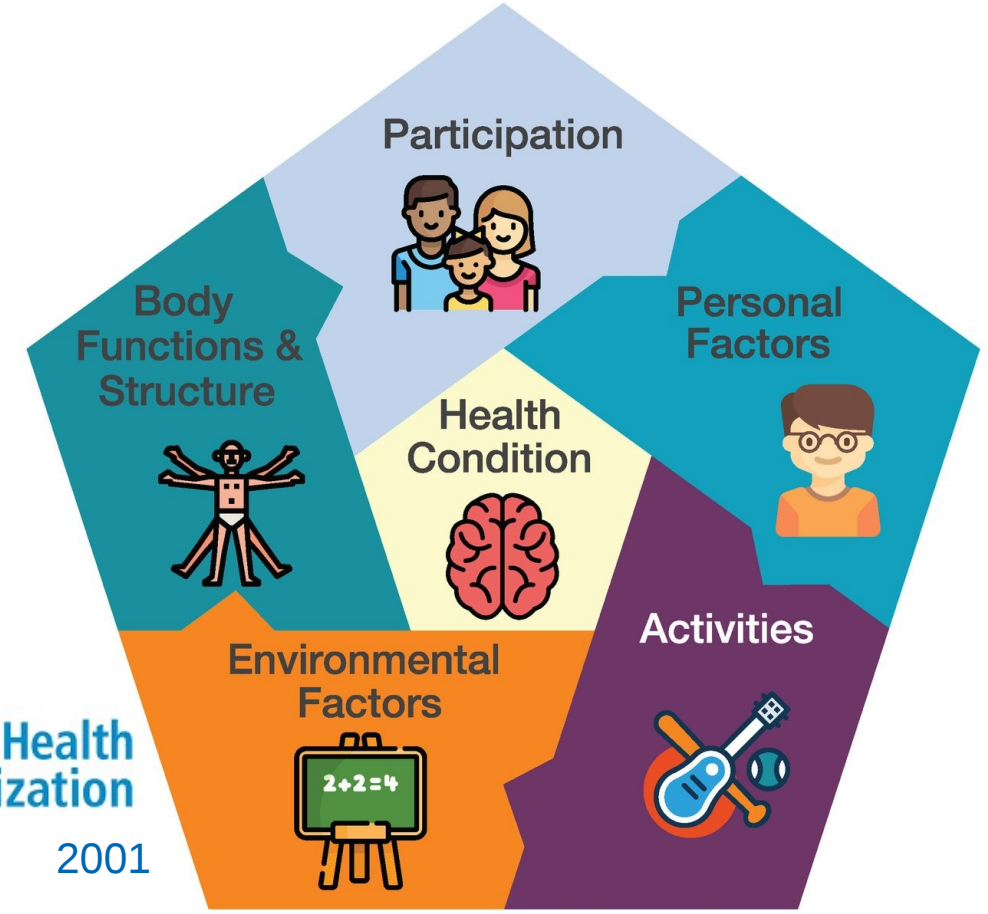
Cerebral palsy describes a group of permanent disorders of the development of movement and posture, causing activity limitation, that are attributed to non-progressive disturbances that occurred in the developing fetal or infant brain.

The motor disorders of cerebral palsy are often accompanied by disturbances of sensation, perception, cognition, communication, behaviour, epilepsy, and by secondary musculoskeletal problems.

International Classification of Functioning, Disability and Health (ICF)



Participatie



World Health Organization

2001

december 16

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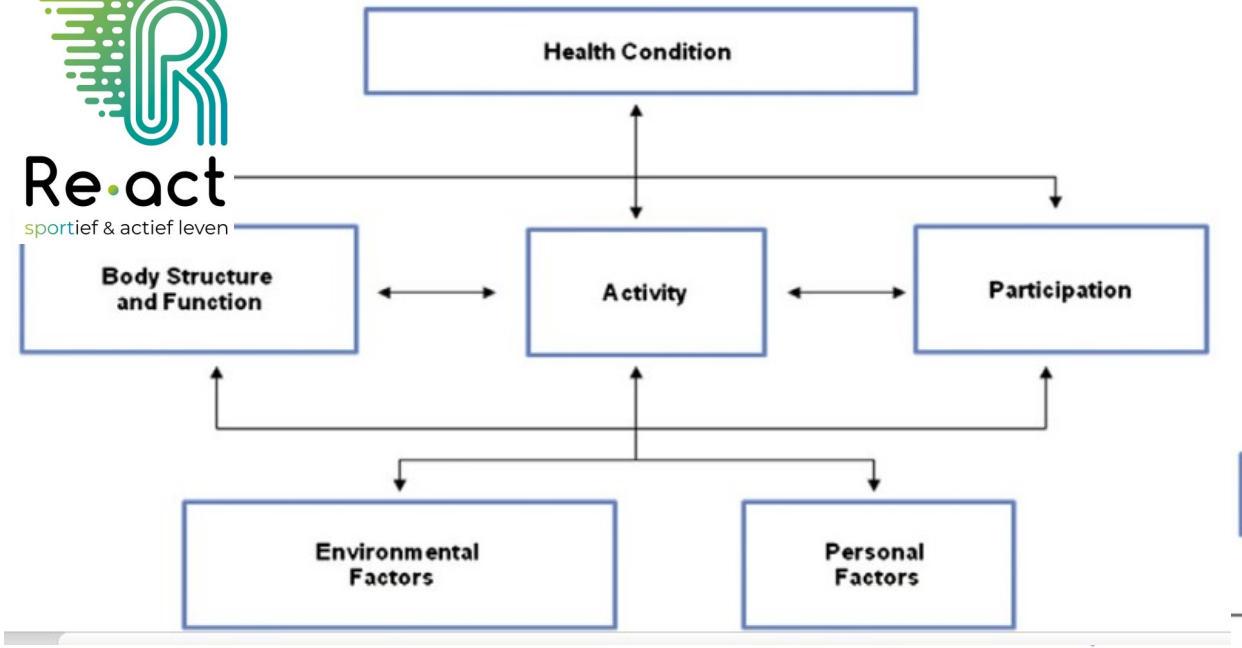
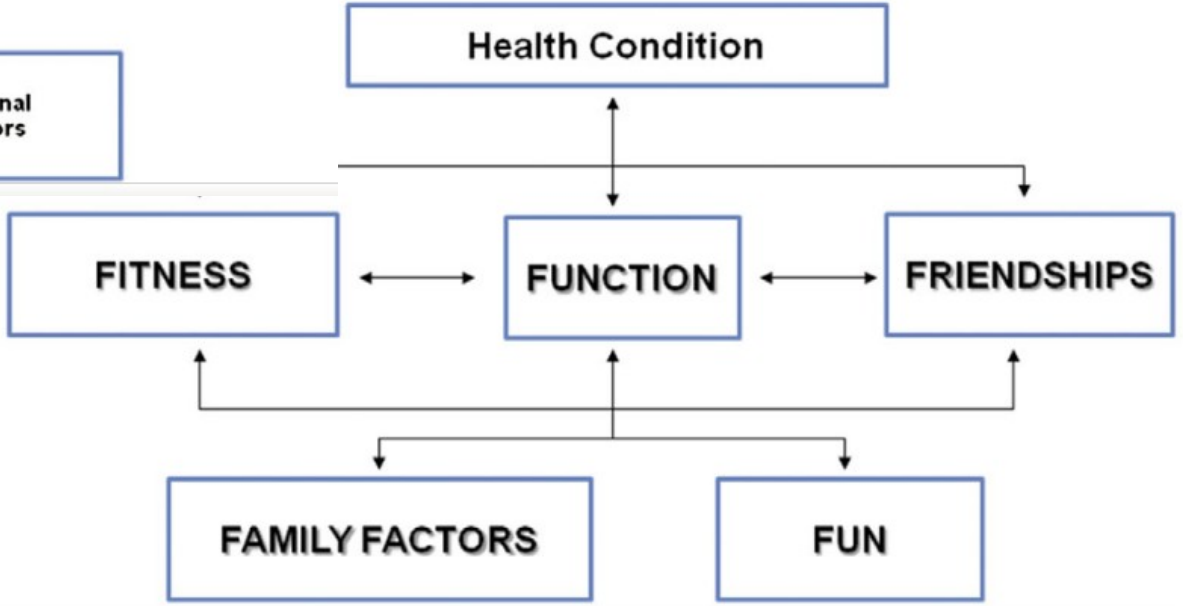
ICF



F-words



DEVELOPMENTAL MEDICINE & CHILD NEUROLOGY LETTER TO THE EDITOR

2016; 58(9):989-90

The formula for health and well-being in individuals with cerebral palsy: physical activity, sleep, and nutrition

Olaf Verschuren Patrick McPhee Peter Rosenbaum Jan Willem Gorter

Tailored **physical activity** promotion, consistent **nutrition**, and time to **rest** and restore oneself together form the formula to health and well-being in individuals with CP

DEVELOPMENTAL MEDICINE & CHILD NEUROLOGY REVIEW

Editor's Choice

Exercise and physical activity recommendations for people with cerebral palsy

OLAF VERSCHUREN[1] | MARK D PETERSON[2] | ASTRID C J BALEMANS[1,3] | EDWARD A HURVITZ[2]

2016; 58(8):798-808

1 Brain Center Rudolf Magnus and Center of Excellence for Rehabilitation Medicine, University Medical Center Utrecht and De Hoogstraat Rehabilitation, Utrecht, the Netherlands. **2** Department of Physical Medicine and Rehabilitation, University of Michigan, Ann Arbor, MI, USA. **3** Department of Rehabilitation Medicine, MOVE Research Institute Amsterdam, VU University Medical Center, Amsterdam, the Netherlands.

Cardiorespiratory Endurance Training

Muscle Strengthening

Physical Activity Across the Activity Continuum

Baseline Physical Activity

DEVELOPMENTAL MEDICINE & CHILD NEUROLOGY SYSTEMATIC REVIEW
2017; 59(10):1004-1018

Reedman S, Boyd RN, Sakzewski L. The efficacy of interventions to increase physical activity participation of children with cerebral palsy: a systematic review and meta-analysis. 2017; 59: 1011–8

Bloemen M, Van Wely L, Mollema J, Dallmeijer A, de Groot J. Evidence for increasing physical activity in children with physical disabilities: a systematic review. 2017; 59: 1004–10

- Physical training alone does not increase physical activity in young people with cerebral palsy.
- Behavioural interventions show conflicting evidence directly after the intervention.
- Behavioural interventions show no increase in physical activity at follow-up.

DEVELOPMENTAL MEDICINE & CHILD NEUROLOGY ORIGINAL ARTICLE

2019; 61(12):1408-1415

Barriers to and facilitators of physical activity for children with cerebral palsy in special education

STACEY L CLEARY[1] | NICHOLAS F TAYLOR[1,2] | KAREN J DODD[3] | NORA SHIELDS[1]

- school priorities: academic work vs physical activity
- student factors: fluctuating health, school absences, and protracted postop rehabilitation
- staffing and environment: pivotal role
- relationships: collaborative, relationship-based care

DEVELOPMENTAL MEDICINE & CHILD NEUROLOGY COCHRANE CORNER

Are exercise interventions effective in patients with cerebral palsy? A Cochrane Review summary with commentary

Cochrane Rehabilitation
2020; 62(1):18-20

Aerobic exercise vs usual care

- may improve gross motor function in the short-term
- does not improve gait speed (very low-quality evidence)
- None of the studies investigated the effect of aerobic exercise on participation or quality of life.

DEVELOPMENTAL MEDICINE & CHILD NEUROLOGY COCHRANE CORNER

Are exercise interventions effective in patients with cerebral palsy? A Cochrane Review summary with commentary

Cochrane Rehabilitation
2020; 62(1):18-20

Resistance training vs usual care

- no improvement in the short- or intermediate-term (low-quality evidence) : gross motor function / gait speed / participation / QoL
- may improve muscle strength in the short-term (very low-quality evidence)
- minor adverse events: pressure on shoulders < backpack (one participant), ankle or foot discomfort, muscle soreness

DEVELOPMENTAL MEDICINE & CHILD NEUROLOGY COCHRANE CORNER

Are exercise interventions effective in patients with cerebral palsy? A Cochrane Review summary with commentary

Cochrane Rehabilitation
2020; 62(1):18-20

Mixed training vs usual care

- no significant difference in gross motor function or gait speed
- improved participation in the short-term (low-quality evidence)
- adverse effects: fall and resultant radius fracture, falls (1 with radius fracture), muscle soreness, cramps, fatigue

Resistance training vs **aerobic exercise**

- no difference in motor function but improvement of muscle strength in the short-term (low-quality evidence)

DEVELOPMENTAL MEDICINE & CHILD NEUROLOGY COMMENTARIES

Physical activity interventions for children and young people with cerebral palsy

JAN WILLEM GORTER
McMaster University – Pediatrics, *CanChild* Centre for Childhood Disability Research, Hamilton, Ontario, Canada.

Lack of evidence supporting the efficacy of interventions to increase and sustain habitual physical activities

Interventions with a **behavioural** component were identified to have the best potential to improve physical activity participation

Exercise appears to be **safe** for people with CP
but its efficacy to improve physical activity participation and long-term health is uncertain

DEVELOPMENTAL MEDICINE & CHILD NEUROLOGY COMMENTARIES

Physical activity interventions for children and young people with cerebral palsy

JAN WILLEM GORTER

The question is:

Are we ready to let go of an impairment-focused approach and move towards **goal-directed, activity- and participation-focused interventions** to promote sustained healthy active living among children and young people with disabilities?

Health development occurs through positive person–environment transactions, requiring an **inclusive environment** for people of all skill levels and abilities.

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