

‘Human movement, rehabilitation and functional recovery’

General description

The study of the impaired human movement system and the consequent disturbed behavioural sensomotor actions has been one of the main areas of interest for the Centre for Human Movement Sciences of the University Medical Centre Groningen (CHMS-UMCG) of the University of Groningen (RUG) from its first inception, now more than 25yrs ago.

Today CHMS is part of the University Medical Centre Groningen, its medical sciences programme. The CHMS is responsible for the Bachelor and Master programmes Human Movement Sciences and for the Master Sport Sciences. The research programme SMARTmovements forms the fundament of our research which is part of the Graduate School Medical Sciences.

Research interests in the accent ‘Human movement, rehabilitation and functional recovery’ are an imminent part of the SMARTmovements programme and are focussed around five themes: *gait & balance; cyclic upper body exercise; handicap, exercise & sports; manual dexterity & upper extremity functioning; diagnostic tools & assistive technology.*

Typical diagnostic study groups are people with an amputation, stroke, spinal cord injury, and children with neurodevelopmental or other chronic disorders as well as able bodied populations. They are subject of research in theory-driven studies that vary from lab-based experimental and modelling studies to epidemiology driven large population studies in rehabilitation care, adapted sports or in other societal contexts.

Research questions of our group focus on restoration of mobility in the context of motor (re-) learning, training and natural recovery, as well as daily functioning, sports performance, and productive participation of adults and children with a disability. Our knowledge should lead to theory and understanding of processes of adaptation and compensation in those with a motor impairment or chronic disease, and provide an evidence-base for future rehabilitation strategies and models. The ICF-model (International Classification of disability, health & Functioning; WHO), the model of stress, strain, fatigue, and work capacity, or the ergonomics models of assistive technology and the built environment are among the driving conceptual frameworks that overarch our work.

In the context of rehabilitation medicine and care the restoration and maintenance of mobility and functioning in persons with chronic impairments is key objective. This is the more so in the context of an increasingly longer life expectancy, an improved medical technology of a greying society and a more demanding personal perspective in the light of healthy aging.

The person with an impairment of the movement system will have to re-learn and train motor behaviour, often with assistive technology and in a complex environment, in order to reach optimal functioning, health and successful participation. An increasing awareness of the importance of evidence-based rehabilitation practice and the need for improved diagnostics and treatment protocols, innovative assistive technology and patient monitoring, all stimulate the research agenda and model the systematic and collaborative research efforts with partners within (e.g. Rehabilitation Medicine, SPRINT) and outside UMCG and RUG.

Within this stimulating societal context human movement sciences and rehabilitation sciences and practice meet and work together in local, national and international collaborations. The

members of our research group have a strong position in this multidisciplinary arena in terms of expertise, multidisciplinary collaboration and knowledge dissemination. It is our intention to further expand on this strong position in the coming years, become even more visible in clinical rehabilitation practice, adapted sports and research and through strengthened collaborations with the Centre for Rehabilitation, the Departments of Orthopaedics and Sportsmedicine and other natural partners.

Mission statement

To conduct ‘state-of-the-art’ scientific research that (1) improves our understanding of (impaired) human movement with or without assistive technology and the mechanisms of restoration of mobility and functioning in rehabilitation, and (2) contributes to the evolution of both human movement and rehabilitation sciences and its implementation in practice and society.

Vision

The human movement scientists in the context of rehabilitation are knowledge providers, both theoretical and applied. They are team players and study and develop theory on human movement and functional restoration, often in multidisciplinary research collaborations. Implementation of knowledge and understanding of impaired human movement and optimal functioning and health in the context of clinical rehabilitation is strived for in rehabilitation and adapted sports practice.

Our research work involves the use and development of existing and innovative theories, methods, techniques and models from the fields of human movement, technical and rehabilitation sciences. It helps restore function and mobility with/without assistive technology and optimize functioning and participation of those with a (neuro-)motor impairment or chronic motor system disease.

Objectives

Fundamental and clinical research into (disturbed) human movement – with or without assistive technology – contributing to:

- Theory development and a fundamental understanding of impaired movement performance, health and functioning in the context of rehabilitation, adapted sports and society
- The understanding of the underlying mechanisms of adaptation and compensation at the level of structures, functions, and organ systems and their complex co-ordination in activities in a meaningful societal context and healthy life
- The development of measurement techniques and learning and training strategies of impaired human movement and the optimization there-off in collaboration with practice and industries; this leads to better and evidence-based rehabilitation strategies and/or assistive technologies
- A better understanding of human functioning and movement performance in general
- An evidence-base of clinical rehabilitation diagnostics, measurement tools, assistive technology and meaningful treatment, learning, training and evaluation strategies
- A high standard profile of productive BA-MA and PhD students in Human Movement Sciences
- The opening-up of the field of rehabilitation care in its broadest sense for current and future BA-MA and PhD students in human movement sciences, as researchers and/or knowledge managers/brokers, policy makers, educators; i.e. self-aware professionals with an important eye for integrity in all its domains.

Strategy

- Stimulate the further development of a consistent and active research group within the context of CHMS with partners from the Centre for Rehabilitation, Departments of Orthopaedics and Sports medicine and other natural partners, such as Rehabilitation Friesland
- Contribute to high level BA and MA program in human movement sciences
- Be visible, respected and well-appreciated in the scientific and academic arena
- Preserve continuity in research potential and where possible expand on the current research activities through multidisciplinary collaboration
- Generate good quality personnel (PhD, Postdoc, PI), resilient to the challenges of today and the future, preserving integrity in teaching, research and interpersonal behaviour throughout
- Further expand the experimental and technological infrastructure
- Successfully acquire research grants for PhD and postdocs research projects through regional, national and European funding, including Ma-PhD projects
- Perform high standard patient-oriented research in the context of rehabilitation, adaptive sports and based on productive contributions of BA-MA and PhD-students
- Develop a strong position in the international (sci) and professional literature
- Develop clinical-rehabilitation research networks, both locally – UMCG, RUG, national and international
- Publish in well-respected scientific journals, preferably in top 25% of the field
- Organize (inter)national congresses and (mini)symposia
- Strive for implementation of innovative knowledge in clinical rehabilitation practice
- Continue to further develop the Northern Expert center on Sport, exercise & Handicap (NESH), SSIG and SPRINT consortium
- Create multidisciplinary collaboration (R&D) on innovative measurement and assistive technology in the context of impaired human movement and functioning with (local) industry and other societal partners.

Methodology

Conceptually, studies are aimed at optimal functioning, and often positioned within the broader context of the ICF. Methodologies, models, experimental expertise and theoretical frameworks range from (neuro)biomechanics and (exercise)physiology to psychology and epidemiology. This offers a platform for multidisciplinary research and collaboration into (aging) individuals with an impairment or chronic disease and their clinical treatment and healthy aging. Lab-based facilities range from well-equipped gross and fine motor labs to CAREN and the work-lab.

Current Research Themes*Gait & Balance*

Human gait (i.e. walking, running) and (dynamic) balance and stability are studied from the perspective of the control of multi-joint dynamics, motor learning, and adaptive control in the case of assistive devices and changes in terrain. Changes in direction and navigation are studied in terms of action-perception coupling, planning and attention, which are interlinked with the control of the dynamics of gait. The energy cost of walking is studied in the context

of individual physical capacity as well as with respect to the bio- and neuromechanical robustness of gait and walking performance in different populations.

Staff : Bert Otten, Rob den Otter, Helco van Keeken, Lucas van der Woude

PhD students: Anne Benjaminse, Alli Gökeler (finished?), Esar van Hal, Trienke IJmker, Klaske van Kammen

Cyclic upper body exercise

Short description: Over 3.3 million people within Europe are wheelchair dependent, and rely on their upper body for mobility and every other daily activity. For (elite) sports performance as well as participation in daily life, it is important to train the upper body optimally. Adequate training comprises aspects of skill acquisition/motor learning, physical exercise capacity, efficiency, talent and ability. Also the prevention of upper body overuse and injuries, mechanisms of fatigue and energy distribution throughout a task or day are studied experimentally as well as in the practical rehabilitation context. Besides regular handrim wheelchair propulsion, alternatives in upper body propulsion and exercise are studied, such as the promising handcycling, lever propulsion and Cruiser exercise.

Staff : Riemer Vegter, Sonja de Groot, Lucas van der Woude

PhD students: Riemer Vegter, Jan van der Scheer, Arjan Bakkum (finished 2014), Inge Eriks (finished 2014), Marieke Kloosterman, Marika Leving (Ma-PhD), Sven Hoekstra (Ma-PhD), Annemarie de Witte, Michel Bekker

Handicap, Exercise & Sports

Sports, exercise and active lifestyle are key to fitness, functioning and health over the lifespan, where automation and mechanics overtake much of the natural physical exercise in today's society. Risks of deconditioning and inactivity are especially prevalent in those with a disability where much more barriers are to be coped with in order to engage in sports or physically active lifestyle. The study of sports, exercise, active lifestyle and handicap helps to reinforce the theoretical fundament of adapted physical activity and sports in rehabilitation and as a crucial element of a lifetime investment. Multidisciplinary research projects and collaborations are typical in this context and bring together building stones to the Northern Expert center for Sports, exercise and Handicap (NESH).

Staff : Noor Mouton, Riemer Vegter, Sonja de Groot, Lucas van der Woude

PhD students: Laurien Disseldorp, Willem Bossers (Healthy aging), Rolinde Alingh, Femke Hoekstra, Moniek Akkerman, A Oosterwijk, Sven Hoekstra (Ma-PhD), Annemarie de Witte, Liesbeth Simelink

Manual dexterity and upper extremity functioning

This line of research takes as a starting point that movements are inherently variable. This variability is studied across various experimental conditions, while learning motor tasks, in children of different ages (development), and during tool use to understand underlying processes of motor control and changes therein. The focus is on manual dexterity tasks, i.e. pointing and apprehension. The clinical focus is on prosthetic use and children with DCD, as well as the motor control of arm-hand movement in general.

Staff: Raoul Bongers, Noor Mouton, Marina Schoemaker, Lucas van der Woude

PhD students: Hanneke Bouwsema (finished 2014), Laura Golenia (Ma-PhD), Ludger van Dijk, Sietske Romkema, Sietske Postema, Ecatarina Golea Vasluian, Inge Tuitert, Michel Bekker

Diagnostic tools & assistive technology

This line of research concentrates on the development of diagnostic tools to evaluate the level of skill of children and adults of a clinical population, mainly for people who miss a body part, or motor dysfunction. These tools are also used to assess functionality of assistive technology, such as wheelchairs and additional devices, and lower limb and upper limb prostheses. The results of the assessment are used for ergonomics optimization of assistive technology and to further develop and improve these, often in close collaboration with industrial partners. This work is indeed part of the SPRINT (<http://www.imdi-sprint.nl/>) initiative.

Staff: Bert Otten, Raoul Bongers, Marina Schoemaker, Helco van Keeken, Lucas van der Woude

PhD students: Anne Benjaminse, Berdien van der Linde, Marieke Kloosterman, Esar van Hal, Riemer Vegter, Annemarie de Witte

Staff input (fte) per 2013

<i>Staff</i>	<i>fte (research)</i>	<i>Affiliation</i>
Bongers, Dr. R.M.	1.0 (0.40)	CHMS-UMCG
De Groot, Dr.S.	0.2 (0.10)	CHMS-UMCG
Den Otter, Dr. A.R.	1.0 (0.40)	CHMS-UMCG
Mouton, Dr. L.J.	0.7 (0.20)	CHMS-UMCG
Otten, Prof Dr. E.	1.0 (0.40)	CHMS-UMCG
Schoemaker, Dr. M.M.	0.5 (0.20)	CHMS-UMCG
Van Keeken, H.	0.8 (0.35)	CHMS-UMCG
Van der Woude, Prof Dr. L.H.V.	1.0 (0.40)	CHMS-UMCG
Vegter, R.J.K., MSc	1.0 (0.40)	CHMS-UMCG
<i>Postdocs/others</i>	<i>fte</i>	<i>Affiliation/Funding</i>
-		
<i>PhD students</i>	<i>fte</i>	<i>Affiliation/Funding</i>
Akkerman, M	0.5	Brandwondenstichting (2017)
Alingh, R.	0.8	VWS (2015)
Bakkum,J.#	1.0	ZonMw (2014)
Bekker,M.#	1.0	Notwill (SW (2018))
Benjaminse, A.	0.4	Fonds NutsOhra/UMCG (2015)
Bossers, W.	0.8	Fonds NutsOhra/UMCG (2014)
de Vries, S.	0.0	Saxion Academie
de Witte, A.#	1.0	Haagse Hogeschool, Raak-Pro(2017)
Disseldorp, L.	1.0	Brandwondenstichting/UMCG (2014)
Eriks, I.	0.2	Nottwil, Sw (2014)
Golea Vasluian, E.*	0.0	Centre for Rehabilitation-UMCG (2014)

Hoekstra, F.	0.8	VWS (2015)
Hünneman, R.	0.0	Faculteit der Letteren (2017)
Gökeler, A	0.3	Centre for Rehabilitation-UMCG (2014)
Ijmer, T.#	1.0	FBW-VU (2015)
Kloosterman, M.#	1.0	RRD (2015)
Oosterwijk, A.*	1.0	Hanze Hogeschool (2017)
Papegaai, S.	1.0	CHMS-UMCG (2016)
Postema, S.*	0.0	Centre for Rehabilitation-UMCG (2017)
Romkema, S.*	1.0	Centre for Rehabilitation-UMCG (2015)
Stoter, A.	0.0	Logica (2017)
Simmelink, L.*	0.2	Centre for Rehabilitation-UMCG (2017)
Smit, C.#	0.2	Reade/VU (2015)
Tuitert, I.	1.0	Marseile (2017)
Van der Linde, B.	0.0	CHMS-UMCG (2014)
Van der Scheer, J.	1.0	ZonMw (2015)
Van Dijk, L.	1.0	CHMS-UMCG (2015)
Van Hal, E.	1.0	SPRINT, CHMS-UMCG (2016)
Van Kammen, K.	1.0	Revalidatie Friesland (2017)
Van Vulpen, L.#	0.4	Reade/VU; WCF (2017)
Vegter, R.J.K.	1.0	CHMS-UMCG (2015)

Ma-PhD trajectories (CHMS-UMCG)

Leving, M.

Hoekstra, S.

Golenia, L.

*: Will promote at other department of UMCG/RUG

#: Will promote at other university

Scientific and societal output and production 2013

Please see individual/personal (MEPA) page on www.rug.nl/staff/

Collaborations: see appendix