Program

2014 ISPGR WORLD CONGRESS

June 29 to July 3, 2014
Vancouver, BC, Canada

Westin Bayshore Hotel

ispgr

INTERNATIONAL SOCIETY FOR POSTURE & GAIT RESEARCH

www.ispgr.org

PROGRAM AT A GLANCE

Time	Sunday	Monday	Tuesday	Wednesday	Thursday
8:30:00 AM	Pre-Congress Workshops	**Keynote 2** Jens Bo Nielsen	Symposium 4 3 person | Symposium 5 3 person | Symposium 6 3 person	**Keynote 3** Tatiana Deliagina	**Keynote 4** Brian Day
8:45:00 AM					
9:00:00 AM					
9:15:00 AM					
9:30:00 AM				Posters & Exhibitors Coffee	Oral Session 7 8 speakers | Oral Session 8 8 speakers
9:45:00 AM		Posters & Exhibitors Coffee			
10:00:00 AM			Posters & Exhibitors Coffee		
10:15:00 AM					
10:30:00 AM					
10:45:00 AM					
11:00:00 AM					
11:15:00 AM					
11:30:00 AM					
11:45:00 AM		Lunch and exhibits (buffet)		Lunch & exhibits (buffet)	AGM
12:00:00 PM					
12:15:00 PM			Lunch & Promising Young Scientist Award presentation		Awards Presentations
12:30:00 PM		Symposium 1 4 persons | Symposium 2 4 persons | Symposium 3 4 persons		Symposium 7 4 person | Symposium 8 4 person | Symposium 9 4 person	
12:45:00 PM					
1:00:00 PM			Oral session 3 6 speakers | Oral session 4 6 speakers		Oral session 9 6 speakers | Oral session 10 6 speakers
1:15:00 PM					
1:30:00 PM					
1:45:00 PM					
2:00:00 PM					
2:15:00 PM					
2:30:00 PM		Break	Free time/ Excursions	Break	Break
2:45:00 PM					
3:00:00 PM		Oral Session 1 8 speakers | Oral Session 2 8 speakers		Oral session 5 8 speakers | Oral session 6 8 speakers	Symposium 10 4 person | Symposium 11 4 person | Symposium 12 4 person
3:15:00 PM					
3:30:00 PM					
3:45:00 PM					
4:00:00 PM					
4:15:00 PM					
4:30:00 PM					
4:45:00 PM					
5:00:00 PM	opening ceremony	Free time		Free time	Free time
5:15:00 PM					
5:30:00 PM	**Keynote 1** Willam H. Warren				
5:45:00 PM					
6:00:00 PM					
6:15:00 PM					
6:30:00 PM	Reception				closing ceremony
6:45:00 PM					
7:00:00 PM			Free time/ Canada Day celebrations		Gala Dinner
7:15:00 PM					
7:30:00 PM					
7:45:00 PM	Free time				
8:00:00 PM					
8:15:00 PM					
8:30:00 PM					
8:45:00 PM					
9:00:00 PM					

Posters
1.5 hour oral
1.5 hour symposia
2 hour orals
2 hour symposia
Keynote
AGM
Coffee
Lunch

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ABOUT ISPGR

The International Society for Posture and Gait Research (ISPGR) is a staff-supported, member driven organization with 500+ members located in over 20 countries around the world.

The society provides a multidisciplinary forum for basic and clinical scientists, provides member benefits and holds regular meetings in order to:

- Present and discuss the latest research and clinical findings relating to the control of posture and gait and related disorders.
- Facilitate interaction between members who meet from all corners of the globe.
- Promote the broad discipline of posture and gait research.

ISPGR History

The International Society for Posture and Gait Research was formed in 1969 under the name the International Society of Posturography, by a group of basic scientists and clinicians who had similar interests in quantifying postural sway during stance. Most of the Society members in the first years were from Europe and Japan.

The first meetings took place in *Madrid* (1971), *Smolenica* (1973), *Paris* (1975), *Sofia* (1977), *Amsterdam* (1979), *Kyoto* (1981) and *Houston* (1983). At the 1983 meeting in Houston the founders realized that interest in posturography had expanded to include the entire area of balance and gait control and at the annual meeting in 1986, the Society was renamed to its current name. By the 1992 meeting in *Portland*, Oregon, the Society had grown to over 300 members worldwide and member interests expanded to include sensory and motor control neurophysiology, biomechanics, movement disorders, neural circuitry, vestibular function, neurological disorders, effects of development and aging, rehabilitation, robotics, modeling, neural compensation, and motor learning as related to control of balance and gait.

Download the official ISPGR Mobile App!

ISPGR is excited to announce the launch of our interactive mobile application for the 2014 World Congress! The ISPGR Mobile App is available for iPhone, Android, Blackberry and any smartphone or tablet that has web-enabled browser capability. Maximize your time and experience with the ISPGR Congress – scan the QR code on the back of your badge to download the app.

The ISPGR app allows you to:

- View all congress information (sessions, abstracts, speakers, exhibitors, maps, attendee profiles, etc.) on your mobile device
- Build a personalized schedule and access any session handouts
- Find information quickly with the universal search feature
- Opt into messaging with other attendees
- Receive important congress-related notifications and updates
- Take notes on your mobile device during specific sessions with the ability to extract the information later
- Browse local restaurants and attractions
- **And much more…**

WELCOME LETTER

Dear Colleagues, Dear Friends,

We are honoured to be the hosts of the 2014 World Congress of the International Society of Posture and Gait Research, which follows a long history of rich scientific discussion and exchange over the past 40 years.

We are pleased to welcome you to Vancouver, British Columbia. It has been 15 years since the last time the ISPGR meeting was held in Canada, and so we are especially excited to be able to introduce a new generation of researchers to the hospitality and natural beauty that our country is known for throughout the world. This will be on full-display as you will be able to join all Canadians in celebrating Canada Day on July 1st, during the meeting.

In planning this Congress, we have tried to further emphasize scientific exchange and networking, by encouraging more audience participation within the symposia, dedicating more time and attention to poster presentations, and providing greater access to your work through the new conference APP and electronic poster stations. We have also continued the Society's tradition of focusing on young researchers and student members, by reducing student costs, supporting the first official student-run symposium, and recognizing the excellence of their work through the Young Investigator's award and NDI Aftab Patla student poster awards. The impact of the Society's dedication to student participation is highlighted by the fact that over 40% of our Congress attendance is made up of student members this year!

We have four world-class keynote speakers highlighting some of the most innovative and novel research in our field, and an exciting scientific program that features, 7 pre-conference workshops, 71 oral presentations, 12 symposia, and 403 poster presentations covering a broad spectrum of posture and gait research.

We want to extend a sincere thanks to all of those individuals who have dedicated their time to help organize this Congress. Special thanks goes to the members of the Scientific Content Committee who have worked hard to help us objectively select this year's symposia, oral and poster presentations, and members of the Awards Committee that have the challenging task of choosing winners for the Young Investigator's award and student poster awards. We also would like to thank the ISPGR board members for their continued support, and our Conference Organizers at DeArmond Management, who have been an essential partner to the Society as we transition into a central role of organizing our future ISPGR World Congresses. Finally, we thank you, in advance, for your individual contributions and efforts to help make this a memorable and successful Congress for all.

We encourage you to take advantage of the opportunity to share and discuss your work, but also to develop new networks of friends and colleagues, plan future collaborations, and create and exchange new ideas and perspectives.

Friends, colleagues, welcome to Vancouver and the 2014 World Congress of the ISPGR!

Mark G. Carpenter
Congress Co-Chair:

Bradford J. McFadyen
Congress Co-Chair

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Scientific Content Committee

Committee Co-Chairs:

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ISPGR World Congress 2015
June 28 - July 2, Seville, Spain
We are pleased to announce that the 2015 ISPGR World Congress will be take place at the Melia Sevilla Hotel, Seville, Spain!
Key dates: Abstract submission opens October 1, 2014 I Registration opens early 2015
visit ispgr.org for details


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on booth #6 at ->
ispgr
International Society for Posture & Gait Research
Vancouver 2014
www.codamotion.com

Meeting Venue

The Westin Bayshore Hotel

601 Bayshore Drive
Vancouver, BC, V6G 2V4

(please review the floor plan at the back of the program for further details)

Registration

World Congress Registration
Registration for the Congress includes admission to all sessions (excluding pre-congress workshops), a copy of the printed program, access to all coffee breaks and lunches daily. In addition, all social events, including the Welcome Reception and Gala Dinner are included in your registration.

Additional Tickets
Pre-Congress Workshops require advance registration and **cost $40**.

Tickets can be purchased separately for your guests and/or children for all conference excursions, the Welcome Reception ($35 for adults, $20 for children), and Gala Dinner ($95 for adults, $40 for children).

Name Badges
Your name badge is your admission ticket to the conference sessions, coffee breaks, meals, reception and Gala. Please wear it at all times. At the end of the conference we ask that you return your badge to the registration desk, or at one of the badge recycling stations.

ISPGR Board Members, Exhibitors and Staff will be identified by appropriate ribbons.

Dress Code
Dress is casual for all ISPGR meetings and social events.

Registration and Information Desk Hours
The Registration and Information Desk, located in the foyer, will be open during the following dates and times:

Sunday	June 29	07:30 – 09:30 15:00 – 18:30
Monday	June 30	08:00 – 17:00
Tuesday	July 1	08:00 – 15:00
Wednesday	July 2	08:00 – 17:00
Thursday	July 3	08:00 – 16:00

Speaker Information
For Oral Sessions, each room will be equipped with

- 1 PC laptop
- 1 LCD projector
- 1 microphone
- 1 laser pointer

All speakers in Symposia and Oral Sessions must upload their presentations, during their allocated times, at the speaker ready room: Mackenzie. If you have any questions please visit the registration desk.

Poster Information

Set-up and Removal
There are three Poster Sessions during the Congress. Poster presenters must set-up and remove their posters during the following times:

Poster Session 1

Set-up:	Monday, June 30	07:30 – 08:30
Dedicated time:	Monday, June 30	09:30 – 11:30
Remove:	Monday, June 30	by 18:00

Poster Session 2

Set-up:	Tuesday, July 1	07:30 – 08:30
Dedicated time:	Tuesday, July 1	10:00 – 12:00
Remove:	Tuesday, July 1	by 18:00

Poster Session 3

Set-up:	Wednesday, July 2	07:30 – 08:30
Dedicated time:	Wednesday, July 2	09:30 – 11:30
Remove:	Wednesday, July 2	by 18:00

Information on Poster Authors (Lead), Poster Numbers and Poster Titles begins on page 51. For a complete copy of all the poster abstracts, please visit the ISPGR website, where you can download an electronic copy.

Easy reference Poster Floor Plans can be found on page 80.

Staff

ISPGR staff from De Armond Management Ltd can be identified by the orange ribbons on their name badges. Feel free to ask any one of our staff for assistance. For immediate assistance please visit the registration desk.

Internet Services

IPSGR attendees have access to complimentary WI-FI in the meeting space area.

WI-FI Intructions: **Username:** **ispgr**
Password: **9121**

- Please connect using the wireless network service '*Westin Conference*' or '*Westin Hotel*' and open your internet browser
- On the Westin Portal page, click the 'I agree' after agreeing to the Terms of Service
- On the next screen, please enter the provided user name and password in the 'ACCESS CODE' section, and click 'submit'
- You will then be directed to the Westin Bayshore homepage at which point, you may go to any website of your choosing, connect to your VPN, or perform email tasks

ispgr INTERNATIONAL SOCIETY FOR POSTURE & GAIT RESEARCH

Membership

Membership in ISPGR is open to scientists, researchers, clinicians and students from around the world involved in the many research and practical aspects of Gait and Posture. Membership dues support the ISPGR's mission of creating a community of multidisciplinary posture and gait researchers and students.

Member Benefits

- Exclusive opportunity to **submit abstracts** for review and consideration for presentation at Society Meetings
- Opportunity to register for Society Meetings at **reduced registration rates**
- Professional **development and networking**
- Access to **online resources** and conference proceedings
- Opportunity to submit applications for **student scholarships and awards**
- Ability to post and review **job and grant opportunities**
- Opportunity to post **news and information** on related events
- Opportunity to **vote** in annual elections for the Board of Directors
- Opportunity to **stand for election** to the Board of Directors
- Opportunity to **serve as an officer** of the Board of Directors
- Opportunity to **serve on Society committees**

Member Categories

Regular Members
Any person who is engaged in research or clinical practice related to posture and gait is eligible to be a regular member.

Student Members
Students enrolled in degree granting programs at institutions of higher learning and post doctoral fellows are eligible to be student members.

Member Dues
ISPGR membership dues are paid annually and cover the calendar year from October 1 to September 30 each year. Current membership dues are:

Regular Member **$100**
Student/Post-Doc Member **$50**

Join a Society Committee

All current ISPGR members are encouraged to serve on a Society committee and actively engage in the future planning of the Society and the World Congress. Committees include:

- Scientific Content Committee
- Awards Committee
- Industrial Relations Committee
- Communications Committee

If you would like to learn more, please arrange a face-to-face meeting with a current board member at the World Congress; either through the member community area on the website or by visiting the registration desk.

ISPGR Excursions Tuesday, July 1st

Both the walking tour and trips to Grouse Mountain have a few spaces left if you wish to register. Delegates who wish to take part in these excursions may register onsite at the registration desk.

Vancouver City Walking Tour with John Atkin
3pm departure, 5pm return (2 hours total) –
Tour departs from the Hotel Lobby

John Atkin is a civic historian and author who conducts tours throughout the city. John offers an interesting and offbeat insight to the city's history and neighbourhoods, and brings an insight of urban planning and development, a love of architecture, and the fascination of the curious to all his tours. This tour will depart from the Westin Bayshore Hotel and will take you through Stanley Park and the West End Neighborhood. Please be sure to wear appropriate footwear and bring water with you.

Cost: $15 per person

The Grouse Grind Hike to the Summit
3pm departure, 7pm return (4 hours total) –
Busses depart from the Hotel Entrance

The Grouse Grind is a 2.9-kilometre trail up the face of Grouse Mountain, commonly referred to as "Mother Nature's Stairmaster." After ascending 2,830 steps, you will enjoy breathtaking views of the city of Vancouver, sparkling Pacific Ocean, Gulf Islands, and surrounding snowy peaks. How fast you can make it to the top depends on your fitness level and how busy the trail is. The average time it takes to reach the top is 1.5 - 2 hours. Please ensure that you wear appropriate footwear and clothing for the hike (temperatures in early July in Vancouver range from 18-28 degrees Celsius), and be sure to bring plenty of water and sunscreen. You'll enjoy a 10 minute ride down as you dangle above the piney mountainside as you take the Skyride back to the base.

Cost: $35 per person (includes transportation to the base of Grouse Mountain, and the gondola back down)

Grouse Mountain "Skyride" Gondola to the Summit and Back

3pm departure, 7pm return (4 hours total) –
Busses depart from the Hotel Entrance

Take a leisurely gondola ride up to the summit of Grouse Mountain. High above towering Douglas firs, breathtaking views of the city of Vancouver, sparkling Pacific Ocean, Gulf Islands, and snowy peaks unfold as you journey up the mountainside. North America's largest aerial tramway system is your gateway to the majestic nature of The Peak of Vancouver, and an experience in itself. Whether you're in search of the perfect photo, or a cocktail with a view, your adventure begins with the Skyride.

Cost: $65 per person (includes transportation to the base of Grouse Mountain, and the return gondola ticket)

ISPGR Canada Day Top Tips

To help you celebrate the National Holiday, Canada Day, July 01 2014, we have highlighted some fun activities to help you explore the city and participate in our lively celebrations:

Canada Day Celebration at Canada Place

www.canadaday.canadaplace.ca

This is the largest Canada Day celebration outside the nation's capital. From 10am to 6pm, guests can enjoy a wide variety of live performances, interactive displays, and many family fun activities. All FREE!

Then, make your way to Georgia Street to enjoy the Canada Day Parade at 7pm, finishing the night with a bang and enjoy the Canada Day Fireworks Show at Canada Place at 10:30pm.

Granville Island

vancouver.about.com/od/historylandmarks/ss/granvilleisland.htm

Granville Island's huge Canada Day celebration, from 8am until midnight, includes a Truly Canadian Pancake Breakfast, a Parade, an official Canada Day Ceremony, live jazz, performers, and MELA!, a South Asian cultural fair. This is the best venue for families with young kids: bring a picnic blanket and take breaks to let the kids run at the free Granville Island Water Park.

Steveston Salmon Festival

www.stevestonsalmonfest.ca

The day begins at 10am with a parade through historic Steveston village, including floats, marching bands, celebrities, politicians, community groups, vintage vehicles & much more. Then, the Festival is officially kicked off at our Opening Ceremonies on the Main Stage at noon with dignitaries, speeches, & the singing of O Canada. After the official opening, the stage bursts with great entertainment all afternoon.

The main attraction is our famous salmon barbecue where over 1200 pounds of wild salmon filets are grilled over open fire pits. This popular treat sells out every year! $15 per plate - cash only.

Canada Day at Fort Langley National Historical Site

Free admission to visit the site where British Columbia was born. There will be multicultural performances, cake, and ceremony and family activities.

Morning Session 09:00 – 12:00 (lunch on own)

Workshop 1 *Location: Stanley Park Salon 1*

Using Tekscan's force & pressure mapping technology to analyze and assess on foot dysfunctions and gait related disorders, balance, risk of falls and concussion related disorders

Presenter: **Dany Lafontaine**, Tekscan Inc., USA

Workshop Overview: The use of in-shoe and floor mat force and pressure mapping measurement technology has become practice in the clinical and research settings. Clinicians and researchers use this technology to study, assess, analysis and treat, among others, foot, gait, balance, risk of falls and concussion related disorders. In this workshop live hands-on data collection with subjects will be made. The captured data will be processed and displayed. Analysis and interpretation of the data will then be made relative to 1) foot dysfunctions and gait related disorders will be carried out, and 2) balance, risk of falls and concussion related disorders.

Workshop goals and objectives: To exposed the attendees to the use of the F-Scan in-shoe and MatScan floor mat force and pressure measurements systems, including 1) data capture protocols, 2) data analysis protocols, and 3) interpretation on the data relative to foot dysfunctions and gait related disorders, and relative to balance, risk of falls and concussion related disorders.

Takeaway skills and knowledge: 1) learning how to operate the F-Scan in-shoe and the MatScan floor mat systems and 2) operating in the software of the systems. Takeaway knowledge includes how to analyze, assess and interpret on foot dysfunctions and gait related disorders, and on balance, risk of falls and concussion related disorders.

Workshop 2 *Location: Stanley Park Salon 2*

Keeping balance: Function and assessment of the saccule and utricle in the clinical neuro-otology setting - Part one: ideas and theories

09:00 – 09:30	***Understanding otolithic function and pathology***
	Neil Longridge, Vancouver General Hospital and University of British Columbia, Canada
09:30 – 10:00	***History taking and clinical assessment of the patient with otolithic pathology***
	Art Mallinson, Vancouver General Hospital and University of British Columbia, Canada
10:00 – 10:30	***Unilateral centrifugation to measure the otoliths; using space research to understand vestibular function***
	Angelique Van Ombergen, University of Antwerp, Belgium
10:30 – 11:00	**Break**
11:00 – 11:30	***Otolithic function in sports performance***
	Philippe Perrin, University of Lorraine, France
11:30 – 12:00	***Otolithic function and fall prevention***
	Mans Magnusson, Lund University, Sweden

Workshop 3 *Location: Stanley Park Salon 3*

Biomechanics and motion capture workshop from Vicon

Presenter: **Jacques Gay**, Vicon, UK

09:00 – 09:30	**Introduction**
09:30 – 10:00	**History of gait modelling**
10:00 – 10:30	**The future of modelling – SCoRE and SARA**
10:30 – 11:00	**Break**
11:00 – 11:30	**Practical demonstration of SCoRE and SARA**
11:30 – 12:00	**Questions**

Workshop 4 *Location: ICORD in the Blusson Spinal Cord Centre (off-site)*

Emerging principles for gait training in neurorehabilitation: new task-specific training strategies

Presenters: **Amanda Chisholm**, University of British Columbia, Canada
Catherine Chan, Vancouver Coastal Health and
NeuroMotion Physiotherapy Clinic, Canada
Tania Lam, University of British Columbia, Canada

Format: This workshop will discuss current research emerging for gait training in neurorehabilitation. We will use robotic-based tools (e.g. Lokomat® robotic gait orthosis, and Ekso™ bionic suit) with each work station to provide practical examples demonstrating the implementation of the principles of gait training to enhance the quality and generalizability of practice. The demonstrations will be performed by individuals with a neurological injury, and they will also share their experiences with different gait training modalities.

09:00 – 09:50	**Introduction & Review of Literature**
09:50 – 10:20	Work Station #1: ***Taking advantage of the adaptability of locomotion in gait rehabilitation strategies***
10:20 – 10:30	**Refreshment Break. Coffee will be provided.**
10:30 – 11:00	Work Station #2: ***Enhancing neuroplasticity through sensory stimulation combined with motor training***
11:00 – 11:30	Work Station #3: ***Incorporating principles of motor learning principles into gait training: Task-specificity, variability, and feedback tools to enhance cognitive***
11:30 – 12:00	**Discussion & Clinical Perspective**

Please Note: This workshop will be held at ICORD in the Blusson Spinal Cord Centre (818 West 10th Ave, Vancouver, BC) on Sunday June 29th from 9am - 12noon. The Human Locomotion Lab has all the materials required to conduct the workshop.

**Please be advised that the Blusson Spinal Cord Centre is closed to the public on weekends. We will have volunteers present to allow attendees to have access into the building (at the front doors facing West 10th Ave) and scanned up to the 3rd Floor. The workshop will be in the 3rd floor Rehabilitation Research Lab. Map and directions available on the ISPGR conference app.*

Afternoon Session 13:00 – 16:00 (lunch on own)

Workshop 5 *Location: Stanley Park Salon 1*

Understanding physical behaviour and behavioural change? How we can derive context rich information on participation in free-living physical activities from body-worn accelerometer data

13:00 – 13:45	***Physical Behaviours Model and Event-Based analysis***
	Malcolm Granat, University of Salford, UK
13:45 – 14:00	***Event-Based analysis across a number of chronic conditions***
	Danny Rafferty, Glasgow Caledonian University, UK and Malcolm Granat, University of Salford, UK
14:00 – 14:15	***Event-based analysis in Intermittent Claudication***
	Malcolm Granat, University of Salford, UK
14:30 – 15:00	**Break**
15:00 – 15:15	***Analysis of data and introduction to practical***
	Douglas Maxwell, PAL Technologies Ltd, UK
15:15 – 15:45	***Group analysis***
	Douglas Maxwell, PAL Technologies Ltd, UK, **Danny Rafferty**, Glasgow Caledonian University, UK and **Malcolm Granat**, University of Salford, UK
15:45 – 16:00	***Data visualisation and context***
	Malcolm Granat, University of Salford, UK

Workshop 6 *Location: Stanley Park Salon 2*

Consensus meeting on clinical stabilometry

13:00 – 13:05	***Introduction: workshop aims and program***
	Lorenzo Chiari, University of Bologna, Italy
13:05 – 13:30	***A survey of the most commonly used stabilometric parameters and their measurement properties***
	Martina Mancini, Oregon Health & Science University, USA and **Antonio Nardone**, Posture and Movement Laboratory, Maugeri Foundation, Italy
13:30 – 13:45	***Influence of the protocol on stabilometric parameters***
	Masahiko Yamamoto, Toho University, Japan
13:45 – 14:.00	***The present status of clinical application of stabilometry and its parameters in Japan***
	Mitsuhiro Aoki, Akita Graduate School of Medicine, Japan
14:00 – 14:15	***The present status of clinical application of stabilometry and its parameters in Latin Countries.***
	Pierre-Marie Gagey, ADAP, France

14:15 – 14:30	***Towards accelerometer-based stabilometry?***
	Sabato Mellone, University of Bologna, Italy
14:30 – 15:00	**Coffee Break**
15:00 – 16:00	***The Consensus process on Clinical stabilometry***
	Kazuo Ishikawa, Akita Graduate School of Medicine, Japan and **Lorenzo Chiari**, University of Bologna, Italy

Workshop 7 *Location: Stanley Park Salon 3*

Keeping balance: Function and assessment of the saccule and utricle in the clinical neuro-otology setting - Part two: results and data

13:00 – 13:30	***Visual vestibular mismatch; visually induced dizziness; what do these terms mean?***
	Art Mallinson, Vancouver General Hospital and University of British Columbia, Canada
13:30 – 14:00	***Otolithic testing techniques in normals; developing a worldwide data base***
	Robby Vanspauwen, University of Antwerp, Belgium
14:00 – 14:30	***New techniques of otolithic assessment; assessment of the medical/legal patient***
	Neil Longridge, Vancouver General Hospital and University of British Columbia, Canada
14:00 – 15:00	**Break**
15:00 – 15:30	***New radiological techniques – diffusion tensor imaging of the vestibular system***
	Angelique Van Ombergen, University of Antwerp, Belgium
15:30 – 14:00	**Open discussion and questions**

DETAILED PROGRAM

Sunday, June 29, 2014

Morning Pre-Congress Workshops

09:00 – 12:00

WS 1. *Stanley Park Salon 1* Using Tekscan's force & pressure mapping technology to analyze and assess on foot dysfunctions and gait related disorders, balance, risk of falls and concussion related disorders

WS 2. *Stanley Park Salon 2* Keeping Balance: function and assessment of the saccule and utricle in the clinical neuro-otology setting - Part one: ideas and theories

WS 3. *Stanley Park Salon 3* Biomechanics and motion capture workshop from Vicon

WS 4. ICORD Workshop *(Offsite)*: Emerging principles for gait training in neurorehabilitation: new task-specific training strategies
Location:
3rd Floor, Blusson Spinal Cord Centre
818 West 10th Avenue (Northwest corner of Willow St & West 10th Ave)
Vancouver, B.C. V5Z 1M9

Afternoon Pre-Congress Workshops

13:00 – 16:00

WS 5. *Stanley Park Salon 1* Understanding physical behaviour and behavioural change - how we can derive context rich information on participation in free-living physical activities from body-worn accelerometer data

WS 6. *Stanley Park Salon 3* Consensus meeting on clinical stabilometry

WS 7. *Stanley Park Salon 2* Keeping Balance: function and assessment of the saccule and utricle in the clinical neuro-otology setting Part two: results and data

Opening of World Congress

17:00 – 17:30 **ISPGR World Congress Opening Ceremony**
location: Bayshore Ballroom ABC

17:30 – 18:30 **Opening Keynote – William H. Warren**, Brown University, USA
location: Bayshore Ballroom ABC

Behavioral dynamics of visually-guided walking: from stepping to swarming

Chair: **Brad McFadyen**, Laval University, Canada

18:30 - 19:30 **Opening Reception**
location: Currents Restaurant and outdoor area

Monday, June 30, 2014

08:30 - 09:30 **Keynote Presentation - Jens Bo Nielsen**, University of Copenhagen, Denmark
location: Bayshore Ballroom ABC

Corticospinal control of gait in humans

Chair: **Jacques Duysens**, KU-Leuven, Belgium

09:30 – 11:30 **Poster Session 1** *location: Bayshore Ballroom DEF*

11:30 – 12:30 **Lunch: posters & exhibits**
location: Bayshore Ballroom DEF & Foyer

Parallel Symposia

12:30 – 14:30 **S.1.** ***Uncovering real-life falls*** *location: Cypress Room*

Chair and discussant: **Chris Todd**, University of Manchester, UK

Participants:

Stephen Robinovitch, Simon Fraser University, Canada
Lorenzo Chiari, Universita' di Bologna, Italy
Clemens Becker, Robert-Bosch-Krankenhaus, Germany
Stefania Bandinelli, Geriatric Unit, ASF, Florence, Italy

S.2. ***Can (biomechanical) mobility parameters serve as a biomarker for neurodegenerative movement disorders?*** *location: Bayshore Ballroom BC*

Co-Chairs:

Walter Maetzler, University Hospital Tuebingen, Germany
Martjin Muller, University of Michigan, USA

Participants:

Alice Nieuwboer, KU Leuven, Belgium
Fay Horak, Oregon Health and Science University, USA
Martijn Muller, University of Michigan, USA
Walter Maetzler, University Hospital Tuebingen, Germany

S.3. ***Advanced methods to identify balance control mechanisms in stance and gait*** *location: Stanley Park Ballroom Salon 1 & 2*

Chair & Discussant: **Herman van der Kooij**, University of Twente, Netherlands

Participants:

Herman van der Kooij, University of Twente, Netherlands
Thomas Mergner, University of Freiburg, Germany
Tim Kiemel, Univeresity of Maryland, USA
Robert Peterka, Oregon Health and Science University, USA

14:30 – 15:00 **Break** *location: Bayshore Ballroom foyer*

Oral Sessions

15:00 – 17:00 **O.1** **Aging Oral** *location: Bayshore Ballroom BC*

Co-Chairs:
Vivian Weerdesteyn, Radboud University, Netherlands
Joe Verghese, Albert Einstein College of Medicine, USA

O.1.1 ***Association between walking smoothness and measures of isometric hand grip and knee extension strength***

Bård Bogen, University of Bergen, Norway

O.1.2 ***Perceptions of gait speed, timing and risk: an experimental study of road-crossing behavior in older people***

Annie Butler, Neuroscience Research Australia

O.1.3 ***Biomechanical characteristics of balance control in obese older adults***

Itshak Melzer, Ben-Gurion University, Israel

O.1.4 ***Hearing loss negatively impacts balance and gait by increasing cognitive load***

Nicoleta Bugnariu, University of North Texas Health Science Center, USA

O.1.5 ***The effect of different walking types on dual-task performance among community dwelling older adults***

Maayan Agmon, University of Haifa, Israel

O.1.6 ***The influence of fear and anxiety on postural sway compensations under postural threat in young and older adults***

Daina Sturnieks, Neuroscience Research Australia, Australia

O.1.7 ***The effects of route previewing on older adults' gaze behavior and stepping accuracy during adaptive locomotion***

Mark Hollands, Liverpool John Moores University, UK

O.1.8 ***Balance control interferes with learning to trace a pattern with mirror-reversed vision in older persons***

Normand Teasdale, Université Laval, Canada

O.2 Sensorimotor Control I *location: Stanley Park Ballroom 1 & 2*

Co-Chairs:

Nandini Deshpande, Queen's University, Canada
Geoffrey Wright, Temple University, USA

O.2.1 ***Inspiratory muscle training improves proprioceptive postural control and sit-to-stand-to-sit in individuals with recurrent non-specific low back pain***

Lotte Janssens, KU Leuven (University of Leuven), Netherlands

O.2.2 ***The quick and the slow: separate time scales of control for human walking***

David Logan, University of Maryland, USA

O.2.3 ***Locomotor control strategies underlying acquisition of a skilled walking task when sensory stimulation is combined with motor practice***

Amanda Chisholm, University of British Columbia, USA

O.2.4 ***Addition of haptic information for postural control in young adults: Light touch reduces more body sway than does the "anchor system"***

Renato Moraes, University of Sao Paulo at Ribeirao Preto, Brazil

O.2.5 ***Cutaneous afferent sensitivity and perceptual threshold in the Human foot sole***

Leah Bent, University of Guelph, Canada

O.2.6 ***Unilateral or bilateral vibration effects during postural control for young adults***

Noémie Duclos, Aix-Marseille University, CNRS, France

O.2.7 ***The mere planning of an imagined step movement suffices to trigger cortical facilitation of somatosensory inputs***

Laurence Mouchnino, Aix-Marseille University CNRS, France

O.2.8 ***Correlation between structural properties of white matter pathways and proprioceptive postural control in individuals with recurrent non-specific low back pain and healthy controls***

Madelon Pijnenburg, University of Leuven, Belgium

Tuesday, July 1, 2014

Parallel Symposia

08:30 – 10:00 **S.4.** ***The role and implications of cortical and other supraspinal areas in control of balance and gait*** *location: Bayshore Ballroom BC*

Chair: **Fay Horak**, Oregon Health and Science University, USA

Participants:

Klaus Jahn, University of Munich, Germany
Daniel Peterson, Oregon Health & Science University, USA
Lynn Rochester, University of Newcastle, UK

S.5. ***Wearable sensory substitution devices for balance or gait dysfunction: Patient-specific design and optimization*** *location: Cypress Room*

Chair: **Patrick Loughlin,** University of Pittsburg, USA
Discussant: **Conrad Wall**, Harvard Medical School, USA

Participants:

John Allum, University Hospital, Basel, Switzerland
Patrick Loughlin, University of Pittsburg, USA
Kathleen Sienko, University of Michigan, USA

S.6. ***Motor-cognitive reserve and risk: new concepts and novel findings*** *location: Stanley Park Ballroom Salon 1 & 2*

Chair & Discussant:
Jeffrey M. Hausdorff, Tel Aviv Sourasky Medical Center and Tel Aviv University, Israel

Participants:

Joe Verghese, Albert Einstein College of Medicine, USA
Anat Mirelman, Tel Aviv Sourasky Medical Center, Israel
Brad Manor, Harvard Medical School, USA

10:00 – 12:00 **Poster Session 2** *location: Bayshore Ballroom DEF*

12:00 – 13:00 **Lunch: Young Investigator Award Presentation** *location: Bayshore Ballroom ABC*

Oral Sessions

13:00 – 14:30 **O.3 Habilitation & Rehabilitation** *location: Bayshore Ballroom BC*

Co-Chairs:
Beatrix Vereijken, Norwegian University of Science and Technology, Norway
Tania Lam, University of British Columbia, Canada

O.3.1 ***Sensory reweighting of proprioceptive information in young and older adults: Improvement through adaptation***

Mihalis Doumas, Queen's University Belfast, Ireland

O.3.2 ***Gait rehabilitation: Does executive function status matter?***

Kristin Lowry, Des Moines University, USA

O.3.3 ***Can functional electrical stimulation of the hamstring muscles improve knee kinematics in stiff knee gait of stroke survivors?***

Martin Tenniglo, Roessingh Research and Development, Netherlands

O.3.4 ***Gait practice during inpatient rehabilitation following stroke***

Suzanne Kuys, Griffith University, Australia

O.3.5 ***Visual cue training to improve walking and turning after stroke: a multi-centre, single-blind feasibility RCT***

Kristen Hollands, University of Salford, UK

O.3.6 ***Balance, dizziness, and kinesthesia in patients with chronic whiplash associated disorders: a prospective randomized study comparing three exercise programs***

Anneli Peolsson, Linköping University, Sweden

O.4 Falls & Falls Prevention *location: Stanley Park Ballroom 1 & 2*

Co-Chairs:
Kim Delbaere, Neuroscience Research Australia
Mirjam Pijnappels, VU University, Netherlands

O.4.1 ***Identifying individuals with difficulty in sit-to-stand movement using dynamic stability limits defined by center of mass acceleration***

Masahiro Fujimoto, University of Maryland School of Medicine, USA

O.4.2 ***The quantity and quality of daily activities in relation with fall history and future falls in older adults***

Kimberley van Schooten, VU University Amsterdam, Netherlands

O.4.3 ***Development and validation of a fall risk assessment tool from the InCHIANTI study***

Pierpaolo Palumbo, University of Bologna, Italy

O.4.4 ***Risk-taking, physical ability and falls in older people***

Stephen Lord, Neuroscience Research Australia, Australia

O.4.5 ***Kinematic analysis of real-life falls in older adults***

Woochol Choi, Simon Fraser University, Canada

O.4.6 ***Perturbation training while walking improves balance control and voluntary stepping parameters in community dwelling elders: a randomized control trial***

Ilan Kurz, Ben Gurion University, Israel

14:30 – 17:00 **Free time with excursions**

Wednesday, July 2, 2014

08:30 – 09:30 **Keynote Presentation** *location: Bayshore Ballroom ABC*

Tatiana Deliagina, Karolinska Institute, Sweden

Neural mechanisms underlying feedback postural control

Chair: **Mark Carpenter**, University of British Columbia, Canada

09:30 – 11:30 **Poster Session 3** *location: Bayshore Ballroom DEF*

11:30 – 12:30 **Lunch: posters and exhibits** *location: Bayshore Ballroom DEF & foyer*

Parallel Symposia

12:30 – 14:30 **S.7.** ***Can we more objectively measure motor-cognitive functioning to diagnose sports-related concussions?*** *location: Cypress Room*

Participants:

Michael Cinelli, Wilfrid Laurier University, Canada
Brad McFadyen, Laval University, Canada
Paul van Donkelaar, University of British Columbia, Canada
Li-Shan Chou, University of Oregon, USA

S.8. ***Implants and wearable aids for balance and gait dysfunction*** *location: Stanley Park Ballroom 1 & 2*

Chair: **Katheen Sienko**, University of Michigan, USA
Discussant: **John Allum**, University Hospital Basel, Switzerland

Participants:

Conrad Wall, Harvard Medical School, USA
Dietmar Basta, University of Berlin, Germany
Lara Thompson, University of the District of Columbia, USA
Yuri Danilov, University of Wisconsin-Madison, USA

S.9. ***Exergaming in the elderly for fall risk reduction and prevention: Challenges and future directions*** *location: Bayshore Ballroom BC*

Chair: **Nina Skjaeret**, Norwegian University of Science and Technology, Norway

Discussant: **Stephen Lord,** University New South Wales, Neuroscience Research Australia

Participants:

Claudine Lamoth, Center for Human Movement Sciences, Netherlands
Daniel Schoene, Neuroscience Research Institute, Australia
Alan Bourke, Ecole Polytechnique Federale de Lausanne (EPFL), Switzerland
Brook Galna, Newcastle University, UK

14:30 – 15:00 **Break** *location: Bayshore Ballroom foyer*

Oral Sessions

15:00 – 17:00

O.5 Neurological Disease *location: Bayshore Ballroom BC*

Co-Chairs:
Walter Maetzler, University of Tuebingen, Germany
Lynn Rochester, Newcastle University, UK

O.5.1 ***The immediate effect of subthalamic deep brain stimulation on sensory and motor aspects of postural control***

Lauren Shreve, Stanford University, USA

O.5.2 ***Training-related improvements in step initiation using self-triggered sensory cueing reveals different expressions of start hesitation in persons with Parkinson's disease***

Robert Creath, University of Maryland School of Medicine, USA

O.5.3 ***Quantitative functional reach in high risk individuals for Parkinson´s disease***

Sandra Hasmann, University Hospital of Tübingen, Germany

O.5.4 ***Functional neuroimaging of prefrontal cortex in Parkinson's disease: effects of cognitive task during seated and standing postures***

Graham Kerr, Queensland University of Technology, Australia

O.5.5 ***The effect of concurrent cognitive loading and asymmetric walking in patients with Parkinson`s disease with and without freezing of gait***

Farshid Mohammadi, KU Leuven, Belgium

O.5.6 ***Balance and gait rehabilitation in patients with cerebellar damage of vascular or degenerative origin***

Anna Turcato, Fondazione Salvatore Maugeri (IRCCS), Scientific Institute of Veruno, Italy

O.5.7 ***Vestibulo-cerebellar influences on gait control***

Roman Schniepp, Ludwig-Maximilian-University of Munich, Germany

O.5.8 ***Post-stroke lower limb spasticity alters the interlimb spatial and temporal synchronisation of centre of pressure displacements across multiple timescales***

Jonathan Singer, Sunnybrook Research Institute, Canada

O.6 Tools & Methods *location: Stanley Park Ballroom 1 & 2*

Co-Chairs:
Shirley Rietdyk, Purdue University, USA
Li-Shan Chou, University of Oregon, USA

O.6.1 ***Quantifying individual components of the timed up and go using the kinect in people living with stroke***

Ross Clark, Australian Catholic University, Australia

O.6.2 ***Estimating gait characteristics from accelerometer recordings - agreement between sensor locations***

Sietse Rispens, VU University Amsterdam, Netherlands

O.6.3 ***Wavelet-based functional ANOVA to reveal statistically-significant contrasts between EMG and kinematics recorded in different experimental conditions***

Johnathan McKay, Emory University and the Georgia Institute of Technology, USA

O.6.4 ***Defining optimal filtering frequencies in electromyographic signal contaminated with movement artefact***

Stephanie Smith, Glasgow Caledonian University, Scotland

O.6.5 ***Electrical vestibular stimulation for the clinic: enhancing vestibulo-motor output and improving subject comfort***

Patrick Forbes, Delft University of Technology, Netherlands

O.6.6 ***A four domain model of gait in older hip-fracture patients based on factor analysis***

Pernille Thingstad, Norwegian University of Science and Technology, Norway

O.6.7 ***Subtle changes in gait domains over 18 months in Parkinson's disease***

Sue Lord, Newcastle University, UK

O.6.8 ***Comparison of methods for the detection of freezing of gait (FOG) in patients with Parkinson's disease***

Gwang-Moon Eom, Konkuk University, South Korea

Thursday, July 3, 2014

08:30 – 09:30 **Keynote Presentation – Brian Day**, University College London, UK

Vestibular influence on whole-body actions revealed by virtual head rotation
location: Bayshore Ballroom ABC

Chair: **Jim Frank**, University of Waterloo, Canada

Oral Sessions

09:30 – 11:30 **O.7 Cognitive Influences and Impairments** *location: Bayshore Ballroom BC*

Co-Chairs:
Mike Cinelli, Wilfred Laurier University, Canada
Karen Li, Concordia University, Canada

O.7.1 ***Differences in gait balance control recovery from concussion between adolescents and young adults***

David Howell, University of Oregon, USA

O.7.2 ***Spatial navigation in patients with cognitive impairment - assessed by the Floor Maze Te***

Gro Tangen, University of Oslo, Norway

O.7.3 ***Contributions of the montreal cognitive assessment (MOCA) to dual task gait performance***

Isabelle Killane, Trinity Centre for Bioengineering, Trinity College Dublin, Ireland

O.7.4 ***Is cognitive flexibility the key to healthy older adults' ability to prioritise attention in dual-task walking and counting?***

Linda Maclean, University of St Andrews, Scotland

O.7.5 ***Transcranial direct current stimulation (tDCS) alters the multi-scale complexity of dual-task postural control in older adults***

Junhong Zhou, Peking University, China

O.7.7 ***Improvement in dual tasking when walking is more closely linked to dual task interference than cognitive function in people with Parkinson's disease***

Sandra Brauer, University of Queensland, Australia

O.7.8 ***Discerning effect of cognitive capacity on dual task in Parkinson's disease and healthy controls***

Lynn Rochester, Newcastle University, UK

O.8 Sensorimotor Control II *location: Stanley Park Ballroom 1 & 2*

Co-Chairs:

Leah Bent, University of Guelph, Canada
Dan Marigold, Simon Fraser University, Canada

O.8.1 ***Haptically mediated inter-personal entrainment depends on postural coordination dynamics during frequency scaled rhythmic sway***

Vassilia Hatzitaki, Aristotle University of Thessaloniki, Greece

O.8.2 ***Temporospatial relationships between axial body segments during standing turns is predominantly determined by turning speed***

Rebecca Robins, Liverpool John Mooores University, UK

O.8.3 ***Potential different functions in discrete regions of the psoas major muscle at the spine and hip during gait***

Rachel Park, University of Queensland, Australia

O.8.4 ***Experimentally induced hip muscle pain alters single-leg dynamic balance performance in healthy young adults***

Anna Hatton, University of Queensland, Australia

O.8.5 ***Direction specific adaptation of trunk muscles during direction related induced experimental pain***

Martin Eriksson Crommert, Örebro University, Sweden

O.8.6 ***Advanced preparation of automatic postural responses occurs during perturbations with predictable and unpredictable directions***

Elizabeth Pasman, University of British Columbia, Canada

O.8.7 ***Adaptation of dynamic balance between unpredictable gait perturbations in healthy participants***

Aurélie Méreu, Université de Montréal, Canada

O.8.8 ***The relationship between plantar-surface pressure and muscle activity during gait***

Stephen Perry, Wilfrid Laurier University, Canada

11:30 – 12:30 **Lunch and Annual General Meeting** *location: Bayshore Ballroom DEF*

12:30 – 13:00 **Award Presentations** *location: Bayshore Ballroom DEF*

Oral Sessions

13:00 – 14:30

O.9 Vestibular Function & Disorders *location: Bayshore Ballroom BC*

Co-Chairs:
Tim Inglis, University of British Columbia, Canada
John Allum, ORL University Clinic, Switzerland

O.9.1 ***Does pharmacological abatement of postural imbalance in acute unilateral vestibulopathy counteract vestibular compensation?***

Andreas Zwergal, University of Munich, Germany

O.9.2 ***The severity of vestibular dysfunction influences postural compensation***

Lara Thompson, University of the District of Columbia, USA

O.9.3 ***Clinical characteristics of idiopathic otolithic vertigo***

Toshihisa Murofushi, Teikyo University School of Medicine, Japan

O.9.4 ***Increased gain of vestibulospinal potentials evoked in neck and leg muscles when standing under height-induced postural threat***

Eduardo Naranjo, University of British Columbia, Canada

O.9.5 ***Spatial characteristics of the muscle response to electrical vestibular stimulation in humans***

Billy Luu, Neuroscience Research Australia

O.9.6 ***Polymodal areas in the right brain support the human sense of upright***

Céline Piscicelli, University Hospital of Grenoble, France

O.10 Activity Monitoring & Exercise *location: Stanley Park Ballroom 1 & 2*

Co-Chairs:
Kirsten Hollands, University of Salford, UK
John Buckley, University of Bradford, UK

O.10.1 ***Association between walking patterns during community ambulation and cognitive function in patients with Parkinson's disease: further insights into motor-cognitive links***

Aner Weiss, Souraski Medical Center, Israel

O.10.2 ***Time spent standing and walking post-stroke: a three year follow up study***

Carolyn Fitton, University of Southampton, UK

O.10.3 ***Feasibility of relating continuous monitoring of turning mobility to fall risk and cognitive function***

Martina Mancini, Oregon Health & Science University, USA

O.10.4 ***Usability and effects of an exergame-based balance training program***

Eling D. de Bruin, Institute of Human Movement Sciences and Sport, ETH Zurich, Switzerland

O.10.5 ***Effects of a highly challenging and systems-specific balance training program on balance, gait, physical activity and fear of falling in Parkinson's disease***

Erika Franzén, Karolinska Institutet, Sweden

O.10.6 ***Move up! Exergames training in children with advanced degenerative ataxia***

Cornelia Schatton, Hertie-Institute for Clinical Brain Research, Germany

14:30 – 15:00 **Break** *location: Bayshore Ballroom foyer*

Parallel Symposia

15:00 – 17:00 **S.10.** ***Proactive and reactive adaptations to slips and trips: implications for fall-risk assessment and rehabilitation*** *location: Cypress Room*

Chair: **Vivian Weerdestyn**, Radboud University, Netherlands

Participants:

Shirley Rietdyk, Purdue University, USA
Mirjam Pijnappels, VU University, Netherlands
Tanvi Bhatt, University of Illinois at Chicago, USA
Clive Pai, Universiity of Illinois at Chicago, USA

S.11. ***Multi-person entrainment in gait and posture: theories and approaches*** *location: Stanley Park Ballroom 1 & 2*

Chair: **Mark T. Elliott**, University of Birmingham, UK

Participants:

Mark T. Elliott, University of Birmingham, UK
Andreas Daffertshofer, VU University Amsterdam, Netherlands
Vassilia Hatzitaki, Aristotle University of Thessaloniki, Greece
Jeffrey M. Hausdorff, Tel Aviv Sourasky Medical Center and Tel Aviv University, Israel

S.12. ***The interplay between cognition and mobility: cutting- edge neuroimaging insights*** *location: Bayshore Ballroom BC*

Chair: **Teresa Liu-Ambrose**, University of British Columbia, Canada

Discussant: **Stephen Lord**, University New South Wales, Neuroscience Research Australia

Participants:

Caterina Rosano, University of Pittsburg, USA
Kim Delbaere, University of New South Wales, Australia
Chun Liang Hsu, University of British Columbia, Canada
Lindsay Nagamatsu, University of Illinois, USA
Teresa Liu-Ambrose, University of British Columbia, Canada

18:30 – 19:00 **Closing Ceremony** *location: Bayshore Ballroom*

19:00 – 23:00 **Gala Dinner and live entertainment** *location: Bayshore Ballroom*

Promising Young Scientist Award Winner 2014

The Promising Young Scientist Award acknowledges superior research by a young investigator in Posture and/or Gait. The Awards Committee is pleased to announce this year's award recipient –

Ross Clark, Australian Catholic University.

Ross is a Lecturer in Advanced Motor Control in the School of Exercise and Sports Science at Australian Catholic University.

Through his research Ross has:

- Found that low cost video gaming and Smartphone technology can be used to accurately assess some aspects of physical function
- Worked with clinicians throughout the world to implement these systems in standard clinical practice
- Used the data from these assessments to help identity patients at risk of poor long-term outcomes

Ross's presentation will take place on Tuesday July 1st, at 12:00 in the Bayshore Ballroom.

Research and Innovation Award in memory of Aftab Patla

Sponsored by Northern Digital, Inc.

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The congress will offer two student poster presentation awards in honour of Dr. Aftab Patla. One award will be for basic science and one for clinical science. Recipients will be chosen from a panel of researchers based on several criteria including:

creativity and originality of research / clarity of presentation / level of understanding

The award winner will be announced at the Closing Ceremony, Thursday July 3, 18:30 – 19:00.

Note: This award is for student poster submissions only.

William H. Warren
Brown University, USA

William H. Warren is Chancellor's Professor of Cognitive, Linguistic, and Psychological Sciences at Brown University, and Director of the Virtual Environment Navigation Lab (VENLab). He received his Ph.D. from the University of Connecticut (1982) and did his post-doctoral work at the University of Edinburgh (1983). He uses virtual reality techniques to investigate the visual control of human action. His primary focus is developing a "pedestrian model" of locomotor behavior and collective crowd dynamics, with applications to visual-motor assessment and rehabilitation. A second line of research studies spatial navigation, including path integration, spatial learning, and the geometry of "cognitive maps". A third project investigates the dynamics of perceptual-motor control in tasks such as bouncing a (virtual) ball on a racket. Warren is author of over 90 scientific papers and the recipient of a Fulbright Research Fellowship, an NIH Research Career Development Award, and Brown's Elizabeth Leduc Teaching Award for Excellence in the Life Sciences.

Behavioral dynamics of visually-guided walking: From stepping to swarming

Locomotion is hierarchically organized, from the individual's step cycle to the collective behavior of human crowds and animal swarms. A behavioral dynamics approach argues that at each level, stable adaptive behavior emerges from the interaction between the individual and its environment, exploiting both physical and informational constraints. At the level of the step cycle, the passive gait dynamics are actively modulated by visual information, one step at a time, to adapt gait to the terrain (Matthis & Fajen, 2013). At the pedestrian level, locomotor trajectories emerge on-line from the agent-environment interaction, without appealing to an internal world model or explicit path planning. I will describe a pedestrian model of steering, obstacle avoidance, interception, and pedestrian interactions derived from experimental studies of walking in a virtual environment. Each basic behavior is modeled as a simple dynamical system, and they can be linearly combined to predict behavior in more complex settings. At the collective level, global crowd behavior emerges from local interactions between pedestrians. Using multi-agent simulation methods, we find that our pedestrian model can generate the patterns of crowd behavior we observe in several "swarm" scenarios (N=20) recorded with motion-capture techniques. I will discuss **(a)** ***Grand Central***, in which individuals criss-cross the room, **(b)** ***random swarm***, in which participants veer left and right while staying together as a group, and (c) ***counterflow***, in which two groups pass through each other. In each scenario, the individual trajectories and global traffic patterns can be simulated with just a few model components. Thus, at each level, locomotor behavior can be understood as emergent behavior, with its dynamics modulated by information to yield stable adaptive action patterns.

Jens Bo Nielsen
University of Copenhagen, Denmark

Jens Bo Nielsen is Professor and Head of the Section ´Neural control of Movement´ at University of Copenhagen, Denmark. After gaining his medical degree and PhD from the University of Copenhagen, Professor Nielsen became Professor and Head of the Physiology Institute at the University of Kiel, Germany in 1995. He returned to the University of Copenhagen in 2000. Professor Nielsen is interested in how the nervous system controls movement in health and disease. His research covers work at the cellular and integrative level in animal models, healthy human subjects and neurological patients. His main research interests are the central control of gait, motor learning and neuroplasticity, voluntary and involuntary contributions to movement, perception of movement and intentionality.

Professor Nielsen has authored or co-authored >160 papers in international peer-reviewed journals, as well as numerous book chapters, meeting abstracts, medical student textbooks and public science books.

Corticospinal control of gait in humans.

Non-invasive imaging and electophysiological techniques have revealed the contribution of the corticospinal tract to the control of human gait during the past 15 years. These techniques have also permitted an evaluation of the development of corticospinal control in children and the significance of corticospinal lesions for gait deficits in neurological patients. The lecture will review these findings with an emphasis on adaptation of corticospinal control of gait in relation to gait training and rehabilitation.

Tatiana Dellagina
Karolinska Institute, Sweden

In 1982, I got PhD degree in neurophysiology at Moscow State University (Russia), where I continued working untill 1990. Since 1990, I am working at Department of Neuroscience, Karolinska Institute (Stockholm, Sweden). My present position is Professor in neuroscience. The areas of my scientific interest are neural mechanisms of rhythmical movements, and interaction of neuronal networks responsible for different aspects of motor behavior. My recent investigations are focused on neural mechanisms of postural control, their impairment caused by damage to different parts of CNS and sensory organs, as well as on developing methods promoting recovery of postural functions. I have published more than 100 scientific papers in international journals and one monograph.

Neural mechanisms underlying feedback postural control

Maintenance of specific body orientation and equilibrium during standing and locomotion is evolutionary old motor function based on in-born neural mechanisms. Impairment of postural control is one of the major motor disorders following spinal cord injury, stroke, etc. Selection of appropriate rehabilitation strategies for compensation of postural deficits depends largely on elucidation of corresponding neural mechanisms. In my talk the recent advances in the studies of feedback mode of postural control in quadrupeds will be discussed. Specific topics include: distribution of postural networks within CNS, principles of their operation, their impairments caused by spinal cord injury, and neural mechanisms of balance control during locomotion

Brian Day
University College London, UK

Brian Day is Professor of Motor Neuroscience at the Institute of Neurology, University College London. After training in mechanical and bio-engineering, in 1978 he moved into the field of human sensorimotor control mechanisms in health and in neurological diseases that cause movement disorders. He has been at the forefront in the development and application of a number of non-invasive techniques for studying sensorimotor processes and circuitry in intact man, most notably transcranial cortical stimulation, and more recently vestibular stimulation. His current research is devoted to understanding multisensory processes that control and integrate whole-body motor activities.

Vestibular influence on whole-body actions revealed by virtual head rotation

The vestibular system is a 6-axis inertial sensor that provides the brain with unique information about motion and orientation of the head in space. It has great potential to influence a host of whole-body motor activities, but difficult to study with conventional tools. Here I describe an electrical vestibular stimulation method that is simple, produces a pure and functional vestibular input and can be applied during a wide range of activities without interference. I will show that it reveals vestibular influences on a host of normal perceptual and motor activities and may be used to probe vestibulomotor asymmetries in disease.

Symposium I Monday June 30, 12:30 - 14:30, Cypress Room

Uncovering real-life falls

Chair and Discussant: **Chris Todd**, University of Manchester, UK

Stephen Robinovitch, Simon Fraser University, Canada

What we've learned from video-based recording of falls in older people residing in long-term care

Video capture of falls in the high-risk long-term care (LTC) setting can provide insight on the biomechanical, situational, and environmental factors that contribute to these events, to help guide the design of interventions. Since 2007, the Technology for Injury Prevention in Seniors program has partnered with two LTC centres in the Vancouver area to record video footage of 1074 falls experienced by 358 individuals, from networks of digital video cameras (n=270) in common areas (hallways, dining rooms, lounges). Individuals captured falling have a mean age of 81 years (SD=9), and 60% are female. We have consent to access medical records in 160 fallers with 602 video-captured falls. Of these, 43% have hypertension, 61% have dementia, 22% have diabetes, 15% have a history of stroke, and 3% have Parkinson's Disease. Over 50% are taking antipsychotics, antidepressants, and/or analgesics. We have analyzed each video to categorize key aspects of fall initiation, descent and impact, using a validated 24-item questionnaire (Yang et al., BCM Geriatrics, 2013). In terms of fall initiation, we have focused on describing the scenarios that lead to falls in LTC (Robinovitch et al., Lancet, 2013). Key observations include (1) the high prevalence of falls due to incorrect weight shifting (41% of all falls) followed by tripping (23%) and loss-of-support with an external object (11%), (2) the similarity in the frequency of falls occurring while transferring and walking, and (3) the finding that, while 74% of individuals were habitual users of walkers and wheelchairs, only 21% of falls occurred while using these devices. In terms of fall descent, we have focused on fall direction and balance recovery attempts. 46% of falls involved attempts to recover balance by stepping, and 23% by grasping a nearby object. Most falls were directed backwards (39%), followed by sideways (28%), forward (17%), and straight down (16%), but there was a marked tendency for individuals to rotate backwards during descent. In terms of fall impact, we have examined the consequences of falls in terms of the impacting body sites, and resulting injuries. Of note, head impact was observed in 37% of cases (Schonnop et al., CMAJ, 2013). Probability for head impact did not associate with hand impact (which occurred in 74% of cases), was highest in forward falls, and associated with hypertension and impaired vision. While head injury was documented in 34% of cases (lacerations, abrasions or hematoma), no concussions were noted. These results suggest several new opportunities for prevention of falls and injuries in LTC, including exercises to enhance transferring and upper limb protective responses, improvements in mobility devices (e.g., self-locking wheelchairs, universal design walkers), advances in the management of medications and visual impairments, improved screening for traumatic brain injury following falls, and environmental modifications such as compliant flooring. In moving forward, the challenge is develop effective methods for linking the video evidence with the clinical and situational context, and sharing that information with stakeholders to drive improvements to fall injury prevention.

Lorenzo Chiari, Universita di Bologna, Italy

What we've learned by recording falls with wearable inertial sensors

Wearable inertial sensors offer a remarkable opportunity to measure body movements in a first-person perspective. The kinematics of body segments to which they are attached can indeed be measured at a reasonably low cost, in terms of intrusiveness and acceptability, and with a more than adequate accuracy. Furthermore, being body-worn they can provide measures even in unstructured environments and outdoor. For these reasons the usage of inertial sensors has been so popular in the field of automatic fall detection. Many different approaches have been explored to solve the fall detection problem using only accelerometers or inertial measurement units (both gyroscopes and accelerometers). Nevertheless, as pointed out in a recent systematic review promoted by the FARSEEING Consortium (Schwickert et al, Z Gerontol Geriat, 2013) which analyzed 96 papers published between 1998 and 2012, the sensor-based devices and their technical specifications varied considerably across studies. Most of the devices included triaxial or bi-/uniaxial accelerometers. Sampling rates and measurement ranges of the sensors were very heterogeneous. The placement of the devices depended on the different sensor types and the number of sensors used for each setting. The most frequent sensor placement positions were waist or hip, followed by trunk attachment; some studies reported combined placement positions. Most publications presented simple detection models with algorithms based on the recognition of a fixed threshold. In some cases these algorithms applied machine learning methods to a minimum of two combined detection phases (e.g. impact and postfall). The findings further indicate a minimal number of analyzed real-world falls and thus the lack of a published evidence base for the existing commercially available fall detection devices. This demonstrates an almost embryonic state of research. Most articles are case reports, case-series or convenience samples and 90/96 depended on simulated falls by younger volunteers rather than real falls amongst elderly people. Algorithmic approaches based on these data, which have been developed using simulations of real-world falls are therefore clearly open for further improvement. As recently outlined by Bagalà et al. (PLoS One, 2012), algorithms calculated from fall simulations in healthy young subjects lack the necessary accuracy requirements for real-world fall detection. They lack either sufficient sensitivity or specificity and would thus produce a high false alarm rate. Contextual information of the fall event such as time, location or prefall activity is scarcely documented. In addition, the mechanisms of the falls are not known as they could not be accurately documented, as yet. With the objective of dealing with the missing evidence base in falls research, the FARSEEING project has started collecting real-world falls by means of wearable sensors. A consensus has been reached and recommendations released on fall definition, fall reporting (including fall reporting frequency, and fall reporting variables), a minimum clinical dataset, a sensor configuration, and variables to describe the signal characteristics (Klenk et al., Z Gerontol Geriat, 2013). From the first 150 falls that were collected we could start the extraction of temporal and kinematic parameters to inform the development of future fall detection algorithms (Bourke et al, ISPGR 2014) and are learning the first rudiments on the 'why' and 'how' such a common but still unexplored process affects the life of millions of elderly each year.

Clemens Becker, University of Stuttgart, Germany

Which are the major knowledge gaps that we still need to fill in falls research

Fall risk and fall prevention research has made considerable progress over the last years but some major knowledge gaps remain. These gaps include conceptualization, analysis of real world fall events, fine tuning and targeting of interventions and finally knowledge translation into large scale programs reaching the population. In a fall phase model we published in 2012 we argued that it is useful to separate the fall into five phases (Becker et al, ZGG, 2012). The analysis of the pre-phase including near fall episodes and gait and transfer abnormalities is likely to increase our knowledge on risk factors for falls and intervention approaches. Time scale analysis of fall prediction using body worn sensors is likely to improve the understanding of precipitating fall risk factors along with video footage and other life logging approaches. Structured detailed fall interviews are complimentary to understand contextual factors in this respect. Video footage is essential to improve the understanding of balance and fall responses during the falling phase. This can lead to improved furniture ergonomics, walking aid and wheelchair design. Currently, a lot of the assumptions rely on lab experiments with healthy subjects on perturbation platforms. Body worn sensors can guide the design of training interventions. The analysis of impact signals can e.g. stimulate product development of protective clothing, absorbing floor materials. Closer looks at the resting and recovery phase are essential to improve home alarm systems and fall detection algorithms to reduce false alarms and thereby enhance adherence. Up to now, most epidemiological studies use fall and faller rates as endpoint. A closer look including long-term monitoring with sensor technology is likely to result in a much more detailed analysis leading to differing approaches. Near fall and impact analysis, presence or absence of falling and landing responses, differing impact signals and recovery response will lead to a variety of options for new intervention strategies or targeting. The 2012 Cochrane Reviews demonstrate that we need different intervention strategies for community dwelling persons with or without need of assistance. Hospital, rehabilitation and long-term care institutions need to implement programs according to their specific needs. In this area major gaps are translational deficits and slow implementation into large scale efforts. This needs to be accompanied by evaluation to identify dilution effects and ineffective implementation to redesign components. It is promising that several large scale European networks such as ProFound, E-no falls, and Farseeing are underway to fill some of these gaps and similar activities are underway in North America and Australasia. Using these synergies it is likely that a lot of the missing links will be available in the next five years mainly supported by using ICT approaches.

Stefania Bandinelli, Azienda Sanitaria di Firenze, Italy

Why 2 out of 3 older subjects living in the community do not fall? The FARSEEING-InChianti study

InCHIANTI-study is a population based epidemiologic study conducted in the Chianti region of Italy to investigate age-related decline in mobility (Ferrucci et al, JAGS, 2000). The ability to walk provides the basis of mobility but is not a synonymous. Natural environment commonly imposes varied challenges while walking. The new models of disability suggest that it is the inability to accommodate these environmental demands on mobility that leads to mobility disability. Adaptation to the environment requires the ability to switch rapidly across motor strategies and modify in itinere the motor program. Thus, not surprisingly, deficits in attention and executive function processes are independently associated with risk of postural instability, impairment in activities of daily living, and falls. Higher gait variability has been described in older adults with frailty, Parkinson's and Alzheimer's disease, and prospectively associated with a high risk of future falls and mobility decline. Interestingly, high stride time gait variability has been shown to predict future falls in community-dwelling older adults, even when gait velocity failed to demonstrate an association. Usual gait speed and brisk walking test are measure of walking ability commonly used in epidemiological studies that have been associated with mobility outcomes and disability in older adults. Personal risk factors for falls vary considerably by location and activity at the time of the fall. Because traditional performance tests are unable to assess how individuals cope with daily challenges posed by the environment, we introduced in the mobility assessment protocol movement sensors implemented in a commercial smartphone (SP) that allows the measure of many different components of movement activity in real life during a 5-days recording in a community dwelling population. The InCHIANTI-FU4 Study has enrolled so far a sample of 376 survivors (S) from Baseline-cohort (285 S ≥ 65yrs). Protocol of the study include the collection of demographic, health, behavioural, mobility, mood and cognitive, biological and metabolic information using a set of validated instruments and scales (home interview, medical examination, mobility performance assessment, biological samples collection, instrumental laboratory tests). The FARSEEING project has allowed implementing some of the mobility tests included in the original InCHIANTI protocol by recording signals of three different sensors built in common SP placed in a pocket and positioned by a belt on the back. Moreover participants have been invited to wear SP for 7 days during their daily activities. Furthermore, S were asked to evaluate feasibility and usability of SP. S have been monitored to detect the occurrence of falls by a monthly telephonic-follow-up for 6 months at then at 1 year. Data collection is almost completed. 125/285 S have been evaluated by FARSEEING-InCHIANTI protocol while 105/125 S (85%) have agreed to wear SP for a week. Mobility characteristics derived by SP signal-recording of such a low-risk population will be presented. Based on this experience we support the idea that SP-Technology enables measuring the real mobility activity during the daily life in older subjects and contributes to define the personal risk profile for falls that could not captured by usual gait speed tests in laboratory.

Symposium II Monday June 30, 12:30 - 14:30, Bayshore Ballroom BC

Can (biomechanical) mobility parameters serve as a biomarker for neurodegenerative movement disorders?

Chair and Discussant: **Walter Maetzler**, University of Tuebingen, Germany
Chair: **Martjin Muller**, University of Michigan, USA

Alice Nieuwboer, KU Leuven, Belgium

Biomarkers for neurodegenerative movement disorders: state of the art and central concepts

According to the Biomarkers Definition Working Group[1] a biomarker is an objectively measured characteristic that serves as an indicator of normal biological processes, pathogenic processes, or responses to treatment intervention. Throughout the literature, the term biomarker and related concepts are often ill-defined. We will start this symposium by defining related terms such as sensitivity, specificity, predictive value, validity, as well as biomarkers for susceptibility and (early) detection of a disease (trait), for diagnosis (state), prognosis (rate), and prediction of treatment effects. Parkinson's disease (PD) will be used as a disease model to present illustrative examples of such markers. In neurodegenerative movement disorders in general, and PD in particular, it is crucial that biomarkers indicate true disease processes rather than compensatory changes. Also, in a complex disease such as PD, a combination rather than a single biomarker is likely to achieve better sensitivity and specificity for classifying at risk individuals, identifying phenotypes with and without cognitive decline and predicting disease progression. Besides molecular, cellular and genetic biomarkers, the detection of prodromal motor or other signs possibly complemented with imaging methods are likely to be part of the different types of PD biomarkers. While biological, clinical or economic considerations will initially provide the foundation for adoption of a specific biomarker, ultimately, robust validation through power-based clinical trials and statistical analysis are essential. After establishing a potential biomarker, independent cross-validation studies are needed to prospectively determine its predictive accuracy while adjusting for confounding factors. Diagnostic and prognostic biomarker development in movement disorders has to allow sensitive and specific risk-stratification within a sufficiently wide 'window of opportunity' for disease-modifying treatment approaches to be effective.

[1]Biomarkers Definition Working Group. Biomarkers and surrogate end points: preferred definitions and conceptual framework. Clin Pharamcol Ther 2001; 69:89-95.

Fay Horak, Oregon Health and Science University, USA

Yes, (biomechanical) mobility parameters can serve as a biomarker for neurodegenerative movement disorders.

Balance and gait impairments characterize progression of Parkinson's disease (PD), predict fall risk, and are important contributors to reduced quality of life. Advances in technology of small, body-worn inertial sensors have made it possible to develop quick, objective measures of balance and gait impairments in the clinic for research trials and clinical practice. Objective balance and gait metrics may eventually provide useful biomarkers for PD. In fact, objective balance and gait measures are already being used as surrogate end-points for demonstrating clinical efficacy of new treatments, in place of counting falls from diaries, using stop-watch measures of gait speed, or clinical balance rating scales. Many objective measures of balance and gait for PD have already been shown to be valid, reliable, sensitive to early disease, related to progression compared to clinical gold-standards such as the UDPRS, and responsive to interventions such as levodopa and deep brain stimulation (DBS). This talk summarizes the types of objective measures sensitive to PD and to levodopa intervention from body-worn sensors. However, identification of balance and gait metrics that are insensitive to levodopa will be most helpful for future neuroprotective trials. We organize the metrics based on the neural control system for mobility affected by PD: postural stability in stance, postural responses, gait initiation, gait (temporal-spatial lower and upper body coordination and dynamic equilibrium), postural transitions, and freezing of gait. However, the explosion of metrics derived by wearable sensors during prescribed balance and gait tasks that are abnormal in people with PD do not yet qualify as behavioral biomarkers because many balance and gait impairments observed in PD are not specific to the disease, nor shown to be related to specific pathophysiologic biomarkers. In the future, the most useful balance and gait biomarkers for PD will be those that are sensitive and specific for early PD and related to the underlying disease process.

Martijn Müller, University of Michigan, USA

No, (biomechanical) mobility parameters likely cannot serve as a biomarker for neurodegenerative movement disorders

An ideal biomarker may serve both as a marker of existing pathology and of pathology progression over time. Using Parkinson's disease as a model, this talk will discuss why it is unlikely that a single biomechanical measure can reach the level of biomarker. Current technology allows for relatively simple assessment of postural instability and gait difficulty (PIGD) features of PD in both the laboratory as well as the natural environment. This would make it an ideal candidate for biomarker selection. The hallmark pathophysiology of Parkinson's disease (PD) is nigrostriatal dopaminergic denervation. However, PD is a multisystem neurodegenerative disease characterized by both monoaminergic and cholinergic system degeneration and white matter lesions and Alzheimer-type pathology (β-amyloid) can often be superimposed on PD-related pathology. The onset of these pathologies is variable and heterogeneous; for example white matter lesions and β-amyloid may not affect all PD patients. Although research studies have shown that all of these pathologies associate with PIGD features they also associate with other symptoms of PD. Thus, a complex picture of multisystem pathology emerges that affects many aspects of motor and non-motor PD features. Simple biomechanical measures may serve as an endpoint marker of overall pathology and disease progress; however, given the complexity and interaction between different pathologies we will likely not be able, at least not in the near future, to parse out state and progression of each of the individual pathologies.

Walter Maetzler, University of Tuebingen, Germany

Everyday-relevant mobility biomarker: Impossible? Possible? Already available?

An ideal biomarker also has a high ecological validity; i.e. it measures everyday-relevant features which, ultimately, improve the quality of life of the affected individual. This is a particularly important aspect for the assessment of changes in chronic diseases such as neurodegenerative movement disorders. This talk will provide information about definition and relevance of the term "ecological validity". Moreover, the talk will provide an overview of potential quantitative mobility markers that have already been associated with everyday life aspects and quality of life in the elderly, and individuals with a neurodegenerative disorder, in particular with Parkinson's disease. I will focus on recent studies that describe the use of small, (relatively) inexpensive and unobtrusive wearable sensors, which measure continuous movement measurement in the home environment of patients to assess disease-relevant problems / changes in the everyday environment. There is hope that data obtained with these techniques can in particular add to the development of high quality progression (bio)markers. Options to improve the quality of these markers will be discussed.

Symposium III Monday June 30, 12:30 - 14:30, Stanley Park Ballroom 1 & 2

Advanced methods to identify balance control mechanisms in stance and gait

Discussant: **Herman van der Kooij**, University of Twente, Netherlands

Herman van der Kooij, University of Twente, Netherlands

Identification of asymmetries in balance control in neurological patients and age dependent changes in balance control in elderly

By applying whole body perturbations and force fields, balance control mechanisms can be manipulated and simultaneously identified. We have developed techniques to measure response behavior and response variability of multi-segmental balance control. These techniques have been applied to identify asymmetries in stroke survivors and PD patients that were not (correctly) detected by conventional posturography techniques. In PD patients, deficit, excessive impairments, and compensatory mechanisms were detected and quantified at the ankle and hip in each leg. In elderly these techniques were able to quantify differences in balance control mechanisms between young and healthy elderly, and between healthy elderly and elderly with balance control problems, polyneuropathy or cataract.

Thomas Mergner, Neurological University Clinic, Germany

Sensor fusion based postural control model and its generalization for use in a modular control architecture of a multiple degrees of freedom body

Postural responses to unforeseen external disturbances such as pseudorandom support surface tilts are re-active, meaning primarily sensor driven. These responses lend themselves to system identification and modeling. While the postural responses tend to be stereotype reflexes in the human newborn, they become context dependent during childhood development. Then, they change appropriately with changes in disturbance modality or amplitude and sensor availability (e.g. eyes open vs. closed). These changes can be viewed to result from automatic sensory re-weightings. When trying to model the mechanisms underlying the re-weightings, one faces the problem of many possible solutions. Inspired by human psychophysical studies of vestibular and proprioceptive self-motion perception, a solution based on sensor fusions was developed. The fusions internally reconstruct the four relevant external disturbances having impact on the supporting joints (during biped stance mainly the ankle joints). The disturbances are: support surface rotation and translation as well as field forces such as gravity and contact force such as a pull. The sensory estimates of these disturbances are commanding the proprioceptive servo control of the joints to produce compensatory torque (disturbance estimation and compensation, DEC concept). In an 'indirect' system identification approach, human experimental data were compared with model simulations, combining DEC with a priori assumptions about the plant (single inverted pendulum biomechanics). Good correspondence between simulated and human data was found. In a next step, the DEC control was hypothetically generalized as a module for controlling a multi-DOF (degrees of freedom) body. Combining modules, one for each DOF, allows controlling multi-DOF balancing in a surprisingly simple way- complexity rises linearly with the number of DOF. From the modular architecture emerges sensory-driven movement coordination between links. This will be demonstrated for the ankle-hip coordination evoked re-actively by anterior-posterior tilt, pro-actively by voluntary trunk bending, and by a combination of both.

Tim Kiemel, University of Maryland, USA

Using perturbations to probe the neural control of walking

Kinematic and EMG responses to sensory and mechanical perturbations have been widely used to probe the neural control of standing. A perturbation at a single frequency primarily produces a postural response only at the same frequency, but with a scaling of amplitude (described by gain) and a phase shift. The response to a broadband perturbation can be characterized in the frequency domain using a frequency responses function (FRF) describing how gain and phase varies across input frequency. A FRF can be converted to an impulse response function (IRF) in the time domain to describe how posture would respond to a brief perturbation. Here we describe an extension of this approach to probe the neural control of gait. In the time domain, we now use a phase-dependent IRF to characterize the effect of a brief perturbation at any phase of the gait cycle. To compute the phase-dependent IRF, we first characterize the response to a broadband perturbation in the frequency domain using an extension of the FRF called the harmonic transfer function (HTF). The idea behind the HTF is that for a periodic system, a perturbation at input frequency f produces outputs at multiple frequencies f + kf0, where f0 is the gait frequency and k is any integer. The HTF uses gain and phase to describe this input-output mapping for each k. We have applied this approach to sagittal-plane dynamics of subjects walking on a treadmill while perturbed by a moving visual scene. Phase-dependent IRFs showed that when the visual scene moved forward, the subjects leaned the trunk forward and moved the center of mass (COM) forward on the treadmill. The COM response was caused not only by the expected increased activation of plantarflexors in late stance, but also by the increased activation of dorsiflexors in early stance.

Robert J. Peterka, Oregon Health & Science University, Oregon, USA

Use of stimulus-response analysis to identify mechanisms contributing to balance control during gait

We previously applied stimulus-response analysis to study balance control during stance by (1) using pseudorandom perturbations to evoke sway responses, (2) using spectral analysis of the stimulus-response data to estimate frequency response functions (FRFs) that characterized stance control dynamics, and (3) identifying how sensory reweighting can explain the observed dependence of FRFs on stimulus amplitude [1]. We now demonstrate that similar methods can be applied to identify mechanisms that control medial-lateral (ML) balance during a stepping-in-place (SiP) task. The SiP task serves as a convenient surrogate for the investigation of ML balance control during a walking gait since ML motion of the body center-of-mass (CoM) is similar in SiP and walking. In 6 adult subjects, pseudorandom surface rotations with peak-to-peak amplitudes of 1°, 2°, and 4° evoked ML sway during both eyes-closed stance and SiP. Response measures included ML CoM angle, step width, and step timing (right and left leg "stance times" and "swing times"). FRFs calculated for both SiP and stance tests showed similar dependence on stimulus amplitude suggesting that sensory reweighting contributed to body-orientation control during both SiP and stance. In addition to controlling body orientation, gait requires dynamic balance control to maintain a stable CoM trajectory. We found no evidence that subjects used a mechanism based on step-to-step modulation of lateral foot placement to control dynamic balance. Instead we found that step timing was modulated such that when, for example, the subject was leaning too far rightward, the right-leg stance time was extended to allow for the corrective action of torque due to gravity to be applied over a longer duration. Step-timing adjustments have previously been suggested as a mechanism to control ML dynamic balance in robots [2].

[1] Peterka, J Neurophysiol, 88:1097-1118, 2002.

[2] Maufroy et al., Auton Robot, 28:331-353, 2010.

Symposium IV Tuesday July 1, 8:30 - 10:00, Bayshore Ballroom BC

The role and implications of cortical and other supraspinal areas in control of balance and gait

Chair: **Fay Horak**, Oregon Health and Science University, USA

Klaus Jahn, Ludwig-Maximilians-University of Munich, Germany

Task-specific human brain networks for supraspinal control of locomotion, postural balance, and spatial navigation

Over the last 10 years, functional imaging of the human brain during different postural and locomotor tasks convincingly demonstrated that the supraspinal network known in quadrupeds is conserved in humans despite their transition to bipedalism during vertebrate phylogeny. This network includes premotor frontal cortex for task planning and initiation, basal ganglia for motor modulation, the thalamus for sensory modulation, the homologues to the pacemakers for gait pattern and speed regulation in the interfastigial cerebellum and bilateral midbrain tegmentum (cerebellar and mesencephalic locomotor regions; pedunculopontine nucleus), their descending target regions in the pontine reticular formation, and the rhythm generators in the cerebellar vermis and paravermal cerebellar cortex.

We present new data and review the literature showing that differences and similarities on the overlapping networks controlling specific tasks such as stance postural equilibrium and gait. For example, steady state locomotion preferentially involves the brainstem and cerebellar network, whereas goal-directed locomotion requires premotor cortical activity. Postural tasks and slow locomotion use multimodal sensory input (via thalamus and cerebellum). More demanding locomotor tasks (e.g., walking along a narrow beam, avoidance of obstacles) activate a fronto-parietal cortical network. Further, as soon as the task involves spatial orientation aspects, the hippocampal formation and the parietal cortex become active.

Task-specific differences in network activity have great impact on the planning and interpretation of studies on healthy subjects and on patients with gait and balance disorders. We will point out that the methods used (e.g., fMRI, PET, fNIRS, EEG) and the specific paradigm (e.g., steady-state vs. goal-directed locomotion; imagined locomotion vs. overground locomotion vs. treadmill locomotion) should be chosen with care to be able to answer the specific research question.

Daniel Peterson, Oregon Health and Science University, Oregon, USA

Supraspinal locomotor control in people with Parkinson Disease- Implications for rehabilitation

Supra spinal brain regions play an important role in human locomotion. Individuals with Parkinson disease (PD) exhibit structural and functional changes in many of the regions associated with locomotion, likely contributing to the locomotor deficits observed in this population. Recent research using a variety of imaging techniques, including task-based functional magnetic resonance imaging (fMRI), resting-state functional connectivity MRI, positron emission tomography (PET), and diffusion tensor imaging (DTI) has begun to elucidate the neural underpinnings of locomotor dysfunction in people with Parkinson disease, identifying a network of regions exhibiting altered activity with respect to healthy adults during gait or gait-like tasks. These differences span much of the brain (motor/pre-motor cortical areas, basal ganglia, cerebellum, brainstem). Several recent studies have focused specifically on freezing of gait, a particularly disturbing and dangerous symptom of PD, noting a number of structure and function neural alterations in those who freeze. For example, alterations in the activity of locomotor structures (e.g. subthalamic nucleus (STN), cerebellum, tegmental brainstem/pedunculopontine nucleus (PPN), striatum), and cortical structures (e.g. insula, supplementary motor area (SMA), pre-SMA) have been noted during gait-like tasks in those who experience freezing. During lower limb motor blocks, thought to be similar to freezing of gait events, the activity in the PPN, globus pallidus, and STN is altered with respect to normal movement. Finally, DTI has shown that the structural connectivity of the PPN with cortical, basal ganglia and cerebellar regions is also altered in freezers and these alterations are related to specific cognitive deficits. Together with resting-state functional connectivity MRI, these data suggest that a complex and distributed group of structures are involved with gait dysfunction and freezing in PD. These findings inform targeted rehabilitation interventions aimed at improving locomotion in those with PD. Further, imaging methods noted above can be used to test whether interventions have effects on neural, as well as behavioral, outcomes. For example, recent reports suggest that freezing of gait may be related to dysfunction in cognitive domains including response inhibition and set-shifting. These findings are supported by imaging data showing altered function in a number of frontal regions related to these cognitive domains. Together, these findings suggest that rehabilitation protocols that incorporate cognitive challenges, specifically response inhibition and set-shifting, may be especially effective at improving freezing of gait in PD.

Lynn Rochester, University of Newcastle, UK

Gait is a cognitive task: mechanisms and therapeutic implications.

For the past decade, the notion that safe and effective gait is due solely to an intact motor system has given way to a more complex model that reflects the cognitive control of gait. Evidence supporting this comes from diverse sources including: behavioural; structural and functional brain imaging; neurophysiological; and neuropathological experiments. Behavioural studies demonstrate a selective association between independent gait characteristics and cognitive functions, allowing a more refined understanding of single and dual-task impairments especially in relation to attentional control and its consequences for gait. To date the evidence has focused on the role of dopamine in gait derived from studies in Parkinson's disease, however recent research suggests that gait, postural control and falls are also subserved by the cholinergic system which has a key role in attention and executive function as well as direct projections to motor outputs. This association is more evident in neurodegenerative disease where the cholinergic system is impaired. This review focuses on the role of the cholinergic system in gait, drawing evidence from neurophysiological and imaging studies. Behavioural studies (dual-task interference, cross-sectional and longitudinal) will also highlight the contribution of different neurotransmitters to gait, postural control and falls, providing evidence of shared pathological substrates. Finally, interventions that target attentional control of movement will be presented along with interventions aimed at improving age-related (cognitive) risk factors. These include pharmacological (e.g. cholinesterase inhibitors), and non-pharmacological (eg attention training, dual task and exercise) approaches, heralding a new era of therapeutic development. The significance of this evidence will be discussed with respect to clinical practice such as developments of pharmacological and behavioural approaches which target enhanced attentional control as a means to reduce gait impairment and falls risk.

Symposium V Tuesday July 1, 8:30 - 10:00, Cypress Room

Wearable sensory substitution devices for balance or gait dysfunction: Patient-specific design and optimization

Chair: **Patrick Loughlin**, University of Pittsburg, USA
Discussant: **Conrad Wall**, Harvard Medical School, USA

John Allum, University Hospital, Basel, Switzerland

Modes of vibrotactile and auditory biofeedback of trunk sway for different patient groups

BACKGROUND: Postural instability is a main feature of several diseases. Providing vibrotactile and auditory feedback of trunk sway has a direct effect on muscle synergies during stance in vestibular loss patients [1], and a positive effect after one training session for those with Parkinson's disease [2]. To achieve these gains a number of feedback modes have been investigated, including lateral or anterior posterior (AP) feedback, dual-tasking and carry-over effects.
METHODS AND RESULTS: Using a headband with 8 equally spaced vibrators and 2 bone-conducting auditory actuators, we first examined whether training with combined vibrotactile and auditory feedback of trunk sway benefits balance control compared to training alone. A benefit of training with biofeedback was present in young adults and to an even greater extent in the elderly [3]. Next we examined whether the benefit differed when feedback was restricted to the AP or lateral direction. For stance, a greater effect of biofeedback was obtained when restricted to the AP direction [4]. For gait, the effects were equal [5]. The benefit of feedback was also tested when dual tasking balance with either motor or mental tasks in the young and elderly [6]. Reductions in sway velocities occurred with feedback for the both tasks in the young but only the motor task in the elderly despite improvement in mental task performance. Finally we established that the carry-over effects for some tasks last about 3 weeks [7] after biofeedback training.
CONCLUSIONS: Bidirectional rather than unidirectional trunk sway information provided by a headband of vibrators is effective in reducing trunk sway in the elderly and patient populations prone to fall. Further research should examine if these effects are increased after a more intensive or repeated training program and if there are longer term carry-over effects.

Patrick Loughlin, University of Pittsburgh, USA

Customizing vibrotactile balance feedback

Falls are the leading cause of serious injury among older adults, resulting in billions of dollars in medical costs and adversely affecting a person's health and quality of life. Accordingly, the development of a balance prosthesis that can provide sensory information that improves balance has become of interest, with clear clinical and economic importance. Owing to the technical challenges and associated risks of an invasive device such as a vestibular implant, the development of a noninvasive balance prosthesis is an area of active research. Different modalities of balance and motion biofeedback have been explored as potential balance prostheses, including auditory, visual, vibrotactile, and mixed modalities. Because it does not interfere with the natural functions of the auditory and visual systems during daily activities, and because many people with vestibular impairments also have hearing impairments and rely heavily on vision for postural cues, several studies have explored the efficacy of vibrotactile feedback (VTF) for improving balance and, to a lesser extent, gait. While these studies have demonstrated improved balance during VTF, most current vibrotactile feedback methods do not take into account the individual's specific balance function, unlike hearing aids and other sensory prosthesis that are tuned to the individual. In this talk, we discuss methods to tailor VTF to the specific user and the potential benefits of doing so. These include subject-specific parameter settings including threshold levels and predictive

feedback based on the subject's postural control time delay.
Kathleen H. Sienko, University of Michigan, USA

Feedback displays for vibrotactile sensory augmentation devices: Spatial resolution and cuing strategies

Sensory augmentation is a technique for augmenting or replacing compromised sensory information. In the context of sensory-based balance impairments, a sensory augmentation device can provide cues of body motion to supplement an individual's intact sensory systems, using inertial measurement units and intuitive vibrotactile feedback displays. Recognizing the reduced quality of life, increased financial costs, and increased mortality risks associated with balance impairments, an overarching goal of our research has been to design, build, and evaluate a sensory augmentation technology platform for use in clinical and home environments that will supplement current balance rehabilitation best practices while emphasizing co-creation with both the prospective patient population and those administering rehabilitation throughout the design process. We have demonstrated that subjects with vestibular loss and older adults can quickly learn to use vibrotactile sensory augmentation in a research laboratory setting to improve postural stability during quiet and perturbed stance. This presentation summarizes our findings on the effects of the vibrotactile feedback display's spatial resolution on postural sway performance during multi-directional surface perturbations. I will furthermore discuss the implications of non-volitional postural responses to torso-based vibrotactile stimulation on the design of vibrotactile displays for balance-related applications.

Symposium VI Tuesday July 1, 8:30 - 10:00, Stanley Park Ballroom 1 & 2

Motor-cognitive reserve and risk: New concepts and novel findings

Discussant: **Jeffrey M. Hausdorff**, Tel Aviv Sourasky Medical Center and Tel Aviv University, Israel

Joe Verghese, Albert Einstein College of Medicine, USA

Motor cognitive risk- MCR

Many clinical pre-dementia syndromes have been proposed to assess dementia risk, but the need for cognitive testing or biomarkers limits their widespread use. Given the growing global burden of dementia, there is an urgent need to optimize risk assessment and accessibility. The Motoric Cognitive Risk Syndrome (MCR), a newly described pre-dementia syndrome characterized by slow gait and cognitive complaints, can be detected without complex tests. In this presentation, we report global prevalence of MCR in 26,000 participants from 22 studies based in 17 countries. We show that MCR is common in seniors, and a strong risk factor for cognitive decline and dementia. The concept of MCR will be described, the possible utility and assessment of this syndrome and its potential for identifying individuals at risk will be addressed. MCR syndrome is common in older individuals, and this concept can be easily applied in a variety of settings to identify older individuals at high risk of developing cognitive decline or dementia.

Anat Mirelman, Tel Aviv Medical center, Israel

Motor cognitive interactions as viewed through the window of fNIRS

The relationship between gait and executive function has been previously studied using neuropsychological tests, imaging (e.g., fMRI), and dual task paradigms. These are all indirect methods that assess associations across the domains. Functional near infrared spectroscopy (fNIRS) is a brain imaging technology that detects hemodynamic changes in the prefrontal cortex. The rationale behind fNIRS is that relevant stimuli produce an increase in regional cerebral blood flow due to higher energy demands in "activated" areas resulting in higher blood oxygenation. The technology is portable and can be used to examine brain activity in a direct way during walking. We will present evidence of motor-cognitive interactions during gait from fNIRS studies in healthy adults, patients with PD, and elderly fallers and show how neural activation during gait changes with age, pathology and in response to training , reflecting on plastic changes as response to interventions.

Brad Manor, Harvard Medical School, USA

Modulating brain activity to understand and improve cognitive-motor control

The observation that performing a cognitive task while walking interferes with locomotor control suggests that the involved tasks compete for shared brain networks and this competition diminishes either one task or both. The notion that dual tasking in general and walking while performing cognitive tasks in particular is dependent upon prefrontal cortex activation suggests that strategies designed to facilitate activation of this brain region may significantly improve performance in one or both tasks. tDCS is one potential strategy to modulate cortical activity that is safe, portable, noninvasive and inexpensive. tDCS modulates cortical activity by inducing a low amplitude current flow between two or more sponge electrodes placed upon the scalp. This current flow changes brain tissue polarity and thus, its excitability. tDCS targeting the prefrontal cortices has proven effective for the treatment of depression and has shown promise in reducing the severity of certain types of chronic pain. Daily sessions of tDCS targeting the sensorimotor cortices may also improve motor outcomes. In this talk, we introduce tDCS as a tool for the study and rehabilitation of locomotion, report initial evidence that tDCS reduces the cognitive dual task costs on walking, and discuss future research applications.

Symposium VII Wednesday July 2, 12:30 - 14:30, Cypress Room

Can we more objectively measure motor-cognitive functioning to diagnose sports-related concussions?

Michael E. Cinelli, Wilfrid Laurier University, Canada

Magnitude and duration of balance impairments following a concussion

Concussions are defined as a, "complex pathophysiological process affecting the brain, induced by traumatic biomechanical forces[1]." It is estimated that over 300,000 cases of sport-related concussions occur annually in the United States among individuals 15-24 years of age[2]. The number and severity of concussion symptoms vary from athlete to athlete, depending on the biomechanical forces and areas of the brain affected. Although no two concussions are similar in nature, balance impairments are a common cardinal symptom. Research suggests that with 90% of concussions, symptoms resolve within 7 days[3,4], and static stability has been shown to recover within 3–5 days using the Balance Error Scoring System (BESS)4. However, we have recently found that balance control of concussed athletes was not fully recovered upon return to play (i.e., 10-48 days post concussion) as indicated by a pronounced increased velocity of Centre of Pressure (COP) in the anterior-posterior (A/P) direction during static balance5 and greater swing time variability during locomotion6. These deficits were evident despite reduction of reported concussion symptoms. We have also demonstrated A/P balance impairment during a gait initiation task, which is a task that challenges the balance control system as it moves from stable static balance to continuously unstable gait. Concussed athletes (~5 days post-concussion) demonstrated significantly greater COP posterior displacement during the loading phase. This increase in posterior COP displacement during the loading phase appears to be a strategy employed to overcome the A/P postural instability to allow for gait initiation to occur. Balance control in the A/P direction is primarily regulated by ankle extensors, which receive input from the descending lateral vestibulospinal tract (VST). We believe that following a concussion, damage to the vestibular system could result in long lasting impairments to the lateral VST and the persistence of poor balance control even in the absence of symptoms.

Bradford J. McFadyen, Université Laval, Canada

Behavioural markers for sensitive, ecologically valid detection of motor-cognitive functional alterations following concussions

Mild Traumatic Brain Injuries (mTBI) are still often under- or mis-diagnosed. Residual deficits in motor-cognitive functioning can remain undetected by traditional, isolated, domain specific, clinical testing resulting in many persons with mTBI being returned prematurely to function. While there are many efforts on developing biomarkers and improving imaging, behavioural markers based on ecological, daily activities that naturally combine cognitive and motor functions have the potential to be more sensitive to such residual deficits. They can also provide context specificity to not only guide diagnosis but more specifically aide return to function decisions. Recent evidence from different work, including that of the symposium presenters, has shown subtle but clear changes following mTBI in dynamic equilibrium and executive functioning within the context of postural tasks and locomotor mobility. In addition, our work has shown how the manipulation of the complexity of cognitive-motor environmental demands can be exploited to better identify persistent deficits following mTBI. Building on such evidence, this talk will address how behavioural markers might be advanced, particularly through the exploitation of various emerging technology (inertial sensors, motion capture, virtual reality), and integrated into clinical practice to improve clinical decision making.

Paul van Donkelaar, University of British Columbia, Canada

Neurocognitive deficits following concussion

Concussion is a challenge to accurately diagnose and manage due to a lack of sufficiently objective biomarkers. Concussions are associated with subjectively experienced physical, cognitive, and psychological symptoms; balance deficits; and cognitive diminishment in many sufferers. These symptoms and problems usually resolve spontaneously over the course of a few days to weeks. Given these challenges, it is difficult to objectively determine the severity of the injury and how to manage it. In the context of contact sports, this can lead to inappropriate return-to-play decisions, leaving athletes vulnerable to subsequent short- and long-term injury if they have not sufficiently recovered. Adults suffering concussion commonly display deficits in maintaining and distributing attention within and between tasks and in the ability to accurately recall items using short-term working memory. In a series of studies over the last decade, we have demonstrated that participants with concussion have marked and long-lasting (up to 2 months) deficits of executive function when performing tasks driven by conflicting cues or requiring task switching. These data imply that executive dysfunction is a common feature underlying some of the behavioural difficulties observed in this patient population. Thus, executive function assessment targeting task-switching holds the promise of providing a sensitive indicator of recovery in the very aspects of neurocognitive functioning that are most compromised due to concussion. In particular, the deficits in these tasks remain after the athlete's performance on clinical assessments has normalized and they have been returned to play.

Li-Shan Chou, University of Oregon, USA

Examination of the effects of concussion on dynamic balance control during dual-task gait

Clinicians often rely on clinical symptoms and neuropsychological tests to determine a proper time for a concussed patient to return pre-injury activity. However, executive dysfunction and motor deficits following a concussion have been found, in adults and adolescents, to require greater recovery time than commonly assessed neuropsychological variables. This suggests that more extensive and complete testing following concussion is needed to make appropriate decisions on return to vigorous activity. Including a cognitive task during walking allows for simultaneous assessment of motor and cognitive performance. Individuals with concussion were reported to adopt a more conservative gait pattern or continue to display altered walking performance during dual-task conditions despite undetectable differences on measurements of symptoms and neuropsychological tests. Our prospective and longitudinal studies further examined how dynamic balance control during dual-task walking is affected by concussion within an acute post-injury interval (<72 hrs) and over the subsequent two months. The center of mass (COM) medial/lateral (M/L) displacement and peak M/L velocity were significantly greater in concussed subjects compared with control subjects during dual-task walking. These data suggest that concussion affects the ability to control body posture and momentum during gait up to two months following injury. Dual-task cost for the walking speed, peak anterior COM velocity and COM M/L displacement for concussed subjects were also found to be greater than control subjects across the two month testing period. This could indicate a disruption of the integration between motor or cognitive function during walking. Taken these findings together, if the ability to walk or maintain balance is inordinately affected by the implementation of a single additional task, individuals suffering from concussion may be less able to avoid hazards during normal activities and thus susceptible to further injury for a prolonged period of time during the post-concussion period.

Symposium VIII Wednesday July 2, 12:30 - 14:30, Stanley Park Ballroom 1 & 2

Implants and wearable aids for balance and gait dysfunction

Chair: **Kathleen Sienko**, University of Michigan
Discussant **John Allum**, University Hospital Basel, Switzerland

Conrad Wall, Harvard Medical School

Preliminary experiences with the beta test version of a vibrotactile tilt feedback belt

Background and aim: A beta test version of a wearable sensory augmentation device that uses vibrotactile feedback of body tilt to help people reduce their sway while standing and walking has been developed. A tilt sensor mounted on the small of the back is used to signal the subject about the magnitude and direction of their displacement away from the vertical. Several published studies have shown that subjects can reduce their sway during standing and walking by using this form of vibrotactile feedback. Reduced sway has been correlated with decreased risk of falling. The overall aim is to use the beta version to finalize the production design of a balance belt to be used for balance rehabilitation therapy. Methods: Ten units have been produced and are presently being placed at selected beta test sites. These sites all perform balance rehabilitation therapy. There is a mixture of private clinics and university associated ones. We aim to collect feedback from these sites, and then use this information to inform the production design within a 6 to 9 month timeframe. Results: The focus of our presentation will be to share the lessons learned from this exercise, and the likely changes that need to be made for the production design. Conclusions: The conclusions of our analysis of the information we learn will be based on the data we get from the test sites and will be presented.

Dietmar Basta, University of Berlin, Germany

Efficacy of vibrotactile vestibular neurofeedback training based on objective body sway measures in everyday-life conditions

Background and aim - Vestibular rehabilitation strategies mostly require a long-lasting training, which is finally not often successful. An individualized neuro-feedback training which is based on a body sway analysis in everyday-life conditions seems to be a more promising approach. Hence, the present study was aimed at investigating the efficacy of individualized vibrotactile neuro-feedback training for vestibular rehabilitation in a double-blind, placebo-controlled multicenter study. Methods - One hundred thirty two patients who experience one of the following balance disorders for more than 12 months were included in the study: canal paresis, otolith disorder, Parkinson's disease, and presbyvertigo. Vibrotactile neurofeedback training was performed daily (15 min) over 2 weeks with the Vertiguard-system in those 6 tasks of the Standard Balance Deficit Test (14 everyday-life conditions) with the most prominent deviations from the normative values. The Vertiguard-system measured the velocity during performing the tasks close to the center of body mass. The device was connected in the training sessions with 4 vibrotactile stimulators and compared the continuously recorded velocity with individually preset thresholds for the stimulator activation in the specific direction (left/right, forward/backward). Results - A significant reduction in trunk and ankle sway as well as in the subjective symptom scores (DHI/VSS) were observed in the verum group. Such an effect could not be found in any of the outcome parameters of the placebo group. Conclusions - The present findings indicate that the individualized vibrotactile neurofeedback training, as applied in the present study, is a highly efficient method for the reduction of body sway in different balance disorders. Even if the rehabilitation with the Vertiguard-system is effective and shows long lasting effects, the future goal is to develop a prosthesis which provides automatically the correct individual feedback thresholds in the everyday-life of the patient. This would be especially important for the treatment of progressive diseases (e. g. Parkinson's).

Lara Thompson, University of the District of Columbia, USA

Vestibular prosthesis tested in non-human primates

Background and Aims: We have investigated the vestibulo-ocular reflex (VOR), tilt perception, and postural stability in rhesus monkeys in the normal state, after bilateral vestibular ablation (BVH state), and in the BVH state aided by an invasive canal prosthesis. Methods: The prosthesis senses angular head velocity and provides this information to the brain by electrically stimulating canal ampullary nerves. Results: We found that the angular VOR is improved by prosthetic stimulation, and that the perception of head orientation in space is affected by electrical stimulation. Postural stability in the BVH monkey during quiet stance was not affected by electrical stimulation, but trunk motion during head turns was reduced by prosthetic stimulation. Conclusions: These results indicate that an invasive canal prosthesis can provide angular head velocity information to the brain that improves the VOR, the perception of head orientation in space, and postural stability associated with head motion. Further work is needed, both in human subjects and non-human primates, to determine more definitively the benefit of invasive canal prosthetics in subjects with severe vestibular deficits.

Yuri P. Danilov, University of Wisconsin-Madison, USA

New approach to neurorehabilitation: cranial nerve noninvasive neuromodulation (CN-NINM technology)

Introduction: The objective of this study was to investigate the efficacy of cranial nerve non-invasive neuromodulation (CN-NINM) intervention using a portable neurostimulator (PoNSTM) device to treat symptoms of chronic mild to moderate traumatic brain injury (mTBI), especially functional deficits in balance, gait, cognition, and mood. Methods: A single-arm pilot study involving 4 subjects with chronic (5.4 yrs) symptoms of mTBI were tested immediately before and after 2 weeks of CN-NINM intervention on standard functional assessments of balance, gait, cognition, memory, and mood state. Subjects also underwent fMR imaging while observing stereo B/W checkerboards progressing/receding, and rotating in pseudorandom motion to excite the vestibular-ocular reflex circuitry. All subjects had previously completed therapeutic interventions for balance & gait dysfunction, had reached a plateau, and declared clinically disabled. Subjects completed twice-daily training sessions for two weeks (5 days/week). Each session involved 20-minutes each of a maximal-challenge balance, and tread-mill-based gait with concurrent CN-NINM stimulation. Results: All subjects exhibited observable improvements in balance and gait, cognitive function, memory, attention and mood. Dynamic Gait Index: a test of 8 facets of gait including modulating speed, turning the head during gait, stepping around and over obstacles, and ability to climb stairs. Subjects exhibited improvements in scores of 13.5, 14, 10, and 21.5 points, respectively on a 24-point scale. A 3-point change is considered clinically and statistically significant. NeuroComTM Computerized Dynamic Posturography Sensory Organization Test (SOT) – standing balance performed under six sensory conditions to quantitatively evaluate the relative use of visual, vestibular and proprioceptive inputs in dynamic balance control. Subjects exhibited improvements in scores of 62, 10, 22, and 47 points, respectively on an age & height normalized scale. A 10-point change is considered clinically and statistically significant. Additionally, TBI Subjects C & D were tested for changes in cognitive function, memory, attention and mood. Their scores on the Brief Repeatable Battery of Neuropsychological Tests (BRBNT) exhibited improvements in all 7 categories of test for declarative and spatial memory, attention, arithmetic capacity, and mood. We observed that twice daily application of superficial electrical stimulation to two major cranial nerves (lingual branch of the trigeminal nerve and lingual branch of the facial nerve), innervating the anterior 2/3rd of the dorsal surface human tongue induces increased activity in the brainstem. The specific regions exhibiting increase metabolic activity in the dorsal pons varolli, superior medulla, and ventrolateral cerebellum all structures intimately involved in balance, gait, head and eye-movement control. We postulate that systematic application of CN-NINM induces processes of neuroplasticity that leads to improved and sustained functional behavior regulated by these structures. Conclusions: Prolonged activation produces sustained increased neural activity in at least the sensory and spinal nuclei of trigeminal nuclei complex, and the caudal part of the nucleus tractus solitarius where both stimulated nerves have direct projections. It may also increase the receptivity of multiple neural circuitries and/or affect internal mechanisms of homeostatic regulation, according to our contemporary concept of synaptic plasticity.

Symposium IX Wednesday July 2, 12:30 - 14:30, Bayshore Ballroom BC

Exergaming in the elderly for fall risk reduction and prevention: Challenges and future directions

Chair: **Nina Skjaeret**, Norwegian University of Science and Technology, Norway
Discussant: **Stephen Lord**, University New South Wales, Neuroscience Research Australia

Claudine Lamoth, University Medical Centre Groningen (UMCG), Netherlands

Development of an interactive gameplay tool for balance training of elderly

Fall related injuries are responsible for disability, physical dysfunction and loss of independence among older adults. Primary causes of falling are postural instabilities during daily activities. Developing a tool to train balance is therefore of great importance. The project "Exergaming for balance training of elderly" of SPRINT/UMCG, aims to develop a gameplay system for balance training of seniors at home and integrates game characteristics that brings added value over conventional balance training [1]. First, an important feature of exergames is that it takes the player's attention away from the motor task and focuses on achieving game performance goals, while simultaneously balance is practiced. This external attention focus results in greater automaticity of postural control [2]. Second, algorithms will be developed to quantify postural control during game play to adapt the game to individual capabilities of the user, and to monitor progression over days/weeks/months [3]. Third, effective balance training programs include high doses and challenging variable exercises, with a large number of repetitions [4]. This can be accomplished by varying game-context and performance requirements. Finally, game systems can provide feedback at different time scales: to the gamer during game play, on activity frequency and duration and users can compare their current performance to past performances, and to other users. These factors might also increase adherence to balance training, because it enhances motivation and enjoyment of exercising. We adopt a multidisciplinary approach in which game designers/programmers, human movement scientists, rehabilitation scientists and biomedical engineers work together. Moreover, the project builds on a user-centered design approach to ensure that the game system will fit the user's demands.

Daniel Schoene, Neuroscience Research, Australia

Stepping exergames and the risk of falling in older people

Stepping exergames such as Dance Dance Revolution emerged in the 1980's and are still popular among young people today. Recently, similar stepping games that use pressure sensors under the feet have been used by researchers to explore their potential in reducing the fall-risk and improving functional outcomes in older people. Besides the potential effects on health-related outcomes the accessible low-cost technology, use as home-based interventions and increased motivation as well as intention-building aspects of exergames offer significant advantages over traditionally delivered exercise programs. However, evidence in samples of older people is scarce. In principle, stimuli emerge on a display screen providing a task to which the player has to react with a step response, therefore demanding perceptual, cognitive and motor capacities. Findings of multiple studies have demonstrated that specific functions from those domains can discriminate fallers from non-fallers. Thus, stepping exergames may provide a means of targeting risk factors in real-life scenarios. So far no studies have been powered to investigate the effect of an exergame intervention on fall rates. Stepping exergames are safe and appear to be feasible as an in-home intervention in healthy samples and under supervision in frailer older adults. There is limited and in parts inconsistent evidence that exergame participation can result in improvements in clinical outcome measures such as balance, fear of falling and cognition. Our group has developed stepping tasks that are not just a modified version of dance games but other tasks that focus on specific cognitive functions in combination with stepping, such as a Trail Stepping task and a step version of Tetris. Preliminary results demonstrate the utility and feasibility in assessing and reducing fall-risk. A randomized controlled trial is currently underway and the results regarding changes in cognitive and motor functional performance from this and other studies will be presented.

Alan Bourke, Ecole Polytechnique Fédérale de Lausanne (EPFL), Switzerland

Challenges of developing an inertial sensor based stepping exergame for the elderly

It has recently been shown that exergaming can increase exercise adherence and uptake in an elderly population thus reducing the risk of falling. Therefore, the motivation to develop virtual reality based exercise interventions is warranted. However, in order to develop such an intervention certain criteria need to be considered. The minimum requirement for these exergames is that they should be fun and engaging as well as challenging and safe. We present the design elements and challenges involved in bringing a virtual reality based stepping exercise intervention from concept through to reality. This exergame, developed in the framework of the EU-funded FARSEEING project, allows the user to interact with a three dimensional graphical environment, which is projected in their field of vision. Direction is given via visual feedback to the user on which target to virtually contact with a virtual representation of their feet in the form of an avatar. The user's feet movements are tracked using inertial sensors which measure true displacement of the feet in real-time which is used as input to the game engine. In order to develop such an exergame a number of technical computational and algorithmic challenges needed to be addressed. We present the technical requirements for the system, including the interface, processing unit, sensors and communication. We also cover the animation, safety and intervention design including the taxonomy and the implemented system for the final virtual reality exergame. We cover in detail the challenges faced when performing real-time foot trajectory measurement and how these were overcome in terms of real-time implementation, developed algorithms for step detection and trajectory measurement where finally we conclude with a presentation of the developed exergame.

Brook Galna, Newcastle University, UK

Designing exercise based computer games for people with Parkinson's disease

Parkinson's disease (PD) is a multi-system neurodegenerative disorder that impairs postural control and mobility, causing falls and reduced levels of physical activity. The overall impact of PD on quality of life is marked. Exercise is effective in improving gait, balance and mobility in PD but professional resources are limited and alternative approaches to provision of exercise and rehabilitation programmes need to be found. An alternative is the use of exercise-based computer games (exergames) such as those played with Nintendo Wii and Microsoft Kinect. However, commercial games are not designed with specific rehabilitation strategies in mind, nor are they designed to accommodate the various motor and non-motor symptoms associated with PD such as tremor, dyskinesia or cognitive dysfunction. This poses challenges to their application and utility. Key features of exercise programs in PD are considered to include: practice of complex tasks (total body movement rather than exercising a single joint); use of sensory input for augmented feedback (e.g. sound and vision) regarding performance; graduated and goal-directed activity; intensity and frequency of practice. In response to these needs, we developed a stepping based exergame using the Microsoft Kinect to rehabilitate balance in people with PD (PD-Kinect). The aims of this presentation will be to i) summarize the emerging literature on exergaming for people with PD; and ii) describe our team's experience in designing an exergame specifically for people with PD. Particular emphasis will be placed on the iterative design process we adopted involving people with PD as well as the feedback we obtained from people with PD who played the game.

Symposium X Thursday July 3, 15:00 - 17:00, Cypress Room

Proactive and reactive adaptations to slips and trips: Implications for fall-risk assessment and rehabilitation

Chair: **Vivian Weerdestyn**, Radboud University, Netherlands

Shirley Rietdyk, Purdue University, USA

Failures of proactive gait adaptations: Individual and environmental characteristics that result in failure to cross a visible, stationary obstacle

Most environmental challenges encountered in daily life are visible from a distance, such as stairs, ramps, and obstacles. The first line of defense to prevent a fall from these challenges is the proactive gait changes made to avoid or accommodate the environment. However, even when an obstacle is perceived in the environment, and proactive gait adaptations were made, failure can still occur due to inadequate adaptations. For example, a person perceives a staircase, elevates the limb to clear the stair, but trips on the stair. These failures also occur in the lab, and most subjects fail at least once when enough trials are observed. Examination of these proactive failures informs fall risk from a new perspective. We have observed that young and older adults have similar obstacle contact rates in a lab setting; so age does not increase the likelihood of obstacle contact in a normally lit environment with a high contrast obstacle. However, older adults are more likely to contact with the lead limb; since lead limb contacts are more difficult to recover from, older adults are less likely to recover and therefore are more likely to become injured. Changes in foot clearance over time appear to indicate that both young and older subjects have an inaccurate perception of obstacle height or that the visuomotor transformation is compromised during control of lead and trail limb elevation. Further, we have begun to systematically manipulate environmental characteristics to empirically determine their direct impact on failures. The identification of antecedents of trips may lead to development of improved interventions, including environmental remediation and proactive obstacle avoidance training.

Mirjam Pijnappels, VU University Amsterdam, Netherlands

Limitations and possibilities in the reactive recovery responses after tripping in older adults

Tripping over an obstacle induces a forward body rotation. Reactive responses need to be fast and powerful in order to restrain this forward angular momentum and to prevent falling. These reactions might be affected by age-related neuromuscular decline and inadequate responses can lead to falls. The first question that will be addressed is why reactive balance recovery responses after tripping are less successful in older adults than in young adults. We tripped young and healthy older adults repeatedly in our experimental setup over suddenly appearing obstacles while walking overground at preferred walking speed. While young adults responded with a single step, older adults were more likely to take multiple shorter steps after recovery foot landing. Our results showed that the support limb plays an important role in balance recovery by generating the appropriate joint moments during push-off, necessary to restrain the forward angular momentum before landing of the recovery foot. Older adults showed similar onsets of muscle activity and joint moments as young adults, but insufficient reduction of the angular rotation during push-off and poorer placement of the recovery limb. The less adequate body orientation at recovery foot landing appeared not to be due to inadequate arm movements, but rather to lower rates of moment generation in all joints and a lower peak ankle moment in the support limb. The second question then to be addressed is whether such inadequate lower limb responses can be improved by training. We found that older trainers who increased their muscle strength capacities over a 16-week resistance training period improved their tripping responses by 49%. Interestingly, controls that did not change in their strength capacities also improved their tripping responses by 20%, indicating that motor skill learning can have beneficial effects on balance recovery. These promising results are further underlined by recent findings that young adults can adjust their ongoing reactive recovery response after tripping. It seems therefore that adjustments and improvements of reactive balance recovery responses are possible, which might be helpful to prevent falls.

Tanvi Bhatt, University of Illinois at Chicago, USA

Fall prognosis and prevention: Perturbation-based assessment, adaptation and generalization in the young, old and neurologically impaired

Despite the commonality of falls within the community-dwelling aging and disabled population, little is known about their mechanism or their contributing factors, with limited tools assessing this crucial aspect. Further, there are limited evidence-based treatment approaches for fall reduction in these populations. Accurate assessment measures can form the baseline for development of appropriate and effective interventions in order to prevent falls and improve quality of life and community participation. Perturbation-based assessment and treatment is an emerging field that holds potential to address the epidemic of falls. Based on previous theoretical and empirical evidence we explored the feasibility of applying laboratory-induced falls for assessment of real-life falls in community-dwelling older adults and people with stroke. Further we examined the validity of different routine (performance-based) clinical balance tests in predicting an imminent fall in these groups. Both traditional qualitative and quantitative balance assessments were obtained. Immediate fall risk was assessed by exposing subjects to an unannounced, novel "real-life-like" slip induced with a low friction moveable platform.

We observed that individuals experiencing a fall on the laboratory slip-test had significantly lower scores on the functional status measures compared to those who recovered. Further the measures of stability and limb support were more sensitive in predicting falls than the functional status measures. Next we examined the adaptation effects induced by such repeated laboratory perturbations and the ability to generalize their effects to different contexts. Healthy subjects were exposed to repeated moveable platform slip perturbations induced under their right limb and were subsequently exposed to slips under the non-trained limb, non-trained surface (oil contaminated vinyl floor) and non-trained perturbation (trips). We observed that the perturbation-training induced adaptations could be significantly generalized between limbs, surfaces and contexts, resulting in reduced fall outcomes on exposure to these novel, non-training environments. Lastly to address the role of neural substrates underlying such adaptations, we asked if the adaptive effects observed within a healthy nervous system would be impacted by a neurological insult such as a stroke. Results indicated that people with hemi-paretic chronic stroke could adapt their center-of-mass stability and compensatory stepping responses similar to healthy older adults for preventing fall-risk. Given these positive results, perturbation-based assessment and training could be used as an adjunct to current rehabilitation paradigms to target fall-prevention.

Yi-Chung (Clive) Pai, University of Illinois at Chicago, USA

Long-lasting human motor memory: Perturbation training against falls among community-dwelling older adults

Letting older adults slip and fall seems counterintuitive. However, due to the vital functional plasticity of the human motor system, allowing older adults to slip and fall in a safely controlled environment may in fact may help them develop skills that subsequently reduce likelihood of falls in uncontrolled and dangerous everyday living situations. Perturbation-training is one such emerging paradigm known to induce shorter-term falls reduction in healthy young as well as older adults. Its longer-term benefits are not fully understood, however. The purpose of this study was to determine the length of time and to what degree older adults could retain their fall-resisting skills acquired from a single perturbation training session. In this conditional three-stage, sequential, pre-post-retest design, subjects underwent the initial training session at the beginning of each stage in precisely the same manner as their cohorts of other stages, and returned to participate in a retest only once at the end of that stage just as did the other cohorts. Seventy-three community-dwelling older adults (≥ 65 years) received perturbation training consisting of 24 slips in the initial session. Outcome measurements, taken upon the first (novel) and the 24th (final) slip of the initial session and the retest slip, included fall-or-no-fall, and stability (quantified by the shortest distance form relative motion state of the center-of-mass and the base-of-support to the limits of stability) at instants prior to (proactive) and after (reactive) the onset of the slip. Whether or not the participants successfully retained their training in the retest of a given stage would then determine the length of time for the retest in the next stage. If the participants in Stage I exhibited significant retention during their 6-month retest, the second cohort of subjects (Stage II) would then retest nine months after their initial training. Alternatively, if six-month retention was not observed in Stage I, Stage II participants would retest three months after their initial session. The outcomes observed for Stage I and Stage II would then dictate whether the retest for the cohort in Stage III would be either at one-and-a-half, four-and-a-half, seven-and-a-half, or at 12 months after their initial session. We found that the training boosted subjects' resistance against falls with a significant reduction from 42.5% falls on the first slip to 0% on the 24th slip. Rate of falls remained low in 6-month (0%), 9-month (8.7%) and 12-month laboratory retest (11.5%); with no significant difference between the three time intervals. Such reduction of falls and its retention were due to the significant training-induced improvement in the proactive and reactive control of stability. The method applied in the present study eliminated any bias resulted from the training effect resulting from multiple retest and provided a high temporal resolution of training retention as fine as 1.5 months. Although it is very time consuming, it offers maximal flexibility. The findings thus enabled us to demonstrate the feasibility of a single session of perturbation training to "inoculate" older adults and to reduce their annual risk of falls.

Symposium XI Thursday July 3, 15:00 - 17:00, Stanley Park Ballroom 1 & 2

Multi-person entrainment in gait and posture: theories and approaches

Chair: **Mark T. Elliott**, University of Birmingham, United Kingdom

Mark T. Elliott, University of Birmingham, UK

The entrainment of gait when walking in group formations

When walking side-by-side, two individuals will tend to fall into step with each other and walk in synchrony. This has been observed in both treadmill walking and natural overground walking. The level of synchrony between walking couples is modulated by the sensory information available within different modalities, with tactile cues (e.g. hand-holding) resulting in the greatest levels of entrainment between couples. Currently, while gait entrainment has been studied under dyadic conditions, it is unclear whether entrainment occurs within larger groups and under what conditions. In my presentation, which forms part of the symposium on Multi-person entrainment in gait and posture, I describe the entrainment of gait between individuals walking in a group of four. In addition, I investigate how entrainment is affected by walking under different conditions, including when holding a conversation within the group (compared to silence) and walking in a rush (compared to relaxed). Groups were gender matched and instructed to walk either in a 2x2 formation or as a single row of four. The experiments took place in a 17m x 12m open area laboratory with a 16 camera Vicon motion capture system (capture volume ~10m x 5m). Participants completed 6 lengths of the lab for each trial while wearing a full Plug-in Gait marker set. Participants were instructed on the formation and walking speed along with a topic of conversation in the talking conditions. I will report the results in terms of the kinematics of movements of each group member under the conditions tested and also the degree of synchrony achieved within the group as a whole and between pairs. I will discuss how results of these kinds of experiments can inform modelling of human-structure interaction research and the prediction of building structural vibration.

Andreas Daffertshofer, VU University, Netherlands
Vivien Marmelat, Movement to Health (M2H), Montpellier-1 University, EuroMov, France

Long-range correlations in temporal sequences – designing auditory cues for locomotion

The temporal correlation structure of consecutive events contains valuable information about its generating process. We focus on power law distributions in systems that are considered generic markers of healthy and adaptive performance. (Persistent) long-range correlations change with task and environmental constraints. Temporal correlation structures of motor events are linked to pathologies like Huntington's and Parkinson's disease. With respect to the latter, auditory cueing is often assumed beneficial for gait stability. Stride length, cadence, and speed can increase, whereas inter-stride variability and occurrence of freezing decrease when patients are 'paced' by a metronome. However, isochronous auditory cues alter the typical dynamics of healthy gait: persistent long-range correlations in stride intervals of self-paced gait can switch to anti-persistent correlations. Hence, we discuss whether a train of auditory cues with more fractal-like correlation structure can yield a more consistent and predictable adaptation of motor performance. This is particularly interesting in the context of so-called 'strong anticipation' that facilitates subjects to synchronize with a metronome even if the sequence is random. We present experimental findings that may form help understanding effects of (correlations in) auditory cueing on gait, which can open new opportunities for optimizing cueing protocols in the presence of neurodegenerative pathologies.

Vassilia Hatzitaki, Aristotle University of Thessaloniki, Greece

Interpersonal entrainment in dancers: Contrasting timing and haptic cues

We examined the nature of interpersonal synchrony mediated by light fingertip touch when individuals rhythmically sway side by side at their own pace, same or different externally imposed (metronome) tempos. Three types of couples participated in two experiments; expert couples, consisting of individuals with at least 8 years systematic practice in traditional Greek dance; novice couples, consisting of individuals with no prior experience in dance and mixed couples, consisting of one expert dancer and one novice partner. Analysis of the centre of pressure signals in the frequency domain revealed that fingertip touch evoked interpersonal synchronization during self-paced sway. During metronome paced sway (0.25 Hz) only expert dancers further increased synchronization suggesting a more efficient integration of tactile and timing cues1. In a subsequent experiment, we asked whether dancers are able to suppress the spontaneous tendency towards entrainment when the two partners sway at different tempos (one at 0.25Hz, the other at 0.35Hz). Haptic touch evoked interpersonal entrainment only in mixed couples whereas touch interference was weaker in novices and absent in experts. Interestingly, in mixed couples, the expert dancer consistently led his/her novice partner2. All together, these results suggest that light fingertip touch evokes spontaneous interpersonal entrainment. The touch effect is stronger when this is provided by an expert in movement timing (i.e. dancer) due to more reliable cues about sway sensed at the fingertip. Suppression of the spontaneous interpersonal entrainment in expert dancers suggests that explicit training in movement timing can modulate the self-organized properties of inter-personal entrainment.

Jeffrey M. Hausdorff, Tel Aviv Sourasky Medical Center and Tel Aviv University, Israel

Modality-specific communication enabling gait synchronization during over-ground, side-by-side walking

An attentive observer will notice that unintentional synchronization of gait between two human walkers occurs fairly frequently. The frequency with which this occurs and the mechanisms underlying this phase-locking of rhythms and the gait pattern have only recently begun to be studied. We examined the potential sensory mechanisms that contribute to the gait synchronization that occurs when two people match their rhythms and gait patterns under natural walking conditions, using quantified measurements. Gender and height matched pairs walked a 70 meter path under five conditions that manipulated the available sensory feedback. The modalities studied were visual, auditory, and tactile. Each modality was investigated in isolation and compared to walking when sensory feedback was withheld and when all three modalities were available. Movement data was recorded using two trunk-mounted triaxial accelerometers. Offline, a gait synchronization index (GSI) was calculated from the vertical component of the acceleration signals, quantifying the synchronization of the gait rhythms on a scale of 0-1 using the phase-synchronization method with 0 indicating no synchrony and 1 indicating maximum synchrony. Overall, 36% of the trials exhibited synchrony. Tactile and auditory feedback showed the greatest ability to synchronize, while visual was the least effective. The results show that gait synchronization during natural walking is not merely anecdotal but is a repeatable phenomenon that is quantifiable and is related to the available sensory feedback modalities. In follow-up work, we investigated the role of attention to determine the degree to which automaticity regulates the synchronization among pairs. Further work is needed to more fully identify the mechanisms that govern the synchronization of walking rhythms, to understand how and why some couples are more likely to walk in synchrony, compared to other, and to characterize the dependence on a variety of known and as yet unidentified sensory communication modalities.

Symposium XII Thursday July 3, 15:00 - 17:00, Bayshore Ballroom BC

The interplay between cognition and mobility: Cutting-edge neuroimaging insights

Chair: **Teresa Liu-Ambrose**, University of British Columbia, Canada
Discussant: **Stephen Lord,** University New South Wales, Neuroscience Research, Australia

Caterina Rosano, University of Pittsburgh, USA

Resilience to brain aging: insights on the significance of subclinical markers of brain abnormalities on cognitive function and mobility.

One hypothesis to explain why older adults remain high functioning late in life is that they have a greater "brain reserve". However, brain reserve has not been objectively quantified, as it has mostly relied on gross measures of whole-brain abnormalities that are largely non-specific manifestation of brain aging. Additionally, the determinants of brain reserve have not been characterized systematically, in relationship to objective measures of brain integrity. We hereby illustrate a method to define resilience to brain aging using objective quantitative measures based on repeated brain magnetic resonance imaging in older adult participants of the Cardiovascular Health Study and Health Aging and Body Composition Study at the Pittsburgh field site. Specifically, we quantified the risk of mortality, dementia, and impaired mobility in older adults in relation to objective quantitative magnetic resonance imaging.

Kim Delbaere, University New South Wales, Australia

White matter integrity, cognitive function, and mobility

Mobility requires the structural and functional integrity of neural networks to process sensorimotor input. White matter (WM) integrity is essential for fast and efficient operation of the neural networks. Reduced WM integrity is associated with increased fall risk, including impaired executive functioning, impaired balance, slow gait, and falls. Specifically, subcortical infarcts (SI) and white matter hyperintensities (WMH) are associated with an increased risk of multiple falls. Both SI and WMH are commonly found in frontal and subcortical areas and could disrupt the integrity of neural networks including the long descending motor fibers and frontal-subcortical circuits that are important for motor control and cognitive function. In recent years, advances in brain imaging techniques (e.g. diffusion tensor imaging tractography) have allowed us to look at WM integrity directly based on the strength and direction of water diffusivity in WM. Disruption in WM integrity, especially in the corpus callosum and longitudinal association fibres, has been associated to gait and balance impairments. It is assumed reduced WM integrity leads to impairments in functional connectivity of the neural networks. This may have an important effect on processing speed which in turn impacts both motor and cognitive functions. Further, the ability to process and integrate information from sensory, visual and motor domains – essential for balance and gait – are compromised as a result of WM damage. This talk will provide a summary of the growing body of literature linking cerebral white matter disease to deficits in cognitive and physical performance and now, impaired mobility.

Chun-Liang Hsu, University of British Columbia, Canada
Lindsay Nagamatsu, University of Illinois, USA

Neural signature of impaired mobility and their significance

Cognitive impairment and impaired mobility are major public health concerns and often coexist – even among functionally independent older adults. The neural basis for this association is currently unclear. We conducted a 12-month observational study to determine the neural correlates of impaired mobility among otherwise healthy community-dwelling older adults aged 70 to 80 years. Specifically, we compared 1) functional brain activation during dual-task performance and 2) functional connectivity (i.e., the temporal coherence of functional brain activation) during rest and a simple finger tapping between fallers (i.e., 2 or more falls in the prior 12 months) and non-fallers (i.e., no falls in the prior 12 months). During functional magnetic resonance imaging (fMRI), participants completed: 1) an event-related cognitive dual-task paradigm and 2) a simple motor tapping task with blocks with rest. Overall, we found that fallers demonstrated reduced hemodynamic response and slower reaction times during dual-task performance compared with non-fallers. Fallers also demonstrated altered between-network functional connectivity. Altered connectivity was observed between the default mode network, fronto-parietal network, and the primary motor sensory network. Thus, a recent history of multiple falls among older adults without a diagnosis of dementia may indicate sub-clinical changes.

Teresa Liu-Ambrose, University of British Columbia, Canada

Neuroimaging evidence for "Central Benefit Model" of exercise in falls prevention

The widely accepted dogma is that improved physical function underlies the effectiveness of exercise interventions in reducing falls risk. However, evidence from our randomized controlled trials suggests that exercise may reduce falls risk via mechanisms other than improved physical function. Specifically, improved cognitive function – specifically, executive functions – and associated functional plasticity may be an important yet under-appreciated mechanism by which the exercise reduces falls risk in older adults. Specifically, we demonstrated that a home-based exercise program of balance and strength reduced falls by 47% among older adults with a significant history of falls -- in the absence of significant improvement in physical function (i.e., balance and muscle strength). Notably, cognitive performance of selective attention and conflict resolution significantly improved in the exercise group compared with the control group. We also found that improved selective attention and conflict resolution secondary to 12 months of progressive resistance training was associated with improved usual gait speed. Furthermore, exercise may reduce falls risk by slowing down the progression of white matter lesions. Neuroimaging evidence from two randomized controlled trials of exercise will be discussed within the context of the proposed central benefit model (Liu-Ambrose et al., 2013).

AUTHOR INDEX

Authors and Presenters

All authors (lead and additional) and presenters are listed here for easy cross-referencing to their respective abstract. The list of full abstracts is available as a download from the ISPGR website (www.ispgr.org) and on the conference app.

Interpreting the presentation numbers:

The first section of the number represents the type of presentation as follows:

- **O** Oral presentation
- **S** Symposium presentation
- **P1** Poster Session 1
- **P2** Poster Session 2
- **P3** Poster Session 3

The second section represents the session number for Oral and Symposium presentations or the subject theme for posters.

The third section indicates the order of presentation for Oral and Symposium presentations or Poster number.

Oral, Symposia and Poster presenters are indicated with a bold Presentation Number.

Poster Themes:

- **A** Activity Monitoring
- **B** Aging
- **C** Balance support device
- **D** Cognitive, attentional and emotional influences
- **E** Coordination of posture and gait
- **F** Development of posture and gait
- **G** Developmental disorders
- **H** Effect of medication on posture and gait
- **I** Ergonomics
- **J** Exercise and physical activity
- **K** Falls and falls prevention
- **L** Habilitation and rehabilitation
- **M** Learning, plasticity and compensation
- **N** Modeling, robotics and biomechanics and implantable neuroprosthesis
- **O** Neurological diseases
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Poster Session 1

Monday, June 30 between 09:30 and 11:30

A Activity Monitoring

P1-A-1 Upright time and transitions long-term post-stroke

Mona Aaslund[1], Bård Bogen[1], Rolf Moe-Nilssen[1], Kristin Taraldsen[2]
[1]University of Bergen, [2]Norwegian University of Science and Technology

P1-A-2 New Smartphone system for personalized and at-home rehabilitation of people with Parkinson's disease: Preliminary Clinical Experience

Marina Brozgol[1], Moran Dorfman [1], Eran Gazit [1], Pablo Bezalel[1], Pieter Ginis[2], Alice Nieuwboer[2], Sinziana Mazilu[3], Alberto Ferrari[4], Laura Rocchi[4], Anat Mirelma[1], Jeffrey Hausdorff [1]
[1]Sourasky Medical Center, [2]Department of Rehabilitation Sciences, KU Leuven, [3]Wearable Systems Laboratory, Swiss Federal Institute of Technology, Zurich, [4]Department of Electronics, Computer Science, and Systems, University of Bologna

P1-A-3 Sensor-derived physical activity parameters predict future falls in individuals with dementia

Michael Schwenk[1], Klaus Hauer[2], Tania Zieschang[2], Jane Mohler[1], Bijan Najafi[1]
[1]University of Arizona, [2]Bethanien-Hospital at the University of Heidelberg

P1-A-4 Comparing cognition and sedentary behavior in people with parkinson disease with matched healthy adults

Chad Swank[1], Ann Medley[1], Mary Thompson[1], Elaine Trudelle-Jackson[1]
[1]Texas Woman's University

P1-A-5 Daily physical activity after hip fracture

Kristin Taraldsen[1], Olav Sletvold[1], Pernille Thingstad[1], Ingvild Saltvedt[1], Malcolm Granat[2], Sebastien Chastin[3], Stian Lydersen[1], Jorunn Helbostad[1]
[1]Norwegian University of Science and Technology (NTNU), [2]University of Salford, [3]Glasgow Caledonian University

B Aging

P1-B-6 The impact of fear of falling on gait under cognitive dual-task.

Daniela Abreu[1], Paulo Santos[1], Paulo Roberto Santiago[2], Erika Tanaka[1]
[1]University of São Paulo, School of Medicine, Ribeirão Preto, SP, Brazil, [2]University of São Paulo, Ribeirão Preto, SP, Brazil

P1-B-7 Fractal analysis of the postural system in elderly subjects with dizziness due to vestibular disorder

Mitsuhiro Aoki[1], Keisuke Mizuta[1], Yatsuji Ito[1], Takashi Tokita[1], Bunya Kuze[1]
[1]Gifu University Graduate School of Medicine

P1-B-8 Modulations on spatial-temporal parameters of gait in the Parkinson disease individuals under muscle fatigue

Fabio Barbieri[1], Paulo Santos[1], Rodrigo Vitório[1], Lucas Simieli[1], Lilian Gobbi[1]
[1]UNESP - São Paulo State University at Rio Claro - Brazil

P1-B-9 Differences in head and body stability between old and young adults during level walking under low light

Gyerae Tack[1], Jinseung Choi[1], Dongwon Kang[1]
[1]Konkuk University

P1-B-10 Comparison of the postural sway velocity of women of different ages

Elisa Libardi[1], Margarete Kochi[1], Roberta Brunelli[1], Jaqueline Porto[1], Carina Junqueira[1], Daniela Abreu[1]
[1]University of São Paulo

P1-B-11 The effects of advancing age on adaptive gait: a comparison of adults aged 20-25 years, 65-79 years, and 80-91 years

Brittney Muir[1], Shirley Rietdyk[1], Jeffrey Haddad[1], Michel Heijnen[1]
[1]Purdue University

P1-B-12 Assessing motor performance by means of wearable inertial sensors

Erika Nerozzi[1], Maurizio Maria Monaco[1], Claudio Tentoni[1]
[1]School of Biotechnology, Pharmacy and Motor Sciences University of Bologna

P1-B-13 Attuning one's steps to visual cues reduces comfortable walking speed in both young and elderly adults

C. (Lieke) E. Peper[1], Miek de Dreu[1], Melvyn Roerdink[1]
[1]VU University Amsterdam

C Balance support device

P1-C-14 The influence of a damper system on the energy expenditure of forearm crutch gait

Megan MacGillivray[1], Bonita Sawatzky[1]
[1]University of British Columbia

P1-C-15 Determinants of usability during rollator-assisted ambulation on ramps in adults with multiple sclerosis

Ivan Solano[1], William Gage[2], Karl Zabjek[3], George Mochizuki[1], William McIlroy[4]
[1]University of Toronto, [2]Toronto Rehabilitation Institute; School of Kinesiology and Health Science, York University, [3]Toronto Rehabilitation Institute; Graduate Department of Rehabilitation Science, University of Toron, [4]Toronto Rehabilitation Institute;

D Cognitive, attentional and emotional influences

P1-D-16 Forward head posture in older subjects is associated with executive deficits

Rajal Cohen[1], Britany Smith[1], Nicole Sanders[1], Kaci Johnson[2], Anita Vasavada[2], Maureen Schmitter-Edgecombe[2]
[1]University of Idaho, [2]Washington State University

P1-D-17 Effect of dual-task on sitting postural control among individuals with a spinal cord injury

Murielle Grangeon[1], Audrey Roy[2], Sylvie Nadeau[1], Cyril Duclos[1], Dany Gagnon[1]
[1]Université de Montréal, [2]Rehabilitation Institute Gingras-Lindsay

P1-D-18 The effects of height-induced postural threat on lower-limb cutaneous reflexes.

Brian Horslen[1], Jean-Sébastien Blouin[1], J Timothy Inglis[1], Mark Carpenter[1]
[1]The University of British Columbia

P1-D-19 Effects of transcranial direct current stimulation (tDCS) to left dorsolateral prefrontal cortex (DLPFC) on working memory and level walking in young adults

On-Yee Amy Lo[1], Sandra Liu[2], Li-Shan Chou[1]
[1]University of Oregon, [2]South Eugene High School

P1-D-20 Effects of mild cognitive impairments on multi-tasking during stair descent in community dwelling older people

Bradford McFadyen[1], Sophie Blanchet[2], Costis Maganaris[3], Bill Baltzopoulos[1]
[1]Laval University, [2]CIRRIS, [3]Liverpool John Moores University

P1-D-21 Balance ability in older adults with and without mild cognitive impairment

James Moore[1], Neva Kirk-Sanchez[1], David Mandel[1]
[1]University of Miami

P1-D-22 Cognitive task performed during upright stance improves postural control in older adults

Natalie Richer[1], Nadia Polskaia[1], Yves Lajoie[1]
[1]University of Ottawa

P1-D-23 Influence of visual target distance on body sway and muscular coactivation at the ankle joint under conditions of fear

Junichi Suganuma[1], Kozo Ueta[2], Shu Morioka[2]
[1]kio univercity, [2]Kio University

P1-D-24 Clinical objectification of the postural and pelvic instability in unipodal, with children presenting developmental dyslexia

Philippe Villeneuve[1], Hélène Bost[2], Fabienne Mons[2], Bernard Weber [2], Sarah Recoules[2]

[1]Institut de Posturologie, [2]Association Posturologie Internationale

P1-D-25 Margin of stability while crossing a dynamic obstacle during overground walking

Tim Worden[1], Lori Vallis[1]

[1]University of Guelph

P1-D-26 Dual-tasking postural control: age-related changes in visuomotor control and attentional capacity

Ting Ting Yeh[1], James Lyons[1], Timothy Lee[1]

[1]McMaster University

E Coordination of posture and gait

P1-E-27 Adaptive locomotion strategies in a single and double obstacle avoidance task

Russell Kennedy[1]

[1]Wilfrid Laurier University

P1-E-28 Knee range of motion influences obstacle avoidance strategies during gait

Emily McIntosh[1], Damjana Milicevic[1], Nicholas Frank[1], Andrew Laing[1], Stephen Prentice[1]

[1]University of Waterloo

P1-E-29 Differences of trunk control between trimesters during gait in nulliparous women

Ryuichi Sawa[1], Takehiko Doi[2], Tsuyoshi Asai[3], Sho Nakakubo[1], Kaori Watanabe[4], Takeshi Taniguchi[5], Rei Ono[1]

[1]Kobe University Graduate School of Health Sciences, [2]National Center for Geriatrics and Gerontology, [3]Kobegakuin University, [4]University of Shiga Prefecture, [5]Taniguchi Hospital

P1-E-30 Postural control changes in visual height intolerance: balance control and anti-gravity muscle activity

Klaus Jahn[1], Max Wuehr[1], Guenter Kugler[1], Roman Schniepp[1], Doreen Huppert[1], Thomas Brandt[1]

[1]University of Munich

H Effect of medication on posture and gait

P1-H-31 Effects of medication on temporal aspects of unplanned turning in Parkinson´s disease

David Conradsson[1], Caroline Paquette[2], Erika Franzén [1]

[1]Karolinska Institutet, [2]Department of Kinesiology and Physical Education, McGill University and Centre for Interdisciplinary

P1-H-32 The effects of fall-risk-increasing drugs (FRIDs) on gait variability in frail elderly

Maartje de Groot[1], Jos van Campen[1], Nienke Kosse[2], Oscar de Vries[3], Jos Beijnen[1], Claudine Lamoth[2]

[1]Slotervaart Hospital, [2]University of Groningen, University Medical Center Groningen, [3]VU University Medical Center

P1-H-33 A double blind randomized, placebo-controlled single dose study of methylphenidate to reduce fall risk in older adults

Itshak Melzer[1], Zamir Shorer[2], Bachner Yaakov[1], Tal Guy[1]

[1]Ben-Gurion University, [2]Ben-Gurion University and Soroka Medical Center

P1-H-34 Hip fractures and "drugs to be avoided"

Margareta Reis[1], Torsten Johansson[1]

[1]Linköping University

I Ergonomics

P1-I-35 Understanding the effects of learning on change in support reactions when exposed to continuous multi-directional perturbations

Carolyn Duncan[1], William McIlroy[2], Avril Mansfield[3], Jeannette Byrne[4], Wayne Albert[5], Scott MacKinnon[4]

[1]Toronto Rehabilitation Institute/Memorial University, [2]Toronto Rehabilitation Institute/University of Waterloo, [3]Toronto Rehabilitation Institute, [4]Memorial University, [5]University of New Brunswick

P1-I-36 How much force do you need to do it?

Martine Gilles[1], Pascal Wild[1]

[1]Institut national de recherche et de sécurité

P1-I-37 Feasibility and validity of functional movement screen in assessing postural control of operative firefighters aged 22-59

Anne Punakallio[1], Miia Wikström[1], Sirpa Lusa[1]

[1]Finnish Institute of Occupational Health

J Exercise and physical activity

P1-J-38 Resistance training, white matter lesion progression, and falls risk: a 12-month randomized controlled trial

Niousha Bolandzadeh[1], Roger Tam[1], Lindsay Nagamatsu[2], Liang Hsu[1], David Li[1], Todd Handy[1], Peter Graf[1], Lynn Beattie[1], Teresa Liu-Ambrose[1]

[1]University of British Columbia, [2]University of Illinoise

P1-J-39 Virtual reality for rehabilitation in Parkinson's disease: preliminary results of a systematic review

Kim Dockx[1], Veerle Van den Bergh[1], Esther Bekkers[1], Pieter Ginis[1], Sabine Verschueren[1], Lynn Rochester[2], Jeff Hausdorff[3], Anat Mirelman[3], Alice Nieuwboer[1]

[1]KULeuven, [2]UNEW, [3]TASMC

P1-J-40 Different effect of stepping cadence with pinnacle trainer

Yu-Chi Hsu[1], Yu-lin Yu[1], Li-Chieh Kuo[1], Fong-Chin Su[1]

[1]National Cheng Kung University

P1-J-41 A comparison of the influence of postural and non-postural muscle fatigue on anticipatory and reactive postural strategies

Ashleigh Kennedy[1], Arnaud Guével[2], Heidi Sveistrup[3]

[1]Toronto Rehabilitation Institute, [2]Université de Nantes, [3]University of Ottawa

P1-J-42 Effects of tandem cycling on gait and balance in parkinson's disease

Ellen McGough[1], Cynthia Robinson[1], Valerie Kelly[1]

[1]University of Washington

P1-J-43 Acute muscle fatigue alters reactive postural control in healthy elderly individuals

Evan Papa[1], Bo Foreman[2], Leland Dibble[2]

[1]University of North Texas Health Science Center, [2]University of Utah

P1-J-44 MET equivalent of gait in people with Chronic Conditions

Daniel Rafferty[1], Martijn Steultjens[1], James Woodburn[1], Lorna Paul[2]

[1]Glasgow Caledonian University, [2]University of Glasgow

K Falls and falls prevention

P1-K-45 Does hip abductor fatigue affect hip position sense and gait parameters in older adults?

Mina Arvin[1], Marco Hoozemans [1], Bart Burger [2], Sabine Verschueren [3], Jaap van Dieën [1], Mirjam Pijnappels [1]

[1]VU University Amsterdam, [2]Medical Centre Alkmaar, [3]KU Leuven

P1-K-46 Improved cognitive flexibility is independently associated with reduced falls risk and falling

Teresa Liu-Ambrose[1], John Best[1], Chun Liang Hsu[1], Jennifer Davis[1], Lindsay Nagamatsu[1]

[1]University of British Columiba

P1-K-47 Attentional demands of falls: Effect of dual-tasking on reactive balance response to large magnitude perturbations.

Tanvi Bhatt[1], **Prakruti Patel**[1]
[1]University of Illinois at Chicago

P1-K-48 Age-related differences in the control of weight-shifting within the surface of support

Elisabeth de Vries[1], **Simone Caljouw**[1], **Milou Coppens**[1], **Klaas Postema**[1], **Gijsbertus Verkerke**[2], **Claudine Lamoth**[1]
[1]University of Groningen, University Medical Center Groningen, [2]University of Groningen, University Medical Center Groningen and University of Twente

P1-K-49 Slow gait, mild cognitive impairment and fall: obu study of health promotion for the elderly

Takehiko Doi[1], **Hiroyuki Shimada**[1], **Hyuntae Park**[1], **Hyuma Makizako**[1], **Kota Tsutsumimoto**[1], **Kazuki Uemura**[1], **Ryo Hotta**[1], **Sho Nakakubo**[1], **Takao Suzuki**[1]
[1]National Center for Geriatrics and Gerontology

P1-K-50 Failure to clear stationary, visible obstacles is affected by surface characteristics

Michel Heijnen[1], **Shirley Rietdyk**[1]
[1]Purdue University

P1-K-51 Towards a better understanding of turning deficits in people with Parkinson's disease

Sophia Hulbert[1], **Ann Ashburn**[1], **Lisa Roberts**[1], **Geert Verheyden**[2]
[1]University of Southampton, [2]University of Leuven

P1-K-52 Does the smoothness of walking under dual-task conditions reflect the risk of falling in patients with stroke?

Yu Inoue[1], **Tetsushi Nonaka**[2], **Kazuhiro Harada**[2]
[1]KIBI International Universit, [2]KIBI International University

P1-K-53 Identifying fall risk factors in psychogeriatric nursing home residents

Nienke Kosse[1], **Maartje de Groot**[2], **Tibor Hortobágyi**[1], **Claudine Lamoth**[1]
[1]University of Groningen, University Medical Center Groningen, [2]Slotervaart Hospital

P1-K-54 Postural strategies to regain balance after dynamic perturbation

Julie Nantel[1], **Shaun Porter**[1]
[1]University of Ottawa

P1-K-55 Walking while listening in an audio-visual virtual reality street scene: Effects of age, dual-task demands, and target location uncertainty

Victoria Nieborowska[1], **Sin-Tung Lau**[2], **Linda Truong**[3], **Eugene Alexandrov**[1], **Alison Novak**[2], **Jennifer Campos**[2], **M. Kathleen Pichora-Fuller**[4], **Karen Li**[1]
[1]Concordia University, [2]Toronto Rehabilitation Institute , [3]Ryerson University, [4]University of Toronto

P1-K-56 Does dual task performance predict recurrent falling in Parkinson's disease?

Carolien Strouwen[1], **Esther Molenaar**[2], **Liesbeth Münks**[1], **Samyra Keus**[2], **Bastiaan Bloem**[3], **Alice Nieuwboer**[1]
[1]KU Leuven, [2]Radboud University Nijmegen Medical Centre, [3]Radboud University Medical Centre

P1-K-57 Are falls related to daily acitivity? Preliminary results of a comparative investigation in neurogeriatic high-risk groups.

Matthis Synofzik[1], **Cornelia Schatton**[1], **Kristin Teubner**[1], **Karin Srulijes**[1], **Lars Schwickert**[2], **Jochen Klenk**[2], **Winfried Ilg**[1], **Walter Maetzler**[1], **Clemens Becker**[2]
[1]Hertie-Institute for Clinical Brain Research, [2]Robert-Bosch Hospital

P1-K-58 The relevance of the nerve conduction velocity to assessment of balance performances in older adults with diabetes mellitus

Chien-Hung Lai[1], **Ting-Yun Wang**[1], **Shih-Ching Chen**[1], **Chun-Wei Kang**[2], **Hsiang-Ching Lee**[1], **Yun-Han Chao**[1], **Chih-Wei Peng**[1]
[1]Taipei Medical University and Hospital, [2]Taipei Medical University Hospital

P1-K-59 Utility of physical performance testing in injurious falls risk stratification among older adults

Rachel Ward[1], **Marla Beauchamp**[2], **Alan Jette**[3], **Suzanne Leveille**[4], **Jonathan Bean**[2]
[1]Spaulding Hospital, Harvard University, Boston Unviersity, [2]Spaulding Hospital, Harvard Medical School, [3]Boston Unviersity School of Public Health, [4]University of Massachusetts College of Nursing and Health Sciences

L Habilitation and rehabilitation

P1-L-60 Cerebral hemispheres: a proprioceptive dependence for postural control?

Noémie Duclos[1], **Luc Maynard**[2], **Djawad Abbas**[2], **Serge Mesure**[1]
[1]Institut of Movement Sciences, [2]CRF Valmante

P1-L-61 Neurorehabilitation in degenerative cerebellar disease by exergames: improvements of ataxia-specific dysfunctions in complex movement sequences

Winfried Ilg [1], **Cornelia Schatton**[1], **Bjoern Mueller** [1], **Nicolas Ludolph**[1], **Martin Giese**[1], **Ludger Schoels** [1], **Matthis Synofzik**[1]
[1]Hertie Institute for Clinical Brain Research

P1-L-62 Development and preliminary evaluation of an enhanced fitness program to promote long-term engagement in physical activity after stroke

Svetlana Knorr[1], **Vivien Poon**[1], **Elizabeth Inness**[1], **Lou Biasin**[1], **Avril Mansfiled**[1]
[1]Toronto Rehabilitation Institute

P1-L-64 Postural control in young adults after chemotherapy in childhood

Måns Magnusson[1], **Einar Einarsson**[1], **Hannes Petersen**[2], **Per-Anders Fransson**[1], **Thomas Wiebe**[1], **Christian Moell**[1]
[1]Lund University, [2]University of Iceland, Reykjavík, Iceland

P1-L-65 Effect of perturbation training on reactive stepping post-stroke: a prospective cohort study with historical control

Avril Mansfield[1], **Jessica Bryce**[1], **Jennifer Wong**[2], **Lou Biasin**[1], **Vivien Poon**[1], **Elizabeth Inness**[1]
[1]Toronto Rehabilitation Institute, [2]University of Toronto

P1-L-66 Lateral balance training after total knee replacement improves functional mobility

Brian Street[1], **Aili Pare**[2], **Lauren Sergio**[1], **William Gage**[1]
[1]York University, [2]Southlake Regional Health Centre

P1-L-67 Lateral trunk lean gait modification increases the energy cost of walking in those with knee osteoarthritis

Judit Takacs[1], **Amy Kirkham**[1], **Kristin Campbell**[1], **Michael Hunt**[1]
[1]University of British Columbia

P1-L-68 Effectiveness of the Wii gaming technology in stroke rehabilitation: A systematic review

Dawn Tan[1], **Aiying Low**[1], **Linus Tan**[1]
[1]Singapore General Hospital

P1-L-69 Auditory observation of stepping actions can cue both spatial and temporal components of gait in Parkinson's disease patients

William Young[1], **Matthew Rodger**[2], **Cathy Craig**[2]
[1]Brunel University, [2]Queen's University Belfast

M Learning, plasticity and compensation

P1-M-70 Postural motor learning in healthy older adults: changes in muscle activity with repeated exposure to continuous translations

Nicholas Frank[1], **Karen Van Ooteghem**[2], **James Frank**[2], **Fay Horak**[3]
[1]Nike Inc., [2]University of Waterloo, [3]OHSU

P1-M-71 **Effects of transcutaneous electrical nerve stimulation on cortical excitability in the primary motor cortex**

***Jer-Junn Luh*[1], Yi-Hsuan Liao[1], In-Leng Lam[1]**

[1]National Taiwan University

P1-M-72 **Adaptations of lower limb kinetics during level and obstructed walking under limited knee range of motion**

***Damjana Milicevic*[1], Damjana Milicevic[1], Emily McIntosh[1], Nicholas Frank[1], Andrew Laing[1], Stephen Prentice[1]**

[1]University of Waterloo

N Modeling, robotics and biomechanics and implantable neuroprosthesis

P1-N-73 **Feasibility of exoskeleton-based balance and gait training combined with somatosensory tongue stimulation in people with MS: a pilot study.**

***J. Megan Brousseau*[1], Tania Lam[2]**

[1]University of British Columbia/ICORD, [2]University of British Columbia/Vancouver Coastal Health Research Institute

P1-N-74 **Body synergy based exoskeleton control designed for hemiplegia**

***Hideki Kadone*[1], Hideki Kadone[1], Kenji Suzuki[1], Yoshiyuki Sankai[1]**

[1]University of Tsukuba

P1-N-75 **Effect of postural configuration on trunk responses to support surface tilt**

***Georg Hettich*[1], Lorenz Assländer[1], Albert Gollhofer[1], Thomas Mergner[1]**

[1]University Freiburg

P1-N-76 **Postural sway evoked by head-turns in normal, vestibular-impaired and vestibular-impaired, prosthesis-assisted rhesus monkeys**

***Lara Thompson*[1], Csilla Haburkacova[2], Wangsong Gong[2], Daniel Lee[2], Conrad Wall III[2], Daniel Merfeld[2], Richard Lewis[2]**

[1]University of the District of Columbia, [2]Massachusetts Eye and Ear Infirmary, Harvard Medical School

P1-N-77 **Center of mass - center of pressure angle critically determines required friction at shoe-floor interface during straight walking**

***Takeshi Yamaguchi*[1], Kei Masani[2]**

[1]Tohoku University, [2]University of Toronto

O Neurological diseases

P1-0-78 **Gait characteristics and turning control following deep brain stimulation: A case study**

***Rebecca Reed-Jones*[1], V.N. Pradeep Ambati[2], Nicholas Murray[2], Fabricio Saucedo[2], Caitlin Schneider[3], Douglas Powell[3]**

[1]University of Prince Edward Island, [2]The University of Texas at El Paso, [3]Campbell University

P1-0-79 **Therapeutic potential of sensory tongue stimulation combined with rehabilitation therapy for balance and gait function in people with incomplete spinal cord injury: a pilot study.**

***Amanda Chisholm*[1], Raza Malik[1], Jean-Sébastien Blouin[1], Jaimie Borisoff[2], Susan Forwell[1], Tania Lam[1]**

[1]University of British Columbia, [2]British Columbia Institute of Technology

P1-0-80 **Does weight-bearing asymmetry affect the threshold for reactive stepping in people after stroke?**

***Digna de Kam*[1], Jip Kamphuis[2], Alexander Geurts[1], Vivian Weerdesteyn[1]**

[1]Radboud University Medical Center, [2]ViaReva

P1-0-81 **Individuals with minimal disability and multiple sclerosis display similar postural and dynamic balance control characteristics as community-dwelling older adults**

***Luke Denomme*[1], Patricia Mandalfino[2], Michael Cinelli[3]**

[1]University of Waterloo, [2]McMaster University, [3]Wilfrid Laurier University

P1-0-82 **Impact of physical guidance on learning a challenging walking task in adults with a history of stroke**

***Vincent DePaul*[1], Laurie Wishart[2], Bashir Versi[3], Ramesh Balasubramaniam[4], Timothy Lee[2]**

[1]Toronto Rehabilitation Institute - UHN, [2]McMaster University, [3]St. Joseph's Healthcare Hamilton, [4]University of California, Merced

P1-0-83 **How does anxiety influence gait in Parkinson's disease?**

***Kaylena Ehgoetz Martens*[1], Colin Ellard[2], Quincy Almeida[3]**

[1]University of Waterloo/ MDRC, [2]University of Waterloo, [3]Wilfrid Laurier University, MDRC

P1-0-84 **Coupling of gait and postural control in early Parkinson's disease**

***Brook Galna*[1], Silvia Del Din[1], Alan Godfrey[1], Sue Lord[1], Lynn Rochester[1]**

[1]Newcastle University

P1-0-85 **Five times sit to stand test in high risk individuals for Parkinson's disease**

***Markus Hobert*[1], David Weiss[2], Sandra Hasmann[2], Eva Schaeffer[2], Johannes Streffer[3], Inga Liepelt-Scarfone[2], Daniela Berg[2], Walter Maetzler[2]**

[1]University of Tuebingen, [2]Center for Neurology, University of Tuebingen, [3]Janssen-Pharmaceutical Companies of Johnson & Johnson

P1-0-86 **The effects of dual task on turning ability in stroke-survivors and older adults**

***Kristen Hollands*[1], Deepak Agnihotri[1], Sarah Tyson[2]**

[1]University of Salford, [2]University of Manchester

P1-0-87 **Do the hamstring muscles play a role in controlling the pelvis during unilateral internal perturbations in standing following stroke?**

***Kimberly Miller*[1], Tanya Ivanova[1], Sue Peters[1], Michael Hunt[1], Jayne Garland[1]**

[1]University of British Columbia

P1-0-88 **Evidence for sensory contributions to freezing of gait in Parkinson's disease: influence of local muscle vibration on freezing in Parkinson's disease**

***Marcelo Pereira*[1], Quincy Almeida[2], Lilian Gobbi[1]**

[1]UNESP - Rio Claro, [2]MDRC - Wilfried Laurier University

P1-0-89 **Post-stroke muscle activation in preparation for heel strike during gait**

***Sue Peters*[1], Michael Hunt[1], Tanya Ivanova[1], S. Jayne Garland[1]**

[1]University of British Columbia

P1-0-90 **The relationship between strength and balance in individuals with Parkinson's disease**

***Amie Peterson*[1], Morgan O'Connor[1], Hans Carlson[1]**

[1]Oregon Health Sciences University

P1-0-91 **Split-belt locomotion modulates gait of patients with Parkinson's disease**

***Christian Schlenstedt*[1], Alfonso Fasano[2], Jan Herzog[1], Meir Plotnik[3], Franziska Rose[4], Jens Volkmann[4], Günther Deuschl[1]**

[1]University Kiel, [2]University of Toronto, [3]University Tel Aviv, [4]University Würzburg

P1-0-92 **Subcortical activity during tonic neuromuscular behavior in healthy and PD populations: An fMRI study**

***W. Geoffrey Wright*[1], Tyler Rolheiser[1]**

[1]Temple University

P Orthopedic diseases and injuries

P1-P-93 Gait adaptations of the intact leg in transfemoral amputees. Influence of a microprocessor controlled prosthetic knee.

Erik Prinsen[1], Marc Nederhand[1], Johan Rietman[1]

[1]Roessingh Research and Development

P1-P-94 Brain activation differs between people with and without knee osteoarthritis during movement of the knee, but not other leg joints: an fMRI study

Camille Shanahan[1], Tim Wrigley[2], Kim Bennell [2], Paul Hodges[3], Michael Farrell [4]

[1]University of Melbourne, The Florey Institute of Neuroscience and Mental Health, [2]University of Melbourne, [3]University of Queensland, [4]The Florey Institute of Neuroscience and Mental Health

P1-P-95 The effect of toe contact with the ground on knee and trunk movement during walking: A preliminary study

Daisuke Uritani[1], Takahiko Fukumoto[1], Chinatsu Sakamoto[2]

[1]Kio University, [2]Yamamoto Hospital

Q Sensorimotor control

P1-Q-96 Visual improvement of human tilt responses relates to lower position and velocity thresholds in multi sensory integration

Lorenz Assländer[1], Georg Hettich[1], Albert Gollhofer[1], Thomas Mergner[2]

[1]Albert-Ludwigs-University of Freiburg, [2]University Clinics Freiburg

P1-Q-97 Improved sitting posture of upper body at rest and working personal computer induced by tactile information via closing special underwear

Yoriko Atomi[1], Tomoaki Atomi[2], Kazuya Tanaka[2], Noboru Hirose[2], Miho Shimizu[1], Yoshiro Koyama[3], Suzuki Hidetoshi [4]

[1]Tokyo University of Agriculture and Technology, [2]Teikyo University of Science, [3]RenYou Co. Ltd., [4]Toray Industries, Inc.

P1-Q-98 Contribution of foot afferents to soleus EMG activity during postural reactions

Dorothy Barthelemy [1], Annie Pham[1], Zoé Miranda[1]

[1]Université de Montréal

P1-Q-100 Interlateral asymmetries in quiet and perturbed unipedal body balance

Luis Teixeira[1], Daniel Coelho[1], Osvaldo Vieira Jr.[1]

[1]University of São Paulo

P1-Q-101 Visual planning in young children's locomotion

Dorothy Cowie[1], Oliver Braddick[2], Janette Atkinson[3]

[1]Durham University, [2]Oxford University, [3]University College London

P1-Q-102 Balance is affected in trans-tibial amputees during single-legged standing on the sound limb.

Nancy St-Onge[1], José Garcia Escorcia[1]

[1]Concordia University

P1-Q-103 Modulation of cutaneous reflexes during overground walking in the absence of vision

Andreas Miller[1], Kim Lajoie[1], Daniel Marigold[1]

[1]Simon Fraser University

P1-Q-104 In-phase and anti-phase entrainment between periodic optic flow and postural sway

Masahiro Shinya[1], Masashi Susawa[1], Daichi Nozaki[1], Kimitaka Nakazawa[1]

[1]The University of Tokyo

P1-Q-105 Motor equivalency during reaching in healthy people

Yosuke Tomita[1], Anatol Feldman[2], Mindy Levin[1]

[1]McGill University, [2]Université de Montréal

P1-Q-106 The cerebral correlates of 3D representation of space in humans

Andreas Zwergal[1], Florian Schöberl[1], Günter Kugler[1], Stefan Kohlbecher[1], Phillip Werner[1], Guoming Xiong[1], Christian la Fougere[2], Thomas Brandt[1], Marianne Dieterich[1], Klaus Jahn[1]

[1]University of Munich, [2]University of Tübingen

R Tools and methods for posture and gait analysis

P1-R-107 Trunk movement in frontal plane during gait in adults with hemiplegia after stroke

Yumi Aga[1], Koji Ohata[1], Kaoru Sakuma[1], Ryosuke Kitatani[1], Yu Hashiguchi[1], Natsuki Yamakami[1], Sayuri Osako[1], Reiko Honda[2], Kumi Nagata[2]

[1]Graduate School of Medicine, Kyoto University, [2]Kyoto University

P1-R-108 Control of locomotor heading during obstacle avoidance in individuals with visuospatial neglect

Gayatri Aravind[1], Anouk Lamontagne[1]

[1]McGill Univeristy

P1-R-109 Number of trials required to accurately evaluate spatiotemporal gait variability data using instrumented mats

Chitra lakshmi K Balasubramanian[1], Joe Stoecklein [1], David Eldridge[1], Robert Page[1], Amit Sethi[2]

[1]University of North Florida, [2]University of Pittsburgh

P1-R-110 An inexpensive, versatile, and user-friendly system for assessing postural steadiness during standing: Software module

Albert Vette[1], Quinn Boser[1], William McIlroy[2]

[1]University of Alberta, [2]University of Waterloo

P1-R-111 Age-associated changes in head jerk measured by accelerometers

Matthew Brodie[1], Hylton Menz[2], Stephen Lord[1]

[1]Neuroscience Research Australia, [2]La Trobe University

P1-R-112 A new gait analysis tool for the assessment of fall risk in older adults

Marina Brozgol[1], Holger Arndt [2], Stefan Burkard [2], Jeff Hausdorff[1], Anat Mirelman[1]

[1]Sourasky Medical Center, [2]Spring Techno GmbH & Co. KG

P1-R-113 Inertial measurement units for monitoring spatio-temporal gait parameters in Parkinson's disease: Validation in a clinical setting

Alberto Ferrari[1], Pieter Ginis[2], Laura Rocchi[3], Lorenzo Chiari[3]

[1]University of Bologna, [2]KU Leuven , [3]Universita' di Bologna

P1-R-114 Gait dynamic stability in children

Ann Hallemans[1], Paula Lobo da Costa[2], Evi Verbecque[1], Luc Vereeck[1], Peter Aerts[1]

[1]University of Antwerp, [2]Federal University of Sao Carlos

P1-R-115 Functional reorganization of the locomotor network in Parkinson patients with freezing of gait

Brett Fling[1], Rajal Cohen[2], Damien Fair[1], John Nutt[1], Fay Horak[1]

[1]Oregon Health and Science University, [2]University of Idaho

P1-R-116 Postural influence between 4 modalities to immediately test the postural influence of foot orthotics

Edouard Ceccaldi[1], Marc Janin[1]

[1]Applied Podiatry College

P1-R-117 Comparison of standard and poincare measures of stride time variability

Isabelle Killane[1], Niall Cosgrave[1], Niamh McDevitt[1], Tim Foran[2], Katie Jane Sheehan[3], John Gormley[4], Rose Anne Kenny[4], Richard Reilly[1]

[1]Trinity College Dublin, [2]St James' Hospital, Dublin, [3]Technology Research for Independent Living (TRIL), [4]St James' Hospital

P1-R-118 Postural control and cognitive efficiency following concussion

Laurie King[1], Fay Horak[1], James Chesnutt[1], Sara Walker[1], Julie Chapman[2]

[1]Oregon Health & Science University, [2]Veterans Affairs Medical Center

P1-R-119 Assessment of the sit-to-stand performance power in older persons by linear encoder

Jochen Klenk[1], Clemens Becker[1], Parvis Farahmand[2], Konstantinos Blatzonis[1], Ulrich Lindemann[1]
[1]Robert-Bosch Hospital, [2]Klinikum Leverkusen

P1-R-120 Support surface acceleration affects tibialis anterior onset latency during support surface translation perturbations

Kimberly Lang[1], Lena Ting[2], J. Lucas McKay[2]
[1]Emory University, [2]Emory University and Georgia Institute of Technology

P1-R-121 Knee stability during walking in elderly with and without knee osteoarthritis

Armaghan Mahmoudian[1], Sjoerd Bruijn[2], Hamidreza Yakhdani[3], Sabine Verschueren[1], Jaap van Dieen[2]
[1]KULeuven, [2]VU University Amsterdam, [3]University of Yazd

P1-R-122 A novel biomechanical measure to quantify post-stroke locomotor stability

Alison Oates[1], Claire Perez[2], Valeri Goussev[2], Bradford McFadyen[1], Joyce Fung[3]
[1]University of Saskatchewan, [2]Jewish Rehabilitation Hospital, [3]McGill University

P1-R-123 A new method to identify gait pattern changes before Freezing of Gait

Luca Palmerini[1], Laura Rocchi[2], Jeffrey Hausdorff[3], Lorenzo Chiari[2]
[1]University of Bologna, [2]Universita' di Bologna, [3]Tel-Aviv Sourasky Medical Center

P1-R-124 The paradigm of complexity analysis of physical activity patterns: concept validation for single-sensor configuration

Anisoara Paraschiv-Ionescu[1], Petra Benzinger[2], Ulrich Lindemann[2], Christopher Moufawad el Achka[1], Clemens Becker[2], Kamiar Aminian[1]
[1]Ecole Polytechnique Federale de Lausanne (EPFL), [2]Robert Bosch Krankenhaus

P1-R-125 Achilles tendon vibration shifts the center of pressure backward in standing and forward in sitting

Dominic Pérennou[1], Guillaume Barbieri[1], Vincent Nougier[1]
[1]Academic Hospital Grenoble

P1-R-126 Motion sequencing of rising from the floor - A model of recovery from falling

Lars Schwickert[1], Clemens Becker[1], Jochen Klenk[1], Ulrich Lindemann[1]
[1]Robert-Bosch-Krankenhaus

P1-R-127 Retest reliability of the Dikablis eye-tracker when sitting, standing and walking

Samuel Stuart[1], Lisa Alcock[2], Brook Galna[2], Sue Lord[2], Lynn Rochester[2]
[1]Institute for Ageing and Health, [2]Institute for Ageing and Health/Newcastle University

P1-R-128 Analysis of different positions by posturography in elderly. Are there differences among recurrent fallers, single fallers and no fallers?

Erika Tanaka[1], Paulo Ferreira[1], Marcela Silva[1], Patricia Silva[1], Priscila Botelho[1], Natalia Rodrigues[1], Mathues Gomes[1], Renato Moraes[1], Daniela Cristina de Abreu[1]
[1]University of São Paulo

P1-R-129 Orthotic-induced changes in rearfoot biomechanics during gait are not reflected in below shoe pressure measurements

Scott Telfer[1], Mandy Abbott[1], James Woodburn[1]
[1]Glasgow Caledonian University

P1-R-130 Decomposition of the Turn-to-Sit subtask in community dwelling older adults: what can it tell us about functional performance, cognition, and parkinsonism?

Aner Weiss[1], Anat Mirelman[1], Aron Buchman[2], David Bennett[2], Talia Herman[1], Jeffrey Hausdorff[1]
[1]Tel Aviv Sourasky Medical Center, [2]Rush University Medical Center

P1-R-131 Investigating spatial orientation: comparing the test-retest reliability of 3 protocols

Fang Zhang[1], Nandini Deshpande[1], Elsie Culham[1]
[1]Queen's University

P1-S-132 Own body transformation and spontaneous task performance in subjects with chronic balance deficits.

John Allum[1], Marina Sleptsova[1], Dagmar Schmid[1], Flurin Honegger[1], Tanja Schatz[2], Cecile Biner[2], Wolf Langewitz[1]
[1]University Hospital Basel, [2]FHNWS

S Vestibular function and disorders

P1-S-133 Validity and reliability of dynamic visual acuity (DVA) measurement during walking

Nandini Deshpande[1], Brian Peters[2]
[1]Queen's University, [2]Human Performance & Engineering Division, Wyle Laboratories

P1-S-134 Vestibular and functional outcomes in children with cochlear implants

Kristen Janky[1], Diane Givens[1]
[1]Boys Town National Research Hospital

P1-S-135 Are the balance responses to vestibular stimulation modulated after depression of the cerebellum?

Chris Lam[1], Gagan Gill[1], Richard Staines[2], Craig Tokuno[3], Leah Bent[1]
[1]University of Guelph, [2]University of Waterloo, [3]Brock University

P1-S-136 Gait characteristics of patients with phobic postural vertigo: effects of fear of falling, attention, and visual input

Klaus Jahn[1], Roman Schniepp[1], Max Wuehr[1], Sabrina Huth[1], Cauchy Pradhan[1], Thomas Brandt[1]
[1]University of Munich

P1-S-137 Visual orientation cues are used to calibrate vestibular information during quiet standing

Adam Toth[1], John Zettel[1], Leah Bent[1]
[1]University of Guelph

P1-J-138 Mechanical loading Characteristics of the Medial Compartment of the Knee Joint during Tai Chi Gait

Wei Liu[1], Jonathan Wolfe[2], John Kovaleski[2]
[1]Auburn University, Rehabilitation Biomechanics Lab, [2]University of South Alabama

Poster Session 2

Tuesday, July 1 between 10:00 and 12:00

A Activity Monitoring

P2-A-1 Drivers of change in physical activity over 18 months in incident Parkinson's disease

Gillian Barry[1], Sue Lord[1], Brook Galna[1], David Burn[1], Lynn Rochester[1]
[1]Newcastle University

P2-A-2 Physical behaviours model and event based analysis - an approach to producing patient-centered outcomes

Malcolm Granat[1]
[1]University of Salford

P2-A-3 3-day activity monitoring confirms inter-ictal alterations in patients with Freezing of Gait

Jeffrey Hausdorff[1], Aner Weiss[1], Talia Herman[1], Marina Brozgol[1], Ariel Tankus[1], Nir Giladi[1]
[1]Tel Aviv Sourasky Medical Center

P2-A-4 Quantifying transitions in patients with Parkinson's disease in the home and community setting

Eran Gazit[1], Tal Iluz [2], Aner Weiss[2], Talia Herman [3], Marina Brozgol [2], Moran Dorfman [2], Nir Giladi [4], Anat Mirelman [2], Jeff Hasdorff [5]
[1]TLVMC, [2]Laboratory for Gait and Neurodynamics, Tel-Aviv Sourasky Medical Center, [3]Sackler Faculty of Medicine, Tel-Aviv University, [4]Sagol School of Neuroscience, Sackler Faculty of Medicine, Tel-Aviv University, [5]Harvard Medical School

P2-A-5 The frequency analysis of acceleration for the detection of falling

Isu Shin[1], Soonjae Ahn[1], Jungyoon Kim[1], Youngho Kim[1]
[1]Yonsei University

P2-A-6 Comparison of 7 physical activity monitors: a validation study

Claudia Mazzà[1], Fabio Storm[1], Ben Heller[2]
[1]The University of Sheffield, [2]Sheffield Hallam University

B Aging

P2-B-7 Effects of non-slip socks on the gait patterns of older people when walking on a slippery surface

Anna Hatton[1], Daina Sturnieks[2], Stephen Lord[2], Joanne Lo[2], Hylton Menz[3], Jasmine Menant[2]
[1]The University of Queensland, [2]Neuroscience Research Australia, [3]La Trobe University

P2-B-8 Differences between older adult "slippers" and "trippers" in measures of dynamic balance during walking

Mark Hollands[1], Derek Peters[2], Paul Robinson[2], Rachel Wright[3]
[1]Liverpool John Moores University, [2]University of Worcester, [3]University of Birmingham

P2-B-9 Postural stability in complex, whole-body movements: exploring age related changes

Andrew Huntley[1], Lori Ann Vallis[1], John Zettel[1]
[1]University of Guelph

P2-B-10 Comparison of muscle power and functionality among adults and the elderly with knee osteoarthritis

Carina Junqueira[1], Roberta Brunelli[1], Elisa Libardi[1], Daniela de Abreu[1]
[1]University of São Paulo

P2-B-11 The effects of ambient lighting and macular degeneration on the ability to integrate motion for accurate foot placement

Daniel Marigold[1], Kim Lajoie[1], M. Scott Alexander[1], David Neima[2], Robert Strath[1], Stephen Robinovitch[1]
[1]Simon Fraser University, [2]N/A

P2-B-12 Obstacle influence on gait variability of individuals with Parkinson disease, Alzheimer dementia and healthy individuals

Lucas Simieli[1], Fabio A. Barbieri[2], Diego Orcioli-Silva[2], Claudia Arroyo-Teixeira[2], Ellen Lirani-Silva[2], Lilian Gobbi[2]
[1]São Paulo State University at Rio Claro, [2]UNESP - São Paulo State University at Rio Claro - Brazil

C Balance support device

P2-C-13 Real-time and carry-over effects of multi-modal biofeedback during gait and balance tasks in the elderly

Shannon Lim[1], Brian Horslen[1], Justin Davis[1], John Allum[2], Mark Carpenter[1]
[1]The University of British Columbia, [2]University Hospital Basel

P2-C-14 Effect of lightly touching to a cane on postural sway during single-leg standing

Kazushige Oshita[1], Kyotaro Funatsu[1], Sumio Yano[2]
[1]Kyushu Kyoritsu University, [2]Kobe University

D Cognitive, attentional and emotional influences

P2-D-15 Effects of instruction on turning in Parkinson's disease

Allan Adkin[1], Jacob Pfeiffer[1], Jae Patterson[1], Craig Tokuno[1]
[1]Brock University

P2-D-16 Association between personality traits and dual task performance among the community dwelling older adults-work in progress

Maayan Agmon[1], Galit Armon[1]
[1]University of Haifa

P2-D-17 Action strategies used to navigate cluttered environments and the effect of postconcussion syndrome

Carmen Baker[1], Michael Cinelli[1]
[1]Wilfrid Laurier University

P2-D-18 Cognitive compensation in the context of an unpredictable platform perturbation and simulated age-related hearing loss

Halina Bruce[1], Gifty Asare[2], Ioannis Makris[3], Daniel Aponte[3], Nancy St-Onge[4], Karen Z. H. Li[2]
[1]Concordia University, [2]PERFORM Centre, Centre for Research in Human Development, Department of Psychology, [3]PERFORM Centre, Department of Exercise Science, [4]PERFORM Centre, Department of Exercise Science, Constance-Lethbridge Rehabilitation Center, Cente

P2-D-19 Critical role of right inferior frontoparietal network in kinaesthetic illusory movement

Fabien Cignetti[1], Marianne Vaugoyeau[1], Bruno Nazarian[1], Muriel Roth[1], Jean-Luc Anton[1], Christine Assaiante[1]
[1]CNRS - Aix-Marseille Université

P2-D-20 The effect of visual tracking on stabilization of posture in a dynamic virtual environment

Orit Elion[1], Sara Snell[1], Emily Keshner[1]
[1]Temple University

P2-D-21 Center of mass movement during sit-to-walk in healthy individuals while feeling emotions

Gu Eon Kang[1], Melissa Gross[1]
[1]University of Michigan

P2-D-22 Gait dynamics during a dual task as marker for cognitive function in patients with dementia

Claudine Lamoth[1], Maartje de Groot[2], Bregje Appels[2], Jos van Campen[2]

[1]University of Groningen, University Medical Centre Groningen, [2]Slotervaart Hospital Amsterdam

P2-D-24 Exploiting the environmental demands of locomotor mobility to detect mTBI: A preliminary study

Bradford McFadyen[1], Isabelle Cossette[1], Marie-Christine Ouellet[1]

[1]Laval University

P2-D-25 The effect of attentional focus on postural control during quiet standing

Nadia Polskaia[1], Eliane Dionne[1], Natalie Richer[1], Yves Lajoie[1]

[1]University of Ottawa

P2-D-26 Impaired cognitive performance is associated with gait speed decline in oldest old people

Marjon Stijntjes[1], D.G. Taekema[2], J. Gussekloo[1], R.G.J. Westendorp[1], C.G.M. Meskers[1], A.J.M. de Craen[1], A.B. Maier[3]

[1]Leiden University Medical Center, [2]Rijnstate Hospital, [3]VU University Medical Center

E Coordination of posture and gait

P2-E-27 Interference between posture and movement underlies difficulty standing up smoothly in healthy adults

Brian Day[1], Timothy Cacciatore[1], Omar Mian[1], Amy Peters[1]

[1]University College London

P2-E-28 Postural adaptation to contracting vs expanding optic flows

Guillaume Giraudet[1], Clementine Faron[1], Jocelyn Faubert[1]

[1]Universite de Montreal

P2-E-29 The influence of height-induced anxiety on human gait characteristics during aperture crossing

Amy Hackney[1], Luke Denomme[1], Michael Cinelli[2], Jim Frank[3]

[1]University of Waterloo, [2]Wilfrid Laurier University, [3]St. Jeromes University

P2-E-30 Energy adaptations of the trunk during transitions from level to inclined surfaces

Glynnis Pardo[1], Stephen Prentice[1]

[1]University of Waterloo

G Developmental disorders

P2-G-31 Examining the sensory integration deficit hypothesis in adolescent idiopathic scoliosis: the case of proprioceptive information

Christine Assaiante[1], Fabien Cignetti[1], Jean-Luc Jouve[2], Gérard Bollini[2], Marianne Vaugoyeau[1]

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P2-G-32 Vestibular assessments in children with global developmental delay: An exploration of test-retest reliability of three evaluation tools.

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J Exercise and physical activity

P2-J-33 Postural control in individuals with spinal cord injury: Training, functional performance, and mechanisms

Anna Bjerkefors [1], Jordan Squair[2], Zhen Chen[3], Tania Lam [3], Mark Carpenter [3]

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P2-J-34 Baseline white matter lesions do not minimize the benefit of resistance training on mobility and balance: results from a 12-month randomized controlled trial

Elizabeth Dao[1], Niousha Bolandzadeh[1], Roger Tam[1], Lindsay Nagamatsu[1], Liang Hsu[1], David Li[1], Teresa Liu-Ambrose[1]

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P2-J-35 Development of a rating scale for perceived stability during balance training

Debbie Espy[1], Nathan Casey[1], Tony Wiland[1], Natalie Kuchta[1], M Reinthal[1]

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P2-J-37 Effects of proprioceptive exercises for patients with chronic low back and neck pain: A systematic review

Michael McCaskey[1], Corina Schuster-Amft[2], Nicole Wenderoth[1], Eling de Bruin[1]

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P2-J-38 The effects of walking on fall prevention in lower-risk community-dwelling older adults

Yoshiro Okubo[1], Yosuke Osuka[1], Songee Jung[1], Raphael Figueroa[1], Takehiko Tsujimoto[1], Tatsuya Aiba[1], Teho Kim[1], Kiyoji Tanaka[1]

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P2-J-39 Locomotor and respiratory adaptability and interactions post-stroke

Cynthia Otfinowski[1], Jadranka Spahija[1], Joyce Fung[1]

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P2-J-40 An intensive exercise program improves motor performances in patients with dementia: translational model of geriatric rehabilitation

Michael Schwenk[1], Ilona Dutzi[2], Bijan Najafi[1], Jane Mohler[1], Klaus Hauer[3]

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P2-J-41 Comparison of swing-related muscles activation in walking and running across a range of speeds.

Camila Taira[1], Ryoji Kiyama[1], Erika Tanaka [2], Kiyohiro Fukudome[1], Tetsuo Maeda[1]

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K Falls and falls prevention

P2-K-42 Reactive gait transitions improve after induced stepping training

Woei-Nan Bair[1], Robert Creath[1], Masashiro Fujimoto[1], Andrea Gaeta[1], Janice Abarro[1], Sandy McCombe-Waller[1], Michelle Prettyman[1], Brock Beamer[1], Mark Rogers[1]

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P2-K-43 Fall risk prediction in high-functioning community-dwelling older adults: Reconsideration of clinical balance measures

Chitra lakshmi K Balasubramanian[1], Dawn Saracino[1], Rob Robinson[1], Amber Boyette[2], Peter Wludyka[1]

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P2-K-44 The role of proprioception during postural control in elderly and Parkinson's Disease patients with a history of falls

Esther Bekkers[1], Kimberly Dockx[1], Sabine Verschueren[1], Elke Heremans[1], Sarah Vercruysse[1], Alice Nieuwboer[1]

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P2-K-45 Adaptations to large-scale treadmill-based perturbation training:Improvements in spatial and temporal parameters of the reactive response

Tanvi Bhatt[1], Prakruti Patel[1]

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P2-K-46 Temporal and kinematic parameters of real falls recorded from older adults using accelerometers attached to the lower back.

***Alan Bourke*[1], Lorenzo Chiari[2], Aminian Kamiar[3], Clemens Becker[4], Lars Schwickert[4], Jochen Klenk[4]**

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P2-K-47 Safety on stairs: influence of a tread edge highlighter and its position

***Richard Foster*[1], John Hotchkiss[1], David Elliott[1], John Buckley[1]**

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P2-K-48 Associate factors to fear of falling in elderly with Parkinson's disease

***Erika Franzén*[1], Maria Hagströmer[1], David Conradsson[1], Maria Nilsson[2]**

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P2-K-49 Validity and reliability of psychological measures related to fear of falling in older community-dwelling individuals

***Laura Hauck*[1], Mark Carpenter[2], James Frank[3]**

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P2-K-51 Higher involvement of executive dysfunction in serious falls will fracture than in slight falls

***Kristell Pothier*[1], Christian Marcelli[1], Valérie Caridroit[1], Pablo Descatoire[1], Pascale Lescure[1], Antoine Langeard[1], Nicolas Bessot[1], Chantal Chavoix[1]**

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P2-K-52 Exploring the causes of falls and balance impairments in people with neuropathy

***Gita Ramdharry*[1], Magdalena Dudziec[1], David Tropman[2], Liz Dewar[3], Amanda Wallace[3], Matilde Laura[3], Robert Grant[1], Mary Reilly[3]**

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P2-K-53 Margin of dynamic stability (MDS) during walking combined with grasping in fallers older adults

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P2-K-54 The influence of the content of speech production and perception on gait variability

***Katie Sheehan*[1], Rose Kenny[2], Isabelle Killane[3], John Gormley[4], Tim Foran[5]**

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P2-K-55 Exergaming for fall risk reduction: Investigating older players' movement characteristics

***Nina Skjæret*[1], Ather Nawaz[1], Kristine Ystmark[1], Jorunn Helbostad[1], Beatrix Vereijken[1]**

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P2-K-56 Biomechanical and physiological determinants for hip impact during falls in older adults

***Yijian Yang*[1], Dawn Mackey[1], Teresa Liu-Ambrose[2], Stephen Robinovitch[1]**

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L Habilitation and rehabilitation

P2-L-57 Wearable auditory biofeedback of gait for persons with Parkinson's Disease

***Alberto Ferrari*[1], Filippo Casamassima[2], Pieter Ginis[3], Eran Gazit[4], Laura Rocchi[2], Moran Dorfman[4], Alice Nieuwboer[3], Lorenzo Chiari[2]**

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P2-L-58 Is perception of vertical impaired in individuals with chronic stroke with a history of 'pushing'?

***Avril Mansfield*[1], Roshanth Rajachandrakumar[2], Lindsey Fraser[3], Cynthia Danells[4], Svetlana Knorr[1], Jennifer Campos[1]**

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P2-L-59 Adapted tango alters center of mass displacement and muscular activity during reactive balance in individuals with Parkinson?s disease

***Johnathan McKay*[1], Lena Ting[1], Madeleine Hackney[2]**

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P2-L-60 Dynamic balance while walking on a treadmill with a load on the ankle in hemiparetic individuals

***Carole Miéville*[1], Séléna Lauzière[2], Martina Betschart[2], Sylvie Nadeau[2], Cyril Duclos[2]**

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P2-L-61 Timing of providing ankle-foot orthoses in (sub)acute stroke patients: first results on balance-related measures of mobility

***Corien Nikamp*[1], Jaap Buurke[1], Marc Nederhand[1], Johan Rietman[1], Hermie Hermens[1]**

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P2-L-62 The effect of local muscle vibration on the sit-to-walk performance

***Marcelo Pereira*[1], Paulo Henrique Pelicioni[1], Lilian Gobbi[1]**

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P2-L-63 The effect of a unilateral ankle foot orthosis on the kinematics in normal walking

***Jacqueline Romkes*[1], Reinald Brunner[1]**

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P2-L-64 Using action-sounds to cue gait in Parkinson's disease patients with freezing of gait

***William Young*[1], Lauren Shreve[2], Emma Quinn[2], Cathy Craig[3], Helen Bronte-Stewart[2]**

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P2-M-65 Visually guided interlimb adaptation during walking in children and adults: 'virtual' split-belt treadmill adaptation

***Julia Choi*[1], Peter Jensen[1], Jens Bo Nielsen[1]**

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M Learning, plasticity and compensation

P2-M-66 Adaptation of multi-joint balance coordination to whole body force fields

***Denise Engelhart*[1], Alfred Schouten[2], Ronald Aarts[1], J Pasma[3], Carel Meskers[4], Andrea Maier[4], Herman van der Kooij[1]**

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P2-M-67 The effects of transcranial transcutaneous electrical nerve stimulation on primary motor cortex enhance implicit motor learning process and cortical excitability

***Jer-Junn Luh*[1], Cheng-Kai Shih[1]**

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N Modeling, robotics and biomechanics and implantable neuroprosthesis

P2-N-68 Modelling of optimal locomotor avoidance strategies with the differential games approach

Anuja Darekar[1], **Valery Goussev**[2], **Bradford McFadyen**[3], **Anouk Lamontagne**[1], **Joyce Fung**[1]
[1]McGill University, [2]Feil & Oberfeld CRIR Research Center, Jewish Rehabilitation Hospital, [3]Laval University

P2-N-69 A case study on gait improvement after clinical program using robot suit HAL in a stroke patient

Hideki Kadone[1], **Yukiko Ueno**[1], **Kiyoshi Eguchi**[1], **Ryohei Ariyasu**[1], **Shigeki Kubota**[1], **Shun Irie**[1], **Hiroaki Kawamoto**[1], **Yoshio Nakata**[1], **Akira Matsushita**[1], **Masataka Sakane**[1], **Yoshiyuki Sankai**[1]
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P2-N-70 Assessment of postural stability and balance in Parkinson disease patients after deep brain stimulation surgery using full body motion capture suit

Kristina Ognjanovic[1], **Mehdi Delrobaei** [2], **Mandar Jog**[3], **Greydon Gilmore**[1]
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P2-N-71 The applicability of the inverted pendulum model to stooping and crouching postures

Tyler Weaver[1], **Michal Glinka**[1], **Andrew Laing**[1]
[1]University of Waterloo

O Neurological diseases

P2-O-72 Increased lateral position of the center of mass during turning is associated with freezing of gait in Parkinson's disease

Aniek Bengevoord[1], **Griet Vervoort**[1], **Wim Vandenberghe**[2], **Alice Nieuwboer**[1], **Joke Spildooren**[1]
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P2-O-73 Deficits in predictive scaling of postural responses in people with Multiple Sclerosis (MS)

Geetanjali Dutta[1], **Fay Horak**[2]
[1]Oregon Health Sciences University, [2]Oregon Health Sciences University, Veterans Adminstration Medical Center

P2-O-74 How does dopaminergic dysfunction in Parkinson's disease influence planning for stepping over multiple obstacles during gait? Insights from gaze behaviour.

Frederico Faria[1], **Jeffery Jones**[2], **Quincy Almeida**[3]
[1]Wilfrid Laurier University/MDRRC, [2]Wilfrid Laurier University, [3]Sun Life Financial Movement Disorders Research & Rehabilitation Centre/Wilfrid Laurier University

P2-O-75 Reduced structural connectivity of proprioceptive neural pathways in MS

Brett Fling[1], **Michelle Cameron**[1], **Fay Horak**[1]
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P2-O-76 Single and dual tasking in high risk individuals for Parkinson's disease

Markus Hobert[1], **Sebastian Kleinhans**[2], **Sandra Hasmann**[2], **David Weiss**[2], **Eva Schaeffer**[2], **Johannes Streffer**[3], **Inga Liepelt-Scarfone**[2], **Daniela Berg**[2], **Walter Maetzler**[2]
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P2-O-77 Adaptability of gait in stroke survivors: Relationships to clinical measures of balance, motor recovery and walking speed

Kristen Hollands[1], **Trudy Pelton**[2], **Jonathan Mathias**[2]
[1]University of Salford, [2]University of Birmingham

P2-O-78 Cutaneous sensory function and plantar foot pressures during walking in people with Multiple Sclerosis

Stephanie Jones[1], **Jebb Remelius**[2], **Karthik Sugumaran**[1], **Michael Busa**[1], **Richard Van Emmerik**[1]
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P2-O-79 The integration of vision and proprioception on obstacle crossing strategies in people with motor-incomplete spinal cord injury.

Raza Malik[1], **Tania Lam** [1]
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P2-O-80 Effects of foot support on sitting postural stability among individuals with spinal cord injury

Matija Milosevic[1], **Kei Masani**[2], **Meredith Kuipers**[1], **Hossein Rahouni**[1], **Mary Verrier**[1], **Kristiina Valter McConville**[3], **Milos Popovic**[1]
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P2-O-81 Effects of aging and disease on frontal brain activation while walking and dual tasking

Anat Mirelman[1], **Inbal Maidan**[1], **Hagar Bernad-Elazari**[1], **Freek Nieuwhof**[2], **Miriam Reelick**[3], **Nir Giladi**[1], **Jeffrey Hausdorff**[1]
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P2-O-82 Cerebellar gray matter volume and balance functions in Parkinson disease

Martijn Muller[1], **Roger Albin**[1], **Nicolaas Bohnen**[1]
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P2-O-83 Neuronal correlates of steering in the human brain - changes induced by stroke

Caroline Paquette[1], **Jean-Paul Soucy**[1]
[1]McGill University

P2-O-84 Asymmetric pattern of lower extremity loading during post-stroke gait

Kara Patterson[1], **Stephanie Marrocco**[2], **Stephen Parsons**[2], **Ian Jones**[3], **Trevor Birmingham**[2]
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P2-O-85 Dual-task interference is related to PPN structural connectivity in people with Parkinson disease who freeze

Daniel Peterson[1], **Rajal Cohen**[2], **Brett Fling**[1], **Martina Mancini**[1], **John Nutt**[1], **Fay Horak**[1]
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P2-O-86 Effect of gaze fixation on gait parameters in Parkinson's Disease

Rebecca Reed-Jones[1], **V.N. Pradeep Ambati**[2], **Nicholas Murray**[2], **Fabricio Saucedo**[2], **Caitlin Schneider**[3], **Douglas Powell**[3]
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P2-O-87 General motor-cognitive deficits in the postural instability and gait disorder (PIGD) subtype in Parkinson's disease (PD)

Griet Vervoort[1], **Aniek Bengevoord**[1], **Alenxandra Vanneste**[1], **Sarah Vercruysse**[1], **Wim Vandenberghe**[1], **Alice Nieuwboer**[1]
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P2-O-88 Postural responses to base of support and visual field in adults with cerebral palsy

Yawen Yu[1], **Emily Keshner**[1], **Carole Tucker**[1], **Elizabeth Thompson**[1], **Richard Lauer**[1]
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P Orthopedic diseases and injuries

P2-P-89 Comparison of postural control with different customized foot orthoses on isolated subtalar arthrodesis

Ceccaldi Edouard[1], Marc Janin[2]
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P2-P-90 Gait kinematics after partial amputation of the toes due to the frostbite

Wanda Forczek[1], Yuri Ivanenko[2], Simon Taylor[3]
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P2-P-91 Fear of falling is not elevated in younger patients after total knee replacement

Brian Street[1], William Gage[1]
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Q Sensorimotor control

P2-Q-92 The effect of concussions on the loading phase of gait initiation

Michael Cinelli[1], Kaley Powers[1], Adam Harper[1]
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P2-Q-93 Do load sensations at the foot sole contribute to enhanced postural stability when ankle feedback is increased?

Brian Dalton[1], Billy Luu[2], John Inglis[2], Michael Koehle[2], HFM Van der Loos[2], Elizabeth Croft[2], Jean-Sébastien Blouin[2]
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P2-Q-94 Proprioceptive vibration effects on older healthy subjects

Noémie Duclos[1], Luc Maynard[2], Serge Mesure[1]
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P2-Q-95 Cortical activity during the planning to cross an obstacle in young healthy adults

Natsu Fujiwara[1], Kozo Ueta[1], Shu Morioka[1]
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P2-Q-96 Analysis of factors influencing the functional reach test in a cohort of 1102 elderly

Sandra Hasmann[1], Markus Hobert[1], Jana Staebler[1], Sebastian Kormeier[1], Gerhard Eschweiler[1], Daniela Berg[1], Walter Maetzler[1]
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P2-Q-97 Reaching the limits of cognitive resources: Control strategies used by children during a multi-task paradigm.

Dorelle Hinton[1], Lori Ann Vallis[1]
[1]University of Guelph

P2-Q-98 Proprioceptive postural control and sit-to-stand-to-sit performance after first-time lumbar micro-discectomy: The effect of surgical approach and early individualized physical therapy

Lotte Janssens[1], Simon Brumagne[1], Kurt Claeys[1], Madelon Pijnenburg[1], Nina Goossens[1], Bart Depreitere[1]
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P2-Q-99 Effect of light touch on quiet stance and reactive postural responses in post-stroke individuals

Alessandra Martinelli[1], Daniel Coelho[1], Fernando Magalhães[2], Andre Kohn[2], Luis Augusto Teixeira[1]
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P2-Q-100 Subcortical structures in humans can be facilitated by transcranial direct current stimulation

Jorik Nonnekes[1], Anass Arrogi[2], Moniek Munneke[2], Edwin van Asseldonk[3], Lars Oude Nijhuis[2], Alexander Geurts[2], Vivian Weerdesteyn[2]
[1]Radboud University Medical Centre, [2]Radboud University Medical Centre Nijmegen, [3]Department of Biomechanical Engineering, MIRA, University of Twente

P2-Q-101 The effect of conflicting virtual scenery on leveled and inclined gait

Meir Plotnik[1], Yotam Bahat[2], Yoav Gimmon[1], Rivka Inzelberg[1]
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P2-Q-102 Insoles impact on imagined and actual movement

Puil Carole[1], Marc Janin[2]
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P2-Q-103 Decline in lateral step initiation in older adults: a longitudinal study

Patrick Sparto[1], J. Richard Jennings[1], Mark Redfern[1], Joseph Furman[1]
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P2-Q-104 The influence of the dorsal foot skin during a vestibular perturbation

Meghan Yip[1], Gagan Gill[1], Christopher Lam[1], Stephen Brown[1], Leah Bent[1]
[1]University of Guelph

P2-Q-105 The relationship of sensory functions with head and trunk control during locomotion in healthy young and older adults

Fang Zhang[1], Nandini Deshpande[1]
[1]Queen's University

P2-Q-106 Brain activation during staircase and plane locomotion

Andreas Zwergal[1], Florian Schöberl[1], Phillip Werner[1], Guoming Xiong[1], Christian la Fougere[2], Klaus Jahn[1]
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R Tools and methods for posture and gait analysis

P2-R-107 The effect of accelerometer mass in the mechanomyography measurement

Soonjae Ahn[1], Youngho Kim[1]
[1]Yonsei University

P2-R-108 Relation between vestibular-ocular reflex tests, and stance and gait posturography after an acute unilateral peripheral vestibular deficit.

John Allum[1], Flurin Honegger[1]
[1]University Hospital Basel

P2-R-109 Multi-segment kinematic assessment of human trunk: sensitivity to skin Artifacts

Sara Mahallati[1], Hossein Rouhani[1], Kei Masani[1], Richard Preuss[1], Milos Popovic[1]
[1]University of Toronto

P2-R-110 Postural responses to closed-loop angular perturbations of support surface

Jan Babic[1], Luka Peternel[1]
[1]Jozef Stefan Institute

P2-R-111 Construct validity and internal consistency of the Mini BESTest in individuals with Parkinson's disease

Martin Benka Wallén[1], Niklas Löfgren[1], David Conradsson[1], Maria Hagströmer[1], Erika Franzén[1]
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P2-R-112 **Assessment of gait pattern in individuals with knee osteoarthritis classified by WOMAC questionnaire**

Roberta Brunelli[1], **Marcello Nogueira-Barbosa[1], Carina Junqueira[1], Elisa Libardi[1], Jaqueline Porto[1], Ana Claudia Rennó[2], Daniela Cristina Abreu[1]**
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P2-R-113 **Motor behavior and influence of pathological state to movement characteristics across different movement classes**

Massimo Cenciarini[1], **Christoph Maurer[1], Maren Bennewitz[1], Hannah Bast[1]**
[1]Albert-Ludwigs-Universität Freiburg

P2-R-114 **Fractal dynamics while walking on conventional and feedback-controlled treadmill**

Gyerae Tack[1], **Jinseung Choi[1], Dongwon Kang[1]**
[1]Konkuk University

P2-R-115 **Postural control stabilises over the first 30 seconds of quiet standing in Parkinson's disease: time series analysis.**

Silvia Del Din[1], **Shirley Coleman[1], Alan Godfrey[1], Brook Galna[1], Lynn Rochester[1]**
[1]Newcastle University

P2-R-116 **Lyapunov exponents in the nonlinear analysis of falls and frailty**

Timothy Foran[1], **Richard Reilly[2], Rose Anne Kenny[2]**
[1]St. James's Hospital, [2]Trinity College Dublin

P2-R-117 **Towards detection of freezing of gait in Parkinson's disease patients during daily living activities**

Eran Gazit[1], **Ariel Tankus[2], Talia Herman[3], Sinziana Mazilu[4], Gerhard Troester[4], Nir Giladi[5], Anat Mirelman [3], Jeffrey Hausdorff[6]**
[1]TLVMC, [2]Neurosurgery Unit, Tel-Aviv Sourasky Medical Center, [3]Laboratory for Gait and Neurodynamics, Movement Disorders Unit, Tel-Aviv Sourasky Medical Center, [4]Wearable Systems Laboratory, Swiss Federal Institute of Technology , [5]Dept. of Neurology, Sac

P2-R-118 **Motor assessment of Parkinson disease patients following deep brain stimulation surgery using gait analysis technology**

Greydon Gilmore[1], **Mehdi Delrobaei[1], Kristina Ognjanovic[1], Mandar Jog[1], Fariborz Rahimi[1], Billy Xian[1]**
[1]Western University

P2-R-119 **A new wavelet-based assessment of inter-joint coordination in walking of young and healthy older adults**

Espen Alexander Ihlen[1], **Beatrix Vereijken[1], Tobias Goihl[1], Per Bendik Wik[1], Olav Sletvold[1], Jorunn Helbostad[1]**
[1]Norwegian University of Science and Technology

P2-R-120 **Age-related changes of verticality perception during upright stance**

Klaus Jahn[1], **Jeannine Bergmann[2], Antoanela Kreuzpointner[1], Carmen Krewer[3], Andreas Schepermann[1], Stanislavs Bardins[1], Friedemann Müller[4], Eberhard Koenig[4]**
[1]University of Munich, [2]University of Munich and Schoen Klinik, [3]Schoen Klinik, [4]Schoen Klinik

P2-R-121 **Dynamic gait instability occurs at different time scales for young and older adults**

Brittney Muir[1], **Jeffrey Haddad[1], Shirley Rietdyk[1], Richard Van Emmerik[2]**
[1]Purdue University, [2]University of Massachusetts

P2-R-122 **The coordination of gait and cane use in people post-stroke**

Claire Perez[1], **Valeri Goussev[1], Joyce Fung[2]**
[1]Jewish Rehabilitation Hospital , [2]McGill University

P2-R-124 **Measurement of relation between plantar skin friction and plantar skin slipped area during a walk**

Takayuki Shiina[1], **Akira Obara[1], Yuka Iijima[1], Shogo Shibasaki[1], Hiroshi Takemura[1], Hiroshi MIzoguchi[1]**
[1]University of Science

P2-R-125 **Using the systems framework for postural control to analyze the components of balance evaluated in standardized balance measures: a scoping review**

Kathryn Sibley[1], **Marla Beauchamp[2], Karen Van Ooteghem[3], Sharon Straus[4], Susan Jaglal[4]**
[1]Toronto Rehabilitation Institute, [2]Harvard Medical School, [3]University of Waterloo, [4]University of Toronto

P2-R-126 **Clinical assessment of trunk muscle and balance function in persons with spinal cord injury**

Jordan Squair[1], **Anna Bjerkefors[2], Mark Carpenter[1]**
[1]University of British Columbia, [2]The Swedish School of Sport and Health Sciences

P2-R-127 **A comparative study on different posturographic descriptors to assess standing balance in young children**

Ann Hallemans[1], **Evi Verbecque[1], Paula Lobo da Costa[2], Marcus Fraga Vieira[3], Luc Vereeck[1], Peter Aerts[1]**
[1]University of Antwerp, [2]Federal University of Sao Carlos, [3]Federal University of Goias

P2-R-128 **Is Kinect suitable for measuring whole body movement patterns during exergaming?**

Mike van Diest[1], **Jan Stegenga[1], Heinrich Wörtche[1], Klaas Postema[2], Gijsbertus Verkerke[2], Claudine Lamoth[2]**
[1]INCAS[3], [2]University Medical Center Groningen

P2-R-129 **Rotation amplitude dependency of the intrinsic ankle stiffness during standing**

Mark Vlutters[1], **Herman van der Kooij[1], Alfred Schouten[1], Tjitske Boonstra[1]**
[1]University of Twente

P2-R-130 **Correct method to measure knee angle in standing phase of gait**

Hiroyuki Yamamoto[1]
[1]HImeji Dokkyo Unuiversity/Faculty of Health Care Sciences

P2-R-131 **Analysis of the tilt of the main axis in normal subjects using the Body Tracking Test**

Tomoe Yoshida[1], **Fuyuko Ikemiyagi[2], Masahiko Yamamoto[2], Mitsuya Suzuki[2]**
[1]Toho University Sakura Medical Center, [2]Toho University (Sakura)

S Vestibular function and disorders

P2-S-132 **Mechanisms of gaze stability during walking: differences between active and passive walking**

Eric Anson[1], **John Carey[2], Tim Kiemel[3], John Jeka[4]**
[1]UMD, [2]Johns Hopkins Medical Institute, [3]University of Maryland, [4]Temple University

P2-S-133 **Unilateral vestibular loss impairs external space representation**

Liliane Borel[1], **Christine Redon-Zouiteni [1], Pierre Cauvin [1], Michel Dumitrescu[1], Arnaud Devèze[2], Jacques Magnan[2], Patrick Péruch [1]**
[1]CNRS/Aix-Marseille University , [2]ENT Department

P2-S-134 **Electrophysiological recording of jerk component of linear vestibulo-ocular reflex in humans**

Hugh Nolan[1], **John Butler[2], Isabelle Killane[3], Heinrich Bülthoff[4], Richard Reilly[2]**
[1]TILDA, [2]Trinity Centre for Bioengineering, Trinity College Dublin, [3]Trinity Center for Bioengineering, Trinity College Dublin, [4]Max Planck Institute for Biological Cybernetics

P2-S-135 **The effects of self-perceived motion in the presence of virtual stimuli and galvanic vestibular stimulation on postural control**

Fabricio Saucedo[1], **Rebecca Reed-Jones[2]**
[1]University of Texas at El Paso, [2]University of Prince Edward Island

P2-S-136 High rate of falls among patients with vertigo and dizziness - data from a tertiary care center
Klaus Jahn[1], Cornelia Schlick[1], Roman Schniepp[1]
[1]University of Munich

Poster Session 3

Wednesday, July 2 between 09:30 and 11:30

A Activity Monitoring

P3-A-1 Pre-impact fall detection using an inertial sensor unit
Soonjae Ahn[1], Isu Shin[1], Jeseong Ryu[1], Youngho Kim[1]
[1]Yonsei University

P3-A-2 Levels and patterns of physical activity and inactivity in elderly individuals with Parkinson's disease
Martin Benka Wallén[1], Håkan Nero[1], Erika Franzén[1], Maria Hagströmer[1]
[1]Karolinska Institutet

P3-A-3 An instrumented version of the Berg Balance Scale to assess postural control
George Fulk[1], Wenlong Tang[2], Edward Sazonov[2], Stacey Zeigler[1]
[1]Clarkson University, [2]University of Alabama

P3-A-4 Prevalence and circumstances of falls in young adults: 29% fell in a five week observation period
Michel Heijnen[1], Shirley Rietdyk[1]
[1]Purdue University

P3-A-5 Low physical activity is associated with impaired cognitive function in PD
Inga Liepelt-Scarfone[1], Bernhard Cerff[2], Malte Kampmeyer[2], Jos Prinzen[3], Markus Hobert[2], Menno Zuidema[3], Susanne Graeber[2], Daniela Berg[2], Walter Maetzler[2]
[1]German Center for Neurodegenerative Diseases and Hertie Institute for Clinical Brain Rearch, [2]Hertie Institute for Clinical Brain Rearch and German Center for Neurodegenerative Diseases, [3]McRoberts B.V

P3-A-6 Accelerometer filter choice - effects on measures of elderly with Parkinson´s disease
Håkan Nero[1], Martin Benka Wallén[1], Erika Franzén[1], Maria Hagströmer[1]
[1]Division of Physiotherapy

P3-A-7 Targeting sedentary behaviour using sensory feedback to change posture
Daniel Rafferty[1], Carol Makarios [1]
[1]Glasgow Caledonian University

B Aging

P3-B-8 Gait and postural sway deteriorate differently with age
Patricia Carlson-Kuhta[1], Jeong-Ho Park[2], Carolin Curtze[1], Martina Mancini[1], Fay Horak[1]
[1]Oregon Health & Science University, [2]Soonchunhyang University, Bucheon Hospital

P3-B-9 Balance and mobility deficits in older adults with Type 2 Diabetes Mellitus who do not report mobility disability
Nandini Deshpande[1], Patricia Hewston[1], Karyna Figueiredo - Ribeiro[2], Tessa Elliott[1], Sebastian Spears[1]
[1]Queen's University, [2]Universidade Federal do Rio Grande do Norte

P3-B-10 Exploring measures to better assess the effect of cold on dynamic balance in a young and older female population
Dwight Waddell[1], Harish Chander[1], Christi Brewer[2]
[1]University of Mississippi, [2]University of Eastern Washington

P3-B-11 Analysis of muscle power and postural control in elderly women of different age groups
Matheus Gomes[1], Daniela Abreu[1], Júlia Reis[2]
[1]University of São Paulo, [2]Federal University of Sergipe

P3-B-12 Comparing compensatory reactions in young and older adults in response to platform perturbations during gait
Emily McIntosh[1], John Zettel[2], Lori Ann Vallis[2]
[1]University of Waterloo, [2]University of Guelph

P3-B-13 Effect of higher muscle coactivation on standing postural response to perturbation in older adults
Koutatsu Nagai[1], Yusuke Okita[2], Shinya Ogaya[3], Yuichi Nakamura[4], Tadao Tsuboyama[4]
[1]Kyoto Tachibana University, [2]Kyoto University, [3]Osaka prefecture University, [4]Kyoto University

C Balance support device

P3-C-14 Functional electrical stimulation of trunk muscles increases trunk stiffness during quiet sitting
Matija Milosevic[1], Kei Masani[2], Noel Wu[1], Kristiina Valter McConville[3], Milos Popovic[1]
[1]University of Toronto, [2]Toronto Rehabilitation Institute - University Health Network, [3]Ryerson University

P3-C-15 Early identification of declining balance in higher functioning older adults
Katie Sheehan[1], Barry Greene[2], Lisa Crosby[3], Clodagh Cunningham[4], Rose Kenny[4]
[1]Vancouver Coastal Health Authority, [2]University College Dublin, [3]Trinity College Dublin, [4]Technology Research for Independent Living

D Cognitive, attentional and emotional influences

P3-D-16 Adaptability of reactive postural responses as a function of voluntary task constraint: influence of aging
Andrea Cristina De Lima-Pardini[1], Daniel Coelho[1], Marina Silva[2], Fay Horak[3], Alessandra Martinelli[1], Nametala Azzi[1], Luis Teixeira[1]
[1]University of Sao Paulo, [2]University Anhanguera, [3]Oregon Health and Science University

P3-D-17 Focusing attention on reaction time improves postural control and reaction time in young adults
Deborah Jehu[1], Alyssa Desponts[1], Nicole Paquet[1], Yves Lajoie[1]
[1]University of Ottawa

P3-D-18 Postural task difficulty decreases the regularity of center of pressure
Kimberlee Jordan[1], Zheng Wang[2], John Challis[2], Karl Newell[2]
[1]Callaghan Innovation, [2]The Pennsylvania State University

P3-D-19 Slow Gait does not protect against distractions
Hyun Gu Kang[1], Dan Thap[2]
[1]California State Polytechnic University, Pomona, [2]Western University of Health Sciences

P3-D-20 Effects of cognitive dual-tasks on postural sway in older adults with Mild Cognitive Impairment
Julia Leach[1], Martina Mancini[1], Jeffrey Kaye[1], Tamara Hayes[1], Fay Horak[1]
[1]Oregon Health & Science University

P3-D-21 **Effects of transcranial direct current stimulation (tDCS) to right posterior parietal cortex (PPC) on visuospatial attention and obstacle crossing in young adults**

On-Yee Amy Lo[1], Li-Shan Chou[1]

[1]University of Oregon

P3-D-22 **Attentional allocation to visually guided walking depends on age and executive function**

Masood Mazaheri[1], Melvyn Roerdink[2], Robert Jan Bood[2], Jacques Duysens[3], Peter Beek[2], C. (Lieke) Peper [2]

[1]MOVE Research Institute Amsterdam, Faculty of Human Movement Sciences, VU University Amsterdam, Amsterdam, Netherlands, [2]MOVE Research Institute Amsterdam, Faculty of Human Movement Sciences, VU University Amsterdam, [3]Department of Kinesiology, KU-Le

P3-D-23 **The "Stroop Walking Task": An innovative dual task for detecting executive function impairment.**

Anaick Perrochon[1], Gilles Kemoun[2], Eric Watelain[3], Benoit Dugue[2], Alain Berthoz[4]

[1]UFR STAPS, University of Poitiers, [2]University of Poitiers, [3]Université de Toulon , [4]Collège de France

P3-D-24 **Influence of cognitive demand on center-of-pressure sway and coactivation of ankle muscles during quiet standing in individuals with stroke**

Kozo Ueta[1], Moe Kikuchi[2], Ryo Sakamoto[2], Michihiro Osumi[1], Hideki Nakano[1], Koichi Mukai[3], Sadaaki Yata[2], Shu Morioka[1]

[1]Kio University, [2]hoshigaoka koseinenkin hospital, [3]shijonawate gakuen University

P3-D-25 **Falling head over heels: assessing the cognitive and electrophysiological processes underlying gait and falls.**

Elizabeth Walshe[1], Sean Commins[1], Richard A. P. Roche[1]

[1]National University of Ireland Maynooth

P3-D-26 **Do individual traits and characteristics influence postural strategy under conditions of height-induced postural threat?**

Martin Zaback[1], Taylor Cleworth[2], Mark Carpenter[2], Allan Adkin[1]

[1]Brock University, [2]University of British Columbia

E Coordination of posture and gait

P3-E-27 **Effect of chronic low back pain in spatio-temporal gait parameters during walking combined with hand prehension movements**

Priscila Abbári Rossi[1], Natalia Rinaldi[1], Renato Moraes[1]

[1]Medicine School of Ribeirao Preto, University of São Paulo

P3-E-28 **The stepping threshold with an upper body pull postural perturbation paradigm**

Dmitry Verniba[1], Ravi Chaudhari[1], William Gage[1]

[1]York University

F Development of posture and gait

P3-F-29 **Obstacle avoidance strategies in the developing child**

Sharissa Corporaal[1], Sjoerd Bruijn[2], Jacques Duysens[1], Stephan Swinnen[1]

[1]KU Leuven, [2]MOVE Amsterdam

P3-F-30 **Development of gait in children revealed by principal component model of lower-limb kinematics and kinetics**

Akira Sawatome[1], Mitsunori Tada[2], Hiroshi Takemura[1], Makiko Kouchi[2], Masaaki Mochimaru[2]

[1]TUS, [2]AIST

H Effect of medication on posture and gait

P3-H-31 **Effects of levodopa and severity of Parkinson's disease on postural sway and gait**

Carolin Curtze[1], Martina Mancini[1], Patricia Carlson-Kuhta[1], John Nutt[1], Fay Horak[1]

[1]Oregon Health & Science University

P3-H-32 **Influence of levodopa on stepping threshold to pulls in Parkinson's disease.**

Irene Di Giulio[1], Rebecca St George[1], Eirini Kalliolia[1], Daniel Voyce[1], Amy Peters[1], Brian Day[1]

[1]University College London

P3-H-33 **N-acetyl-L-leucine accelerates vestibular compensation after unilateral labrinthectomy by action in the cerebellum and thalamus**

Andreas Zwergal[1], Lisa Günther[1], Guoming Xiong[1], Klaus Jahn[1], Michael Strupp[1], Marianne Dieterich[1], Christian la Fougere[2], Roswitha Beck[1]

[1]University of Munich, [2]University of Tübingen

J Exercise and physical activity

P3-J-34 **Exergaming (Xbox Kinect®) versus mirror matched gym based exercise for postural control in healthy adults: a Randomised Controlled Trial.**

Gillian Barry[1], Alasdair MacSween[2], John Dixon[2], Paul van-Schaik[2], Denis Martin[2]

[1]Newcastle University, [2]Teesside University

P3-J-35 **On the move: Feasibility of a group-based motor learning exercise program in community-dwelling older adults with impaired mobility**

Jennifer Brach[1], Sara Francois[2], Subashan Perera[1], Jessie VanSwearingen[1], Stephanie Studenski[1]

[1]University of Pittsburgh, [2]Washington University

P3-J-36 **Objectively measured training progression in Parkinson´s disease - is dual-tasking an interfering factor?**

David Conradsson[1], Håkan Nero[1], Niklas Löfgren[1], Maria Hagströmer[1], Erika Franzén [1]

[1]Karolinska Institutet

P3-J-38 **Changes in characteristics of physical activity after stroke**

Niruthikha Mahendran[1], Suzanne Kuys[2], Sandra Brauer[1]

[1]University of Queensland, [2]Allied Health Research Collaborative, The Prince Charles Hospital

P3-J-39 **Effects of low intensity functional electrical stimulation assisted cycling training in stroke patients on brain plasticity and electromyography**

Chih-Wei Peng[1], Shih-Ching Chen[1], Chao-Chen Lo[2], Pei-Yu Huang[2], Cheng-Yen Huang[2], Chien-Hung Lai[1], Jia-Jin Chen[2]

[1]Taipei Medical University and Hospital, [2]National Cheng Kung University

P3-J-40 **Virtual reality-based balance training using body-worn sensors: Results of a pilot study in older adults**

Michael Schwenk[1], Gurtej Grewal[1], Bahareh Honarvararaghi[1], Stefanie Schwenk[1], Jane Mohler[1], Dharma S. Khalsa[2], Bijan Najafi[1]

[1]University of Arizona, [2]Alzheimer's Research and Prevention Foundation

P3-J-41 **Promoting functional plasticity to promote mobility: Preliminary data from a 6-month randomized controlled trial**

Teresa Liu-Ambrose[1], Shirley Wang[1], Chun Liang Hsu[1], Michelle Voss[2], Niousha Bolandzadeh[1], Elizabeth Dao[1], Ging-Yuek Hsiung[1], Teresa Liu-Ambrose[1]

[1]University of British Columiba, [2]University of Iowa

K Falls and falls prevention

P3-K-42 Influence of a dual-task on foot clearance during gait in people with incident Parkinson's disease

Lisa Alcock[1], Brook Galna[2], Sue Lord[2], Lynn Rochester[2]
[1]Faculty of Medical Sciences, Newcastle University, [2]Institute for Ageing and Health, Newcastle University

P3-K-43 Incidence, type, and control of medio-lateral protective stepping in older fallers and non-fallers

Woei-Nan Bair[1], Michelle Prettyman [1], Brock Beamer[1], Mark Rogers[1]
[1]University of Maryland, Baltimore

P3-K-44 Age-related differences in CoM downward acceleration and velocity profiles during stair descent: effects of high risers

John Buckley[1], Richard Foster[1], Bill Baltzopoulos[2], Costis Maganaris[3], Neil Reeves[4]
[1]University of Bradford, [2]Brunel University , [3]Liverpool John Moores University, [4]Manchester Metropolitan University

P3-K-45 Motor and cognitive correlates of gait slowing in a challenging environment in people with Parkinson's disease

Maria Joana Caetano[1], Jasmine Menant[1], Colleen Canning[2], Daniel Schoene[1], Jooeun Song[2], Serene Paul[2], Stephen Lord[1]
[1]Neuroscience Research Australia, [2]University of Sydney

P3-K-46 Reduced ability to discriminate shadows from surface undulations contributes towards increased falls risk in older adults

Mark Hollands[1], Benjamin Curzon-Jones[2], Andrew Schofield[1]
[1]Liverpool John Moores University, [2]University of Birmingham

P3-K-47 Do cognitive and motor impairments predict balance control post-stroke

Ashleigh Kennedy[1], William McIlroy[1]
[1]Toronto Rehabilitation Institute

P3-K-48 Maori and nonMaori in advanced age, a contrast of frailty measures and falls: LILACS NZ

Ngaire Kerse[1], Ruth Teh[1], Simon Moyes[1], Lorna Dyall[1], Tim Wilkinson[2], Martin Connolly[1]
[1]University of Auckland, [2]University of Otago

P3-K-49 ERP measures reveal dual-task interference in postural performance in young adults

Carrie Elaine Little[1], Marjorie Woollacott[1]
[1]University of Oregon

P3-K-50 Presynaptic control of balance in healthy subjects

Zoé Miranda[1], Dorothy Barthélemy [1]
[1]Université de Montréal

P3-K-51 FFRAT, a web-based assessment tool for evaluating fall risk in the elderly

Lorenzo Chiari[1], Luca Cattelani[1], Pierpaolo Palumbo[1], Luca Palmerini[1], Stefania Bandinelli[2], Federico Chesani[1]
[1]Universita' di Bologna, [2]Azienda Sanitaria di Firenze

P3-K-52 Acute effect of an adapted racquetball training on motor symptoms and balance in PD

Shaun Porter[1], Chris Dalton[1], Julie Nantel[1]
[1]University of Ottawa

P3-K-53 Association between spasticity and balance impairments in persons post-stroke

Reza Rahimzadeh Khiabani[1], George Mochizuki[2], Farooq Ismail[3], Chris Boulias[3], William Gage[1], Chetan Phadke[3]
[1]York University, [2]University of Toronto, [3]West Park Health Care Centre

P3-K-54 The effects of added body mass on spatiotemporal gait measures and gait variability during treadmill walking

Brian Street[1], Andrew Sweetnam[1], William Gage[1]
[1]York University

P3-K-55 Investigating the relationship between sarcopenia and functional measures of gait and posture in community-dwelling and assisted-living older adults

Lori Ann Vallis[1], Emily McIntosh[1], Taylor Campbell[1], K. Brent Smale[1]
[1]University of Guelph

P3-K-56 Cognitive neural network modulation in relation to balance impairments

Kelly Westlake[1], Elizabeth Woytowicz[1], Chandler Sours[1], Joseph Rosenberg[1], Rao Gullapalli[1]
[1]University of Maryland, Baltimore

P3-K-57 Anxiety-related changes in the conscious control of gait

William Young[1], Mark Williams[1]
[1]Brunel University

L Habilitation and rehabilitation

P3-L-58 Influence of proprioceptive vibrations on postural strategies for stroke patients: a hemispheric dependence

Noémie Duclos[1], Luc Maynard[2], Djawad Abbas[2], Serge Mesure[1]
[1]Institut of Movement Sciences, [2]CRF Valmante

P3-L-59 Complex muscle vibration patterns to induce gait-like lower limb movements: A proof of concept in healthy and neurologically affected participants

Cyril Duclos[1], Claire Kemlin[2], Dany Gagnon[1], Joseph-Omer Dyer[1]
[1]Université de Montréal, School of rehabilitation, [2]Centre for Interdisciplinary Research in Rehabilitation (CRIR-IRGLM)

P3-L-60 Immediate effects of anterior weight shift training on muscle coactivation during gait in adults with hemiplegia after stroke

Ryosuke Kitatani[1], Koji Ohata[1], Kaoru Sakuma[1], Yumi Aga[1], Natsuki Yamakami[1], Yu Hashiguchi[1], Sayuri Osako[1], Shigehito Yamada[1]
[1]Kyoto University

P3-L-61 Acute and short-term changes in serum BDNF concentration following treadmill-based exercise in people with motor-incomplete SCI

Tania Lam[1], Zhen Chen[1], Mohamed Sayed-Ahmed[2], Abdulaziz Al-Yahya[2]
[1]University of British Columbia, [2]King Saud University

P3-L-62 Anticipatory postural adjustments and step execution during gait initiation in water: A pilot study

Andresa Marinho-Buzelli[1], Ana Barela[2], Jose Angelo Barela[2], Melissa Celestino[2], Milos Popovic[1], Mary Verrier[1]
[1]University of Toronto, [2]Cruzeiro do Sul University

P3-L-63 The effect of restricting arm movements on walking speed in children with Cerebral Palsy and Typically Developing children

Pieter Meyns[1], Wouter Hoogkamer[1], Sjoerd Bruijn[2], Kaat Desloovere[1], Jacques Duysens[1]
[1]KU Leuven, [2]VU University Amsterdam

P3-L-64 Aftereffect of a new robot-assisted gait training on kinematics and kinetics during walking in individuals after stroke

Koji Ohata[1], Aki Watanabe[2], Hideaki Takahashi[3], Noriaki Ichihashi[1]
[1]Graduate school of Medicine, Kyoto University, [2]Yufuin Kosenenkin Hp., [3]Honda R&D

P3-L-65 Changes in gait in adults with chronic hemiparesis after balance training on a mobile mechanized surface while gaming

M Ann Reinthal[1], Debbie Espy[1]
[1]Cleveland State University

P3-L-66 Low-level laser therapy as a possible resource to improve muscle regeneration in aged rats

Natalia Rodrigues[1], Fatma Vatansever[1], Livia Assis[2], Sabrina Peviani[3], Joao Durigan[4], Fernando Moreira[3], Michael Hamblin[5], Nivaldo Parizotto[3]
[1]University of Sao Paulo, [2]Federal University of Sao Paulo, [3]Federal University of Sao Carlos, [4]University of Brasilia, [5]HAVARD University

M Learning, plasticity and compensation

P3-M-67 Adaptations to reduced ankle motion during level & obstacle walking

Jonathan Singer[1], Eoghan Landy[2], Stephen Prentice[2]
[1]Sunnybrook Research Institute, [2]University of Waterloo

P3-M-68 Mechanisms of motor adaptation in reactive balance control

Lena Ting[1], Torrence Welch[2]
[1]Emory University and Georgia Tech, [2]Rimkus Consulting

N Modeling, robotics and biomechanics and implantable neuroprosthesis

P3-N-69 The effect of robot-assisted gait training on chronic stroke survivor - a case report

Chien-Hung Lai[1], Chih-Chao Hsu[2], Shih-Ching Chen[1], Jiunn-Horng Kang[1], Chih-Wei Peng[1], Su-Hsien Lin[2]
[1]Taipei Medical University and Hospital, [2]Taipei Medical University Hospital

P3-N-70 Effect of auditory cues on the fractal dynamics of human gait during treadmill walking

Kei Masani[1], Hossein Rouhani[2], Masaki Abe[3], Kimitaka Nakazawa[3], Daichi Nozaki[3]
[1]Toronto Rehabilitation Institute - UHN, [2]Toronto Rehabilitation Institute, [3]University of Tokyo

P3-N-71 Role of muscle coactivation and reaction time in postural perturbation in the elderly

Shinya Ogaya[1], Koutatsu Nagai[2], Yusuke Okita[3], Koji Nonaka[1], Akira Iwata[1], Yumi Higuchi[1], Satoshi Fuchioka[1]
[1]Osaka Prefecture University, [2]Kyoto Tachibana University, [3]Kyoto University

P3-N-72 Comparing two approaches for predicting the balance recovery performances by stepping

Thomas Robert[1], Pascal Vallee[2]
[1]Université de Lyon, [2]Université de Lyon, IFSTTAR/UCBL

O Neurological diseases

P3-O-73 Concurrent reduction in plantar cutaneous sensation and complexity of postural control in people with Multiple Sclerosis

Michael Busa[1], Stephanie Jones[1], Richard Van Emmerik[1]
[1]University of Massachusetts Amherst

P3-O-74 Impact of a gait-specific feedback strategies during a single session of fast walking training after stroke.

Vincent DePaul[1], Adam Jongsma[1], Gena Matta[1], Avril Mansfield[1], William McIlroy[1]
[1]Toronto Rehabilitation Institute - UHN

P3-O-75 Electroencephalography in Parkinson's Disease patients with freezing of gait while stepping in place

Conor Fearon[1], Saskia Wachter[2], Niamh McDevitt[2], Elaine Harrington[1], John Butler[2], Timothy Lynch[1], Richard Reilly[2]
[1]Dublin Neurological Institute, [2]Trinity Centre for Bioengineering

P3-O-76 Progression of gait dysfunction in incident Parkinson's disease over 18 months

Brook Galna[1], Sue Lord[1], David Burn[1], Lynn Rochester[1]
[1]Newcastle University

P3-O-77 The disruption of postural responses and arm reach in standing from a loud acoustic stimulus can be modified by training in persons post-stroke

Vicki Gray[1], Mark Rogers[1], Sandy McCombe Waller[1]
[1]University of Maryland Baltimore

P3-O-78 Objective assessment of gait in Parkinson's disease: The effects of motor subtypes and medication

Talia Herman[1], Aner Weiss[2], Marina Brozgol[2], Shirley Shema[2], Ziv Sberlo[2], Nir Giladi[3], Jeffrey Hausdorff[4]
[1]TLVMC, [2]Laboratory for Gait and Neurodynamics, Movement Disorders Unit, Tel-Aviv Sourasky Medical Center, [3]Dept of Physical Therapy, Sackler Faculty of Medicine, and Sagol School of Neuroscience, Tel-Aviv Un, [4]Sackler Faculty of Medicine and Sagol School

P3-O-79 Split-belt adaptation in cerebellar patients with focal lesions

Wouter Hoogkamer[1], Sjoerd Bruijn[2], Stephan Swinnen[3], Frank Van Calenbergh[4], Jacques Duysens[3]
[1]KULeuven, [2]VU University Amsterdam, [3]KU Leuven, [4]University Hospitals Leuven

P3-O-80 Effects of anti-parkinson medications on dual-task walking in people with Parkinson's disease

Valerie Kelly[1], Rebecca Archer[1], Anne Shumway-Cook[1]
[1]University of Washington

P3-O-81 The integration of vision and proprioception on obstacle crossing strategies in people with motor-incomplete spinal cord injury.

Raza Malik[1], Tania Lam [1]
[1]University of British Columbia

P3-O-82 Predicting factors of dual task gait velocity in Parkinsons disease

Esther Molenaar[1], Carolien Strouwen[2], Liesbeth Münks[2], Samyra Keus[1], Bastiaan Bloem[1], Alice Nieuwboer[3]
[1]Radboud University Medical Centre, [2]KU Leuven-University of Leuven, [3]KU Leuven-University Leuven

P3-O-83 Gait cycle timing parameters and their correlation with functional and subjective gait assessments among persons with multiple sclerosis

Meir Plotnik[1], Robert Naismith[2], Joanne Wagner[3]
[1]Sheba Medical Center, [2]Washington University School of Medicine, [3]Saint Louis University

P3-O-84 Anticipatory postural reactions and arousal state during external perturbations are altered in people with stroke

Courtney Pollock[1], Mark Carpenter[1], Alessio Gallina[1], Taian Vieira[2], Tanya Ivanova[1], S. Jayne Garland[1]
[1]University of British Columbia, [2]Universidade Federal do Rio de Janeiro

P3-O-85 Gray matter loss mediates the association between functional connectivity of the salience network and PIGD symptoms

Jeffrey Hausdorff[1], keren Rosenberg-Katz[1], Talia Herman[1], Yael Jacob[1], Nir Giladi[1], Talma Hendler[1]
[1]Tel Aviv Sourasky Medical Center

P3-O-86 Cortical mechanisms underlying the sensorimotor enhancement of locomotion post stroke induced by light haptic touch

Samir Sangani[1], Anouk Lamontagne[1], Joyce Fung[1]
[1]McGill University

P3-O-87 Is freezing of gait in Parkinson's disease associated with changes in gaze behaviour?

Carolina Silveira[1], Danielle Bell-Boucher[2], Frederico Pieruccini-Faria[2], Eric Roy[1], Quincy Almeida[2]
[1]University of Waterloo, [2]Sun Life Financial Movement Disorders Research and Rehabilitation Centre/Wilfrid Laurier University

P3-O-88 Freezing beyond gait in Parkinson's disease: an update on current neurobehavioral evidence

Sarah Vercruysse[1], Moran Gilat[2], James Shine[2], Elke Heremans[1], Simon Lewis[2], Alice Nieuwboer[1]
[1]K.U.Leuven, [2]The University of Sydney

P3-O-89 Early differentiation in neural connectivity between PIGD and TD subtypes of Parkinson?s disease (PD): a preliminary resting state fMRI analysis

Griet Vervoort[1], Wim Vandenberghe[1], Alice Nieuwboer[1], Sarah Vercruysse[1]
[1]KU Leuven

P Orthopedic diseases and injuries

P3-P-90 Balance after total hip arthroplasty (THA) and the effect of hip abductor strength

Fang Lin[1], Julie Ermoloff[2], Justin Moore[2], Brett Painter[2], Kimberly Pittenger[2]
[1]Dr. William M Scholl College of Podiatric Medicine/Rosalind Franklin University of Medicine and Science, [2]Northwestern University

P3-P-91 The impact of a concurrent task on simple and complex walking performance in persons with transfemoral amputation

Sara Morgan[1], Brian Hafner[1], Valerie Kelly[1]
[1]University of Washington

P3-P-92 Adaptation strategies in starting and stopping gait and the additional value of a self adapting microprocessor controlled knee.

Marc Nederhand[1], Erik Prinsen[2], Johan Rietman[2]
[1]Roessingh, Research and Development, [2]Roessingh, Centre for Rehabilitation

P3-P-93 A novel evaluation of knee proprioception ability based on the analysis of Multiscale Entropy

Hui Zhang[1], Long Jiang[2], Diange Zhou[2], Jianhao Lin[2], Jue Zhang[1], Jing Fang[1]
[1]Peking University, [2]Peking University People's Hospital

Q Sensorimotor control

P3-Q-94 Developmental changes in the neural network of proprioceptive processing from adolescence to adulthood

Christine Assaiante[1], Fabien Cignetti[1], Bruno Nazarian[1], Muriel Roth[1], Jean-Luc Anton[1], Marianne Vaugoyeau[1]
[1]CNRS - Aix-Marseille Université

P3-Q-95 Alterante foot placement strategies: Avoidance of multiple obstacles

Brittany Baxter[1], Michael Cinelli[1]
[1]Wilfrid Laurier University

P3-Q-96 Changes in paretic and non-paretic lower limb muscle activities during gait on a split-belt treadmill in chronic stroke survivors

Martina Betschart[1], Séléna Lauzière[1], Carole Miéville[1], Bradford McFadyen[2], Sylvie Nadeau[1]
[1]University of Montreal, Center for Interdisciplinary Research in Rehabilitation (CRIR-IRGLM), [2]Faculté de médécine, Université Laval

P3-Q-97 Visuo-locomotor coordination for manual wheelchair versus biped navigation: A Preliminary Study

Caroline Charette[1], Francois Routhier[2], Bradford McFadyen[1]
[1]Université Laval, [2]Laval University

P3-Q-98 Body configuration at first stepping foot contact critically determines the ability to recover from large sideways perturbations in healthy young subjects.

Digna de Kam[1], Jolanda Roelofs[1], Astrid van der Zijden[1], Stephen Robinovitch[1], Vivian Weerdesteyn[1]
[1]Radboud University Medical Center

P3-Q-99 Postural sway and gaze can track the chaotic motion of a visual target

Vassilia Hatzitaki[1], Anastasia Kyvelidou[2], George Sofianidis[3], Nick Stergiou[2]
[1]Eidikos Logariasmos Kondilion Erevnas A.P.TH, [2]University of Nebraska at Omaha, [3]Aristotle University of Thessaloniki

P3-Q-100 Influence of different standing conditions on Light Touch effect which focus on the relation between subjective attention strength

Tomoya Ishigaki[1], Kozo Ueta[1], Shu Morioka[1]
[1]Kio University

P3-Q-101 Effect of balance training on postural control in elderly people

Christoph Maurer[1], Isabella Wiesmeier[1]
[1]Universitätsklinikum Freiburg

P3-Q-102 Sensory reweighting of proprioceptive input during balance control as function of age and disease

Jantsje Pasma[1], Denise Engelhart[2], Alfred Schouten[3], Andrea Maier[4], Carel Meskers[1], Herman van der Kooij[2]
[1]Leiden University Medical Center, [2]University of Twente, [3]Delft University of Technology, [4]VU University Medical Center

P3-Q-103 Can young adults adjust their recovery step during unexpected tripping?

Zrinka Potocanac[1], Jaap van Dieën[2], Sabine Verschueren [1], Jacques Duysens[1], Mirjam Pijnappels [2]
[1]KU Leuven, [2]MOVE Research Institute Amsterdam, Faculty of Human Movement Sciences, VU University Amsterdam

P3-Q-104 Obstacle avoidance strategies across two age groups of children

Nicole Reinders[1], Robyn Hubbert[1], Micheal Cinelli[1], Pam Bryden[1]
[1]Wilfrid Laurier University

P3-Q-105 The effect of unilateral muscular fatigue on blind navigation

Natalie Richer[1], Martin Bilodeau[1], Étienne Bisson[2], Yves Lajoie[1]
[1]University of Ottawa, [2]Queen's University

P3-Q-106 Sensorimotor integration used for rhesus monkey postural control

Lara Thompson[1], Adam Goodworth[2], Csilla Haburcakova[3], Daniel Merfeld[3], Conrad Wall III[3], Richard Lewis[3]
[1]University of the District of Columbia, [2]University of Hartford, [3]Massachusetts Eye and Ear Infirmary, Harvard Medical School

R Tools and methods for posture and gait analysis

P3-R-107 Dual task costs of cognitive-functional versus cognitive-non-functional tasks among older adults

Maayan Agmon[1], Einat kodesh[2], Racheli Kizony[3]
[1]University of Haifa, [2] University of Haifa, [3]University of Haifa and, Sheba Medical Center, Israel

P3-R-108 Dynamics of sensory reweighting following sudden loss or return of sensory orientation information contributing to balance control

Lorenz Assländer[1], Robert Peterka[2]
[1]Albert-Ludwigs-University of Freiburg, [2]Oregon Health & Science University

P3-R-109 Developing an item bank for the examination of gait adaptability post-stroke using a mixed-methods framework

Chitra lakshmi K Balasubramanian[1], David Clark[2], Emily Fox[3], Amy Stagliano[1], Lou Demark[4], Craig Velozo[1]

[1]University of North Florida, [2]University of Florida, [3]University of Florida, Brooks Rehabilitation Hopsital, [4]Brooks Rehabilitation Hospital

P3-R-110 Instrumented balance assessment using Wii Balance Boards in people following stroke: Reliability and potential clinical application

Kelly Bower[1], Jennifer McGinley[1], Kimberly Miller[2], Ross Clark[3]

[1]The University of Melbourne, [2]The University of British Columbia, [3]Australian Catholic University

P3-R-112 Altered Spinal posture in people with Parkinson's disease and the relationship with balance

Carolyn Fitton[1], Malcolm Burnett[1], Dorit Kunkel[1], Geert Verheyden[2], Ann Ashburn[1]

[1]University of Southampton, [2]University of Leuven

P3-R-113 Quantifying dynamic instability in cerebellar ataxic gait

Winfried Ilg [1], Zofia Fleszar[1], Cornelia Schatton[1], Bjoern Mueller[1], Nicolas Ludolph[1], Ludger Schoels [1], Martin Giese[1], Matthis Synofzik[1]

[1]Hertie Institute for Clinical Brain Research

P3-R-114 Stair-specific algorithms for identification of touch-down and foot-off when descending or ascending a non-instrumented staircase

Richard Foster[1], Alan De Asha[1], Neil Reeves[2], Constantinos Maganaris[3], John Buckley[1]

[1]University of Bradford, [2]Manchester Metropolitan University, [3]Liverpool John Moores University

P3-R-115 Insole plantar pressures can reliably assess gait along both linear and curved trajectories

Marco Godi[1], Anna Maria Turcato[1], Antonio Nardone[1], Marco Schieppati[1]

[1]Fondazione Salvatore Maugeri

P3-R-116 Associations between quantitative mobility measures derived from components of conventional mobility testing and parkinsonian gait in older adults.

Jeffrey Hausdorff[1], A Weiss[1], A Buchman[2], S Leurgans [2], V Vander Horst [3], R Dawe[4], A Mirelman[1], L Barnes [5], R Wilson[5]

[1]Tel Aviv Sourasky Medical Center, [2]Rush Alzheimer's Disease Center, Rush University Medical Center, [3]Department of Neurology, Beth Israel Deaconess Medical Center, [4]Department of Diagnostic Radiology and Nuclear Medicine, Rush University Medical Center,

P3-R-117 Development of novel walking analyzing device, caterpillar type treadmill

Yuka Iijima[1], Takumi Ishikawa[1], Takayuki Shiina[1], Hiroshi Takemura[1], Hiroshi Mizoguchi[1]

[1]Tokyo University of Science

P3-R-118 The effects of walking perturbation intensities on the dynamic and postural balance examined by the destabilizing/stabilizing forces.

Nabil Ilmane[1], Simon Croteau[1], Cyril Duclos[1]

[1]University of Montreal

P3-R-119 Field assessment of gait: Valid measures of step length and step width provided with a simple, inexpensive device

Albert Kim[1], Junyoung Kim[1], Shirley Rietdyk[1], Babak Ziaie[1]

[1]Purdue University

P3-R-120 Can wearable inertial movement sensors detect impaired voluntary postural adjustments in people with low back pain?

Karen Lomond[1], Mahmoud El-Gohary[2], Juvena Hitt[3], Rebecca Ouelette-Morton[3], Kyle MacGregor[3], Jesse Jacobs[1], Sharon Henry[3]

[1]Central Michigan University, [2]APDM Inc, [3]University of Vermont

P3-R-121 Evaluation methods of CB-Brace for knee osteoarthritis.

Yasuhiro Mine[1], Yoshiyuki Kobayashi[2], Kaoru Kimura[3], Tamotsu Sakima[3]

[1]Toyo University, [2]National Institute of Advanced Industrial Science and Technology, [3]SAKIMA Prosthetics & Orthotics Co.

P3-R-122 Comparison of performance on the Balance Evaluation Systems Test (BESTest) and Sensory Organization Test (SOT) in community dwelling older adults

James Moore[1], Neva Kirk-Sanchez[1], David Mandel[1]

[1]University of Miami

P3-R-123 Content validity and feasibility of a survey to investigate participation in gait rehabilitation studies by individuals with stroke

Kara Patterson[1], Nicole Gallant[2], Tracey Ormiston[2], Mandy Whitechurch[2], Chad Patience[2], Janet Brown[2]

[1]University of Toronto, [2]Western University

P3-R-124 Visual sampling in Parkinson's disease: current methodological issues

Samuel Stuart[1], Lisa Alcock[2], Brook Galna[2], Sue Lord[2], Lynn Rochester[2]

[1]Institute for Ageing and Health, [2]Institute for Ageing and Health/Newcastle University

P3-R-125 Test re-test reliability of center of pressure measures of standing balance in people with knee osteoarthritis

Judit Takacs[1], Mark Carpenter[1], S. Jayne Garland[1], Michael Hunt[1]

[1]University of British Columbia

P3-R-126 Flexibility of turning strategies while walking in healthy adults

Naofumi Tanaka[1], Ryushin Hashiba[2], Hiroki Hashikami[2], Shino Kazahari[2], Asako Hirayama[2], Yoshihiro Muraoka[3], Shin-Ichi Izumi[1]

[1]Tohoku University Graduate School of Medicine, [2]Medical Court Hachinohe West Hospital, [3]Waseda University

P3-R-127 Estimating center of pressure and centre of mass patterns in stroke subjects during daily life activities using force sensing shoes

Fokke Van Meulen[1], Jasper Reenalda[2], Corien Nikamp[2], Jaap Buurke[2], Peter Veltink[1]

[1]University of Twente, [2]Rehabilitation Center het Roessingh

P3-R-128 Inter- and intra-tester reproducibility of the Unipodal Test of Pelvic Stability

Philippe Villeneuve[1], Marie Geronimi[2], Anne Laure Broise[3], Pierre Marie Gagey[3]

[1]Institut de Posturologie, [2]Université du Sud Toulon Var , [3]Association posturologie Internationale

P3-R-129 Examining Falling Behaviour in Young Adults with a 2D Perturbation Platform

Stephen Robinovitch[1], Shane Virani[1], Colin Russell[1]

[1]Simon Fraser University

P3-R-130 New Maximum Entropy Method(MEM) power spectrum notation of the stabilometry

Masahiko Yamamoto[1], Tomoe Yoshida[1], Fuyuko Ikemiyagi[1], Mitsuya Suzuki[1]

[1]Toho University

P3-R-131 A novel interpretation of postural control with ensembled EMD embeded DFA

Junhong Zhou[1], Jue Zhang[1], Jing Fang[1]

[1]Peking University

S Vestibular function and disorders

P3-S-132 The effects of adding Vestibular Rehabilitation Therapy to Benign Paroxysmal Positional Vertigo (BPPV) intervention plan on balance of elderly patients: initial findings of the RCT

Nandini Deshpande[1], Karyna Figueiredo - Ribeiro[2], Ricardo Guerra[2], Raysa Freitas[2], Rafaela Santos[2], Bruna Oliveria[2], Camila Silva[2], Lidiane Ferreira[2]
[1]Queen's University, [2]Universidade Federal do Rio Grande do Norte

P3-S-133 Otolith dysfunction caused by acoustic neuroma affects head stability during gait

Kazuo Ishikawa[1], Yoshiaki Itasaka[1], Eigo Omi[1], Koh Koizumi[1]
[1]Akita Graduate School of Medicine

P3-S-134 Management of vertigo and difficulty of gait caused by head injuries

Eigo Omi[1]
[1]Akita University School Of Medicine

P3-S-135 Balance control dynamics and sensory reweighting investigated using combinations of pseudorandom surface-tilt and galvanic-vestibular stimuli

Robert Peterka[1], Adam Goodworth[2]
[1]Oregon Health & Science University, [2]University of Hartford

P3-S-136 Human perception of galvanic vestibular stimulation

Ryan Peters[1], Brandon Rasman[1], Timothy Inglis[1], Jean-Sébastien Blouin[1]
[1]University of British Columbia

P3-S-137 Visual dependence may be related to vestibular hypofunction in cerebral palsy

Yawen Yu[1], Maureen Maniulit[1], Richard Lauer[1]
[1]Temple University

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C-Motion Inc. *booth 27*

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Forcelink *booth 13*

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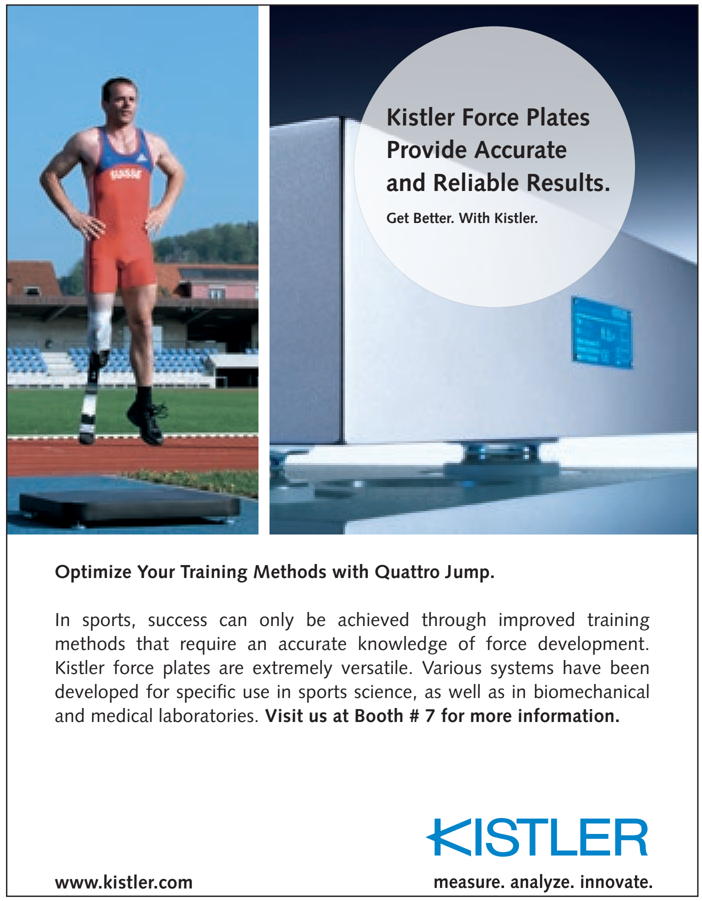

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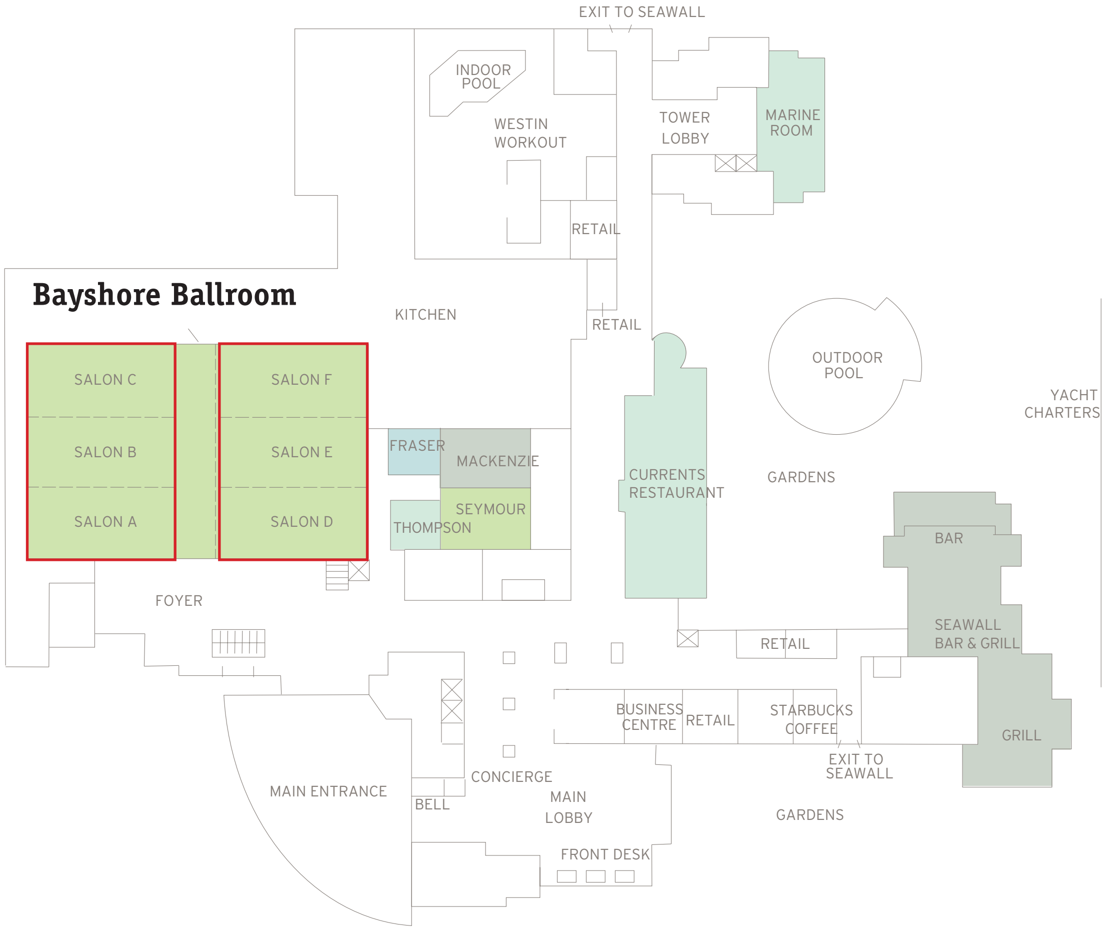

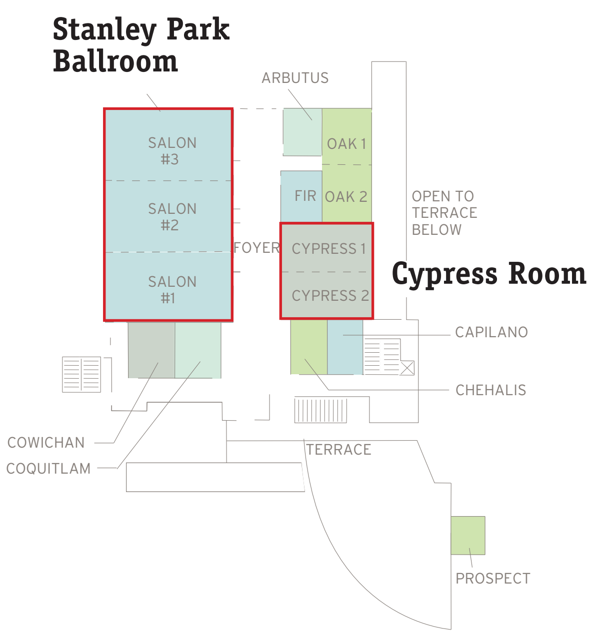

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Stanley Park Ballroom 1 & 2
Breakout Room 2

Cypress Room
Breakout Room 3

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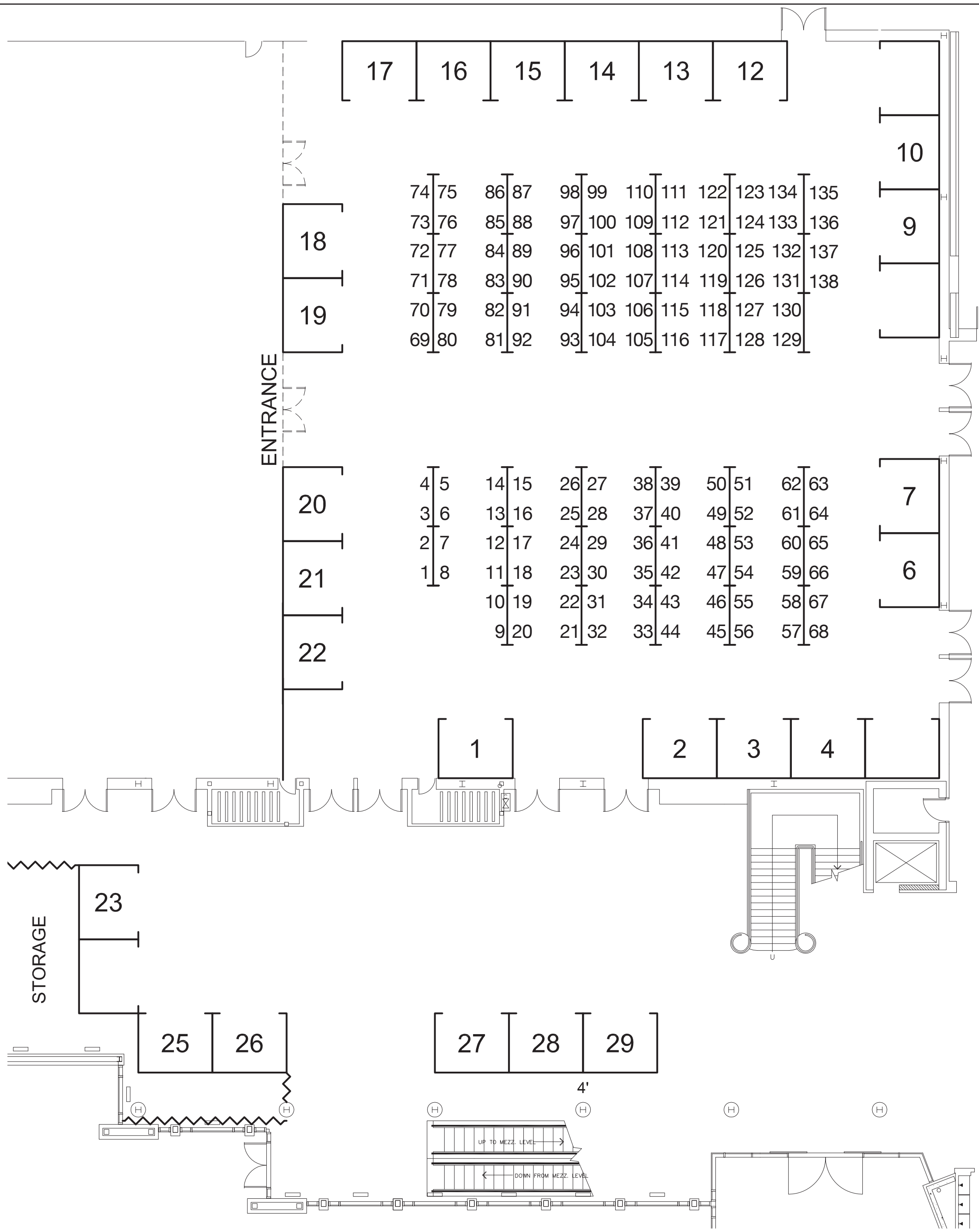

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27	C-Motion Inc.
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13	Forcelink
21	Gait Up
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10	Mobility Research Inc.
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