ispgr

INTERNATIONAL SOCIETY OF POSTURE & GAIT RESEARCH

Program

2019 ISPGR WORLD CONGRESS

June 30 to July 4
Edinburgh

Edinburgh International Conference Centre

@ISPGR

#ISPGR2019

ispgr.org

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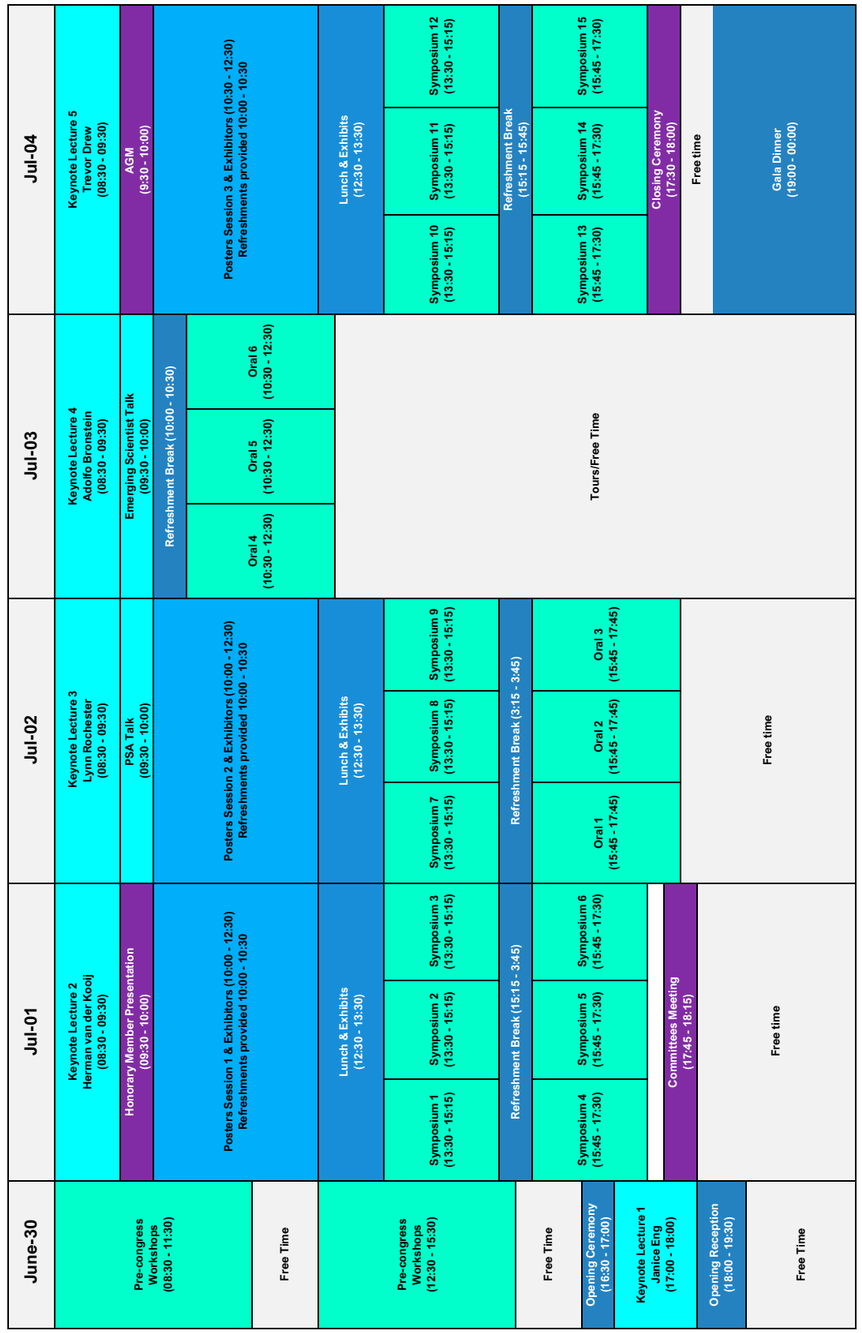
PROGRAM AT A GLANCE



WELCOME LETTER

We are honoured and excited to serve as co-chairs for the 2019 World Congress of the International Society of Posture and Gait Research. We are pleased to welcome you to the historic city of Edinburgh, the capital city of Scotland. This year marks the 50th anniversary of the marriage between basic and clinical researchers discussing and exchanging scientific knowledge surrounding postural control and gait. ISPGR has grown significantly from the first meeting in 1969. It all began as a relatively small discussion about posturography among researchers, mostly from Japan and Europe, and grew steadily to the current meeting of close to 700 delegates from around the world, discussing and sharing basic and clinical aspects of gait, posture, and balance control across the lifespan. We are extremely thrilled about the growth and success of this year's meeting, we received a record number of abstract submissions. We are sure that the success of this meeting had nothing to do with us, but rather with the fact that Edinburgh is the second most popular tourist destination in the UK. Aside from its popularity, Edinburgh has long been a centre of education, particularly in the fields of medicine, the sciences, and engineering and so it is the perfect location to be celebrating our Society's Golden anniversary. Neither of us are from this area, but as you know, the conference venues are chosen independent of the co-chairs' affiliations in order to offer its members value for money, accessibility, great conference facilities, and tourist attractions. Our management company has worked hard to ensure excellent meeting, dining, and tourist experiences. In planning this meeting, we have built on the success of previous meetings and responded to member feedback by providing more of what you valued most. Accordingly, we have selected pre-conference workshops that reflect the needs of the members, brought in five excellent world-class keynote speakers to cover all the major areas of our society, and increased the number of member-led symposia sessions. As in previous years, we have allocated significant time and attention to poster presentations and scheduled them in such a way as to encourage attendance. We have also continued the Society's tradition of focusing on young researchers and student members by awarding student oral, poster and travel awards, as well as recognizing excellent early-career researchers through the Emerging and Promising Scientist Awards. The impact of the Society's dedication to student participation is highlighted by the fact that over 40% of our meeting attendance is made up of student members this year! We want to extend sincere thanks to all individuals who have dedicated their time to help organize this meeting. We extend special thanks to the members of the Scientific Content Committee, and particularly its Chair and ISPGR Vice-President, Dr. Vivian Weerdesteyn, who has worked hard to help us objectively select this year's symposia, oral and poster presentations. We are also especially grateful to the members of the Awards Committee that have the challenging task of choosing winners for the awards. We also would like to thank the ISPGR board members for their continued support, and our Conference Organizers at Podium Conferences, who have been an essential partner to the Society. Finally, we thank you, in advance, for your individual contributions and efforts to help make this a memorable and successful meeting 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, **"Fàilte gu Dùn Èideann"** and the 2019 World Congress of the ISPGR!

Kristen Hollands & **Michael Cinelli**
Congress Chairs

LEADERSHIP

PRESIDENT

Mark Hollands *(Europe)*
Liverpool John Moores University, GBR

VICE PRESIDENT

Vivian Weerdesteyn *(Europe)*
Radboud University Medical Centre, NLD

SECRETARY

Kim Delbaere *(Asia-Pacific)*
Neuroscience Research Australia, UNSW, AUS

TREASURER

Nicoleta Bugnariu *(Americas)*
University of North Texas Health Science Center, USA

ELECTED REPRESENTATIVES: 2016 – 2020

Anouk Lamontagne *(Americas)*
McGill University, CAN

Mirjam Pijnappels *(Europe)*
MOVE Research Institute, NLD

Shinya Masahiro *(Asia-Pacific)*
Hiroshima University, JPN

William Geoffrey Wright *(Americas)*
Temple University, USA

ELECTED REPRESENTATIVES: 2018 – 2022

Sjoerd Bruijn *(Europe)*
VU Amsterdam, NLD

Sue Lord *(Asia-Pacific)*
Auckland University of Technology, NZL

Anat Mirelman *(Asia-Pacific)*
Tel Aviv University, ISR

Patrick Sparto *(Americas)*
University of Pittsburgh, USA

SCIENTIFIC CONTENT COMMITTEE

Committee co-chairs:

Vivian Weerdesteyn
Radboud University, NLD (ISPGR Vice-President)

Kristen Hollands
University of Salford, GBR (2019 World Congress co-chair)

Michael Cinelli
Wilfrid Laurier University, CAN (2019 World Congress co-chair)

Committee representatives:

Lisa Alcock *Newcastle University, GBR*
Fabio Augusto Barbieri *Univ. Estadual Paulista, BRA*
Tanvi Bhatt *University of Illinois, USA*
Michael Cinelli *Wilfrid Laurier University, CAN*
Mihalis Doumas *Queen's University Belfast, GBR*
Brett Fling *Colorado State University, USA*
Richard Foster *Research Institute for Sport and Exercise Sciences, GBR*
Brook Galna *Newcastle University, GBR*
Kristen Hollands *University of Salford, GBR*
Mark Hollands *Liverpool John Moores University, GBR*
Klaus Jahn *University of Munich, DEU*
Claudine Lamoth *University of Groningen, NLD*
Avril Mansfield *University of Toronto, CAN*
Jasmine Menant *Neuroscience Research Australia, AUS*
Manuel Montero Odasso *Western University, CAN*
Martijn Müller *University of Michigan, USA*
Toshihisa Murofushi *Teikyo University, JPN*
Melvyn Roerdink *Vrije Universiteit Amsterdam, NLD*
Kathryn Sibley *University of Manitoba, CAN*
Patrick Sparto *University of Pittsburgh, USA*
John Stins *Research Institute MOVE, NLD*
Herman van der Koiij *Delft University, NLD*
Will Young *Brunel University, GBR*

MEMBERSHIP

ispgr INTERNATIONAL SOCIETY OF POSTURE & GAIT RESEARCH

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
- 20% discount on a subscription to ISPGR's official publication, Posture & Gait, published by Elsevier 8 times per year
- Ability to post and review job and grant opportunities
- Opportunity to post news and information on related events opportunity to vote in 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.

Students & Post Docs

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 good for a two-year period beginning on October 1 and expiring September 30 of the second year. Current membership dues are:

Regular member $150USD
Student/Post-Doc member $75USD

JOIN A COMMITTEE

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

- Scientific content committee
- Awards committee
- External relations committee
- Communications committee

If you would like to learn more about committees or the Society, please join us on **Monday July 1 at 17:45** at the Committees information meetings in the Sidlaw suite (level 3).

ABOUT ISPGR

The International Society of Posture and Gait Research (ISPGR), formerly called the International Society of Posturography 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 of 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 The International Society for Postural and Gait Research but was more familiarly known as the International Society for Posture and Gait Research. 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. A minor change to the Society name, plus revisions to the bylaws occurred in 2014 and the Society is now known as the **International Society of Posture and Gait Research**.

CONGRESS GENERAL INFORMATION

MEETING VENUE

Edinburgh International Conference Centre (EICC)

The Exchange, 150 Morrison St, Edinburgh EH3 8EE

(please review the floor plan on page 138 program for further details)

WORLD CONGRESS REGISTRATION

Registration for the Congress includes admission to all sessions, access to all coffee breaks and lunches daily. In addition, registration includes the welcome reception, plus the opportunity to purchase discounted tickets to the whisky tasting and gala dinner. **All tickets can be purchased from the registration desk.**

NAME BADGES

Your name badge is your admission ticket to the conference sessions, coffee breaks, meals, and reception. 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 Strathblane Hall, will be open during the following dates and times:

Sunday, June 30 . . . . . 07:30 – 19:30
Monday, July 1 . . . . . 07:30 – 17:30
Tuesday, July 2 . . . . . 07:30 – 17:30
Wednesday, July 3 . . . . . 07:30 – 13:00
Thursday, July 4. . . . . 07:30 – 17:30

SOCIAL MEDIA POLICY

The use of social media onsite at conferences is on the rise. This may create some opportunities but may also be considered by some as a threat. We propose to emphasize the opportunities; increased exposure, openness, and inclusiveness, while also providing the opportunity to help support those who wish to prevent unwanted exposure.

ISPGR encourages communication between members and the use of social media. Please note the following guidelines:

- ISPGR provides icons and stickers for permission and prohibition of photo recording, video recording and sharing on social media. These stickers are available onsite at the registration desk, and online as jpeg icons ***ispgr.org/presentation-guidelines*** to include with online presentations
- Members are encouraged to explicitly indicate their wishes by using the various stickers and icons available to them
- Please respect a presenters' wishes if they indicate the information presented is not to be captured or shared
- If there's no explicit indication of intent, assume that any media capturing of the presentation is prohibited and ask presenter their wishes. Always take into consideration the possibility that presenters do not want their presentation to be recorded or shared

SPEAKER INFORMATION

For all oral sessions, each room will be equipped with

- 1 laptop (facilitating both Keynote and PowerPoint)
- 1 LCD projector
- 1 microphone
- 1 laser pointer

All speakers must refer to their specified upload times, sent previously via email and included on the app and website. Please visit the registration desk if you have any questions.

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, July 1	07:30 – 08:30
Dedicated time:	Monday, July 1	10:30 – 12:30
Remove:	Monday, July 1	by 18:00

Poster session 2

Set-up:	Tuesday, July 2	07:30 – 08:30
Dedicated time:	Tuesday, July 2	10:30 – 12:30
Remove:	Tuesday, July 2	by 18:00

Poster session 3

Set-up:	Thursday, July 4	07:30 – 08:30
Dedicated time:	Thursday, July 4	10:30 – 12:30
Remove:	Thursday, July 4	by 15:45

Any posters not removed by the identified time will be held at the registration desk until the end of the congress. Any posters that remain unclaimed by the end of the congress will be disposed of.

Information on poster authors, poster numbers and poster titles begin onpage 71. for a complete copy of all the poster abstracts, please visit ***ispgr.org***, where you can download an electronic copy.

Easy reference poster floor plans can be found on page 138.

STAFF

ISPGR staff from Podium Conference Specialists can be identified by the orange ribbons on their name badges. Feel free to ask any one of our staff for assistance.

INTERNET SERVICES

ISPGR attendees have access to complimentary WIFI in the meeting area space area.

WIFI instructions:

Username: **Delegate**
Password: **haymarket**

ISPGR HALF DAY TOURS

WEDNESDAY, JULY 3

Booking: If you have pre-booked a tour online, you will find a ticket in the back of your badge, indicating which tour you have booked and the departure time.

Please note: due to the popularity pre-booking is required for all tours

Location: All tours will be departing from Mercat Cross, a 15-minute walk from the EICC (see map section of app for directions)

Time: The tours are leaving at various times starting from 14:00. If you have booked a tour, please check your departure time.

TOUR 1:
HISTORIC WALKING TOUR INCLUDING ACCESS TO EDINBURGH CASTLE

Skip the long queues for Edinburgh Castle, by joining this popular historic walking tour!

$45 USD per person (children 5-15 $30): includes a walking tour with local guide, and front of queue access with guided tour of Edinburgh Castle

Discover an Edinburgh beyond the reach of tour buses and guidebooks. Your expert guide will take you to the places where history was made – the wynds, closes, courtyards and homes of Edinburgh's Old Town. You'll be hanging on your tour guide's every word, as the true stories of the capital's past unfold.

TOUR 2:
GHOSTLY UNDERGROUND WALKING TOUR

$20USD per person (children 5-15 $15): includes exclusive access to Edinburgh's rarely seen underground vaults, and a lively walking tour with a local guide

This walking includes exclusive access to some of Edinburgh's 'most haunted' underground vaults. First, you'll follow your cloaked guide through the shadowy closes of Edinburgh's Old Town. These are dark streets untouched by daylight, filled with a strange silence, their damp walls carrying only the faintest echo of the crowds on the high street you've left behind.

With the scene set, you'll descend into the depths of the city – and listen in horror to its dark and sinister side. Torture. Murder. Hangings. From body snatchers to the real-life Jekyll and Hyde, you'll be gripped by the true tales that lie hidden beneath Edinburgh's streets. Please note: this tour may not be suitable for young children.

PRE-CONGRESS WORKSHOPS
SUNDAY, 30 JUNE 2019

All pre-congress workshops will take place at the Edinburgh International Conference Centre (EICC) unless otherwise stated

JOURNAL WORKSHOPS

AUTHORS' WORKSHOP:

Authors' rights and responsibilities

Morning session: 08:30 – 10:00
Location: Carrick suite (level 1)
This workshop will cover ethical issues including plagiarism and will be presented by the Editors and Publisher of Gait and Posture.

REVIEWERS' WORKSHOP:

Identifying limitations in scientific articles

Morning session: 10:15 – 11:45 (lunch on own)
Location: Carrick suite (level 1)
Organisers: Presented by the **Editors and Publisher of Gait and Posture**

WORKSHOP 1:

Mixed reality for posture and gait research: Principles and applications

Morning session: 08:30 - 11:30 (lunch on own)
Location: Moorefoot room (level 0)
Organiser: Melvyn Roerdink *Vrije Universiteit Amsterdam, NLD*
Mixed reality, the integration of real and digital worlds, is the rising star in the virtuality continuum. A promising advance in that regard are untethered and transparent headsets equipped with a holographic display unit, through which 3D holograms are not only overlaid but anchored to and interacting with the wearer's environment. This merging of real and digital worlds affords a realistic interaction with digital content during free movements in open environments. The main goal of this mixed-reality workshop is to get attendees familiar with the basic principles of mixed reality and its potential for posture and gait research through lecture-like plenary presentations intermingled with demos. What is mixed reality? How does it relate to virtual reality and augmented reality? How does it merge holographic content with the real world? What can I do with mixed reality? A second goal is to offer attendees hands-on experience with mixed reality in a research context through four different interactive demos: 1) the eyes, the ears and the brains of mixed reality, 2) Holobstacle, a mixed-reality application for studying holographic obstacle avoidance in the lab, 3) MR-Automated Mobility Assessment, a mixed-reality application to guide the wearer to self-initiate and complete clinical mobility assessments and 4) Holocue, a mixed-reality application for on-demand cue activation to reduce freezing of gait in Parkinson's disease patients.

WORKSHOP 2:

Pursuing an industry position after graduate school

Morning session: 08:30 - 11:30 (lunch on own)
Location: Tinto room (level 0)
(Free to trainees/graduate students and post docs - preregistration required)
Organiser: Adam Goodworth *University of Hartford, USA*
Graduates with advanced degrees in human movement disciplines are often interested in non-academic career pathways. However, graduates are typically provided with very little perspective or direction in how to consider a non-academic

career. As it turns out, there are a wide variety of non-academic pathways. These include start up companies, clinical facilities, product development, forensic sciences, private research centers, and more. Our workshop will provide 1) an overview of the common non-academic career pathways, 2) presentations from ISPGR members with significant non-academic employment, 3) a question and answer session with the speakers and a panel of approximately five ISPGR industry sponsors, and 4) an open time for relationship building. To focus on a pragmatic goal, presenters and panel members will address three guiding questions – 1) How is/was research conducted and applied in your non-academic setting, 2) What skills do potential employees need to be successful in your setting, 3) What are practical steps interested researchers and graduate students could take to move toward a career in your setting? The presentation is geared toward graduate students and academic faculty interested in a non-academic career. However, established academic researchers may also find the workshop interesting to help in their mentoring of graduate students in career directions, and to gain knowledge about how research is translated and used in non-academic settings.

Speakers Include:

Lewis Nashner – Experience leading clinical rehab engineering companies
James Borrelli – Experience in forensic engineering
Tyler Cuddeford – Experience in Nike Sport Research Lab
Rebecca Robins – Data science management at DataCamp

WORKSHOP 3:

Assessing real world mobility: Are we ready for the digital revolution?

Afternoon session: 12:30 – 15:30 (lunch on own)
Location: Moorefoot room (level 0)
Organiser: Lynn Rochester *Newcastle University, GBR*

The goal of the workshop is to provide the audience with a comprehensive overview of the challenges and opportunities of digital technology to assess real world mobility outcomes. Given the ageing population and concomitant increasing chronic burden, we need low-cost, widely-accessible tools to measure, monitor, and predict mobility problems. Mobility assessment in the real world forms the ideal place and digital technology the ideal partner. But are we ready for this? What are the significant challenges associated with this endeavour? This pre-conference workshop will review the state of the art of current mobility assessment tools across a range of different and relevant disease populations to set the scene for where we are now. We will then explore the challenges and opportunities of digital technology to enhance the current status from a range of different perspectives: the technical challenges for accurate measurement; clinical validation; the big-data challenge; the end user of technology; and implementation in practice.

WORKSHOP 4:

Advanced rehabilitation technology to boost your research!

Afternoon session: 12:30 – 15:30 (lunch on own)
Location: Offsite (University of Edinburgh venue)

For a detailed program and directions to the venue, please refer to the 'congress resources' section of the congress app
Location link: ***www.ed.ac.uk/informatics/about/location***

Organiser: Frans Steenbrink *Motek Medical*

In this workshop we will outline the state-of-the-art of currently available rehabilitation technology for gait and balance research. More specifically, we will focus on real-time visual feedback, gait adaptability, and gait perturbations using an instrumented dual-belt treadmill, motion capturing and other technology in combination with an application development framework to create custom research applications. Compared to most other (over-ground) motion labs, the treadmill set-up allows for more functional gait tasks to be evaluate in scientific protocols. Also controlled manipulations, such as slit-belt walking with deviating speeds for each belt, can be used to study motor-control in both healthy individuals and patient. Cognitive, visual and mechanical perturbations using the walking surface of the treadmill can be used to study pathology-specific responses. By controlling input settings for the perturbations and collecting parameters related to balance and locomotion, input-output responses can be evaluated to better understand the human system. In this workshop we will introduce the different concepts related to advance human movement research. Together, we will think of examples of how new research concepts can be integrated in laboratory setting using different types of technology. Also, we will interactively show and adjust several research applications using motion capture and virtual reality technologies and invite you to engage in our discussion on how we can use technology better understand the health and pathological human balance-and locomotion system.

DETAILED PROGRAM

SUNDAY JUNE 30

All congress sessions will take place at the Edinburgh International Conference Centre (EICC) unless otherwise stated.

PRE-CONGRESS WORKSHOPS

MORNING WORKSHOPS

08:30 - 10:00 ***Gait & Posture authors' workshop: Authors' rights and responsibilities***

Location: Carrick (level 1)

08:30 - 11:30 **WS.1.** ***Mixed reality for posture and gait research: Principles and applications***

Location: Moorefoot (level 0)

08:30 - 11:30 **WS.2.** ***Pursuing an industry position after graduate school***

Location: Tinto (level 0)

10:15 - 11:45 ***Gait & Posture reviewers' workshop: Identifying limitations in scientific articles***

Location: Carrick (level 1)

AFTERNOON WORKSHOPS

12:30 - 15:30 **WS.3.** ***Assessing real world mobility: Are we ready for the digital revolution?***

Location: Moorefoot (level 0)

12:30 - 15:30 **WS.4.** ***Advanced rehabilitation technology to boost your research!***

Location: Offsite (University of Edinburgh venue)

Please refer to the 'congress resources' section of the app for further details on venue and program. Location info: ***www.ed.ac.uk/informatics/about/location***

OPENING OF WORLD CONGRESS 2019

16:30 – 17:00 ***Opening ceremony***

Location: Pentland auditorium (level 3)

17:00 – 18:00 ***Keynote lecture 1***

Location: Pentland auditorium (level 3)

Janice Eng *University of British Columbia, CAN*

Interventions to improve mobility after stroke: A journey from mechanisms and clinical trials to implementation science

Chair: **Michael Cinelli** *Wilfrid Laurier University, CAN*

18:00 – 19:30 ***Opening reception***

Strathblane Hall (level 0)

MONDAY JULY 1

LECTURES

08:30 – 09:30 ***Keynote lecture 2***

Location: Pentland auditorium (level 3)

Herman van der Kooij *University of Twente, NLD*

Studying human balance control by perturbations: Insights and applications for wearable robotics

Chair: **Vivian Weerdesteyn** *Radboud University Medical Center, NLD*

09:30 – 10:00 ***Honorary member presentation***

Location: Pentland auditorium (level 3)

2019 Honorary members:

Anne Shumway-Cook *University of Washington, USA*

Rolf Moe-Nilssen *University of Bergen, NOR*

10:00 – 12:30 ***Posters session 1 and exhibitors***

(Refreshments provided 10:00 – 10:30)

Location: Strathblane & Lomond (level 0)

Poster listings begin on page 71

12:30 – 13:30 ***Lunch and exhibits***

Location: Strathblane & Lomond (level 0)

13:30 – 15:15 **SYMPOSIUM SESSIONS 1 – 3**

S.1 *Virtual reality in motion: Moving posture and gait research forward with do-it-yourself vs turnkey systems*

Location: Pentland suite (level 3)

Chair: **Anouk Lamontagne** *McGill University, CAN*
Moderators: **Haylie Miller** *UNT Health Science Centre, USA*
Meir Plotnik *Sheba Medical Center, ISR*
Participants:

Desiderio Cano Porras *Tel Aviv University and Center of Advanced Technologies in Rehabilitation, ISR*
Marco Buhler *McGill University, CAN*
Nicoleta Bugnariu *University of North Texas Health Science Center at Forth Worth, USA*
Anouk Lamontagne *McGill University, CAN*
Meir Plotnik *Sheba Medical Center, ISR*

S.2 *fNIRS data to understand cortical mechanisms underpinning exercise interventions*

Location: Fintry suite (level 3)

Chair: **Jasmine Menant** *NeuRA, Australia, AUS*
Participants:

Paulo Pelicioni *Neuroscience Research Australia, AUS*
Eling de Bruin *ETH Zurich, CHE*
Rodrigo Vitorio *Instituto de Biociências, UNESP – Universidade Estadual Paulista, BRA*
Anat Mirelman *Tel-Aviv Sourasky Medical Centre, ISR*

S.3 *Balance, gait and falls post stroke: Steps towards a better future*

Location: Sidlaw suite (level 3)

Chairs: **Vivian Weerdesteyn** *Radboud University Medical Center, NLD*
Itshak Melzer *Ben-Gurion University of the Negev, ISR*
Participants:

Shirley Handelzalts *Ben-Gurion University of the Negev, ISR*
Tanvi Bhatt *University of Illinois, USA*
Gelsy Torres-Oviedo *University of Pittsburgh, USA*
Jolanda Roelofs *Radboud University Medical Center, NLD*
Itshak Melzer *Ben-Gurion University of the Negev, ISR*
Vivian Weerdesteyn *Radboud University Medical Center, NLD*

15:15 – 15:45 ***Refreshment break***

Location: Strathblane & Lomond (level 0)

15:45 – 17:30 **SYMPOSIUM SESSIONS 4-6**

S.4 *Going from here to there and beyond: Fundamental theories and applications from what we have learned about human navigation of cluttered environments*

Location: Fintry suite (level 3)

Chair: **Anouk Lamontagne** *McGill University, CAN*
Participants:

Bradford McFadyen *Université Laval, CAN*
Michael Cinelli *Wilfrid Laurier University, CAN*
Anne-Hélène Olivier *Université de Rennes, Inria, FRA*
Julien Pettré *Université de Rennes, Inria, FRA*

S.5 *Falls prevention should start in middle age - Lessons on prevention from cardiology may advance fall prevention in old age*

Location: Sidlaw suite (level 3)

Chair: **Stephen Lord** *Neuroscience Research Australia, AUS*
Participants:

James Richardson *University of Michigan, USA*
Michele Callisaya *University of Tasmania, AUS*
Mirjam Pijnappels *VU Amsterdam, NLD*
Kim Delbaere *Neuroscience Research Australia, UNSW, AUS*

S.6 *Turning as measure of functional mobility: When biomechanics, neural control, and technology come together*

Location: Pentland suite (level 3)

Chairs: **Martina Mancini** *Oregon Health & Science University, USA*
Fay Horak *Oregon Health & Science University, USA*
Participants:

Marco Schieppati *International University of Health, Exercise and Sports, LUX*
Lorenzo Chiari *University of Bologna, ITA*
Inbal Maidan *Tel Aviv Sourasky Medical Center, ISR*
Martina Mancini *Oregon Health & Science University, USA*

17:45 – 18:15 ***Committee interest meeting***

Location: Sidlaw suite (level 3)

TUESDAY JULY 2

08:30 – 09:30 ***Keynote lecture 3***

Location: Pentland auditorium (level 3)

Lynn Rochester *University of Newcastle, GBR*

Gait - A step in the right direction?

Chair: **Sue Lord** *Auckland University of Technology, NZL*

09:30 – 10:00 ***PSA talk***

Location: Pentland auditorium (level 3)

Jenna Yentes *University of Nebraska at Omaha, USA*

Nonlinear analysis: Translating the theoretical into clinical applications

10:00 – 12:30 ***Posters session 2 and exhibitors***

(Refreshments provided 10:00 – 10:30)

Location: Strathblane & Lomond (level 0)

Poster listings begin on page 71

12:30 – 13:30 ***Lunch and exhibits***

Location: Strathblane & Lomond (level 0)

13:30 – 15:15 **SYMPOSIUM SESSIONS 7 – 9**

S.7 *From basic science to clinical practice: Anxiety, attentional focus and the control of posture and gait*

Location: Pentland suite (level 3)

Chair: **William Young** *Brunel University London, GBR*

Participants:

Toby Ellmers *Brunel University, GBR*
Elmar Kal *VU Amsterdam, NLD*
Martin Zaback *VU Amsterdam, NLD*
Liis Uiga *VU Amsterdam, NLD*

S.8 *Data analytics in the wild: Translating emerging wearable inertial and camera methods to fall prevention intervention strategies*

Location: Fintry suite (level 3)

Chairs: **James Tung** *University of Waterloo, CAN*
Alan Godfrey *Northumbria University, GBR*

Participants:

Alan Godfrey *Northumbria University, GBR*
Silvia Del Din *Newcastle University, GBR*
Mina Nouredanesh *University of Waterloo, CAN*
Stephen Robinovitch *Simon Fraser University, CAN*
Kim van Schooten *Neuroscience Research Australia (NeuRA), AUS*

S.9 *Spinal cord stimulation for gait dysfunction and postural instability in Parkinson's disease*

Location: Sidlaw suite (level 3)

Chair: **Mandar Jog** *Western University, CAN*
Moderator: **Olivia Samotus** *Western University, CAN*

Participants:

Olivia Samotus *London Health Sciences Centre, GBR*
Romulo Fuentes *Universidad de Chile, CHL*
Helen Bronte-Stewart *Stanford University, USA*

15:15 – 15:45 ***Refreshment break***

Location: Strathblane & Lomond (level 0)

15:45 – 17:45 **ORAL SESSIONS 1 – 3**

O.1 *Parkinson's disease*

Location: Fintry suite (level 3)

Co-Chairs: **Martijn Muller** *University of Michigan, USA*
Brook Galna *University of Newcastle, GBR*

O.1.i *Episodic motor impairments of falls and freezing of gait differ in regional cerebral central cholinergic system changes in Parkinson's disease*

Presenter: **Nicolaas Bohnen**

Nicolaas Bohnen[1], Prabesh Kanel[2], Zhi Zhou[2], William Dauer[2], Roger Albin[1], Martijn Muller[2]

[1]University of Michigan & VAMC, [2]University of Michigan

O.1.ii *Immediate and long-term effects of intensive multimodal balance and gait training on gait and gait variability in Parkinson's disease*

Presenter: **Linda Rennie**

Linda Rennie[1], Niklas Löfgren[2], Erika Franzén[2]

[1]Sunnaas Rehabilitation Hospital, [2]Karolinska Institutet

O.1.iii *Comprehensive measures of balance and gait in GBA mutation carriers and non-carriers in Parkinson's disease*

Presenter: **Rosie Morris**

Rosie Morris[1], Douglas Martini[1], Katrijn Smulders[2], Valerie Kelly[3], Amie Hiller[1], Kathy Chung[1], Shu-Ching Hu[3], Cyrus Zabetian[3], Kathleen Poston[4], Ignacio Mata[3], Karen Edwards[5], Thomas Montine[4], Joseph Quinn[1], Fay Horak[1]

[1]Oregon Health & Science University, [2]Sint Maartenskliniek, [3]University of Washington, [4]Stanford School of Medicine, [5]University of California

O.1.iv *Effects of a 6-week cognitively challenging agility exercise program in people with Parkinson's disease*

Presenter: **Fay Horak**

Martina Mancini[1], Fay Horak[1], Naoya Hasegawa[1], Se Hee Jung[1], Vrutangkumar Shah[1], Anjanibhargavi Ragothaman[1], Daniel Peterson[2], Katrijn Smulders[3], Patricia Carlson-Kuhta[1], John Nutt[1], Laurie King[1], Jodi Lapidus[1], Martina Mancini[1]

[1]Oregon Health & Science University, [2]Arizona State University, [3]Sint Maartenskliniek

O.1.v *Textured insoles improve gait in people with Parkinson's disease who have impaired peripheral sensation*

Presenter: **Graham Kerr**

Graham Kerr[1], Feng Qiu[1], Keith Davids[2], Ewld Hennig[1], Michael Cole[3], Sandy Brauer[4], Anna Hatton[4]

[1]Queensland University of Technology, [2]Sheffield Hallam University, [3]Australian Catholic University, [4]University of Queensland

O.1.vi *Test-retest reliability and minimal detectable change of the new freezing of gait questionnaire*

Presenter: **Pieter Ginis**

Pieter Ginis[1], Carolien Strouwen[2], Bauke Dijkstra[1], Bastiaan Bloem[3], Alice Nieuwboer[1]

[1]KU Leuven, [2]Hasselt University, [3]Radboud University Medical Center

O.1.vii *Gait deficits in early stage Parkinson's disease are related to the expression of REM sleep without Atonia*

Presenter: **Colum MacKinnon**

Sommer Amundsen Huffmaster[1], Matthew Petrucci[1], Devin O'Connell[1], Maria Linn-Evans[1], Jae Woo Chung[1], Paul Tuite[1], Colum MacKinnon[1]

[1]University of Minnesota

O.1.viii *Inter-individual balance adaptations in response to perturbation treadmill training in Parkinson's disease*

Presenter: **Sarah Klamroth**

Sarah Klamroth[1], Heiko Gassner[1], Jürgen Winkler[1], Björn Eskofier[1], Jochen Klucken[1], Klaus Pfeifer[1], Simon Steib[1]

[1]Friedrich-Alexander-University Erlangen-Nürnberg

O.2 *Aging and falls*

Location: Pentland suite (level 3)

Co-chairs: **Kathryn Sibley** *University of Manitoba, CAN*

Fabio Barbieri *São Paulo State University, BRA*

O.2.i *Prevention of cautious strategy in obstacle-avoidance situations in older adults: The effect of spatial constraints on collision-avoidance behavior*

Presenter: **Takahiro Higuchi**

Takahiro Higuchi[1], Risa Okada[1], Ryo Watanabe[1], Takuya Goto[1], Tomoki Hakamata[1], Ryota Hiyoshi[1], Ryuma Yonemoto[1], Akiko Imura[1]

[1]Tokyo Metropolitan University

O.2.ii *The association of clinic-based mobility tasks and measures of community performance and risk*

Presenter: **Michele Callisaya**

Michele Callisaya[1], Joe Verghese[2]

[1]University of Tasmania, [2]Albert Einstein College of Medicine

O.2.iii *The inter-relationships between glycemic markers and gait patterns across age groups*

Presenter: **Maayan Agmon**

Maayan Agmon[1], Ram Weiss[2], Hagit Hochner[2], Iaroslav Youssim[2], Yechiel Friedlander[2], Tamar Shochat[1], Rachel Kizony[1]

[1]University of Haifa, [2]Hebrew University

O.2.iv *Motoric cognitive risk syndrome and risk for falls, their recurrence and post-fall fractures: results from a prospective observational population-based cohort study*

Presenter: **Harmehr Sekhon**

Harmehr Sekhon[1], Gilles Allali[2], Olivier Beauchet[1]

[1]Jewish General Hospital and Lady Davis Institute for Medical Research, Faculty of Medicine, McGill University, [2]Geneva University Hospital and University of Geneva

O.2.v *Obstacle-induced trip perturbation training: proactive and reactive adaptation to reduce falls in community-dwelling older adults*

Presenter: **Yiru Wang**

Yiru Wang[1], Shuaijie Wang[1], Tanjeev Kaur[1], Tanvi Bhatt[1]

[1]University of Illinois at Chicago

O.2.vi *Standing steadiness and variability of older adults on a step ladder*

Presenter: **Erika Pliner**

Erika Pliner[1], Daina Sturnieks[2], Kurt Beschorner[1], Mark Redfern[1], Stephen Lord[2]

[1]University of Pittsburgh, [2]Neuroscience Research Australia

O.2.vii *The effectiveness of the StandingTall home-based, unsupervised balance exercise program in preventing falls in community-dwelling older people*

Presenter: **Kim Delbaere**

Kim Delbaere[1], Kim van Schooten[1], Stephen Lord[1], Lindy Clemson[2], GA Rixt Zijlstra[3], Jacqueline Close[4]

[1]University of New South Wales, [2]University of Sydney, [3]University of Maastricht, [4]Prince of Wales Hospital

O.2.viii *Walking adaptability for targeted fall-risk assessments*

Presenter: **Daphne Geerse**

Daphne Geerse[1], Melvyn Roerdink[1], Johan Marinus[2], Jacobus van Hilten[2]

[1]Vrije Universiteit Amsterdam, [2]Leiden University Medical Center

O.3 *Somatosensory & vestibular function*

Location: Sidlaw suite (level 3)

Co-chairs: **Patrick Sparto** *University of Pittsburgh, USA*

Mark Carpenter *University of British Columbia, CAN*

O.3.i *Noisy galvanic stimulation and vestibular perception: Otolith versus semicircular canal mediated mechanisms*

Presenter: **Klaus Jahn**

Klaus Jahn[1], Aram Keywan[2], Max Wuehr[2]

[1]Schoen Klinik Bad Aibling and University of Munich, [2]University of Munich

O.3.ii *Postural regulation strategies in Ehlers-Danlos Syndrome hypermobility type*

Presenter: **Emma Gabrielle Dupuy**

Emma Dupuy[1], Leslie Decker[1]

[1]UMR-S 1075 COMETE UNICAEN/INSERM

O.3.iii *Haptic touch feedback that is sway-referenced and graded can improve center of mass stability in post-concussion syndrome*

Presenter: **Tyler Cuddeford**

Andrew Meszaros[1], Alyssa Carey[1], Tyler Cuddeford[1]

[1]George Fox University

O.3.iv *Perception of gait movements using gait-like vibrations in individuals with and without sensorimotor deficits*

Presenter: **Tapin Alexandre**

Tapin Alexandre[1]

[1]Université de Montréal

O.3.v *3D head stability of people with vestibular dysfunction during gait in variable sensory conditions*

Presenter: **Brian Loyd**

Brian Loyd[1], Janie Saviers-Steiger[1], Peter Fino[1], Serene Paul[2], Mark Lester[3], Lee Dibble[1]

[1]University of Utah, [1]University of Utah, [2]University of Sydney, [3]Army-Baylor University

O.3.vi *Interaction between lower limb cutaneous and muscle afferent pathways during standing*

Presenter: **Robyn Mildren**

Robyn Mildren[1], Gregg Eschelmuller[1], Ryan Peters[2], Jean-Sebastien Blouin[1], Mark Carpenter[1], J. Timothy Inglis[1]

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

O.3.vii *Subthreshold electrical noise enhances mechanically-evoked cutaneous reflexes*

Presenter: **Tushar Sharma**

Tushar Sharma[1], Ryan Peters[2], Leah Bent[1]

[1]University of Guelph, [2]University of Calgary

O.3.viii *The plantar surface of the foot: The bigger picture*

Presenter: **Leah Bent**

Leah Bent[1], Erika Howe[1], Simone Smith[1], Nicholas Strzalkowski[2], Ryan Peters[3], Timothy Inglis[4]

[1]University of Guelph, [2]Mount Royal University, [3]University of Calgary, [4]University of British Columbia

WEDNESDAY JULY 3

08:30 – 09:30 **Keynote lecture 4**

Location: Pentland auditorium (level 3)

Adolfo Bronstein *Imperial College London, GBR*

Visual control of posture

Chair: **Mark Hollands** *John Moores University, GBR*

09:30 – 10:00 **Emerging Scientist talk**

Deborah Jehu *University of British Columbia, CAN*

Best practices for the assessment and therapeutic intervention of cognition and mobility in aging populations

10:00 – 10:30 **Refreshment break**

Location: Strathblane & Lomond (level 0)

10:30 – 12:30 **ORAL SESSIONS 4 – 6**

O.4 *Balance control*

Location: Fintry suite (level 3)

Co-chairs: **Vivian Weerdesteyn** *Radboud University, NLD*
Daniel Peterson *Arizona State University, USA*

O.4.i *Effect of external base-of-support perturbation parameters on measures of forward reactive stepping*

Presenter: **Taylor Winberg**
Taylor Winberg[1], Andrew Laing[1]
[1]University of Waterloo

O.4.ii *Upward perturbation – novel methodology to study stumbling during walking*

Presenter: **Desiderio Cano Porras & Meir Plotnik**
Desiderio Cano Porras[1], Jesse Jacobs[2], Rivka Inzelberg[3], Gabriel Zeilig[1], Meir Plotnik[1]
[1]Sheba Medical Center, [2]University of Vermont, [3]Tel Aviv University

O.4.iii *A startle response is not evoked during falls following large postural perturbations in young adults*

Presenter: **Andrew Sawers**
Andrew Sawers[1], Stephen Robinovitch[1], Vivian Weerdesteyn[2]
[1]University of Illinois at Chicago, [2]Radboud University Medical Center

O.4.iv *Cortical midfrontal theta activity scales with acceleration of whole-body mechanical perturbations and reactive stepping behavior*

Presenter: **Teodoro Solis-Escalante**
Teodoro Solis-Escalante[1], Mitchel Stokkermans[2], Michael Cohen[2], Vivian Weerdesteyn[1]
[1]Radboud University Medical Center, [2]Donders Institute for Brain, Cognition, and Behavior

O.4.v *Balance perturbation training for rehabilitation of dynamic balance in acquired brain injury victims: An exploratory interventional prospective trial and a neuroimaging investigation*

Presenter: **Katherin Joubran**
Katherin Joubran[1], Lior Shmuelof[1], Simona Bar Haim[1]
[1]Ben-Gurion University of the Negev

O.4.vi *Impaired sensorimotor transformations for balance in Parkinson disease are associated with future falls*

Presenter: **J Lucas McKay**
Lucas McKay[1], Kimberly Lang[2], Sistania Bong[1], Madeleine Hackney[2], Stewart Factor[2], Lena Ting[1]
[1]Emory University and Georgia Tech, [2]Emory University

O.4.vii *Effects of a single bout of cardiovascular exercise on balance learning: A comparison of different exercise intensities*

Presenter: **Philipp Wanner**
Philipp Wanner[1], Theresa Müller[1], Klaus Pfeifer[1], Simon Steib[1]
[1]Friedrich-Alexander University Erlangen-Nürnberg

O.4.viii *Neuromodulation of lumbosacral spinal networks enables independent standing after complete paraplegia*

Presenter: **Dimitry Sayenko**
Dimirtry Sayenko[1], V.Reggie Edgerton[2], Yury Gerasimenko[2]
[1]Houston Methodist Research Institute, [2]University of California, Los Angeles

O.5 *Coordination of gait*

Location: Pentland suite (level 3)

Co-chairs: **Nicoleta Bugnariu** *University of North Texas Health Science Center, USA*
Claudine Lamoth *University of Groningen, NLD*

O.5.i *Muscle synergy complexity in children with cerebral palsy during the development of walking*

Presenter: **Annike Bekius**
Annike Bekius[1], Coen Zandvoort[1], Jennifer Kerkman[1], Andreas Daffertshofer[1], Annemieke Buizer[1], Jaap Harlaar[2], Nadia Dominici[1]
[1]Vrije Universiteit Amsterdam, [2]Delft University of Technology

O.5.ii *Humans use multi-objective control to regulate lateral foot placement when walking*

Presenter: **Jonathan Dingwell**
Jonathan Dingwell[1], Joseph Cusumano[1]
[1]Pennsylvania State University

O.5.iii *Walking with narrow steps: Are we more stable through increased sensory contributions? A galvanic vestibular stimulation study*

Presenter: **Sjoerd Bruijn**
Sjoerd Bruijn[1], Jaap Van Dieën[1], Rina Magnani[2], Patrick Forbes[3]
[1]VU Amsterdam, [2]Goiás State University, [3]Erasmus MC

O.5.iv *The spine in gait – a differentiated analysis of spinal rotary motion*

Presenter: **Ulrich Betz**
Ulrich Betz[1], Janine Huthwelker[1], Jürgen Konradi[1], Claudia Wolf[1], Ruben Westphal[1], Kjell Heitmann[2], Helmut Diers[1], Philipp Drees[1]
[1]University Medical Center of the Johannes Gutenberg University Mainz, [2]DIERS International GmbH

O.5.v *Spatial updating of remembered goal position during barrier avoidance*

Presenter: **Brittany Baxter**
Brittany Baxter[1], William Warren[1]
[1]Brown University

O.5.vi *Type of prosthesis influences functional performance and quality of life in patients with transtibial amputations*

Presenter: **Ophélie Puissegur**

Ophelie Puissegur[1], Gordon Stevens[2], Elizabeth Ginzel[2], Rita Patterson[1], Nicoleta Bugnariu[1]

[1]University of North Texas Health Science Center, [2]Baker O&P

O.5.vii *Deficient tibialis anterior activity following inward perturbation during walking predisposes elderly to use stepping rather than ankle strategies to control balance*

Presenter: **Maarten Afschrift**

Maarten Afschrift[1], Friedl De Groote[1], Ilse Jonkers[1]

[1]KU Leuven

O.5.viii *Influence of required coefficient of friction on rate of shoe wear*

Presenter: **Sarah Hemler**

Sarah Hemler[1], Jessica Sider[1], Kurt Beschorner[1]

[1]University of Pittsburgh

O.6 *Cognitive, attentional and emotional influences*

Location: Sidlaw suite (level 3)

Co-chairs: **Anat Mirelman** *Tel Aviv Sourasky Medical Center, ISR*

John Stins *VU Amsterdam, NLD*

O.6.i *The effects of dual tasking and aging on event related potential (ERP) components of gait cycle*

Presenter: **Inbal Maidan**

Inbal Maidan[1], Shiran Shustak[1], Dmitry Patashov[2], Eran Gazit[1], Boris Shapiro[2], Aviran Levy[2], Nir Giladi[1], Jeff Hausdorff[1], Anat Mirelman[1]

[1]Tel-Aviv Sourasky Medical Center, [2]Holon Institute of Technology

O.6.ii *The neural signature of impaired dual tasking in Idiopathic REM sleep behavior disorder patients: An fMRI study*

Presenter: **Kaylena Ehgoetz Martens**

Kaylena Ehgoetz Martens[1], Elie Matar[2], James Shine[1], Joseph Phillips[3], Matthew Georgiades[1], Ronald Grunstein[4], Glenda Halliday[1], Simon Lewis[1]

[1]University of Sydney, [2]Brain and Mind Centre, [3]University of Western Sydney, [4]Woolcock Medical Institute

O.6.iii *An invisible hand: Automatic preparation for arresting a fall when viewing a handrail*

Presenter: **David Cole**

David Cole[1], Butler Blake[1], Mahmoud Mansour[1], Sarah Schwartz[1], David Bolton[1]

[1]Utah State University

O.6.iv *Embodiment of painful situations and its postural correlates*

Presenter: **Thierry Lelard**

Thierry Lelard[1], Olivier Godefroy[1], Said Ahmaidi[1], Pierre Krystkowiak[1], Harold Mouras[1]

[1]Université de Picardie

O.6.v *Shift in attentional allocation during cognitive-motor dual-tasking following cognitive or physical training in healthy older adults*

Presenter: **Rachel Downey**

Karen Li[1], Rachel Downey[1], Louis Bherer[2], Thien Tuong Minh Vu[3], Kristell Pothier[4], Brittany Intzandt[1], Tudor Vrinceanu[2], Thomas Vincent[5], Anil Nigam[5], Antony Karelis[6], Laurent Bosquet[7], Nicolas Berryman[8]

[1]Concordia University, [2]Université de Montréal, [3]Centre hospitalier Université de Montréal, [4]University of Tours, [5]Centre de recherche de l'Institut de Cardiologie de Montréal, [6]Université du Québec à Montréal, [7]Université de Poitiers, [8]Bishop's University

O.6.vi *Postural threat effects on perceptions of lower leg somatosensory stimuli during standing*

Presenter: **Taylor Cleworth**

Taylor Cleworth[1], Ryan Peters[2], Romeo Chua[3], J. Timothy Inglis[3], Mark Carpenter[3]

[1]University of Waterloo, [2]University of Calgary, [3]University of British Columbia

O.6.vii *Can split-belt treadmill training improve dual-task turning performance in patients with Parkinson's disease with Freezing of gait*

Presenter: **Nicholas D'Cruz**

Nicholas D'Cruz[1], Pieter Ginis[1], Jana Seuthe[2], Christian Schlenstedt[2], Alice Nieuwboer[1]

[1]KU Leuven, [2]Christian-Albrechts-University (CAU) of Kiel

O.6.viii *Look where you are thinking*

Presenter: **Yogev Koren**

Yogev Koren[1], Yisrael Parmet[1], Ilay Sofer[1], Ohad Ben-Shahar[1], Rotem Mairon[1], Simona Bar-Haim[1]

[1]Ben-Gurion University

12:30 on-wards **Free time and half day tours of Edinburgh**

For details on the half day tours, please refer to page 8

THURSDAY JULY 4

08:30 – 09:30 **Keynote lecture 5**

Location: Pentland auditorium (level 3)

Trevor Drew *University of Montreal, CAN*

A Cortical Network for the planning and execution of visually-guided gait modifications

Chair: **Yury Ivanenko** *IRCCS Fondazione Santa Lucia, ITA*

09:30 – 10:00 **Annual General Meeting**

Location: Pentland auditorium (level 3)

10:00 – 12:30 **Poster session 3 and exhibits**
(Refreshment break from 10:00 – 10:30)
Location: Strathblane & Lomond (level 0)
Poster listings begin on page 71

12:30 – 13:30 **Lunch and exhibits**
Location: Strathblane & Lomond (level 0)

13:30 – 15:15 **SYMPOSIUM SESSIONS 10 – 12**

S.10 Virtual reality as a tool to alter multisensory perception and human motor learning

Location: Fintry suite (level 3)

Chair: **Daniel Ferris** *University of Florida, USA*
Moderator: **Karen Li** *Concordia University, CAN*
Participants:

Daniel Ferris *University of Florida, USA*
Jennifer Campos *Toronto Rehabilitation Institute, CAN*
James Finley *University of Southern California, USA*
Karen Li *Concordia University, CAN*

S.11 Balance training using perturbations to prevent falls: Is it feasible and effective?

Location: Pentland suite (level 3)

Chair: **Stephen Lord** *Neuroscience Research Australia, AUS*
Participants:

Tanvi Bhatt *University of Illinois, USA*
Kiros Karamanidis *London South Bank University, GBR*
Avril Mansfield *Toronto Rehabilitation Institute, CAN*
Yoshiro Okubo *Neuroscience Research Australia, AUS*

S.12 The challenge of preventing stair falls: Understanding the individual contributions of, and interplay between, environmental and intrinsic factors

Location: Sidlaw suite (level 3)

Chair: **Bradford J. McFadyen** *Université Laval, CAN*
Participants:

Richard Foster *Liverpool John Moores University, GBR*
Alison Novak *Toronto Rehabilitation Institute-UHN, CAN*
Neil Reeves *Manchester Metropolitan University, GBR*
Mark Hollands *Liverpool John Moores University, GBR*
Bradford McFadyen *Université Laval, CAN*

15:15 – 15:45 **Refreshment break**
Location: Strathblane & Lomond (level 0)

15:45 – 17:30 **SYMPOSIA SESSIONS 13 – 15**

S.13 Early development of human locomotion and its functional consequences

Location: Fintry suite (level 3)

Chair: **Yury Ivanenko** *Fondazione Santa Lucia, ITA*
Moderators: **Marianne Barbu-Roth** *Paris Descartes University, FRA*
David Anderson *San Francisco State University, USA*
Participants:

Marianne Barbu-Roth *Paris Descartes University, FRA*
Yury Ivanenko *Fondazione Santa Lucia, ITA*
David Anderson *Marian Wright Edelman Institute, San Francisco State University, USA*
Christine Assaiante *Aix Marseille University, FRA*

S.14 Maximising interdisciplinary methods to assess falls risk in clinical groups

Location: Sidlaw suite (level 3)

Chair: **Chesney Craig** *Manchester Metropolitan University, GBR*
Moderator: **Clemens Becker** *Robert-Bosch Hospital, GER*
Participants:

Chesney Craig *Manchester Metropolitan University, GBR*
Kim van Schooten *Neuroscience Research Australia, AUS*
Will Young *Brunel University, GBR*
Claudine Lamoth *University of Groningen, NLD*
Clemens Becker *Robert Bosch Hospital, DEU*
Yuhan Zhou *University of Groningen, NLD*

S.15 STOP! Age-related changes in sensorimotor inhibition and the associated implications for impaired gait and balance control

Location: Pentland suite (level 3)

Chair: **Brett Fling** *Colorado State University, USA*
Participants:

Brett Fling *Colorado State University, USA*
Rachael Seidler *University of Florida, USA*
Tibor Hortobagyi *University of Groningen Medical Center, NLD*
Anita Christie *University of Western Ontario, CAN*

17:30 – 18:00 **Awards presentation ceremony**
Location: Pentland (level 3)

– 2019 ISPGR World Congress ends –

19:00 – late **Gala dinner**
Location: Cromdale Hall (EICC, level -2)
With entertainment provided by **Òr Cèilidh Band**

AWARDS

PROMISING SCIENTIST AWARD WINNER 2019

Sponsored by **Elsevier,**
publishers of Gait & Posture Journal

The Promising Scientist Award acknowledges those who have performed superior research in posture and/or gait early in their career. The awards committee is pleased to announce this year's award recipient

Jenna Yentes *University of Nebraska at Omaha, USA*

Dr. Jenna Yentes received her PhD in biomechanics from the University of Nebraska in 2013. She is currently an Assistant Professor in the Department of Biomechanics at the University of Nebraska at Omaha, where she directs the INSPIRE research group. Her research focuses on functional outcomes in those that suffer from pulmonary disease, namely chronic obstructive pulmonary disease. Dr. Yentes' group were the first to document biomechanical changes in gait in persons with chronic obstructive pulmonary disease. Jenna has also explored the clinical utility of locomotor respiratory coupling in this population. Her research has shown that non-varying coupling is related to energy expenditure. She has filed two patent applications related to a wearable technology for monitoring coupling. In addition, Dr. Yentes has published several methods papers regarding the use of nonlinear algorithms such as sample entropy with human movement data. Her work in this area has pushed for increased transparency regarding selection of parameters to be used in such algorithms, as many findings can be an artifact of parameter choice. She hopes to continue her work in this area, cultivating proper use and interpretation of nonlinear data.

Nonlinear analysis: Translating the theoretical into clinical applications

The popularity of nonlinear analysis has grown exponentially in the past 20 years. Yet, with many of the algorithms their biological interpretation or clinical translation remains ambiguous, which has led to a confusion of their use in the field of gait and posture research. Furthermore, careful parameter selection is important to ensure results are not an artifact of parameter selection. In this presentation, I will focus on nonlinear tools to quantify coupling of biorhythms (i.e., walking and breathing) and further, how these tools have been used to inform clinical applications.

PSA presentation:
Tuesday July 2, 09:30 – 10:00

EMERGING SCIENTIST AWARD WINNER 2019

Sponsored by **Elsevier,**
publishers of Gait & Posture Journal

The Emerging Scientist Award acknowledges those who have performed superior research in posture and/or gait within three years of their PhD degree. The awards committee is pleased to announce this year's award recipient

Deborah Jehu *University of British Columbia, CAN*

The objective of Deborah's research has been to generate new insights into improving therapeutic intervention techniques, informing best practices in cognitive and mobility assessment, and increasing the knowledge on compensatory strategies across different sensorimotor, cognitive, and psychological contexts in populations with cognitive and mobility disability. Deborah completed her PhD in Human Kinetics at the University of Ottawa, and has collaborated with researchers, interdisciplinary healthcare professionals, health authorities, and industry partners in Winnipeg, British Columbia, Ontario, Hong Kong, and Portland. Now funded by the Michael Smith Foundation for Health Research and working with Dr. Liu-Ambrose, Deborah is expanding her expertise to include implementation science and the cognitive contributions following therapeutic interventions in clinical populations.

Best practices for the assessment and therapeutic intervention of cognition and mobility in aging populations

A fall can be life changing and even fatal. Exercise is the most important corrective factor in improving cognitive and mobility fall-risk factors. However, many interventions have been unsuccessful in decreasing fall-risk and/or falls, which may be a function of 1) the intervention itself or 2) the selected outcome measures. Design (i.e., frequency, intensity, type, and time) and delivery (e.g., intervention timing following injury) are important considerations for efficacious primary and secondary fall prevention interventions.

Ensuring that the outcome measures have adequate psychometric properties is critical in order to determine that improvements are a result of the intervention rather than measurement error. Including commonly reported fall-risk outcome measures across interventions would also improve between-study comparability. Notably, both the intervention and assessment should be tailored according to the population. In this talk, I will discuss best practices in the assessment and therapeutic intervention of cognitive and mobility fall-risk factors across a variety of populations.

ESA presentation:
Wednesday July 3, 09:30 – 10:00

CONFERENCE AWARDS

ISPGR is pleased to support the trainee members with presentation awards during the World Congress. Recipients of the various awards 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 awards will be announced at the closing session on **Thursday July 4.**

BEST TALK BY A TRAINEE

One best talk will be awarded to a student or post doc member of ISPGR who presents an oral presentation at the World Congress.

AFTAB PATLA INNOVATION AWARD

Thank you to **NDI Digital** for continuing to support the Aftab Patla Award. The ISPGR awards committee 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.

BEST POSTER FOR POSTDOCTORAL FELLOWS

In addition to the Aftab Patla Innovation Award, awarded to student poster presenters, ISPGR also offers two best poster awards for Postdoctoral Fellows. One award will be for basic science and one for clinical science.

TRAVEL STIPENDS

ISPGR is pleased to provide five trainee members with travel stipends based on their contributed submissions as selected by the Awards Committee. Congratulations to all the winners!

Annike Bekius *Vrije Universiteit, NLD*

Muscle synergy complexity in children with cerebral palsy during the development of walking

Sarah Hemler *University of Pittsburgh, USA*

Influence of required coefficient of friction on rate of shoe wear

Janis Kim *University of Illinois at Chicago, USA*

The frequency and circumstances of falls reported by unilateral lower limb prosthesis users

Rosie Morris *Oregon Health and Science University, USA*

Comprehensive measures of balance and gait in GBA mutation carriers and non-carriers in Parkinson's Disease

Sutton Richmond *Colorado State University, USA*

Bridging the callosal gap in gait: A mechanistic evaluation of white matter's role in bilateral coordination

KEYNOTE SPEAKERS

Janice Eng *University of British Columbia, CAN*

Janice Eng is a Professor in the Department of Physical Therapy at the University of British Columbia and Director of the Rehabilitation Research Program at the GF Strong Rehab Centre. She has clinical training in physical therapy and occupational therapy, as well as training in biomedical engineering. Her PhD was supervised by the late Dr. David Winter in the topic of 3D gait analysis. Since then, she has focused on stroke recovery and rehabilitation, from mechanisms to clinical trials, and more recently on implementation science. She is a Senior CANResearch Chair and has published over 200 peer-reviewed journal publications in the field of neurological rehabilitation. Two of her stroke exercise programs, GRASP for improving arm and hand function and FAME for improving fitness and mobility, are used in over 1500 sites in 40 countries. Through a series of randomized controlled trials, her FAME program has been shown to improve mobility, postural reflexes, fitness, bone health, cognition, and reduce falls in people living with a stroke.

Keynote address: **June 30, 17:00 – 18:00**

Interventions to improve mobility after stroke: A journey from mechanisms and clinical trials to implementation science

Stroke is a common condition with 1 in 5 persons having a stroke after age 55. Furthermore, there is an increasing stroke occurrence in younger adults due to the epidemic of obesity and diabetes. While stroke affects multiple domains of function, regaining and improving walking is high on the priority of stroke survivors. This presentation will first describe mechanistic research aimed at understanding how muscle function, balance and walking are altered by stroke. In addition, data quantifying the intensity of inpatient rehabilitation and physical activity in the community of individuals after stroke will be presented. The development and efficacy of interventions to improve postural reflexes, balance, mobility and reduce falls after stroke will then be discussed, including novel interventions utilizing wearable sensors, as well as robotic exoskeletons. In particular, the concept of repetitions and neuroplasticity, in addition to the importance of the time window of neurological recovery after stroke will be examined. Lastly, methods and theories to facilitate the implementation of complex stroke rehabilitation and exercise programs will illustrate translation of knowledge to real-world practice.

Herman van der Kooij *University of Twente, NLD*

Prof. Dr. ir. Herman van der Kooij, (1970) received his Phd with honors (cum laude) in 2000 and is professor in Biomechatronics and Rehabilitation Technology at the Department of Biomechanical Engineering at the University of Twente (0.8 fte), and Delft University of Technology (0.2fte), the Netherlands. His expertise and interests are in the field of human motor control, adaptation, and learning, rehabilitation and wearable robots, diagnostic, and assistive robotics, virtual reality, rehabilitation medicine, and neuro computational modeling. He has published over 200 publications in the area of biomechatronics and human motor control. He was awarded the prestigious Dutch VIDI and VICI personnel grants in 2001 and 2015 respectively. He is associate editor of IEEE TBME and IEEE Robotics and Automation Letters, member of IEEE EMBS technical committee of Biorobotics, and was member of several scientific program committees in the field of rehabilitation robotics, bio robotics, and assistive devices. He is the founder and coordinator of the European FP7 project Symbitron, the national program wearable robotics and the national 4TU program Soft Robotics. He is the general chair of the IEEE Biorobotics conference in 2018 in the Netherlands.

Keynote address: **July 1, 08:30 – 09:30**

Studying human balance control by perturbations: Insights and applications for wearable robotics

We study human balance control during standing and walking by analysing the responses evoked by mechanical perturbations. We developed simple template models and more realistic neuro-mechanical models to interpreted and predict how humans respond to various mechanical perturbations and how they maintain balance. We translate these predictive models into human inspired controllers of wearable robots. We demonstrated that with this translational approach we can enhance standing balance and the walking speed of subjects with an incomplete spinal cord injury wearing an exoskeleton.

Lynn Rochester *Newcastle University, GBR*

Lynn is Professor of Human Movement Science in the Institute of Neuroscience, Newcastle University. She is Director of the Clinical Ageing Research Unit, a translational clinical research platform focussed on experimental medicine including a significant number of Parkinson's disease clinical trials. She set up and leads the Brain and Movement Research Group (BAM) (***bam-ncl.co.uk***), comprised of a multidisciplinary team of clinicians, clinical scientists and clinical engineers with a research focus on age related gait and mobility disorders. Her main research interests are in neurodegenerative disease (particularly Parkinson's disease) focused on the motor and non-motor mechanisms of gait and falls, surrogate markers of disease and disease progression (in particular cognitive decline and falls risk), development and evaluation of novel interventions, and technological applications in healthcare using wearable sensors. She is Chair of the Parkinson's UK Excellence Network Evidence Based Practice Committee and takes a key role in academic and professional leadership. She is an honorary consultant physiotherapist and set up and leads an academic physiotherapy service based in the Regional Movement Disorders Service at Newcastle upon Tyne Hospitals NHS Foundation Trust.

Keynote address: **July 2, 08:30 – 09:30**

Gait - A step in the right direction?

How do we keep people with neurodegenerative disease mobile and safe? This was the question we started with many years ago. It is a fundamental aim and the raison d'etre for myself and my research group as we directed a concerted, collaborative effort over the subsequent decade. Why is this important? People who develop age related neurodegenerative conditions such as Parkinson's have to cope with significant mobility problems. Walking (or gait) features at the top of their list of concerns. This is understandable as it reduces independence and leads to an increased risk of falls. As if this is not enough, becoming less active adds to the overall burden of disease. To date managing gait problems remains a significant challenge – not helped by the fact that an understanding of the causes is still evolving. Efforts to mitigate mobility loss by targeting gait impairments are therefore key and we need to start as early as possible.

Gait is complex and complex problems require complex solutions! Adopting a 360-degree perspective provides a platform to approach this, incorporating a multi-domain approach to include multiple contributing systems (including cognition and vision) and key pathological, neural and genetic substrates. We had two key objectives: to describe gait impairments from prodromal to late disease in PD; and to determine what drives them. Leveraging large and longitudinal datasets in well described patient cohorts was fundamental in combination with strategic collaboration and multidisciplinary input to help probe these objectives. We aimed to link our findings to novel measurement tools using wearable technology, and intervention development and this was coupled with a focus on the needs of our key stakeholders.

Key insights demonstrated that gait impairments appear early even in the prodromal stages and drive early falls risk. They evolve selectively underpinned by multiple substrates enhancing our understanding of the mechanisms of gait impairment. Our findings promote an earlier, more preventative approach than previously recognised. Cognitive function, particularly attention, plays a significant early role and impacts on the visual control of gait. We showed this is driven by shared pathological substrates such as cholinergic disturbance and abnormal proteinopathy. These findings have informed therapeutic approaches utilising attention as a substrate to improve movement amongst others. Conversely, gait impairments also provide insights into cognitive function, demonstrating their symbiotic relationship. This has delivered other benefits such as tools to predict declining cognitive function along with insights for therapeutic development. Extending the remit of measurement, we showed that different features of gait appear sensitive to different dementia subtypes. Together our work suggests that discrete patterns or signatures of impairment may support enhanced diagnosis even in early/prodromal detection and a window of opportunity for neuroprotective therapy.

Collectively our work has contributed to the role of gait as a clinical biomarker for enhanced diagnosis, disease monitoring and risk prediction and provided the basis for therapeutic development. We have linked our findings to develop the tools to translate our work to the real-world using low cost wearable technology. Importantly this has addressed an unmet need for industry, clinicians and patients – the key stakeholders of our work. We set out with an ambitious aim. We have learnt a lot along the way, most important of all being that none of this is feasible without the collaborators and team to deliver it!

Adolfo Bronstein *Imperial College London, GBR*

Adolfo Bronstein is Professor of Clinical Neuro-otology at Imperial College London and a Consultant Neurologist at Charing Cross Hospital and at the National Hospital for Neurology and Neurosurgery, Queen Square, London. He heads the Neuro-otology Unit in the Division of Brain Sciences at Imperial College. He has written over 250 papers on clinical and basic aspects of eye movements, balance and spatial orientation. His book, 'Dizziness' received a 'High Commendation' at the 2008 BMA Medical Book prize Competition. Prof Bronstein is an enthusiastic teacher of neuro-otology and balance disorders in European and world neurological societies. In 2008 he obtained the Nylen-Hallpike Prize of the Barany Society for outstanding contribution to clinical neuro-otology. His current research interests are the high order mechanisms involved in central compensation of peripheral vestibular disorders as well as the role of small vessel white matter disease in balance dysfunction in the elderly. He was the founder and first chairman of the British Society of Neuro-otology, chairman of the neuro-otology panel for the European Federation of Neurological Sciences and president of the clinical neuroscience section of the Royal Society of Medicine.

Keynote address: **July 3, 08:30 – 09:30**

Visual control of posture

In order to isolate the visual contribution to the control of postural balance, experiments in which subjects are exposed to large-field visual motion (optokinetic) stimuli are reviewed. In these situations, at motion onset, the visual stimulus signals subject self-motion, but inertial, vestibulo-proprioceptive cues do not. Visually evoked postural responses (VEPR) thus induced can be quickly suppressed by cognitive status or simple repetition of the stimulus, if the inertial self-motion cues available to the subject are reliable. In a conceptual model to be presented, the process of assessing the reliability, and degree of matching, of visual and inertial signals is carried out by a General comparator; in turn able to access the Gain control mechanism of the visuo-postural system. Complexity and congruency in the visual stimulus itself are assessed by a Visual comparator, e.g. the presence of motion parallax in the visual stimulus can reverse the sway response direction. VEPR can also be re-oriented according to the position of the eyes in the head and the head on the trunk. This indicates that ocular and cervical proprioceptors must also access the Gain control mechanism so that visual stimuli can recruit and silence different postural muscles appropriately. The overall gain of the visuo-postural system is also influenced by less easily defined idiosyncratic factors, such as visual dependence and psychological traits; interestingly both these factors have been found to be associated with poor long term outcome in vestibular disorders. The experimental results and model presented illustrate that the visuo-postural system is a wonderful example of interaction between physics (e.g. stimuli geometry, body dynamics), neuroscience and the border zone between neurology and psycho-somatic medicine.

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Trevor Drew *University of Montreal, CAN*

Trevor Drew undertook his undergraduate studies in physiology at Bristol University and then undertook a Ph.D. at the same institution under the supervision of Dr. David Armstrong. He received his Ph.D. in 1981. He then undertook postdoctoral studies with Dr. Serge Rossignol at the Université de Montréal in Quebec, Canada. He accepted a position as assistant professor in the Department of Physiology in 1984 and became full professor in 1996. He transferred his affiliation to the Department of Neuroscience on its formation in 2013. His research is directed at the contribution of supraspinal structures to the control of visually-guided locomotion and particularly how we plan visually-guided modifications of gait. Much of his work has focused on the contribution of the motor cortex to the execution of gait modification but recent work has concentrated on the contribution to planning. This latter work has focused on the contribution of the posterior parietal cortex and, more recently, the premotor cortex. Each of these areas (in contrast to the motor cortex) shows increased neuronal activity prior to gait modifications, consistent with contributions to different aspects of planning, including: object localisation; limb selection; foot placement; and limb trajectory formation.

Keynote address: **July 4, 08:30 – 09:30**

A Cortical network for the planning and execution of visually-guided gait modifications

Even in the most mundane of situations, we continually modify our gait to manoeuvre around natural and man-made obstacles, such as the curbs on each side of a street. In more exacting circumstances, for example, walking in the mountains or playing sports, such modifications of gait become more critical and more complex. Common to all such gait modifications in healthy subjects is the use of vision to evaluate the terrain and to anticipate changes to the normal gait pattern.

Such anticipatory gait modifications are produced by a rich network of cortical and subcortical structures. In my presentation, I will discuss the cortical contribution to such visually-guided gait modifications with a particular emphasis on the planning processes that are required to successfully negotiate a moving obstacle. These planning processes begin with the identification of the presence and the dimensions of an obstacle, together with the location of that obstacle with respect to the body. Subsequently, one must select the limb that will be the first to step over that obstacle and assure that the supporting (plant) limb is appropriately positioned in front of the obstacle.

Studies in cats, from multiple laboratories, have shown the importance of the motor cortex for the production of the pattern of muscle activity in the limb as it steps over an obstacle. However, the available evidence suggests that the motor cortex does not participate in the planning of that step. Instead, our studies point to the posterior parietal and premotor cortices (PPC and PMC) as being involved in the planning. Results from lesion and single unit recording studies in cat suggest that the PPC is important in estimating the relative location of an obstacle with respect to the body. However, there is little evidence that the PPC is directly involved in specifying the changes in muscle activity in a given limb during the approach to the obstacle. Instead our recent studies suggest that heterogeneous populations of cells in the PMC contribute to this transformation of a global signal into one that specifies the precise spatiotemporal pattern of muscle activity required to step over a moving obstacle.

In sum, the available evidence suggests a cortical network for the planning and execution of gait modifications that resembles that described in detail for the control of reaching in non-human primates. However, while reaching studies are generally made from a static position, the planning of gait modifications requires dynamic processes that must integrate and account for the movement of both the subject, and if necessary, objects in the environment. The studies summarized here, provide a starting point for understanding this complex behaviour. (Supported by the CIHR).

S.1 Virtual reality in motion: Moving posture and gait research forward with do-it-yourself vs turnkey systems

Chair: **Anouk Lamontagne** *McGill University, CAN*

Location: Pentland suite (level 3)

Moderators: **Haylie Miller** *UNT Health Science Centre, USA*

Meir Plotnik *Sheba Medical Center, ISR*

S.1i

Complex problems require complex solutions - Dynamic postural control in ecologically valid virtual environments

Nicoleta Bugnariu[1], Haylie Miller[1], Rita Patterson[1], Linda Thibodeau[2]

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

BACKGROUND: Clinical assessments of sensory, perceptual and cognitive elements that influence postural control are often conducted in a fragmented way, one at the time. Likewise, common clinical balance and mobility assessments often have low sensory and attentional demands. The disconnect between these discipline-specific findings obtained while patients are seated (e.g. hearing loss, cognitive impairment), and the impact of these findings in the real world where patients need to maintain balance and walk in complex environments, while attending to cognitive tasks and social interactions, represents a barrier in defining the true effect of a particular impairment on postural control. **METHODS**: We used a high-end immersive virtual reality (VR) system (CAREN; MotekforceLink) with motion capture, surround sound with integrated standardized audiological tests and eye-tracking, to investigate multisensory integration and postural control in adults and individuals with Autism Spectrum Disorder (ASD). In study 1, we tested dynamic postural control in 19 young (M=27.2), 20 old adults with normal hearing (M=68.7), and 20 old adults with hearing loss (M=71.2). Participants completed single- and dual- tasks of standardized audiology tests during surface perturbations in standing and walking. In study 2, we assessed dynamic balance of 6 age-matched pairs of adults with and without ASD aged 18-43. Participants wore eye-tracking glasses (ETG 2.5w; SensoMotoric Instruments) that allowed binocular eye tracking at 60 Hz during natural, unrestricted head movement. **RESULTS**: Centre of pressure variability in mediolateral direction increased ($p<.05$) in adults with hearing loss vs. controls when performing the dual postural/cognitive auditory task. Older adults with hearing loss had longer reaction time for initiating compensatory stepping responses compared to controls ($p<.01$) both in single- and dual-task conditions. Self-selected gait speed was slower ($p<.05$) in adults with hearing loss vs. controls, but only as long as they attended to the auditory task. In study 2, we observed a wider range of head-eye strategies used by participants to foveate targets compared to data generated using lower-end VR, and quantified differences in ASD vs. controls in the use of head and torso segments during stepping and leaning behaviors. The integration of eye-tracking with the 180° surround VR revealed reduced fixation of static stimuli and less efficient tracking of moving stimuli that likely contribute to impairments in postural control in ASD individuals. **CONCLUSIONS**: When auditory or visual inputs are reduced or conflicting, perception of the environment is incomplete and the cognitive demands may be increased, potentially leading to maladaptive balance responses. High-end immersive VR systems are powerful tools for manipulating inputs in repeatable and scalable ways to parse the various sensory influences on static and dynamic postural control in different populations.

S.1ii

VR for investigating perception and action during locomotion and for balance and gait rehabilitation

Desiderio Cano Porras[1], Gabriel Zeilig[1], Rivka Inzelberg[2], Meir Plotnik[1]

[1]Sheba Medical Center, [2]Tel Aviv University

How do humans incorporate perception of gravity while walking? To what extent virtual reality (VR) technology contributes to engage neurological patients in balance and gait rehabilitation treatments? This presentation addresses this type of questions. The advent of VR, especially when combined with advanced motion capture that allows automated biofeedback, offers the unprecedented ability to manipulate visual perception and physical experience during balance and walking tasks. Mainly through this ability, VR has succeed to open new horizons for fundamental and applied research. First, we will present original research that introduces a paradigm in which participants walking on a treadmill are exposed to virtual inclinations (i.e. VR visual scenes simulating uphill and downhill walking). By testing conditions in which the inclination of the visual scene was either congruent or incongruent with the physical inclination of the treadmill, this paradigm allowed us to effectively interfere with perception-action coupling. Our findings contribute to unravel mechanisms of sensorimotor integration in the context of environmental transitions, and provide evidence for a visual perception of gravity during locomotion. Second, to assess the clinical impact of VR on the rehabilitation of balance and gait, we will discuss the results of a recent study reviewing the application of VR in clinical trials, and the conclusions from a recent report based on three years of experience using VR in routine clinical practice. Additionally, perspectives on the implementation and effects of different VR systems during rehabilitation of neurological patients will be presented. Although the systematic review identified studies with evidence that VR has advantages to promote motor learning and motivation, an overall poor methodological quality and a lack of theory-driven choices is a serious concern. Lastly, understanding the characteristics of VR is key for the design and planning of research (e.g. to dissociate the impact of visual cues vs. physical body-based cues) and for addressing specific sensory, motor and cognitive deficits during neurological rehabilitation. For example, to combine VR with other devices in order to, besides the visual input stimulation, integrate other sources of sensory cues (e.g. vestibular, haptic). In terms of VR-based rehabilitation, an evidence-based framework to incorporate theories of neuroplasticity and motor learning is needed. In particular, considering that VR facilitates the incorporation of motor learning principles through task-oriented repetitive training. One challenge is to develop an efficient transition of VR-based rehabilitation as a tool for routine clinical practice.

S.1iii

Characterization of pedestrian avoidance in a virtual environment using low-cost VR equipment

Marco Buhler[1], Anouk Lamontagne[1]

[1]McGill University

BACKGROUND: In recent years, cutting-edge and affordable virtual reality (VR) systems developed by the games industry have become widely accessible. The extent to which such systems provide the required accuracy for research and elicit behaviours that are analogous to those observed in the real word, however, is yet to be determined. We used a low-cost VR system to examine pedestrian circumvention strategies as a complex locomotor task required for community walking in a virtual environment (VE) and contrasted the strategies with those observed in the physical environment (PE). AIM: (1) To estimate the extent to which circumvention strategies in response to static and moving pedestrians in the VE differ from those observed in the PE; (2) To estimate changes in circumvention strategies with repeated practice in the two environments and; (3) To contrast circumvention strategies obtained two head mounted displays (HMD) (gamers HMD vs. research type). **METHODS**: Twelve participants were assessed while walking towards a target and avoiding a collision with pedestrians in a PE and VE (random order). The VE, viewed with the HTC VIVE (gamers HMD), simulated the PE. In the static obstacle (SO) condition, participants avoided one interferer that remained static at 3 or 3.5 m from the participants' starting position. In the dynamic obstacle (DO) condition, one interferer randomly approached from the left, middle or right (± 40°, 0°), towards a theoretical point of collision located 3.5 m ahead of the starting position. For the DO condition, 40 trials were recorded in 8 experimental blocks to estimate the effect of repeated practice. Two subjects repeated the experiment with the NVISOR SX60 (research HMD). **RESULTS**: Compared to the PE, circumventing static and moving pedestrians in the VE was characterized by slower walking speeds (SO: $\Delta=0.17\pm0.02$m/s (mean ± 1SE); $p<0.001$, DO: $\Delta=0.13\pm0.04$ m/s; $p<0.01$) and larger minimum clearances (SO: $\Delta=0.10\pm0.02$; $p<0.01$, DO: $\Delta=0.10\pm0.02$; $p<0.01$). No significant differences were observed between environments when contrasting the distance from the obstacle at onset of deviation (SO: $p=0.17$, DO: $p=0.18$). Similar behavior as a function of obstacle direction or location was observed in both environments. Furthermore, repeated practice caused a significant increase in average walking speed ($p<0.05$), which was similar between the VE and PE. In the participants who repeated the task with two HMDs, larger minimum distances, smaller distances at onset and slower walking speeds were qualitatively observed with the NVISOR vs. HTC VIVE. **CONCLUSIONS**: Although the enlarged obstacle clearances and slower walking speeds in the VE suggest the use of "safer" circumvention strategies, our results

show that VR can reproduce similar adaptations as a function of obstacle condition and repeated practice. Furthermore, differences obtained with the two types of HMD suggest that the characteristics of VR equipment can modulate the user's responses.

S.1iv

Low-cost virtual reality tools for gait assessment and rehabilitation

Anouk Lamontagne[1], Joyce Fung[1]

[1]McGill University

BACKGROUND: Virtual reality (VR) allows creating ecological scenarios for assessment and training of complex motor tasks. While there is emerging evidence on VR effectiveness for gait rehabilitation, the complexity, high cost and poor accessibility of VR systems can limit its use in clinical settings. Our team is exploring the use of low-cost VR solutions made possible with advances in the games industry and their applicability to locomotor rehabilitation. More specifically, we: (1) developed a VR assessment to quantify goal-directed navigation deficits in post-stroke unilateral spatial neglect (USN); (2) identified barriers and facilitators to the use of VR for USN evaluation in the clinical setting; (3) examined the impact of a low-cost omnidirectional treadmill on locomotor adaptations and (4) developed a VR intervention protocol involving low-cost VR equipment to promote community ambulation after stroke. **METHODS**: Low-cost immersive VR technologies and open-source game engines were used. In study 1, stroke participants with and without USN were assessed while navigating towards virtual shopping items located in different locations. In study 2, barriers and facilitators were identified using focus groups involving clinicians. In study 3, body kinematics were contrasted between walking on an omnidirectional treadmill vs. overground in healthy young participants. In study 4, an integrated knowledge translation approach was used to develop a VR training toolkit for community ambulation rehabilitation after stroke. **RESULTS**: In study 1, the VR assessment revealed greater heading errors and navigation times in participants with USN. In study 2, several barriers and facilitators to using VR for USN assessment were identified, including personal, institutional, client suitability and equipment factors. In study 3, different strategies for speed adaptation (cadence and/or step length) and trajectory reorientation (temporal coordination of head, thorax, pelvis) were observed during treadmill vs. overground walking. In study 4, scenarios targeting different dimensions of community ambulation (e.g. endurance, speed, postural transitions, traffic, cognitive load) were developed, allowing participants to train according to individually-tailored goals while progressing through levels of increasing difficulty/complexity. **CONCLUSIONS**: Low-cost VR tools show great potential for assessment and training of locomotor disorders. Notably, results show that VR can identify visual-perceptual deficits in post-stroke USN and their impact on goal-directed navigation. Addressing the identified barriers/facilitators could assist the adoption of VR assessment tools in clinical settings. Locomotor adaptations in VR, however, differ to some extent from those observed in the physical world. As the technology is rapidly evolving, future research should focus on not only the validation of VR tools but also on developing training paradigms exportable to different VR systems.

S.2 fNIRS data to understand cortical mechanisms underpinning exercise interventions

Chair: **Jasmine Menant** *NeuRA, AUS*

Location: Fintry suite (level 3)

S.2i

Effects of step training in older people and people with Parkinson's disease on haemodynamic changes in cognitive and motor cortical areas during stepping performance and gait adaptability

Paulo Pelicioni[1]

[1]Neuroscience Research Australia

BACKGROUND AND AIM: There is accumulating evidence from functional near-infrared spectroscopy (fNIRS)-based studies of increased Prefrontal Cortex (PFC) activation when older people walk and perform a secondary complex task versus simple walking. This increased reliance on cognitive-motor control resources to maintain balance under challenging situations is also apparent in people with Parkinson's Disease (PD), who display inherent motor impairments and executive functioning deficits. Impaired stepping and reduced cognitive functioning are well-established fall risk factors in older people and more so in people with PD. In pilot studies, home-based volitional step training while playing computer games significantly improved balance, dual-task ability and cognitive functions in older people; such training modality is likely to equally benefit people with PD providing sufficient training dose and adequate initial supervision are given. Yet the neural mechanisms underpinning the effectiveness of this training type have not been studied. As part of two ongoing randomized-controlled trials (RCTs), we aim to investigate the effects of the following in-home computerised game playing training interventions on haemodynamic changes in cognitive and motor cortical areas using fNIRS during stepping and gait tasks: (i) seated cognitive-only training using a touch pad versus cognitive-motor step training using a step mat versus usual care in older adults (smart+step RCT); (ii) combined cognitive-motor step mat training and reactive step training versus usual care in people with PD (SAFE-PD RCT). **METHODS**: The smart+step involves 75 older adults and its active interventions for 6 months (120min per week). The SAFE-PD involves 44 people with PD. The active intervention involves a 3-month home-based cognitive-motor stepping training programme (40-80min per week), supplemented with two laboratory-based sessions of reactive step training. In both RCTs, participants are assessed at baseline prior to randomisation and then at three (SAFE-PD) or six months (smart+step). Haemodynamic changes are recorded with a 16-optode fNIRS system placed over the PFC and motor cortices while participants perform three cognitively-demanding stepping tasks on a computerised mat (both RCTs) and a gait adaptability test (SAFE-PD only). **RESULTS**: The trials are ongoing and full results will be presented at the ISPGR World Congress. **CONCLUSIONS**: We hypothesise that: (i) for the smart+step , the 6-month training programs will improve participants' cognitive performance in the cognitive training group and both cognitive and physical capacity in the cognitive-motor training group, and that such improved capacities will be associated with increased activity in the PFC region and motor cortices as applicable, (ii) for the SAFE-PD trial, the 3-month intervention will improve cognitive and physical capacities and increase PFC and motor cortices activity during the stepping and gait tests.

S.2ii

fNIRS data to understand the effects of rhythmic auditory cueing and acute aerobic exercise on cortical activation during walking

Rodrigo Vitório[1]

[1]São Paulo State University (UNESP)

BACKGROUND AND AIM: The ability to cognitively process the environment and formulate appropriate locomotor plans for navigation can be compromised with ageing and in neurodegenerative pathologies such as Parkinson's disease (PD). Ageing- and PD-related walking impairments are associated with increased risk of falling and decreased independence. Therefore, effective interventions aimed to maintain safe mobility in older adults and people with PD are essential. Although recent studies confirmed the involvement of functional alterations of the brain cortex to walking impairments, less is known about the extent to which therapeutic interventions are able to modify cortical activation related to walking. Rhythmic auditory cueing and aerobic exercise are two of the most common interventions used for gait rehabilitation in older adults and people with PD. However, the underlying neural correlates are unclear. Functional near-infrared spectroscopy (fNIRS) devices, which assess cortical activity through the haemodynamic response of the brain, can be used to fill this gap in the literature. This symposium presentation will cover studies using fNIRS to examine the effects of rhythmic auditory cueing and acute aerobic exercise on cortical activation during walking in the context of ageing and PD. **METHODS**: Protocols combining fNIRS data and spatiotemporal parameters of gait were used in two different experiments. Experiment #1 tested the effects of rhythmic auditory cueing in older adults. Cues were delivered with a digital metronome at preferred stepping frequency and participants were instructed to step in time to the beats. Experiment #2 is designed

to test the effects of a single 40-minute session of aerobic exercise (65% to 70% of the maximum heart rate; performed in a stationary bicycle ergometer) in people with PD. **RESULTS**: I will summarize findings from these two experiments and discuss them with those available in the literature. In short, findings from experiment #1 suggest that gait benefits (i.e. reduced gait variability) obtained with rhythmic auditory cueing were achieved through increased activity in multiple cortical areas. Although still preliminary, findings from experiment #2 suggest that prefrontal cortical activity slightly decreases after aerobic exercise in people with PD. **CONCLUSIONS**: fNIRS provides an innovative approach to assess brain cortical activity related to the control of human locomotion in interventional studies. fNIRS data can help researchers and health professionals to better understand the neural mechanisms underpinning the effectiveness of therapeutic interventions.

S.2iii

Assessing human locomotion through mobile brain imaging techniques: Opportunities, pitfalls and future directions

Eling D. De Bruin[1], Federico Gennaro[1], Patrick Eggenberger[2]
[1]ETH Zürich, [2]EMPA

BACKGROUND AND AIM: EEG and Functional near-infrared spectroscopy (fNIRS) have been involved in several studies related to human mobility. Both measurements hint towards promising opportunities, however, there are some pitfalls that need to be resolved before considering their routine clinical use in isolation or in combination. We discuss several pitfalls and propose research addressing them. Examples relate to validity, reliability and reproducibility of these methods in ecologically valid scenarios and in different populations. **METHODS**: Recent technological developments give rise to the expectation that EEG and movement artefacts related problems during human locomotion might be overcome. Several studies started using fNIRS for the assessment of functional brain activation during human bipedalism. fNIRS has the advantage being less prone to movement artefacts contamination. However, using fNIRS to study brain activity during locomotion has some limitations. Some of these disadvantages can be eluded with the help of a multimodal approach where fNIRS and EEG are used in combination. **RESULTS**: fNIRS measures concentration changes in both HbO2 and Hb simultaneously, which has shown useful to remove motion artefacts (Cui et al., 2010). Limitations of fNIRS technology include its limited penetration depth (1-2 cm) which only allows to assess changes in superficial cortical areas, as well as the limited spatial resolution of ~1 cm (Tong and Frederick, 2010). Additionally, strenuous physical tasks may affect fNIRS signals due to systemic vascular changes (Perrey, 2008). Currently no standardized fNIRS procedures and signal processing techniques exist to measure cortical activity during locomotion (Herold et al., 2017; Vitorio et al., 2017).To improve accuracy of fNIRS multi-distance measurement technique is recommended (Herold et al. (2017)), however, not many studies so far used this technique. The possibility of combining EEG and fNIRS measurement systems allows covering additional brain areas to assess effects in large-scale functional brain network connectivity, while providing greater spatial and temporal resolution. EEG detects very brief processes in the range of 100 ms but suffers related to spatial resolution. fNIRS provides good localization but the comparably slow vascular response limits temporal resolution. Hence, when both methods are simultaneously used they provide complementary information about neuronal and hemodynamic aspects of brain activation. Due to their tolerance to participants' motion artefacts and portability, experiments can be performed under real-life conditions. **CONCLUSIONS**: The last two decades have opened a new and fascinating "door" on the motor control research field investigating neuronal communication in human locomotion. This field of research is still in its fledgling state, however, is promising for revealing some aspects of the brain's role in human locomotion.

S.2iv

The role of the prefrontal cortex in automaticity of movement in neurodegeneration - findings from fNIRS studies

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BACKGROUND AND AIM: It is now well accepted that gait and mobility are complex activities that are not solely automatic but rather rely on cognition resources, particularly in tasks that require more attention and faster processing speed, such as multitasking and gait adaptability. Traditionally, the role of cognition was assessed using dual-task paradigms (walking while performing a secondary cognitive task) which provided indications of the role of attention and executive function in the regulation of gait control. Functional near-infrared spectroscopy (fNIRS), an optical neuroimaging technique for investigating brain activation while participants move freely, enabled a direct investigation of cognitive resources during gait. This talk will focus on the contribution of prefrontal cortex to movement, its adaptation with task difficulty and changes in activation with age and neurodegeneration. **METHODS**: Data will be presented from several studies using FNIRS exploring mechanisms of motor-cognitive interactions in Parkisnon's disease and effects of intervention. **RESULTS**: Data from recent FNIRS studies will be discussed regarding the role of the frontal cortex in the control and automaticity of gait in Parkinson's disease and whether targeted interventions could reduce reliance on cognitive resources during walking. **CONCLUSIONS**: Points for discussion will be raised on automaticity of movement, potential interventions to enhance mobility and the use of FNIRS as an applicable clinical tool for assessment.

S.3: Balance, gait and falls post stroke: Steps towards a better future

Chairs: **Vivian Weerdesteyn** *Radboud University Medical Center, NLD*
Itshak Melzer *Ben-Gurion University of the Negev, ISR*
Location: Sidlaw suite (level 3)

S.3i

Analysis of brain lesion impact on balance and gait after stroke

Shirley Handelzalts[1], Itshak Melzer[1], Nachum Soroker
[1]Ben Gurion University

BACKGROUND: Falls are among the most common medical complications after stroke. About 70% of persons with stroke (PwS) fall during the first six months after discharge from hospital or rehabilitation setting and it remains a considerable health concern throughout their life span. In addition to physical consequences associated with fractures and related injuries, falls may have serious psychological and social consequences such as functional decline, poor quality of life, dependency, social isolation and depression. Reactive balance control is essential for fall prevention, however, only a few studies have explored the effects of lesion characteristics (location and extent) on balance control in PwS. **AIM**: To assess the impact of lesion characteristics on reactive and anticipatory balance capacity, gait, and hemiparetic lower limb function in PwS. **METHODS**: Forty-six subacute PwS were exposed to forward, backward, right and left unannounced horizontal surface translations in 6 increasing intensities, while standing. Fall threshold (i.e., perturbation intensity that results in a fall into the harness system) was measured. In addition, the Berg Balance Scale (BBS), 6 Minute Walk Test (6MWT) and Lower Extremity Fugl-Meyer (LEFM) were measured. Lesion effects were analyzed separately for left- and right-hemisphere damaged (LHD, RHD) patients, using voxel-based lesion-symptom mapping (VLSM). **RESULTS**: Voxel clusters where damage exerted a significant impact on balance, gait and lower-limb function were found in the corticospinal tract, in its passage in the corona radiata and in the posterior limb of the internal capsule. Additional significant impact was found to lesions affecting the putamen and the external capsule. Balance, gait, and hemiparetic lower limb function showed much overlap of the corresponding 'significant' voxel clusters. Test scores of RHD and LHD patients were affected largely by damage to homologous regions, with the LHD group showing a wider distribution of 'significant' voxels. **CONCLUSIONS**: The study corroborates and extends previous findings by demonstrating that balance control, gait, and lower limb function are all affected mainly by damage to essentially the same brain structures, namely - the corticospinal tract and adjacent structures in the capsular-putaminal region.

S.3ii

Perturbation-based assessment and training for fall-risk reduction in people with chronic stroke: Effect of perturbation intensity and motor-impairment on behavioral outcomes

Tanvi Bhatt[1]

[1]*University of Illinois at Chicago*

The spectrum of motor impairments and deficits in reactive balance continue to persist on a longer-term in hemi-paretic stroke survivors even after recovering ambulatory ability; predisposing them to environmental falls. Previous work has established the significance of perturbation-based fall-risk assessment and training in prediction and reducing fall-risk in healthy older adults. This talk will focus on translation of work from the healthy older adults to people with chronic hemiparetic stroke (PwHS). We examined feasibility of using stance support surface perturbations (slip and trip) to assess reactive stability control, compensatory stepping and fall-risk in PwHS and examined contributions from paretic and non-paretic limbs for recovery. Results indicate that a ~50% fall rate during slip-stance perturbation with paretic compensatory stepping under unconstrained conditions and with paretic limb when explicit instructions were provided. Recovery from slips was more challenging with > falls and lack of step initiation than trip perturbations which yielded > compensatory stepping responses and very few falls. PwHS demonstrated impaired intensity-scaling of reactive stepping responses compared to healthy age-similar adults. We subsequently also examined fall-risk in PwHS under both paretic and non-paretic limbs to overground gait-slips. The fall rate and stability control during overground slips was similar to stance-perturbations under both limbs when the perturbation intensity was small, however upon a longer slip, the falls under the paretic limb significantly increased, especially in those with greater lower limb motor impairment and gait abnormalities. We subsequently examined adaptation effects to a mixed slip-and-trip stance-perturbation training paradigm and effect of motor impairment on training-induced adaptations. Results indicated the ability of the high functioning, low impairment (HFLI) group to successfully tolerate large magnitude perturbations to rapidly improve stability control and lower fall incidence within 1st five trials. However the low functioning, high impairment group was able to demonstrate adaptation only after lowering perturbation intensity. Post-training both groups were able to demonstrate scaling to a higher intensity and shorter-term retention up to several weeks. Lastly, we examined the ability of training-induced adaptations to generalize to novel opposing trip perturbations and effect of mixed-slip-and trip training on fall-risk and stability control. Findings indicate a positive transfer of training effects within the compensatory stepping response achieved by a direction specific amplitude modulation of step length and further ability of PwHS to adapt to mixed perturbation training by achieving a stability state that would be resilient to both slips and trips. These findings could be leveraged for designing protocols to enhance inter-limb generalization of training effects.

S.3iii

Sensorimotor adaptation post-stroke through the lens of muscle activity

Gelsy Torres-Oviedo[1], **Pablo Iturralde**[1], **Digna de Kam**[1]

[1]*University of Pittsburgh*

BACKGROUND AND AIM: Human movements are flexible as we continuously adapt to changes in the environment by recalibrating our motor commands and generating corrective actions. Sensorimotor recalibration occurs upon repeated exposure to predictable changes in the environment, whereas corrective actions serve as an immediate response to overcome sudden environmental changes. Corrective movements during walking are thought to simply reflect environmental transitions independently from sensorimotor recalibration (Morton and Bastian, 2006). However, recent studies suggest that corrective responses could be influenced by sensorimotor recalibration (Wagner and Smith, 2008). Thus, we asked if corrective motor commands are adapted and the extent to which this is a cerebral-dependent process. **METHODS**: We investigated cerebral involvement in adaptation of corrective actions using stroke as a disease model. We characterized changes in muscle activity in stroke survivors (n=15) and unimpaired individuals (n=15) before, during, and after walking on a split belt treadmill moving the legs at different speeds, which has been shown to induce sensorimotor recalibration (Reisman et al. 2005). Muscle activity was recorded bilaterally across 15 leg muscles. **RESULTS**: On the one hand, we found that corrective muscle responses in stroke survivors and controls were equally indicative of sensorimotor recalibration of gait. On the other hand, the steady state structure of muscle activity post-stroke in the novel split environment differed from that of controls. This indicates that stroke survivors have a limited ability to adjust movements to the new environmental demands. **CONCLUSIONS**: Corrective responses are indicative of sensorimotor recalibration of the motor system and this recalibration process does not require intact cerebral structures. This is the case even if muscle activity after cerebral damage is impaired in an altered environment. Taken together, our results suggest that the sensorimotor recalibration to generate motor commands and the execution of those commands are partially dissociable processes. The recalibration process does not require cerebral structures, whereas the execution process does. From a clinical perspective our results are interesting because they suggest that sensorimotor recalibration could be exploited to induce gait rehabilitation.

S.3iv

Minor stroke, major balance problems?

Jolanda Roelofs[1], **Ingrid Schut**[2], **Alfred Schouten**[2], **Alexander Geurts**[1], **Vivian Weerdesteyn**[1]

[1]*Radboud University Medical Center,* [2]*Delft University of Technology*

BACKGROUND AND AIM: Due to successful thrombolysis, an increasing part of the post-stroke population consists of individuals who have sustained a 'minor stroke'. Thus far, this group has received very little attention, both clinically and scientifically, with regard to the possible motor consequences. Their usual care mainly focuses on prevention of a new stroke. Yet, persons after a minor stroke may still experience subtle balance and gait impairments, which are not always visible to the naked clinical eye. So far, the prevalence of these subtle impairments and their implications for daily life functioning are not clear. **METHODS**: This talk will summarize the evidence regarding the consequences of a minor stroke on physical capacity and functioning, with a particular emphasis on the results of two cohort studies we have recently conducted. Both studies included a (sub)group of people > 6 months after minor stroke with (almost) complete recovery of leg motor impairments (Fugl-Meyer assessment of the lower extremity >= 24). We will discuss the results of clinical and lab-based balance and gait tests, as well as data on falls and physical activity in daily life. **RESULTS**: Persons after minor stroke walked on average 0.5 km/h slower and scored 1.9 points lower on the mini-Balance Evaluation Systems Test (mini-BESTest; range: 0-28) compared to healthy age-matched controls. Thirteen percent of the persons after minor stroke scored near-maximal on the mini-BESTest, whereas this was the case for 61% of the controls. These impairments in dynamic balance capacity were also reflected by the lower perturbation intensities that persons after minor stroke could sustain with a single step and by the impaired reactive step quality after translational perturbations on a moving platform. During stepping from stance towards illuminated targets that sometimes moved during mid-step, minor stroke survivors placed their foot further from the new target position (i.e., made larger errors) than controls. Furthermore, 21% of the persons after minor stroke showed an asymmetric kinetic contribution of each leg to standing balance. With regard to daily life, persons after minor stroke fell twice as often as controls. In addition, the total intensity of daily physical activity (i.e., standing, walking, running, cycling) was lower for minor stroke participants compared to controls, whereas no significant differences were found in total time or volume (i.e., time x intensity) of physical activity. **CONCLUSIONS**: Individuals after minor stroke who present with (almost) complete clinical recovery of leg motor impairments may still show substantial balance and gait impairments. Given the double fall rates in this population, these balance and gait impairments appear to be clinically relevant. These results may point at an important unmet clinical need in the minor stroke population.

S.4: Going from here to there and beyond: Fundamental theories and applications from what we have learned about human navigation of cluttered environments

Chair: **Anouk Lamontagne** *McGill University, CAN*

Location: Fintry suite (level 3)

S.4i

Meeting the brief history of human biped navigation research head on

Bradford McFadyen[1]

[1]*CIRRIS-Université Laval*

Human biped navigation, like all human movement, reveals a fusion between the person and the environment. We can only safely navigate when we properly attend to and anticipate the combined underlying personal and environmental aspects. Yet, effective and safe navigation is threatened by impaired personal capacity and precarious elements within the natural and built environment. While human biped navigation has evolved over millions of years, formal scientific study of it has only significantly progressed over the past few decades. This research has provided evidence of visual-locomotor coordination underlying anticipatory locomotor adjustments relative to environmental topography and social context. Different theories regarding the roles of anticipatory versus on-line control of bipedal navigation have been proposed along with control variables such as personal space and time to contact that drive our locomotor adaptations. In this talk, I will lay out some of the current evidence from our and other laboratories with respect to theories and the control variables for human biped navigation, as well as briefly discuss the evolution in protocols that have been used including both real and computer-generated environments. In addition, I will discuss some of the advantages and disadvantages of transferring current evidence and protocols to the clinic in relation to assessing and intervening in navigational capacity following acquired brain injury.

S.4ii

Control laws that govern people's actions when interacting with other people and other objects in different environments

Michael Cinelli[1]

[1]*Wilfrid Laurier University*

Walking safely through a cluttered environment requires avoiding static and moving obstacles and, more specifically, other pedestrians. Fortunately, collisions between pedestrians or other objects rarely occur because vision plays a key role in safely and efficiently guiding routes away from collisions and towards open spaces. Visual information about an environment is gathered through eye movements, which allows individuals to appropriately adapt locomotion in response to obstacles. In this way, vision helps pedestrians to select pathways that will guide them towards openings and away from structures that would cause injury. Avoidance behaviours can be affected by fundamental differences in an object's movement (i.e., stationary vs. moving) and/or physical (i.e., human vs. nonhuman) characteristics. The ability to perceive an object's characteristics and make appropriate behavioural adjustments to avoid a collision is critical to safe locomotion in a dynamically changing environment. My research examines safe human locomotion in cluttered environments, which is affected by the dynamics between the person and the environment, such that changes to the person and/or the environment should result in a change in actions. My presentation will focus on manner in which people interact with other people in different environments, how they use visual information to guide their avoidances, and whether visual information and avoidance behaviours are consistent regardless of the objects' physical or movement properties. The following control laws that govern pedestrians' actions will be discussed: 1) when passing through an aperture created by two people, pedestrians will account for the personal space requirements of both people resulting in more cautious behaviours compared to passing through similar sized poles; 2) Virtual Reality (VR) elicits behaviours that are not consistent with real world environments when constraining actions, however, when people are free to choose their own pathway, avoidance behaviours in VR match those in real world; 3) in situations in which a future collision is imminent (i.e., 180° collision course), pedestrians' will use time-to-contact to initiate a change pathway and maintain a consistent temporal distance only if the approaching human is moving along an uncertain path; 4) there are sex-differences in collision avoidance behaviours with an approaching female; and 5) gaze behaviours are directed mostly towards an approaching pedestrian's trunk when preparing an avoidance behaviour. This type of information will help expand crowd simulation models used in many industries (film, security, architecture) to accurately simulate person-person interactions in natural environments.

S.4iii

Collision avoidance between two pedestrians: How future risk of collision can be used to describe motion adaptations? Is virtual reality relevant to study interactions between pedestrians?

Anne-Hélène Olivier[1]

[1]*University of Rennes / MimeTic Team*

Interactions between individuals and their environment represent the basic synergies of our daily life. In this context, this presentation will focus on the collision avoidance task between two pedestrians. Following the assumption that collision avoidance is a reciprocal task, we suggested a mutual variable named MPD to describe such an interaction. MPD is a continuous function of time that corresponds, for each instant of the interaction, to the future distance of closest approach based on pedestrians' current position, orientation and speed. Its value then represents the future risk of collision. Any change in MPD value in time corresponds to an adaptation of pedestrians' motion. We designed an experiment paradigm, where 30 pedestrians, by dyad having 90° crossing trajectories, were asked to walk to the opposite side of a gymnasium and avoid any collision on their path. Our results showed that pedestrians adapt their motion only when required, i.e., when MPD at the beginning of the interaction is too low (<1 m). Based on the temporal evolution of MPD during the interaction, the avoidance strategy can be described according to three successive phases: observation where MPD(t) is constant, reaction where MPD(t) increases to acceptable values by adapting locomotion and regulation where MPD(t) reaches a plateau. This regulation phase showed that the collision avoidance task is solved before the crossing. When studying individual contributions to MPD evolution, results showed that both pedestrians contribute to the collision avoidance task. Nevertheless, the pedestrian crossing second contributes more than the one crossing first, suggesting asymmetric contribution depending on the role in the interaction. While these results are useful to understand interactions between pedestrians, the control of the experimental variables is complex. We therefore provided effort to validate Virtual Reality (VR) as a relevant tool to study interactions between pedestrians because it allows a strong experimental control and it offers safe situations that can be of interest when considering specific population. Reproducing the same experimental setup as in real conditions, we asked 17 participants to perform a collision avoidance task with a virtual walker. They can navigate in the virtual environment using several locomotion metaphors (including a joystick as well as full-body motions). Based on the evolution of MPD during the interaction, results showed that motion adaptations performed in VR are qualitatively similar as in real conditions, despite some quantitative differences. These results opens perspectives in the use of VR to develop new experimental paradigms, as well as to study specific populations where real conditions setup can be challenging.

S.4iv

Modeling and simulation of human navigation

Julien Pettre[1]

[1]*Inria*

The simulation of human navigation, and by extension, crowd simulation, is a very active research field with a wide range of applications, including architecture design, autonomous vehicle control, crowd management and safety, visual effects for movies or video games. Research in Human Movement Science (HMS) is a great source of inspiration for the design of new simulation models and algorithms. This presentation will give an overview of the research questions addressed in the field of crowd simulation, and how they connect to HMS. A specific category of crowd simulation algorithms, called microscopic approaches, simulate a crowd as a set of agent moving independently, and interacting together. Each agent is equipped with a set of rules that reproduce the way humans navigate in their environment. More specifically, agent influence one another motion according to the a model of local interaction. The presentation will present several examples of such model of interaction, and explain their evolution in time. Crowd simulation started with most basic agents represented as charged particules, progressively moving toward more evolved agents equipped with simulated perception systems, and capable of controlling their motion to what they virtually perceive. The benefit of transdisciplinary approaches - including the role of HMS - will be highlighted and discussed. We will conclude the presentation by listing the questions remaining open in the field.

S.5: Falls prevention should start in middle age - Lessons on prevention from cardiology may advance fall prevention in old age

Chair: **Stephen Lord** *Neuroscience Research Australia, AUS*
Location: Sidlaw suite (level 3)

S.5i

Is the middle-aged patient still a Jedi? Estimating declines in capacities required to successfully respond to a perturbation while walking

James Richardson[1]
[1]*University of Michigan*

BACKGROUND AND AIM: The ability to respond successfully to a perturbation while walking, during the approximate 350 ms available, requires near optimal neuromuscular and/or short latency neurocognitive functions. Clinicians and patients can be be falsely reassured that these essential neuromuscular and neurocognitive attributes are fully intact if the patient does not report falling. However, this is no more valid than concluding that a patient has no cardiac risk factors if s/he has not yet had a myocardial infarction. Therefore the aim of this presentation is to present one possible model of perturbation response, and to provide evidence that the essential neuromuscular and neurocognitive attributes upon which this response model depends (distal proprioceptive precision, short latency inhibitory processing, simple processing speed, and rate of torque generation in proximal muscles) decline in a sub-clinical manner during the middle years of life. We propose that this early decline can lead to falls later in life, analogous to the insidious progression of known cardiac risk factors which can lead to later life myocardial infarction. **METHODS**: Nerve conduction studies, the most objective measure of peripheral neuromuscular function, are known to decline during mid-life. These will be correlated with a laboratory-based means for determining frontal plane foot/ankle proprioceptive thresholds, with special reference to nerve conduction parameters in the fully normal range. Additionally, a novel means for determining short latency (400 ms) inhibitory processing accuracy and simple reaction time will be evaluated across mid-life age groups. **RESULTS**: Nerve conduction studies in healthy subjects without neuropathy demonstrate negative correlations with frontal plane foot/ankle proprioceptive precision, (R/p = -.737/.002 and -.494/.061 for fibular conduction velocity (m/s) and amplitude (mV), respectively). Additionally, short latency inhibitory processing accuracy and simple reaction time decline with age in healthy subjects younger than 50 years old (R/p = -.436/.004 and .338/.027, respectively). **CONCLUSIONS**: Clinicians and patients often do not detect subtle decrements in neuromuscular and neurocognitive functions which appear to begin before age 50, but appear to have functional relevance with regard to the deceptively athletic capacity to successfully respond to a perturbation while walking. However, the evidence presented suggests that with further prospective work we may be able to arm clinicians with tools sufficiently sensitive to detect these subtle declines, and in so doing track fall risk factors from mid-life on as is currently done for cardiac disease, allowing intervention before the "falling disease" becomes manifest.

S.5ii

Falls in middle age - A neglected issue?

Michele Callisaya[1]
[1]*University of Tasmania*

BACKGROUND AND AIMS: Falls are a major health issue causing considerable injury, morbidity and mortality. Most work to date on falls prevention has occurred in older adults (>65 years) with approximately 1 in 3 community-dwelling older people falling each year. We have shown a similar incidence of falls in both men (29.4%) and women (44.7%) of 'late' middle-age (60-64 years). Others have reported an incidence of falls in middle age (age 45-64 years) as high as 1 in 6 in a 3-month period. However this middle-aged group of women has largely been ignored in the context of falls prevention. This presentation will outline findings from the literature including from our longitudinal study of risk factors and circumstances of falls in middle aged women (PreFALL). We will also describe more novel methods (functional near infrared spectoscopy) currently being trialled to understand and assess falls risk in healthy populations. **METHODS**: PreFALL is a cohort of women who were assessed in 2011-12 on a number of factors including lower limb muscle strength and balance. In 2017, two hundred and eight one women returned (average age=55 years; range 42-63) for a comprehensive falls risk assesement including balance, mobility, strength, cognition, depression, physical activity, fear of falling and incontinence. Falls and their circumstances were ascertained prospectively via questionnaire over 12 months. **RESULTS**: We will present the results of the PreFALL study that shows balance and mobility begin attenuating in midlife. We will also present the incidence and circumstances of falls and the factors that predict them. The second half of this presentation will outline the role of functional near infrared spectroscopy and its potential in predicting falls in healthy populations. **CONCLUSIONS**: Our findings indicate that falls are not only a problem in older age, but also in middle age. Like in the fields of cardiology or even dementia, where factors in midlife are used in the prediction (and ultimately prevention) of future disease, a focus on falls prevention in midlife should be considered a key component of maintaining good health into older age.

S.5iii

What people can do and what they actually do; Self-efficacy in the self-management of falls prevention

Mirjam Pijnappels[1]
[1]*Vrije Universiteit Amsterdam*

BACKGROUND AND AIM: Gait characteristics on the quantity and quality daily life gait relate to falls and discriminate between people at risk of falls, already at late midlife. This relation between gait quality and falls appears modulated by self-perceived gait stability. An inadequate perception of one's own abilities may result in selecting inappropriate motor behaviour strategies and errors in daily life tasks could lead to falls. Age-related physical and cognitive decline might augment an inadequate self-efficacy. This presenation will focus on disparities between self-perceived and actual physcial abilities in stepping tasks and how a mismatch between what people can do and what they actually do can be derived from daily life gait characteristics; as well as on a new paradigm to detect such disparities in healthy older populations. **METHODS**: In the VIBE study, 284 relatively healthy older individuals (65 years and older) were tested on their physical abilities, self-perceived abilities and cognitive performance at baseline and after one year. They also wore an accelerometer on their lower back twice for one week, to monitor the amount of daily life physical activities, and to quantify daily life gait characteristics. During the 12 month follow-up period, the incidence of falls and participants' self-efficacy and health status was monitored monthly using questionnaires and telephone calls. A subsample of the VIBE cohort performed additional measurements in a stepping down paradigm, as to capture participants' self-perceived ability in their motor behaviour strategies when selecting either a heel or toe landing when stepping down level changes of different heights. **RESULTS**: Outcomes of measures of participants' actual and self-perceived abilities will be presented, as well as their daily life amount and quality of daily life gait. We observed disparities on the individual level between participants' actual abilities and their motor behaviour reflecting their self-perceived ability, as well as in their physical activity characteristics. **CONCLUSIONS**: People seem not all to select motor behavioral strategies and physical activities levels according to their actual abilities. Although these behavioral choices seem task and time-specific, they may indicate a higher risk of falling in the case of overestimation. Underestimation might induce a lower risk of falling due to inactivity and avoidance of exposure to challenging situations, at least on the stort term (commonly evaluated over one year). However, on the longer term, it may boost physical and functional decline and increase risk of falls as a consequence of unsuccessful ageing. Active ageing may be hard to achieve without an increase in fall risk. Yet, similar to cardiac risk factors, people should be aware of the their short and long term fall risk and be educated from early ages on how to monitor their self-efficacy in self-management of preventing falls.

S.5iv

Modifiable fall risk factors and the application of personalized medicine

Kim Delbaere[1]

[1]*Neuroscience Research Australia, UNSW*

BACKGROUND AND AIM: Aging encompasses functional and structural changes in both central and peripheral sensorimotor systems, with substantial impacts on stability and falls. The ability to stay upright requires coordination of sensory and neuromuscular systems, as well as higher-level cognitive processing. Furthermore, certain affective parameters, such as depression and fear of falling, may also influence fall risk beyond the effects of neuromuscular and cognitive attributes. This talk will discuss how sub-optimal age-related changes in specific physical, affective and cognitive factors affect fall risk and preventative strategies. **METHODS**: 1,203 participants (71±13yrs; 655♀), including 500 healthy older people and 703 people with balance disorders (dementia, N=175; multiple sclerosis, N=210; Parkinson's disease, N=318) have been tested on sensorimotor function, cognitive function and affect and were follwed up for falls. **RESULTS**: Concomittant deficiencies in physical, affective and cognitive function are common in normal ageing. An increased risk of falling is often the result of an accumulation of sub-clinical, non-symptomatic processes that summate over time across this triad. At the same time, a range of diseases and age-related health conditions can also cause physical disability that increase fall risk. Our results confirm that deficits in cognition (executive function) and affect (depressive symptoms, fear of falling) are at least equally important as sensorimotor function for fall prediction and should therefore be included in fall-risk assessments. A suite of reliable and sensitive clinical measures have been identified that detect subtle changes in peripheral neuromuscular function, cognitive processing speed, and psychological distress; and guide a more tailored approach to fall prevention. **CONCLUSIONS**: Normal ageing is associated with changes in gait and increased risk of falling. Mental and physical capacities are even more strongly affected in people with Parkinson's disease, Alzheimer's disease, or a history of stroke, as their disease symptoms progress. Targeted fall prevention strategies are important in older people at high risk of falls; however, similar to 'healthy ageing', fall prevention should not abruptly start at the age of 65. Fall prevention strategies should be adopted at younger ages; for example by maintaining physically and mentally active lifestyles. Fall risk profiling should be used to identify long-term risk factors and offer guidance towards lifestyle changes (e.g. exercise), preventive medical treatments (e.g. cataract) and education. Crucially, the general public, as well as clinicians, need to recognize falls are not an inevitable consequence of old age and understand their risk factor profile in the same manner many people currently know their cardiac risk factors. The application of personalized medicine guided by basic principles for self-management should be the next frontier in fall risk management.

S.6: Turning as measure of functional mobility: When biomechanics, neural control, and technology come together

Chairs: **Martina Mancini** *Oregon Health & Science University, USA*

Fay Horak *Oregon Health & Science University, USA*

Location: Pentland suite (level 3)

S.6i

How is turning different from straight ahead gait, how we think it is structured, and how it can be enhanced

Marco Schieppati[1]

[1]*International University of Health, Exercise and Sports, LUNEX University*

During our everyday activity, linear walking is intermingled with turns or steering courses when moving within the environment. The underlying biomechanical pattern requires adapted muscle activation for progression. Muscle-synergy studies suggest that rectilinear and curvilinear walking share a unique motor command and that fine-tuning of synergies during curvilinear conditions adapts the kinematic strategy to the biomechanical requirements. The strategy helps exploit gravity when steering, much as we do during gait initiation. Medio-lateral gravity torque is produced by appropriate foot placements that exploit gravity by letting-go and braking spells in order to produce the appropriate centripetal force. Turning implies trunk rotation over the stance leg. This can be studied by stepping in place on a rotating platform while maintaining a fixed body orientation in space. This procedure elicits a post-effect consisting in inadvertent turning while stepping in place eyes closed (podokinetic after-rotation, PKAR). Not surprisingly, voluntary turning while stepping in place also produces a post-effect similar to PKAR. The post-effect of voluntary turning shares all the features of PKAR, and both take place inadvertently, suggesting that the command to turn might share the same neural circuits underpinning the behaviour produced by podokinetic stimulation. Asymmetric axial muscle vibration also produces turning while stepping. PKAR is modulated by delivering asymmetric vibration to paravertebral muscles. Right-sided vibration reduces or reverses clockwise PKAR, whereas left-sided vibration increased PKAR velocity. Under all conditions, changes in foot step angle are coherent with body angular velocity. Hence, both PKAR and vibration effects and the post-effect of voluntary turning appear to depend on a common mechanism that possibly integrates effects on the straight ahead and inflow from proprioceptors. Curvilinear trajectories represent a challenge for patients affected by movement disorders. Freezing is not uncommon in patients with Parkinson's disease (PD) during turning. However, PD patients can learn to produce turning while stepping through appropriate training and this capacity translates into improved overground curved walking. Repeated sessions of podokinetic stimulation, requiring a progressively larger effort, favour the production of PKAR and curved walking in PD. Post-training, the velocity of walking increases, more so for the circular than the linear trajectory.

S.6ii

The quality & quantity of real-world turns are poorer in prospective fallers

Lorenzo Chiari[1], **Julia Leach**[1], **Pierpaolo Palumbo**[1], **Stefania Bandinelli**[2], **Sabato Mellone**[1]

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BACKGROUND AND AIM: Although turning has been reported as one of the leading activities performed during a fall, and falls during turning result in 8-times more hip fractures than falls during linear gait, the quantity and quality of turns resulting in falls remain unknown since turns are rarely assessed during activities of daily living. Our hypothesis is that turning difficulty in real world activities is an early sign of balance instability and may be indicative of elevated fall risk. **METHODS**: We used in-home activity monitoring methods to investigate the relationship between turning strategies and fall risk in a high-functioning cohort of 160 community-dwelling older adults (a subsample of the InCHIANTI study) (Leach et al., 2018). Turn measures and activity rates were quantified. Fall incidence within 12 months from continuous monitoring defined fall status. **RESULTS**: Based on the analysis of 718,582 turns we found future recurrent fallers to exhibit both lower turn quantity and quality compared to the future non-/single fallers across a one-week monitoring period. Future recurrent fallers turned less often throughout their day and appeared to be less stable during one of the most common turn types (i.e., the 90° turn), as expressed by longer turn durations, lower turn velocities, and more steps utilized to complete the turn. Additionally, recurrent fallers walked slower, walked/turned less, and were more sedentary throughout their day. There was no difference in the overall active rate between the two groups, suggesting that impaired gait and turning ability, specifically, may have served as a significant contributing factor to the elevated fall risk within this cohort. **CONCLUSIONS**: Given the fact that 90° turn is the most unstable type of turn neurorehabilitation could focus on modifying turning strategies for 90° turns, with an emphasis on scaling turning speeds at different speeds of walking. Assessment tools targeting turning ability should also be adopted (e.g., the L-Test). If instrumented, as in the instrumented Timed Up and Go test, turn quality could be quantified and monitored throughout the duration of rehabilitation. Assessing turn quality via wearable sensors would indeed enable one to determine the efficacy of specific intervention strategies. Since directly impacting and improving turning ability lies in the forefront of our efforts to prevent future falls, adopting a neurorehabilitation approach with quantitative capabilities is essential.

S.6iii

Turning deficits in patients with Parkinson's disease and the role of the prefrontal cortex during turning

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BACKGROUND AND AIM: Turning has been implicated as a complex task that requires both motor and cognitive resources. For patients with Parkinson's disease (PD), turning impairments are common features of gait disturbances, even in early stages of the disease, that are exacerbated with disease progression and can be a trigger for freezing of gait, falls, and reduced independence. Previous studies documented motor changes of turning in PD including impaired axial coordination, reduction of spatial gait parameters, a greater number of steps, and more time to complete a turn. In contrast, the role of cognition in performing turns is more controversial. Intuitively, one could suggest that turning ability and the recruitment of the prefrontal region would be mediated by cognitive abilities mainly associated with motor planning and attention. Indeed, some evidence suggests that turns become slower and less efficient in the presence of a cognitive load, supporting the idea that turns demand attention and prefrontal activation, however, this evidence is indirect. Therefore, the aim of this work is to provide direct evidence on the role of prefrontal cortex during turns in PD patients. **METHODS AND RESULTS**: Prefrontal activation during turns was investigated using functional near infra-red spectroscopy (fNIRS) in patients with PD. Interestingly, we found that PD patients use the prefrontal cortex during turning to a lesser extent than during straight-line walking. In addition, the degree of prefrontal activation during turning was related to background motor abilities, in particular ambulation function, showing that patients with better mobility reduced activation more than patients with worse mobility. Moreover, in another study that included patients with freezing of gait (FOG), we observed that during turns with freezing, i.e., unsuccessful turns, prefrontal cortex activation increased, compared to straight-line walking. In contrast, during turns without freezing, i.e., successful turns, prefrontal activation decreased, compared to straight-line walking. **CONCLUSIONS**: These findings demonstrate that during turning the prefrontal cortex plays a different role from straight line walking that may depend on the motor abilities of the patient. Higher prefrontal activation during turning in patients with relatively worse ambulation and FOG may reflect a compensatory attempt at improving turning performance. This possibility is consistent with a proposed model of gait failures in PD which posits that in the presence of reduced motor automaticity and poor gait, cognitive resources, in particular prefrontal regions, are called into play in attempt to compensate for these motor deficits. These findings suggest that improving ambulation in patients may increase the efficiency of brain activation by reducing prefrontal activation. Futures studies should examine activation in other brain regions and in response to specific interventions that target motor abilities.

S.6iv

Rehabilitation treatment for turning: Role of wearable technology

Martina Mancini[1], Samuel Stuart[1], Fay Horak[1], Laurie King[1]

[1]Oregon Health & Science University

Nearly every task performed during the day requires some amount of turning [1]. Difficulty in turning during gait is a major contributor to mobility limitations, falls and reduced quality of life in older people and people with movement disorders (e.g. Parkinson's disease). Moreover, falls during turning are particularly dangerous because they usually result in contact of the femur with the ground, which results in eight times more hip fractures compared with falls during straight walking [2,3]. Turning gradually becomes more difficult as we age due to increasing sensorimotor impairments. The ability to modify our locomotor trajectory by turning safely is important for functional independence but, surprisingly, turning is much more difficult for the nervous system to control than straight-ahead walking. It has been suggested that neural systems related with turning may be more vulnerable to impairments than those related with straight-ahead gait since turning involves more inter-limb coordination, more coupling between posture and gait, and modifications of locomotor patterns requiring frontal lobe cognitive and executive function that plays a role in postural transitions. Based on those impairments, a rehabilitation program for turning should include components of: coordination (inter-limb, temporal, spatial), consistency (reducing variability), challenge (speed, direction, sensory input, cognitive challenges). This guided discussion will review rehabilitation programs that target different aspects, such as muscle flexibility, weight shifting, coordination, and open-loop external cueing to improve turning outcomes. In parallel, we will also review the potential of wearable technology to improve rehabilitation programs outcomes by 1) providing objective measures at the impairment level, 2) providing a greater sensitivity to detect subtle changes in turning and 3) providing data on turning during regular daily function (home monitoring). Lastly, wearable technology could also be of help in providing patients with feedback about their performance during the rehabilitation session (closed-loop cueing). References [1] Glaister BC, Bernatz GC, Klute GK, Orendurff MS. Gait Posture, 2007. [2]. Cummings SR, Nevitt MC. Osteoporosis international, 1994. [3]. Feldman F, Robinovitch SN. Journal of biomechanics, 2007.

S.7: From basic science to clinical practice: Anxiety, attentional focus and the control of posture and gait

Chair: **William Young** *Brunel University London, GBR*

Location: Pentland suite (level 3)

S.7i

The role of movement specific reinvestment in attention focus and gait behaviour by older adults

Liis Uiga[1]

[1]University of Waikato

BACKGROUND AND AIM: The Theory of Reinvestment (Masters, 1992; Masters & Maxwell, 2008) argues that using conscious step-by-step movement processes to control the movement mechanics online can disrupt performance of relatively automated motor skills. Conscious movement processing (i.e., movement specific reinvestment) is a function of personality, specific context of the task and a variety of psychological, physiological and environmental contingent triggers. As such, the propensity for movement specific reinvestment varies from one person to another and from one context to the next. The aim of this presentation is to provide the theoretical underpinnings of movement specific reinvestment and its association with gait behaviour in older adults. **METHODS**: Empirical research conducted in our laboratory examining gait behaviour by older adults will be introduced. **RESULTS**: We have shown that older adults with a high propensity for movement specific reinvestment are more aware of their limb movements and less aware of the external environment when walking on ground level and/or navigating obstacles, whereas, older adults with a low propensity for movement specific reinvestment are less aware of their limb movements and more aware of the external environment. High inclination for movement specific reinvestment has been further associated with less accurate stepping, despite increased preparation and planning times. **CONCLUSIONS**: As conscious processes are slow and attention demanding, it is possible that older adults with a high inclination for movement specific reinvestment need more time to 'plan' their movements; however, this inefficient information processing leads to worse stepping accuracy that might lead to future falls. The findings of these studies have implications for practitioners (e.g., rehabilitation) and signal that caution should be taken when providing detailed verbal instructions that cause conscious movement processing.

S.7ii

Postural threat and standing balance control: Do changes in attention play a role?

Martin Zaback[1]

[1]University of British Columbia

Postural threat, manipulated through changes in surface elevation, has been used to examine how fear of falling influences balance control. When standing at the edge of an elevated surface, individuals typically lean away from the platform edge and demonstrate higher frequency and smaller amplitude postural adjustments [1]. While these threat-related changes in standing behaviour have been consistently replicated, the underlying mechanisms are not well understood. One theory

is that emotionally-evoked neurophysiological changes are responsible. Support for this theory comes from research that has demonstrated facilitation of balance relevant vestibular and proprioceptive reflexes when standing under conditions of height-related postural threat [2-4], as well as increased cortical processing of balance relevant sensory inputs [5]. Such changes in sensorimotor set could contribute to the tighter regulation of standing balance typically observed when threatened. Alternatively, threat-related changes in standing balance may be influenced by changes in cognitive strategy. Recent work has demonstrated that there are broad changes in attention when standing under conditions of postural threat; individuals tend to dwell on threat-related stimuli, employ various self-regulatory strategies, and engage in greater conscious movement processing [6-8]. The latter is of particular interest, as redirecting attention toward one's movements may interfere with otherwise automatic postural control processes, potentially influencing standing behaviour [9]. This presentation will discuss recent work from our lab that has examined associations between threat-related changes in conscious movement processing and standing balance control, along with existing work that has examined how the manipulation of attention influences standing balance under non-threatening as well as threatening conditions. Discussion will also focus on how known neurophysiological and attentional changes associated with threat may interact to influence standing behaviour. The overall aim of this presentation will be to provide insight into whether changes in attention represent an important mechanism underlying the relationship between postural threat and standing balance control.
[1] Adkin and Carpenter (2018), Front. Neurol. 9:789; [2] Horslen et al. (2013), J. Neurophysiol. 110:899-906; [3] Horslen et al. (2014), J Physiol.592:3671-3685; [4] Naranjo et al. (2016), J. Neurophysiol. 115:833-842; [5] Adkin et al. (2008), Neurosci. Lett. 435:120-125; [6] Huffman et al. (2009), Gait Posture 30:528-532; [7] Zaback et al. (2016), Gait Posture 45:19-24; [8] Johnson et al. (in press), Psych. Res.; [9] Young and Williams, (2015), Gait Posture 41:7-12

S.7iii

Anxiety, attentional focus and the visuomotor control of adaptive locomotion

Toby Ellmers[1]
[1]*Brunel University*

A growing body of research has sought to understand how emotion and attention influence the control of posture and gait. This presentation will describe how fall-related anxiety, and associated changes in attention (e.g., an internal focus/conscious movement processing), influence how young and older adults control locomotion. Specific focus will be directed towards discussing how anxiety can disrupt the visuomotor processes necessary for adaptive gait, such as the proactive feedforward planning required to effectively avoid an obstacle. Previous research highlights marked differences, based on fall-risk, in the visuomotor control of adaptive locomotion. For example, older adults deemed to be at a high risk of falling often display both reduced feedforward planning and impaired on-line visual control of stepping movements (e.g., Chapman & Hollands, 2006; Young et al., 2012) - behaviours associated with increased stepping errors and, therefore, reduced safety. Young and Williams (2015) identified heightened fall-related anxiety as one potential mechanism underlying these 'high-risk' visual-search behaviours. Specifically, these authors proposed that anxiety-induced internal focus (and subsequent attempts to consciously control movement) mediates the relationship between fear of falling and altered patterns of visual search. This presentation describes a series of experiments conducted in our laboratory, which have directly manipulated fall-related anxiety and attentional focus in order to evaluate the impact of fall-related anxiety (and associated changes in attention) on visual-search during locomotion. The results from this research highlight a causal relationship between increased anxiety and disrupted visuomotor control of locomotion, and identify conscious movement processing/control as one possible underlying factor. This presentation will conclude by attempting to conceptualise these findings within previously presented psychological frameworks, such as Attentional Control Theory (Eysenck et al., 2007) and Reinvestment Theory (Masters & Maxwell, 2008).

S.7iv

Attentional control strategies for retraining gait and balance control in rehabilitation: One size fits all?

Elmar Kal[1]
[1]*VU University*

BACKGROUND AND AIM: Considerable evidence from basic science suggests that conscious movement processing can disrupt motor performance in healthy adults and elderly. This finding could have important ramifications for clinical practice, as it implies that therapists should try to discourage their patients from using conscious control while moving. This may be especially appropriate for patients with stroke or Parkinson's, and elderly fallers. These clinical groups often report a particularly strong tendency to rely on conscious movement processing in daily life. **METHODS**: Focusing specifically on stroke rehabilitation, this presentation will try to answer whether (and how) the negative effects of conscious movement processing on motor performance translate to the clinical setting. For a comprehensive assessment, the presentation will first describe the results of observations regarding how physical therapists currently use internal focus strategies (which promote conscious control) when treating patients with stroke. Second, experimental studies will be discussed that have investigated the immediate and long-term effects of learning using internal focus strategies across a range of motor tasks (e.g., stepping, balancing, reaching). **RESULTS**: Combined, results of these studies challenge the notion that conscious motor processing is fundamentally maladaptive per se. Rather, converging evidence shows that an individual's motor skill, proprioception, and attentional capacity can partially determine whether an internal, conscious strategy will benefit or disrupt motor performance. For example, a recent randomised trial suggests that conscious processing may only disrupt balance when patients have relatively intact proprioceptive and motor control, and might actually be beneficial in individuals with impairments in these areas. **CONCLUSIONS**: To conclude, anxiety-induced changes in attentional control may sometimes be adaptive in people with movement difficulties. It may be appropriate for therapists to screen their patients' motor, proprioceptive and cognitive skills to be better able to adapt their use of instructions to the individual patient.

S.8: Data analytics in the wild: Translating emerging wearable inertial and camera methods to fall prevention intervention strategies

Chairs: **James Tung** *University of Waterloo, CAN*
Alan Godfrey *Northumbria University, GBR*
Location: Fintry suite (level 3)

S.8i

Digital gait biomarkers beyond the laboratory: Advantages and challenges

Silvia Del Din[1]
[1]*Newcastle University*

Digital gait biomarkers are emerging as a powerful tool to detect early disease and monitor progression across a number of conditions. Typically, quantitative gait assessment has been limited to specialised laboratory facilities. However, measuring gait in home and free-living/community settings may provide a more accurate reflection of gait performance as it allows walking activity to be captured over time in habitual contexts. Modern accelerometer-based wearable technology allows objective measurement of digital gait biomarkers, comprising metrics of free-living walking activity/behaviour as well as discrete gait characteristics. This presentation will address the feasibility, advantages and challenges of measuring digital gait outcomes during free-living activity for discriminating pathology and detecting early risk. The use of traditional digital gait outcomes and novel metrics as a measurement tool for characterising patient populations, discriminating disease (e.g. Parkinson's disease) and detecting risk (e.g. prodromal stage of disease) will also be discussed. Data driven approaches for disease classification and progression will also be presented. Quantification of digital gait outcomes in free-living/unsupervised environments presents considerable challenges due to: sensor limitations; lack of standardised protocols, definitions and outcomes; engineering challenges; and contextual recognition. However our preliminary results are encouraging regarding the use of digital gait biomarkers for application in large multi-centre clinical trials, for supporting diagnosis and guiding clinical decision making.

S.8ii

Fall risk assessment with wearables in the wild: Towards recommended free-living outcomes

Mina Nouredanesh[1], Alan Godfrey[2], James Tung[1]

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

Current wearables, largely inertial measurement unit-based devices (IMUs, e.g. accelerometer, gyroscope) have been used to quantify a range of physical functioning/capability related tasks. Most notable are gait related activities such as intermittent and continuous (predefined timed, e.g. 2 minutes) walking during clinical/laboratory observational-based testing. Other examples include transitions, turns and composite measures of physical capability such as timed-up-and-go (TUG). Utilising IMUs to objectively quantify outcomes during those tasks adopts an instrumented approach which have shown promise for fall risk assessment (FRA) during laboratory-based protocols. Yet, true IMU value resides beyond the laboratory while monitoring more natural, habitual activities. Discrete, high resolution IMUs can gather data continuously in any environment. Current state of the art has primarily focused on gait assessment during 3 to 7 day studies but notable challenges remain which are also evident during gathering free-living turning, transition and composite related data. Despite the growing body of literature focusing on the development of novel IMU-based free-living FRA methods, there is little consensus on use of language (e.g. quantity vs macro) and outcomes (e.g. spatiotemporal gait, sedentary duration, quantity of missteps). Moreover, this is complicated by the (i) inconsistent inclusion and description of gait outcomes within discrete domains associated with fall prediction (e.g. postural control, pace); (ii) methodological and algorithm descriptions of how gait and other activities are defined from free-living IMU bout segmentation; and (iii) dearth of contextual analysis surrounding IMU captured free-living gait and fall related events. From a detailed narrative literature review, we highlight inconsistencies within the literature while providing recommendations towards the harmonisation and standardization of outcomes for free-living FRA by: (a) proposing a new conceptual framework to map free-living IMU-based outcomes; and (b) identifying outcomes with strong predictive power for falls. Furthermore, current limitations associated with collecting and analyzing free-living IMU-based data only are discussed. Consequently, we introduce the potential of body-worn egocentric cameras to complement IMU data with contextual information (to detect fall-related environmental hazards, circumstance and location) while proposing new approaches to complement existing gait models with outcomes from video data.

S.8iii

Video capture of falls in long-term care from cameras mounted to ceilings and walls: Lessons from an 11 year cohort study

Stephen Robinovitch[1], Natalie Shishov[1], Vicki Komisar[1]

[1]Simon Fraser University

For the past 11 years, we have partnered with two long-term care facilities in the Vancouver area in a cohort study of falls. The study involves the collection of video footage of real-life falls collected from networks of cameras mounted to ceilings and walls in common areas (dining rooms, hallways and lounges). To date, we have analyzed over 2400 falls experienced by over 650 residents, using structured questionnaires to explore the characteristics of fall initiation, descent, impact and recovery. These validated tools allow us to quantify the activities that older adults were attempting at the time of the fall, the characteristics of the environment, the nature of balance recovery attempts, the direction of the fall, and the body parts experiencing impact during the fall. The size of the database allows us to narrow our focus to examining falls in specific patient subgroups, situational or environmental contexts, or injury outcomes including hip fracture (see Figure). We are now sharing a database of 105 falls for reuse by researchers through the NYU-based Databrary network. Environmental cameras have specific strengths and weaknesses for video capture of falls. Once installed, they do not rely on the user to adopt or wear the technology. They can provide extensive coverage (at a cost) and high resolution images. The external view of the fall facilitates analysis of the time-varying kinematics of the body during falls with video digitization or modelling software. However, each camera only captures movements in it's field-of-view, and occlusions are common. In contrast, body-mounted cameras can provide continuous footage regardless of location. For any type of video system, the range of feasible outcomes is limited to what can be reliably observed from the video. For example, our questionnaire quantifies the biomechanical nature of imbalance (slip, trip, loss of support, etc), but we cannot determine from the video the physiological factors underlying imbalance. Challenges arise in extracting the intent or thoughts of the individual from video. Body-centric cameras may provide complementary information on head orientation or gaze. Another challenge is automatic detection of events of interest, such as falls (a process that is facilitated in long-term care through incident reports, and the ability to capture weeks or even months of video footage on large hard drives). The development of computer vision techniques to automatically extract a range of useful outcomes from video footage is a worthwhile but challenging goal. Preliminary attempts to detect falls from video footage with machine learning algorithms show about 70% accuracy in detecting falls, but may be higher for body-centric cameras.

S.8iv

Daily-life gait analysis to evaluate fall risk and mobility decline

Kim van Schooten[1]

[1]Neuroscience Research Australia/University of New South Wales

Wearables are becoming ubiquitous for activity tracking and can provide insight into quality of movement. These devices can be used to unobtrusively assess the amount and quality of gait someone engages in during daily life, which has been linked to fall risk. This presentation will provide an overview of the opportunities, challenges and limitations of using wearable sensors in large-scale studies to assess fall risk and mobility decline. It will also discuss how video-based approaches may advance the field. The first part of the presentation will focus on sensitivity of daily-life gait to change, which is essential for use beyond screening. We collected repeated assessments in 169 older people, 2 weeks apart, to assess stability of daily-life gait quality characteristics. Our results show that gait characteristics were comparable (all $p \geq 0.11$) and strongly correlated between the two assessments ($r = 0.77$ to 0.97). Recent work on sensitivity to change over a year as a result of time or a balance exercise intervention will also be discussed. Whilst initial results are promising, the field is still in its infancy. Future work should address standardisation of daily-life gait analysis and rigorous testing of methodology. Video observation might assist in validating some of the underlying assumptions of daily-life gait analysis, as well as provide insight into contextual influences, which cannot readily be assessed with accelerometers. Hence, the second part of the presentation will focus on how wearable and video-based approaches may complement and enrich each other to discuss the future of these techniques to improve efficient use in clinical-based studies.

S.9: Spinal cord stimulation for gait dysfunction and postural instability in Parkinson's disease

Chair: **Mandar Jog** *Western University, CAN*

Location: Sidlaw suite (level 3)

Moderator: **Olivia Samotus** *Western University, CAN*

S.9i

Effects of spinal cord stimulation on mobility and cortical activity in Parkinson's disease patients with severe gait dysfunction and ON-freezing

Olivia Samotus[1], Andrew Parrent[2], Mandar Jog[2]

[1]Western University, [2]London Health Sciences Centre

BACKGROUND AND AIM: Axial motor symptoms such as gait dysfunction and freezing of gait (FOG) are highly disabling and result in injuries, and loss of independence and quality of life in Parkinson's disease (PD) patients. The response of axial symptoms to dopaminergic therapy and deep brain stimulation is limited and unpredictable. Individualized programming of epidural spinal cord stimulation (SCS) has been shown to reduce the number of FOG episodes and improve spatiotemporal gait features over 6-months. We investigated how motor cortical excitability is modulated by SCS therapy

for PD gait dysfunction over a 12-month period. **METHODS**: Mid-thoracic SCS was implanted in 10 PD patients with levodopa-resistant FOG and gait dysfunction. Primary motor intracortical facilitation and inhibition activities were assessed using paired-pulse transcranial magnetic stimulation (pp-TMS) protocols targeting the first dorsal interosseous (FDI) and tibialis anterior (TA) muscles. SCS programming was individualized to each participant's spatiotemporal gait metrics within the first month post-SCS implantation. Ambulatory and turning gait tasks and pp-TMS measures were collected pre-SCS implantation and at 3-, 6-, and 12-months of SCS use while participants were OFF and ON dopaminergic medication. **RESULTS**: SCS significantly reduced the number of FOG episodes and improved dynamic postural balance, stride velocity, step length, single support and swing times acutely (1-hour in the lab with SCS ON) and with chronic SCS use (participants on medication with the SCS turned OFF and ON) compared to pre-SCS. At baseline, impaired intracortical facilitation (ICF) levels in the lower limb cortical areas were correlated to stride length and velocity gait parameters while participants were off medication. ICF levels increased with chronic SCS use while participants were off and on medication. With SCS, short afferent inhibition levels in the upper limb were improved and correlated to improvements in spatiotemporal gait dynamics. **CONCLUSIONS**: Observed gait improvements by SCS in PD participants may be governed by enhancing motor cortical activity.

S.9ii

Subthalamic neural signatures of gait impairment and FOG in Parkinson's disease and the response to 60 Hz and 140 Hz deep brain stimulation

Helen Bronte-Stewart[1], Chioma Anidi[1], Johanna O'Day[1], Ross Anderson[1], Muhammad Furqan Afzal[1], Judy Syrkin-Nikolau[1], Anca Velisar[1]

[1]Stanford University Medical Center

BACKGROUND AND AIM: Freezing of Gait (FOG) is a devastating axial motor symptom in Parkinson's disease (PD) leading to falls, injury and loss of independent living. The response of FOG to dopaminergic medication and deep brain stimulation (DBS) is complex, variable and yet to be optimized. Fundamental gaps in the knowledge of the underlying neuro-biomechanical mechanisms of FOG render this symptom one of the unsolved problems in the treatment of PD. Subcortical neural features of gait impairment and FOG in PD are largely unknown due to the challenge of accessing deep brain circuitry in freely moving human subjects, and due to the difficulty of eliciting FOG. Since FOG is episodic we hypothesized that dynamic features of subthalamic (STN) beta oscillations (beta bursts) may contribute to the freezer phenotype during gait tasks that elicited FOG. We also investigated whether STN DBS at 60 Hz or 140 Hz affected beta burst dynamics and gait impairment differently in Freezers and Non-Freezers. **METHODS**: Synchronized STN local field potentials from an investigative implanted sensing neurostimulator (Activa® PC+S, Medtronic Inc, FDA IDE, Stanford IRB approved), and gait kinematics/kinetics were recorded in 12 PD subjects, off medication, during forward walking and stepping in place (SIP on dual force plates) tasks under the following randomly presented conditions: NO, 60 Hz, and 140 HZ STN DBS. **RESULTS**: Prolonged movement band beta burst durations differentiated Freezers from Non-Freezers during gait without FOG, and were longer during periods of FOG in Freezers. In Freezers, both 60 Hz and 140 Hz DBS improved gait arrhythmicity and shortened burst durations during gait without FOG, reduced the percent time of FOG and shortened burst durations during FOG. In contrast STN DBS at either frequency left unchanged the normal gait parameters and short burst durations in Non-Freezers. **CONCLUSIONS**: This study demonstrates that prolonged periods of excessive beta oscillations and synchrony (longer beta burs durations) are important neural markers for freezing behavior and FOG in PD and that STN DBS modulates longer not shorter beta burst durations while improving gait arrhythmicity and FOG, thereby acting to restore physiological signaling in sensorimotor networks.

S.9iii

Behavioral and electrophysiological effects of spinal cord stimulation Parkinson's disease animal models

Rómulo Fuentes[1], Aquiles Martínez[1], María Florencia Alamos[2]

[1]Universidad de CHL, [2]Pontificia Universidad Católica de CHL

BACKGROUND AND AIM: Dopamine replacement therapy is effective for treating appendicular symptoms of Parkinson's disease (PD), but is less effective for axial symptoms like posture and gait impairments. For the first time, we applied the novel use of thoracic spinal cord stimulation (SCS) to restore locomotion and improve freezing, bradykinesia and rigidity symptoms in rodent and primate parkinsonian animal models. The objective is to discuss the possible mechanisms of action of SCS for treating gait in parkinsonian disorders. **METHODS**: In several studies involving different PD animal models, acute pharmacologically induced dopamine-depleted mice, chronic 6- hydroxydopamine (6-OHDA) lesioned rats, rats with alpha-synuclein over expression, and marmosets with 6-OHDA lesion we measured behavioural and electrophysiological responses to SCS. In vivo electrophysiological recordings within the brain motor circuit using local field potential and single neuron were measured before and after SCS was applied. **RESULTS**: The functional recovery was paralleled by the disruption of the pathological low-frequency synchronous oscillatory activity, leading to an electrophysiological state normally preceding spontaneous initiation of locomotion. Neuronal activity patterns of dorsolateral striatum and primary motor cortex (MI) were also significantly altered. **CONCLUSIONS**: These studies suggest that SCS effect is not just due to a local effect on the spinal cord. It seems that SCS can interfere with brain dynamics, leading to states that allow movement. SCS should be considered as an additional treatment option for PD-patients.

S.10: Virtual reality as a tool to alter multisensory perception and human motor learning

Chair: **Daniel Ferris** *University of Florida, USA*

Location: Fintry suite (level 3)

Moderator: **Karen Li** *Concordia University, CAN*

S.10i

Limitations and opportunities for virtual reality sensorimotor training

Daniel Ferris[1]

[1]University of Florida

BACKGROUND AND AIM: Previous research using virtual reality for motor skills training has failed to demonstrate it can accelerate or improve training outcomes relative to training in the real world. Sensorimotor training seems to inhibit motor learning compared to practicing the real world task. Potential reasons for the inhibited motor learning are the slow refresh rate of visual displays, disconnect between visual display and vestibular feedback, reduction in peripheral vision, and/or added cognitive load. As a result, many attempts at improving sensorimotor training with virtual reality have not fared well in comparison to real world training. Although there appear to be drawbacks to virtual reality training, there are advantages to using virtual reality that allow for perturbations or manipulations to training that cannot be done in the real world. For example, virtual reality can induce added stress safely in a human by modifying the training environment. Walking on a balance beam four stories off the ground is safer and easier to accomplish in virtual reality than in the real world. Another example of training modifications that can be more easily accomplished with virtual reality compared to the real world are visual perturbation. Introducing transient changes to the visual field with virtual reality can cause individuals to downgrade their dependence on visual feedback and increase their dependence on proprioceptive feedback. These types of virtual reality modifications enable researchers to enhance motor learning outcomes during sensorimotor training. **METHODS**: My laboratory has studied how electrocortical brain activity (i.e. high-density electroencephalography) and whole body biomechanics change in regard to virtual reality modifications during sensorimotor training. We often use an experimental paradigm of subjects walking on a treadmill-mounted balance beam as it is a functional locomotor task that requires active lateral balancing. With virtual reality, we have been able to modify the sensory feedback to individuals as they practice the sensorimotor locomotor task. **RESULTS**: Virtual reality modifications can modify physiological parameters during training

along with motor learning outcomes after practice. The electrocortical data indicates that the choice in virtual reality modifications can have distinct effects on brain network activity, providing insight into the neurophysiological mechanisms for modified motor learning outcomes. **CONCLUSIONS**: Combining biomechanical and electrocortical measurements during experimental modifications of sensorimotor training with virtual reality can greatly enhance the design of new training approaches. In addition to providing new insight into how the brain controls human movement, the techniques can also inform computer scientists and engineers how they might improve virtual reality systems for enhanced sensorimotor training outcomes.

S.10ii

Using simulation technologies to study multisensory self-motion perception and mobility: Effects of age-related changes to sensory and cognitive functions

Jennifer Campos[1], M. Kathleen Pichora-Fuller[2], Karen Li[3], Natalie Phillips[3], Laurence Harris[4]

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BACKGROUND As we move though our environment, our brain integrates visual, auditory, proprioceptive and vestibular inputs. Optimally integrating these inputs allows us to perceive self-movement parameters (e.g. heading direction) with greater certainty. However, much remains to be understood regarding how sensory inputs are integrated in the brain to support mobility and how age-related changes to sensory and cognitive functions affect these processes. Virtual Reality (VR) and simulation technologies are unique tools for multisensory research given the ability to strategically manipulate individually sensory inputs. Further, these technologies can be used to mimic everyday conditions, which is informative when applying fundamental knowledge in multisensory and sensory-cognitive integrative processes to real world mobility-related challenges. First, I will describe Toronto Rehab's Challenging Environment Assessment Laboratory (CEAL) which houses a motion platform, advanced driving simulator and immersive projection-based VR system with treadmill. Second, I will describe studies evaluating sensory-motor-cognitive interactions during tasks of standing balance, walking, and passive motion. **METHODS AND RESULTS**: 1. We evaluated age-related changes to visual-vestibular integration using the motion platform and a head-mounted display to perform psychophysical heading estimation tasks. Results indicate that older and younger adults both demonstrate increased estimate precision from congruent bimodal inputs (visual+vestibular) compared to unimodal inputs (visual or vestibular alone); however, during sensory conflicts (conflicting visual and vestibular heading angles), older adults do not demonstrate reliability-based sensory weighting as would be predicted by optimal integration. 2. We used the projection-based VR simulator to evaluate standing balance and walking performance during multisensory, multitasking conditions. Specifically, participants either walked or stood within a simulated city scene while either performing an auditory divided attention task or no secondary task. Dual-task costs were evaluated and suggest that mobility-related functions were prioritized; particularly in older individuals with and without hearing loss and older adults at risk of cognitive decline. **CONCLUSIONS** Understanding how sensory inputs are integrated to support mobility helps extend traditional approaches of studying sensory systems independently. Reproducing realistic and challenging conditions can provide novel insights into sensory and cognitive interactions.These processes may change with age-related sensory and cognitive declines. Simulators can provide novel methods of systematically studying the fundamentals of multisensory integration and can provide an important middle ground between traditional labs/clinics (controlled/safe) and the real world (uncontrolled/dangerous). Funding: NSERC, CIHR, Alzheimer's Association

S.10iii

Development of low-cost virtual reality applications to assess sensorimotor function and improve real-world mobility

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BACKGROUND AND AIM: Recent advances in consumer-level virtual reality (VR) have opened the door for the development of low-cost, fully-immersive systems for interactive mobility training. The promise of VR for improving mobility lies in its ability to mimic real-world challenges such as obstacles and crowds while providing systematic control over the environment and augmented performance feedback. However, creating effective training applications requires an understanding of how sensory feedback provided in VR is integrated with ongoing locomotor commands and how the practice of locomotor skills in VR transfers to the real world. Here, I will share recent work from our lab exploring sensorimotor integration and locomotor skill learning in virtual reality, and conclude with a description of how we use this information to develop interactive mobility training experiences. **METHODS**: We first investigated how visual feedback about the lower extremities influenced the coordination between head orientation and foot placement during a treadmill-based virtual obstacle negotiation task. During the task, participants received one of three types of visual feedback about the lower extremities: no feedback, end-point feedback, and a link-segment model. In a second study, we examined how people acquired a novel obstacle negotiation skill in VR and evaluated how this skill transferred to the real-world. Transfer of learning was assessed by measuring how VR-based training influenced participants' foot clearance during over-ground negotiation of a physical obstacle. We also assessed retention of the learned skill on the treadmill and over-ground 24 hours after the initial session. **RESULTS**: The presence of a visual representation of the lower extremities led to greater downward head pitch during the approach to and subsequent crossing of an obstacle. Moreover, this strategy was associated with increased safety margins during trailing limb crossing. In our study of skill learning, we found that participants systematically learned to reduce foot clearance during the VR trials, and this reduction in foot clearance transferred to over-ground walking. Moreover, this skill was retained in VR and over-ground on Day 2. Lastly, we found that retention in each environment was associated with the final level of performance in the same environment on Day 1. **CONCLUSIONS**: These results demonstrate that the quality of visual information about the lower extremities influences visuomotor coordination during virtual obstacle negotiation. Moreover, we showed that locomotor skills can be learned in VR and the retention of these skills is associated with performance during skill acquisition in a context-dependent manner. Ultimately, gaining a deeper understanding of sensorimotor control and learning in the context of VR is critical for informing the development of effective VR-based clinical interventions to improve mobility.

S.11: Balance training using perturbations to prevent falls: Is it feasible and effective?

Chair: **Stephen Lord** *Neuroscience Research Australia, AUS*

Location: Pentland suite (level 3)

S.11i

Perturbation training for fall-prevention: Inception, evolution, translation

Tanvi Bhatt[1]

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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. Perturbation training is an emerging, task-specific intervention that exposes individuals to self- or externally-generated perturbations, entraining proactive and reactive control mechanisms for fall prevention. We examined the adaptation and training effects to repeated laboratory-induced 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 tasks perturbation (trips). We observed that the perturbation-training induced adaptations could be significantly generalized across limbs, functional tasks, and training devices, resulting in reduced fall outcomes on exposure to these novel, non-training environments. Preliminary results indicate that older adults are able to demonstrate similar adaptations and generalizations. Findings from systematic large scale clinical trials indicate in older adults indicate that single-session, training-induced adaptations can be retained in a laboratory setting for up to 12 months with maximum retention at 3 months with a gradual motor memory decay from 6 to 9 to 12 months. To facilitate translation of such training into clinical environments, we subsequently

conducted an RCT to examine adaptation effects induced from treadmill-slip-perturbation training in older adults and their generalization to overground slips. Results indicated that treadmill-slip-perturbation training though effective in inducing reactive adaptations in stability control and reducing fall-risk to novel overground slips was less effective than the task-specific overground slip training. Conversely overground trip-perturbation training though resulted in significant adaptations within a single-session in terms of stability control and obstacle hit, shorter-term retention was not as robust as slip-induced. Further, considerations of optimal dosage for perturbation training will be discussed. Lastly we examined if the adaptive effects observed within a healthy nervous system would be impacted by a neurological insult such as a stroke. Results indicated that upon exposure to overground slips people with hemi-paretic chronic stroke could acquire adaptations in stability control similar to healthy older adults both under affected and non-affected limbs (albeit at different rates) 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.

S.11ii

Adaptation and retention of reactive gait stability to trip perturbations in older adults

Kiros Karamanidis[1], Epro Gaspar[1], Chris McCrum[2], Matthias König[1]

[1]London South Bank University, [2]Maastricht University Medical Centre+

Gait stability declines and falls incidence increases with age. Most falls among older people occur during gait, often due to tripping or slipping. Thus, the ability to respond appropriately to unexpected external disturbances in the mechanical environment during gait, and to improve and retain such fall-resisting skills are important for preventing falls. Task-specific assessment of gait stability and adaptability, in addition to potential training-induced improvements in the recovery stepping behaviour of older adults, comprise an interesting experimental approach to assess and influence mechanisms that may affect the safety of human gait. In a series of laboratory-based studies, we investigated how gait stability and adaptability during walking with trip-like perturbations are affected by age and muscle-tendon unit mechanical properties, in order to better understand the underlying mechanisms of the decline in locomotor function across the adult lifespan. We demonstrated that the ability to control dynamic stability in response to a novel trip-like perturbation during walking has already begun to deteriorate by middle age, however, even in old age the ability to adapt gait and improve stability following repeated perturbations is preserved. In subsequent studies we showed that leg-extensor muscle strength and tendon stiffness limit gait stability during unexpected, untrained perturbations, but that the potential for adaptive improvement after repeated perturbations during walking seems not to be related to the age-related degeneration in muscle-tendon unit capacities. Concerning the long-term retention of acquired gait stability improvements, we found that the neuro-motor system of older adults is capable of retaining the improved fall-resisting skills over a prolonged time period (years) with minimal decay over time. In summary, our findings support the hypothesis that the aged neuro-motor system can facilitate reactive balance responses by upgrading its neuromuscular coordination and retaining those balance improvements over several years and may thereby reduce the risk of falling. Whether training effects are also translated to other balance tasks will be discussed.

S.11iii

Pursuit of ecological validity in perturbations used for reactive balance training: Studies using the trip and slip walkway in young and older adults

Yoshiro Okubo[1], Matthew Brodie[1], Daina Sturnieks[1], Stephen Lord[1]

[1]Neuroscience Research Australia

The greater fall reduction effect shown by balance training using perturbations, compared to general exercises, are likely related to the greater task-specificity of the trained movements (Okubo et al., 2017). Ecologically valid perturbations (i.e. similar to real life hazards) may be crucial for training balance to prevent falls. The most common causes of falls among community-dwelling older adults are trips and slips (Berg et al., 1997). Therefore, we developed a walkway that provides unpredictable trips and slips while walking at usual gait speed. We will present results from two pilot experiments and a randomised controlled trial (RCT) using this trip and slip walkway. Our first pilot study with 10 young participants indicated (i) rapid adaptations (in a few trials) are related to prediction of the perturbation type and location, (ii) gait adaptations based on prediction do not transfer to trips and slips that occur in new, unexpected locations, and (iii) improvement of reactive responses occurs more slowly. The second pilot study with 10 young and 10 older participants indicated that increasingly unpredictable perturbations (i.e. less prediction and more reactive response) resulted in increased anxiety and a 30% dropout in older adults. This indicates training reactive balance in a single session is not optimal and older adults require more staged progression in learning appropriate responses to unpredictable trips and slips. This informed a RCT which involved 44 older adults taking part in three sessions of trips, slips and mixed training (intervention) and sham step training (control). At post-assessment, relative to the control group, the intervention group experienced -60% fewer total falls (rate ratio [RR]=0.40, 95% confidence interval [CI]=0.22-0.76), -67% fewer slip falls (RR=0.33, 95% CI=0.12-0.90) and -51% fewer trip falls (RR=0.49, 95% CI=0.21-1.12) in the laboratory (Figure 1). These findings indicate older adults can improve reactive responses to trips and slips with high unpredictability. Further research is required to examine its effects in reducing real-life falls and improve clinical feasibility of the training paradigm while maintaining its efficacy and ecological validity.

S.11iv

Can balance training with perturbations actually be implemented in rehabilitation practice?

Avril Mansfield[1], Elizabeth Inness[1]

[1]University Health Network

Reactive balance training (RBT) with perturbations is a relatively new treatment approach, and lack of awareness and knowledge of new interventions is often the primary barrier to clinical implementation of new practices. Furthermore, specific characteristics of RBT pose challenges for implementation into clinical practice. Most notably, previous studies of RBT usually use custom equipment (e.g., walkways, moving platforms) or programmable treadmills to deliver the perturbations. Lack of time, lack of equipment, poor equipment reliability, and knowledge and skills required to use the equipment are some common barriers to using new treatments in rehabilitation practice when new devices are involved. Therefore, relying on equipment to provide the perturbations may pose a significant challenge to implementing RBT into clinical practice. Additionally, reactive balance control is not assessed routinely in clinical practice, which presents a challenge for identifying client-specific reactive balance dyscontrol that can be targeted with training. We have developed task-oriented RBT methods that do not require specialized equipment, and have implemented these methods into neurorehabilitation practice at our institution for individuals with stroke, acquired brain injury, and spinal cord injury. This presentation will discuss our experiences implementing RBT, results of studies we have conducted evaluating the effect of RBT on reactive balance control and falls in daily life, and results of a survey of healthcare professionals' use of RBT in clinical practice. Using an integrated knowledge translation approach, working collaboratively with clinical partners, we iteratively developed an approach to outline principles of training (e.g., motor learning and 'FITT' principles), inclusion/exclusion criteria and safety considerations, and potential training strategies based on underlying dyscontrol. Our work demonstrates that low-tech RBT is feasible in neurorehabilitation practice, can improve reactive balance control, and has the potential to prevent falls in daily life. With an aim to translate this practice to other settings, we undertook a Canadian-wide survey to understand current practices. Results of our survey suggest that RBT is used frequently in clinical practice (used by >75% of respondents). Lack of knowledge of RBT is the most significant barrier for those who do not use this method in their practices. Healthcare professionals who were familiar with RBT and open to using it in practice reported barriers related to training, knowledge, human resources, client characteristics, and the practice setting. While low-tech RBT methods are feasible and effective, a question remains as to which perturbations methods are most effective. Our ongoing and future work aims to further develop and evaluate knowledge translation tools to support clinical uptake of RBT in other rehabilitation settings.

S.12: The challenge of preventing stair falls: Understanding the individual contributions of, and interplay between, environmental and intrinsic factors

Chair: **Bradford J. McFadyen** *Université Laval, CAN*

Location: Sidlaw suite (level 3)

S.12i

The challenges and opportunities of simulating stair falls in a laboratory environment to inform stair and handrail design

Alison Novak[1]

[1]*Toronto Rehabilitation Institute-UHN*

Falls can be prevented on a population-level through environmental changes. This is because these extrinsic risk factors are amenable to correction and do not require modifications in individual behaviour or physical function. In the case of stairs, environmental changes can effectively occur through modifications to building codes and standards. However, to affect policy change considerable empirical evidence is needed. When evaluating changes in stair and handrail design parameters there are two aspects of prevention to consider. Firstly, we must understand the effectiveness of the environmental parameter to prevent the unexpected occurrence of a slip, trip, misstep, or other event which may lead to a fall (i.e. to prevent the balance loss from occurring in the first place). In addition to preventing the balance loss from occurring, we must also understand the effectiveness of the environmental parameter to prevent a fall from occurring when an unexpected event occurs and an appropriate balance recovery reaction is required. In general, this component of addressing stair falls has been much more difficult to evaluate in a laboratory environment given concerns with safely simulating stair falls. Adding to this challenge, ~ 40% of falls on stairs result in backward rotation of the body, while 50% of falls result in forward rotation. These distinct forms of balance loss on stairs place different demands on whole-body control to generate sufficient recovery reactions and should be uniquely simulated in the laboratory environment. To date, several methods to simulate stair falls have been employed in our lab, including support surface removal, support surface rotations and translations, and induced slips. While some of these methods produced the intended type of balance loss, there was significant variability in global recovery responses between participants. In the case of handrail usage specifically, evaluation of size and shape parameters on comprehensive biomechanical measures is a challenge given the lack of repeatability. To address this, a maximum withstood perturbation protocol (MWP) has been implemented; perturbations are delivered via support surface translations demanding participants to reach and grasp for a nearby handrail without stepping. The perturbations increase in magnitude until the participant fails. The MWP permits us to create a repeatable testing protocol where full handrail reliance is required and systematic modifications in design parameters can be assessed. The external validity of this testing paradigm, however, remains unknown. Moving forward, this research will comprehensively evaluate parameters of stair and handrail design to support effective balance recovery reactions, including more detailed analyses of stepping and grasping responses considering age and impairment. Ongoing work is actively being translated to policy makers in CANand internationally to inform stair and handrail codes and standards.

S.12ii

Stair biomechanics in ageing and diabetic neuropathy: Personal factors underpinning fall risk

Neil Reeves[1]

[1]*Manchester Metropolitan University*

Stair negotiation is one of the most physically challenging activities performed on a daily basis with evidence from studies in both young and older adults measuring joint moments on stairs of standard dimensions. The challenging nature of stair negotiation is particularly evident at the ankle joint where older adults need to employ biomechanical strategies to remain within the limits of their maximum joint moment capacity. On standard rise stairs (170mm), older adults are able to control their descent through increased co-contraction of knee and ankle extensor muscles in a way that reduces their downward centre of mass (CoM) velocity and acceleration compared to young adults. This 'conservative strategy' likely compensates for their reduced lower limb strength, since upon landing, older adults are much slower at arresting downwards CoM velocity compared to young adults. Slower attenuation of the landing impact stems from a reduced ability to generate adequately high eccentric ankle moments at high angular velocities and necessitates using the lowering leg to minimise the loads on the outstretched landing leg. Older adults adopting a sideways stepping strategy (facing sideways, two feet on each step) minimise the elevated joint moment demands at an increased rise height (170mm to 220mm) compared to a typical 'step-over-step' strategy (facing forwards, one foot on each step) and a step-by-step strategy (facing forwards, two feet on each step). Notably, there was minimal increase in ankle joint moment with this sideways stepping strategy and even a slight reduction in the landing limb. Sideways stepping may therefore be considered as a useful strategy to minimise ankle joint moment demands in high fall-risk groups on stairs. The response of the landing limb during stair descent is particularly important in arresting the CoM velocity and ensuring a controlled landing. Whilst ageing reduces ankle strength capacity, diabetic peripheral neuropathy (DPN) not only reduces ankle strength but involves a complete absence of foot sensation affecting knowledge of foot-ground contact. People with DPN pre-activate plantar flexor muscles earlier while the landing limb is being lowered onto the step during descent to compensate for absent sensation. Despite earlier pre-activation, this clinical population shows a much slower rate of ankle joint moment development after contacting the step compared to matched-controls without diabetes and a group with diabetes but no neuropathy. This has implications for limb instability and unsteadiness. Overall, marked impairments to balance control on stairs have been observed in patients with DPN compared to controls and a group with diabetes but no neuropathy. Impaired sensory perception and motor control in the lower limb with DPN is therefore a key factor influencing joint moment development and balance control, placing this clinical group at particularly high risk for falls.

S.12iii

Using visual markings to enhance the visual environment on stairs and reduce stair fall-risk

Richard Foster[1]

[1]*Liverpool John Moores University*

Ambiguous visual properties of stair surfaces are important contributing factors to risky behaviour which can lead to stair falls. Age-related declining visual function or onset of visual impairment contribute to older adults being more susceptible to stair falls. Additional environmental visual factors that contribute to stair negotiation being so challenging include low lighting levels, patterned surfaces and surfaces that are uniform in colour (e.g. Fig. 1A). Locating a stair edge may therefore be easier with the presence of visually contrasting strips (edge highlighters), placed across the stair tread to clearly delineate the edge from the rest of the tread. However, incorrect positioning of edge highlighters on stair treads can also be dangerous. Our previous work has shown that when misleading edge highlighters are set back from the tread edge (e.g. by up to 30 mm), as commonly seen on public stairwells, foot clearances in young and older adults are significantly closer to the tread-edge. Furthermore, for stairs that are uniform in colour or with misleading edge highlighters, accidental foot contacts increase, especially for those with visual impairment. We suggest that an edge highlighter placed flush with the tread-edge clearly delineates the tread from the step below, enabling adequate and less variable foot clearance. Visual markings on surfaces may also alter visual perception or create an illusory effect (e.g. exposure to patterned surfaces on carpets in the home or tiled pavements/sidewalks). Our computer-based perception tests were previously developed to assess perceptual responses to various visual cue configurations on stairs in young adults. The visual cues appeared as black and white vertical stripes arranged at varying spatial frequencies on a stair riser with an abutting edge highlighter on the stair tread (Fig. 1B), representing a version of the horizontal-vertical illusion (Fig. 1C). Young adults significantly overestimated (up to 25%) the true height of stair risers (190 mm) compared to a plain riser, and the magnitude of overestimation tended to increase with increasing spatial frequencies. When the striped visual cue was superimposed on to physical steps and stairs, there was a significant increase in foot clearance (approximately 1 cm; 17.5%) for older adults during stair ascent, with no accompanying destabilizing effects on postural stability. This suggests there may be a link between what participants visually perceive and their corresponding stepping action. Ongoing research is focused on determining if there is an explicit perception and action link in older adults in response to the visual cue on stairs, and whether the striped visual cue can be simplified in appearance (reduced spatial frequency) and remain effective. Understanding this could help in determining visual cues suitable to place on home or public stairs to help improve stair safety for older adults.

S.12iv

Studying the interplay between cognitive factors and stairwell illumination to better understand falls risk during stair descent

Mark Hollands[1], Neil Thomas[1]

[1]Liverpool John Moores University

BACKGROUND AND AIM: Our previous work has shown how cognitive factors such as self-confidence and anxiety can influence where individuals look during adaptive locomotor tasks. For example, when walking on targets and stepping over obstacles anxious older adults tend to look away early from imminent obstacles to look at future hazards which, paradoxically, results in reduced stepping accuracy and increased risk of tripping on the imminent obstacle. Stair walking represents a particularly hazardous locomotor activity which can evoke strong feelings of anxiety and fear of falling in older adults especially when illumination levels are low or stair dimensions are challenging or irregular. Cognitive factors such as anxiety and fear of falling influence where and when individuals look on stairs, especially at low light levels, which has repercussions for their walking safety. For example, older adults tend to look less far ahead (i.e. closer to their feet) during stair descent resulting in altered head posture and associated destabilizing changes to centre of mass behaviour. Adequate illumination is important for stair safety. Lighting has become particularly pertinent since incandescent bulbs were banned in many countries, resulting in households using energy saving compact fluorescent lamp (CFL) bulbs. These can take minutes to reach full brightness, which may leave stairwells poorly lit during initial use. Light emitting diode (LED) bulbs are also energy efficient, but reach full brightness immediately and may offer a better alternative. Our own analysis of light bulb characteristics has clearly demonstrated that "Low" and "high" power CFL bulbs only produced illumination of 10 and 20 lux respectively averaged over the time taken to descend the stairs. This compared to 35 and 112 instantaneous lux from the low and high power LED bulbs. In order to determine the extent to which stair walking safety was affected by these varying levels of illumination (together with a very bright 300Lux illumination representing optimal lighting), whole-body 3D kinematics (Vicon motion analysis system) and force platform kinetics (3 Kistler force platforms) were recorded to quantify various biomechanical markers of stepping safety and postural stability. **RESULTS**: During low illumination conditions both younger and older adults report lower self-confidence in their ability to descend stairs safely (Figure 1A) yet only younger adults appear to compensate by adjusting their walking strategies to increase postural stability e.g. by reducing the variability in their trunk vertical acceleration during weight transfer from one step to another (Figure 1B). **CONCLUSIONS**: The implication of these results, (together with those from ongoing analyses of biomechanics and gaze behaviour), for falls risk assessment, individualised falls prevention interventions and built environment design will be discussed.

S.13: Early development of human locomotion and its functional consequences

Chair: **Yury Ivanenko** *Fondazione Santa Lucia, ITA*

Location: Fintry suite (level 3)

Moderators: **Marianne Barbu-Roth** *Paris Descartes University, FRA*

David Anderson *San Francisco State University, USA*

S.13i

What does newborn skateboarding tell us about the ontogeny of human locomotion?

Marianne Barbu-Roth[1], David Anderson[2], Vincent Forma[1], Joëlle Provasi[3]

[1]Paris Descartes University- CNRS, [2]San Francisco State University, [3]Ecole Pratique des Hautes Etudes

BACKGROUND AND AIM: The acquisition of bipedal locomotion is a celebrated milestone in infant development. However, most human infants start to crawl long before they walk and even without practice, adults retain remarkable crawling capacities. This common observation raises important questions about the connection between bipedal and quadrupedal locomotion and the development of both forms of locomotion during early infancy. Even adult upright bipedal locomotion is not free of quadrupedal mechanisms, with the arms mirroring the motions of the legs, but perhaps more surprising and puzzling are recent reports of a functional quadrupedal organization of the spinal networks underlying walking. When and how does this quadrupedal organization emerge during infant development? Extensive studies of upright bipedal stepping in the newborn have created the impression that humans are born bipeds. In our current study, we challenge this notion by showing that 2-day-old newborns are functional quadrupeds. METHOD: The existence of this independent quadrupedal locomotion was revealed by using a mini skateboard that supported the newborn's head and trunk and freed the arms to move. We tested 60 at-term typical newborns in two one-minute randomly-ordered conditions: (i) crawling in a prone position on a Mattress (Mattress condition) and (ii) crawling on the mattress with the mini skateboard (Crawli condition). The number and characteristics of the infant's leg and arm locomotor movements were captured using synchronized video and infra-red motion capture cameras. **RESULTS**: In the Crawli condition, the analyses of the number and types of limb movements and their characteristics, the coactivation of limb pairs, and the displacement across the surface, revealed that newborns are able to use arms and legs to crawl with locomotor patterns similar to those documented during quadrupedal locomotion in animals and human adults. In the Mattress condition, newborns were not able to move their arms and propel themselves, as they were impeded by the weight of their head and trunk. **CONCLUSIONS**: This discovery questions the well-established bias toward studying newborns as bipeds and lends credence to the idea that all forms of locomotion, including bipedal gait, could be organized quadrupedally in humans and represented biologically in spinal neuromotor networks from birth. We propose that humans are born as quadrupeds and develop bipedal competencies later, in concert with maturationally- and experience-driven anatomical changes and practice locomoting in a variety of different contexts. This proposition has very important, though yet to be experimentally verified, implications for the design of interventions for infants at risk for locomotor delays. It suggests these interventions may be more efficacious at hastening the onset of independent walking if they promote quadrupedal locomotion in the early months of life.

S.13ii

Development of spinal locomotor output

Yury Ivanenko[1]

[1]IRCCS Fondazione Santa Lucia

INTRODUCTION. In this presentation, various findings, ideas and approaches will be considered that represent important conceptual frameworks for characterizing and understanding human locomotor development, with a particular emphasis on the first years of life. The spinal cord does not simply transmit information to and from the brain and its maturation and physiologic state determines reflex, postural and locomotor control. We will discuss recent advances in understanding how motor commands are expressed at different stages of human development. **METHODS**. The spinal locomotor output can be assessed by identifying the basic patterns of lumbosacral motoneuron activity from multimuscle recordings. The idea that the CNS may control complex interactions by modular decomposition has received considerable attention. Each human lower limb contains over 50 muscles, comprising many intrinsic foot muscles, that are coordinated during locomotion. It has been argued that the nervous system may control numerous muscles through modularity, using neural patterns to activate muscles in groups. We explored this idea for human locomotion by examining the spinal locomotor output during early development along with maturation of coordinated patterns of limb motion. **RESULTS**. The development of human locomotion from the neonate to the adult starts from a rostrocaudal excitability gradient in the spinal motor output and involves a progressive reduction of EMG burst durations and a functional reorganization of the pattern generation circuitry with increasing age. Furthermore, the accomplishment of mature locomotor movements relies upon the integrated coordination of the lower and upper limbs and the trunk, as well as integration of proper load-related proprioceptive feedback. Foot placement patterns in human neonates and the episodes of alternating arm-leg oscillations suggest the potential contribution of load-related proprioceptive feedback and/or the expression of variations in the locomotor program already during early manifestations of stepping on ground in human babies. We will also present data on how early injuries to developing motor regions of the brain in children with cerebral palsy substantially affect maturation of the spinal locomotor output and consequently the future locomotor behavior. **CONCLUSIONS**. The complexity and flexibility of the spinal locomotor output changes with age. We discuss the precursor of the mature locomotor pattern in infants also in comparison with other animals.

S.13iii

Does balance help explain why infant crawling & walking induce changes in visual proprioception?

David Anderson[1], Minxuan He[1], Joseph Campos[2]

[1]San Francisco State University, [2]University of California, Berkeley

INTRODUCTION: Visual proprioception is the sense of self-movement produced by patterns of optic flow. Prior research has shown a dramatic shift in infants' responsiveness to peripheral lamellar optic flow (PLOF) following the onset of hands-and-knees crawling, evidenced by their robust postural compensation to movements of the side-walls of a moving room. This shift in visual proprioception may be driven by the visual system's need to regulate multiple tasks during crawling. If balance control can be relegated to the periphery, then central vision is freed to monitor the environment to ensure the surface affords locomotion and obstacles and apertures are negotiated successfully. This explanation predicts that changes in visual proprioception would be less obvious for infants who initially crawl on their bellies because belly-crawling places limited demands on balance control. It is also possible that the onset of walking induces further changes in visual proprioception because walking demands a different type of balance control than crawling. We tested these predictions in three experiments. **METHOD**: Experiment 1 involved comparisons among 64 8-month-old infants categorized as pre-crawlers (n = 25), belly-crawlers (n = 15), and hand-and-knees crawlers (n = 24). Experiment 2 examined 7 infants with spina bifida across the transition to independent belly crawling. Experiment 3 examined 77 11.5-13.5 month-old infants who were categorized as: 1) proficient crawlers (n = 31), 2) less proficient walkers (n = 22), and 3) proficient walkers (n = 24). All infants were tested for responsiveness to PLOF from side-wall motion in a moving room. **RESULTS**: Experiment 1 revealed that hands-and-knees crawlers were significantly more responsive to PLOF than pre-crawlers ($p = .04$) and marginally more responsive than belly-crawlers ($p = .06$), whereas pre-crawlers and belly-crawlers did not differ from each other. Omnibus ANOVA: $F(2, 61) = 3.93$, $p < .05$. A Wilcoxon signed-ranks test on the spina bifida infants from Experiment 2 revealed no significant changes in responsiveness to PLOF across the transition from pre-crawling to belly crawling, $Z = -.34$, $p = .81$. The Experiment 3 results showed that the less proficient walkers were more responsive to PLOF than the proficient crawlers ($p = .04$) but not the more proficient walkers ($p = .23$), Omnibus ANOVA: $F(2, 75) = 3.10$, $p < .05$. **DISCUSSION**: These findings support the idea that the balance demands associated with new forms of locomotion drive important changes in visual proprioception. The acquisition of skills that place new demands on balance control appears to heighten responsiveness to visual input and facilitate the differentiation of information contained in patterns of optic flow and the subsequent mapping of this information onto motor control strategies.

S.13iv

The internal body representation in a developing brain

Christine Assaiante[1]

[1]CNRS

BACKGROUND AND AIM: In order to perceive and act in its environment, the individual's body and its interactions with the environment are represented in the brain. The precise knowledge about how our body is involved in action allows us to act or to interact with our social and non-social environment. At the cerebral level, this knowledge is stored in an internal representation labelled the body schema (BS). The BS is built through ontogenesis and is constantly updated using sensory information. Nevertheless, proprioception that encompasses the perception of positional changes and movements of body parts appears to be the most essential sensory modality to build and to update the BS. BS must be updated during development due to many factors such as morphological changes, acquisition of motor skills, and cognitive practice (Assaiante et al, 2014). **METHODS**: Using a neurosensory approach, the aim of our studies was to highlight the building of the BS through childhood (7-12 years old) and adolescence (13-17 years old) by exploring through proprioceptive integration the maturation of its cerebral basis and its link with behavioural improvement during development. To this end, brain imaging and behavioural performance requiring proprioceptive information were associated to explore the different processes (i.e. perception-action coupling, sensory integration) leading to the elaboration and to the update of an internal body representation in a developing brain. **RESULTS**: Our results reveal that the neural basis subtending the BS was already well established as early as the age of 7, although still immature in some aspects. This included a lower level of somatosensory and posterior parietal regions activation, and the exclusive activation of the frontopolar cortex in children compared to adults (Fontan et al, 2017). We also found that proprioceptive network is still undergoing refinement during adolescence, including a shift from diffuse to focal Functional Connectivity (FC) and a decreased FC strength. This developmental effect was particularly pronounced for frontostriatal connections. Furthermore, changes in FC features continued beyond adolescence, although to a much lower extent. (Cignetti et al, 2016). **CONCLUSION**: Altogether, these findings support the slow maturation of the proprioceptive integration and point to a protracted developmental time course for the BS network, which breaks with the relatively early functional maturation often associated with sensorimotor networks. References: Assaiante, C., Barlaam, F., Cignetti, F., Vaugoyeau M. (2014). Building of body schema during childhood and adolescence: a neurosensory approach. Neurophysiologie Clinique / Clinical Neurophysiology, (2014) Cignetti, F., Fontan, A., Menant, J., Nazarian, B., Roth, M., Anton, JL., Vaugoyeau, M., Assaiante, C. (2016). Early adolescence as a main time window of plasticity in organization of the proprioceptive brain network. Cerebral Cortex, 27: 1285-1296.

S.14: Maximising interdisciplinary methods to assess falls risk in clinical groups

Chair: **Chesney Craig** *Manchester Metropolitan University, GBR*

Moderator: **Clemens Becker** *Robert-Bosch Hospital, GER*

Location: Sidlaw suite (level 3)

S.14i

An interdisciplinary approach to assess the electrophysiological, kinematic and gaze factors related to gait and fall risk in older adults

Chesney Craig[1], Paul Holmes[1], John-Stuart Brittain[2], Will Young[3], Zoe Franklin[1], Nicola Ray[1]

[1]Manchester Metropolitan University, [2]University of Birmingham, [3]Brunel University London

PURPOSE AND BACKGROUND: Early identification of individuals at high risk of falls is essential to ensure efficient fall prevention interventions. Given the heterogeneity of fall accidents that are experienced by some older adults, it is important to utilize a multifactorial approach to assess fall risk. Although multifactorial approaches have successfully identified a number of functional and behavioral outcome measures that can predict subsequent falls, less is known about the neural profile associated with fall risk. The advent of mobile electroencephalography (EEG) technology and advanced signal processing algorithms have enabled remote online measurement of neural activity during active gait, which may provide unique insights into the neural control of asymptomatic and clinically-impaired gait. The field is, however, still in its infancy and we are unaware of any publication to date that has used mobile EEG in a clinical population during natural gait. This talk will outline how we have employed an interdisciplinary approach to provide a comprehensive characterization of the neural, kinematic, muscle, gaze and psychological factors that may discriminate fallers from non-fallers during naturalistic gait, adaptive gait and obstacle avoidance. **METHODS**: We present a novel experimental method that combines mobile 64-channel EEG, wireless electromyography (EMG), motion tracking and mobile eye-tracking, to assess naturalistic gait and obstacle avoidance in older people with ($N = 20$, Mage = 72.32 ± 5.58) and without identified fall risk ($N = 20$, Mage = 73.32 ± 4.55), compared to young adults ($N = 20$, Mage = 27.75 ± 4.96). These variables were assessed simultaneously during a 2-minute looped walk, followed by a walking and turning 'on cue' task, which assessed adaptive gait and obstacle avoidance. Participants walked either straight towards the end of a 6.5m walkway or turned right or left at an intersection depending on a visual cue presented during the walk. During half of the walking trials, an obstacle was present in one of the pathways. Independent Component Analysis was used to remove movement-related artifact from the EEG signals. Ongoing data analysis (at the time of writing) will analyze group differences in gait variables, lower-limb muscle activity, task-relevant gaze fixations and EEG â band oscillations during each gait condition. **DISCUSSION**: This complex multi-modality experimental protocol considered interactions between related disciplines for a more valid study design, implementation, analysis and interpretation. The interdisciplinary approach, its implementation and current results highlight important implications for assessing fall risk in older adults. In addition, we will outline how the strengths and limitations of our experimental approach provide insights for future research. Recommendations based on this study are currently being implemented in a similar protocol investigating fall risk in Parkinson's Disease.

S.14ii

Sensorimotor, neuropsychological and daily-life gait assessments to identify people at high risk for falls

Kim van Schooten[1]

[1]*Neuroscience Research Australia/University of New South Wales*

PURPOSE AND BACKGROUND Falls are a multifactorial problem with causes amongst sensorimotor, cognitive and affective domains. Whilst there is a range of tools for assessing fall risk, few encompass all these domains. Moreover, recent studies suggest that not only one's balance abilities but also their activity behaviour affect the probability of experiencing a fall. This presentation will address the utility of clinical tests and daily-life gait to identify people at high risk for falls. It will draw upon multidisciplinary studies to discuss the strengths and weaknesses of these approaches and presents results of an interdisciplinary study combining these techniques to assess fall risk. **METHODS** The first part of the presentation will consider recent observations on multifactorial risk factors for falls in general and clinical ageing populations. We pooled data of 1,230 participants (74±10yrs; 640♀), including 500 community-dwelling older people and four clinical groups with balance disorders (Parkinson's disease, N=312; dementia, N=175; stroke survivors, N=140; multiple sclerosis, N=111), to characterise similarity in risk factors for falls. Our results confirm that deficits in cognition (executive function) and affect (depressive symptoms, concern about falling) are at least equally important as sensorimotor function in fall-risk prediction and should therefore be included in routine clinical assessment. The second part of the presentation will review current evidence for using daily-life gait characteristics to identify people at risk for falls. This part will touch upon dependency on activity recognition, estimation of characteristics, models used to predict risk and fall-risk definitions. Recent work on the predictive ability for falls of daily-life gait characteristics combined with clinical tests of sensorimotor, cognitive and affective function in older people will be presented and compared to previous work. **DISCUSSION** Taken together, the studies will provide an overview of interdisciplinary approaches, combining sensorimotor, neuropsychological and daily-life gait assessments, to assess fall risk in various populations. Transdisciplinary collaboration is needed to implement these assessments into clinical practice.

S.14iii

Addressing misconceptions relating to fear of falling and the control of adaptive gait

William Young[1]

[1]*Brunel University London*

BACKGROUND AND AIMS: The problem of how to predict and prevent falls is a major concern for governments and health services dealing with the wide-ranging economic and social consequences of falls and related injuries. Over recent decades much research has been carried out to identify physical, social and environmental risk-factors for falls. Factors within each of these categories can serve as strong predictors of fall-risk, particularly concerning measures of functional balance. However, some researchers argue that too much emphasis is placed on simple clinical outcome measures, in part, because such tests are generally considered to encompass physiological status along with numerous trait and state factors relating to individual differences in disposition etc. This being the case, such assessments are not sensitive to certain specific dispositions and associated behaviours that might have an independent role in influencing balance in specific tasks/contexts. Being fearful of falling is an example of such a disposition. Much research has demonstrated the impact that fear of falling (or concern about one's balance ability) can have on functional outcomes associated with fall-risk. However, researchers have only recently started to evaluate how fear of falling (and related state anxiety) can influence attentional processes/biases and associated prioritisation strategies during movement planning and execution. **METHODS** AND **RESULTS**: This presentation will cover examples of potential misinterpretations evident in the literature, relating specifically to how fear of falling influences the control of balance and adaptive gait. In particular, the talk will focus on mechanisms suggested to underpin conservative movement strategies observed in fearful older adults (including increased muscle co-contractions and reduced visual search behaviour). Examples will be given from my own laboratory where we applied extant anxiety-related psychological theories (e.g., Reinvestment and Attentional Control Theory) to the context of ageing and falls, only to establish through incremental studies that the perspectives set out by such theories do not always readily translate and, in some cases, can lead to misconceptions that cause fundamental problems with our capacity to interpret findings. The objective of this presentation is, therefore, to promote discussion about how we can be vigilant to potential misconceptions so that we might best-inform the selection of specific outcome measures used in future research. **CONCLUSIONS**: The presentation will conclude with a summary of what 'we think we know now' in the context of anxiety-related changes in attention during gait, along with recommendations for how current knowledge can be utilised by future cross-sectional and prospective studies evaluating fall-risk in older adults.

S.14.iv

Automatic recognition of gait patterns with machine learning

Yuhan Zhou[1], **Tibor Hortobágyi**[1], **Claudine Lamoth**[1]

[1]*University Medical Center Groningen*

PURPOSE AND BACKGROUND: Physical, emotional, cognitive, behavioral and social factors and their interactions underlie gait and balance abilities and fall risk in older adults. The International Classification of Functioning, Disability and Health (ICF) model can be used as a framework to examine the multifactorial nature of gait and balance decline and fall risk. For machine learning to contribute significantly and meaningfully to the understanding and prevention of fall risk and the estimation of movement related disorders, the collaboration between different disciplines (clinicians, physiotherapists, data scientists,) is necessary. Here, we present a model using an aggregate analysis of gait accelerometer data from healthy adults and geriatric patients. The first purpose of this study was to identify the most accurate machine learning method to automatically classify gait patterns in groups of participants; the final purpose of the model is to early identify at-risk gait and evaluate treatment outcomes. **METHODS**: Healthy young and middle-aged adults (n=58, age: 42.7±16.60), healthy old adults (n=54, age: 74.6±5.71), and geriatric patients without cognitive impairment (n=126, age: 79.3±5.81) participated in this study. Trunk accelerations were measured with 3D accelerometers (DynaPort® MiniMod, McRoberts BV & iPod touch 4G, iOS 6, Apple Inc.; sample frequency±100 Hz) during three minutes of walking. From the 3D accelerometer signals, we extracted 23 dynamic gait variables quantifying gait pace, stability, regularity, variability. A Kernel Principal Component Analysis (KPCA) was applied to extract underlying gait features and reduce the dimensionality of the data for Support Vector Machine (SVM) classification, compared other machine learning methods Random Forest (RF) and Artificial Neural Network (ANN) with raw features. These methods also can be extended for other kinds of variables to predict different labels, such as fall risk and Parkinson's disease. **RESULTS**: KPCA reduced gait data dimensions efficiently from 23 dimensions to five dimensions, explaining97% of the variance, and representing gait features of pace, synchronization, regularity, and variability. Preliminary analyses showed that both SVM (accuracy=89%, AUC=0.91) and ANN (accuracy=90%, AUC=0.87) could differentiate gait patterns between the three age-based groups. RF was sensitive to parameter selection and results in worse classification performance (accuracy=73% and AUC=0.86). **CONCLUSIONS**: Aging affects specific gait features that can be identified by non-linear approaches such as KPCA followed by SVM or ANN classifiers. Both of these classifier methods reveal differences in temporal gait characteristics between age groups. Future analyses will add data on person's objective and subjective measures at the different levels of the ICF model. In addition, different machine learning models will be added to investigate labelled disorders, to finally predict the risk of falling.

S.15: STOP! Age-related changes in sensorimotor inhibition and the associated implications for impaired gait and balance control

Chair: **Brett Fling** *Colorado State University, USA*
Location: Pentland suite (level 3)

S.15i

Age-related reductions in tactile and motor inhibitory function start early: Implications for gait and balance

Rachael Seidler[1], Marit Ruitenberg, Kaitlin Cassady, Kathleen Hupfeld[1]
[1]University of Florida

BACKGROUND AND AIM: Previous work documents that surround inhibition and intra-/interhemispheric inhibition in the somatosensory and motor systems are mediated by gamma-aminobutyric acid (GABA). Surround inhibition describes cortical lateral inhibition of surrounding receptive fields upon skin contact or muscle activity, resulting in a sharper neural representation of stimuli. Surround inhibition has also been shown to extend to contralateral homologous representations and to the motor system. The effects of healthy aging on these inhibitory functions and their underlying mechanisms are neither well characterized nor understood. Thus, in the current study we determined tactile thresholds for a given finger while either a neighboring or the contralateral digit were simultaneously stimulated; this allowed us to test tactile surround inhibition in individuals across a wide range of ages. We also used bimanual motor tasks to assess motor intra- and inter-hemispheric inhibition to illustrate the trajectory of decline and to test for associations between age differences in the two systems. **METHODS**: Participants ranging from 18 to 76 years old performed assessments of tactile and motor inhibitory function. To evaluate tactile surround inhibition, we determined tactile thresholds for a given finger while either a neighboring or the contralateral digit were simultaneously stimulated. Typically, this results in higher (i.e., less sensitive) tactile thresholds, due to surround inhibition. Since inhibitory function declines with age, however, we predicted that low amplitude stimulation on a neighboring finger would decrease tactile thresholds for older adults due to "spillover" effects. Participants also performed motor tapping tasks requiring asynchronous movements of two neighboring digits or of two homologous digits (i.e. bimanual actions), which we have previously linked to inhibitory function. **RESULTS**: Older age associated with greater decreases in tactile detection threshold when a stimulus was simultaneously applied to a neighboring or the contralateral homologous finger. These findings are indicative of age-related declines in surround inhibition. Additionally, increasing age was significantly associated with poorer performance on the motor task requiring asynchronous actions of neighboring fingers on the same hand, again supporting reduced intrahemispheric inhibition with age. Declines in inhibitory function were evident starting in the fifth decade of life, but were not correlated between tactile and motor systems. **CONCLUSIONS**: Our findings demonstrate that aging impacts tactile and motor inhibitory function, particularly for behaviors that are mediated by GABA neurotransmission. In ongoing work we are evaluating whether similar age declines in inhibitory function are evident for the lower limbs, are associated with magnetic resonance spectroscopy measures of GABA, and are associated with age declines in gait performance. NIH 1R56AG043402.

S.15ii

The effects of age and task difficulty on the neural control of standing balance

Tibor Hortobagyi[1], Tulika Nandi[1], Selma Papegaaij[2]
[1]University Medical Center Groningen, University of Groningen, [2]MOTEK

BACKGROUND AND AIM: We examined the hypothesis that when quiescent standing is challenged by reductions in base of support, sensory perturbations, or old age, motor cortical (M1) supervision of standing balance becomes necessary with a putative role assigned to the GABAergic inhibitory system. **METHODS**: We collected transcranial magnetic stimulation data while healthy adults stood in a wide, narrow, tandem, and one-legged stance and healthy young and old adults stood with and without support at the chest, stood on a rigid and foam surface with eyes open or closed, and sat or leaned forward with and without a support at the chest. We also examined the effects of a simulated balance task on dual-task costs while lying in an MRI scanner. **RESULTS**: While the net corticospinal input to biomechanically relevant leg muscles increases with reductions in base of support in the mediolateral direction and GABAergic inhibition decreases, these outcomes do not correlate with sway magnitude (1,2). Likewise, M1's involvement became more prominent in free vs. supported standing (3). There also was disinhibition of M1 in standing independent of age but an age-specific reduction in GABAergic intracortical inhibition that correlated with center of pressure velocity when subjects stood on foam, a proprioceptive perturbation (4). When healthy young and old adults sat and voluntarily leaned forward with and without a chest support, the area of EMG suppression produced by brain stimulation, i.e., GABAergic intracortical inhibition, was ~60% smaller in unsupported vs. supported leaning and sitting, with no difference between these latter two conditions (5). Leaning closer to the maximum without support correlated with less M1 inhibition. While age did not affect the motor control strategy as quantified by the modulation of M1 activity, the modulation appeared at a lower task difficulty with increasing age. The critical factor in modulating M1 activity is postural challenge instead of contraction aim (voluntary, postural) or posture. When standing difficulty was simulated in an MRI scanner by keeping a forward or backward falling avatar vertical by plantarflexing toward a load cell in combination with a calculation task, the age-related increase in brain activation and dual-task costs did not correlate, suggesting that the dual-task costs were not due to increased structural interference (6). **CONCLUSION**: When quiet standing is challenged by reductions in base of support, sensory perturbations, or old age, motor cortical supervision of standing balance becomes evident. Future experiments will clarify if age- and task-differences in M1 activation underlie impaired postural control and postural instability. 1.Nandi GP 60:135-140, 2018. 2.Nandi FHN12:303, 2018. 3.Papegaaij EJAP 116:959-967, 2016. 4.Papegaaij FAN 6:28, 2014. 5.Papegaaij EG 73:78-85, 2016. 6.Papegaaij PONE 12(12):e0189025, 2017.

S.15iii

Effects of age and mental fatigue on dynamic postural control

Anita Christie[1], Amanda Morris[2]
[1]The University of Western Ontario, [2]The University of Oregon

BACKGROUND AND AIM: Mental fatigue is a psychophysiological state that occurs after or during prolonged periods of cognitive activity. Older adults report higher levels of fatigue than young adults, which is associated with impaired motor performance. Despite these important associations, little is known about the direct impact of mental fatigue on physical function. The reduction in attentional resources that occurs with mental fatigue may exacerbate compromises in balance control in older adults. The aim of this work is to examine the impact of mental fatigue on postural control in older adults and to identify neural contributions to reduced function. **METHODS**: We examined the impact of mental fatigue on responses to postural perturbations in young and older adults. Participants stood on two force platforms that were anteriorly translated at random intervals before, during and following a mentally fatiguing task. Postural responses to the perturbations and assessments of neuromuscular properties, including transcranial magnetic stimulation measures of corticospinal excitability and intracortical inhibition were assessed before, during and after the mentally-fatiguing task. In a sub-group of young individuals with reported high levels of mental fatigue and measured impairments in gait balance control, magnetic resonance spectroscopy was used to assess concentrations of glutamate and gamma-aminobutyric acid (GABA) in the primary motor cortex (M1) and the dorsolateral prefrontal cortex (DLPFC). **RESULTS**: Older adults had slower reaction times and greater postural responses to perturbations than young. Mental fatigue did not differentially affect the magnitude of the postural responses in young and older adults. However, the velocity of the postural responses to perturbations was slower in older adults compared with young, during conditions of mental fatigue. Older adults had a greater reduction in overall muscle activity during the postural response following mental fatigue than young. Relative to young, older adults showed a similar change in corticospinal excitability in response to mental fatigue, but a greater change in intracortical inhibition. In a population of individuals who report high levels of mental fatigue, and demonstrate impaired dynamic balance control, we have shown a lower glutamate:GABA ratio in M1, but a higher Glutamate:GABA ratio in the DLPFC. **CONCLUSION**: The condition of mental fatigue may impact some aspects of dynamic balance control, particularly in older adults. Concurrent changes in muscle activation and intracortical inhibition suggest central factors involving inhibition are likely involved in the observed alterations in postural control. The region-specific imbalances in neurotransmitters in a sub-group of young individuals may help to inform observed changes with mental fatigue in older adults.

S.15iv

Age-related differences in associations between dynamic gait characteristics and motor cortex inhibition

Brett Fling[1], Clayton Swanson[1]

[1]Colorado State University

BACKGROUND AND AIM: Healthy aging is associated with structural and functional alterations in the brain and declines in multiple facets of motor performance including gait, balance, and motor coordination. For example, interlimb coordination and performance during turning both diminish with age, posing a risk for gait-related injuries. Cortical inhibitory processes are essential for optimal motor control and undergo age-related alterations that may account, at least in part, for these behavioral deficits. In this regard, a key role is played by gamma-aminobutyric acid (GABA), the principal inhibitory neurotransmitter within the nervous system. Recent studies demonstrate that levels of motor inhibition are related to GABAergic function and that levels of GABA diminish with advancing age. In fact, levels of inhibition within the motor cortex are significantly associated with coordination of the upper extremities, however, it is unknown if this same association exists for dynamic lower extremity control required for daily tasks such as coordinating the legs while walking and turning. **METHODS**: Our results are from a current sample of nearly 50 healthy adults, comprised of younger (18-30 years old) and older adults (65-80 years old). Cortical inhibition is assessed via the cortical and ipsilateral silent period within the dominant and non-dominant cortical hemisphere, both of which are elicited by TMS within muscles of the lower extremities. Dynamic measures of gait, including the phase coordination index and multiple measures of turning performance, are collected and analyzed through the use of six, wireless inertial sensors during 2- or 6-minute over-ground walking trials at a self-selected pace. **RESULTS**: We report that older adults demonstrate significantly reduced performance during turning coupled with reduced coordination and increased variability during over-ground walking, compared to a younger cohort. In addition, we report reduced cortical inhibition within the non-dominant (right) motor cortex of these older adults. Interestingly, measures of gait coordination and variability demonstrated a positive relationship with cortical inhibition in the younger adults, while there was a negative correlation between inhibition and these same behavioral measures in older adults. Furthermore, motor cortex inhibition was significantly associated with multiple turning characteristics. **CONCLUSIONS**: Taken together, these results propose a fundamental difference in the relationship between motor cortex inhibition and lower extremity control with age; younger adults are better able to maintain lower extremity coordination and variability with reduced cortical inhibition, whereas older adults with increased cortical inhibition demonstrate better mobility performance. Importantly, these findings are complimentary to previous work demonstrating age-related differences in the association between motor cortex inhibition with bimanual control.

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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.

CODE	THEME
A	Activity monitoring
B	Adaptation, learning, plasticity & compensation
C	Aging
D	Biomechanics
E	Brain imaging/activation during posture & gait
F	Cognitive impairments
G	Cognitive, attentional, and emotional influences
H	Coordination of posture and gait
I	Development of posture and gait
J	Developmental disorders
K	Devices to improve posture and gait
L	Effect of medication on posture and gait
M	Exercise and physical activity
N	Falls and fall prevention
O	Habilitation & rehabilitation
P	Modeling
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NOTES

POSTER SESSION INFO

POSTER SESSION 1: MONDAY 1ST JULY

A - Activity monitoring

P1-A-1 Monitoring walking activity with wearable technology in rural-dwelling older adults in Tanzania: A feasibility study nested within a frailty prevalence study

Presenter: **Silvia Del Din**

Silvia Del Din[1], Emma Grace Lewis[2], William Gray[2], Harry Collin[1], John Kissima[3], Lynn Rochester[4], Catherine Dotchin[2], Sarah Urasa[5], Richard Walker[2]
[1]Newcastle University, [2]Northumbria Healthcare NHS Foundation Trust, North Tyneside General Hospital, [3]Hai District Hospital, [4]Institute of Neuroscience, Newcastle University, [5]Kilimajaro Christian Medical Centre

P1-A-2 The impact of freezing of gait in daily life: A wearable sensors approach

Presenter: **Martina Mancini**

Martina Mancini[1], Vrutangkumar Shah[1], Carolin Curtze[2], Samuel Stuart[1], Mahmoud El-Gohary[3], James McNames[4], Fay Horak[1], John Nutt[1]
[1]Oregon Health & Science University, [2]University of Nebraska Omaha, [3]APDM, [4]Portland State University

B - Adaptation, learning, plasticity and compensation

P1-B-3 Targeted familiarization based on user feedback and motor control principles to optimize positive adaptation strategies for learning to walk with a passive load-bearing exoskeleton: A feasibility study

Presenter: **Laurent Bouyer**

Laurent Bouyer[1], Krista Best[2], Thomas Karakolis[3], Gabriel Diamond-Ouellette[4], Etienne Lamoureux[4], Kurt Modie[5]
[1]Université Laval, [2]CIRRIS-Universite Laval, [3]Defence Research and Development Canada, [4]Mawashi Science & Technology, [5]Defence Science and Technology Australia

P1-B-4 The moving platform illusion in older adults: Effects of the duration of adaptation to a sway-referenced environment on perceptual delays and postural aftereffects

Presenter: **Mihalis Doumas**

Mihalis Doumas[1], Laura Coulter[1]
[1]Queen's University Belfast

P1-B-5 Foot speed perception during split-belt treadmill adaptation in adults with Parkinson's disease

Presenter: **Dorelle Hinton**

Dorelle Hinton[1], Roger Wei[1], David Conradsson[2], Caroline Paquette[1]
[1]McGill University, [2]Karolinska Institutet

P1-B-6 Influence of smartphone use while walking: The relationship between obstacle avoidance and adaptive walking caused by smartphone use

Presenter: **Sato Ren**

Sato Ren[1], Kotaro Shimizu[1], Koyuki Nishikawa[2], Yuriko Kihara[3], Kazunari Itou[4], Keita Tai[5], Taketo Furuna[1]
[1]Sapporo Medical University, [2]Goryokaku Hospital, [3]Japan Health Care College, [4]Asahikawa Rehabilitation Hospital, [5]Houseikai Motomachi Himawari Clinic

P1-B-7 Gait adaptations in response to perturbation treadmill training in Parkinson's disease: Time-course, sustainability and transfer

Presenter: **Simon Steib**

Simon Steib[1], Sarah Klamroth[1], Gassner Heiko[1], Cristian Pasluosta[1], Bjoern Eskofier[1], Juergen Winkler[1], Jochen Klucken[1], Klaus Pfeifer[1]
[1]Friedrich-Alexander University (FAU) Erlangen-Nürnberg

P1-B-8 Task-specific modulation of the soleus H-reflex following a single balance training session

Presenter: **Craig Tokuno**

Craig Tokuno[1], Louis-Solal Giboin[2], Andreas Kramer[2], Markus Gruber[2]
[1]Brock University, [2]University of Konstanz

P1-B-9 Large errors upon introduction vs. removal of the training environment have distinct effect on the generalization of locomotor adaptation

Presenter: **Gelsy Torres-Oviedo**

Gelsy Torres-Oviedo[1], Digna de Kam[1], Wouter Staring[2]
[1]University of Pittsburgh, [2]Radboud University Medical Center

P1-B-10 Changes in muscle activation patterns underlie split-belt gait adaptation

Presenter: **Danique Vervoort**

Danique Vervoort[1], Rob den Otter[1], Tom Buurke[1], Nicolas Vuillerme[2], Tibor Hortobágyi[1], Claudine Lamoth[1]
[1]University of Groningen, University Medical Center Groningen, [2]University Grenoble-Alpes

P1-B-11 Prolonged exposure to height-related threat: Adaptation and retention of standing balance outcomes

Presenter: **Martin Zaback**

Martin Zaback[1], Minh Luu[1], Allan Adkin[2], Mark Carpenter[1]
[1]University of British Columbia, [2]Brock University

C - Aging

P1-C-12 Two-year change in gait variability in community-living older adults

Presenter: **Bård Bogen**

Bård Bogen[1], Mona Aaslund[1], Anette Ranhoff[1], Rolf Moe-Nilssen[1]
[1]University of Bergen

P1-C-13 The effects of mechanical and cognitive constraints on beam walking in older adults

Presenter: **Andréia Abud da Silva Costa**

Andréia Abud da Silva Costa[1], Tibor Hortobágyi[2], Andrew Sawers[3], Renato Moraes[4]
[1]Ribeirão Preto School of Medicine - FMRP-USP, [2]University Medical Center Groningen, [3]The University of Illinois at Chicago, [4]University of São Paulo

P1-C-14 Low function based on spatio-temporal gait variables and disability

Presenter: **Takehiko Doi**

Takehiko Doi[1], Sho Nakakubo[1], Kota Tsutsumimoto[1], Minji Kim[1], Satoshi Kurita[1], Hideaki Ishii[1], Hiroyuki Shimada[1]
[1]National Center for Geriatrics and Gerontology

P1-C-15 Age-related differences in lower limb joint moments during turning gait

Presenter: **Yuto Fukuda**

Yuto Fukuda[1], Takeshi Yamaguchi[1]
[1]Tohoku University

P1-C-16 "COgnitive and Motor interaction in Older populatioNs (ComOn)" - A prospective multi-center study for quantitative evaluation of treatment effectiveness in 1000 geriatric patients with cognitive and motor deficits

Presenter: **Johanna Geritz**

Johanna Geritz[1], Sara Maetzold[1], Andrea Pilotto[2], Marta Corrà[3], Mariana Morscovich[4], Maria Rizzetti[5], Barbara Borroni[2], Alessandro Padovani[2], Annekathrin Alpes[1], Corinna Bang[1], Igor Barcellos[4], Ralf Baron[1], Thorsten Bartsch[1], Jos Becktepe[1], Daniela Berg[1], Lu Bergeest[1], Philipp Bergmann[1,] Raquel Bouca-Machado[6], Michael Dre[7], Christin Ehlers[1], Morad Elshehabi[1], Susan Farahmandi[1], Andre Franke[1], Anja Friederich[1], Corinna Geisler[1], Janne Gierthmuhlen[1], Oliver Granert[1], Sebastian Heinzel[1], Maren Heller[1], Markus Hobert[1], Marc Hofmann[8],Philipp Hullemann[1], Bjorn Jemlich[9], Laura Kerkmann[1], Stephanie Knupfer[1], Katharina Krause[1], Maximilian Kress[1], Sonja Krupp[10], Jennifer Kudelka[1], Gregor Kuhlenbaumer[1], Roland Kurth[11], Frank Leypoldt[1], Corina Maetzler[1], Luis Maia[12], Patricia Neumann[13], Katharina Niemann[1], Christian Ortlieb[1], Steffan Paschen[1], Hoang Pham[1], Thomas Puehler[14], Franziska Radloff[1], Christian Riedel[1], Simone Sablowsky[1], Elena Schanz[1], Linda Schebesta[1], Andreas Schicketmuller[8], Simone Studt[11], Martina Thieves[9], Sebastian Ullrich[9], Paul Urban[13], Nuno Vila-Cha[12], Elke Warmerdam[1], Tobias Warnecke[15], Michael Weiss[1], Anna Wiegard[1], Clint Hansen[1], Walter Maetzler[1]
[1]Christian-Allbrechts-University of Kiel, [2]University of Brescia, [3]Centro Hospitalar do Porto, [4]Federal University of Paraná, [5]FERB ONLUS-S Isidoro Hospital, [6]University of Lisbon, [7]Ludwig-Maximillians Universität München, [8]Hasomed GmbH, [9] Stadtisches Krankenhaus Kiel, [10]Red Cross Hospital Geriatric Centre, [11]ZIP, Centre for Integrative Psychiatry, [12]Centro Hospitalar do Porto, [13]Asklepios Klinik Barmbek, [14]Universitätsklinikum Schleswig-Holstein Campus Kiel, [15]University Hospital Muenster

P1-C-17 Specific gait measures predict cognitive decline in highly educated older adults

Presenter: **Jeffrey Hausdorff**

Elissa Ash[1], Tali Ben Porat[2], Odelia Elkana[1], Natalie Ganz[1], Jeff Hausdorff[1]
[1]Tel-Aviv Sourasky Medical Center, [2]Academic College of Tel Aviv-Yaffo

P1-C-18 Medical, sensorimotor and cognitive factors associated with gait variability: a longitudinal population-based study

Presenter: **Oshadi Jayakody**

Oshadi Jayakody[1], Monique Breslin[1], Velandai Srikanth[2], Michele Callisaya[1]
[1]University of Tasmania, [2]Peninsula Health, Monash University

P1-C-19 Power spectral changes in ankle plantar flexors in people with Parkinson's during walking - implications for gait?

Presenter: **Annette Pantall**

Annette Pantall[1], Othello Cope[1], Shu En Lee[1], Silvia Del Din[1], Lisa Alcock[1]
[1]Newcastle University

P1-C-20 Fat mass index and the performance of older people in the 6-minute walking test

Presenter: **Tatiane Pontes**

Tatiane Pontes[1], Fernanda Pessanha[2], Renato Freire Júnior[1], Natália Alves[2], Karina Pfrimer[2], Priscila Fassini[2], Eduardo Ferriolli[2]
[1]University of São Paulo, [2]Faculty of Medicine of Ribeirão Preto

P1-C-21 Postural stability during reaching-to-grasping while standing in young adults and older adults with and without a history of falls

Presenter: **Natalia Rinaldi**

Natalia Rinaldi[1], Renato Moraes[2]
[1]Federal University of Espirito Santo, [2]University of São Paulo

P1-C-22 Changes in Achilles tendon reflex strength during quiet standing with age

Presenter: **Margot Schmidt**

Margot Schmidt[1], Robyn Mildren[1], Gregg Eschelmuller[1], Jean-Sebastien Blouin[1], Mark Carpenter[1], J. Timothy Inglis[1]
[1]University of British Columbia

P1-C-23 Biomechanical balance control in older adults: A systematic review and meta-analysis

Presenter: **Joke Spildooren**

Pieter Meyns[1], Lotte Palmers[1], Sander Verbeek[1], Joke Spildooren[1]
[1]Hasselt University

P1-C-24 PreventIT feasibility RCT: Improving physical function in older age by changing people's habits in daily life

Presenter: **Kristin Taraldsen**

Kristin Taraldsen[1], A.Stefanie Mikolaizak[2], Andrea Maier[3], Elisabeth Boulton[4], Kamiar Aminian[5], Clemens Becker[2], Sabato Mellone[6], Chris Todd[4], Mirjam Pijnappels[3], Beatrix Vereijken[1], Jorunn Helbostad[1]
[1]Norwegian University of Science and Technology, [2]Robert-Bosch-Krankenhaus, [3]Vrije Universiteit Amsterdam, [4]University of Manchester, [5]Ecole Polytechnique Fédérale de Lausanne (EPFL), [6]University of Bologna

D - Biomechanics

P1-D-25 The role of limb length and stature in the transition from walking to running

Presenter: **Niamh Gill**

Niamh Gill[1], Kristen Hollands[1], Anmin Liu[1], Dale Walker[1], Andrew Roberts[2], Thomas O'Leary[2], Julie Greeves[2], Richard Jones[1]
[1]University of Salford, [2]Army Personnel Research Capability

P1-D-26 Virtual reality training affects joint angle strategies which correlate with safer real-world obstacle crossing

Presenter: **Chanel LoJacono**

Chanel LoJacono[1], Michael Kress[1], Christopher Rhea[1]
[1]University of North Carolina, Greensboro

P1-D-27 Excessive arm swings and asymmetric walking lead to more variability in the trunk kinematics

Presenter: **Cézar Mezher**

Cézar Mezher[1], Allen Hill[1], Tarique Siragy[1], Julie Nantel[1]
[1]University of Ottawa

P1-D-28 Plantar pressures and muscle activity of normal and pes planus foot postures wearing different footwear during treadmill walking

Presenter: **Katrina Protopapas**

Katrina Protopapas[1], Stephen Perry[1]
[1]Wilfrid Laurier University

P1-D-29 Sagittal balance control during perturbed walking

Presenter: **Maud van den Bogaart**

Maud van den Bogaart[1], Sjoerd Bruijn[2], Jaap van Dieën[2], Pieter Meyns[3]
[1]UHasselt, [2]Vrije Universiteit Amsterdam, [3]Hasselt University

E - Brain imaging/activation during posture and gait

P1-E-30 Mapping the cortical representation of lower-limb muscles using transcranial magnetic stimulation

Presenter: **Jennifer Davies**

Jennifer Davies[1]
[1]Cardiff University

P1-E-31 Reduced weight-shifting skills during single- and dual-task conditions are accompanied by altered neural activation in ageing

Presenter: **Veerle de Rond**

Veerle de Rond[1], Diego Orcioli-Silva[2], Lynn Rochester[3], Jean-Jacques Orban de Xivry[1], Annette Pantall[4], Alice Nieuwboer[1]
[1]KU Leuven, [2]São Paulo State University (UNESP), [3]Institute of Neuroscience, Newcastle University, [4]Newcastle University

P1-E-32 Postural state modulation of reactive balance control

Presenter: **Mark Laylor**

Mark Laylor[1], Paula Polastri[2], Jessy Varghese[1], William McIlroy[1]
[1]University of Waterloo, [2]São Paulo State University (UNESP)

P1-E-33 Functional interplay between body sway and parieto-premotor network revealed by somatosensory potentials evoked by foot sole stimulation and microneurography

Presenter: **Laurence Mouchnino**

Laurence Mouchnino[1], Marie Fabre[1], Edith Ribot-Ciscar[1], Rochelle Ackerley[1], Jean-Marc Aimonetti[1], Pascale Chavet[1], Jean Blouin[1], Martin Simoneau[2]
[1]Aix Marseille Université, [2]Université Laval

P1-E-34 An exploratory in vivo voxel-based PET analysis of cholinergic correlates of postural sway variability in Parkinson disease

Presenter: **Martijn Muller**

Martijn Muller[1], Uros Marusic[2], Prabesh Kanel[1], Nicolaas Bohnen[1]
[1]University of Michigan, [2]Science and Research Centre Koper

P1-E-35 Neural correlates of body dynamics

Presenter: **Nicholas Murray**

Nicholas Murray[1], Gustavo Sandri Heidner[1], Caitlin O'Connell[1], Chris Mizelle[1], Zac Domire[1]
[1]East Carolina University

P1-E-36 Evidence for an alternate neural control in freezing of gait during complex walking

Presenter: **Caroline Paquette**

Trina Mitchell[1], Alexandra Potvin-Desrochers[1], Anne-Louise Lafontaine[1], Oury Monchi[2], Alexander Thiel[1], Caroline Paquette[1]
[1]McGill University, [2]University of Calgary

P1-E-37 A brainstem, subcortical and cortical network for dynamic balance control in healthy older adults

Presenter: **Elizabeth Pasman**

Elizabeth Pasman[1], Martin McKeown[1], Saurabh Garg[1], Taylor Cleworth[2], Bastiaan Bloem[3], J Timothy Inglis[1], Mark Carpenter[1]
[1]University of British Columbia, [2]University of Waterloo, [3]Radboud University Medical Center

P1-E-38 Functional near-infrared imaging of the temporo-parietal junction during vestibular rotational stimulation

Presenter: **Patrick Sparto**

Patrick Sparto[1], Theodore Huppert[1], Helmet Karim[1], Joseph Furman[1]
[1]University of Pittsburgh

P1-E-39 Understanding the hemodynamic response and sensory contribution to automatic postural control

Presenter: **Gabrielle St-Amant**

Gabrielle St-Amant[1], Tabassum Rahman[1], Nadia Polskaia[1], Sarah Fraser[1], Yves Lajoie[1]
[1]University of Ottawa

P1-E-40 Structural neural correlates of independent gait characteristics in Parkinson's disease

Presenter: **Joanna Wilson**

Joanna Wilson[1], Brook Galna[1], Sue Lord[2], Alison Yarnall[1], Rachael Lawson[1], Gordon Duncan[3], Tien Khoo[4], David Burn[1], Lynn Rochester[5], John-Paul Taylor[1]
[1]Newcastle University, [2]Auckland University of Technology, [3]University of Edinburgh, [4]Griffith University, [5]Institute of Neuroscience, Newcastle University

F - Cognitive impairments

P1-F-41 Step-length changes caused by a dual-task test among individuals undergoing memory assessment - a pilot study

Presenter: **Anna Cristina Åberg**

Anna Cristina Åberg[1], Fredrik Tinmark[2], Lars Berglund[1], Kjartan Halvorsen[1], Vilmantas Giedraitis[1]
[1]Uppsala University, [2]The Swedish School of Sport and Health Sciences, GIH

P1-F-42 Comparison in postural sway between healthy control and mild cognitive impaired group with dual tasks

Presenter: **Junggil Kim**

Junggil Kim[1], Jinsoo Lee[1], Jeongwoo Seo[1], Jinseong Choi[1], Gyerae Tack[1]
[1]Konkuk University

P1-F-43 Is gait variability a biomarker of neurodegenerative disorders?

Presenter: **Manuel Montero-Odasso**

Manuel Montero Odasso[1], Yanina Sarquis-Adamson[1], Natalie Ravid[2], Quincy Almeida[3], Frederico Pieruccini-Faria[1], Kerry Howell[2], Richard Camicioli[2]
[1]University of Western Ontario, [2]University of Alberta, [3]Wilfrid Laurier University

P1-F-44 The association between spatial navigation and physical function in memory clinic patients

Presenter: **Gro G. Tangen**

Gro Tangen[1], Anne-Brita Knapskog[2], Elisabeth Telenius[1], Geir Selbæk[1], Kristin Taraldsen[3]
[1]Norwegian National Advisory Unit on Ageing and Health, [2]Oslo University Hospital, [3]Norwegian University of Science and Technology

G - Cognitive, attentional, and emotional influences

P1-G-45 Effects of concussion history on centre of pressure during static dual-tasking in collegiate athletes

Presenter: **Kelsey Bryk**

Kelsey Bryk[1], Jaclyn Caccese[1], Katherine Hunzinger[1], Thomas Buckley[1]
[1]University of Delaware

P1-G-46 Does it matter where you look during obstacle crossing?

Presenter: **HyeYoung Cho**

HyeYoung Cho[1], Nathaniel Romine[1], Fabio Barbieri[2], Shirley Rietdyk[1]
[1]Purdue University, [2]São Paulo State University (UNESP)

P1-G-47 The influence of social anxiety on balance and walking task assessment in older women

Presenter: **Diego Orcioli-Silva**

Diego Orcioli-Silva[1], Elizabeth Pasman[2], Lilian Gobbi[1], Mark Beauchamp[2], Mark Carpenter[2]
[1]São Paulo State University (UNESP), [2]University of British Columbia

P1-G-48 Lateropulsion is common after right hemisphere stroke, strongly related to spatial neglect, and the primary cause of mobility limitation

Presenter: **Dominic Pérennou**

Dominic Pérennou[1], Shenhao Dai[2], Emmauelle Clarac[2], Andréa Kistner[2], Patrice Davoine[2], Anne Chripin[2], Marie Jaeger[2], Olivier Detante[2], Marc Hommel[2], Monica Baciu[2], Céline Piscicelli[1]
[1]University Hospital Grenoble-Alpes, [2]Grenoble Alpes University Hospital

P1-G-49 Using virtual reality to safely increase mobility-related anxiety when turning in simulated environments

Presenter: **Tiphanie Raffegeau**

Tiphanie Raffegeau[1], Mindie Clark[1], Bradley Fawver[1], William Young[2], Mark Williams[1], Keith Lohse[1], Peter Fino[1]
[1]University of Utah, [2]Brunel University

P1-G-50 Does postural threat influence the StartReact effect in a lateral stepping task?

Presenter: **Vivian Weerdesteyn**

Vivian Weerdesteyn[1], Milou Coppens[1], Tim Inglis[2], Mark Carpenter[2]
[1]Radboud University Medical Center, [2]University of British Columbia

P1-G-51 Dual task gait interference in Parkinson's disease: The impact of baseline cognitive capacity

Presenter: **Rosie Morris**

Rosie Morris[1], Ellen Lirani-Silva[2], Rachael Lawson[3], Alison Yarnall[3], Brook Galna[3], Sue Lord[4], Lynn Rochester[5]
[1]Oregon Health & Science University, [2]São Paulo State University (UNESP), [3]Newcastle University, [4]Auckland University of Technology, [5]Institute of Neuroscience, Newcastle University

P1-G-52 The multiscale dynamics of resting-state brain activity is associated with the performance of dual task standing postural control in older adults

Presenter: **Junhong Zhou**

Junhong Zhou[1], Laura Dubreuil Vall[2], Brad Manor[1], Giulio Ruffini[2]
[1]Harvard Medical School, [2]Neuroelectrics

H - Coordination of posture and gait

P1-H-53 Combined diabetes and arthritis are associated with declined gait speed

Presenter: **Bader Alqahtani**

Bader Alqahtani[1], Aqeel Alenazi[1], Mohammed Alshehri[2]
[1]Prince Sattam Bin Abdualziz University, [2]Jazan University

P1-H-54 Healthy young adults use vision for postural control similarly at low and high virtual heights

Presenter: **Eric Anson**

Eric Anson[1], Nicole Kuznetsov[1], Raul Rodriguez[1], Kyle Critelli[1], Benjamin Crane[1]
[1]University of Rochester

P1-H-55 Body sway is mediated by vestibular cortical dominance

Presenter: **Adolfo Bronstein**

Adolfo Bronstein[1], Patricia Castro[1], Diego Kaski[2], Hussein Al-Fazly[1], Deniz Ak[1], Liam Oktay[1], Qadeer Arshad[1]
[1]Imperial College London, [2]University College London

P1-H-56 Postural balance at children survived after posterior fossa tumor

Presenter: **Anna Dreneva**

Dmitry Skvortsov[1], Anna Dreneva[2], Vladimir Kasatkin[3], Alexander Karelin[3]
[1]Government University, [2]Rehabilitation center "Russcoe Pole", [3]Dmitry Rogachev National Research Center of Pediatric Hematology, Oncology and Immunology

P1-H-57 Full body responses in visually perturbed quiet stance

Presenter: **David Engel**

David Engel[1], Adrian Schütz[1], Frank Bremmer[1]
[1]Philipps-Universität Marburg

P1-H-58 Balance mechanisms differ across cadences on a self-paced treadmill

Presenter: **Tyler Fettrow**

Tyler Fettrow[1], David Grenet[1], Hendrik Reimann[1], Ian Sotnek[1], Elizabeth Kaye[1], Maelyn Arcodia[1], John Jeka[1]
[1]University of Delaware

P1-H-59 The ability to switch from a trail limb avoidance to a lead limb accommodation strategy

Presenter: **Félix Fiset**

Félix Fiset[1], Bradford McFadyen[1]
[1]Université Laval

P1-H-60 Specificity of trunk postural responses to three-dimensional surface stimuli

Presenter: **Adam Goodworth**

Adam Goodworth[1], Cody Barrett[2], Jonathan Rylander[2], Brian Garner[2]
[1]University of Hartford, [2]Baylor University

P1-H-61 The effects of intensive balance training in individuals with chronic spinal cord injury on quiet standing centre of pressure measures

Presenter: **Olinda Habib Perez**

Olinda Habib Perez[1], Janelle Unger[2], Katherine Chan[1], Jae Lee[2], Kei Masani[2], Kristin Musselman[2]
[1]Toronto Rehabilitation Institute, [2]University of Toronto

P1-H-62 Arm swing and gait symmetry affects gait stability and interlimb coordination

Presenter: **Allen Hill**

Allen Hill[1], Julie Nantel[1]
[1]University of Ottawa

P1-H-63 Kinesiological study for normal walking gait on irregular surface

Presenter: **Kenta Igarashi**

Kenta Igarashi[1], Koichi Koganezawa[1]
[1]Tohoku University

P1-H-64 Effects of Dance for Parkinson's on gait and dual-ask gait in Parkinson's disease assessed using Vicon 3D-motion capture

Presenter: **Graham Kerr**

Nadeesha Kalyani[1], Karen Sullivan[1], Gene Moyle[1], Sandy Brauer[2], Erica Rose Jeffrey[3], Graham Kerr[1]
[1]Queensland University of Technology, [2]University of Queensland, [3]Dance for Parkinson's Australia and Queensland Ballet

P1-H-65 Gross and fine balance control during walking in stroke patients and healthy controls

Presenter: **Noel Keijsers**

Noel Keijsers[1], Yara Luijten[1], Bart Nienhuis[1]
[1]Sint Maartenskliniek

P1-H-66 Effects of freezing joint degrees of freedom on dynamic postural balancing

Presenter: **Kentaro Kodama**

Kentaro Kodama[1], Kazuhiro Yasuda[2], Hideo Yamagiwa[3]
[1]Kanagawa University, [2]Waseda University, [3]Tokyo Metropolitan Tobu Medical Center

P1-H-67 Ankle and hip joint coordination during quiet standing for individuals with incomplete spinal cord injury

Presenter: **Jae Lee**

Jae Lee[1], Angela (Jaeeun) Yoo[2], Katherine Chan[3], Janelle Unger[1], Kristin Musselman[1], Kei Masani[1]
[1]University of Toronto, [2]Institute of Biomaterials and Biomedical Engineering, University of Toronto, [3]Toronto Rehabilitation Institute

P1-H-68 Variability of gait, bilateral coordination in unilateral vestibular loss patients

Presenter: **Hwan Ho Lee**

Hwan Ho Lee[1]
[1]Kosin University College of Medicine, Korea

P1-H-69 Walking through an aperture while penetrating from the paretic side reduces the rate of collision for stroke individuals

Presenter: **Daisuke Muroi**

Daisuke Muroi[1], Yutaro Saito[1], Aki Koyake[1], Takahiro Higuchi[2]
[1]Kameda Medical Center, [2]Tokyo Metropolitan University

P1-H-70 Feasibility of visual cues to promote walking turns in Parkinson's disease

Presenter: **Rebecca Reed-Jones**

Rebecca Reed-Jones[1], Tyler Baker[1], Jenna Pitman[2]
[1]University of Prince Edward Island, [2]University of Guelph

P1-H-71 Haste makes waste: on the trade-off between walking speed and target-stepping accuracy

Presenter: **Melvyn Roerdink**

Melvyn Roerdink[1], Daphne Geerse[1], Lieke Peper[1]
[1]Vrije Universiteit Amsterdam

P1-H-72 Influence of body weight supported treadmill training parameters on muscle coordination in hemiparetic walking

Presenter: **Bryant Seamon**

Bryant Seamon[1], Shraddha Srivastava[1], Richard Neptune[2], Lindsay Perry[3], Carolynn Patten[4], Steven Kautz[1]
[1]Ralph H. Johnson VA Medical Center, [2]University of Texas at Austin, [3]University of St. Augustine for Health Sciences, [4]University of California Davis School of Medicine

P1-H-73 Comparative characteristics of obstacle avoidance strategy in young and older adults in various walking conditions

Presenter: **Kotaro Shimizu**

Kotaro Shimizu[1], Yuriko Kihara[2], Koki Iwata[1], Takahiro Higuchi[3], Taketo Furuna[1]
[1]Sapporo Medical University, [2]Japan Health Care College, [3]Department of Health Promotion Science, Tokyo Metropolitan University

P1-H-74 Does discrete versus cyclic full body reaching tasks influence hip and spine excursions?

Presenter: **James Thomas**

James Thomas[1]
[1]Virginia Commonwealth University

I - Development of posture and gait

P1-I-75 The development of running in children

Presenter: **Margit Bach**

Margit Bach[1], Francesco Menna[2], Andreas Daffertshofer[1], Nadia Dominici[1]
[1]Vrije Universiteit Amsterdam, [2]University of Rome Tor Vergata

P1-I-76 Evaluation of balance in adolescent idiopathic toe walkers

Presenter: **Marybeth Grant-Beuttler**

Marybeth Grant-Beuttler[1], R. Caprice Hollandsworth[1], Shweta Chheda[1], Richard Beuttler[1], Afshin Aminian[2], Rahul Soangra[1]

[1]Chapman University, [2]Children's Hospital of Orange County

P1-I-77 Reactive and anticipatory postural response mechanisms during continuous platform oscillation in children and adolescents

Presenter: **Richard Mills**

Richard Mills[1], Heidi Sveistrup[2]
[1]Manchester Metropolitan University, [2]University of Ottawa

P1-I-78 Children's walking in complex environments: One step at a time?

Presenter: **Rachel Mowbray**

Rachel Mowbray[1], Janna Gottwald[2], Manfei Zhao[1], Anthony Atkinson[1], Dorothy Cowie[1]
[1]Durham University, [2]Uppsala University

P1-I-79 Inertial sensor based normative postural sway parameters in typically developing children and young adults

Presenter: **Joan Ann O'Keefe**

Joan O'Keefe[1], Alexandra Palmer[1], Rachel Tracy[1], Stephanie Voss[1], Medha Parulekar[1], Caitlin Bailey[1], Nicollette Purcell[1], Elizabeth Berry-Kravis[1]
[1]Rush University Medical Center

P1-I-80 Inertial sensor based normative spatiotemporal gait and Timed Up and Go parameters in typically developing children and young adults

Presenter: **Joan Ann O'Keefe**

Joan O'Keefe[1], Stephanie Voss[1], Rachel Tracy[1], Alexandra Palmer[1], Medha Parulekar[1], Nicollette Purcell[1], Marie Fefferman[1], Elizabeth Berry-Kravis[1]
[1]Rush University Medical Center

P1-I-81 Minimum Predicted Distance: Applying a common metric to collision avoidance strategies between typically developing children and adult walkers

Presenter: **Victoria Rapos**

Victoria Rapos[1], Michael Cinelli[1], Natalie Snyder[1], Armel Crétual[2], Anne-Hélène Olivier[2]
[1]Wilfrid Laurier University, [2]University of Rennes / Inria

P1-I-82 Experimental study of biomechanics of "military crawl" locomotion, pilot study

Presenter: **Dmitry Skvortsov**

Dmitry Skvortsov[1], Alina Aisenshtein[2], Vladimir Kasatkin[3], Anatoliy Shipilov[2], Victor Anisimov[2]
[1]Government University, [2]Rehabilitation center "Russcoe Pole", [3]Dmitry Rogachev National Research Center of Pediatric Hematology, Oncology and Immunology

J - Developmental disorders

P1-J-83 Effects of saccadic eye movements on postural stabilization in dyslexic children

Presenter: **Jose Barela**

Jose Barela[1], Newton Tesima[2], Vitor Amaral[2], Ana Barela[2]
[1]São Paulo State University (UNESP), [2]Cruzeiro do Sul University

P1-J-84 Effects of neutralization of symmetry of the Maxwell spot on postural control in children with dyslexia. Clinical cases report

Presenter: **Marc Janin**

Emmanuelle Pivron Braquet[1], Marc Janin[2], Alix Couvrat[3], Claire Carraurer[3], Lucie Pirodeau[3], Marina Vincent[3], Marion Miral[3], Sophie Richer de Forge[3], Tipahaine Dreillard[3], Valerie Riviere[3], Benoit Maille[3], Nicolas Imbert[3], Briskmann Didier[3]
[1]PODOLOGUE, [2]Université de Pau et des pays L'adour, [3]Krys Poitiers

P1-J-85 The Kids-BESTest of postural control predicts gross motor coordination in primary school children with and without coordination difficulties

Presenter: **Leanne M Johnston**

Leanne Johnston[1], Gemma Allinson[1], Breanna Raatz[1], Rosalee Dewar[1], Sally Hannah[1]
[1]University of Queensland

P1-J-86 Developmental Coordination Disorder co-occurs at high rates among children and adolescents with Autism Spectrum Disorder

Presenter: **Haylie Miller**

Haylie Miller[1], Gabriela Sherrod[2], Priscila Caçola[3]
[1]University of North Texas Health Science Center, [2]University of Alabama, Birmingham, [3]University of Texas at Arlington

P1-J-87 Effect of orthopaedic shoes and orthopaedic insoles on gait in patients with Dravet syndrome

Presenter: **Lore Wyers**

Lore Wyers[1], Karen Verheyen[1], Berten Ceulemans[2], An-Sofie Schoonjans[1], Kaat Desloovere[3], Patricia Van de Walle[1], Ann Hallemans[1]
[1]University of Antwerp, [2]Antwerp University Hospital, [3]KU Leuven

K - Devices to improve posture and gait

P1-K-88 Improvements in balance control for multiple sclerosis patients with vibro-tactile biofeedback of trunk sway

Presenter: **John Allum**

John Allum[1], Christel Schouenborg[2], Bettina Fischer-Barnicol[1], Venessa Haller[1], Nathanael Lutz[2], Heiko Rust[3], Oezguer Yaldizli[1]
[1]University Hospital Basel, [2]Bern University of Applied Sciences, [3]Charing Cross Hospital

P1-K-89 Avoiding 3D holographic obstacles: Does it differ from negotiating real obstacles?

Presenter: **Bert Coolen**

Bert Coolen[1], Daphne Geerse[1], Melvyn Roerdink[1]
[1]Vrije Universiteit Amsterdam

P1-K-90 Evaluating the efficacy of a novel therapeutic tool for standing balance after spinal cord injury: A case series

Presenter: **David Houston**

David Houston[1], Jae Lee[2], Emerson Grabke[3], Angela (Jaeeun) Yoo[3], Kai-Lon Fok[3], Janelle Unger[2], Kei Masani[2], Kristin Musselman[2]
[1]Rehabilitation Sciences Institute, University of Toronto, [2]University of Toronto, [3]Institute of Biomaterials and Biomedical Engineering, University of Toronto

P1-K-91 Design improvement and clinical assessment of personal standing mobility Qolo for voluntary sit-to-stand posture transition of persons with thoracic level spinal cord injury

Presenter: **Hideki Kadone**

Hideki Kadone[1], Yukiyo Shimizu[1], Shigeki Kubota[1], Diego Paez[1], Yasushi Hada[1], Masashi Yamazaki[1], Kenji Suzuki[1]
[1]University of Tsukuba

P1-K-92 Effects of sensory augmentation activation thresholds on balance performance in people with vestibular disorders

Presenter: **Kathleen Sienko**

Tian Bao[1], Catherine Kinnaird[1], Wendy Carender[1], Kathleen Sienko[1]
[1]University of Michigan

P1-K-93 Staying UpRight in Parkinson's disease: A novel postural intervention

Presenter: **Samuel Stuart**

Samuel Stuart[1], Alan Godfrey[2], Lynn Rochester[3], Fay Horak[1], Martina Mancini[1]
[1]Oregon Health & Science University, [2]Northumbria University, [3]Institute of Neuroscience, Newcastle University

P1-K-94 Gait variability decreases with use of carbon fiber footplates in children with idiopathic toe walking

Presenter: **Srikant Vallabhajosula**

Srikant Vallabhajosula[1], Melissa Scales[1]
[1]Elon University

P1-K-95 Treadmill training in a virtual environment improves gait and balance in patients with incomplete spinal cord injury

Presenter: **Rosanne van Dijsseldonk**

Rosanne van Dijsseldonk[1], L.A.F. de Jong[2], B.E. Groen[2], M. Vos-van der Hulst[2], A.C.H. Geurts[3], N.L.W. Keijsers[2]
[1]Radboudumc & Sint Maartenskliniek, [2]Sint Maartenskliniek, [3]Radboud University Medical Center

L - Effect of medication on posture and gait

P1-L-96 Botulinum toxin injection to the upper limb may indirectly improve gait in patients with post-stroke spasticity- an open-label prospective pilot study

Presenter: **Shani Kimel Naor**

Shani Kimel Naor[1], Oren Cohen[2], Elizabeta Shprits[3], Sharon Hassin-Baer[1], Yael Dotan-Marom[1], Gilad Yahalom[1], Oleg Marzeliak[1], Lilach Ephraty[1], Hanna Strauss[1], Rivka Inzelberg[4], Meir Plotnik[1]
[1]Sheba Medical Center, [2]Tel-Aviv University, [3]Technion, Technological Institute of Israel, [4]Tel Aviv University

P1-L-97 Evaluation of adult cerebral palsy gait with spasticity of gluteus medius anterior fibers before and after local treatment with botulinum toxin

Presenter: **Philippe Thoumie**

Philippe Thoumie[1], Florence Babany[1]
[1]Hospital Rothschild APHP Sorbonne University

M - Exercise and physical activity

P1-M-98 Evaluation of measurement properties of the instrumented and repeated Timed Up and Go (5iTUG)

Presenter: **Ronny Bergquist**

Ronny Bergquist[1], Corinna Nerz[2], Kristin Taraldsen[1], Clemens Becker[2], Sabato Mellone[3], Beatrix Vereijken[1], Jorunn Helbostad[1], Stefanie Mikolaizak[2]
[1]Norwegian University of Science and Technology, [2]Robert-Bosch-Krankenhaus, [3]University of Bologna

P1-M-99 Controlling the uncontrollable - perceptions of balance in people with Parkinson´s disease

Presenter: **Hanna Johansson**

Hanna Johansson[1], Erika Franzén[1], Kirsti Skavberg Roaldsen[1], Maria Hagströmer[1], Breiffni Leavy[1]
[1]Karolinska Institutet

P1-M-100 Athletes adopt different control strategies compared to non-athletes with increased postural demands

Presenter: **Jenna Pitman**

Jenna Pitman[1], Rhianna Malcolm[1], David Shulman[1], Becky Breau[1], Michael Cinelli[2], Lori Ann Vallis[1]
[1]University of Guelph, [2]Wilfrid Laurier University

P1-M-101 Could lifestyle-integrated exercise interventions change physical activity behavior of young older adults?

Presenter: **Gaëlle Prigent**

Gaelle Prigent[1], Anisoara Ionescu[1], Wei Zhang[1], Kristin Taraldsen[2], Beatrix Vereijken[2], Jorunn L. Helbostad[2], Kamiar Aminian[1]
[1]Ecole Polytechnique Fédérale de Lausanne (EPFL), [2]Norwegian University of Science and Technology

P1-M-102 Predicting physical activity in obese and normal weight older adults based on cognitive and physical function

Presenter: **Noah Rosenblatt**

Noah Rosenblatt[1], Sai Yalla[1]
[1]Rosalind Franklin University of Medicine and Science

P1-M-103 Posture of lunge motion during a shuttle sprint test in soft tennis elite players

Presenter: **Hidenori Shinohara**

Hidenori Shinohara[1], Koji Kawakami[2], Kazutaka Takahashi[3], Ayane Ogura[4], Kenji Takahashi[5], Hirofumi Ida[4]
[1]Nippon Sports Science University, [2]Sports Intelligence, [3]University of Tsukuba, [4]Jobu University, [5]Aichi Gakusen University

N - Falls and fall prevention

P1-N-104 Comparing muscle power and muscle strength training using Thera-band for reducing fall risk in community-dwelling older adults

Presenter: **Kenneth Cheng**

Kenneth Cheng[1], Kim Chan[1]
[1]Chinese University of Hong Kong

P1-N-105 Is there an optimal recovery step landing range to prevent backward fall from slips: Evidence from large-scale overground slips

Presenter: **Tanvi Bhatt**

Tanvi Bhatt[1], Shuaijie Wang[1], Yiru (Emma) Wang[1]
[1]University of Illinois at Chicago

P1-N-106 Towards tailored fall prevention: Identifying modifiable risk factors in older people

Presenter: **Femke Hulzinga**

Femke Hulzinga[1], Kimberley Van Schooten[2], Kim Delbaere[2]
[1]KU Leuven, [2]Neuroscience Research Australia

P1-N-107 Falls in a longitudinal Parkinson's disease cohort: What can we learn from baseline gait assessment in non-fallers over six years?

Presenter: **Heather Hunter**

Heather Hunter[1], Lisa Alcock[2], Sue Lord[3], Rosie Morris[4], Lynn Rochester[5], Alison Yarnall[2]
[1]Newcastle-upon-Tyne Hospitals NHS Foundation Trust, [2]Newcastle University, [3]Auckland University of Technology, [4]Oregon Health & Science University, [5]Institute of Neuroscience, Newcastle University

P1-N-108 Motoric Cognitive Risk syndrome falls incidence and trajectory of gait and cognitive change in an octogenarian cohort: Te Puawaitanga o Nga Tapuwae Kia Ora Tonu, LiLACS NZ

Presenter: **Sue Lord**

Sue Lord[1], Simon Moyes[2], Ruth Teh[2], Waiora Port[2], Marama Muru-Lanning[2], Catherine Bacon[2], Tim Wilkinson[3], Ngaire Kerse[2]
[1]Auckland University of Technology, [2]University of Auckland, [3]Otago University

P1-N-109 Increasing plantar somatosensory performance on the one leg stance test in elderly

Presenter: **Emmanuelle Pivron Braquet**

Emmanuelle Pivron Braquet[1], Marc Janin[2]
[1]PODOLOGUE, [2]Université de Pau et des pays L'adour

P1-N-110 Aggressive proactive balance training using a multi-directional harness system and adapted video gaming: A case series

Presenter: **Ann Reinthal**

M Ann Reinthal[1], Debbie Espy[1], Lorenzo Bianco[1], John DeMarco[1], Emily Punchak[1]
[1]Cleveland State University

P1-N-111 Effect of the rate of change of an external balance perturbation

Presenter: **Thomas Robert**

Thomas Robert[1], Marine Guinamard[1], Pascal Chabaud[1], Laurence Cheze[1], Marie-Laure Mille[2]
[1]Université de Lyon, [2]Aix Marseille Université

P1-N-112 Administration and scoring procedures for performance-based clinical balance tests do not accommodate practice effects among lower limb prosthesis users

Presenter: **Andrew Sawers**

Andrew Sawers[1], Brian Hafner[2]
[1]University of Illinois at Chicago, [2]University of Washington

P1-N-113 Kinematic analysis of videos of real-life falls in older adults using Kinovea software

Presenter: **Nataliya Shishov**

Nataliya Shishov[1], Karam Elabd[1], Vicki Komisar[1], Stephen Robinovitch[1]
[1]Simon Fraser University

P1-N-114 Dynamic stability measures respond uniquely to destabilization during asymmetric walking

Presenter: **Tarique Siragy**

Tarique Siragy[1], Julie Nantel[1]
[1]University of Ottawa

P1-N-115 Total knee replacement patient's preoperative time to recovery expectations are related to fall risk

Presenter: **Brian Street**

Brian Street[1]
[1]California State University, Bakersfield

P1-N-116 Posturography differences between recurrent and non-recurrent fallers

Presenter: **Kyra Twohy**

Kyra Twohy[1], Vinayak Vijayan[1], Kimberly Bigelow[1]
[1]University of Dayton

P1-N-117 An examination of muscle quality, functional test performance and fall risk in "young-old" women: A pilot study

Presenter: **Jodi Ventre**

Jodi Ventre[1], Christopher Morse[1], David Tomlinson[1], Chesney Craig[1]
[1]Manchester Metropolitan University

P1-N-118 Treadmill gait-slip training in healthy community-dwelling older adults: Mechanisms of within trial adaptation for a progressive ascending-and-mixed intensity protocol

Presenter: **Yiru Wang**

Yiru Wang[1], Shuaijie Wang[1], Anna Lee[1], Clive Pai[2], Tanvi Bhatt[1]
[1]University of Illinois at Chicago, [2]Retired from University of Illinois at Chicago

P1-N-119 The effects of time-pressure on adaptive gait in individuals with and without central vision loss

Presenter: **Tjerk Zult**

Tjerk Zult[1], Matthew Timmis[1], Jonathan Allsop[2], Shahina Pardhan[1]
[1]Anglia Ruskin University, [2]Royal Air Force College Cranwell

O - Habilitation & rehabilitation

P1-O-120 Instrumenting gait and balance assessment at home and in the community; exploratory data from the ACTIVATE feasibility study

Presenter: **Christopher Buckley**

Christopher Buckley[1], Silvia Del Din[1], Patrica McCue[1], Heather Hunter[2], Sue Lord[3], Chris Price[1], Lisa Shaw[1], Helen Rogers[1], Lynn Rochester[4], Sarah Moore[1]

[1]Newcastle University, [2]Newcastle-upon-Tyne Hospitals NHS Foundation Trust, [3]Auckland University of Technology, [4]Institute of Neuroscience, Newcastle University

P1-O-121 Targeted transcranial electric stimulation mitigates the dual task cost to gait speed in older adults

Presenter: **Brad Manor**

Brad Manor[1], Junhong Zhou[1], On-Ye Lo[1], Alexa Ludington[1], Racheli Katz[2], Marina Brozgol[2], Pablo Cornejo Thumm[2], Jeff Hausdorff[2]

[1]Harvard Medical School, [2]Tel-Aviv Sourasky Medical Center

P1-O-122 Perturbation induced stepping in stroke: a way to use the more involved leg

Presenter: **Katherine M Martinez**

Katherine Martinez[1], Mary Blackinton[2], M. Samuel Cheng[2], Mark Rogers[3], Marie-Laure Mille[4]

[1]Northwestern University Feinberg School of Medicine, [2]Nova Southeastern University, [3]University of Maryland, [4]Aix Marseille Université

P1-O-123 The effect of an exergame intervention on clinical balance scales in children with cerebral palsy: Preliminary results from two non-randomized trials

Presenter: **Pieter Meyns**

Pieter Meyns[1], Ian Blanckaert[2], Chloé Bras[3], Jaap Harlaar[4], Laura van de Pol[3], Frederik Barkhof[3], Hilde Van Waelvelde[2], Annemieke Buizer[3]

[1]Hasselt University, [2]Ghent University, [3]Amsterdam UMC, Vrije Universiteit Amsterdam, [4]Delft University of Technology

P1-O-124 How do spatiotemporal gait parameters change from the acute phase to 3 months later following a stroke?

Presenter: **Ole Petter Norvang**

Ole Petter Norvang[1], Torunn Askim[1], Anne Eitrem Dahl[2], Pernille Thingstad[1]

[1]Norwegian University of Science and Technology, [2]Trondheim University Hospital

P1-O-125 Robotic intervention improves lateral gait symmetry in acute post-stroke patients

Presenter: **Chun Kwang Tan**

Chun Kwang Tan[1], Hideki Kadone[1], Hiroki Watanabe[1], Aiki Marushima[2], Yasushi Hada[1], Masashi Yamazaki[1], Yoshiyuki Sankai[1], Kenji Suzuki[1]

[1]University of Tsukuba, [2]Faculty of Medicine, University of Tsukuba Hospital

P - Modeling

P1-P-126 Collision avoidance between walkers with a twist: Strategies for curvilinear and rectilinear paths

Presenter: **Anne-Hélène Olivier**

Sean Lynch[1], Richard Kulpa[1], Laurentius Meerhoff[2], Anthony Sorel[1], Julien Pettré[2], Anne-Hélène Olivier[1]

[1]University of Rennes / Inria, [2]Inria Rennes

P1-P-127 Identification of gait characteristics for early diagnosis of Parkinson's disease with machine learning

Presenter: **Rana Zia Ur Rehman**

Rana Zia Ur Rehman[1], Silvia Del Din[1], Yu Guan[1], Jian Qing Shi[1], Lynn Rochester[2]

[1]Newcastle University, [2]Institute of Neuroscience, Newcastle University

Q - Neurological diseases

P1-Q-128 Influence of mild impairment of Parkinson's disease on gait initiation

Presenter: **Ana Barela**

Ana Barela[1], Giovanna Machado[1], Douglas Russo-Junior[1], Flávia Doná[2], Henrique Ferraz[2], Jose Barela[3]

[1]Cruzeiro do Sul University, [2]Federal University of São Carlos (UFSCar), [3]São Paulo State University (UNESP)

P1-Q-129 The habituation of postural responses to perturbations is delayed in people with Parkinson's disease

Presenter: **Victor Beretta**

Victor Beretta[1], Mark Carpenter[2], Fabio Barbieri[1], Paulo Cezar Santos[1], Diego Orcioli-Silva[1], Marcelo Pereira[1], Lilian Gobbi[1]

[1]São Paulo State University (UNESP), [2]University of British Columbia

P1-Q-130 Perception of verticality correlates with postural and balance deficits in patients with Parkinson disease

Presenter: **Gaia Bonassi**

Gaia Bonassi[1], Laura Mori[1], Martina Putzolu[1], Chiara Ponte[1], Alessandro Botta[1], Giovanna Lagravinese[1], Laura Avanzino[1], Elisa Pelosin[1]

[1]University of Genoa

P1-Q-131 Repetitive head impacts do not impair single task gait in collegiate ice hockey players

Presenter: **Thomas Buckley**

Thomas Buckley[1], Melissa DiFabio[1], Jessie Oldham[2], Katherine Breedlove[3], Curtis Johnson[1]

[1]University of Delaware, [2]Boston Children's Hospital, [3]University of Michigan

P1-Q-132 Cholinergic upregulation in dorsomedial thalamus prior to conversion to freezing of gait in Parkinson's disease

Presenter: **Nicholas D'Cruz**

Nicholas D'Cruz[1], Martijn Muller[2], Prabesh Kanel[2], Alice Nieuwboer[1], Nico Bohnen[2]

[1]KU Leuven, [2]University of Michigan

P1-Q-133 Turning velocity and coordination in multiple sclerosis

Presenter: **Lee Dibble**

Brian Loyd[1], Grace Hunt[1], Annie Fangman[1], Peter Fino[1], Lee Dibble[1]

[1]University of Utah

P1-Q-134 The neural correlates of motor imagery of mediolateral dynamic balance in Parkinson's disease

Presenter: **Bauke Dijkstra**

Bauke Dijkstra[1], Moran Gilat[1], Sabine Verschueren[1], Alice Nieuwboer[1]

[1]KU Leuven

P1-Q-135 Effect of dopamine on mediolateral dynamic balance in Parkinson's disease and freezing of gait

Presenter: **Moran Gilat**

Moran Gilat[1], Bauke Dijkstra[1], Alice Nieuwboer[1]

[1]KU Leuven

P1-Q-136 Effects of perturbation-based balance training on balance, gait and balance confidence in subacute persons with stroke: A randomized controlled trial

Presenter: **Shirley Handelzalts**

Shirley Handelzalts[1], Michal Kanner-Furman[1], Ganit Gray[1], Nachum Soroker[2], Itshak Melzer[1]

[1]Ben-Gurion University, [2]Loewenstein Rehabilitation Hospital

P1-Q-137 The effect of combined transcutaneous direct current stimulation and locomotor training on spinal excitability in an individual with chronic spinal cord injury

Presenter: **Kelly Hawkins**

Kelly Hawkins[1], Lou DeMark[2], Arian Vistamehr[2], Geneva Tonuzi[2], David Fuller[1], David Clark[3], Emily Fox[1]

[1]University of Florida, [2]Brooks Rehabilitation, [3]Malcom Randall VA Medical Center; University of Florida

P1-Q-138 The differences in sagittal plane whole-body angular momentum during gait between patients with hemiparesis and healthy people

Presenter: **Keita Honda**

Keita Honda[1], Yusuke Sekiguchi[1], Takayuki Muraki[1], Shin-Ichi Izumi[1]

[1]Tohoku University

P1-Q-139 Unravelling quantitative measures of free-living ataxic gait in cerebellar patients using wearable sensors

Presenter: **Winfried Ilg**

Winfried Ilg[1], Jens Seemann[1], Matthis Synofzik[1]

[1]Hertie Institute for Clinical Brain Research

P1-Q-140 Can transcranial direct current stimulation improve gait initiation in individuals with Parkinson's disease?

Presenter: **Jonathan Lommen**

Jonathan Lommen[1], Anthony Carlsen[1], Julie Nantel[1]

[1]University of Ottawa

P1-Q-141 Electromyographic profiles of gait initiation in people with Parkinson's disease: The effects of external sensory cueing

Presenter: **Colum MacKinnon**

Colum MacKinnon[1], Lesley Perg[1], Chiahao Lu[1], Matthew Petrucci[1], Abigail Kohut-Jackson[1], Paul Tuite[1], Sommer Amundsen Huffmaster[1]
[1]University of Minnesota

P1-Q-142 The effects of obstacle size and timing on prefrontal cortex activation in patients with Parkinson's disease

Presenter: **Inbal Maidan**

Inbal Maidan[1], Topaz Sharon[1], Ilan Kurz[2], Hagar Bernad-Elazari[1], Shiran Shustak[1], Ira Galperin[1], Anat Mirelman[1], Jeff Hausdorff[1]
[1]Tel-Aviv Sourasky Medical Center, [2]Ben-Gurion University

P1-Q-143 Post-stroke walking characteristics on association between motor paralysis and walking speed by cluster analysis

Presenter: **Naomichi Mizuta**

Naomichi Mizuta[1], Yusaku Takamura[1], Shintaro Fujii[1], Naruhito Hasui[1], Tomoki Nakatani[2], Masako Tsutsumi[2], Junji Taguchi[2], Shu Morioka[3]
[1]Department of Neurorehabilitation, Graduate School of Health Sciences, Kio University, [2]Takarazuka Rehabilitation Hospital, [3]Kio University

P1-Q-144 Reweighting of sensory information during gait in Parkinson's disease

Presenter: **Marcelo Pereira**

Marcelo Pereira[1], Quincy Ameida[2], Lilian T. Gobbi[3]
[1]São Paulo State University (UNESP), [2]Wilfrid Laurier University, [3]UNESP - Rio Claro

P1-Q-145 Brain functional connectivity changes associated to freezing of gait in Parkinson's disease

Presenter: **Alexandra Potvin-Desrochers**

Alexandra Potvin-Desrochers[1], Trina Mitchell[1], Thomas Gisiger[1], Caroline Paquette[1]
[1]McGill University

P1-Q-146 Occupational therapy intervention to improve the quality of life of client with Friedreich's Ataxia- A case study of complete rehabilitation from complete dependency to living independently

Presenter: **Deepa Pradhan**

Deepa Pradhan[1]
[1]Mumbai University

P1-Q-147 Can saccadic eye movements minimize the deleterious effect of ankle muscle fatigue on postural control in people with Multiple Sclerosis?

Presenter: **Felipe Balistieri Santinelli**

Felipe Santinelli[1], Emerson Sebastião[2], Fabiana Silva[1], Gabriel Moretto[1], Luiz Felipe Imaizumi[1], Lucas Simieli[1], Richard Van Emmerik[3], Fabio Barbieri[1]
[1]São Paulo State University (UNESP), [2]Northern Illinois University, [3]University of Massachussets

P1-Q-148 Adaptive capacity to split-belt treadmill walking of people with Parkinson's disease with freezing of gait

Presenter: **Jana Seuthe**

Jana Seuthe[1], Nicholas D'Cruz[2], Pieter Ginis[2], Burkhard Weisser[1], Alice Nieuwboer[2], Christian Schlenstedt[1]
[1]Christian-Allbrechts-University of Kiel, [2]KU Leuven

P1-Q-149 Dual task gait cost in Parkinson's disease patients with and without depressive symptoms

Presenter: **Carolina Silveira**

Carolina Silveira[1], Frederico Pieruccini-Faria[2], Eric Roy[3], Quincy Almeida[4]
[1]Lawson Health Research Institute, [2]University of Western Ontario, [3]University of Waterloo, [4]Wilfrid Laurier University

P1-Q-150 Automatic detection of Bradykinesia in Parkinson's disease

Presenter: **Elke Warmerdam**

Elke Warmerdam[1], Gerhard Schmidt[2], Clint Hansen[1], Walter Maetzler[1], Rana Zia Ur Rehman[3]
[1]Christian-Allbrechts-University of Kiel, [2]Kiel University, [3]Newcastle University

P1-Q-151 Non-invasive vagus nerve stimulation: A non-pharmacological approach to target gait impairment in Parkinson's disease?

Presenter: **Alison Yarnall**

Alison Yarnall[1], Rosie Morris[2], John-Paul Taylor[1], Mark Baker[1], Lynn Rochester[3]
[1]Newcastle University, [2]Oregon Health & Science University, [3]Institute of Neuroscience, Newcastle University

P1-Q-152 Using analogies to overcome freezing of gait: A first step towards making the first step

Presenter: **Will Young**

William Young[1], Amy Maslivec[1], Anna Fielding[1], Mark Wilson[2], Meriel Norris[1], John Cossar[1]
[1]Brunel University, [2]University of Exeter

R - Orthopedic diseases and injuries

P1-R-153 Functional electrical stimulation during gait following anterior cruciate ligament reconstruction - A preliminary study

Presenter: **Shmuel Springer**

Shmuel Springer[1], Uria Moran[2], Uri Gottlieb[2], Arnon Gam[2]
[1]Ariel University, [2]IDF Medical Corps

S - Proprioceptive function and disorders

P1-S-154 How varying levels of skin stretch affect perceived skin stretch sensitivity

Presenter: **William MacDonald**

William MacDonald[1], Simone Smith[1], Shawn Beaudette[2], Stephen Brown[1], Leah Bent[1]
[1]University of Guelph, [2]University of Ottawa

U - Robotics

P1-U-155 Reshaping of gait coordination with robotic intervention in myelopathy patients with residual motor disturbances after surgery

Presenter: **Sandra Puentes**

Sandra Puentes[1], Hideki Kadone[1], Shigeki Kubota[1], Tetsuya Abe[2], Yukiyo Shimizu[1], Yasushi Hada[1], Aiki Marushima[2], Masashi Yamazaki[1], Yoshiyuki Sankai[1], Kenji Suzuki[1]
[1]University of Tsukuba, [2]Faculty of Medicine, University of Tsukuba Hospital

V - Sensorimotor control

P1-V-156 Testing the potential of immersive technologies for measuring motor skills

Presenter: **Mshari Alghadier**

Mshari Alghadier[1], Jack Brooks[1], Faisal Mushtaq[1], Mark Mon-Williams[1]
[1]Institute of Psychological Sciences

P1-V-157 The effects of changes to body dimensions on an aperture crossing task

Presenter: **Braden Boley**

Braden Boley[1], Michael Cinelli[1]
[1]Wilfrid Laurier University

P1-V-158 Examining body size-characteristics on obstacle avoidance behaviour in human locomotion

Presenter: **Sheryl Bourgaize**

Sheryl Bourgaize[1], Bradford McFadyen[2], Michael Cinelli[1]
[1]Wilfrid Laurier University, [2]Université Laval

P1-V-159 Balance control during the reintegration of proprioceptive and vestibular information

Presenter: **Jean-Philippe Cyr**

Jean-Philippe Cyr[1], Martin Simoneau[1], Noémie Anctil[1]
[1]Université Laval

P1-V-160 Frequency characteristics of heteronymous Achilles tendon reflexes during quiet stance

Presenter: **Gregg Eschelmuller**

Gregg Eschelmuller[1], Robyn Mildren[1], Jean-Sebastien Blouin[1], Mark Carpenter[1], J. Timothy Inglis[1]
[1]University of British Columbia

P1-V-161 Comparing the effects of four different haptic modalities on the standing balance of individuals with an incomplete spinal cord injury

Presenter: **Pawan Kumar**

Pawan Kumar[1], Tarun Arora[2], Joel Lanovaz[1], Renato Moraes[3], Kristin Musselman[4], Alison Oates[1]
[1]University of Saskatchewan, [2]Cleveland Clinic Foundation, [3]University of São Paulo, [4]University of Toronto

P1-V-162 Balance control in young adult athletes with a history of recent concussion (> 3 months) during a lower limb reaching task

Presenter: **Katelyn Mitchell**

Katelyn Mitchell[1], Michael Cinelli[1]
[1]Wilfrid Laurier University

P1-V-163 Light touch with two hands rather than one more effectively reduces postural sway, but number of contact points does not similarly influence the effectiveness of the haptic anchors in older adults

Presenter: **Renato Moraes**

Renato Moraes[1], Bruno Bedo[1], Vitor Arpini[1], Rosangela Batistela[1], Paulo Santiago[1], Eliane Mauerberg-deCastro[2]
[1]University of São Paulo, [2]São Paulo State University (UNESP)

P1-V-164 Adaptability of human gait: Effect of training with red noise auditory stimuli on gait fluctuation patterns

Presenter: **Cecilia Power**

Cecilia Power[1], Jeevaka Kiriella[1], Janessa Drake[1], William Gage[1]
[1]York University

P1-V-165 Assessment of balance after repeated sub-concussive head trauma in female athletes

Presenter: **Christopher Rhea**

Christopher Rhea[1], Sam DuBois[1], Victoria Blevins[1], Kristen Schleich[2], Scott Ross[1], Donna Duffy[1]
[1]University of North Carolina, Greensboro, [2]Elon University

P1-V-166 Effect of the horizontal-vertical illusion on stepping-over action

Presenter: **Ryota Sakurai**

Ryota Sakurai[1], Kentaro Kodama[2], Yu Ozawa[3]
[1]Tokyo Metropolitan Institute of Gerontology, [2]Kanagawa University, [3]Waseda University

P1-V-167 Sensory weighting and organization strategies used by young adults with CLBP during standing

Presenter: **Jennifer Sansom**

Jennifer Sansom[1], Karen Lomond[2]
[1]Central Michigan University, [2]Ithaca College

P1-V-168 Associations between motor cortex inhibition and stable turning characteristics in healthy controls and people with Multiple Sclerosis

Presenter: **Clayton Swanson**

Clayton Swanson[1], Andrew Monaghan[1], Sutton Richmond[1], Tyler Whittier[1], Brett Fling[1]
[1]Colorado State University

W - Tools and methods for posture and gait analysis

P1-W-169 Correlation between mandibular position and modification of stabilometric parameters (LFS, VarVit)

Presenter: **Michele Barbera**

Michele Barbera[1], Nicolò Barbera[1], Emanuele Barbera[2], Andrea Fregoni[1]
[1]Studio Dentistico Barbera, [2]Università degli Studi di Milano

P1-W-170 Loading response peak anchoring: A novel solution for the double-belt problem

Presenter: **Oran Ben-Gal**

Oran Ben-Gal[1], Glen Doniger[1], Maya Cohen[1], Michal Schnaider-Beeri[1], Meir Plotnik[1]
[1]Sheba Medical Center

P1-W-171 Evaluation of balance recovery from unpredictable large-magnitude perturbations through the compensatory arm and leg movements (CALM) scale

Presenter: **Marina Betelli**

Luis Teixeira[1], Marina Betelli[1], Patricia Takazono[1], Caroline Souza[1], Julia Oliveira[1], Daniel Coelho[1], Jacques Duysens[2]
[1]University of São Paulo, [2]Catholic University of Leuven

P1-W-172 An evaluation of a proprietary motion capture system via kinematic analysis

Presenter: **Vincenzo Di Bacco**

Vincenzo Di Bacco[1], Dmitry Verniba[1], William Gage[1]
[1]York University

P1-W-173 Estimating lateral margin of stability during walking and turning using inertial sensors

Presenter: **Peter Fino**

Peter Fino[1], Carolin Curtze[2]
[1]University of Utah, [2]University of Nebraska Omaha

P1-W-174 Automated and quantification of the tandem walking using a wearable device

Presenter: **Natalie Ganz**

Natalie Ganz[1], Eran Gazit[1], Amit Hadad[2], Aron Buchman[3], Anat Mirelman[1], Jeff Hausdorff[1]
[1]Tel-Aviv Sourasky Medical Center, [2]Tel Aviv University, [3]Rush Alzheimer's Disease Center

P1-W-175 Creating and validating a shortened version of the community balance & mobility scale for application in young seniors

Presenter: **Katharina Gordt**

Katharina Gordt[1], A.Stefanie Mikolaizak[2], Kristin Taraldsen[3], Ronny Bergquist[3], Jeanine Van Ancum[4], Corinna Nerz[2], Mirjam Pijnappels[4], Andrea Maier[4], Jorunn Helbostad[3], Beatrix Vereijken[3], Clemens Becker[2], Michael Schwenk[5]
[1]Network Aging Research, [2]Robert-Bosch-Krankenhaus, [3]Norwegian University of Science and Technology, [4]Vrije Universiteit Amsterdam, [5]Heidelberg University

P1-W-176 Towards better quantification of freezing of gait in Parkinson's disease: The added value of performance timing

Presenter: **Talia Herman**

Talia Herman- Feinstein[1], Moria Dagan[2], Shirley Shema-Shiratzky[1], Marina Brozgol[1], Tal Reches[1], Nir Giladi[1], Brad Manor[3], Jeff Hausdorff[1]
[1]Tel-Aviv Sourasky Medical Center, [2]Tel Aviv University, [3]Harvard Medical School

P1-W-177 Test-retest reliability of force plate balance measures in individuals with chronic stroke

Presenter: **Andrew Huntley**

Andrew Huntley[1], Elise Belhacel[2], Raabeae Aryan[3], Alison Schinkel-Ivy[4], Anthony Aqui[1], Avril Mansfield[1]
[1]Toronto Rehabilitation Institute, [2]Institut ESIPE Créteil (ISBS) - Université Paris-Est Créteil, [3]University of Toronto, [4]Nipissing University

P1-W-178 Peak plantar ankle flex push-off power estimation using single inertial measurement units

Presenter: **Xianta Jiang**

Xianta Jiang[1], Mohsen Gholami[1], Janice Eng[2], Carlo Menon[1]
[1]Simon Fraser University, [2]University of British Columbia and GF Strong Rehab Centre

P1-W-179 Reliability of different clinical techniques for assessing foot posture

Presenter: **Muge Kirmizi**

Muge Kirmizi[1], Mehmet Cakiroglu[1], Ibrahim Simsek[1], Ata Elvan[1], Salih Angin[1]
[1]Dokuz Eylul University

P1-W-180 Factors associated with daily variation in gait performance in older adults

Presenter: **Alexa Ludington**

Alexa Ludington[1], Junhong Zhou[1], Wanting Yu[1], Brad Manor[1], On-Yee Lo[1]
[1]Harvard Medical School

P1-W-181 Development of instrumented shoe with miniature high-capacity load vector sensor and application to gait assessment

Presenter: **Masato Shindo**

Masato Shindo[1], Takeshi Yamaguchi[1], Yoshihiro Sasaki[2], Kazuo Hokkirigawa[1]
[1]Tohoku University, [2]Research Institute for Electromagnetic Materials

P1-W-182 Validity and usability of a mixed reality headset for automated mobility assessment

Presenter: **Ruopeng Sun**

Ruopeng Sun[1], Roberto Aldunate[1], Jacob Sosnoff[1]
[1]University of Illinois at Urbana-Champaign

P1-W-183 Can we elicit increasing lumbar flexion movement using a standardized reaching paradigm in an immersive virtual reality environment?

Presenter: **Susanne van der Veen**

Susanne van der Veen[1], Dana Nocera[2], Kellen Kubik[2], Emma Fish[2], James Thomas[1]
[1]Virginia Commonwealth University, [2]Ohio University

P1-W-184 Quantification of seated balance control using system identification

Presenter: **Albert Vette**

Albert Vette[1], Kshitij Agarwal[1], Alireza Noamani[1], Andrew Williams[1], Hossein Rouhani[1]
[1]University of Alberta

X - Vestibular function and disorders

P1-X-185 Postural instability in subjects with Usher syndrome

Presenter: **Simona Caldani**

Simona Caldani[1], Maria Pia Bucci[1], Maud Tisne[1], Isabelle Audo[2], Thierry Van Den Abbeele[1], Sylvette Wiener Vacher[1]
[1]Hopital Robert Debré, [2]CHNO

P1-X-186 Balance performance in bilateral vestibulopathy in relation to sensorimotor integration

Presenter: **Nolan Herssens**

Nolan Herssens[1], Evi Verbecque[2], Wim Saeys[1], Luc Vereeck[1], Vincent Van Rompaey[1], Christopher McCrum[3], Kenneth Meijer[3], Ann Hallemans[1]
[1]University of Antwerp, [2]University of Hasselt, [3]Maastricht University

P1-X-187 Determination of an objective threshold for galvanic vestibular stimulation

Presenter: **Youstina Mikhail**

Youstina Mikhail[1], Jean-Marc Mac-Thiong[2], Dorothy Barthélemy[3]
[1]Centre for Interdisciplinary Research in Rehabilitation (CRIR-IRGLM), [2]CIUSSS Centre-Sud-de-l'Île-de-Montréal, [3]Université de Montréal

P1-X-188 Evaluation of after-effects of noisy vestibular stimulation on vestibular motion perception

Presenter: **Max Wühr**

Max Wühr[1], Aram Keywan[1], Klaus Jahn[1]
[1]Ludwig-Maximillians Universität München

P1-X-189 Body equilibrium function in the course of Ménière's disease

Presenter: **Masahiko Yamamoto**

Masahiko Yamamoto[1]
[1]Toho University

Y - Visual function and disorders

P1-Y-190 A perceptual perspective: Exploring visual search patterns during freezing of gait in Parkinson's disease

Presenter: **Lotte Hardeman**

Lotte Hardeman[1], Elmar Kal[2], Toby Ellmers[2], Will Young[2], Anna Fielding[2]
[1]Vrije Universiteit Amsterdam, [2]Brunel University

P1-Y-191 Examining the relationship between visual acuity, executive function and postural control in cognitively healthy adults and adults with Alzheimer's dementia

Presenter: **Susan Hunter**

Susan Hunter[1], Alison Divine[2], Humberto Omana[1], Andrew Johnson[1], Jeff Holmes[1], Keith Hill[3], Walter Wittich[4]
[1]University of Western Ontario, [2]University of Leeds, [3]Curtin University, [4]University of Montreal

POSTER SESSION 2: TUESDAY 2ND JULY

A - Activity monitoring

P2-A-1 The effect of sensor location on the assessment of sit-to-stand transitions

Presenter: **Arash Atrsaei**

Arash Atrsaei[1], Benoît Mariani[2], Kamiar Aminian[1]
[1]Ecole Polytechnique Fédérale de Lausanne (EPFL), [2]Gait Up S.A.

P2-A-2 Real-world steps, cadence and walking bouts estimated by wrist sensor: Effects of aging, obesity and gender in a population-based cohort study

Presenter: **Abolfazl Soltani**

Abolfazl Soltani[1], Anisoara Ionescu[1], Pedro Manuel Marques-Vidal[2], Kamiar Aminian[1]
[1]Ecole Polytechnique Fédérale de Lausanne (EPFL), [2]Department of Internal Medicine of CHUV

B - Adaptation, learning, plasticity and compensation

P2-B-3 Adaptation induced change in overground slip recovery outcomes: Distinct strategies or continuum of an emerging single strategy control?

Presenter: **Tanvi Bhatt**

Tanvi Bhatt[1], Shuaijie Wang[1], Yi-Chung Pai[2], Yiru Wang[1]
[1]University of Illinois at Chicago, [2]Retired from University of Illinois at Chicago

P2-B-4 Investigating proactive balance control in individuals with incomplete spinal cord injury

Presenter: **Mackenzie Bone**

Mackenzie Bone[1], Kristin Musselman[2], Joel Lanovaz[1], Tarun Arora[3], Gary Linassi[4], Alison Oates[1]
[1]University of Saskatchewan, [2]University of Toronto, [3]Cleveland Clinic Foundation, [4]Saskatchewan Health Authority

P2-B-5 Locomotor savings of split-belt gait adaptation indicate long-term adaptation processes

Presenter: **Tom Buurke**

Tom Buurke[1], Claudine Lamoth[1], Lucas van der Woude[1], Rob den Otter[1]
[1]University Medical Center Groningen

P2-B-6 Singular Spectrum Analysis for the detection of adaptation rates in split-belt data

Presenter: **Rob den Otter**

Rob den Otter[1], Tom Buurke[1], Claudine Lamoth[1]
[1]University Medical Center Groningen

P2-B-7 Implicit and explicit motor learning in gait rehabilitation of people after stroke: A randomized controlled single blind trial

Presenter: **Li-Juan Jie**

Li-Juan Jie[1], Melanie Kleynen[2], Kenneth Meijer[1], Anne Beurskens[2], Susy Braun[2]
[1]Maastricht University, [2]Zuyd University of Applied Sciences

P2-B-8 Hands up in the air and wave them like you care: Effect of exposure on upper limb kinematics during continuous, multi-directional perturbations

Presenter: **Vicki Komisar**

Carolyn Duncan[1], Alison Schinkel-Ivy[2], Andrew Laing[3], Vicki Komisar[4]
[1]Michigan Technological Institute, [2]Nipissing University, [3]University of Waterloo, [4]Simon Fraser University

P2-B-9 Neuromuscular adaptations in balance control following a lower-limb transfemoral amputation

Presenter: **Cristian Pasluosta**

Cristian Pasluosta[1], Claudia Ramos Claret[2], Georg Herget[2], Lukas Kouba[2], Daniel Wiest[3], Jochen Adler[3], Vinzenz von Tscharner[4], Thomas Stieglitz[2]
[1]Friedrich-Alexander University (FAU) Erlangen-Nürnberg, [2]University of Freiburg, [3]Sanitätshaus Pfänder, [4]University of Calgary

P2-B-10 Developing resilience to unpredictable body balance perturbations: Contextual interference effect in the training of compensatory arm and leg movements

Presenter: **Luis Teixeira**

Luis Teixeira[1], Patricia Takazono[1], Marina Betelli[1], Caroline Souza[1], Julia Oliveira[1], Daniel Coelho[1], Jacques Duysens[2]
[1]University of São Paulo, [2]Catholic University of Leuven

P2-B-11 How does balance affect gait in stroke survivors?

Presenter: **Susanne van der Veen**

Susanne van der Veen[1], Ulrike Hammerbeck[2], Kristen Hollands[3]
[1]Virginia Commonwealth University, [2]Manchester University, [3]University of Salford

C - Aging

P2-C-12 Cognitive-motor interference in older adults while navigating in an ecological environment

Presenter: **Catherine Agathos**

Catherine Agathos[1], Marcia Bécu[1], Konogan Baranton[2], Delphine Bernardin[3], Angelo Arleo[1]
[1]Sorbonne Université, INSERM, CNRS, Institut de la Vision, [2]Essilor International, [3]Essilor Canada

P2-C-13 Parkinsonian gait in aging: A signature of Alzheimer's pathology

Presenter: **Gilles Allali**

Gilles Allali[1], Eric Morel[2], Stephane Armand[1], Frederic Assal[1]
[1]Geneva University Hospitals, [2]University of Geneva

P2-C-14 Effect of High Intensity Interval Training combined with citrulline supplementation on gait parameters and its predictors in healthy older women: A pilot study

Presenter: **Mylene Aubertin**

Mylène Aubertin-Leheudre[1]
[1]Université du Québec à Montréal

P2-C-15 Rate of muscle force development during fatigue: Impact of age

Presenter: **Marc Belanger**

Marc Belanger[1], Charlotte Pion[1], Justine Lai[1], Said Mamouh[1], Mylène Aubertin-Leheudre[1]
[1]Université du Québec à Montréal

P2-C-16 Can years of education predict gait speed? A cross-sectional study of community-dwelling Brazilian older adults

Presenter: **Renato Freire Júnior**

Renato Freire Júnior[1], Jaqueline Porto[1], Julia Fernandes[1], Larissa Bocarde[1], Tatiane Pontes[1], Karoliny Cruz[2], Juliane Belém[3], Daniela Abreu[1]
[1]University of São Paulo, [2]Federal University of Amazonas - UFAM, [3]Family Health Support Center - Coari - AM

P2-C-17 Is trunk strength associated with functional mobility in older women?

Presenter: **Emily Gregg**

Emily Gregg[1], Gareth Nicholson[1], Clive Beggs[1], Athanassios Bissas[1]
[1]Leeds Beckett University

P2-C-18 Which lower limb muscle strength could be associated with low gait speed in frail older people?

Presenter: **Daniela Cristina Abreu**

Natalia Iosimuta[1], Natalia Alves[2], Emanuella Angeluni[2], Fernanda Pessanha[2], Larissa Marques[2], Renato Freire Junior[3], Eduardo Ferriolli[2], Daniela Abreu[4]
[1]Federal University of Amapa, [2]Ribeirão Preto Medical School, University of São Paulo, [3]Federal University of Manaus, [4]University of São Paulo

P2-C-19 Spatiotemporal gait parameters for older adults - An interactive model adjusting reference data for gender, age, and body height

Presenter: **Rolf Moe-Nilssen**

Rolf Moe-Nilssen[1], Jorunn Helbostad[2]
[1]University of Bergen, [2]Norwegian University of Science and Technology

P2-C-20 The effects of fatigue and age on gait dynamics

Presenter: **Paulo Cezar Rocha Santos**

Paulo Cezar Santos[1], Tibor Hortobágyi[2], Inge Zijdewind[2], Lilian Gobbi[1], Fabio Barbieri[1], Claudine Lamoth[3]
[1]São Paulo State University (UNESP), [2]University of Groningen, University Medical Center Groningen, [3]University Medical Center Groningen

P2-C-21 Age-related differences in the energy cost of walking while thinking

Presenter: **Britney Williams**

Britney Williams[1], Taylor Woods[1], James Lang[2], Jessie Vanswearingen[3], Kristin Lowry[1]
[1]Des Moines University, [2]Iowa State University, [3]University of Pittsburgh

P2-C-22 Effects of age-related changes in step length and step width on the friction requirement at shoe-floor interface during straight level walking

Presenter: **Takeshi Yamaguchi**

Takeshi Yamaguchi[1], Kei Masani[2]
[1]Tohoku University, [2]University of Toronto

D - Biomechanics

P2-D-23 Neural mechanisms of balance and gait adaptations after downslope walking

Presenter: **Nikki Aitcheson-Huehn**

Nikki Aitcheson-Huehn[1], Jayne Kalmar[1], Michael Cinelli[1]
[1]Wilfrid Laurier University

P2-D-24 Elucidation of the trunk motion affecting the knee joint stress during gait

Presenter: **Masahiro Edo**

Masahiro Edo[1], Fumiko Kamijo[2], Toshihiko Sato[3]
[1]Chiba Prefectural University of Health Sciences, [2]Showa University, [3]Bunkyo Gakuin University

P2-D-25 Effect of trunk brace on forward bending movement characteristics in patients with scoliosis

Presenter: **Wei-Chun Hsu**

Wei-Chun Hsu[1], Muhammad Izhar Ahmed[1], Chao-Chin Chang[1], Chi Kuang Feng[2], Shi-Jinn Horng[1], Chung-Hsien Kuo[1], Shang-Chih Lin[1]
[1]National Taiwan University of Science and Technology, [2]Taipei Veterans General Hospital, National Yang Ming University, National Defense of Medial Center

P2-D-26 Relationship between foot posture assessment techniques and dynamic plantar pressure variables

Presenter: **Muge Kirmizi**

Muge Kirmizi[1], Mehmet Cakiroglu[1], Ibrahim Simsek[1], Salih Angin[1]
[1]Dokuz Eylul University

P2-D-27 Lateral stability during anterior and posterior support surface perturbations in people with chronic stroke

Presenter: **Christopher McCrum**

Christopher McCrum[1], Andrew Huntley[2], Alison Schinkel-Ivy[3], Avril Mansfield[2]
[1]Maastricht University, [2]Toronto Rehabilitation Institute-University Health Network, [3]Nipissing University

P2-D-28 Using induced acceleration to study the effects of age and grade on the joint moment strategy to control knee flexion during weight acceptance in walking

Presenter: **Jeroen Waanders**

Jeroen Waanders[1], Tibor Hortobágyi[1], Alessio Murgia[1], Paul DeVita[2], Jason Franz[3]
[1]University of Groningen, University Medical Center Groningen, [2]East Carolina University, [3]University of North Carolina at Chapel Hill and North Carolina State University

E - Brain imaging/activation during posture and gait

P2-E-29 Are there associations between prefrontal cortex activity and turning behaviors in people with and without freezing of gait?

Presenter: **Valeria Belluscio**

Valeria Belluscio[1], Samuel Stuart[2], Elena Bergamini[1], Giuseppe Vannozzi[1], Martina Mancini[2]
[1]Interuniversity Centre of Bioengineering Bohnes, University of Rome Foro Italico, [2]Oregon Health & Science University

P2-E-30 Validation of divergent neural dysfunction in idiopathic REM sleep behaviour disorder patients separated using clinical phenotyping

Presenter: **Kaylena Ehgoetz Martens**

Kaylena Ehgoetz Martens[1], Elie Matar[1], James Shine[1], Joseph Phillips[2], Ronald Grunstein[1], Glenda Halliday[1], Simon Lewis[1]
[1]University of Sydney, [2]University of Western Sydney

P2-E-31 Prefrontal cortex activity requirements when young and older people perform cognitively-demanding stepping tasks in supported and unsupported conditions: A fNIRS study

Presenter: **Jasmine Menant**

Jasmine Menant[1], Paulo Pelicioni[1], Daina Sturnieks[1], Stepehen Lord[1]
[1]Neuroscience Research Australia, University of New South Wales

P2-E-32 Exploration of brain cholinergic correlates of gait in Parkinson disease: An in vivo voxel-based [18F] FEOBV PET analysis

Presenter: **Martijn Muller**

Martijn Muller[1], Prabesh Kanel[1], Nicolaas Bohnen[1]
[1]University of Michigan

P2-E-33 Brain activation associated with active and passive overground gait in a robotic exoskeleton

Presenter: **Sue Peters**

Sue Peters[1], Denis Louie[1], Shannon Lim[1], Chieh-ling Yang[1], Janice Eng[1]
[1]University of British Columbia

P2-E-34 Auditory-evoked cortical activity preceding postural instability

Presenter: **Paula Polastri**

Paula Polastri[1], Mark Laylor[2], Jessy Varghese[2], William McIlroy[2]
[1]São Paulo State University (UNESP), [2]University of Waterloo

P2-E-35 Brain functional substrate of gait observation in Parkinson's disease

Presenter: **Martina Putzolu**

Martina Putzolu[1], Giulia Bommarito[1], Cecilia Cerulli[1], Giovanna Lagravinese[1], Carla Ogliastro[1], Gaia Bonassi[1], Laura Avanzino[1], Matilde Inglese[1], Elisa Pelosin[1]
[1]University of Genoa

P2-E-36 Higher resting state connectivity of the dopaminergic motor network may reduce age-related step length variability

Presenter: **Caterina Rosano**

Caterina Rosano[1], Helmet Karim[1], Andrea Rosso[1], Nicolas Bohnen[2], Howard Aizenstein[1], Stephen Smagula[1], Stephanie Studenski[1]
[1]University of Pittsburgh, [2]University of Michigan

P2-E-37 Removal of artifacts to compute intra stride cortical dynamics with EEG in Parkinson's disease

Presenter: **Marlieke Scholten**

Marlieke Scholten[1], Markus Siegel[2], Daniel Weiss[1]
[1]Hertie Institute for Clinical Brain Research, [2]Centre for Integrative Neuroscience (CIN) & MEG Center

P2-E-38 Cortical response to open and closed-loop tactile cueing during walking and turning in Parkinson's

Presenter: **Samuel Stuart**

Samuel Stuart[1], Martina Mancini[1]
[1]Oregon Health & Science University

P2-E-39 Influence of anxiety on prefrontal cortical activity during usual walking and obstacle crossing in older adults

Presenter: **Rodrigo Vitório**

Nubia Conceição[1], Priscila Sousa[1], Diego Orcioli-Silva[1], Victor Beretta[1], Ellen Lirani-Silva[1], Lilian Gobbi[1], Rodrigo Vitório[1]
[1]São Paulo State University (UNESP)

F - Cognitive impairments

P2-F-40 Gait patterns and cognitive decline: A longitudinal population-based study

Presenter: **Oshadi Jayakody**

Oshadi Jayakody[1], Monique Breslin[1], Velandai Srikanth[2], Michele Callisaya[1]
[1]University of Tasmania, [2]Peninsula Health, Monash University

P2-F-41 Is free-living gait assessment a useful marker of cognitive impairment and dementia disease subtype?

Presenter: **Riona Mc Ardle**

Riona Mc Ardle[1], Brook Galna[1], Silvia Del Din[1], Alan Thomas[1], Lynn Rochester[2]
[1]Newcastle University, [2]Institute of Neuroscience, Newcastle University

P2-F-42 Developing exercise groups for persons with dementia

Presenter: **Kristin Taraldsen**

Kristin Taraldsen[1], Elisabeth Boulton[2], Jorunn Helbostad[1], Ingvild Saltvedt[1], Gro Tangen[3], Randi Granbo[1]
[1]Norwegian University of Science and Technology, [2]University of Manchester, [3]Norwegian National Advisory Unit on Ageing and Health

P2-F-43 The effects of cognitive impairment on the multi-scale dynamics of standing postural control in older adults

Presenter: **Junhong Zhou**

Junhong Zhou[1], Brad Manor[1], J. Riley McCarten[2], Michael Wade[3], Azizah Jor'dan[1]
[1]Harvard Medical School, [2]Minneapolis Veterans Affairs Medical Center, [3]University of Minnesota - Twin Cities

G - Cognitive, attentional, and emotional influences

P2-G-44 The validity and predictive validity of the Gait-Specific Attentional Profile (G-SAP)

Presenter: **Adam Cocks**

Adam Cocks[1], William Young[1], Toby Ellmers[1], Joseph McCarthy[1], Noel Kinrade[1]
[1]Brunel University

P2-G-45 Emotional, cognitive, and postural adaptations to repeated postural threat exposure

Presenter: **Kyle Johnson**

Kyle Johnson[1], Martin Zaback[2], Craig Tokuno[1], Mark Carpenter[2], Allan Adkin[1]
[1]Brock University, [2]University of British Columbia

P2-G-46 Reading the mind: Pupillometry as a means to measure conscious movement processing?

Presenter: **Elmar Kal**

Elmar Kal[1], Nieck Detillon[2], Bram Kragting[2], John van der Kamp[2]
[1]Brunel University, [2]Vrije Universiteit Amsterdam

P2-G-47 Factors associated with texting while walking performance across different environments

Presenter: **Tal Krasovsky**

Tal Krasovsky[1], Patrice Weiss[1], Rachel Kizony[1]
[1]University of Haifa

P2-G-48 Dual-task gait training is not superior to single-task gait training within 3 years of stroke: A randomized controlled trial

Presenter: **Prudence Plummer**

Prudence Plummer[1], Jody Feld[1], Lisa Zukowski[2], Bijan Najafi[3]
[1]University of North Carolina at Chapel Hill, [2]High Point University, [3]Baylor University

P2-G-49 Increasing the distance of an external focus of attention enhances learning: A replication and extension of McNevin, Shea and Wulf (2003)

Presenter: **Nadia Polskaia**

Nadia Polskaia[1], Rebecca Bond[1], Juliane Ratte[1], Yves Lajoie[1]
[1]University of Ottawa

P2-G-50 Relating reaction times to local sway features to unveil intermittency in postural control

Presenter: **John Stins**

John Stins[1], Melvyn Roerdink[1]
[1]Vrije Universiteit Amsterdam

P2-G-51 Smartphone-based balance assessment for older adults enrolled a 12-week attentionally focused balance training intervention: Preliminary data

Presenter: **Ruth Stout**

Ruth Stout[1], Lauren Higgins[1], Danielle Felsburg[1], Masahiro Yamada[1], Sean Cochrane[1], Chanel LoJacono[1], Amanda Barclift[1], John Palazzolo[1], Jeff Labban[1], Louisa Raisbeck[1], Jeffery Fairbrother[2], Christopher Rhea[1]
[1]University of North Carolina, Greensboro, [2]University of Tennessee

P2-G-52 Postural adjustments during manual motor imagery in young and older people

Presenter: **Chloe Wider**

Chloe Wider[1], Mark Andrews[1], Hayley Boulton[1], Suvobrata Mitra[1]
[1]Nottingham Trent University

H - Coordination of posture and gait

P2-H-53 The association of confidence in walking, fear of falling and cautious gait in older adults

Presenter: **Maha Almarwani**

Maha Almarwani[1], Jennifer Brach[2]
[1]King Saud University, [2]University of Pittsburgh

P2-H-54 Postural control following a sport-related concussion changes in response to continuous platform rotations

Presenter: **Harry Bailey**

Harry Bailey[1], Cameron Kirk[1], Richard Mills[2], Richard Foster[1]
[1]Liverpool John Moores University, [2]Manchester Metropolitan University

P2-H-55 Control of the trunk during walking: Early manifestations of antero-posterior angle changes

Presenter: **Ioannis Bargiotas**

Ioannis Bargiotas[1], Juan Mantilla[1], Danping Wang[1], Pierre-Paul Vidal[1]
[1]CNRS, SSA, University Paris Descartes (Paris IV)

P2-H-56 Dual tasks during treadmill walking in a fully immersive virtual environment

Presenter: **Lars Peder Bovim**

Lars Peder Bovim[1], Beate Gjesdal[1], Silje Maeland[1], Bård Bogen[1]
[1]Western Norway University of Applied Sciences

P2-H-57 Beat perception and production abilities affect responsiveness of temporal gait asymmetry to rhythmic auditory stimulation following stroke

Presenter: **Lucas Crosby**

Lucas Crosby[1], Jennifer Wong[2], Jessica Grahn[3], Joyce Chen[1], Dina Brooks[1], Kara Patterson[1]
[1]University of Toronto, [2]Toronto Rehabilitation Institute, [3]Brain & Mind Institute - Western University

P2-H-58 Unwinding the control of walking turns

Presenter: **Carolin Curtze**

Carolin Curtze[1]
[1]University of Nebraska Omaha

P2-H-59 Head anticipation during auditory instructed locomotion

Presenter: **Felix Dollack**

Felix Dollack[1], Hideki Kadone[1], Monica Perusquia Hernandez[1], Kenji Suzuki[1]
[1]University of Tsukuba

P2-H-60 The effect of changes in body weight on postural control in obese and non-obese adults: A pilot study

Presenter: **Daniela Godoi**

Daniela Godoi[1], Rafael Santi[1]
[1]Federal University of São Carlos (UFSCar)

P2-H-61 Repetitive experience touching door edges with fingers while walking through an aperture to improve fine-tuning of collision-avoidance behavior

Presenter: **Tomoki Hakamata**

Tomoki Hakamata[1], Yoshitsugu Kondo[2], Takahiro Higuchi[3]
[1]Tokyo Metropolitan University, [2]Tokushima Bunri University, [3]Department of Health Promotion Science, Tokyo Metropolitan University

P2-H-62 The influence of anxiety on motor strategy selection during a stepping down paradigm in older adults

Presenter: **Nick Kluft**

Nick Kluft[1], Sjoerd Bruijn[1], Jaap van Dieën[1], Mark Carpenter[2], Mirjam Pijnappels[1]
[1]Vrije Universiteit Amsterdam, [2]University of British Columbia

P2-H-63 Exploring the relationships between trunk sway, walking speed and gender

Presenter: **Joel Lanovaz**

Joel Lanovaz[1], Sahya Bhargava[1], Robert Downey[1], Alison Fedoriuk[1], Logan Michalishen[1], Serena Saini[1], Alison Oates[1]
[1]University of Saskatchewan

P2-H-64 Motor deficits in Parkinson's disease are heterogeneously corrected for by Deep Brain Stimulation

Presenter: **Christoph Maurer**

Christoph Maurer[1]
[1]University Freiburg

P2-H-65 Slower reactive turning while walking in older adults: An association with cognitive-motor function

Presenter: **Takahito Nakamura**

Takahito Nakamura[1], Takahiro Higuchi[2], Touyou Kikumoto[1], Fumihiko Hoshi[1]
[1]Saitama Prefectural University, [2]Tokyo Metropolitan University

P2-H-66 Feedforward and feedback control components in the generation of automatic postural responses

Presenter: **Julia Oliveira**

Nametala Azzi[1], Julia Oliveira[1], Daniel Coelho[1], Luis Teixeira[1]
[1]University of São Paulo

P2-H-67 Postural reactions and spinal excitability modulation during balance perturbation following incomplete spinal cord injury

Presenter: **Charlotte Pion**

Charlotte Pion[1], Mélissa St-Pierre Bolduc[2], Zoé Miranda[2], Maureen MacMahon[3], Dorothy Barthélemy[2]
[1]Université du Québec à Montréal, [2]Université de Montréal, [3]CIUSSS Centre-Sud-de-l'île-de-Montréal

P2-H-68 The effects of cognitive interference on gait and turning in Huntington's disease

Presenter: **Nicollette Purcell**

Nicollette Purcell[1], Jennifer Goldman[1], Bryan Bernard[1], Joan O'Keefe[1]
[1]Rush University Medical Center

P2-H-69 Sensory contributions to head and lumbar sway in healthy individuals and those with mild traumatic brain injury

Presenter: **Tiphanie Raffegeau**

Tiphanie Raffegeau[1], Mindie Clark[1], Lucy Parrington[2], Robert Peterka[2], James Chesnutt[2], Laurie King[2], Peter Fino[1]
[1]University of Utah, [2]Oregon Health & Science University

P2-H-70 Bridging the callosal gap in gait: A mechanistic evaluation of white matter's role in bilateral coordination

Presenter: **Sutton Richmond**

Sutton Richmond[1], Clayton Swanson[1], Tyler Whittier[1], Daniel Peterson[2], Brett Fling[1]
[1]Colorado State University, [2]Arizona State University

P2-H-71 The contribution of intralimb kinetic coordination in lower limb to control of propulsion and weight support at a wide range of gait speed in young and elderly people

Presenter: **Yusuke Sekiguchi**

Yusuke Sekiguchi[1], Dai Owaki[1], Keita Honda[1], Shin-Ichi Izumi[1]
[1]Tohoku University

P2-H-72 Postural balance at children survived after posterior fossa tumor, acute lymphoblastic leukemia and hematopoietic stem cell transplantation

Presenter: **Dmitry Skvortsov**

Dmitry Skvortsov[1], Alexey Parshikov[2], Daria Zhuk[2], Vlad Nikulin[2], Serafima Chechelnitskaya[2], Vladimir Kasatkin[3], Alexander Karelin[3]
[1]Government University, [2]Rehabilitation center "Russcoe Pole", [3]Dmitry Rogachev National Research Center of Pediatric Hematology, Oncology and Immunology

P2-H-73 Tandem Walking Test kinematics - A normal data

Presenter: **Dmitry Skvortsov**

Dmitry Skvortsov[1], Alina Aisenshtein[2], Vladimir Kasatkin[3], Anatoliy Shipilov[2]
[1]Government University, [2]Rehabilitation center "Russcoe Pole", [3]Dmitry Rogachev National Research Center of Pediatric Hematology, Oncology and Immunology

P2-H-74 Postural adaptations in response to haptic forces during self-paced treadmill walking post-stroke

Presenter: **Gianluca Sorrento**

Gianluca Sorrento[1], Philippe Archambault[2], Joyce Fung[2]
[1]Jewish Rehabilitation Hospital (CISSS-Laval), [2]McGill University

P2-H-75 The role of vision in backward walking in patients with stroke

Presenter: **Meng-Ru Tsai**

Meng Ru Tsai[1], Pei-Yun Lee[2], Nai-Hua Kuo[1], Chih-Hung Chen[1], Sang-I Lin[1], Pei-Yun Lee[2]
[1]National Cheng Kung University, [2]National Taiwan University Hospital Bei-Hu Branch

P2-H-76 Fluctuation of center of pressure and the affecting factors in young children

Presenter: **Naomi Tsugita**

Naomi Tsugita[1], Syuhei Kobayashi[1], Shino Ogawa[1], Taiko Shiwa[1], Yasuko Funabiki[1]
[1]Kyoto University

P2-H-77 Age-related changes in reactive arm responses following support surface perturbations

Presenter: **Lori Ann Vallis**

David Shulman[1], Jaykob Price[1], Lori Ann Vallis[1]
[1]University of Guelph

P2-H-78 Exploring the interaction between motor competence and dual task walking in adolescents

Presenter: **Benjamin Weedon**

Benjamin Weedon[1], Patrick Esser[1], Johnny Collett[1], Hooshang Izadi[1], Shawn Joshi[1], Andy Meaney[1], Anne Delextrat[1], Helen Dawes[1]
[1]Oxford Brookes University

P2-H-79 Mechanical consequences of trunk flexion on slopes during human walking

Presenter: **Amy Wu**

Amy Wu[1], Salman Faraji[2], Christopher Easthope[3], Auke Ijspeert[2]
[1]Queen's University, [2]Ecole Polytechnique Fédérale de Lausanne (EPFL), [3]University Hospital Balgrist

I - Development of posture and gait

P2-I-81 Characteristics of postural adjustments in sitting reach task in adults with cerebral palsy

Presenter: **Yui Sato**

Yui Sato[1], Hideyuki Tashiro[1], Naoki Kozuka[1]
[1]Sapporo Medical University

P2-I-82 Balance recovery following mediolateral pelvis perturbations during slow walking

Presenter: **Michelle van Mierlo**

Michelle van Mierlo[1], Boris Ruwe[1], Mark Vlutters[1], Edwin H. F. van Asseldonk[1], Herman van der Kooij[1]
[1]University of Twente

J - Developmental disorders

P2-J-83 Reproducibility of the Timed Up and Go (TUG) standard and dual task versions in school-aged children with and without coordination difficulties

Presenter: **Leanne M Johnston**

Leanne Johnston[1], Breanna Raatz[1], Gemma Allinson[1], Rosalee Dewar[1], Sally Hannah[1]
[1]University of Queensland

P2-J-84 Will my child walk? New insights into the relationship between lower limb muscle strength and gross motor function in children with spina bifida myelomeningocele

Presenter: **Leanne Johnston**

Leanne Johnston[1], Ashleigh Gehrig[1], Nicole Thomas[2]
[1]University of Queensland, [2]Children's Health Queensland Hospital & Health Service

P2-J-85 A retrospective study towards characterizing the long-term effects of single-event multilevel surgery on gait consistency in children with spastic bilateral cerebral palsy

Presenter: **Rosa Visscher**

Rosa Visscher[1], Nadine Hasler[1], Marie Freslier[2], Navrag Singh[1], Reinald Brunner[2], Erich Rutz[2]
[1]ETH Zurich, [2]University Children's Hospital Basel

P2-J-86 Functional gait in children with developmental coordination disorder compared to typically developing children

Presenter: **Vivian Weerdesteyn**

Rosanne Kuijpers[1], Ellen Smulders[1], Vivian Weerdesteyn[1]
[1]Radboud University Medical Center

K - Devices to improve posture and gait

P2-K-87 Non-invasive spinal cord stimulation for the treatment of motor symptoms of Parkinson`s disease

Presenter: **María Alamos**

Maria Alamos[1], Aquiles Martinez[2], Carlos Juri[1], Rómulo Fuentes[2]
[1]Pontificia Universidad Catolica de Chile, [2]Universidad de Chile

P2-K-88 Effect of postural insoles on iliotibial band syndrome in runners: a multicentre prospective study

Presenter: **Isabelle Barnier**

Isabelle Barnier[1], Marie-Emmanuelle Rouchon[2], Frédéric Viseux[3]
[1]Posturopody Class 2016/17, Connaissance & Evolution, FR75012, [2]Posture Lab, FR75012 Paris, [3]LAMIH - University of Valenciennes - France

P2-K-89 Effect of learning to use a single-point cane on gait and cognitive demands of walking in people with mild to moderate Alzheimer's dementia

Presenter: **Susan Hunter**

Susan Hunter[1], Alison Divine[2], Humberto Omana[1], Walter Wittich[3], Andrew Johnson[1], Keith Hill[4], Jeff Holmes[1]
[1]University of Western Ontario, [2]University of Leeds, [3]University of Montreal, [4]Curtin University

P2-K-90 The effect of Arctic Grip contact area on footwear performance during winter walking

Presenter: **Kristie Liu**

Kristie Liu[1], Tilak Dutta[2]
[1]University of Toronto, [2]Toronto Rehabilitation Hospital

P2-K-91 The effect of real-time biofeedback on lumbar spine and lower limb kinematics and kinetics during repetitive lifting

Presenter: **Yanto Naude**

Yanto Naudé[1], Grant Mawston[1], Jeff Kilby[1], Mark Boocock[1]
[1]Auckland University of Technology

P2-K-92 The effects of non-invasive transcranial brain current stimulation (tDCS) on posture over stable and unstable surfaces in people with Parkinson's: A randomised double-blind sham-controlled crossover study

Presenter: **Jing Qi**

Jing Qi[1], Graham Kerr[2], Karen Sullivan[2], Simon Smith[3], Marcus Meinzer[4]
[1]Institute of Health and Biomedical Innovation, [2]Queensland University of Technology, [3]University of Queensland, [4]UQ Centre for Clinical Research

P2-K-93 Examining the long term effects of using the anchor system on postural control during walking

Presenter: **Kirat Shukla**

Kirat Shukla[1], Joel Lanovaz[1], Alison Oates[1]
[1]University of Saskatchewan

P2-K-94 A feasibility study for gait training with foot-floor contact angle feedback

Presenter: **Kathleen Sienko**

Christina Ma[1], Tian Bao[2], Victor Le[2], April Chambers[3], Peter Shull[4], Yong-Ping Zheng[5], Rakié Cham[3], Kathleen Sienko[2]
[1]Jönköping University, [2]University of Michigan, [3]University of Pittsburgh, [4]Shanghai Jiao Tong University, [5]The Hong Kong Polytechnic University

L - Effect of medication on posture and gait

P2-L-95 The effects of levodopa on prefrontal activation during gait in individuals with Parkinson's disease

Presenter: **Moria Dagan**

Moria Dagan[1], Hagar Bernad-Elazari[2], Talia Herman[2], Rachel Harrison[3], Junhong Zhou[4], Shiran Shustak[2], Marina Brozgol[2], Nir Giladi[2], Anat Mirelman[2], Brad Manor[4], Jeff Hausdorff[2]
[1]Tel Aviv University, [2]Tel-Aviv Sourasky Medical Center, [3]Institute for Aging Research, Hebrew SeniorLife, Harvard Medical School, [4]Harvard Medical School

P2-L-96 The effects of dopaminergic drug on turning in people with and without Parkinson's disease

Presenter: **Douglas Martini**

Douglas Martini[1], Graham Harker[1], John Nutt[1], Fay Horak[1]
[1]Oregon Health & Science University

P2-L-97 Objective gait and balance outcome measures for efficacy of cyclodextrin treatment in Niemann-Pick Type C (NPC): a case series

Presenter: **Joan Ann O'Keefe**

Joan O'Keefe[1], Jessica Joyce[1], Nicollette Purcell[1], Kathryn Wrobel[1], Medha Parulekar[1], Elizabeth Berry-Kravis[1]
[1]Rush University Medical Center

M - Exercise and physical activity

P2-M-98 Lifestyle integrated functional exercise for inpatients suffering from cognitive impairment - a transitional approach to prevent hospitalized older adults from functional decline

Presenter: **Nacera Belala**

Nacera Belala[1], Michael Schwenk[1], Clemens Becker[2]
[1]Heidelberg University, [2]Robert-Bosch-Krankenhaus

P2-M-99 Association between motor skills and physical activity in preschoolers

Presenter: **Becky Breau**

Becky Breau[1], Berit Steenbock[1], Marvin Wright[1], Christoph Buck[1], Mirko Brandes[1]
[1]Leibniz Institute for Prevention Research and Epidemiology

P2-M-100 A validation and comparison of Actigraph GT9X Link and RunScribe Plus accelerometers for the estimation of skeletal loading during habitual physical activities

Presenter: **Simon Higgins**

Simon Higgins[1], Srikant Vallabhajosula[1]
[1]Elon University

P2-M-101 The beneficial effects of multisensory balance training in older adults: A systematic review

Presenter: **Shu-Chun Lee**

Shu-Chun Lee[1], Li-Yun Yeh[1]
[1]Taipei Medical University

P2-M-102 The effect of bed rest on balance control in healthy adults: A systematic scoping review

Presenter: **Tyler Saumur**

Tyler Saumur[1], Sarah Gregor[1], George Mochizuki[1], Avril Mansfield[2], Sunita Mathur[1]
[1]University of Toronto, [2]Toronto Rehabilitation Institute

P2-M-103 Effect of slope squat on lower-extremity muscle activity

Presenter: **Jennifer Davies**

Yi Wan[1], Jianqiao Wang[2], Jennifer Davies[1], Kate Button[1], Mohammad Al-Amri[1]
[1]Cardiff University, [2]China Rehabilitation Research Center

N - Falls and fall prevention

P2-N-104 A novel multivariate approach to characterise stair-negotiating behaviour and detect fall risk in older adults

Presenter: **Thijs Ackermans**

Thijs Ackermans[1], Natasha Francksen[1], Raul Casana-Eslava[1], Carolyn Lees[1], Vasilios Baltzopoulos[1], Paulo Lisboa[1], Mark Hollands[1], Thomas O'Brien[1], Constantinos Maganaris[1]
[1]Liverpool John Moores University

P2-N-105 Walking for better outcomes and recovery: The effect of WALK-FOR in preventing hospital-associated functional decline among older adults

Presenter: **Maayan Agmon**

Maayan Agmon[1], Anna Zisberg[1], Yaniv Cohen[1], Efrat Gil[2], Yehudith Chayat[3], Chedva Levin[4], Nurit Gur-Yaish[1], Debbi Rand[5]
[1]University of Haifa, [2]Clalit Health Services, Israel, [3]Hemek Medical Center, [4]Lev Academic Center, Jerusalem, [5]Tel-Aviv University

P2-N-106 Lateral loss of balance among one-time fallers and recurrent fallers reveals contrasted differences in step thresholds and spatiotemporal parameters compared to non-fallers

Presenter: **Shani Batcir**

Shani Batcir[1], Guy Shani[1], Amir Shapiro[1], Yoav Gimmon[1], Ilan Kurz[1], Itshak Melzer[1]
[1]Ben-Gurion University

P2-N-107 Falling down - limbs and trunk muscles responses to vertical perturbations

Presenter: **Desiderio Cano Porras**

Desiderio Cano Porras[1], Jesse Jacobs[2], Rivka Inzelberg[3], Ofer Keren[1], Gabriel Zeilig[1], Meir Plotnik[1]
[1]Sheba Medical Center, [2]University of Vermont, [3]Tel Aviv University

P2-N-108 Falls and locomotor capabilities in lower limb amputees. First results of a retrospective study from the MOTU project

Presenter: **Lorenzo Chiari**

Lorenzo Chiari[1], Serena Moscato[1], Pericle Randi[2], Luca Palmerini[1], Angelo Davalli[2], Pierpaolo Palumbo[1]
[1]Alma Mater Studiorum - Universita' di Bologna, [2]INAIL Prosthesis Centre

P2-N-109 Measuring foot clearance on outdoor walkways

Presenter: **Ghazaleh Delfi**

Ghazaleh Delfi[1], Megan Kamachi[1], Jose Beltran[2], Tilak Dutta[1]
[1]Toronto Rehabilitation Institute / University of Toronto, [2]Toronto Rehabilitation Institute

P2-N-110 Wearable sensor detection of real-world trips in at-fall risk community dwelling older adults

Presenter: **Shirley Handelzalts**

Shirley Handelzalts[1], Neil Alexander[1], Linda Nyquist[2], Debra Strasburg[1], Nicholas Mastruserio[2], Lauro Ojeda[1]
[1]University of Michigan

P2-N-111 Static balance following a 12-week attentionally focused balance training intervention: Preliminary data

Presenter: **Lauren Higgins**

Lauren Higgins[1], Masa Yamada[1], Ruth Stout[1], Danielle Felsberg[1], Chanel LoJacono[1], Sean Cochran[1], Amanda Barclift[1], John Palazzolo[1], Jeff Labban[1], Jeffrey Fairbrother[1], Christopher Rhea[1], Louisa Raisbeck[1]
[1]University of North Carolina, Greensboro

P2-N-112 Joint angle variance in the bipedal linked chain during curb negotiation

Presenter: **Ashwini Kulkarni**

Ashwini Kulkarni[1], HyeYoung Cho[1], Chuyi Cui[1], Shirley Rietdyk[1], Satyajit Ambike[1], Fabio Barbieri[2]
[1]Purdue University, [2]São Paulo State University (UNESP)

P2-N-113 Functional Gait Assessment (FGA) after a 12-week attentionally focused balance training intervention: Preliminary data

Presenter: **Danielle Felsberg**

Danielle Felsberg[1], Lauren Higgins[1], Ruth Stout[1], Masahiro Yamada[1], Sean Cochran[1], Chanel LoJacono[1], Amanda Barclift[1], John Palazzolo[1], Jeff Labban[1], Jeffrey Fairbrother[1], Christopher Rhea[1], Louisa Raisbeck[1]
[1]University of North Carolina, Greensboro

P2-N-114 Falling for it: The effects of anxiety on balance control

Presenter: **Anna Fielding**

Anna Fielding[1], Will Young[1], Andrew Parton[1]
[1]Brunel University

P2-N-115 Effects of step direction and stimulus modality on step reactions during a prolonged motor-cognitive task in older adults

Presenter: **Eleftheria Giannouli**

Eleftheria Giannouli[1], Wiebren Zijlstra[1]
[1]German Sport University Cologne

P2-N-116 Association of walk ratio during normal gait speed and fall in community-dwelling elderly people

Presenter: **Sho Nakakubo**

Sho Nakakubo[1], Takehiko Doi[1], Kota Tsutsumimoto[1], Min-Ji Kim[1], Satoshi Kurita[1], Hideaki Ishii[1], Hiroyuki Shimada[1]
[1]National Center for Geriatrics and Gerontology

P2-N-117 Validating the rate of perceived stability scale to measure balance training intensity among older adults

Presenter: **Ann Reinthal**

M Ann Reinthal[1], Debbie Espy[1], Lorenzo Bianco[1], Kathryn Kroszkewicz[1]
[1]Cleveland State University

P2-N-118 Transfer and retention effects of perturbation-based treadmill training in older adults

Presenter: **Markus Rieger**

Markus Rieger[1], Selma Papegaaij[2], Mirjam Pijnappels[1], Frans Steenbrink[2], Jaap van Dieën[1]
[1]Vrije Universiteit Amsterdam, [2]Motek Medical BV

P2-N-119 Elderly fallers and non-fallers adjust their posture in anticipation of perturbations

Presenter: **Thomas Robert**

Thomas Robert[1], Charlotte Le Mouel[2], Romain Tisserand[3], Romain Brette[4]
[1]Université de Lyon, [2]Max Planck Institute of Intelligent Systems, [3]University of British Columbia, [4]Sorbonne Université, INSERM, CNRS, Institut de la Vision

P2-N-120 The influence of fear priming on whole-body reaching in young and older adults

Presenter: **Alexander Stamenkovic**

Alexander Stamenkovic[1], Susanne van der Veen[1], James Thomas[1]
[1]Virginia Commonwealth University

P2-N-121 Fall risk and falls are related to spatiotemporal gait asymmetry in older adults: Effect of gait speed

Presenter: **Brian Street**

Brian Street[1]
[1]California State University, Bakersfield

P2-N-122 Lateral balance capacity after external perturbation in persons with chronic stroke

Presenter: **Hideyuki Tashiro**

Hideyuki Tashiro[1], Yui Sato[1], Naoki Kozuka[1]
[1]Sapporo Medical University

P2-N-123 Do falls precede or follow changes in self-efficacy scores regarding falls and gait in community dwelling older adults?

Presenter: **Roel Weijer**

Roel Weijer[1], Marco Hoozemans[1], Jaap van Dieën[1], Mirjam Pijnappels[1]
[1]Vrije Universiteit Amsterdam

O - Habilitation & rehabilitation

P2-O-124 Mediolateral constraints during overhead unloading result in altered gait dynamics and balance regulation

Presenter: **Christopher Easthope**

Christopher Easthope[1], Niklas Ignasiak[2], Mathias Bannwart[1], Sara Bayer[1], Armin Curt[1], Georg Rauter[3], Marc Bolliger[1]
[1]University Hospital Balgrist, [2]Chapman University, [3]University Basel

P2-O-125 Immediate effects of Voluntary-induced Stepping Response (VSR) training on protective stepping in persons with chronic stroke: A randomized control trial

Presenter: **Kristen Hollands**

Kristen Hollands[1], Pornprom Chayasit[2], Mark Hollands[3], Rumpa Boonsinsukh[2]
[1]University of Salford, [2]Srinakharinwirot University, [3]Liverpool John Moores University

P2-O-127 Effects of modified exercise programme for improving axial rigidity and turning dysfunction in individuals with Parkinson's disease

Presenter: **Fuengfa Khobkhun**

Fuengfa Khobkhun[1], Mark Hollands[1], Amornpan Ajjimaporn[2]
[1]Liverpool John Moores University, [2]Mahidol University

P2-O-128 Differences in lateral symmetry of muscle synergies between acute post-stroke patients undergoing robot-assisted therapy and conventional therapy

Presenter: **Chun Kwang Tan**

Chun Kwang Tan[1], Hideki Kadone[1], Hiroki Watanabe[1], Aiki Marushima[1], Yasushi Hada[1], Masashi Yamazaki[1], Yoshiyuki Sankai[1], Kenji Suzuki[1]
[1]University of Tsukuba

P - Modeling

P2-P-129 Visual effects on human balancing responses to support surface translation

Presenter: **Emre Akcay**

Emre Akcay[1], Vittorio Lippi[2], Lorenz Assländer[3], Thomas Mergner[2]
[1]Kocaeli University, [2]Neurological University Clinics, Freiburg, [3]University of Konstanz

P2-P-130 Expanding a model of the dynamic Margin of Stability to evaluate balance control following support-surface perturbations

Presenter: **Keaton Inkol**

Keaton Inkol[1], Lori Ann Vallis[1]
[1]University of Guelph

Q - Neurological diseases

P2-Q-131 Obstacle crossing in fallers with and without Parkinson's disease; influence of attentional demand

Presenter: **Lisa Alcock**

Lisa Alcock[1], Brook Galna[1], Richard Foster[2], Jeff Hausdorff[3], Sue Lord[4], Lynn Rochester[5]
[1]Newcastle University, [2]Liverpool John Moores University, [3]Tel-Aviv Sourasky Medical Center, [4]Auckland University of Technology, [5]Institute of Neuroscience, Newcastle University

P2-Q-132 Parkinson's disease delays predictable visual cue processing although does not affect complex and non-predictable visual cue processing in postural control

Presenter: **José Barela**

Jose Barela[1], Caio Cruz[2], Flávia Doná[3], Vitor Amaral[4], Henrique Ferraz[3], Ana Barela[4]
[1]São Paulo State University (UNESP), [2]University of São Paulo, [3]Federal University of São Carlos (UFSCar), [4]Cruzeiro do Sul University

P2-Q-133 Impact of attentional abilities on step initiation in patients with Parkinson's disease with and without freezing of gait

Presenter: **Madli Bayot**

Madli Bayot[1], Aurore Braquet[1], Céline Tard[1], Luc Defebvre[1], Kathy Dujardin[1], Arnaud Delval[1]
[1]University of Lille - Inserm U1171-Degenerative and Vascular Cognitive Disorders

P2-Q-134 Postural biomechanical predictors of subjective and objective measures of severity of freezing of gait in Parkinson's disease

Presenter: **Daniel Coelho**

Daniel Coelho[1], Caroline Souza[1], Carla Silva-Batista[1], Andrea de Lima-Pardini[2], Alexandre Bastos[2], Luis Teixeira[1]
[1]University of São Paulo, [2]Federal University of ABC

P2-Q-135 Is mediolateral dynamic balance in Parkinson's disease similar between freezers and non-freezers?

Presenter: **Bauke Dijkstra**

Bauke Dijkstra[1], Moran Gilat[1], L. Eduardo Cofré Lizama[2], Sabine Verschueren[1], Alice Nieuwboer[1]
[1]KU Leuven, [2]University of Melbourne

P2-Q-136 Factors related to unanticipated obstacle negotiation success: Association with Parkinson's disease and motor planning

Presenter: **Irina Galperin**

Irina Galperin[1], Eran Gazit[2], Ilan Kurtz[1], Topaz Sharon[2], Marina Brozgol[2], Nir Giladi[2], Anat Mirelman[2], Jeff Hausdorff[2]
[1]Center for the Study of Movement, Cognition and Mobility, Neurological Institute, Tel Aviv Sourasky, [2]Tel-Aviv Sourasky Medical Center

P2-Q-137 Oxygenated hemoglobin concentration levels during usual walking and obstacle course in people with Parkinson's Disease (PD)

Presenter: **Lilian Gobbi**

Lilian Gobbi[1], Diego Orcioli-Silva[1], Priscila Sousa[1], Nubia Conceição[1], Victor Beretta[1], Ellen Lirani-Silva[1], Rodrigo Vitório[1]
[1]São Paulo State University (UNESP)

P2-Q-138 Characterization of novel centre of pressure cyclogram measures during double support phase of gait in people with stroke

Presenter: **Sarah Gregor**

Sarah Gregor[1], Julie Vaughan-Graham[2], Kara Patterson[1]
[1]University of Toronto, [2]Toronto Rehabilitation Institute

P2-Q-139 Influence of ankle-foot orthosis with different type of joint on walking parameters in stroke patients

Presenter: **Naruhito Hasui**

Naruhito Hasui[1], Naomichi Mizuta[1], Yasutaka Higa[2], Yasutada Yamamoto[2], Ayaka Matsunaga[2], Tomoki Nakatani[2], Masako Tsutsumi[2], Junji Taguchi[2], Yohei Okada[3]
[1]Department of Neurorehabilitation, Graduate School of Health Sciences, Kio University, [2]Takarazuka Rehabilitation Hospital, [3]University of Kio

P2-Q-140 Can quantitative gait parameters serve as progression marker of Parkinson's disease? A longitudinal study over 5 years

Presenter: **Markus Hobert**

Markus Hobert[1], Susanne Nussbaum[2], Tanja Heger[2], Daniela Berg[1], Walter Maetzler[1], Sebastian Heinzel[1]
[1]Christian-Allbrechts-University of Kiel, [2]University of Tuebingen

P2-Q-141 What can EMG tell us about the neuromotor control of gait in Parkinson's disease?

Presenter: **Aisha Islam**

Aisha Islam[1], Lisa Alcock[1], Kianoush Nazarpour[1], Lynn Rochester[2], Annette Pantall[1]
[1]Newcastle University, [2]Institute of Neuroscience, Newcastle University

P2-Q-142 Split-Belt Treadmill walking in people with Parkinson's disease: A systematic review

Presenter: **Seuthe Jana**

Jana Seuthe[1], Nicholas D'Cruz[2], Pieter Ginis[2], Burkhard Weisser[1], Daniela Berg[1], Günther Deuschl[3], Alice Nieuwboer[2], Christian Schlenstedt[1]
[1]Christian-Allbrechts-University of Kiel, [2]KU Leuven, [3]University Hospital Schleswig Holstein, Christian-Albrechts University Kiel

P2-Q-143 Functional gait disorders and the broken escalator phenomenon

Presenter: **Diego Kaski**

Diego Kaski[1], Denise Lin[2], Akila Ramamoorthy[2], Patricia Castro[2], Amy Edwards[2], Jan Coebergh[3], Mark Edwards[3], Adolfo Bronstein[2]
[1]University College London, [2]Imperial College London, [3]St George's Hospital

P2-Q-144 Central cholinergic activity and risk of falls in patients with Parkinson's disease and freezing of gait

Presenter: **Giovanna Lagravinese**

Giovanna Lagravinese[1], Gaia Bonassi[1], Martina Putzolu[1], Alessandro Botta[1], Carola Cosentino[1], Anat Mirelman[2], Elisa Pelosin[1], Laura Avanzino[1]
[1]University of Genoa, [2]Tel-Aviv Sourasky Medical Center

P2-Q-145 Why do asymmetric gait patterns persist after deep brain stimulation in Parkinson's disease?

Presenter: **Deepak Ravi**

Deepak Ravi[1], Michelle Gwerder[1], Niklas Ignasiak[2], Christian Baumann[3], Mechtild Uhl[3], William Taylor[1], Navrag Singh[1]
[1]ETH Zurich, [2]Chapman University, [3]University Hospital Zurich

P2-Q-146 The effect of closed-loop tactile feedback on gait initiation in people with Parkinson's disease with Freezing of Gait

Presenter: **Christian Schlenstedt**

Christian Schlenstedt[1], Daniel Peterson[2], Martina Mancini[3]
[1]Christian-Allbrechts-University of Kiel, [2]Arizona State University, [3]Oregon Health & Science University

P2-Q-147 Clinical meaningful thresholds of temporal and spatial gait parameters in the context of the differential diagnosis in gait ataxia

Presenter: **Roman Schniepp**

Roman Schniepp[1], Max Wuehr[1], Julian Decker[1]
[1]Ludwig-Maximillians Universität München

P2-Q-148 Quantity and quality of gait in PD, MS and healthy people in a community setting

Presenter: **Vrutangkumar Shah**

Vrutangkumar Shah[1], James McNames[2], Patricia Carlson-Kuhta[1], Rebecca Spain[1], John Nutt[1], Mahmoud El Gohary[3], Fay Horak[1], Carolin Curtze[4]
[1]Oregon Health & Science University, [2]Portland State University, [3]APDM, [4]University of Nebraska Omaha

P2-Q-149 Antero-posterior foot placement is disturbed in people with Parkinson's disease: Preliminary data

Presenter: **Lucas Simieli**

Lucas Simieli[1], Sjoerd Bruijn[2], Erwin E van Wegen[3], Fabio Barbieri[1], Jaap van Dieën[2]
[1]São Paulo State University (UNESP), [2]Vrije Universiteit Amsterdam, [3]Amsterdam Universitair Medisch Centrum

P2-Q-150 Predictors of subjective and objective measures of severity of freezing of gait in Parkinson's disease

Presenter: **Caroline Souza**

Caroline Souza[1], Acacio Neto[1], Daniel Coelho[1], Andrea Lima-Pardini[2], Raquel Marquesini[1], Alana Batista[1], Egberto Barbosa[1], Carlos Ugrinowitsch[1], Luis Teixeira[1], Carla Silva-Batista[1]
[1]University of São Paulo, [2]Federal University of ABC

P2-Q-151 Natural progression of gait impairment in early Parkinson's disease: A six-year prospective incident cohort study

Presenter: **Joanna Wilson**

Joanna Wilson[1], Alison Yarnall[1], Sue Lord[2], Lisa Alcock[1], Rosie Morris[3], David Burn[1], Lynn Rochester[4], Brook Galna[1]
[1]Newcastle University, [2]Auckland University of Technology, [3]Oregon Health & Science University, [4]Institute of Neuroscience, Newcastle University

P2-Q-152 MTBI and PTSD are dissociable using novel posturography assessments

Presenter: **W.Geoffrey Wright**

W. Geoffrey Wright[1], Amanda Haskell[2], Labeeby Servatius[2], Justin Handy[3], Richard Servatius[2]
[1]Temple University, [2]Veterans Administration Medical Center (VAMC), [3]NSMRL

P2-Q-153 Frailty status predicts falls in early Parkinson's disease

Presenter: **Alison Yarnall**

Alison Yarnall[1], Shauna Holland[1], Rosie Morris[2], Sue Lord[3], Brook Galna[1], Lynn Rochester[4]
[1]Newcastle University, [2]Oregon Health & Science University, [3]Auckland University of Technology, [4]Institute of Neuroscience, Newcastle University

R - Orthopedic diseases and injuries

P2-R-154 Collegiate athletes with a conservative gait strategy are more likely to sustain a lower extremity musculoskeletal injury following concussion

Presenter: **Jessie Oldham**

Jessie Oldham[1], David Howell[2], Christopher Knight[3], Jeremy Crenshaw[3], Thomas Buckley[3]
[1]Boston Children's Hospital, [2]Children's Hospital Colorado, [3]University of Delaware

T - Psychiatric disorders

P2-T-155 Short postural training affects stability in children with autism spectrum disorders

Presenter: **Simona Caldani**

Simona Caldani[1], Maud Tisne[1], Paola Atzori[1], Hugo Peyre[1], Richard Delorme[1], Maria Pia Bucci[1]
[1]Hopital Robert Debré

U - Robotics

P2-U-156 Bilateral reshaping of gait coordination in hemiparetic stroke patients after early robotic intervention

Presenter: **Sandra Puentes**

Sandra Puentes[1], Hideki Kadone[1], Hiroki Watanabe[1], Yasushi Hada[1], Tomoyuki Ueno[1], Aiki Marushima[2], Yoshiyuki Sankai[1], Kenji Suzuki[1]
[1]University of Tsukuba, [2]Faculty of Medicine, University of Tsukuba Hospital

V - Sensorimotor control

P2-V-157 Effects of ankle muscle fatigue and visual behavior on postural sway in young adults

Presenter: **Fabio Barbieri**

Fabio Barbieri[1], Tiago Penedo[1], Lucas Simieli[1], Ricardo Barbieri[2], Alessandro Zagatto[1], Jaap van Dieën[3], Mirjam Pijnappels[3], Sérgio Rodrigues[1], Paula Polastri[1]
[1]São Paulo State University (UNESP), [2]Graduate Program in Physical Education and Sport at School of Physical Education and Sport of Ribeir, [3]Vrije Universiteit Amsterdam

P2-V-158 Lightly gripping a motionless handle: Study of postural sway decrease and correlation between transient force changes applied to the handle and balance

Presenter: **Angélina Bellicha**

Angélina Bellicha[1], Andrés Trujillo-León[1], Wael Bachta[1]
[1]Sorbonne Université - ISIR

P2-V-159 Dynamic reweighting of three modalities for sensor fusion after repetitive head impact

Presenter: **Jaclyn Caccese**

Jaclyn Caccese[1], Fernando dos Santos[1], John Jeka[1]
[1]University of Delaware

P2-V-160 Threat-related changes in postural control in virtual environments

Presenter: **Jernej Camernik**

Jernej Camernik[1], Sanja Kezic[2], Jan Babic[1]
[1]Institute Jozef Stefan, [2]Jozef Stefan Institute

P2-V-161 The effects of lighting level on balance in dancers

Presenter: **Elizabeth Coker**

Elizabeth Coker[1], Terry Kaminski[2]
[1]NYU/Tisch School of the Arts, [2]Teachers College of Columbia University

P2-V-162 Gender and form of thin plantar retrocapital metatarsal bar stimulations influence on postural control

Presenter: **Marc Janin**

Marc Janin[1]
[1]Université de Pau et des pays L'adour & Podiatrist office Poitiers

P2-V-163 The role of the vestibular system in the preparation of arm movements

Presenter: **Michael Kennefick**

Michael Kennefick[1], Joel Burma[1], Paige Copeland[1], Paul van Donkelaar[1], Chris McNeil[1], Brian Dalton[1]
[1]University of British Columbia Okanagan

P2-V-164 Support Surface Translation - Sway responses of vestibular able subjects resemble those of vestibular loss subjects

Presenter: **Thomas Mergner**

Thomas Mergner[1], Emre Akcay[2], Vittorio Lippi[1], Lorenz Assländer[3]
[1]Neurological University Clinics, Freiburg, [2]Kocaeli University, [3]University of Konstanz

P2-V-165 The effects of remote subthreshold stimulation on skin sensitivity in the lower extremity

Presenter: **Emma Plater**

Emma Plater[1], Ryan Peters[2], Leah Bent[1]
[1]University of Guelph, [2]University of Calgary

P2-V-166 Electrocortical dynamics related to ankle proprioception reweighting

Presenter: **Martin Simoneau**

Martin Simoneau[1], Catherine Bluteau[1], Anctil Noémie[1]
[1]Université Laval

P2-V-167 Collision avoidance between two walkers: Reduced avoidance behaviour in previously concussed athletes

Presenter: **Natalie Snyder**

Natalie Snyder[1], Michael Cinelli[1], Victoria Rapos[1], Armel Crétual[2], Anne-Hélène Olivier[2]
[1]Wilfrid Laurier University, [2]University of Rennes / Inria

P2-V-168 Virtual time-to-contact indicates deficits in state prediction in women with multiple sclerosis

Presenter: **Tyler Whittier**

Tyler Whittier[1], Sutton Richmond[1], Andrew Monaghan[1], Clayton Swanson[1], Brett Fling[1]
[1]Colorado State University

W - Tools and methods for posture and gait analysis

P2-W-169 Test-retest reliability of frequency-domain measures of balance among people with sub-acute stroke

Presenter: **Raabeae Aryan**

Raabeae Aryan[1], Andrew Huntley[2], Elizabeth Inness[2], Kara Patterson[1], Avril Mansfield[2]
[1]University of Toronto, [2]Toronto Rehabilitation Institute

P2-W-170 Evaluation of gait in the non-rigid XoSoft exo-skeleton in stroke and SCI patients

Presenter: **Chris Baten**

Chris Baten[1], Corien Nikamp[1], Leendert Schaake[1], Jaap Buurke[1]
[1]Roessingh Research and Development

P2-W-171 Development of a clinical scale to assess retropulsion in neurological disorders

Presenter: **Jeannine Bergmann**

Jeannine Bergmann[1], Carmen Krewer[1], Eberhard Koenig[1], Friedemann Müller[1], Klaus Jahn[2]
[1]Schön Klinik Bad Aibling, [2]Ludwig-Maximillians Universität München

P2-W-172 The inter relations between arm-leg, arm-arm and leg-leg coordination during human walking

Presenter: **Maya Cohen**

Maya Cohen[1], Uri Rosenblum[2], Desiderio Cano Porras[1], Oran Ben Gal[2], Meir Plotnik[1]
[1]Sheba Medical Center, [2]Center for the Study of Movement, Cognition and Mobility, Neurological Institute, Tel Aviv Sourasky

P2-W-173 Can an Inertial Measurement Unit assess the Shank-to-Vertical Angle in healthy individuals?

Presenter: **Lysanne de Jong**

Lysanne de Jong[1], Yvette Kerkum[2], Jeske Jansens[1], Noel Keijsers[1]
[1]Sint Maartenskliniek, [2]OIM Orthopedie

P2-W-174 Mobility disability in older adults through the eyes of the tandem walk

Presenter: **Natalie Ganz**

Natalie Ganz[1], Eran Gazit[1], Aron Buchman[2], Anat Mirelman[1], Jeff Hausdorff[1]
[1]Tel-Aviv Sourasky Medical Center, [2]Rush Alzheimer's Disease Center

P2-W-175 Thinking about walking: A new approach to quantifying gait initiation using a wearable sensor

Presenter: **Eran Gazit**

Eran Gazit[1], Marina Brozgol[1], Pablo Cornejo Thumm[1], Robert Dawe[2], Thomas Curran[2], Anat Mirelman[1], Jeff Hausdorff[1], Aron Buchman[2]
[1]Tel-Aviv Sourasky Medical Center, [2]Rush Alzheimer's Disease Center

P2-W-176 The association between physical capacity, physical performance, and fall risk in young seniors

Presenter: **Katharina Gordt**

Katharina Gordt[1], Anisoara Paraschiv-Ionescu[2], Anna Mikolaizak[3], Kristin Taraldsen[4], Sabato Mellone[5], Ronny Bergquist[4], Jeanine Van Ancum[6], Corinna Nerz[3], Miriam Pijnappels[6], Andrea Maier[6], Jorunn Helbostad[4], Beatrix Vereijken[4], Clemens Becker[3], Kamiar Am
[1]Network Aging Research, [2]Ecole Polytechnique Fédérale de Lausanne (EPFL), [3]Robert-Bosch-Krankenhaus, [4]Norwegian University of Science and Technology Trondheim, [5]University of Bologna, [6]Vrije Universiteit Amsterdam

P2-W-177 Gait analysis by the use of handy three-dimensional acceleration sensors

Presenter: **Kazuo Ishikawa**

Kazuo Ishikawa[1], Aya Asari[1], Hiromoto Kimura[1]
[1]Japanese Red Cross Akita Hospital

P2-W-178 Development and content validity of a scale assessing lateropulsion in stroke patients: The SCALA

Presenter: **Dominic Pérennou**

Dominic Pérennou[1], Anais Odin[2], Emmuelle Clarac[2], Andréa Kistner[2], Shenhao Dai[2], Maud Barbado[2], Emilie Chipon[2], Carole Vuillerot[2], Jean-Luc Bosson[2], Alexandre Moreau-Gaudry[2], Céline Piscicelli[1]
[1]University Hospital Grenoble-Alpes, [2]Grenoble Alpes University Hospital

P2-W-179 Impact of a thin plantar orthopaedic insert on posture and locomotion

Presenter: **Carole Puil**

Carole Puil[1], Anne Hélène Olivier[2], Armel Crétual[3]
[1]Rennes University - IFPEK - M2S Laboratory, [2]Rennes University -INRIA - M2S Laboratory, [3]University of Rennes / Inria

P2-W-180 Deterioration of specific aspects of gait during the instrumented 6-minute walk test among people with multiple sclerosis

Presenter: **Shirley Shema Shiratzky**

Shirley Shema Shiratzky[1], Eran Gazit[1], Ruopeng Sun[2], Keren Regev[1], Arnon Karni[1], Jacob Sosnoff[2], Anat Mirelman[1], Jeff Hausdorff[1]
[1]Tel-Aviv Sourasky Medical Center, [2]University of Illinois at Urbana-Champaign

P2-W-181 Preliminary evaluation of a self-guided fall risk assessment tool for older adults

Presenter: **Ruopeng Sun**

Ruopeng Sun[1], Roberto Aldunate[1], Vignesh Paramathayalan[2], Rama Ratnam[1], Sanjiv Jain[3], Daniel Morrow[1], Jacob Sosnoff[1]
[1]University of Illinois at Urbana-Champaign, [2]Robert-Bosch-Krankenhaus, [3]Carle Foundation Hospital

X - Vestibular function and disorders

P2-X-182 Body spatial representation in unilateral vestibular patients: Evolution before and after surgery

Presenter: **Liliane Borel**

Liliane Borel[1], Mathilde Bachelard-Serra[2], Laurence Bernard-Demanze[2], Jean-Pierre Lavieille[2], Arnaud Saj[3], Jacques Honoré[4]
[1]CNRS & Aix-Marseille Univ, [2]Hôpital de la Conception, AP-HM, [3]Geneva University Hospitals, [4]Université de Lille

P2-X-183 The effect of roll circular vection on the subjective postural horizontal

Presenter: **Taylor Cleworth**

Taylor Cleworth[1], John H. Allum[2], Emma Nielsen[3], Mark Carpenter[3]
[1]University of Waterloo, [2]University of Basel Hospital, [3]University of British Columbia

P2-X-184 EEG correlates of postural dizziness of aging

Presenter: **Richard Ibitoye**

Richard Ibitoye[1], Patricia Castro[1], Onur Guven[1], Amy Edwards[1], Qadeer Arshad[1], Adolfo Bronstein[1]
[1]Imperial College London

P2-X-185 Quantitative gait analysis of acoustic neuroma patients using portable accelerometer

Presenter: **Koh Koizumi**

Koh Koizumi[1], Kazuo Ishikawa[2]
[1]Akita University, [2]Japanese Red Cross Akita Hospital

P2-X-186 Phase- and speed-dependent modulation of vestibulo-ocular reflexes during walking

Presenter: **Max Wühr**

Max Wühr[1], Haike Dietrich[1]
[1]Ludwig-Maximillians Universität München

P2-X-187 Optimal treatment period for vestibular balance rehabilitation in patients with chronic unilateral vestibular dysfunction

Presenter: **Toshiaki Yamanaka**

Toshiaki Yamanaka[1]
[1]Nara Medical University

P2-X-188 The utricular hypofunction of patients with type 2 diabetes mellitus has a subtle influence on the static postural control with neck extension

Presenter: **Kathrine Jáuregui-Renaud**

Kathrine Jáuregui-Renaud[1], Catalina Aranda-Moreno[1], Julio Villaseñor-Moreno[1], María Giraldez-Fernandez[1], Martha Gutierrez-Castañeda[1], Ignacio Figueroa-Padilla[1], Ana Saucedo-Zainos[1]
[1]Instituto Mexicano Del Seguro Social

P2-X-189 Detecting alterations in head movements in individuals with vestibulopathy of varying etiology

Presenter: **Brian Loyd**

Lee Dibble[1], Brian Loyd[1], Annie Fangman[1], Janie Savier-Steiger[1], Mark Lester[2], Serene Paul[3]
[1]University of Utah, [2]Army-Baylor University, [3]University of Sydney

P2-X-190 Can the vestibulocollic response be modulated by optic flow?

Presenter: **Yawen Yu**

Yawen Yu[1], Emily Keshner[2]
[1]Colorado State University, [2]Temple University

POSTER SESSION 3: THURSDAY 4TH JULY

A - Activity monitoring

P3-A-1 Associations between laboratory-based assessments and daily physical activity in patients with Parkinson's disease: Can one replace the other?

Presenter: **Ira Galperin**

Inbar Hillel[1], Ira Galperin[1], Silvia Del Din[2], Esther Bekkers[3], Alice Nieuwboer[3], Giovanni Abbruzzese[4], Laura Avanzino[5], Freek Nieuwhof[6], Bastiaan Bloem[6], Lynn Rochester[7], Ugo Della Croce[8], Andrea Cereatti[8], Nir Giladi[1], Anat Mirelman[1], Jeff Hausdorff[1]
[1]Tel-Aviv Sourasky Medical Center, [2]Newcastle University, [3]KU Leuven, [4]University of Genova & IRCCS San Martino Teaching Hospital, [5]University of Genoa, [6]Radboud University Medical Center, [7]Institute of Neuroscience, Newcastle University, [8]University of Sassari & Interuniversity Centre of Bioengineering of the Human Neuromusculoskeletal

P3-A-2 Comparison among PD, MS and healthy people between prescribed gait test and continuous monitoring of gait in a community setting

Presenter: **Vrutangkumar Shah**

Vrutangkumar Shah[1], James McNames[2], Patricia Carlson-Kuhta[1], Rebecca Spain[1], John Nutt[1], Mahmoud El Gohary[3], Fay Horak[1], Carolin Curtze[4]
[1]Oregon Health & Science University, [2]Portland State University, [3]APDM, [4]University of Nebraska Omaha

B - Adaptation, learning, plasticity and compensation

P3-B-3 Examining neural plasticity for slip-perturbation training: An fMRI study

Presenter: **Tanvi Bhatt**

Tanvi Bhatt[1], Patel Prakruti[1], Shamali Dusane[1], Sophie DelDonno[1], Scott Scott Langenecker[1]
[1]University of Illinois at Chicago

P3-B-4 Modulation of H-reflex; Effect of age and surface stiffness

Presenter: **Leila Alizadehsaravi**

Leila Alizadehsaravi[1], Sjoerd Bruijn[1], Huub Maas[1], Jaap van Dieën[1]
[1]Vrije Universiteit Amsterdam

P3-B-5 After-effect magnitude predicts retention in split-belt gait adaptation

Presenter: **Tom Buurke**

Tom Buurke[1], Claudine Lamoth[1], Lucas van der Woude[1], Rob den Otter[1]
[1]University Medical Center Groningen

P3-B-6 Combined study of segmental movements and motion of the centre of mass during adaptation on a split-belt treadmill

Presenter: **Luigi Catino**

Luigi Catino[1], Chiara Diletta Malloggi[2], Luigi Tesio[2]
[1]Università degli Studi di Milano, [2]IRCCS Santa Lucia Foundation

P3-B-7 Perceptions of induced temporal gait asymmetry in healthy adults

Presenter: **Lucas Crosby**

Lucas Crosby[1], Jessica Grahn[2], Joyce Chen[1], Kara Patterson[1]
[1]University of Toronto, [2]Brain & Mind Institute - Western University

P3-B-8 Retention of entrained auditory fractal patterns during gait

Presenter: **Vincenzo Di Bacco**

Vincenzo Di Bacco[1], Jeevaka Kiriella[1], Kristen Hollands[2], William Gage[1]
[1]York University, [2]University of Salford

P3-B-9 A new approach using electrical muscle stimulation to elucidate sensorimotor adaptation in human postural control system

Presenter: **Shota Hagio**

Shota Hagio[1], Anvar Azat[1], Daichi Nozaki[1]
[1]University of Tokyo

P3-B-10 Cortical correlates of gait adaptation to walking with a transfemoral dummy prosthesis

Presenter: **Vera Kooiman**

Vera Kooiman[1], Vivian Weerdesteyn[1], Helco van Keeken[2], Natasha Maurits[2], Teodoro Solis-Escalante[1]
[1]Radboud University Medical Center, [2]University of Groningen, University Medical Center Groningen

P3-B-11 Retention, savings and interlimb transfer of reactive gait adaptations in humans following unexpected perturbations

Presenter: **Christopher McCrum**

Christopher McCrum[1], Kiros Karamanidis[2], Paul Willems[1], Wiebren Zijlstra[3], Kenneth Meijer[1]
[1]Maastricht University, [2]London South Bank University, [3]German Sport University Cologne

C - Aging

P3-C-13 Effect of postural training in age-related macular degeneration subjects

Presenter: **Hortense Chatard**

Hortense Chatard[1], Laure Tepenier[2], Talal Beydoun[2], Olivier Offret[2], Sawsen Salah[2], José-Alain Sahel[3], Saddek Mohand-Said[3], Maria Pia Bucci[4]
[1]INSERM, [2]Department of Ophthalmology, Assistance Publique-Hôpitaux de Paris, Paris Descartes University, [3]Sorbonne University, Institut de la Vision, Centre Hospitalier National d'Ophtalmologie des Quinze-V, [4]Hopital Robert Debré

P3-C-14 Normative data of turning parameters in a large cohort of older adults using wearable sensors a four-year longitudinal study

Presenter: **Morad Elshehabi**

Morad Elshehabi[1], Minh Pham[1], Clint Hansen[1], Elke Warmerdam[1], Susanne Nussbaum[2], Daniela Berg[1], Walter Maetzler[1]
[1]Christian-Allbrechts-University of Kiel, [2]University of Tuebingen

P3-C-15 Regional associations of grey matter volume with gait variability-the Tasmanian Study of Cognition and Gait

Presenter: **Oshadi Jayakody**

Oshadi Jayakody[1], Monique Breslin[1], Richard Beare[2], Velandai Srikanth[2], Helena Blumen[3], Michele Callisaya[1]
[1]University of Tasmania, [2]Peninsula Health, Monash University, [3]Albert Einstein College of Medicine

P3-C-16 Healthy older adults regulate lateral stepping in destabilizing environments

Presenter: **Meghan Kazanski**

Jonathan Dingwell[1], Meghan Kazanski[1], Joseph Cusumano[1]
[1]Pennsylvania State University

P3-C-17 Do falls or fragility predict fracture in Māori and non-Māori in advanced age; LiLACS NZ

Presenter: **Ngaire Kerse**

Ngaire Kerse[1], Ruth Teh[1], Leah Palaper[1], Oliver Menzies[1], Catherine Bacon[1]
[1]University of Auckland

P3-C-18 Adherence to a programme has greater impact on function and behavioural complexity improvement than group allocation in young seniors at risk of functional decline

Presenter: **A. Stefanie Mikolaizak**

A. Stefanie Mikolaizak[1], Kristin Taraldsen[2], Elisabeth Boulton[3], Beatrix Vereijken[2], Chris Todd[3], Anisoara Paraschiv-Ionescu[4], Kamiar Aminian[4], Andrea Maier[5], Mirjam Pijnappels[5], Katharina Gordt[1], Jorunn Helbostad[2], Clemens Becker[1]
[1]Robert Bosch Medical Foundation, [2]Norwegian University of Science and Technology, [3]University of Manchester, [4]Ecole Polytechnique Fédérale de Lausanne (EPFL), [5]Vrije Universiteit Amsterdam

P3-C-19 Gait speed assessed by a 4-meter walk test is not representative of daily-life gait speed in community-dwelling adults

Presenter: **Mirjam Pijnappels**

Mirjam Pijnappels[1], Jeanine Van Ancum[1], Kimberley van Schooten[2], Nini Jonkman[1], Bas Huijben[3], Rob Van Lummel[3], Carel Meskers[4], Andrea Maier[1]
[1]Vrije Universiteit Amsterdam, [2]Neuroscience Research Australia, University of New South Wales, [3]McRoberts, [4]Amsterdam UMC, Vrije Universiteit Amsterdam

P3-C-20 The effect of optic flow stimuli on standing balance in young and older people with low and high fall risk

Presenter: **Daina Sturnieks**

Daina Sturnieks[1], Matthew Brodie[1], Brandon Chen Yi Tan[2], Michela Persiani[3], Stephen Lord[1]
[1]Neuroscience Research Australia, University of New South Wales, [2]University of New South Wales, [3]Sede di Fisiologia Università di Bologna

P3-C-21 Associations between mobility and dementia subtypes in nursing home residents

Presenter: **Karen Sverdrup**

Karen Sverdrup[1], Sverre Bergh[2], Geir Selbæk[1], Pernille Thingstad[3], Gro Tangen[1]
[1]Norwegian National Advisory Unit on Ageing and Health, [2]Innlandet Hospital trust., [3]Norwegian University of Science and Technology

P3-C-22 Consistency and test-retest reliability of stepping tests designed to measure self-perceived and actual physical stepping ability in older adults

Presenter: **Roel Weijer**

Roel Weijer[1], Marco Hoozemans[1], Jaap van Dieën[1], Mirjam Pijnappels[1]
[1]Vrije Universiteit Amsterdam

D - Biomechanics

P3-D-23 Stiff-knee gait: Effects of knee restriction in the gait of non-impaired individuals

Presenter: **Ana Barela**

Ana Barela[1], Odair Ramirez[1], Dinah Santana[1], Melissa Celestino[1], Valeriya Gritsenko[2], Sergiy Yakovenko[2], José Barela[3]
[1]Cruzeiro do Sul University, [2]West Virginia University, [3]São Paulo State University (UNESP)

P3-D-24 The effects of varying midsole cushioning in footwear on gait in females with multiple sclerosis

Presenter: **Andrew Monaghan**

Andrew Monaghan[1], Sutton Richmond[1], Clayton Swanson[1], Daniel Peterson[2], Brett Fling[1]
[1]Colorado State University, [2]Arizona State University

P3-D-25 Anticipatory postural adjustment for an accurate step

Presenter: **Masahiro Shinya**

Masahiro Shinya[1], Hiroki Yamada[1]
[1]Hiroshima University

P3-D-26 Motion patterns that cause the increase of integrated knee muscle torque in individuals with knee osteoarthritis

Presenter: **Moeka Sonoo**

Moeka Sonoo[1], Tsutomu Fujino[2], Keisuke Kubota[1], Shunsuke Kita[1], Hiroki Hanawa[1], Keisuke Hirata[1], Takanori Kokubun[1], Naohiko Kanemura[1]
[1]Saitama Prefectural University, [2]University of Human Arts and Sciences

P3-D-27 The effect of self-paced and fixed speed treadmill walking on the energetic cost of transport

Presenter: **Kyra Theunissen**

Kyra Theunissen[1], Guy Plasqui[1], Peter Feys[2], Annelies Boonen[1], Annick Timmermans[2], Pieter Meyns[2], Kenneth Meijer[3]
[1]Maastricht University Medical Center, [2]Hasselt University, [3]Maastricht University

P3-D-28 Are a few millimeters added under the big toe enough to improve postural control in elite handball players?

Presenter: **Frederic Viseux**

Frédéric Viseux[1], Philippe Villeneuve[2], Rodolfo Parreira[3], Franck Barbier[1], Antoine Lemaire[4], Sebastien Leteneur[1]
[1]LAMIH - University of Valenciennes - France, [2]Posture Lab - Paris, [3]LaNEx - University of Southern Santa Catarina - Brazil, [4]CETD - Centre Hospitalier de Valenciennes – France

E - Brain imaging/activation during posture and gait

P3-E-29 The effect of walking speed on cortical activity in young and older adults

Presenter: **Lisa Alcock**

Lisa Alcock[1], Rodrigo Vitório[2], Samuel Stuart[3], Lynn Rochester[4], Annette Pantall[1]
[1]Newcastle University, [2]São Paulo State University (UNESP), [3]Oregon Health & Science University, [4]Institute of Neuroscience, Newcastle University

P3-E-30 Parkinson's disease affects neural activation during continuous alterations to the split-belt treadmill: An [18F] FDG PET Study

Presenter: **Dorelle Hinton**

Dorelle Hinton[1], Alexander Thiel[1], Laurent Bouyer[2], Jean-Paul Soucy[1], Caroline Paquette[1]
[1]McGill University, [2]Université Laval

P3-E-31 Readiness potential of gait initiation recorded with mobile EEG

Presenter: **Nadine Jacobsen**

Nadine Jacobsen[1], Stefan Debener[1]
[1]University of Oldenburg

P3-E-32 Single-session transcranial direct current stimulation alters the cortical response to dual task walking in functionally-limited older adults-a pilot study

Presenter: **Azizah Jor'dan**

Azizah Jor'dan[1], Hagar Bernard-Elazari[2], Anat Mirelman[2], On-Yee Lo[3], Jeffrey Hausdorff[2], Brad Manor[3]
[1]VA Boston Healthcare System/Harvard Medical School, [2]Tel-Aviv Sourasky Medical Center, [3]Hebrew SeniorLife

P3-E-33 Activity in the sensorimotor cortex during action observation of walking combined with motor imagery

Presenter: **Naotsugu Kaneko**

Naotsugu Kaneko[1], Hikaru Yokoyama[2], Yohei Masugi[3], Katsumi Watanabe[4], Kimitaka Nakazawa[1]
[1]University of Tokyo, [2]Tokyo University of Agriculture and Technology, [3]Tokyo International University, [4]Waseda University

P3-E-34 Functional near infra-red spectroscopy neuroimaging of prefrontal cortex in Parkinson's disease during cognitive tasks under different postures

Presenter: **Graham Kerr**

Graham Kerr[1], Mark Muthalib[2], Roger Pegoraro[1], Luisa Roeder[1], Ian Stewart[1], Simon Smith[3]
[1]Queensland University of Technology, [2]University of Montpellier, [3]University of Queensland

P3-E-35 Brain activation during real-time walking post-stroke: Systematic review

Presenter: **Shannon Lim**

Shannon Lim[1], Dennis Riley Louie[1], Janice Eng[1]
[1]University of British Columbia

P3-E-36 Resting state functional connectivity of normal and dual-task walking in healthy older adults

Presenter: **On-Yee Lo**

On-Yee Amy Lo[1], Mark Halko[2], Victoria Poole[1], Junhong Zhou[3], Lewis Lipsitz[1], Brad Manor[3]
[1]Hebrew SeniorLife / Harvard Medical School, [2]Beth Israel Deaconess Medical Center / Harvard Medical School, [3]Harvard Medical School

P3-E-37 Prefrontal and motor cortical activity during stepping tasks in older people at low and high risk of falling

Presenter: **Paulo Pelicioni**

Paulo Pelicioni[1], Stephen Lord[1], Nigel Seng[1], Bethany Halmy[1], Daina Sturnieks[1], Rui Liu[1], Jasmine Menant[1]
[1]Neuroscience Research Australia, University of New South Wales

P3-E-38 The neural correlates of discrete gait characteristics in ageing: A structured review

Presenter: **Joanna Wilson**

Joanna Wilson[1], Liesl Allcock[2], Riona Mc Ardle[1], John-Paul Taylor[1], Lynn Rochester[3]
[1]Newcastle University, [2]Hexham General Hospital, [3]Institute of Neuroscience, Newcastle University

P3-E-39 Cortical muscle synergy representations reveal functional modulation as a function of short-term balance training

Presenter: **Coen Zandvoort**

Coen Zandvoort[1], Jaap van Dieën[1], Nadia Dominici[1], Andreas Daffertshofer[1]
[1]Vrije Universiteit Amsterdam

F - Cognitive impairments

P3-F-40 Gait as a potential marker of cognitive decrements in Type 2 Diabetes (T2DM): Early results from the ENBIND study

Presenter: **Adam Dyer**

Adam Dyer[1], Isabelle Killane[2], Benjamin Campbell[2], Killian Tobin[2], Richard Reilly[1], Isabella Batten[1], Nollaig Bourke[1], James Gibney[1], Sean Kennelly[1]
[1]Trinity College Dublin, [2]Dublin Institute of Technology

P3-F-41 Gait as a signature of cognitive impairment and dementia disease subtype

Presenter: **Riona Mc Ardle**

Riona Mc Ardle[1], Brook Galna[1], Alan Thomas[1], Lynn Rochester[2]
[1]Newcastle University, [2]Institute of Neuroscience, Newcastle University

P3-F-42 Association of gait domains and incident falls in mild cognitive impairment: Results from the gait and brain study

Presenter: **Frederico Pieruccini-Faria**

Frederico Pieruccini-Faria[1], Yanina Sarquis-Adamson[1], Manuel Montero-Odasso[1]
[1]University of Western Ontario

P3-F-43 Older people with dementia have reduced daily-life activity and impaired daily-life gait when compared to age-sex matched controls

Presenter: **Morag Taylor**

Morag Taylor[1], Matthew Brodie[1], Kimberley van Schooten[1], Kim Delbaere[1], Jacqeline Close[1], Narelle Payne[1], Lyndell Webster[1], Jessica Chow[1], Garth McInerney[1], Susan Kurrle[2], Stephen Lord[1]
[1]Neuroscience Research Australia, University of New South Wales, [2]University of Sydney

G - Cognitive, attentional, and emotional influences

P3-G-44 The effects of virtual reality-induced postural threat on performance of a walking balance task

Presenter: **Amir Boroomand-Tehrani**

Amir Boroomand-Tehrani[1], Andrew Huntley[2], David Jagroop[2], Jennifer Campos[2], Kara Patterson[1], Luc Tremblay[1], Avril Mansfield[2]
[1]University of Toronto, [2]Toronto Rehabilitation Institute

P3-G-45 Move aside: Approach-avoidance theories scrutinized

Presenter: **Daniëlle Bouman**

Daniëlle Bouman[1], John Stins[1], Peter Beek[1]
[1]Vrije Universiteit Amsterdam

P3-G-46 Priming distorts sense of instability during postural control

Presenter: **Adolfo Bronstein**

Adolfo Bronstein[1], Patricia Castro[1], Sami Mahmoud[2], Efstratia Papoutselou[1], Constanza Fuentealba[3], Qadeer Arshad[1]
[1]Imperial College London, [2]Technische Universität München, [3]Universidad San Sebastian

P3-G-47 Patterns of dual-task interference at hospital discharge post stroke

Presenter: **Jody Feld**

Jody Feld[1], Prudence Plummer[1]
[1]University of North Carolina at Chapel Hill

P3-G-48 The effect of age and anxiety on objective and subjective instability

Presenter: **Richard Ibitoye**

Patricia Castro[1], Diego Kaski[2], Richard Ibitoye[1], Marco Schieppati[3], Michael Furman[1], Qadeer Arshad[1], Adolfo Bronstein[1]
[1]Imperial College London, [2]University College London, [3]Lunex University

P3-G-49 The nature of motor-cognitive relationship beyond age and disease

Presenter: **Inbal Maidan**

Inbal Maidan[1], Preeti Sunderaraman[2], Eran Gazit[1], Anat Mirelman[1], Yaakov Stern[2], Jeff Hausdorff[1]
[1]Tel-Aviv Sourasky Medical Center, [2]Columbia University Medical Center

P3-G-50 Fear of heights saturates 20 to 40 meters above ground

Presenter: **Max Wühr**

Max Wühr[1], Katharina Breitkopf[1], Julian Decker[1], Gerado Ibarra[1], Doreen Huppert[1], Thomas Brandt[1]
[1]Ludwig-Maximillians Universität München

P3-G-51 The influence of virtual height on visually evoked balance responses

Presenter: **Emma Nielsen**

Emma Nielsen[1], Taylor Cleworth[2], Mark Carpenter[1]
[1]University of British Columbia, [2]University of Waterloo

H - Coordination of posture and gait

P3-H-52 Tumors of cerebellum effect on saccadic system and gait

Presenter: **Alina Aizenshtein**

Alina Aizenshtein[1], Marina Shurupova[1], Vladimir Kasatkin[1], Dmitriy Skvortsov[2], Alexander Karelin[1]
[1]Dmitry Rogachev National Research Center of Pediatric Hematology, Oncology and Immunology, [2]Federal Research and Clinical Centre of Russia's Federal Medical-Biological Agency (FNKC FMBA)

P3-H-53 Daily variation in executive function predicts daily variation in dual task walking performance in older adults

Presenter: **Sarah Allen**

Sarah Allen[1], Junhong Zhou[1], Alexa Ludington[1], Bonnie Wong[1], Brad Manor[1]
[1]Harvard Medical School

P3-H-54 Effects of discrete visual cues on anticipatory eye movement and segment rotation during walking turns in neurotypical young adults and persons with Parkinson's disease

Presenter: **Tyler Baker**

Tyler Baker[1], Jenna Pitman[2], Adam Johnston[1], Andrew Godbout[1], Rebecca Reed-Jones[1]
[1]University of Prince Edward Island, [2]University of Guelph

P3-H-55 Modification of gait intralimb coordination: Objective comparison of hip-knee cyclograms of individuals with incomplete spinal cord injury vs healthy subjects

Presenter: **Maude Barreau**

Maude Barreau[1], Manuel Jose Escalona Castillo[1], Alexandre Tapin[1], Martin Vermette[2], Dany H. Gagnon[1], Cyril Duclos[1]
[1]Université de Montréal, [2]IRGLM

P3-H-56 Walking speed choices among married couples: Middle-aged and older adults walk slower when walking with their partner

Presenter: **HyeYoung Cho**

HyeYoung Cho[1], Anna Forster[1], Samuel Hatala[1], Manuel Ochoa[1], Sharon Christ[1], Melissa Franks[1], Elizabeth Richards[1], Shirley Rietdyk[1]
[1]Purdue University

P3-H-57 Variability of the inter-joint coordination during grade walking

Presenter: **Arthur Dewolf**

Arthur Dewolf[1], Patrick Willems[1]
[1]Universite catholique de Louvain

P3-H-58 Effect of voluntary gaze movement on gait steering control

Presenter: **Felix Dollack**

Felix Dollack[1], Monica Perusquia-Hernandez[1], Hideki Kadone[1], Kenji Suzuki[1]
[1]University of Tsukuba

P3-H-59 How much does pregnancy affect female's gait pattern?

Presenter: **Wanda Forczek**

Wanda Forczek[1], Yury Ivanenko[2], Marcin Salamaga[3], Agata Maslon[1], Marta Curylo[1], Barbara Fraczek[1], Agnieszka Suder[1]
[1]University of Physical Education, [2]IRCCS Santa Lucia Foundation, [3]Cracow University of Economics

P3-H-60 Looking downward while walking is more challenging than looking forward for ambulatory chronic stroke patients

Presenter: **Yu-Chu Hsueh**

Yu-Chu Hsueh[1], Pei-Yun Lee[2], Pei-Yun Lee[2], Chih-Hung Chen[1], Hui-Yu Tseng[3], Sang-I Lin[1]
[1]National Cheng Kung University, [2]National Taiwan University Hospital Bei-Hu Branch, [3]Tainan Hospital, Ministry of Health and Welfare

P3-H-61 Postural sway in young adults with and without chronic low back pain

Presenter: **Karen Lomond**

Karen Lomond[1], Nick Paselk[2], Nilanthy Balendra[2], Burkhardt Zachery[2], Phillion Brooke[2], Jennifer Sansom[2]
[1]Ithaca College, [2]Central Michigan University

P3-H-62 Effect of arm motion on postural strategies during uphill and downhill walking

Presenter: **Mary Elise MacDonald**

Mary Elise MacDonald[1], Allen Hill[1], Julie Nantel[1]
[1]University of Ottawa

P3-H-63 The path curvature of the body centre of mass during walking as an index of balance control in patients with Multiple Sclerosis

Presenter: **Chiara Diletta Malloggi**

Chiara Diletta Malloggi[1], Luigi Catino[2], Viviana Rota[1], Laura Perucca[1], Stefano Scarano[1], Luigi Tesio[1]
[1]IRCCS Santa Lucia Foundation, [2]Università degli Studi di Milano

P3-H-64 Older adults adopted a more conservative strategy to step into a hole when compared to the task of stepping down a curb

Presenter: **Renato Moraes**

Renato Moraes[1], Luciana Santos[1], Rosangela Batistela[1]
[1]University of São Paulo

P3-H-65 Differences in pre-season postural control based on sport type

Presenter: **John Palazzolo**

John Palazzolo[1], Daniel Goble[2], Jeff Labban[1], Scott Ross[1], Donna Duffy[1], Christopher Rhea[1]
[1]University of North Carolina, Greensboro, [2]Oakland University

P3-H-66 Walking with large axial pelvis rotations causes changes in axial thorax-pelvis coordination as observed in low back pain

Presenter: **Maarten Prins**

Maarten Prins[1], Luca Cornelisse[2], Onno Meijer[2], Peter van der Wurff[1], Sjoerd Bruijn[2], Jaap van Dieën[2]
[1]Military Rehabilitation Centre 'Aardenburg', [2]Vrije Universiteit Amsterdam

P3-H-67 Negative effects of cognitive interference and altered sensory input on balance in Huntington's disease

Presenter: **Nicollette Purcell**

Nicollette Purcell[1], Jennifer Goldman[1], Bichun Ouyang[1], Bryan Bernard[1], Joan O'Keefe[1]
[1]Rush University Medical Center

P3-H-69 Analysis of center of mass velocity during dual-task in fallers and non-fallers elderly: Gait combined with prehension task during avoidance of an obstacle

Presenter: **Natalia Rinaldi**

Natalia Rinaldi[1], Janine Carvalho Camargos[1], Leticia Avellar[1], Anselmo Frizera[1]
[1]Federal University of Espirito Santo

P3-H-70 Motor flexibility during locomotion: An important component of functional mobility in older adults

Presenter: **Noah Rosenblatt**

Noah Rosenblatt[1], Christopher Hurt[2], Nils Eckardt[3]
[1]Rosalind Franklin University of Medicine and Science, [2]University of Alabama, Birmingham, [3]University of Oldenburg

P3-H-71 Landing under conditions of height-induced threat

Presenter: **Bénédicte Schepens**

Bénédicte Schepens[1], M J Luu[2], Mark Carpenter[2]
[1]Universite catholique de Louvain, [2]University of British Columbia

P3-H-72 The modulation of trunk coordination for various step widths

Presenter: **Hai-Jung (Steffi) Shih**

Hai-Jung (Steffi) Shih[1], Kornelia Kulig[1]
[1]University of Southern California

P3-H-73 Can a fractal visual motion cue modulate postural sway complexity?

Presenter: **Haralampos Sotirakis**

Harris Sotirakis[1], Nicholas Stergiou[2], Dimitrios Patikas[1], Vassilia Hatzitaki[1]
[1]Aristotle University of Thessaloniki, [2]University of Nebraska at Omaha

P3-H-74 Muscle activity in the affected leg of stroke patients can be manipulated by altering guidance offered to the unaffected leg during Lokomat walking

Presenter: **Sylvana Weiland**

Sylvana Weiland[1], Heleen Reinders-Messelink[2], Annemarijke Boonstra[2], Lucas van der Woude[1], Rob den Otter[1]
[1]University Medical Center Groningen, [2]Rehabilitation center 'Revalidatie Friesland'

I - Development of posture and gait

P3-I-75 The motor control of running in children and their development

Presenter: **Margit Bach**

Margit Bach[1], Andreas Daffertshofer[1], Nadia Dominici[1]
[1]Vrije Universiteit Amsterdam

P3-I-76 Spatiotemporal gait characteristics in adolescent idiopathic toe walkers

Presenter: **Richard Beuttler**

Rahul Soangra[1], Richard Beuttler[1], Caprice Hollandsworth[1], Shewta Chheda[1], Afshin Aminian[2], Marybeth Grant-Beuttler[1]
[1]Chapman University, [2]Children's Hospital of Orange County

P3-I-78 Balance and postural control in healthy children under 12 years of age: A systematic review

Presenter: **Prasath Jayakaran**

Prasath Jayakaran[1], Katie Bromley[1], Hayley Foster[1], Nikko Kim[1], Karaitiana Smith[1]
[1]University of Otago

P3-I-79 Modular control of the leading and trailing limbs during obstacle clearance in children: Preliminary results

Presenter: **Michael MacLellan**

Michael MacLellan[1]
[1]University of Prince Edward Island

P3-I-80 Development of postural control during single-leg standing in children aged 3-10 years

Presenter: **Hiroki Mani**

Hiroki Mani[1], Saori Miyagishima[2], Naoki Kozuka[2], Kenji Taneda[1], Takahiro Inoue[1], Kenta Takeda[1], Tadayoshi Asaka[1]
[1]Hokkaido University, [2]Sapporo Medical University

J - Developmental disorders

P3-J-81 Feedforward motor control in developmental dyslexia and developmental coordination disorder: Does comorbidity matter?

Presenter: **Christine Assaiante**

Christine Assaiante[1], Fabien Cignetti[2], Marianne Vaugoyeau[1], Aurelie Fontan[1], Marianne Jover[3], Brigitte Chabrol[3]
[1]CNRS, [2]CNRS, TIMC-IMAG UMR 5525, [3]AMU

P3-J-82 Use of cluster analysis for gait classification of patients with syndrome of Dravet

Presenter: **Ann Hallemans**

Ann Hallemans[1], Lore Wyers[1], Karen Verheyen[1], An-Sofie Schoonjans[1], Berten Ceulemans[2], Patrica Van de Walle[1]
[1]University of Antwerp, [2]Antwerp University Hospital

P3-J-83 Concurrent validity of the Clinical Test of Sensory Interaction of Balance (CTSIB) Kids-BESTest criteria with laboratory center of pressure measures in children with and without cerebral palsy

Presenter: **Leanne M Johnston**

Leanne Johnston[1], Rosalee Dewar[1], Kylie Tucker[1], Andrew Claus[1], Rob Ware[2]
[1]University of Queensland, [2]Griffith University

P3-J-84 Postural control in young adults with high-functioning Autism Spectrum Disorder (ASD): Distinguishing between general and sensory channel-specific impairments

Presenter: **Rebekah Knox**

Rebekah Knox[1], Mihalis Doumas[1]
[1]Queen's University Belfast

K - Devices to improve posture and gait

P3-K-85 A development of a bicycle-simulator-balance trainer with a novel system that provide customized unexpected perturbations during bicycling (the PerStBiRo system)

Presenter: **Shani Batcir**

Shani Batcir[1], Yaakov Livne[1], Rotem Lev Lehman[1], Guy Shani[1], Amir Shapiro[1], Itshak Melzer[1]
[1]Ben-Gurion University

P3-K-86 Immediate effect of a rehabilitation dog on weight-bearing and balance during early prosthetic training in individuals with vascular lower-limb amputation

Presenter: **Cyril Duclos**

Cyril Duclos[1], Brendon Pham[2], Valérie Martin-Lemoyne[3], Dany Gagnon[2]
[1]Université de Montréal, [2]Université de Montréal, School of rehabilitation, [3]Centre for Interdisciplinary Research in Rehabilitation (CRIR-IRGLM)

P3-K-87 Effect of multi-tasking on gait and cognitive demands in adults with Alzheimer's dementia experienced in using a 4-wheeled walker

Presenter: **Susan Hunter**

Susan Hunter[1], Alison Divine[2], Humberto Omana[1], Walter Wittich[3], Andrew Johnson[1], Keith Hill[4]
[1]University of Western Ontario, [2]University of Leeds, [3]University of Montreal, [4]Curtin University

P3-K-88 Evaluation of corrective moment of measurement orthosis using CB brace for knee osteoarthritis

Presenter: **Yasuhiro Mine**

Yasuhiro Mine[1], Tamotsu Sakima[2]
[1]Toyo University, [2]SAKIMA Prosthetics & Orthotics Co.,Ltd.

P3-K-89 Development of an active mechanical harness system

Presenter: **Ann Reinthal**

M Ann Reinthal[1], Debbie Espy[1], Lorenzo Bianco[1], Poya Khalaf[1], John DeMarco[1]
[1]Cleveland State University

P3-K-90 Plantar foot mechanoreceptor topography and lower limb muscle activity

Presenter: **Kelly Robb**

Kelly Robb[1], Stephen Perry[1]
[1]Wilfrid Laurier University

P3-K-91 Spinal cord stimulation improves gait and modulates cortical activity in parkinsonian patients unresponsive to dopaminergic medication

Presenter: **Olivia Samotus**

Olivia Samotus[1], Maria Alamos[2], Andrew Parrent[1], Mandar Jog[1]
[1]London Health Sciences Centre, [2]Pontificia Universidad Catolica de Chile

P3-K-92 How to encourage others: A perception-empathy biofeedback system for preventing falls in older adults

Presenter: **Kazuhiro Yasuda**

Kazuhiro Yasuda[1], Yuki Hayashi[1], Hiroyasu Iwata[1]
[1]Waseda University

L - Effect of medication on posture and gait

P3-L-93 Gait speed does not mediate the association between antidepressants and falls

Presenter: **Orna Donoghue**

Orna Donoghue[1], Robert Briggs[1], Frank Moriarty[2], Rose Kenny[1]
[1]Trinity College Dublin, [2]Royal College of Surgeons in Ireland

M - Exercise and physical activity

P3-M-95 Perturbation treadmill training: Sustainable effects on clinical gait and postural stability symptoms as well as gait variability in Parkinson's disease

Presenter: **Heiko Gaßner**

Heiko Gaßner[1], Simon Steib[2], Sarah Klamroth[2], Cristian Pasluosta[2], Werner Adler[2], Bjoern Eskofier[2], Klaus Pfeifer[2], Jürgen Winkler[2], Jochen Klucken[2]
[1]University Hospital Erlangen, [2]Friedrich-Alexander University (FAU) Erlangen-Nürnberg

P3-M-96 Clinical outcome measures and the patient experience: What we can learn from conducting a process evaluation of a balance training intervention

Presenter: **Breiffni Leavy**

Breiffni Leavy[1], Conran Joseph[1], Hanna Johansson[1], Erika Franzén[1]
[1]Karolinska Institutet

P3-M-97 Effect of community-based brisk walking on enhancing motor and non-motor symptoms in people with Parkinson's disease

Presenter: **Margaret Mak**

Margaret Mak[1], Irene Wong[1]
[1]The Hong Kong Polytechnic University

P3-M-98 Effects of strength training the hip abductor-adductor muscles on protective stepping: A pilot study

Presenter: **Marie-Laure Mille**

Marie-Laure Mille[1], Maria Papaiordanidou[2], Guillaume Florent[3], Karim El Koulali[3], Jean-Louis Vercher[3], Richard Fitzpatrick[4]
[1]Aix Marseille Université, [2]URF STAPS, Univ. de Bourgogne, [3]CNRS & Aix-Marseille Univ, [4]University of New South Wales

P3-M-99 Effect of muscle fatigue on postural stability and muscular activation of the supporting leg in soccer players' kicking

Presenter: **Julia Oliveira**

Julia Oliveira[1], Caroline Souza[1], Daniel Coelho[1], Luis Teixeira[1]
[1]University of São Paulo

N - Falls and fall prevention

P3-N-100 Increased resilience of judoists to unpredictable large-magnitude perturbations to body balance

Presenter: **Marina Betelli**

Marina Betelli[1], Julia Oliveira[1], Patricia Takazono[1], Caroline Souza[1], Daniel Coelho[1], Luis Teixeira[1]
[1]University of São Paulo

P3-N-101 The effect of hearing loss on balance control - Do hearing aids help?

Presenter: **Nicoleta Bugnariu**

Nicoleta Bugnariu[1], Victoria Kowalewski[1], Rita Patterson[1], Linda Thibodeau[2]
[1]University of North Texas Health Science Center, [2]University of Texas at Dallas

P3-N-102 Synergistic ground reaction forces during double support while negotiating a curb

Presenter: **Chuyi Cui**

Chuyi Cui[1], HyeYoung Cho[1], Ashwini Kulkarni[1], Shirley Rietdyk[1], Fabio Barbieri[2], Satyajit Ambike[1]
[1]Purdue University, [2]São Paulo State University (UNESP)

P3-N-103 The effect of handrail cross-sectional design on centre of mass control during compensatory reach-to-grasp reactions to recover balance

Presenter: **Philippa Gosine**

Philippa Gosine[1], Vicki Komisar[2], Alison Novak[1]
[1]Toronto Rehabilitation Institute, [2]Simon Fraser University

P3-N-104 Falls and hip fractures: A biomechanically based model of sex and age specific risk assessment

Presenter: **Andrew Hudson**

Andrew Hudson[1], Brian Street[2]
[1]University of California, Bakersfield, [2]California State University, Bakersfield

P3-N-105 Effects of thin plantar stimulation on postural coordination patterns

Presenter: **Marc Janin**

Marc Janin[1], Emmanuelle Pivron Braquet[2], Frédéric Noé[3]
[1]Université de Pau et des pays L'adour, [2]PODOLOGUE, [3]Laboratoire Mouvement, Equilibre, Performance, Santé (EA 4445)

P3-N-106 Sex differences in predictors of subsequent falls in senior fallers: A prospective study of the Vancouver Falls Prevention Cohort

Presenter: **Deborah Jehu**

Deborah Jehu[1], Jennifer Davis[1], Kristin Vesley[1], Winnie Cheung[1], Anna Egbert[1], Liu-Ambrose Teresa[1]
[1]University of British Columbia

P3-N-107 The frequency and circumstances of falls reported by unilateral lower limb prosthesis users

Presenter: **Janis Kim**

Janis Kim[1], Matthew Major[2], Brian Hafner[3], Andrew Sawers[1]
[1]University of Illinois at Chicago, [2]Northwestern University, [3]University of Washington

P3-N-108 Effect of holding and grasping objects on risk for head impact during falls in older adults

Presenter: **Vicki Komisar**

Vicki Komisar[1], Nataliya Shishov[1], Stephen Robinovitch[1]
[1]Simon Fraser University

P3-N-109 Different types of tripping over an unexpected obstacle while walking on level ground - age and contributing factors

Presenter: **Ilan Kurz**

Ilan Kurz[1], Shlomit Eyal[2], Inbal Maiden[2], Anat Mirelman[3], Nir Giladi[3], Jeff Hausdorff[3]
[1]Ben-Gurion University, [2]Center for the Study of Movement, Cognition and Mobility, Neurological Institute, Tel Aviv Sourasky, [3]Tel-Aviv Sourasky Medical Center

P3-N-110 Balance control in young healthy adults: Is relative performance across tasks indicative of a balance control characteristic?

Presenter: **Gary Mangan**

Gary Mangan[1], William McIlroy[1]
[1]University of Waterloo

P3-N-111 Anticipatory and reactionary postural movements during handrail grasping while forward walking in young and older adults

Presenter: **Emily McIntosh**

Emily McIntosh[1], Lori Ann Vallis[1]
[1]University of Guelph

P3-N-112 Compensatory rapid leg movements during unexpected loss of balance while walking- differences between fallers and non fallers

Presenter: **Hadas Nachmani**

Hadas Nachmani[1], Shani Batcir[1], Itzhak Melzer[1]
[1]Faculty of Health Sciences at Ben-Gurion University of the Negev

P3-N-113 Fear of falling following a 12-week attentionally focused balance training intervention: Preliminary data

Presenter: **Louisa Raisbeck**

Louisa Raisbeck[1], Lauren Higgins[1], Ruth Stout[1], Danielle Felsberg[1], Sean Cochran[1], John Palazzolo[1], Jeff Labban[1], Christopher K[1]
[1]University of North Carolina, Greensboro

P3-N-114 Assessing recovery time from unexpected loss of balance during walking in young and older adults

Presenter: **Uri Rosenblum Belzer**

Uri Rosenblum Belzer[1], Itzik Melzer[2], Shani Kimel-Naor[1], Lotem Kribus-Shmiel[1], Yotam Bahat[1], Gabi Zeilig[1], Meir Plotnik[1]
[1]Sheba Medical Center, [2]Ben-Gurion University

P3-N-115 Re-enactment - a method to reproduce real-world fall events

Presenter: **Kim Sczuka**

Kim Sczuka[1], Lars Schwickert[1], Clemens Becker[1], Jochen Klenk[1]
[1]Robert-Bosch-Krankenhaus

P3-N-116 Designing optimal visual cues to increase stair climbing safety in young and older adults

Presenter: **Timmion Skervin**

Timmion Skervin[1], Mark Hollands[1], Constantinos Maganaris[1], Andrew Schofield[2], Neil Thomas[1], Richard Foster[1]
[1]Liverpool John Moores University, [2]Aston University

P3-N-117 Postural sway of the fallers based on retrospective and prospective studies with CTSIB

Presenter: **Gyerae Tack**

Taeho Kim[1], Jinsoo Lee[1], Junggil Kim[1], Jeongwoo Seo[1], Jinseong Choi[1], Gyerae Tack[1]
[1]Konkuk University

P3-N-118 A biomechanics-based investigation of walking aid use in gait laboratory and home settings

Presenter: **Sibylle Thies**

Sibylle Thies[1], Alex Bates[1], Eleonora Costamagna[1], Laurence Kenney[1], Malcolm Granat[1], Jo Webb[1], Helen Dawes[2]
[1]University of Salford, [2]Oxford Brookes University

O - Habilitation & rehabilitation

P3-O-119 Effects of dance on motor and non-motor symptoms of Parkinson's disease: A feasibility study

Presenter: **Anna Carapellotti**

Anna Carapellotti[1], Michail Doumas[1]
[1]Queen's University Belfast

P3-O-120 Enhanced postural control in experienced karate practitioners: Further evidence that practice does make perfect

Presenter: **Jeffrey Hausdorff**

Amit Hadad[1], Natalie Ganz[2], Eran Gazit[2], Nathan Intrator[1], Jeff Hausdorff[2]
[1]Tel Aviv University, [2]Tel-Aviv Sourasky Medical Center

P3-O-121 Characteristics of people with stroke who withdraw from mobility and balance rehabilitation research studies

Presenter: **Kara Patterson**

Kara Patterson[1], Jennifer Wong[2], Avril Mansfield[2]
[1]University of Toronto, [2]Toronto Rehabilitation Institute

P - Modeling

P3-P-122 Collision avoidance between a walker and a person on an electric powered wheelchair

Presenter: **Anne-Hélène Olivier**

Anne-Hélène Olivier[1], Nicolas Le Borgne[2], Marie Babel[2], Armel Crétual[1], Julien Pettré[2]
[1]University of Rennes / Inria, [2]Inria Rennes

P3-P-123 Accounting for sensory noise is important to simulate stable and human-like control of perturbed standing balance

Presenter: **Tom Van Wouwe**

Tom Van Wouwe[1], Friedl De Groote[1], Lena Ting[2]
[1]KU Leuven, [2]Emory University and Georgia Tech

Q - Neurological diseases

P3-Q-124 The effect of dopaminergic medication on planned gait termination in Parkinson's disease

Presenter: **Ali Aljaroudi**

Ali Aljaroudi[1], Nicolaas Bohnen[1], Martijn Müller[1]
[1]University of Michigan

P3-Q-125 Protective postural control with divided attention: Effects of Parkinson's disease

Presenter: **Jordan Barajas**

Daniel Peterson[1], Jordan Barajas[1], Anandita Nadkarni[2], Linda Denney[3], Shyamal Mehta[4]
[1]Arizona State University, [2]Carnegie Mellon University, [3]Northern Arizona University, [4]Mayo Clinic

P3-Q-126 Initial center of pressure position prior anticipatory postural adjustments during gait initiation in people with Parkinson's disease with freezing of gait

Presenter: **Madli Bayot**

Madli Bayot[1], Delval Arnaud[1], Hansen Clint[2], Walter Maetzler[2], Christian Schlenstedt[2]
[1]University of Lille - Inserm U1171-Degenerative and Vascular Cognitive Disorders, [2]Christian-Allbrechts-University of Kiel

P3-Q-127 The effect of a high intensity treadmill training and self-management program on physical activity in stroke patients undergoing rehabilitation: A RCT

Presenter: **Sandra Brauer**

Sandra Brauer[1], Suzanne Kuys[2], Jenny Paratz[3], Louise Ada[4]
[1]University of Queensland, [2]Australian Catholic University, [3]Griffith University, [4]University of Sydney

P3-Q-128 Unpredictable gait perturbation training improves reactive responses, and gait stability functions contrary to gait training without perturbations in stroke individuals

Presenter: **Vahid EsmaeiliMahani**

Vahid EsmaeiliMahani[1], Laurent Bouyer[2], Cyril Duclos[1]
[1]Université de Montréal, [2]Université Laval

P3-Q-129 Feature selection of objective metrics of balance dysfunction in Parkinson's disease

Presenter: **Naoya Hasegawa**

Naoya Hasegawa[1], Vrutangkumar Shah[1], Anjanibhargavi Ragothaman[1], Samuel Stuart[1], Patricia Carlson-Kuhta[1], John Nutt[1], Fay Horak[1], Tadayoshi Asaka[2], Martina Mancini[1]
[1]Oregon Health & Science University, [2]Hokkaido University

P3-Q-130 Influence of reactive balance training on responses to an unexpected slip in individuals with chronic stroke: A randomized controlled trial

Presenter: **Andrew Huntley**

Andrew Huntley[1], Alison Schinkel-Ivy[2], Anthony Aqui[1], Avril Mansfield[1]
[1]Toronto Rehabilitation Institute, [2]Nipissing University

P3-Q-131 Motor training improves motor performance at the preclinical stage of degenerative cerebellar ataxia

Presenter: **Winfried Ilg**

Winfried Ilg[1], Matthis Synofzik[1]
[1]Hertie Institute for Clinical Brain Research

P3-Q-132 Influence of environmental context on locomotor skill learning in virtual reality in people with Parkinson's disease

Presenter: **Aram Kim**

Aram Kim[1], James Finley[1]
[1]University of Southern California

P3-Q-133 Executive functioning, muscle power and reactive balance are major contributors of gait adaptability in people with Parkinson´s disease

Presenter: **Stephen Lord**

Maria Joana Duarte Caetano[1], Stephen Lord[2], Natalie Allen[3], Jooeun Song[3], Serene Paul[3], Colleen Canning[3], Jasmine Menant[2]
[1]Prefeitura Municipal de São Carlos, [2]Neuroscience Research Australia, University of New South Wales, [3]University of Sydney

P3-Q-134 Diurnal systematic variance of gait during normal daily monitoring

Presenter: **James McNames**

James McNames[1], Vrutangkumar Shah[2], Patty Carlson-Kuhta[2], Mahmoud El-Gohary[3], John Nutt[2], Rebecca Spain[2], Fay Horak[2], Carolin Curtze[4]
[1]Portland State University, [2]Oregon Health & Science University, [3]APDM, [4]University of Nebraska Omaha

P3-Q-135 Objective quantifiable assessment of nocturnal movements in patients with Parkinson's disease using a wearable sensor

Presenter: **Anat Mirelman**

Anat Mirelman[1], Inbar Hillel[1], Lynn Rochester[2], Bastiaan Bloem[3], Laura Avanzino[4], Alice Nieuwboer[5], Inbal Maidan[1], Shirley Shiratzki[1], Talia Herman[1], Jesse Cederbaum[6], Nir Giladi[1], Jeff Hausdorff[1]
[1]Tel-Aviv Sourasky Medical Center, [2]Institute of Neuroscience, Newcastle University, [3]Radboud University Medical Center, [4]University of Genoa, [5]KU Leuven, [6]Biogen Biotechnologies, Cambridge Massachusets

P3-Q-136 Evaluation of gait parameter thresholds to distinguish idiopathic Parkinson's disease from atypical parkinsonism using instrumented gait analysis

Presenter: **Ken Möhwald**

Ken Möhwald[1], Julian Decker[2], Max Wuehr[2], Roman Schniepp[2]
[1]University Hospital, LMU Munich, [2]Ludwig-Maximillians Universität München

P3-Q-137 Persons with MS exhibit declines in upper body control during walking

Presenter: **Steven Morrison**

Steven Morrison[1], Cortney Armitano[1], Corey Rynders[2], Jake Sosnoff[3]
[1]Old Dominion University, [2]University of Colorado, [3]University of Illinois at Chicago

P3-Q-138 Effect of different exercise regimens on walking performance in people with multiple sclerosis

Presenter: **Klara Novotna**

Klara Novotna[1], Lucie Sucha[1], Petr Reznicek[1], Lukas Sobisek[2], Eva Kubala Havrdova[1]
[1]Charles University, [2]Czech Economical University, Faculty of Probability

P3-Q-139 Fast paced gait may be more discriminating than dual tasking for detecting severity of gait and turn deficits in Fragile X-Associated Tremor/Ataxia Syndrome (FXTAS)

Presenter: **Joan O'Keefe**

Joan O'Keefe[1], Danielle Carns[1], Joseph Guan[1], Erin Robertson[1], Timothy Tung[1], Nicollette Purcell[1], Elizabeth Berry-Kravis[1], Deborah Hall[1]
[1]Rush University Medical Center

P3-Q-140 Leukoaraiosis, an invisible factor contributes to balance and gait disorders after stroke

Presenter: **Dominic Pérennou**

Dominic Pérennou[1], Shenhao Dai[2], Céline Piscicelli[1], Emmanuelle Clarac[2], Patrice Davoine[2], Anne Chrispin[2], Andréa Kistner[2], Marie Jaeger[2], Olivier Detante[2], Monica Baciu[2], Marc Hommel[2]
[1]University Hospital Grenoble-Alpes, [2]Grenoble Alpes University Hospital

P3-Q-141 Balance control impairments in Fabry disease

Presenter: **Philippe Perrin**

Philippe Perrin[1], Laetitia Peultier-Celli[2], François Feillet[2], Roland Jaussaud[2]
[1]University of Lorraine and University Hospital Nancy, [2]Université de Lorraine et CHRU de Nancy

P3-Q-142 Development of an automated, instrumented composite index to quantify the performance of a 'freezing provoking test' in patients with Parkinson's disease

Presenter: **Tal Reches**

Tal Reches[1], Eran Gazit[1], Moria Dagan[2], Talia Herman[1], Pablo Cornejo Thumm[1], Nir Giladi[1], Manor Brad[3], Jeff Hausdorff[1]
[1]Tel-Aviv Sourasky Medical Center, [2]Tel Aviv University, [3]Hebrew SeniorLife / Harvard Medical School

P3-Q-143 The impact of split-belt treadmill walking on freezing related gait features in Parkinson's disease

Presenter: **Christian Schlenstedt**

Christian Schlenstedt[1], Jana Seuthe[1], Pieter Ginis[2], Markus Hobert[1], Nicholas D'Cruz[2], Alice Nieuwboer[2]
[1]Christian-Allbrechts-University of Kiel, [2]KU Leuven

P3-Q-144 Global lower limb coactivation during gait in patients with cerebellar ataxia

Presenter: **Mariano Serrao**

Mariano Serrao[1], Lorenzo Flori[2], Tiwana Varrecchia[3], Carmela Conte[4], Antonella Tatarelli[2], Carlo Casali[1], Francesco Pierelli[1], Francesco Draicchio[2], Alberto Ranavolo[2]
[1]Sapienza University of Rome, [2]INAIL, [3]University Roma Tre, [4]Fondazione Don Gnocchi, Milan

P3-Q-145 Clinical correlates of fatigue in patients with multiple sclerosis: Is mental fatigue more important than gait speed?

Presenter: **Shirley Shema Shiratzky**

Shirley Shema Shiratzky[1], Ruopeng Sun[2], Keren Regev[1], Arnon Karni[1], Jacob Sosnoff[2], Jeff Hausdorff[1], Anat Mirelman[1]
[1]Tel-Aviv Sourasky Medical Center, [2]University of Illinois at Urbana-Champaign

P3-Q-146 Does transcranial direct current stimulation improve reaction times of people after stroke during balance perturbations, gait initiation, or voluntary movement?

Presenter: **Wouter Staring**

Wouter Staring[1], Milou Coppens[1], Alexander Geurts[1], Vivian Weerdesteyn[1]
[1]Donders Institute, Radboud University Medical Centre

P3-Q-147 Protective stepping in multiple sclerosis: A pilot study

Presenter: **Charles Van Liew**

Charles Van Liew[1], Leland Dibble[1], Grace Hunt[2], K. Foreman[2], Daniel Peterson[1]
[1]Arizona State University, [2]University of Utah

P3-Q-148 Walking speed improves with arm swing manipulation in people with Parkinson's disease

Presenter: **Vinicius Zampier**

Vinicius Zampier[1], Rodrigo Vitório[1], Victor Beretta[1], Diego Jaimes[1], Diego Orcioli-Silva[1], Lilian Gobbi[1]
[1]São Paulo State University (UNESP)

P3-Q-149 The effects of Parkinson's disease and essential tremor on the multiscale dynamics of hand tremor motion

Presenter: **Junhong Zhou**

Junhong Zhou[1], Dongning Su[2], Shuo Yang[2], Ying Wang[2], Zhu Liu[2], Hua Pan[2], Tao Feng[2]
[1]Harvard Medical School, [2]Beijing Tiantan Hosptital, Capital Medical University

R - Orthopedic diseases and injuries

P3-R-150 Effects of repetitive head impacts on tandem gait performance over an ice hockey season

Presenter: **Melissa DiFabio**

Melissa DiFabio[1], Jessie Oldham[2], Thomas Buckley[1]
[1]University of Delaware, [2]Boston Children's Hospital

P3-R-151 How persons with transtibial amputation regulate lateral stepping in destabilizing environments

Presenter: **Jonathan Dingwell**

Jonathan Dingwell[1], Jonathan Rylander[2], Joseph Cusumano[1], Jason Wilken[3]
[1]Pennsylvania State University, [2]Baylor University, [3]University of Iowa

P3-R-152 Knee joint function and walking biomechanics in patients in acute phase anterior cruciate ligament (ACL) tear

Presenter: **Dmitriy Skvortsov**

Sergey Kaurkin[1], Dmitriy Skvortsov[1], Alexander Akhpashev[1]
[1]Federal Research and Clinical Centre of Russia's Federal Medical-Biological Agency (FNKC FMBA)

P3-R-153 Function of the knee joint during walking before and after the meniscus resection

Presenter: **Dmitriy Skvortsov**

Sergey Kaurkin[1], Dmitriy Skvortsov[1], Alexander Akhpashev[1]
[1]Federal Research and Clinical Centre of Russia's Federal Medical-Biological Agency (FNKC FMBA)

S - Proprioceptive function and disorders

P3-S-154 Reduced balance stability in obese individuals is associated with low tactile sensibility of the feet soles

Presenter: **Luis Teixeira**

Luis Teixeira[1], Jair Bueno[1], Caroline Souza[1], Daniel Coelho[1]
[1]University of São Paulo

P3-S-155 Investigation of the relationship between talking time on the mobile phone and neck proprioception, pain, and disability in the university students

Presenter: **Gamze Yalcinkaya**

Gamze Yalcinkaya[1], Nurullah Buker[1], Yesim Sengul
[1]Health Sciences Institute

U - Robotics

P3-U-156 Does the selection of specific control strategy options during walking with a wearable robotic exoskeleton affect muscle synergies in healthy individuals?

Presenter: **Manuel J. Escalona**

Manuel Escalona[1], Daniel Bourbonnais[1], Damien Le Flem[1], Michel Goyette[1], Cyril Duclos[1], Dany Gagnon[1]
[1]University of Montreal

P3-U-157 Do high and low spinal cord injured subjects learn exoskeleton skills differently?

Presenter: **Rosanne van Dijsseldonk**

Rosanne van Dijsseldonk[1], I.J.W. van Nes[2], H. Rijken[2], H. van de Meent[3], N.L.W. Keijsers[2]
[1]Radboudumc & Sint Maartenskliniek, [2]Sint Maartenskliniek, [3]Radboud University Medical Center

V - Sensorimotor control

P3-V-158 A balance control model for vestibular loss subjects balancing on a tilting support

Presenter: **Lorenz Assländer**

Lorenz Assländer[1], Georg Hettich[2], Markus Gruber[1], Thomas Mergner[3]
[1]University of Konstanz, [2]Aesculab, [3]Neurological University Clinics, Freiburg

P3-V-159 Synergies between postural control, eye movements and cognitive involvement in precise visual tasks performed upright

Presenter: **Cédrick Bonnet**

Cedrick Bonnet[1], Tanguy Davin[1], Jean-Yves Hoang[1], Stéphane Baudry[2]
[1]University of Lille, [2]Université Libre de Bruxelles

P3-V-160 How does visual input affect the learning process of a balance skill?

Presenter: **Orit Elion**

Orit Elion[1], Yotam Bahat[2], Itamar Sela[3], Itzchak Siev-Ner[4], Patrice (Tamar) Weiss[3], Avi Karni[3]
[1]Ariel University, [2]Sheba Medical Center, [3]University of Haifa, [4]C. Sheba Medical Center, Tel Hashomer, Israel

P3-V-161 Obesity and gait: where/when body representation and its symbolic counterpart meet in the brain?

Presenter: **Marie Fabre**

Marie Fabre[1], Pascale Chavet[1], Théo Fornerone[1], Benjamin Juan[1], Olivier Abossolo[2], Fabrice Pardo[3], Lionel Dany[1], Laurence Mouchnino[1]
[1]Aix Marseille Université, [2]Clinique St Christhophe, [3]Clinique St Christophe

P3-V-162 Postural control during induced stabilization of the center of mass and light touch

Presenter: **Dasa Gorjan**

Dasa Gorjan[1], Angélina Bellicha[2], Jernej Camernik[1], Wael Bachta[2], Jan Babic[1]
[1]Institute Jozef Stefan, [2]Sorbonne Université - ISIR

P3-V-163 Comparison of EMG parameters during uphill walking on a self-paced treadmill and outdoors

Presenter: **Eunice Ibala**

Eunice Ibala[1], Karen Chase[1], Nicholas Smith[1], Andrew Kerr[1]
[1]University of Strathclyde

P3-V-164 Anticipatory postural adjustments while initiating a step on a flat surface or over an obstacle

Presenter: **Hirofumi Ida**

Hirofumi Ida[1]
[1]Jobu University

P3-V-165 Central sensorimotor integration delays: Does response latency to pseudorandom balance perturbations relate to reaction time?

Presenter: **Douglas Martini**

Douglas Martini[1], Lucy Parrington[1], Peter Fino[2], Robert Peterka[1], Laurie King[1]
[1]Oregon Health & Science University, [2]University of Utah

P3-V-166 Augmenting balance with tactile robotic feedback

Presenter: **Raymond Reynolds**

Raymond Reynolds[1], Lorenz Asslander[2], Craig Smith[1]
[1]University of Birmingham, [2]University of Konstanz

P3-V-167 Foot sole cutaneous stimulation mitigates plantar flexor fatigue

Presenter: **Simone Smith**

Simone Smith[1], Geoffrey Power[1], Leah Bent[1]
[1]University of Guelph

P3-V-168 Lightbulb characteristics affect stepping biomechanics during stair descent in young and older adults

Presenter: **Neil Thomas**

Neil Thomas[1], Costis Maganaris[1], Thomas O'Brien[1], Richard Foster[1], Vasilios Baltzopoulos[1], Carolyn Lees[1], Timmion Skervin[1], Mark Hollands[1]
[1]Liverpool John Moores University

P3-V-169 Performance of dual-tasking between arm movement and postural adjustments in subjects with stroke

Presenter: **Yosuke Tomita**

Yosuke Tomita[1], Nicolas Turpin[2], Daniele Piscitelli[3], Mindy Levin[3]
[1]Takasaki University of Health and Welfare, [2]University of la Réunion, [3]McGill University

P3-V-170 Unidirectional beta connectivity from motor cortex to muscle is involved in voluntary modification of locomotor muscle activity in humans

Presenter: **Hikaru Yokoyama**

Hikaru Yokoyama[1], Naotsugu Kaneko[2], Yohei Masugi[3], Tetsuya Ogawa[2], Katsumi Watanabe[4], Kimitaka Nakazawa[2]
[1]Tokyo University of Agriculture and Technology, [2]University of Tokyo, [3]Tokyo International University, [4]Waseda University

W - Tools and methods for posture and gait analysis

P3-W-171 Straight vs curved walking: Quantification of dynamic balance through an instrumented version of the Figure-of-8-Walk-Test

Presenter: **Valeria Belluscio**

Valeria Belluscio[1], Elena Bergamini[1], Yuri Russo[1], Amaranta Orejel Bustos[1], Marco Tramontano[2], Giuseppe Vannozzi[1]
[1]Interuniversity Centre of Bioengineering Bohnes, University of Rome Foro Italico, [2]Santa Lucia Foundation

P3-W-172 Extending the centre of pressure to include handhold forces

Presenter: **James Borrelli**

Emily King[1], James Borrelli[2], Vicki Komisar[3], Brian Maki[4], Alison Novak[4]
[1]University of Waterloo, [2]University of Maryland, [3]Simon Fraser University, [4]Toronto Rehabilitation Institute

P3-W-173 Normative data for Balance Tracking System (BTrackS) modified Clinical Test of Sensory Integration and Balance (mCTSIB)

Presenter: **Daniel Goble**

Daniel Goble[1], Harshan Brar[1], Elise Brown[1], Charles Marks[1], Harsimran Baweja[2]
[1]Oakland University, [2]San Diego State University

P3-W-174 Gaps between gait measured in the lab during usual and dual-task walking compared to free-living walking: Evidence from 24/7 monitoring of older adults

Presenter: **Inbar Hillel**

Inbar Hillel[1], Laura Avanzino[2], Lynn Rochester[3], Ugo Della Croce[4], Marcel Olde Rikkert[5], Silvia Del Din[6], Pieter Ginis[7], Nir Giladi[1], Anat Mirelman[1], Jeff Hausdorff[1]
[1]Tel-Aviv Sourasky Medical Center, [2]University of Genoa, [3]Institute of Neuroscience, Newcastle University, [4]University of Sassari & Interuniversity Centre of Bioengineering of the Human Neuromusculoskeleta, [5]Donders Institute, Radboud University Medical Centre, [6]Newcastle University, [7]KU Leuven

P3-W-175 Development of a body balance assessment system with integrated virtual reality technology; construct validity testing in healthy older adults

Presenter: **Yu Imaoka**

Yu Imaoka[1], Nadja Saba[1], Anne Vanhoestenberghe[2], Eling de Bruin[3]
[1]ETH Zurich, [2]University College London, [3]Karolinska Institutet

P3-W-176 A novel functional ambulation toolkit to assess children with locomotor deficits

Presenter: **Alexandra Leclerc-Valade**

Alexandra Leclerc-Valade[1], Jolin Jiang[1], Liav Lugassy[1], Zachary Weber[1], Elizabeth Dannenbaum[2], Claire Perez[1], Filomena Pietrangelo[2], Lora Salvo[2], Joyce Fung[1]
[1]McGill University, [2]Jewish Rehabilitation Hospital (CISSS-Laval)

P3-W-177 A do-it-yourself low-cost foot switch device to measure stride intervals

Presenter: **Masahiro Okano**

Masahiro Okano[1], Tadao Isaka[1]
[1]Ritsumeikan University

P3-W-178 Performance of surface and fine-wire electrodes over time when recording from the tibialis anterior in walking

Presenter: **Joanna Reeves**

Joanna Reeves[1], Chelsea Starbuck[1], Wasseem Rafiq[1], Chris Nester[1]
[1]University of Salford

P3-W-179 Integrating technology into clinical practice for the assessment of balance and mobility: Perspectives of exercise professionals practicing in retirement and long-term care

Presenter: **Kathryn Sibley**

Kathryn Sibley[1], Karen Van Ooteghem[2], Elizabeth Inness[3], Avril Mansfield[3], Jaimie Killingbeck[4]
[1]University of Manitoba, [2]University of Waterloo, [3]Toronto Rehabilitation Institute, [4]Schlegel Villages

P3-W-180 Accepting the null hypothesis: How and why?

Presenter: **John Stins**

John Stins[1]
[1]Vrije Universiteit Amsterdam

P3-W-181 Muscle coordination changes with assistance from lumbar support exoskeleton

Presenter: **Chun Kwang Tan**

Chun Kwang Tan[1], Hideki Kadone[1], Kousei Miura[2], Tetsuya Abe[2], Masao Koda[2], Yasushi Hada[1], Masashi Yamazaki[1], Yoshiyuki Sankai[1], Kenji Suzuki[1]
[1]University of Tsukuba, [2]Faculty of Medicine, University of Tsukuba Hospital

P3-W-182 Application and evaluation of the extrapolated centre of mass as a clinical gait stability measure

Presenter: **Albert Vette**

Albert Vette[1], Jeremy Hall[1], Juan Forero[1], Jacqueline Hebert[1]
[1]University of Alberta

P3-W-183 Influence of taking a rest between measurement of stabilometry with eyes open and closed

Presenter: **Tomoe Yoshida**

Tomoe Yoshida[1], Masahiko Yamamoto[1], Kazuo Ishikawa[2], Eigo Ohmi[3]
[1]Toho University, [2]Japanese Red Cross Akita Hospital, [3]Akita University

X - Vestibular function and disorders

P3-X-184 Abnormal subjective vertical perception in patients with vestibular migraine

Presenter: **Mitsuhiro Aoki**

Mitsuhiro Aoki[1], Hisamitsu Hayashi[1], Bunya Kuze[1]
[1]Gifu University Hospital

P3-X-185 Recovery of head trunk kinematics during functional movement tasks following unilateral vestibular hypofunction

Presenter: **Lee Dibble**

Lee Dibble[1], Brian Loyd[1], Grace Hunt[1], Mark Lester[2], Serene Paul[3]
[1]University of Utah, [2]Army-Baylor University, [3]University of Sydney

P3-X-186 Vestibular precision and postural sway variability

Presenter: **Adam Goodworth**

Adam Goodworth[1], Yulia Valko[2], Robert Peterka[3], Daniel Merfeld[4], Faisal Karmali[5]
[1]University of Hartford, [2]University Hospital Zurich, [3]Oregon Health & Science University, [4]Ohio State University, [5]Massachusetts Eye and Ear Infirmary

P3-X-187 Risk of falling in bilateral vestibulopathy: How should we predict this?

Presenter: **Nolan Herssens**

Nolan Herssens[1], Evi Verbecque[2], Wim Saeys[1], Luc Vereeck[1], Bieke Dobbels[3], Julie Moyaert[3], Vincent Van Rompaey[1], Ann Hallemans[1]
[1]University of Antwerp, [2]University of Hasselt, [3]Antwerp University Hospital

Y - Visual function and disorders

P3-Y-188 Virtual perturbations: Individual differences in static posture

Presenter: **Robert McIlroy**

Robert McIlroy[1], Michael Barnett-Cowan[1]
[1]University of Waterloo

P3-Y-189 Visual exploration during walking and turning in mild traumatic brain injury and controls

Presenter: **Samuel Stuart**

Samuel Stuart[1], Lucy Parrington[1], Doug Martini[1], Peter Fino[2], James Chesnutt[1], Laurie King[1]
[1]Oregon Health & Science University, [2]University of Utah

P3-Y-190 Measuring dynamic balance control in children with cerebral palsy

Presenter: **Ruud van der Weel**

Ruud Van der Weel[1], Audrey van der Meer[1]
[1]Norwegian University of Science & Technology

EXHIBITOR PROFILES

AMTI (TT3)

AMTI understands that the best research begins with the best equipment. We continually strive to develop the most accurate and reliable Multi-Axis Force Platforms and Sensors for your biomechanics research. Our innovative OPTIMA performance system revolutionizes multi-axis force measurement technology offering a 10-fold improvement in accuracy over any other force platform on the market. Whether studying Balance, Gait, or Sport Biomechanics, researchers and clinicians around the world rely on AMTI platforms to deliver the most accurate force measurements. Shouldn't you? Stop by our booth or visit our website www.amti.biz to learn more about what we have to offer.

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APDM Wearable Technologies (Booth 3)

APDM offers solutions for quantifying human movement by combining Opal sensors with sophisticated algorithms. Deployed by thousands of researchers and clinicians worldwide, APDM solutions streamline data collection and analysis. Mobility Lab generates spatiotemporal gait and balance outcome measures and has been used to analyze disease-sensitive outcome measures in neurodegenerative conditions as well as to more precisely track a patient's response to an intervention by clinicians and in pharma clinical trials. Other solutions include Motion Studio for access to precisely synchronized raw inertial data and Moveo Explorer for automated full body kinematic data analysis including joint angles.

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Charnwood Dynamics Limited/Codamotion (TT 4)

Pioneering 3D Motion capture for 30 years, for research and Clinical applications. Our technology is used by leading Gait Labs worldwide. An active marker technology that is cost affective, portable and easy to use.

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CIR Systems/GAITRite (Booth 10)

World Leader for 26 years in Temporo-Spatial Gait Analysis, GAITRite® Systems capture with unsurpassed accuracy,objective data necessary to reliably document patient condition and progression. Our unique proprietary software identifies, through a multitude of specific Spatial-Temporal Gait parameters, asymmetries and deviations from normal time and distance values. In the research venue, GAITRite® allows for the building of large subject databases for extensive data mining. The new 3D Camera allows for upper body data collection by simply walking on the system. GAITRite has in excess of 11,000 worldwide peer reviewed publications,in research & numerous disciplines.

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Cometa Systems (TT6)

Cometa Systems is a leading provider of medical and research instruments for motion analysis. Our wireless EMG and IMU sensors are the smallest on the market, can be easily integrated with other systems, and are the only ones to be IPX7 certified for underwater use.

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Delsys Europe (Booth 8)

Delsys, being at the forefront of innovative developments in Electromyography (EMG) for more than 25-years, has established the foundation for unmatched signal quality, consistency, reliability and, continues to challenge the status quo to put technology in the hands of researchers and clinicians. The Delsys Trigno wireless technology builds upon this solid foundation allowing unrestricted subject motion while maintaining unmatched signal quality. Acutely demonstrated through the latest Trigno sensor technologies such as Trigno Avanti and Trigno Quattro sensors providing EMG and IMU through both desktop and mobile applications.

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Elsevier (Gait & Posture Journal)

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Gait & Posture is the official journal of ISPGR and is a vehicle for the publication of up-to-date basic and clinical research on all aspects of locomotion and balance.

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Gait Up SA (Booth 14)

Born in research 18 years ago, Gait Up combines wearable sensors, algorithms and biomechanics, to provide world leading motion analysis. We empower wearables to rival accuracy of legacy motion labs, with real life convenience that counts. Our mission is to enhance health, sport, and society by providing easy yet accurate measures of the 6th vital sign: Movement.

albin.pinard@gaitup.com

MediTouch (TT2)

MediTouch was established in 2004 with the aim of developing and distributing innovative physical rehabilitation solutions for hospital, community clinic and home care use. The HandTutor is used worldwide in major rehabilitation facilities, private occupational and physiotherapist practices and by home care patients. The balancetutor's new technology allows the therapist to create postural perturbation such as a slip or a trip. Its advanced technology utilizes the platform's movement in a medial/lateral and forward/backward direction while the patient is standing, walking or running allowing customized postural control practice in the specific gait phase.

info@meditouch.co.il
@MediTouch

Motek (Booth 1)

Motek is a global leader in virtual reality and robotics research and rehabilitation, combining almost 20 years of experience in high-level technologies. Building the most versatile devices, Motek integrates the latest technologies ensuring real-time data quality and synchronization. From global knowledge exchange to unique research set-ups, Motek empowers every stage of your research on human movement. Together, we will set future standards to maintain healthy and independent lifestyles for everyone.

NDI (Northern Digital Inc)

Sponsor of the Aftab Patla Innovation Award

NDI is a global-leading innovator and manufacturer of 3D measurement and motion tracking solutions. Since 1981 we've helped our customers bring optical and electromagnetic tracking to image-guided surgery, biomechanics research, automotive assembly, AR/VR, and so much more. NDI is headquartered in Waterloo, Canada, with 225+ employees across four global offices.

msci@ndigital.com
www.ndigital.com
@ndimeasurement

Neurosoft (TT1)

The Neurosoft Company was founded in 1992. Nowadays it is one of the largest manufacturers of the medical equipment for neurophysiology and electrodiagnostics. We manufacture devices for EEG, EMG, ECG, TMS, IOM, PSG, rehabilitation and other fields. Rehabilitation is one of the most promising and priority vectors of the company's development. The Neurosoft Company can offer the customers the Steadys gait assessment and training system with biofeedback, the Multitrainer digital system for cardiac rehabilitation and the Neuro-MS/D transcranial magnetic stimulator that has proven itself in the treatment of many psychiatric and neurological disorders.

Skorobogatko@neurosoft.com

PAL Technologies Ltd (Booth 4)

The activPAL(tm) provides researchers with an objective measure of free-living lying, sedentary, upright and ambulatory activities. The new activPAL4+ model includes a magnetometer and barometer in addition to the standard acceleration sensor allowing turning during stepping to be quantified as well as stair ascent. The activPAL is unique in being able to quantify time cycling and in car travel, providing the opportunity to understand mobility choices (active travel vs car). This gives the researcher previously unreported yet valuable insights into the context of free-living behaviours, providing the evidence to link health outcomes with physical behaviours.

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@paltechnologies

ProtoKinetics Gait Analysis Walkways (Booth 9)

ProtoKinetics offers The Premiere Gait Analysis System: Zeno Walkway powered by PKMAS software: Quantify, Track, Trend, Report... Measure the impact exercise, bracing and Partial Body Weight Support treadmill training have on functional outcomes and to mitigate fall risk. Capture and analyze difficult gaits such as: freezing, overlapping footfalls, weaving walker tracks, quad canes and toe drags that other walkways cannot. In addition, PKMAS offers unique and standardized protocols: walking, turning, gait initiation, static balance, Limits of Stability. Primary Gait Screen and the Four Square Step Test. Please visit our booth to experience our best in class product knowledge in person!

sales@protokinetics.com
protokinetics.com
@protokinetics

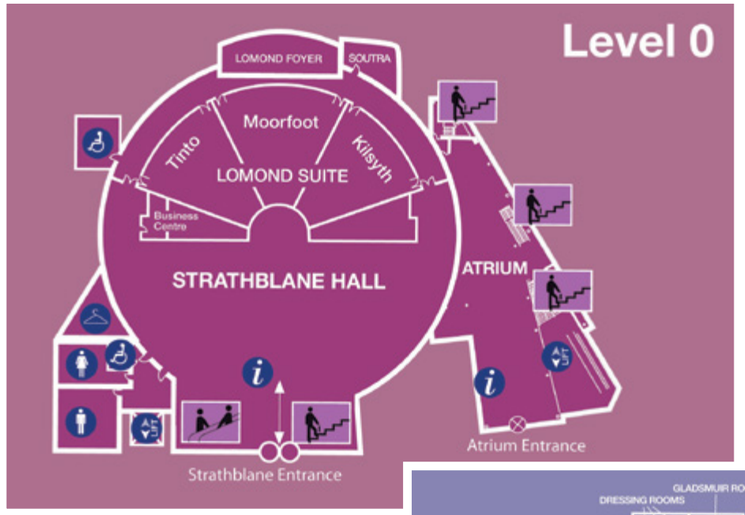
Vicon Motion Systems Ltd (Booth 2)

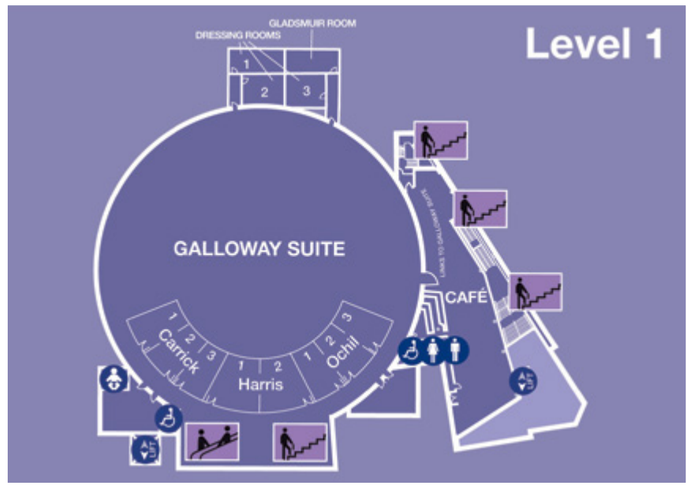
Sponsor of the 2019 ISPGR World Congress App

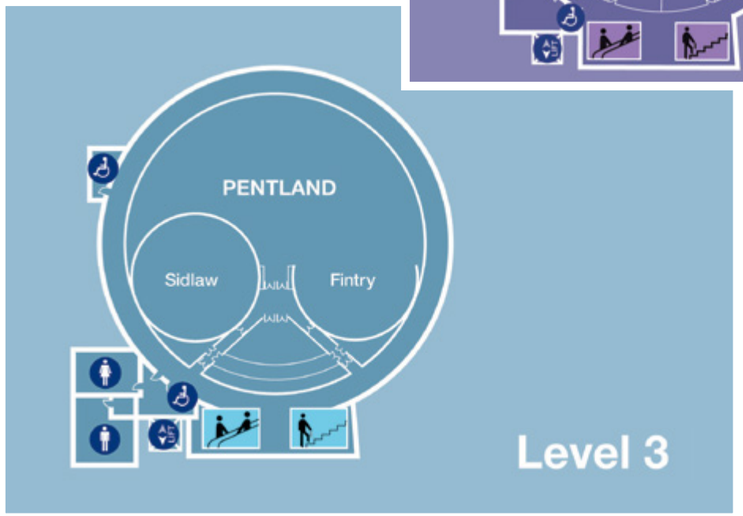
Vicon delivers highly accurate 3D motion capture systems for use in gait analysis. Nearly400 clinical gait labs world-wide use Vicon technology. Its flagship camera line, the Vicon Vantage, offers the highest resolution, frame rates and accuracy available, allowing detailed motion capture in almost any environment. Bonita is Vicon's next-generation camera, combining size, power, and price performance into one amazing solution. Vicon was established in Oxford, UK, in 1984 and is now a subsidiary of the Oxford Metrics Group Plc. Some of Vicon's global clients include Liverpool John Moores University, University of Vienna; Nuffield Orthopaedic Centre; University of Brussels; Northumbria University.

tina.holland@vicon.com
www.vicon.com

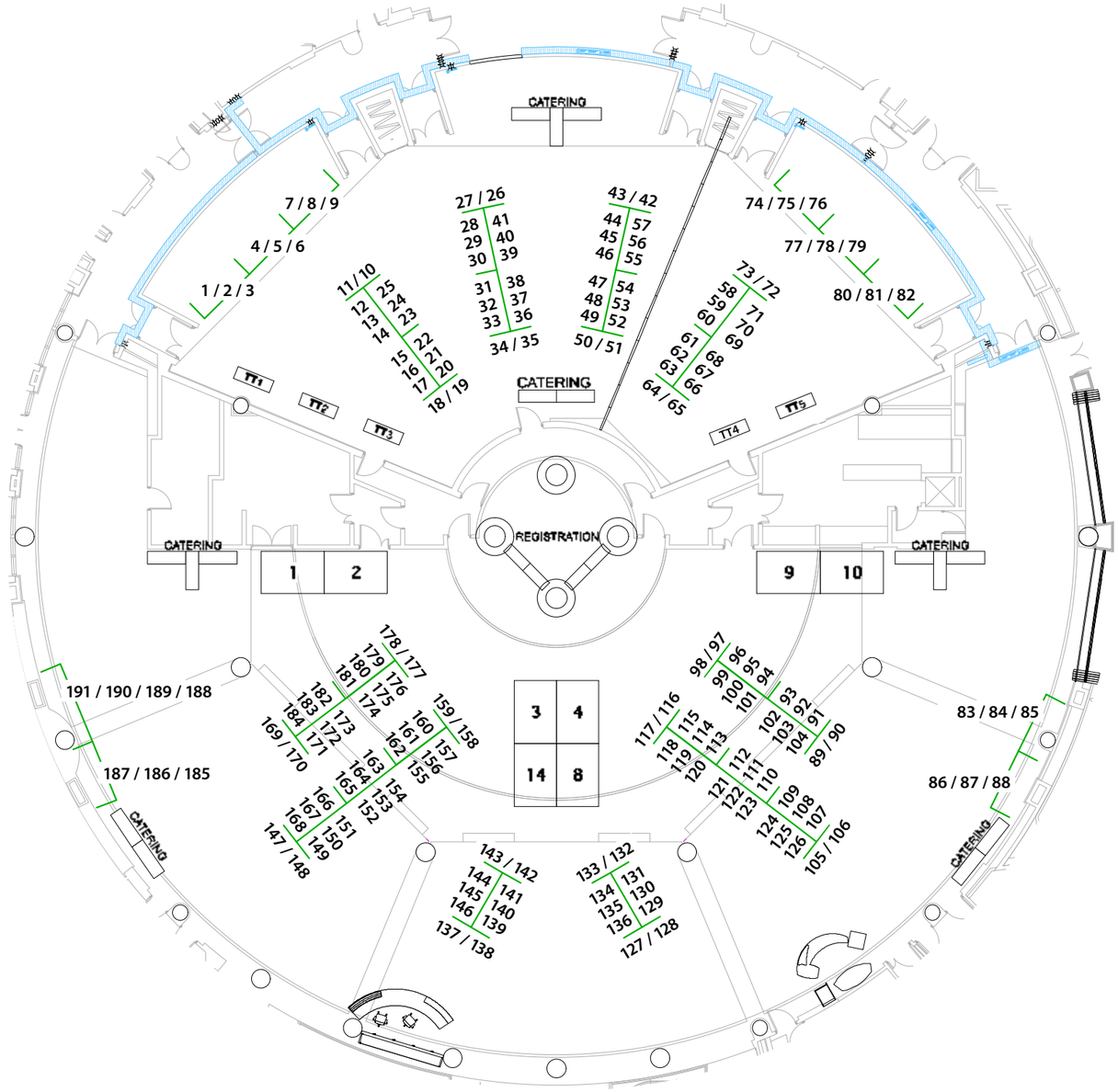
MEETING FLOOR PLANS







POSTER & EXHIBITOR FLOOR PLAN



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PROTOKINETICS Leading Innovation in Gait & Balance Measurement

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